

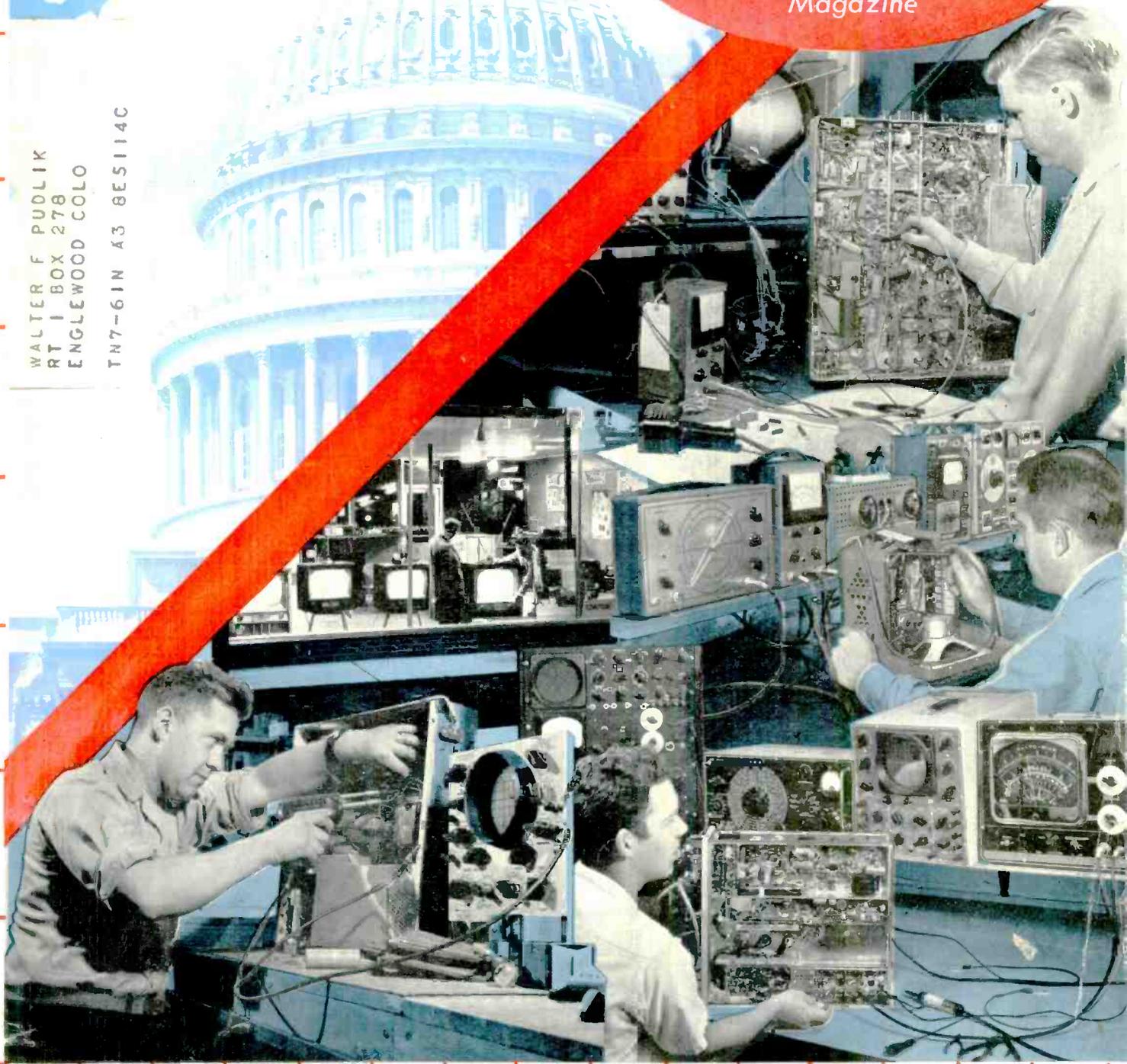
# ELECTRONIC TECHNICIAN

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World's Largest Electronic Trade Circulation

January, 1959

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**FRONT COVER** After the past year of recession, 1959 happily promises to be a year of economic growth for the nation. This offers service dealers and technicians opportunities to improve their plant facilities, and expand maintenance operations to cover hi-fi, industrial electronics and communications, as well as radio-TV. For special story on how to obtain Government aid in financing your growth, see page 35.

## FEATURES and ARTICLES

<b>Welcome SERVICE Subscribers (Editorial)</b> .....	29
<b>"Tuning in the Picture"</b> .....	30
<b>Hi-Fi Servicing with a Harmonic Distortion Meter</b> <i>N. H. Crowhurst &amp; Robert Cornell</i> .....	32
<b>1958 TV-Electronic Industry Statistics</b> .....	34
<b>The Lowdown on Small Business Administration Loans</b> . . . . . <i>L. D. Farrar</i>	35
<b>Extend VOM or VTVM for Reactance Measurements</b> . . . . . <i>Al Diamond</i>	36
<b>"Tough Dog" Corner</b> .....	37
<b>Radio-Frequency Induction &amp; Dielectric Heating</b> .....	38
<b>Heterodyning Sine &amp; Complex Waveforms</b> .....	40
<b>Cumulative Article Index, Jan. 1958 through Dec. 1958</b> .....	42
<b>Free Literature</b> .....	45
<b>Shop Hints</b> .....	47
<b>Building a Technical Library</b> .....	48
<b>New Audio Products</b> .....	62

## DEPARTMENTS

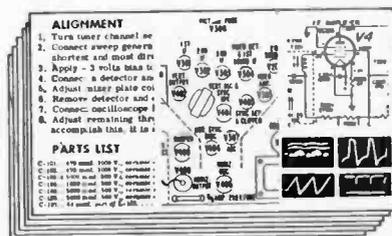
<b>Editor's Memo</b> .....	4	<b>Calendar of Coming Events</b> .....	31
<b>Letters to the Editor</b> .....	10	<b>New Books</b> .....	61
<b>News of the Industry</b> .....	18	<b>Association News</b> .....	68
<b>Catalogs &amp; Bulletins</b> .....	25	<b>Reps. &amp; Distrs.</b> .....	72
<b>Audio Newsletter</b> .....	26	<b>New Products</b> .....	74

## CIRCUIT DIGESTS

81

## IN THIS ISSUE

(16 pp. latest schematics—see last page)  
ADMIRAL: TV Chassis 14YP3D  
DOMINION ELECTROHOME Canada:  
TV Model Viscount, Viscount MK1,  
Viceroy, Viceroy MK1  
MAGNAVOX: TV Chassis 28 Series  
MOTOROLA: Stereo Phonograph Chassis  
HS704  
PHILCO: TV Chassis 9L38, 9L38U  
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You need only  
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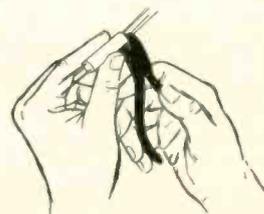
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MR-4	10	500 to 15,000	47	60c
MR-5	10	3,000 to 50,000	12	90c

all types 10% tolerance

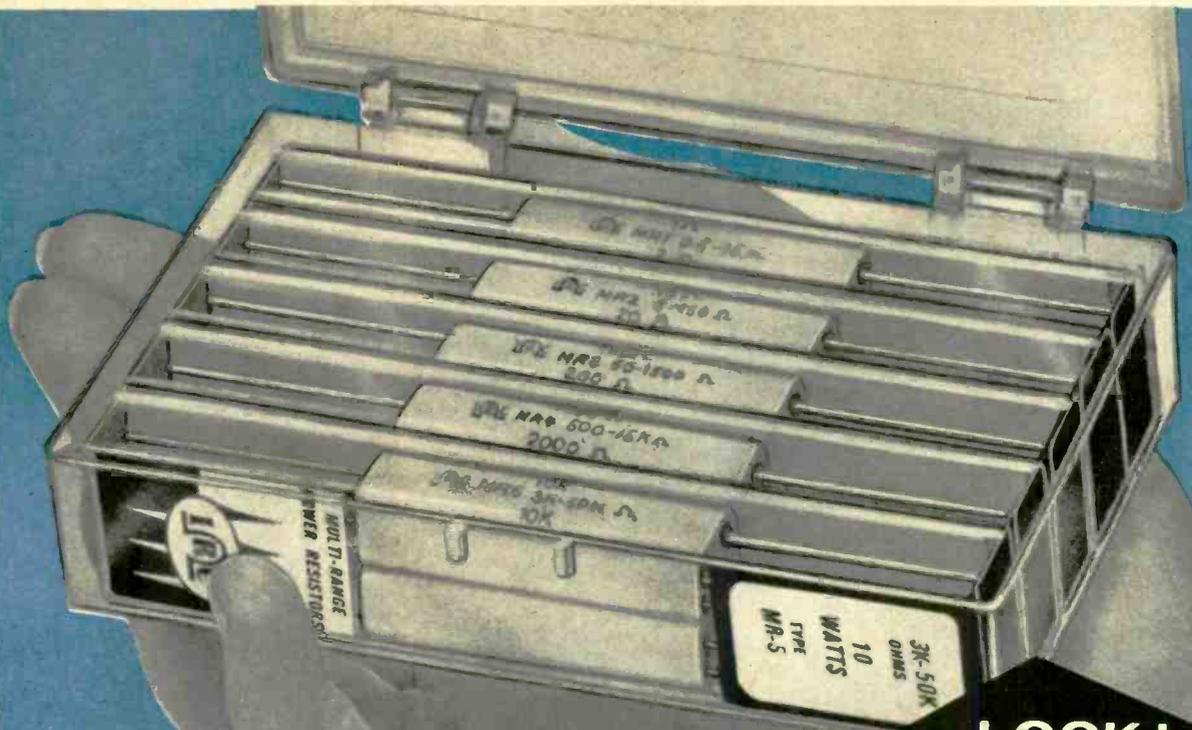
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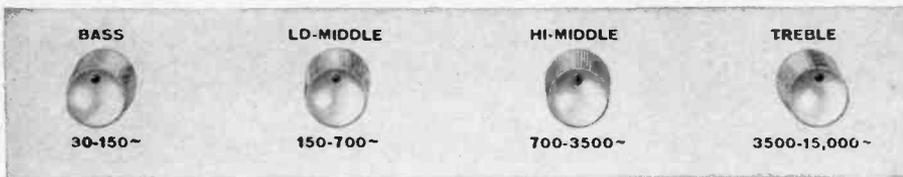
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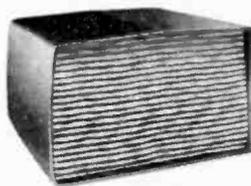
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## NEW BLONDER-TONGUE MODEL A-1 HIGH FIDELITY AMPLIFIER

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## Editor's Memo



New readers constantly join us, but this month is something special. The welcome mat is out to the thousands of former *Service* subscribers who will now receive *Electronic Technician*.

These newly acquired friends may be curious about what we do in these pages, and why. First note the multi-color cover. Each month a different art design is used.

The Letters to the Editor column represents a cross-section of interesting reader correspondence. Let's hear *your* views. Whether we agree or disagree with them, within space limitations there's a good chance we'll publish your letter.

This Editor's Memo column is personal and unpredictable. It has covered business tips, wry comment, jokes, accusations and pretty girls.

The editorial page generally reflects the official position of the magazine on important issues, and its observations and thoughts on topics of major interest. Sometimes we step on people's toes when they deserve it.

"Tuning In" section? We hope you can be informed and entertained here at the same time.

Acceptable "Shop Hints" earn \$3 to \$10 each for our readers. Surely you've developed a time-saver or bench aid of some sort at one time or another. Send us a description of it.

"Tough Dogs" are service jobs which do not respond in the usual way to proper troubleshooting procedures. Let's hear about some of the puzzlers you've solved. \$10 each if we can use them.

To discuss the major technical and business articles would take too long. Just look at the annual article index in this issue. Note the broad range covered — TV, audio, circuits, test equipment, industrial electronics, components, etc.

You can receive copies of the free literature, and more information on the new products described simply by filling in the special coupon for this purpose.

The "Circuit Digests" section is a real servicing aid, bringing you the latest TV-radio-hi-fi schematics. It's the only service of its kind.

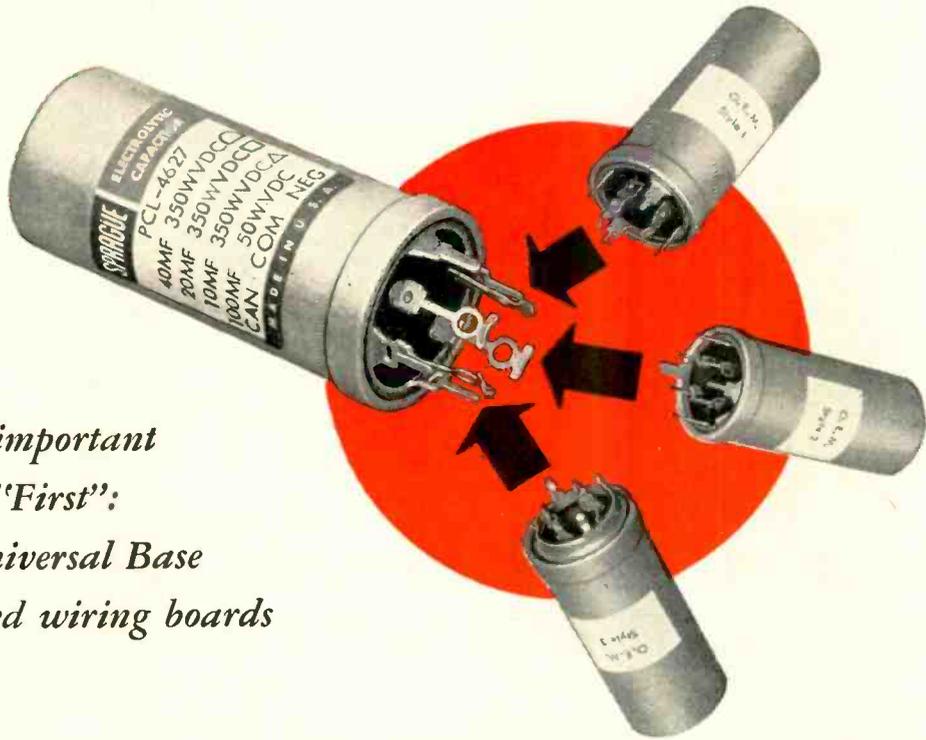
And every May you can look forward to a complete Buyers Directory of products and manufacturers, with addresses, plus a national roster of service associations.

Yes, we try to cram as much worthwhile information into these pages as we can. It's all intended to serve the professional electronic technician and service dealer.

*Al Forman*

# Sprague **PRINT-LOK**\* 'lytics

with **universal bases** for printed wiring boards  
**simplify servicing**      **reduce inventory**



*Another important  
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3-in-1 Universal Base  
for printed wiring boards*

Sprague's new PRINT-LOK Electrolytic Capacitors have a newly-developed universal base that's designed to fit all sets. A touch of your pliers is all that's needed to adapt PRINT-LOK capacitors to any one of three different types of printed circuit bases!

How's that for simplified servicing? And just as important, you need only stock a third as many 'lytics as were required previously. Still another feature—PRINT-LOK capacitors also replace standard twistbase electrolytic capacitors.

\*Trademark

PRINT-LOK capacitors are hermetically sealed in aluminum cases to give extra long life and top performance under extremely high temperatures and high surge voltages, as well as in high ripple selenium rectifier circuits.

Sprague's new TV Electrolytic Capacitor Replacement Guide K-103 gives complete listings for PRINT-LOK 'lytics as well as standard TWIST-LOK capacitors. Get your free copy from your distributor, or send 10c to cover handling to Sprague Products Co., 65 Marshall Street, North Adams, Massachusetts.

**don't be vague...insist on**

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**Type T . . . for most economical replacement.** Encapsulated in Mallo-Seal\*, this lowest-priced model can stand 500 hours in boiling water. Available in handy packs of five each for mounting by leads, and in kits using plug-in rectifiers, with mounting hardware. 400 and 365 volt ratings, 0.5 ampere. Also available from 50 to 600 P.I.V. inclusive.

\*Trademark of P. R. Mallory & Co. Inc.



**Type P . . . for plug-in replacement.**

Fuse model fits sets already converted to this type of silicon unit. Available in 5-packs, and as conversion kits for half-wave, full-wave or doubler application, with fuse clip and mounting hardware. 400 and 365 volt ratings, 0.5 ampere. Also available from 50 to 600 P.I.V. inclusive.



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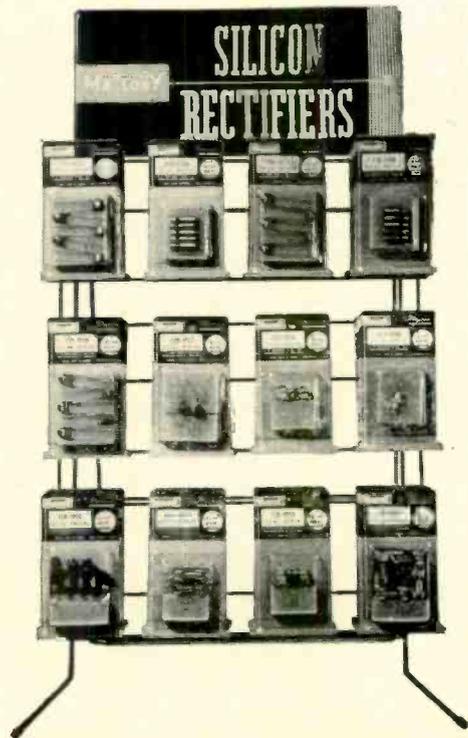
# *Junction* Silicon Rectifiers

A completely new concept in silicon rectifier design gives these new Mallory models reliability never before possible. At the heart of each is a unique diffused junction silicon element, product of extensive Mallory research in semi-conductors, which has these characteristics:

- Low reverse leakage** ..... less than 250 microamperes
- Low forward drop** ..... less than 0.5 volt
- Exceptional life** ..... takes over 2000 hours at 85 C, with 1.5 million switching operations without failure
- Moisture-proof** ..... exceeds humidity requirements by four times (MIL 202A)
- High reliability** ..... 100% testing eliminates premature failures, protects you against call-backs

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



Sylvania received Altoona's official welcome through front-page headlines and a special feature section filled with congratulations.

Why the whole town made such a fuss over

# Sylvania's new tube plant



For one thing—Altoona folks know that progress by an important resident company means the whole town progresses. Sylvania's President, Don Mitchell, at the multi-million-dollar plant's formal opening called it "the largest in the receiving tube industry—containing many innovations."

This is where you come in. Because most of these innovations affect your business profit. As the world's most modern tube plant, Altoona will be producing the world's most reliable tubes in both commercial and

military types. Two of the industry's biggest bugaboos, intermittent shorts resulting from dust and lint and unstable emission caused by contamination and humidity variations during tube manufacture, promise to be vastly improved. You'll be hearing more about these developments in the future.

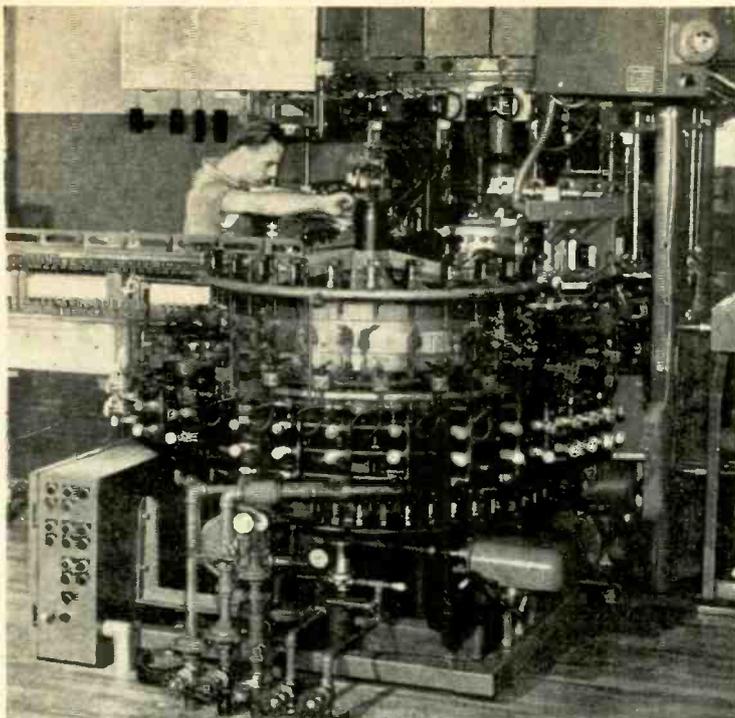
The Altoona plant is as much a dedication to the independent serviceman as it is to the entire tube industry. It's a modern example of why profit-minded dealers are relying on Sylvania tubes.



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for High Performance at Low Cost—



**the Model 68** Modestly Priced, Metal-Cased VTVM

- 5 Peak-to-Peak Voltage Ranges: 0-8-32-160-800-3200 volts
- 5 (+) Plus and 5 (-) Minus DC Voltage Ranges:  
0-3-12-60-300-1200 volts, 13 1/3 Meg. input
- 5 Hi-Impedance RMS AC Ranges: 0-3-12-60-300-1200 volts
- 5 Resistance Ranges Up to 1000 Megohms
- 5 Zero-Center Reference Ranges
- Extra-Large, 5 1/4" Wide-Angle PACE Meter

Model 68: blue-grey ripple-finished steel cabinet, 5 7/8" x 7 3/4" x 3 1/2". Complete with tubes, ohmmeter battery and manual. Net Price: \$54.50

for Battery-Powered Portability—



**the Model 78** Battery-Operated, Metal-Cased VTVM

- A MUST Where Power Line is Unavailable
- A MUST Where Power Line Connection is Undesirable
- 6 Zero-center DC Voltage Ranges:  
0 = 1.5, = 6, = 30, = 150, = 600, = 1500 volts; 13 1/3 Meg. input
- 5 Ohmmeter Ranges to 1000 Megohms
- 5 Hi-Impedance RMS AC Ranges: 0-3-12-60-300-1200 volts
- Extra-Large, 5 1/4" Wide-Angle PACE Meter

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- More Functions—More Ranges—More Sensitivity:  
7 functions . . . 40 ranges . . . 26 2/3 megs input
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specially engineered for accuracy on pulsed and TV wave forms
- 6 Zero Center DC Voltage Ranges: to 1200 volts . . .  
also, 6 (-) minus and 6 (+) plus DC voltage ranges
- 5 Electronic Ohmmeter Ranges: to 1000 Megohms
- Extra-Large, 5 1/4" Wide-Angle PACE Meter

Model 88: Molded phenolic case, 5 3/8" x 7" x 3 1/8". Complete with AC line cord, ohmmeter battery, 3-way probe and manual. Net Price: \$74.50

for The Ultimate in Performance and Operating Ease—



**the Model 98** Laboratory VTVM with 7" Meter

- PRECISION's Finest VTVM:  
More Ranges—More Functions—High Sensitivity
- 6 P-to-P Voltage Ranges to 3200 volts: specially engineered for maximum accuracy on pulsed wave forms
- 6 True-Zero-Center DC Voltage Ranges:  
26 2/3 Megohms input to = 1200 volts
- 6 Electronic Ohmmeter Ranges to 1000 Megohms
- 6 Minus and 6 Plus DC Voltage Ranges:  
to 1200 volts 13 1/3 Megs input
- 6 Hi-Impedance RMS AC Ranges to 1200 volts
- 8 DC Current Ranges: from 0-300 microamps to 12 Amps
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Model TV-8.....Super-High-Voltage Safety Test Probe (for Models 88 and 98).....	Net Price \$14.75
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## LETTERS

To the Editors

### We Flunk Latin

Editor, ELECTRONIC TECHNICIAN:

What kind of Latin is "Trostice"? Don't blame it on the printer, since it occurs on pages 1 and 27 of the December issue. An electronic technician should have a well-rounded education because of the very important customer approach. So study your Latin, then "Respice, Prospice."

PAUL STECHER

New York, N.Y.

• Back in our school days we always did much better in math and science than Latin. It shows.—Ed.

### Attorney General

Editor, ELECTRONIC TECHNICIAN:

Let me commend you for your great assistance to the organized service industry in your letter to Mr. Louis J. Lefkowitz, Attorney General of the State of New York (Editor's Memo, December 1958 issue), concerning his "Guide for Consumers—10 Pointers for Careful Buying." We first called attention to his unjust release in June 1958. Since then we have received bundles of letters, and have met with him twice. Whether we have gained anything or not is to be questioned. At any rate, whatever progress we make with his office in the future will depend on letters such as yours. Your letter will be called to the attention of ESFETA members. Service will support those people who support us.

GEORGE CARLSON  
Secretary

Empire State Federation of Electronic Technicians Associations  
Jamestown, N. Y.

### Poison Pen Pal

Editor, ELECTRONIC TECHNICIAN:

I think your rag stinks.

HENRY L. ROBERT

Manchester, Conn.

### Captive Service

Editor, ELECTRONIC TECHNICIAN:

Congratulations on your editorial on captive service (November 1958). No doubt many small service dealers have been affected by the policies of these manufacturers. We for one make it a policy not to recommend any of these brands. I run a five-man organization doing strictly TV service, and I feel certain that our advice is very influential. I hope you have started a corrective trend in the TV service industry.

HARRY T. ELLIS

Delta Television Service  
Cliffside Park, N. J.

(Continued on page 14)

*Mr. Service Dealer...*

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RECENT ADVERTISEMENT IN

# LIFE



**COACHES MIDGET-LEAGUE TEAM.** For the past two years, Theodore W. Fickert, TV technician of Hatfield, Pa., has shown his 25-boy club how to play baseball. Active in community causes, he helped organize the Hatfield Junior Chamber of Commerce, and served as its secretary and state director; participates in the Heart Fund and other worthy drives; and is on the planning committee of St. Peter's Lutheran Evangelical Church.



**A BRIGHTER, CLEANER CITY** owes much to Bryce McNeely's work in connection with the Kelso, Wash., program for civic beautification. Bryce is on the mayor's committee for school and city improvement, is state JC vice president, and promotes young men's leadership training.



**MAKES OTHERS' TROUBLES HIS OWN.** One of the few TV technicians in an 85-mile area, T. E. "Buck" Adams of Channing, Tex., often aids in roadside emergencies, helps pen run-away cows, and has worked to improve local Baptist Church, parsonage.

**CRIPPLED CHILDREN LEARN TO WALK** through fund-raising efforts of Vernon E. Brooks, Norristown, Pa., who helped obtain \$100,000 to build a school for spastic paraplytics. Mr. Brooks (center) is a director of the Chamber of Commerce, and a prime mover in Red Cross, Community Chest, United Fund, and Salvation Army work. As national president of the American Business Club, he helped obtain more than 100 scholarships for the training of physical and speech therapists. He is chairman of the Muscular Dystrophy unit for the Tall Cedars of Lebanon.



# All-American TV Technicians

**HELPED TORNADO VICTIMS.** When disaster struck the area around Menomonie, Wis., on June 4, Vernon Townsend quickly organized emergency radio facilities to speed relief to the sufferers. A leading member of the Radio Amateur Civil Emergency service, he is active in Dunn County civil defense work, and also maintains a radio entertainment service for the local city-county hospital.

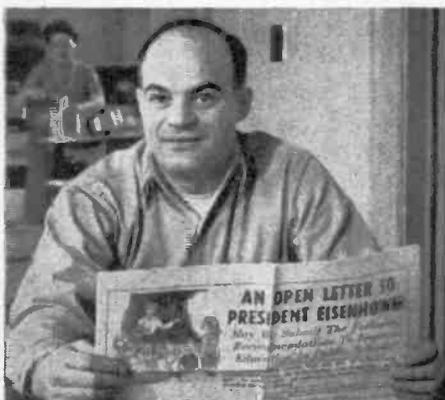




**TEACHES SCOUTS RADIO.** Boys in Brockton, Mass., learn Morse Code and the elements of electronics at an early age, from instruction by TV technician Albert P. Kazukonis. Much of the equipment he supplies without charge. A devoted youth and community worker, Mr. Kazukonis is treasurer and a past president of the Electronic Technicians Guild of Massachusetts, Brockton Chapter.



**DONATED LOUDSPEAKER SYSTEM.** The 1958 Centennial parade and pageant at Bloomington, Minn., owed much of its success to the fine amplifier system installed without charge by Edwin B. Haines. Ed is widely known for the time, effort, and equipment he has supplied for the 2,000 boys in Bloomington's sports program. He is a leader and counselor in Boy Scout work, and gives assistance to the Lions and the Bloomington Civic League.



**SPENDS TO PROMOTE EDUCATION.** Out of his own pocket, A. George Catavolo, TV technician of Somerville, Mass., financed two full-page newspaper ads which presented to the President recommendations on public school education. Last year George contributed over 50 radios, plus his time, to teach boys electronics.



**WORLD OF TOMORROW!** This novel space radio-man hat, invented by Stanley Everett of Alhambra, Cal., helped publicize many worthy drives. Stanley is president of the Los Angeles Electric League; a director of the Alhambra Chamber of Commerce; past president of Kiwanis and district chairman of the United Fund drive.



**COMMUNITY SERVICE** is a watchword with Wayne E. Lemons of Buffalo, Mo. An active Rotarian, he works with Boy Scouts, promotes Little League baseball, and has instructed TV technicians in surrounding cities. He is West Central vice-president of the National Alliance of Television Electronic Service Associations.

# Win General Electric Awards

**P**OPLE the nation over nominated candidates for the 1958 All-American Awards, honoring TV service technicians. This broad response showed how important a place the television technician holds in our community life, and how widely esteemed are his efforts in aid of others.

The Award winners, shown here, were chosen by a panel of judges including John Sparkman, U. S. Senator and Chairman, Select Committee

on Small Business; Bennett Cerf, television panelist and head of Random House publishing firm; and Charles Shearer, 1957-58 president of the National Junior Chamber of Commerce.

With these Awards, General Electric pays tribute to the part played by the independent television technician in making this a better country for all. *General Electric Company, Receiving Tube Department, Owensboro, Kentucky.*

*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**  
2-111-231



Winners received this trophy, \$500 for community benefit, and a trip to Wash., D.C., for luncheon with Senator John Sparkman.

a major  
breakthrough  
in  
TV-FM  
reception!



# New **JERROLD** Amplified TV-FM HOME SYSTEM

IMPROVES TV-FM RECEPTION . . . IN EVERY ROOM!

Permits simultaneous operation of TV and FM sets in every room . . . provides better reception from existing antenna than if each set has its own antenna! Any number of additional receivers can easily be plugged in!

- Increases enjoyment of all TV Channels, FM Stations!
- Improves Color TV, Stereo and AM Radio Reception!
- Quick, easy Screwdriver Installation in New or Existing Homes!
- Use With Any Antenna—Indoor or Outdoor!

As Necessary to Modern Living As Electrical Outlets!

## HOME SYSTEM KIT

Model HSK-300 \$6775 List  
Contains everything (except antenna)  
for installing 5-outlet system . . . including Twin-Lead.

JERROLD's wire-gripping plugs and outlets require no wire stripping...no soldering!



Write for Free 16-Page Booklet on  
JERROLD TV-FM Home System



# JERROLD

## ELECTRONICS CORP.

Dept. PD 128 The Jerrold Building, Philadelphia 32, Pa.  
Jerrold Electronics (Canada) Ltd.  
Export Representatives, CBS International, New York 22, N.Y.

LOOK TO JERROLD FOR AIDS TO BETTER TELEVIEWING

(Letters. Continued from page 10)

### Dissenter

Editor, **ELECTRONIC TECHNICIAN**:

Your magazine is the best available electrically. Sorry I can't say the same for your editorial poppycock in the November 1958 issue. Every bird named in the Editor's Memo comes to mind when reading "Fighting Mad Over Captive Service." Mad? The mad is caused by fear of not being capable of competing with the big organizations. I keep my prices higher than anyone. Mister, I am a service technician. I am better than good. Anyone who has the privilege to watch me repair their electronic equipment will know I am good, and if the person has had previous experience with any huge service company fixing their equipment, then the person will know me to be the genius I am. Captive service? You are crazy as the birds. To capture you have to be huge. To hold you have to be the genius I am. These are two different things. I'm the screwball who grossed just under \$20,000 last year. My business and private phones are unlisted, and I do not advertise. New customers are always trying to get me.

C. B. WARD

Los Angeles, Calif.

### Missing Friend

Editor, **ELECTRONIC TECHNICIAN**:

I hope you can run a brief mention about a missing friend of mine. His name is Bernie Bedrock. He operated his own TV sales and service shop and was in the habit of reading the various trade publications. His wife is dying of cancer, and his two daughters are pleading, "Please come home."

J. GREENBLATT

North Hollywood, Calif.

### Last of the Mohicans

Editor, **ELECTRONIC TECHNICIAN**:

Now that *Service* and *Electronic Servicing* have passed on, **ELECTRONIC TECHNICIAN** is the last magazine being published for the working electronic technician. I haven't read your magazine for some time, but if your editorial and articles are anything like they used to be, I shall look forward to each issue.

JOHN A. DOYLE

Doyle's TV Radio Service  
Bath, Maine

### Kudo for Stereo

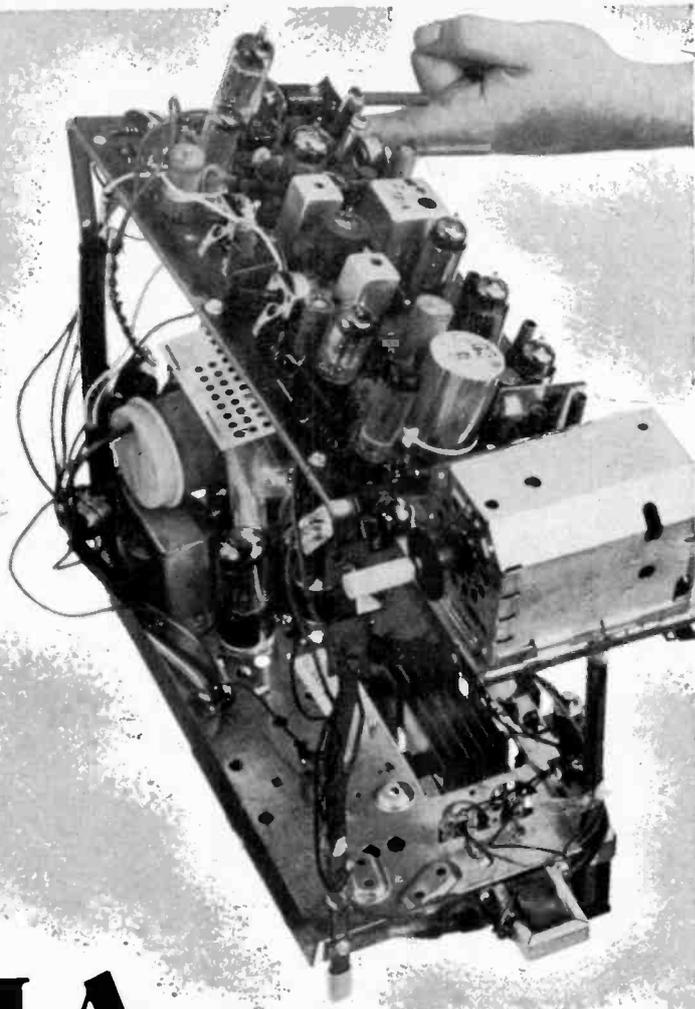
Editor, **ELECTRONIC TECHNICIAN**:

The article, "The Meaning of Stereo," in September's *Stereo* 1959 section is one of the best statements I've seen on this subject. I would like your permission to reproduce this for our customers.

J. W. RUBIN

Manager, Adv.-Sales Promotion  
Allied Radio Corp.  
Chicago, Ill.

Its two year  
record  
speaks for  
itself!



# SYLVANIA S-110 CHASSIS

Only 10½ lbs. without yoke

*performance proved*

- **Better performance under the extremes of line voltage variation.** The advanced high voltage design of the SYLVANIA S-110 Chassis adjusts automatically for maximum performance at both high- and low-voltage extremes.
- **Better performance under heat, humidity and freezing conditions.** The rigid specifications of reliability of components in the SYLVANIA S-110 Chassis assures better performance and longer trouble-free life under extremes of humidity and temperature conditions.  
Alkyd Resin used in the high voltage socket of the S-110 Chassis withstands moisture, dirt and even frost accumulations without any permanent damage, even if these conditions are severe enough to cause arcing. Top performance is assured regardless of warehouse locations.
- **Cuts repair time by 60%.** The orderly arrangement of components in the SYLVANIA S-110 Chassis means that most defects can be located in seconds. Circuit can be traced easily from either side by shadow graph method over your bench light.
- **Designed for maximum strength and minimum weight.** The SYLVANIA S-110 Chassis has all-around girder frame construction which gives it the most favorable strength to weight ratio in the industry. This means easier handling and faster servicing because of its light weight. Yet the S-110 is sturdy and rigid when mounted in the cabinet.

## THE CHASSIS MODERN MANUFACTURING METHODS BUILT

Advanced printed circuitry and components of the type used in the performance-proved SYLVANIA S-110 Chassis are required and specified in the design and production of guided missiles and space equipment where absolute reliability and ruggedness are demanded.



# SYLVANIA

*Pioneer in modern manufacturing methods*

# Now-Kit or Wired

A new  
**VoltOhmyst<sup>®</sup>**  
**Kit-WV-77E(K)**  
 for only  
**\$29<sup>95</sup>\***

RCA WV-77E VOLTOHMYST  
 (completely wired and calibrated for only \$49.95\*)

\*User Price (Optional)



Look what you get in this  
 Easy-to-assemble VTVM Kit!

- Meter electronically protected against burnout—PLUS—ohms-divider network fuse-protected. Unit is burnout proof!
- Ultra-slim probes and flexible leads—easy-to-use in those tight spots!
- Cables can be stored in sleeve attached to handle for increased portability! (Plenty of room for power cord, tool!)
- Separate scales for 1½ volts rms and 4 volts peak-to-peak assure rated accuracy on low ac readings!
- Famous RCA VoltOhmyst circuit means excellent stability under conditions of line voltage fluctuation—PLUS—special circuit minimizes effects of residual gas in bridge tube!
- Easier, faster-to-read scales—meter scale color-coded to match range switch!
- Extra-rugged 400-microampere meter movement!
- Metal case shields sensitive electronic bridge from rf fields!
- Front panel is brushed aluminum—all lettering is acid-etched to last the life of the unit!

Both kit and wired unit  
 available locally from  
 your RCA Distributor!

TV service technicians, hams, hobbyists—now you can buy this easy-to-assemble RCA VTVM kit! Step up and meet the new RCA VoltOhmyst which incorporates famous VoltOhmyst quality, accuracy, and performance—an instrument you'll be proud to display "on the job!"

You get simplified step-by-step instructions, laminated circuit board construction, oversized drawings—all the help needed to accomplish mechanical and electrical assembly faster than you've ever believed possible!

You can buy this instrument, kit or wired "off the shelf" at your local RCA Distributor. Either way, you are assured of an instrument which can give you long, dependable performance. See the RCA WV-77E VoltOhmyst—Kit or Wired—today!



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

## SPECIFICATIONS

### Ranges:

DC—0.02 volt to 1500 volts in 7 overlapping ranges

RMS—0.1 volt to 1500 volts in 7 overlapping ranges

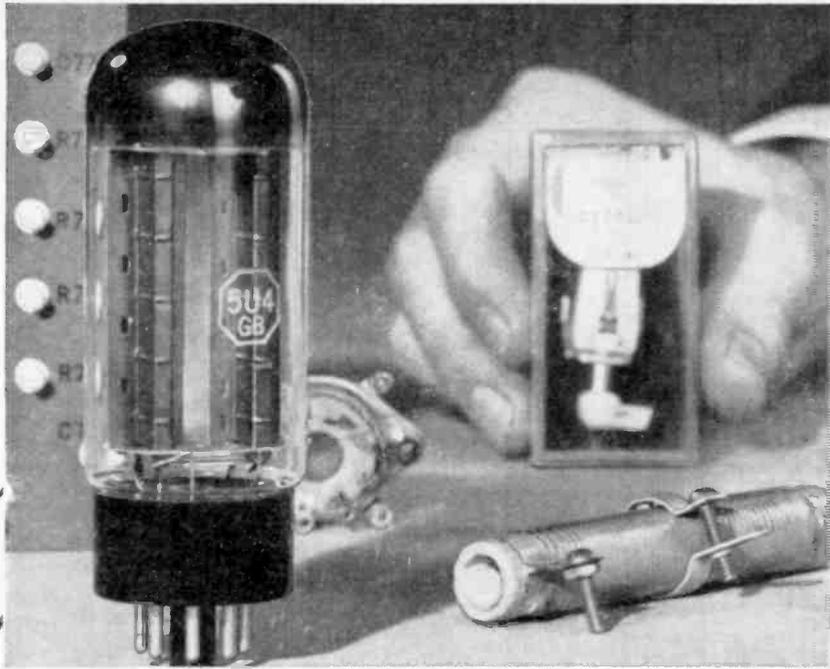
Peak-to-peak—0.2 volt to 4000 volts in 7 overlapping ranges

Resistance—from 0.2 ohm to 1000 megohms in 7 overlapping ranges. Zero-center indicator for discriminator alignment

Accuracy—±3% of full scale on dc ranges  
 ±5% of full scale on ac ranges

Frequency Response—flat within ±5%, from 40 cycles to 5 Mc on the 1.5, 5, and 15-volt rms ranges and the 4, 14 and 40-volt peak-to-peak ranges

DC Input Resistance—standard 11 megohms (1 megohm resistor in probe)



*Now you can  
be sure he'll  
get his tuner  
sooner...*



## **IT'S THERE IN HOURS... AND COSTS YOU LESS!**

Your packages go anywhere Greyhound goes... and Greyhound goes over a million miles a day! That means faster, more direct service to more areas, including many, many places not reached by other public transportation.

What's more, Greyhound Package Express offers this service seven days a week... twenty-four hours a day... even on week-ends and holidays! Packages get the same care and consideration as Greyhound passengers... riding on dependable Greyhound buses on their regular runs. And you can send C.O.D., Collect, Prepaid—or open a Charge Account.

So remember — anything from tubes to transformers can be sent Greyhound Package Express. Call your nearest Greyhound bus station or write to Greyhound, Dept. H-1, 5600 Jarvis Ave., Chicago, Ill.



look what  
**\$28<sup>95</sup>**  
 buys in  
 high fidelity  
 equipment!

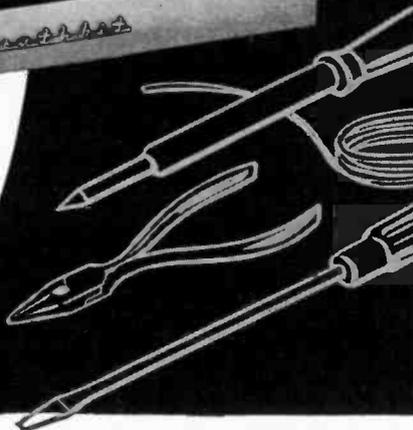


Manufacturer  
 of the finest  
 electronic equipment  
 in kit form



A complete 12-watt hi-fi amplifier-preamplifier combination in one stylish unit . . . and at less than half the price you would expect to pay!  
 Only

**\$28.95**



**BOOKSHELF 12-WATT AMPLIFIER KIT**

An amplifier and preamplifier in one compact unit. The EA-2 has more than enough power for the average home hi-fi system and provides full range frequency response from 20 to 20,000 CPS within  $\pm 1$  db, with less than 1% harmonic distortion at full 12 watt output over the entire audio range (20 to 20,000 CPS). IM distortion is less than 1.5% at 12 watts with low hum and noise. EL84 tubes are used in a push-pull tapped-screen output circuit. Inputs consist of crystal phono, tuner, and mag phono with RIAA equalization. Separate bass, treble and hum balance controls are featured. Taps provided for 4, 8 and 16 ohm speakers. Add this unit to your present system for simple stereo conversion. Complete instructions and pictorial diagrams show where every part goes and assures you of quick, easy assembly. Handsome vinyl clad steel cover measures 12½" W. x 8¾" D. x 4¾" H. Neon pilot light on front. Shpg. Wt. 15 lbs.

many more kits  
 to choose from!

Send for this free catalog describing over 100 easy-to-build kits in hi-fi-test-marine and amateur radio fields.



**HEATH COMPANY**

Benton Harbor 18, Mich.



a subsidiary of Daystrom, Inc.

name \_\_\_\_\_  
 address \_\_\_\_\_  
 city & state \_\_\_\_\_

**News of the Industry**

**ALLEN B. DU MONT LABS., INC.** has appointed **JOSEPH P. GORDON** as general manager of Tube Operations.

**GENERAL INSTRUMENT CORP.** has named **PHILIP M. PRITCHARD** as marketing manager for entertainment electronic components.

**AMERICAN TELEVISION & RADIO CO.** reports the purchase of **ECKSTEIN RADIO & TELEVISION CO.**, of Minneapolis. The products will be marketed under the ATR label.

**INT'L CORRESPONDENCE SCHOOLS** has named **JOSEPH A. RISE** as Director of the School of Electrical Communications.

**PHILCO CORP.** reports the appointment of **JOHN R. HOWLAND** to sales manager, Closed-Circuit Television and Product Control Equipment, Government and Industrial Div.

**JOHNS-MANVILLE Dutch Brand Div.** reports the opening of a new plant in south Chicago; and the promotion of **C. GREGG GEIGER** to general sales manager.

**JOHN F. RIDER PUBLISHER, INC.** reports that contracts have been signed for the translation of a number of titles in their line, into several foreign languages and publication in the respective countries.

**INSTITUTE OF RADIO ENGINEERS** has elected: Pres., **ERNST WEBER**; Vice Pres., **DONALD B. SINCLAIR**; and Directors, **FERDINAND HAMBURGER, JR.**, and **BERNARD M. OLIVER**.

**RADIO CORP. OF AMERICA** reports the following appointments: **L. HARRISS ROBINSON**, manager of marketing, Surface Communications Dept., Defense Electronic Products; **GORDON R. VANCE**, manager, Sales Coordination, Distributor Sales, Electron Tube Div.

**REK-O-KUT CO., INC.** has announced the winners of their Combined Consumer and Dealer Contest. Of over 50 dealer window displays submitted, the top award of a round-trip flight to the Brussels World's Fair and Paris went to **M. A. GRIBBLE**, of the **SIXTH AVE RECORD SHOP**, Portland, Ore. Round-trip flights to Bermuda, second and third place awards, went to **JIM CONOSCENTI**, **CONCERTO ROOM INC.**, Pittsburgh, Pa.; and to **DENNIS E. WONN**, **BOYD-WONN HI-FI SHOP**, Vallejo, Calif. The Consumer Sweepstakes were won by **RICHARD MINDEL**, who won a trip to the Brussels World's Fair and Paris. One hundred other winners were named.

(Continued on page 22)



## **DESTROYED—NOT FIRST QUALITY!**

**...why General Electric ships only top-grade tubes!**

One small area in every General Electric receiving tube plant is given over to destruction. Here steel jaws chew to fragments any tubes that happen to fall short of first-quality standards. These tubes cannot be "recovered," re-branded, or used or shipped in any manner.

A single high level of quality holds for General Electric tubes. In every case, they're the top product of facilities that lead the industry. See your friendly G-E tube distributor! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Ky.*

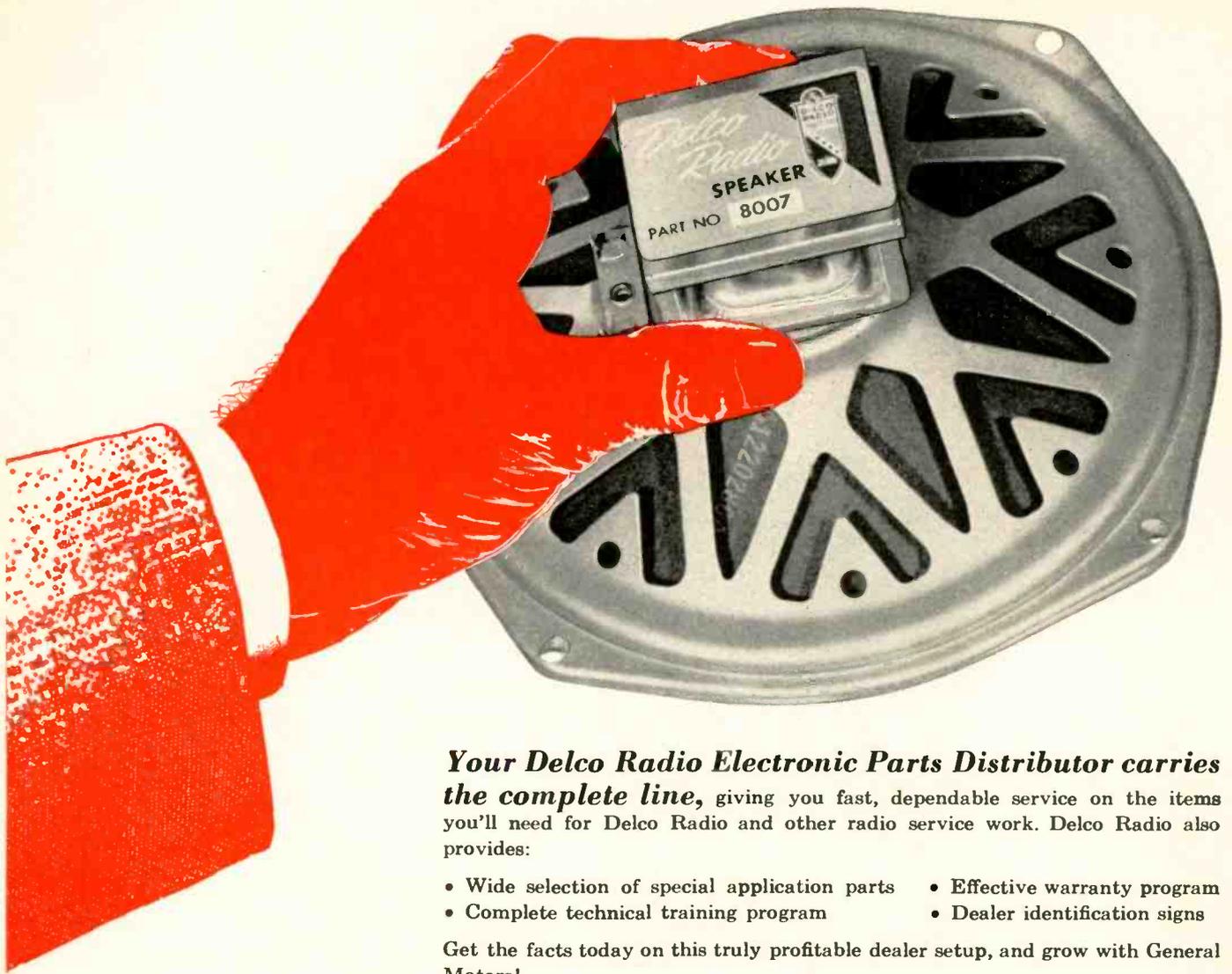
*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**

2-111-2C1

# Use Delco Radio Service Parts!

8-inch "Hi-Fi" speaker, No. 8007 offers the most highs, the most lows, the most watts in a medium-price speaker. Designed for replacement use and high fidelity audio systems.



*Your Delco Radio Electronic Parts Distributor carries the complete line,* giving you fast, dependable service on the items you'll need for Delco Radio and other radio service work. Delco Radio also provides:

- Wide selection of special application parts
- Complete technical training program
- Effective warranty program
- Dealer identification signs

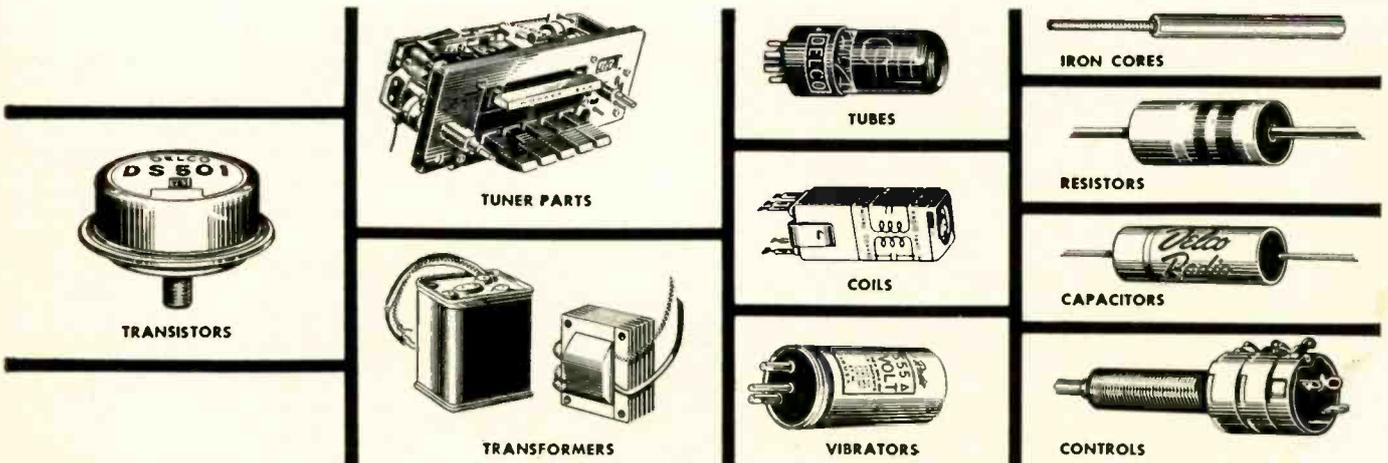
Get the facts today on this truly profitable dealer setup, and grow with General Motors!

Available everywhere through  
Electronic Distributors  
associated with . . .



## DELCO RADIO

DIVISION OF GENERAL MOTORS, KOKOMO, INDIANA





*Silicon Rectifier...* ...1N2078

## NEW Tung-Sol 1N2078 designed and made for simple, speedy TV replacement!

Tung-Sol's new 1N2078 diffused junction silicon rectifier possesses distinct advantages the service industry will welcome. Optimum physical and electrical characteristics combine to make 1N2078 convenient to handle and install, and assure your TV and radio service customers the high-grade performance they want and appreciate.

**Small size, easy to install.** Tung-Sol's 1N2078 is smaller than most semiconductor devices, at no sacrifice in efficiency. Long

flexible leads can be quickly soldered to existing connections with no additional hardware. This is especially suited to printed circuitry.

**Long life.** Negligible voltage drop that remains stable over lengthy operation promotes long life. 1N2078 virtually unaffected by high current surges . . . maintains high B+ over full-length operation.

**Special insulated case.** Special case insulates against chassis shorts to further ease replacement. Also, 1N2078 dissipates its own heat . . . needs no heat sink . . . yet never requires derating. Only leads get hot.

You can replace any other device and, in some cases, rectifier tubes, with the new, high-quality Tung-Sol 1N2078. For complete information . . . to stock up, contact your distributor or: Tung-Sol Electric Inc., Newark 4, New Jersey.

**1N2078 Maximum ratings (100°C) capacitive load:**

(Similar types available with Peak Inverse Voltages ranging from 50 up to 500)

Peak Inverse Voltage	400 Volts
Continuous D. C. Reverse Working Voltage	400 Volts
Average D. C. Output Current	500 mA dc
Peak Recurrent Forward Current	5 Amps.
½ Cycle Surge Current	30 Amps.
Full Load Voltage Drop @ 25°C	1.1 Volts
RMS Input Voltage	130 Volts
Minimum Series Resistance (for capacitive filter)	5 ohms, 10 watt

 **TUNG-SOL**®

Plus Profits for You... now at your

# PHILCO DISTRIBUTOR

Add to your volume and profit... with  
Philco's line of universal products for  
the Hi-Fi, Stereo and  
Tape Recorder  
enthusiast



## NEEDLES

- DIAMOND
- SAPPHIRE
- OSMIUM



## ANTI-STATIC SPRAY

Minimizes surface noise  
and insures needle  
glide.



## 45 RPM INSERTS

Custom-built for  
long wear.



## RECORD BRUSHES

Eliminate harmful dust  
from precious  
records.



## FULL-FIDELITY TAPE

Extra strength and  
extra length.

Further evidence of Philco's  
PROGRAM OF COMPLETENESS  
to America's Service Dealers.



COMPLETE PHILCO NEEDLE CATALOG  
Cross references are complete  
... Illustrations are big ...  
Makes selling easy.



WORLD WIDE DISTRIBUTION: Service Parts • Power  
Packed Batteries • Universal Components • Long-Life  
Tubes • Heavy Duty Rotors • Star-Bright 20/20 Picture  
Tubes • Long-Distance Antennas • Appliance Parts  
• Laundry Parts • Universal Parts and Accessories.

**PHILCO**® Famous for Quality the World Over

(News of the Industry  
Continued from page 18)

SWITCHCRAFT, INC. has named  
THOMAS L. DOWELL as distributor  
sales manager.

UNIVERSAL TRANSISTOR PROD-  
UCTS CORP. has appointed GEORGE  
L. ZIFF as sales engineer.

MORAN PRODUCTS CO. is the new  
name of ROTOR SERVICE CO., Cleve-  
land, antenna rotator manufacturer.

ZENITH RADIO CORP. announces  
the purchase of the entire capital stock  
of CENTRAL ELECTRONICS INC.,  
Chicago. CENTRAL will operate as a  
wholly owned ZENITH subsidiary.

P. R. MALLORY & CO., INC. has  
named MOGENS E. CHRISTIANSEN as  
general sales manager of the MALLORY  
BATTERY CO., Cleveland. Mr. Chris-  
tiansen was formerly assistant general  
sales manager.

HOFFMAN ELECTRONICS CORP.  
reports the following promotions:  
HENRY F. SCHOEMEHL to general  
sales manager; and ROY J. HERTER  
to assistant director of marketing, Semi-  
conductor Div.

QUAM NICHOLS states that their  
special ninety-day promotion on hi-fi  
speakers is winning warm acceptance  
by distributors and dealers. The promo-  
tion points out that list prices provide  
profit for distributor and serviceman.  
Audiophile net to the public is not  
offered.

CHANNEL MASTER CORP. has filed  
an action in the Federal Court, Northern  
District of Ohio, Eastern Div., against  
WHILE-AWAY PRODUCTS CO., of  
Toledo, Ohio, for an infringement of  
Patent No. 2,817,085, covering the  
CHANNEL MASTER "T-W" (Traveling  
Wave) Antenna.

ALTEC COMPANIES, INC. has an-  
nounced the appointment of LEWIS E.  
GILLINGHAM as marketing director  
and advertising manager. Also the  
resignation of ROBERT J. CARRING-  
TON, advertising manager. The firm  
includes ALTEC SERVICE CO., ALTEC  
LANSING CORP., PEERLESS ELEC-  
TRICAL PRODUCTS, and NEWPATHS,  
INC.

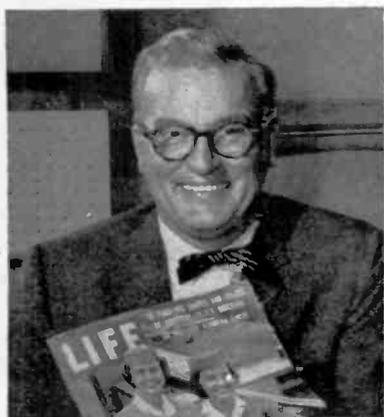
SERVICE INSTRUMENTS CORP.  
announces the following: Registration  
of their trade mark, SENCORE, has  
been officially granted; SENCORE re-  
ports test equipment will be featured  
in ELECTRONIC TECHNICIAN maga-  
zine, in at least six different advertise-  
ments appearing in each monthly issue  
during 1959; and ED FLAXMAN has  
been appointed Vice Pres.

For more information on new prod-  
ucts described in this issue, fill in  
coupon on page 45.



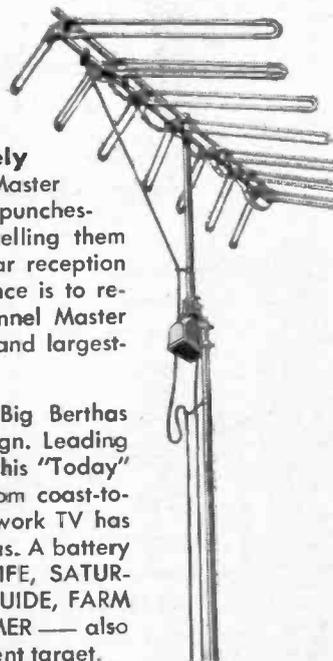
Dave Garroway, NBC-TV star, tells his viewers to replace their old antennas with T-W's.

# **Let Garroway show you** *...how CHANNEL MASTER promotes antenna replacements on network TV, in national ads*



There are millions upon millions of over-aged, obsolete antennas in use today — providing weak TV reception for their owners. **These antennas must be replaced immediately** — and that's just what Channel Master has been telling the public in a no-punches-pulled ad campaign. We're also telling them that the best way to get good, clear reception and more years of peak performance is to replace their old antennas with Channel Master T-W's — the world's most powerful and largest-selling fringe area antennas.

We've wheeled advertising's Big Berthas onto the firing line for this campaign. Leading the barrage is Dave Garroway on his "Today" show, with 134 NBC-TV stations from coast-to-coast. This is the first time that network TV has ever been used to advertise antennas. A battery of 6 top consumer magazines — LIFE, SATURDAY EVENING POST, LOOK, TV GUIDE, FARM JOURNAL and PROGRESSIVE FARMER — also takes aim on the antenna replacement target.



**CHANNEL MASTER CORP**  
 ELLENVILLE, NEW YORK

Copyright 1954 Channel Master Corp.

<p><b>DR330 Dynamic Cardioid and Ribbon</b></p>  <p>Variable low-medium impedance and polar pattern. Frequency response 40 to 15,000 cps. Ideal for radio and TV. LIST \$250.00</p>	<p><b>DR332 Dynamic and Ribbon Cardioid</b></p>  <p>Variable impedance . . . low, medium, high. Unidirectional polar pattern. Frequency response 50 to 10,000 cps. For P.A. and general use. LIST \$162.50</p>	<p><b>R331 Ribbon—Bi-Directional</b></p>  <p>Variable impedance . . . low, medium, high. Bi-directional for P.A. and recording. Frequency response 40 to 10,000 cps. LIST \$140.00</p>	<p><b>TRC Series . . . Push Button Styles</b></p>  <p>Low or high impedance, wide response. For recording, conference, P.A. D204 Dynamic Types: LIST \$17.00—\$24.30 B204 Ceramic Types: LIST \$16.00—\$17.30 X204 Crystal Types: LIST \$16.00—\$18.30</p>
<p><b>D44 Dynamic—Omni-Directional</b></p>  <p>Low impedance; response 50 to 15,000 cps. For motion picture use on booms, excellent for outdoor (with wind screen). LIST \$235.00</p>	<p><b>D33 Dynamic—Omni-Directional</b></p>  <p>Variable impedance . . . low, medium; response 40 to 15,000 cps. For radio-TV, P.A., recording. LIST \$130.00</p>	<p><b>D22 Dynamic—Omni-Directional</b></p>  <p>Variable impedance . . . low, high; response 50 to 12,000 cps. For P.A., studio, general audio use. LIST \$99.50</p>	<p><b>D4 Dynamic—Omni-Directional</b></p>  <p>Low impedance; response 50 to 8,000 cps. Rugged construction, for P.A., etc. LIST \$28.00 D4T similar, but high impedance. LIST \$31.00</p>

# Your All-AMERICAN Line of MICROPHONES . . . *AMERICAN MICROPHONES* FOR EVERY BROADCAST, P. A., MOBILE OR RECORDING NEED



<p><b>D4G Lecturer's Dynamic</b></p>  <p>Low impedance; response 100 to 7,500 cps. Black leather-covered neckband. LIST \$49.00 D4GT similar, but high impedance. LIST \$51.00</p>	<p><b>D9A Dynamic Cardioid</b></p>  <p>Low impedance; response 100 to 7,000 cps. For P.A. and general purpose. LIST \$82.50 D9AT similar, but high impedance. LIST \$86.50</p>	<p><b>D6 Dynamic Public Address</b></p>  <p>Low impedance; response 50 to 7,000 cps. All purpose; rugged construction. LIST \$46.00 D6T similar, but high impedance. LIST \$49.00</p>	<p><b>D7 Dynamic General Purpose</b></p>  <p>Low impedance; response 150 to 10,000 cps. Well built; useful everywhere. LIST \$46.00 D7T similar, but high impedance. LIST \$49.00</p>
<p><b>D7PR Dynamic . . . Handle Type</b></p>  <p>Low impedance; response 150 to 10,000 cps. Press-to-talk switch. LIST \$52.50 D7TPR similar, but high impedance. LIST \$55.00</p>	<p><b>D7H Dynamic General Purpose</b></p>  <p>Low impedance; response 150 to 10,000 cps. General use; pigtail lead. LIST \$46.00 D7HT similar, but high impedance. LIST \$49.00</p>	<p><b>Tape Recorder Microphone</b></p>  <p>High impedance; response 100 to 6,000 cps. Omni-directional; ideal for home use. X203 Crystal Types: LIST \$8.35—\$9.65 B203 Ceramic Types: LIST \$11.50—\$12.80</p>	<p><b>D801 Miniature Dynamic</b></p>  <p>Low impedance; response 250 to 6,000 cps. Compact; can be concealed. LIST \$14.75</p>
<p><b>Crystal Microphones</b></p>  <p>C7H . . . stand type (illus.) LIST \$21.75 CL2 . . . lapel type LIST \$17.25 RC . . . desk type LIST \$13.50</p>	<p><b>501 Series . . . Mobile Types</b></p>  <p>Low or high impedance; response 300 to 3,000 cps. Rugged construction. D501 Dynamic Types: LIST \$25.50—\$34.00 C501 Carbon Types: LIST \$24.50—\$33.00</p>	<p><b>504 Series . . . Mobile Types</b></p>  <p>Low impedance; response 300 to 3,000 cps. Rugged, moisture-proof. C504 Carbon Types: LIST \$31.00—\$38.00</p>	<p><b>Dynamic Hand Sets</b></p>  <p>Low impedance, for use with radio transmitters, intercoms, etc. H602 TYPES: LIST \$21.00—\$25.80</p>

**ALSO —  
ACCESSORIES AND  
REPLACEMENT PARTS  
PHONO PICKUP ARMS  
AND CARTRIDGES**



**Write Today for free Catalog 58**

**NEW American  
TONE ARM ADAPTER**  
converts standard-tone arm to stereo.  
Wiring adapter with output jack.  
No. 1101  
LIST \$2.15

**American Microphone MFG. CO.** division of G-C—Textron Inc.

Western Plant: Los Angeles 18, California  
Main Plant: **ROCKFORD, ILLINOIS, U.S.A.**

## Catalogs & Bulletins

**VOLTMETER:** The new digital voltmeter model 402 is covered on data sheet 19-24. Specifications, applications, dimensions and price are included. Kin Tel, 5725 Kearny Villa Rd., San Diego 12, Calif. (ELECTRONIC TECHNICIAN B1-4)

**TUBES:** A 40-page supplement to the Engineer's Handbook contains new and revised data for fourteen types and eight curve sheets. The table of contents lists more than 500 types now included in the Handbook. CBS-Hytron, Danvers, Mass. (ELECTRONIC TECHNICIAN B1-1)

**ULTRASONIC CLEANER:** Series 5000 SonBlaster is described in a new data sheet. The series consists of 23 systems for applications to mass-production cleaning or degreasing. Narda Ultrasonics Corp., 625 Main St., Westbury, N. Y. (ELECTRONIC TECHNICIAN B1-5)

**RADIO:** A new 4-page brochure covers the Trans-Solar radio which operates on free power from the sun, on light from an incandescent bulb, or by battery. Specifications and operating instructions are given. Hoffman Electronics Corp., 3761 S. Hill St., Los Angeles 7, Calif. (ELECTRONIC TECHNICIAN B1-3)

**CONVERSION CHART:** How to convert tape recorders to stereo by replacing the existing head, and adding another amplifier, is shown in this chart. Over 200 tape recorder models are listed and information shows which one of the four basic mounting heads should be used. Nortronics Co. Inc., 1015 S. 6th St., Minneapolis 4, Minn. (ELECTRONIC TECHNICIAN B1-6)

**TUBES:** Catalog 2220 is a 6-page, two-color, illustrated brochure giving specifications, applications and performance data. Includes data on model 3050 vacuum gauge, designed to measure pressures of 1/1000 to 1/10,000 mm. of mercury. Central Electronic Manufacturers, Denville, N. J. (ELECTRONIC TECHNICIAN B1-2)



"He won't get very far. . . . I wrote it"

ELECTRONIC TECHNICIAN • January, 1959

"FELLAS—THERE'S GOLD IN THESE

# C-D TWIN TREASURE CHESTS"

- **FILLED WITH C-D CAPACITORS**  
the finest you can use to establish customer confidence.
- **FASTER CAPACITOR TURNOVER**  
because you'll always have the fast movers on hand.
- **SPEEDS UP YOUR WORK**  
because replacements are easy to identify, always handy
- **HANDSOME METAL CABINETS**  
make shop neater, prevent misplaced pieces.



### SUGGESTED CONTENTS:

**TWIST-PRONG SECTION CONTAINS** 12 popular C-D "Preferred Type" Twist-Prongs (and room for 6 more)

**TUBULAR SECTION CONTAINS** 16 popular C-D "Blue Beaver" Tubular Electrolytics

73 PM Mylar Tubulars

**BOTH CABINETS ARE FREE. YOU PAY ONLY FOR THE PREFERRED C-D CAPACITORS.**  
YOUR COST: \$49.95

See C-D's "Treasure Chests" at your Cornell-Dubilier distributor or write to Cornell-Dubilier Electric Corporation, South Plainfield, N. J., Department ET-1.



Consistently Dependable  
**CORNELL-DUBILIER**  
SERVICE CAPACITORS



## America's Fastest-Growing Service Capacitor Line...



# NEW!

### TOBE MYLAR\* MOLDED TUBULAR CAPACITORS

- *Molded of DuPont Mylar*, one of the finest insulation materials ever developed.
- *Thermoset Case Construction* secures leads and sections firmly to withstand extremes of handling, vibration, shock and soldering temperatures.
- *High Insulation Resistance*: Average megohm values per unit 10,000 at 25°C. Small capacitance variation with thermal change.
- *Temperature Operating Range*: -55° to +130°C.
- *Moisture Resistant*: Exceeds JAN-C-91 requirements.
- *Non-Inductive*: Extended foil construction insures low resistance connections and low RF impedance.

#### DESIGNED FOR SERVICE DEALERS

#### NEW TOBE MYLAR\* CAPACITOR KIT

FREE KIT CONTAINS  
80 CAPACITORS

ONLY  
**\$15<sup>84</sup>**



Compact, clear-plastic dispenser contains an assortment of 80 Tobe Mylar capacitors in the most popular sizes, ratings and quantities for quick, efficient servicing. Covers over 60 different ratings at 200, 400 and 600 working volts and from .0001 to 1.00 mfd. Dealer pays only for the Tobe Mylar capacitors, kit is free.

Today, order your Tobe Mylar Kit from your Tobe Distributor



TOBE DEUTSCHMANN CORPORATION, NORWOOD, MASSACHUSETTS



GLASER-STEERS moves into larger plant at 155 Oraton St., Newark, N. J.

ASTATIC releases General Catalog 33-3, Cartridge Guide CRC-58.

SHURE ad manager Howard T. Harwood named ad chairman of EP&EM.

ALTEC names Lewis E. Gillingham marketing director and ad manager.

RECOTON appoints Stang Sales rep in N. Y.-N. J. The firm reports the resignation of VP Jack Karns. Alfred Wish is the new VP, Hank Miller sales manager.

ERCONA has been named sole U. S. distributor of British Reslo microphones. Models range from \$59.50 to \$84.95.

CBS is expanding phono operations. The Columbia Phonograph Dept. is being shifted from Columbia Records to CBS-Hytron.

SERVICE TECHNICIAN association in Philadelphia is planning to set up a test standard and buying guide on rated hi-fi units.

JENSEN MFG. is furnishing retailers with "Stereo Center" speaker merchandising display. DS-100 dual or pair of SS-100 systems are used.

BOGEN-PRESTO acquires exclusive distribution rights to phono mechanisms made by Lenco A. G., Burgdorf, Switzerland. Four models to be marketed in the U. S. under the Bogen name are B-21, B-59, B-60 and B-61.

PHILCO has petitioned the FCC to establish an experimental field test program to test the company's new AM radio stereo broadcasting system. This system is reported to be compatible in that it does not degrade AM service to existing monophonic receivers.

RCA announces that production of its magazine loading stereo tape recorder started on Dec. 1. First unit is a 3-speaker portable, the SCP2. Auxiliary speaker for stereo is the SHS13 @ \$9.95 or SHS12 @ \$19.95.

FISHER introduces the MPX-10 multiplex adaptor, designed for stereo use with FM tuners. It is produced under Crosby license, @ \$79.50, less cabinet. KARG is another company making such a unit, the MX-1 @ \$99.50.

UNITED CATALOG announces the United Cost System, a useful jobber business aid. It contains latest jobber cost prices, manufacturer policies and new item announcements. Many jobbers have subscribed to service @ \$25/mo.

BELL SOUND becomes a full division of Thompson Ramo Wooldridge, effective Jan. 1, 1959. The firm was acquired by Thompson Products in 1953.

CONSUMERS UNION Dec. 1958 Buying Guide issue devotes 9 pages to rating hi-fi speakers (as well as 11 pages rating whiskey and wine). To say that CU is way off base would be understatement. Of the many speakers on the market, only 3 makes are considered very good—2 smaller companies making full range units, and one Japanese tweeter import handled by a mail jobber. Again, this distorted reflection on the hi-fi industry points up the need for self-monitoring by manufacturers, perhaps along lines parallel to the publishing industry's circulation audits, as we suggested earlier. Nasty or clever editorials are not the answer. Neither are piecemeal rebuttal tests by independent labs. We strongly urge the Institute of High Fidelity Manufacturers to outline a general approach to the problem in a special meeting called for this purpose.



## The Greater Vibrator

Radiart Vibrators are unaffected by bounce, jounce, heat, cold, moisture. There's a replacement type for every 6- and 12-volt application. Ask your Radiart Distributor for a free Radiart Vibrator Replacement Guide or write The Radiart Corporation, 2900 Columbia Avenue, Indianapolis 5, Indiana.



**RADIART**  
TOBE  
**Vibrators**

# Independent TV-Radio Service Dealers:

# THIS AD IS FOR YOU! \*

next time you call a  
TV-Radio Service Dealer...  
ask yourself  
these 4 questions



## 1 DOES HE HAVE AN ESTABLISHED BUSINESS FACILITY?

It takes a big investment to set up a properly equipped TV-Radio service operation. When the Service Dealer has a place of business—particularly in your community—you can be certain he's planning to stay. Your business is important to him. As an independent small businessman in your community he's going to do everything he can to satisfy you. It's the only way he can assure his own future.

## 2 DOES HE GUARANTEE HIS WORK AND PARTS?

It's standard practice to guarantee work and parts and most qualified dealers do so. Be sure to find out the duration of the guarantee so that you will know just how long you are protected. Remember, however, the guarantee covers only the parts replaced by the dealer, not everything in the set. If some other tube or component fails during the guarantee period the dealer cannot be held responsible.

## 3 DOES HE CHARGE A FAIR PRICE FOR A HOME SERVICE CALL?

Be sure the Service Dealer you choose makes a charge sufficient to cover his time and transportation expenses. Like any other businessman, your Service Dealer has basic costs... overhead, rent, taxes, insur-

ance, salaries, etc. . . . expenses that must be considered when he establishes his service call charges.

## 4 DOES HE PROVIDE AN ITEMIZED BILL?

He should, for his own protection as well as yours. Then you know exactly what work was done, which parts replaced and exactly how much each cost. You both know what replacements are covered by the guarantee in case of an early failure.

If the answer is yes to all four of these questions, the chances are you'll receive fast, competent, expert TV-Radio service at prices that are reasonable.

What's more, the chances are he'll be a Raytheon Bonded Electronic Technician and that's an added bonus for you. These expert technicians offer a 90 day work and parts guarantee that is backed by a Bonded Electronic Technician and that's an added bonus for you. These expert technicians offer a 90 day work and parts guarantee that is backed by a Bonded Electronic Technician and that's an added bonus for you. These expert technicians offer a 90 day work and parts guarantee that is backed by a Bonded Electronic Technician and that's an added bonus for you. These expert technicians offer a 90 day work and parts guarantee that is backed by a Bonded Electronic Technician and that's an added bonus for you.

They observe a strict 8-Point Code of Business Ethics designed to protect you. For the quick, safe, sure solution to all TV-Radio servicing problems, call a Raytheon Bonded Electronic Technician.

For Your Convenience  
Raytheon TV-Radio Service Dealers  
Are Listed in The Yellow Pages of  
Your Telephone Directory



**Raytheon Quality TV and Radio Tubes Mean Better Set Performance for You** . . . When a Service Dealer replaces old tubes with Raytheon Tubes you're sure of long life and lasting operation. Produced by Raytheon, pioneers in electronics, these fine tubes are made to the same rigid standards of quality and precision that are made to the major Raytheon Tubes, Transistors and Diodes that are designed into the major missiles. A lifetime of experience in the development and production of Raytheon Tubes for military, industrial and commercial applications is behind them. That's why you are certain of satisfaction from Raytheon TV and Radio Tubes.



Excellence in Electronics

Raytheon Manufacturing Company, Distributor Products Division, 56 Chapel Street, Newton 58, Massachusetts

Raytheon is running this advertisement in the January 19, 1959 editions of NEWSWEEK and TIME magazines to help you. Read it carefully. It makes four simple suggestions to set owners that should result in substantial increases in service business for qualified Independent TV-Radio Service Dealers. It clarifies the set owners' misunderstand-

ings about the standard work and parts guarantee. Giant blow-ups of this advertisement are available from your Raytheon Tube Distributor at no cost to you. Be sure to feature one in your shop window.

# ELECTRONIC TECHNICIAN

SERVICE

## Welcome *SERVICE* Subscribers

Something new has been added. Starting this month, **ELECTRONIC TECHNICIAN** goes to thousands of *SERVICE* subscribers to fill the unexpired portion of their subscriptions after October 1958—when we purchased and merged *Service* into **ELECTRONIC TECHNICIAN**.

To the *SERVICE* readers who are receiving **ELECTRONIC TECHNICIAN** for the first time—welcome to the fold. We are delighted to have you join our fraternity of professional technician readers. And we hope you will be as outspoken as our old-time readers in telling us what you like, what you don't, and how we can best serve you.

### **Our Aims and Policies**

To help us get acquainted more quickly with former *SERVICE* subscribers—and further to clarify some points for our long-time friends—let's state some of the important things **ELECTRONIC TECHNICIAN** believes in and does.

First, we are dedicated completely to serving the electronic maintenance industry, disseminating useful information, and fighting for the rights of independent service businesses.

We cater to the professional technician. We are not interested in the hobbyist, so we do not sell on newsstands.

We are the only magazine in the electronic service trade to publish a complete Buyers Directory (every May), and to provide, at no extra cost, 16 pages of the latest schematics every month (Circuit Digests, inside back cover).

We believe technicians should join and be active in their local service associations.

We are firmly opposed to captive service—that is, service business grabbed by the set manufacturer or his distributor by combining service cost with the set's purchase price. (Copies of our editorial, "Fighting Mad Over Captive Service," available on request.)

Though we are affected by the same rising production costs which are forcing other electronic publishers to increase their subscription price, we plan to retain the same rate in effect since **ELECTRONIC TECHNICIAN** was founded.

We believe that a well-informed technician, be he employer or employee, has a most promising future in the constantly expanding electronic industry. Not only do the growing number of radio and TV sets require maintenance, but high fidelity, communications and industrial electronics are opening new avenues toward greater installation, sales and repair opportunities.

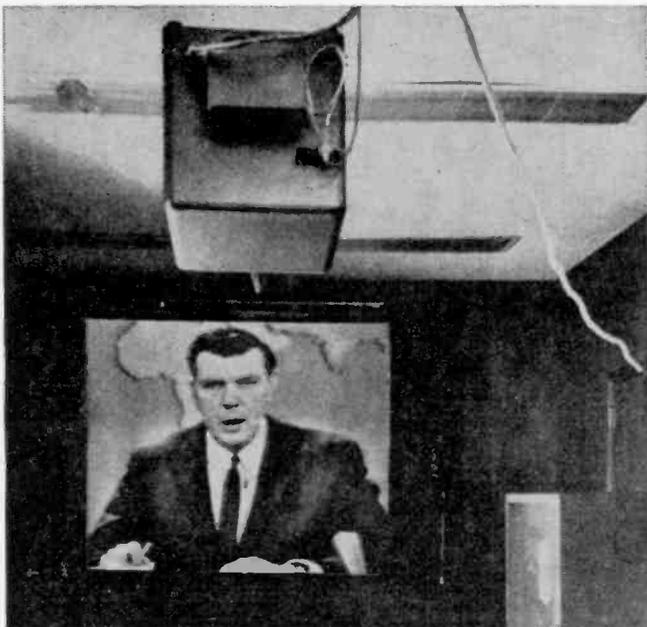
And we believe that the electronic technician is a vital force in shaping the fabulous electronic future.

# Tuning In the

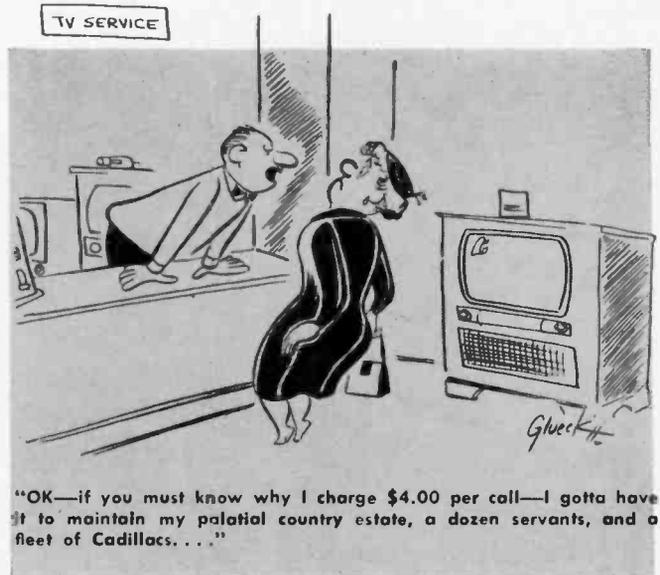
**HIGH FIDELITY** has become important business for service dealers and technicians—and vice versa. Manufacturers are catering to the servicing arm of the industry more than ever. Blonder-Tongue has come out with a hi-fi tuner and amplifier line designed to be sold from the jobber through the service technician to the consumer. Units carry a list price instead of audiophile net. Walco (Electrovox) has developed a Super Bonus Club program based on stamps removed from phono needle boxes. Based on the number of stamps, small dealers can obtain paid-up life insurance, hospitalization and other big company type benefits. And as many technicians have found out, most hi-fi units sold by jobbers can be purchased by technicians at below "audiophile net" for profitable resale and custom installation.

**REGULATED HIGH-VOLTAGE DC:** is magnetically regulated and capable of providing 2,300 volts at 15-50 milliamperes, with  $\frac{1}{4}\%$  regulation. Isolation of the control and output sensing circuits from the high-voltage output is accomplished by placing the control element—a self-saturating magnetic amplifier—on the low-voltage input side of the regulated supply and by adding an auxiliary winding for output sensing. Silicon rectifiers in the high-voltage output circuit and in the voltage reference circuit are used. A conventional voltage doubler serves as the high-voltage rectifier.

## COMPACT TV PROJECTOR



Remote control TV projector throws picture up to 12 by 15 ft. on movie screen. Unit by Giant View div. of Meilink may be suspended from ceiling or placed on table without obstructing view, thereby making possible use in smaller rooms than were previously possible.



**FTC WAR ON FICTITIOUS PRICES.** Solid support for the Federal Trade Commission's drive to curb price trickery in advertising has been volunteered by representatives of the nation's most influential business organizations, including those for newspapers, radio and television, advertising, and the Better Business Bureaus. The object of this effort is to combat the practice of many merchants and manufacturers to exaggerate the original price of consumer products in order to make the selling price appear to be a bargain. A month ago the FTC issued a nine-point guide to clarify where and how this kind of deception violates the law.

**THINK YOU'RE FAST** with that tube tester? Well, RCA has come up with a machine (for tube manufacturers) which tests up to 2,500 electron tubes in an hour. Fifteen individual electrical tests are performed on each tube. Here's how it works. The operator inserts the tubes into sockets on a conveyor, or into a chute if the tubes are to be automatically loaded. As the tubes travel along the conveyor, they are preheated and tested at various stations. Those not meeting specification are ejected at the respective station. Good tubes continue to the final station—all automatically.

**INTERESTING SALES TREND** noted by Ken Tibbetts, vice president of the National Credit Office, is that jobber sales volume is increasing at the fastest rate in certain low-population areas. This underscores the importance of dealer outlets in non-metropolitan markets, many of which have been sorely neglected by a number of manufacturers. It must be recognized that some 70% of the nation's population is in towns of under 100,000.

# Picture .....



AMERICANS may have more than half of the world's 117,800,000 telephones (63,621,000 to be more exact), but people in other countries are out-talking us. We averaged 460 conversations per person last year, but Canadians hit a 497 average. Alaska averaged 581 conversations, the most talkative area of all.

AN ADVERTISING TRADE magazine has a section called, "Advertising We Can Do Without." We nominate the Lewyt Corp. for this dubious honor for its ad on an "electronic" vacuum cleaner. The beater sweeper and headlight are claimed to be electronic, though the former is a rotating nylon brush. When we asked the company exactly what was electronic about the vacuum cleaner, what components were used, etc., we were told that the president was in Europe, and the policy ruling was that nothing was to be released on the unit.

**LOUD FIDELITY.** Residents of Paramus, N.J., were warned not to panic while Bogen tests its 9 kw (that's right, KILOWatts) public address system. This 76-speaker giant is an airborne system to enable the Air Force to direct ground activity from a considerable altitude. To avoid sound damage, the speakers are pointed skyward during the tests, instead of groundward as they would in actual use.

**FABULOUS GROWTH** for transistor volume is anticipated by James Sweeney, GE semiconductor marketing manager. 1958 sales of 44,000,000 units is about 3½ times as many as 1956. For 1959, sales of 66,000,000 transistors are predicted, a 40% gain.

## CALENDAR OF COMING EVENTS

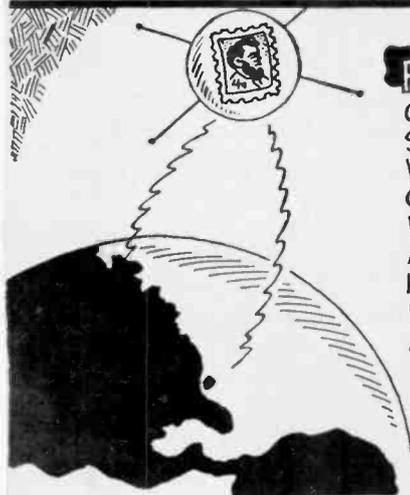
- Jan. 12-14: 5th Natl. Symposium on Reliability & Quality Control, Bellevue-Stratford Hotel, Philadelphia, Pa.
- Jan. 21-23: Southwest Electronic Exhibit, Ariz. State Fairgrounds, Phoenix, Ariz.
- Jan. 26-29: Plant Maintenance & Engineering Show, Public Auditorium, Cleveland, Ohio
- Mar. 3-5: Western Joint Computer Conference, Fairmont Hotel, San Francisco, Calif.
- Mar. 23-26: IRE National Convention, Coliseum & Waldorf-Astoria Hotel, New York, N. Y.
- May 6-8: Electronic Components Conference, Ben Franklin Hotel, Philadelphia, Pa.
- May 11-13: Joint Conference on Automatic Techniques, Pick-Congress Hotel, Chicago, Ill.
- May 18-20: 1959 Electronic Parts Distributors Show, Conrad Hilton Hotel, Chicago, Ill.

### HI-FI SHOWS

- Feb 7-10: Cow Palace, San Francisco, Calif.
- Feb 16-23: Biltmore Hotel, Los Angeles, Calif.

**ONE YEAR SERVICE** guarantee on its "StenOtape" tape recorder-transcriber, has been announced by American Geloso Electronics, 312 Seventh Ave., New York City. The guarantee will be carried out by independent service technicians, whom the firm invites to seek franchises.

## RANDOM NOISE



POST OFFICE SYSTEM OF FUTURE MAY UTILIZE STANDARD LETTER FORMS WHOSE CONTENTS ARE CONVERTED TO MICROWAVE SIGNALS WHICH ARE BOUNCED OFF SATELLITE REPEATER STATION. IT WILL COST THE SAME AS AIR MAIL, BE TWICE AS FAST

TOM HIGGINS JR.



**ROBOT COAL MINER** CONTROLLED BY ONE MAN HAS SENSING ELEMENTS WHICH TELL OPERATOR IF MACHINE IS HEADING INTO COAL. THIS REMOTE SYSTEM WILL BE AVAILABLE IN 5 TO 10 YEARS



LIST PRICES FOR TV SETS ARE HEADING UPWARD IN 1959. RISE SHOULD RANGE FROM \$5 TO \$20

# Hi-Fi Servicing With A

## Standard Shop Procedure Plus Proper Test Equipment Extracts

### HARMONIC DISTORTION

#### Significance

#### Ease Of Use In The Field

#### Equipment

- Audio Signal Generator
- Harmonic Distortion Meter
- Oscilloscope

#### Measurements

- Output Level
- Distortion
- Hum

NORMAN H. CROWHURST  
&  
ROBERT CORNELL

• Servicing hi-fi equipment is a specialized endeavor which combines regular servicing procedure with certain laboratory techniques. The hi-fi owner is discerning of quality, and particularly critical of distortion. Distortion measurements and analyses are a must. What discourages many technicians in the beginning is the apparent complexity of the many different forms of distortion. This situation is not helped much by the lack of agreement as

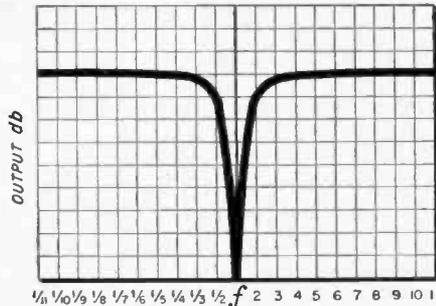


Fig. 2—Sharply tuned notch filter removes the fundamental and leaves only the harmonics:

to what distortion is undesirable, and to what degree it must exist before it becomes objectionable. Some engineers may feel that a certain amount of harmonics may actually enhance the listening quality of certain types of musical programs. Others will argue that if the sound isn't in the program source, it shouldn't be in the output of the speaker. Almost all authorities believe that reproduced notes not harmonically related to the original signal is better left out. This is usually a product of intermodulation distortion (IM) where two signals get together and a third one develops because of sum or difference beat notes. Research on what distortion is of importance is still in progress, and more information is becoming available.

To point up the problem of evalu-

ating the significance of distortion readings, consider the amplifier that sounds nice and clean and yet according to the harmonic distortion analyzer has a very high distortion figure. On the other hand, where does the distortion come from when the readings are low, and the amplifier sounds terrible? IM techniques do not fare any better. An amplifier may come through admirably for one set of test conditions and make out poorly for another. Too many variables as to the selection of different frequencies, and relative amplitudes enables a large number of unrelated measurements to be made, which may or may not reflect what the amplifier will do under actual operating conditions. Some efforts have been made to standardize this procedure, but several methods prevail, and there is considerable disagreement as to the merits of each.

An important consideration in developing any system of measurements, is ease of accomplishment in the field as well as in the laboratory. Total harmonic distortion measurements are easier to accomplish, contain fewer variables, and are more widely used. It is therefore of advantage to know what is involved in the use of an harmonic distortion analyzer. One basic concept of a well designed audio amplifier is that it is a linear device.

Fig. 1—Harmonic distortion meter measures total amplifier output after the fundamental has been removed. The scope aids in interpreting the measured voltages.

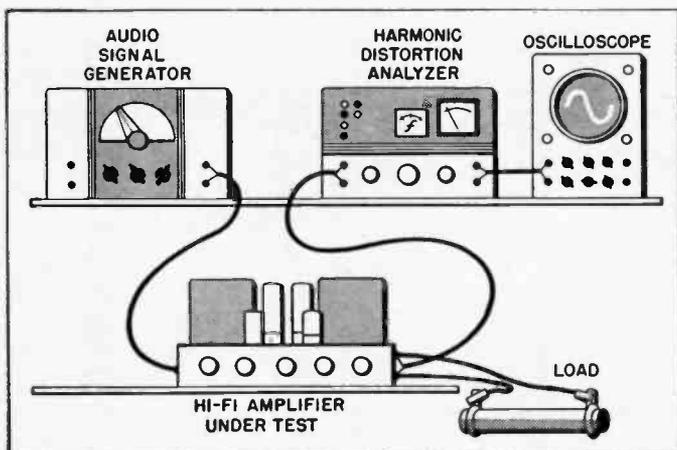
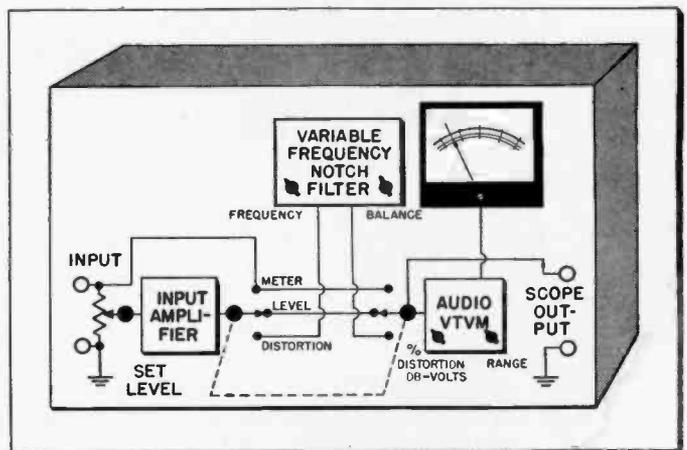


Fig. 3—In addition to showing total harmonic distortion as a percentage of the entire output signal, the analyzer can be used as an audio VTVM to measure hum, noise, rated output, and other levels.



# Harmonic Distortion Meter

Laboratory Intelligence From Harmonic Distortion Measurements



If a pure sine wave signal is fed into the amplifier, theoretically, the output should be the same clean signal only amplified. Should any non-linearity exist, the output will be distorted. It can be shown that a distorted waveform contains many sine waves which are harmonically related to the fundamental. IM distortion is also a function of non-linear amplification, and somewhere along the line, under certain conditions, relationships do exist between IM and harmonic distortion.

To determine harmonic distortion, it is necessary to inject a harmonic-free sine wave signal into the amplifier, and measure the signal at the output before and after the fundamental has been removed. If there are no harmonics present, the output signal would be zero, assuming of course that hum and noise are not present, after the fundamental has been removed. The presence of harmonic components are measured, and expressed as a percentage of the total output signal.

% Distortion =

$$\frac{\text{Output Signal-Fundamental}}{\text{Output Signal + Fundamental}} \times 100$$

Because the amplifier may exhibit different distortion characteristics at different frequencies, and at different signal levels, it is more significant to develop a family of readings. These are accomplished quite rapidly once the equipment is connected.

Use of the equipment is straightforward and logical, once the technician has an overall concept of what is happening. As in a fine camera, each control and adjustment affects the picture; when properly made the finished product represents the object of interest. The chain-like arrangement in Fig. 1 shows a logi-

cal flow of signal from a good audio signal generator to the amplifier under test and to the distortion meter. The scope is highly desirable, but not essential to the tests. The scope does enable the observation of what is being measured. Hum, noise and other spurious or parasitic response can be seen and to some extent the meter readings can be interpreted and become even more meaningful.

Before showing how to twist the knobs, it is well to keep in mind what the distortion analyzer does. Essentially it traps out the fundamental frequency of the test signal from the amplifier output and permits everything else to be measured by the meter circuit. The response curve of the analyzer in Fig. 2 shows a very sharply tuned trap, and relatively flat response to all frequencies above the second harmonic. The purpose of the knob twirling then is to adjust the trap to the fundamental frequency. The meter circuit measures the signal with and without fundamental, and is calibrated to indicate percentages, db, and volts. Of course it stands to reason that the harmonic content of the test signal from the generator must be significantly lower than the harmonic distortion of the amplifier for the readings to be meaningful. A generator's signal can be cleaned up by using appropriate filters if necessary. It is also essential that the

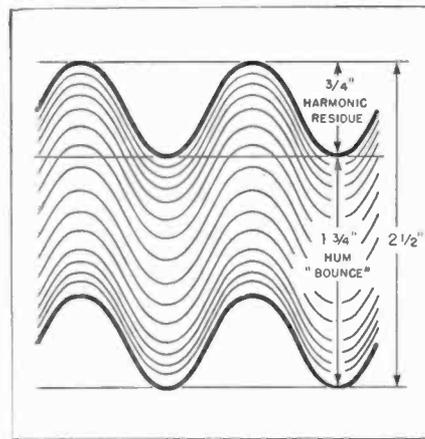
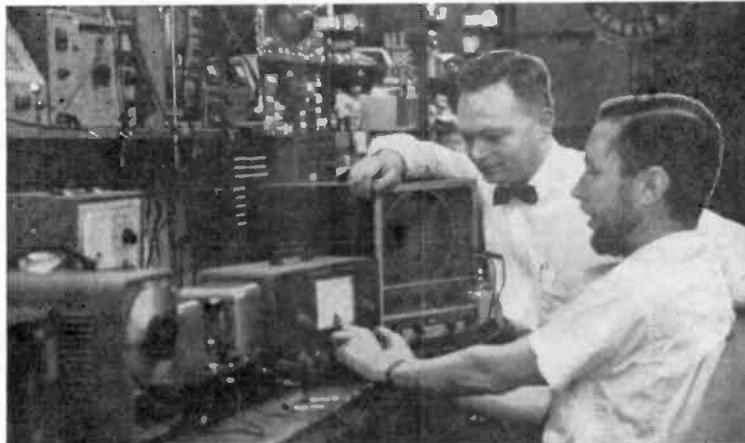


Fig. 4—To estimate the amount of hum in the harmonic meter reading determine the ratio of hum bounce to the total peak-to-peak amplitude, and multiply it by the meter amplifier's input and output impedances be properly terminated.

Adjust the generator's output level to obtain the desired power output from the amplifier. Assuming that 25 watts is desired, and the resistive load used to match the amplifier's output impedance is 16 ohms, the output voltage required is 20 volts. This is easily derived from the power equals  $E^2$  over  $R$  formula. Fig. 3 is a functional diagram of a distortion analyzer showing the operating controls.

Voltage can be measured by the audio VTVM function of the distortion analyzer. To use this function it is necessary to select the proper (Continued on page 34)



Authors Cornell and Crowhurst (l to r) put an amplifier through its paces. Sometimes it takes two hands to obtain minimum reading one on the frequency selector and the other on the balance control.

# 1958 TV-Electronic Industry Statistics

## TELEVISION

New sets .....	5,900,000
\$ volume at retail .....	\$1,080,000,000
Sets scrapped .....	2,800,000

## TELEVISION SETS IN USE

U.S. homes* with b & w sets .....	42,800,000
Secondary sets in above homes .....	4,800,000
Sets in business places, institutions .....	2,700,000
Color sets (included above) .....	360,000
Total TV sets in U.S. ....	50,300,000

## RADIO

New sets .....	12,300,000
\$ volume at retail .....	\$ 452,000,000

## RADIO SETS IN USE

U.S. homes* with sets .....	52,900,000
Secondary sets in above homes .....	50,400,000
Sets in business places, institutions .....	13,100,000
Automobile sets .....	42,800,000
Total radio sets in U.S. (including 14,500,000 FM) .....	159,200,000

\*Includes all dwellings such as apartment hotels, etc.

## ANNUAL RETAIL BILL FOR SERVICING

190,000,000 replacement receiving tubes	\$ 340,000,000
6,600,000 replacement picture tubes	\$ 260,000,000
Antennas, components, parts, instruments	\$ 840,000,000
Labor	\$1,170,000,000
Total servicing bill	\$2,610,000,000

## INDUSTRIAL ELECTRONICS

Industrial electronics, factory sales .....	\$1,450,000,000
Industrial electronic & communications maintenance (22.8% of outlets) .....	\$ 76,000,000
Industrial electronics & communications, sales through 6.8% of service outlets	\$ 12,900,000

## TV-ELECTRONIC TECHNICIANS

Major service outlets .....	63,500
Parts jobber business accounted for .....	68%

## TUBES MANUFACTURED

### Picture Tubes

Number made (including 3.4 million rebuilds) .....	12,500,000
% used for replacement .....	52.8%

### Receiving Tubes

Number made .....	430,000,000
% used for replacement .....	44.2%

## TRANSISTORS

Number made .....	45,000,000
% used for replacement .....	6%

## TELEVISION STATISTICS 1946-1956

Year	Sets Manufactured	Total Sets in Use	TV Stations on Air
1946	10,000	8,000	5
1947	250,000	230,000	20
1948	1,000,000	1,000,000	44
1949	3,000,000	3,800,000	100
1950	7,500,000	10,500,000	107
1951	5,600,000	15,750,000	108
1952	6,300,000	21,800,000	123
1953	7,300,000	28,000,000	350
1954	7,300,000	33,000,000	415
1955	7,800,000	39,000,000	465
1956	7,300,000	43,900,000	495
1957	6,800,000	47,240,000	512
1958	5,900,000	50,300,000	526

## AUDIO

Home Hi-Fi Service (74.5% of outlets)	\$ 114,000,000
PA Installation & Repair (37.1% of outlets)	\$ 59,000,000
Phonographs sold	4,500,000
Phonographs \$ volume at retail	\$ 365,000,000
Phonographs in U.S.	37,100,000
Tape recorders sold	550,000
Tape recorder \$ volume at retail	\$ 102,000,000
Hi-Fi audio \$ volume	\$ 230,000,000

ELECTRONIC TECHNICIAN statistics are an industry reference, used each year by such authoritative sources as the World Almanac.

(Continued from page 33)  
 position of the function switch, and the proper range. Sometimes a separate set of terminals are provided for this purpose. If preferred, a separate audio voltmeter could be used. Once the input frequency and level is set to get the desired output voltage, turn the function switch to the "calibrate," or "set-level" position, making sure that the range switch is at 100%. Adjust the input control of the distortion analyzer so that it reads full scale. This sets the gain of the analyzer so that the next measurement can be related and expressed as a percentage of the first reading, and not just another voltage reading. Next place the func-

(Continued on page 52)

Norman Crowhurst emphasizes the importance of having appropriate equipment for hi-fi servicing. Selection of kits or factory made testers depends upon individual preference and need.



# The Lowdown On Small Business Administration Loans

## Who May Borrow? How To Obtain A Loan

LARSTON D. FARRAR \*

• Many small electronics firms have been getting loans from, or with the aid of, the Small Business Administration (SBA). Commercial banks have become very choosy about the businesses to which they will extend adequate credit.

Inquiries about loan policies were tabulated and presented to SBA officials for their answers. The questions and answers do present most of the pertinent general information. For specific cases it may be desirable to contact the nearest field office, the address of which can be obtained by writing to the Small Business Administration, 811 Vermont Ave., N. W., Washington 25, D. C.

Q. What type or types of loans are available from the SBA, and what businessmen are eligible?

A. Small Business Administration loans are available to small companies in the manufacturing, wholesaling, retailing and service fields.

There are four types of SBA loans. These are: (1) Participation; (2) Direct; (3) Limited Loan Participation, and (4) Disaster.

A Participation Loan is one made jointly by the SBA and banks or other private lending institutions. Two thirds of the agency's loan approvals are in this category. In many cases of bank-participation loan agreements, the bank will assist the potential borrower with the filing of the loan application.

A Direct Loan is one in which there is no bank participation. All of the funds are advanced by the Government. It is the policy of the SBA to make direct loans only after the inability of negotiating a bank-

participation agreement has been exhausted. The SBA will not make any type of loan, Direct or Participation, until the potential borrower has tried, unsuccessfully, to obtain a regular bank loan. By law, the SBA can make loans to small firms only when financing is not otherwise available on reasonable terms. If the bank will not make a loan even with the SBA participation, the businessman may then apply for a direct loan from the SBA. His application must be accompanied by a letter from the bank stating that it is unable to make the loan. If the businessman's firm is located in a city of 200,000 population or more, his application to the SBA must be accompanied by letters from two banks stating that they cannot grant the requested loan.

A Limited Loan Participation loan is designed especially to assist small retailers, wholesale distributors and service establishments, although other types of business loans are also available to them. As a rule, small concerns in these fields have very little in the way of tangible collateral which they can pledge for a loan. However, they often have a good earnings record, competent management, and a creditable record with local banks for meeting their obligations. Under this plan, the SBA will participate with a bank in a loan to a firm up to a maximum of \$15,000, or 75 per cent of the total amount of the loan, whichever is the lesser. Generally, the participating bank's share in the loan must represent additional exposure on the part of the bank equal to not less than 25 per cent of the total amount of the loan. The maximum maturity on Limited Loan Participation agreements is five years. Maturity of other types of SBA loans may be as long as 10 years.



A Disaster loan is made to businessmen, home-owners, and individuals, in areas designated as "disaster areas" by a federal agency, for any of a number of reasons. These are low-interest loans—three per cent—made to tide over those stricken by disaster until they can get on their feet.

Q. Is it any easier to get a Small Business Administration loan if I can arrange for partial private financing?

A. Naturally, if a local bank, which is familiar with a small firm's credit record and its day-to-day operations, is willing to share in an SBA loan to the firm, helps to assure the Agency that the loan is a good risk. Further, since the bank has done more of the necessary credit investigation before the loan request is submitted to the SBA, the Agency can usually process this type application more quickly.

Q. What are the maximum amounts available to me?

A. The amount which you may borrow from the SBA depends upon how much you need to carry out the intended purpose of the loan. However, under the Small Business Act of 1953, which created the Agency, the largest loan the Small Business Administration can make to any one borrower is \$350,000.

Q. What are the terms of repayment on a loan?

A. SBA's business loans usually are repayable in regular monthly  
(Continued on page 67)

of "Washington Lowdown."

# Extend VOM Or VTVM For Reactance Measurements

## Voltage Divider Circuit Enables Quantitative Evaluation

AL DIAMOND

• The use of a capacitance and inductance bridge and other quantitative checkers are of advantage in many instances of radio, TV and industrial electronic servicing. Peaking and other wave-shaping circuits, tuned circuits, etc., are usually critical of the value of the reactive components therein. A VOM or VTVM, in addition to the host of other functions, can be used to measure inductive and capacitive reactances. Some meters are already calibrated for this purpose, but most of them are not. Even those that are, can have their range and versatility extended by knowing and applying some of the pertinent principles and techniques.

In addition to the meter, an a-c voltage source is required. A 60-cycle power line or a signal generator

Table 1—Percent of applied voltage developed across the standard in the voltage divider without meter loading.

Unknown $X_L$ in mh $X_C$ in $\mu f$	0.01		0.1		1.0	
	$L_s$	$C_s$	$L_s$	$C_s$	$L_s$	$C_s$
0.001	91	9				
0.002	83	17				
0.004	71	29				
0.005	67	33				
0.006	63	37				
0.008	55	45				
0.01	50	50				
0.02	33	67	91	9		
0.04	20	80	71	29		
0.05	17	83	67	33		
0.06	14	86	63	37		
0.08	11	89	55	45		
0.1	9	91	50	50	91	9
0.2			33	67	83	17
0.4			20	80	71	29
0.5			17	83	67	33
0.6			14	86	63	37
0.8			11	89	55	45
1.			9	91	50	50
2.					33	67
4.					20	80
5.					17	83
6.					14	86
8.					11	89
10.					9	91

could be used. Except for the difference in calibration, the same general rules apply to both capacitive and inductive reactance measurements. Straight voltage-divider action takes place when two or more elements are placed in series with a voltage source, as shown in Fig. 1. It is possible to substitute resistors for the known reactive elements, and still obtain similar divider action. On the other hand, it is not desirable to mix inductive and capacitive elements in the same voltage divider test circuit except for special known cases—under these circumstances phase changes and resonant conditions could cause misleading interpretation.

The action of the divider is seemingly simple. If the unknown component is equal to the known component (standard) then the voltage across each will be exactly half. In the case of capacitors, the larger the unknown the less reactance it has,

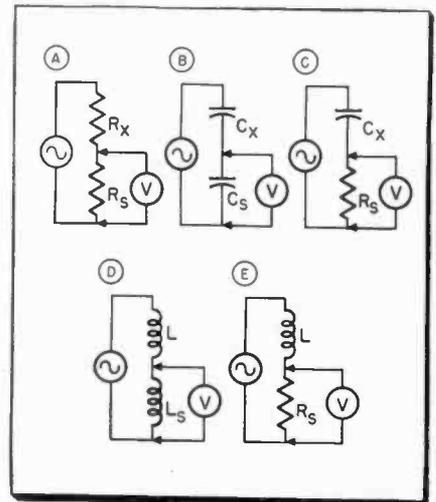


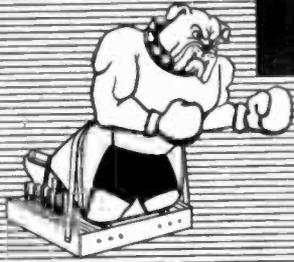
Fig. 1—Voltage divider action permits reactance measurements with the VOM or VTVM.

and the more voltage is impressed across the standard. The converse is true of inductors and resistors. Table 1 contains a series of percentages of (Continued on page 65)

Tables 2 & 3—Reactance values, in ohms, of inductors and capacitors at indicated frequencies. Top table calls out approximate size of resistors which may be substituted for  $L_s$  and  $C_s$ .

$L_s$ & $C_s$ Reactance In Ohms								
L in mh C in $\mu f$	60 cps		400 cps		1,000 cps		500 kc	
	$X_L$	$X_C$	$X_L$	$X_C$	$X_L$	$X_C$	$X_L$	$X_C$
0.01	0.0038	265,000	0.026	40,000	0.062	16,000	32	32.
0.1	0.038	26,500	0.26	4,000	0.62	1,600	320	3.2
1.0	0.38	2,650	2.6	400	6.2	160	3,200	0.32

L in mh C in $\mu f$	60 cps		400 cps		1,000 cps		500 kc	
	$X_L$	$X_C$	$X_L$	$X_C$	$X_L$	$X_C$	$X_L$	$X_C$
0.001	0.0004	2,600,000	0.0025	398,000	0.006	159,000	3	320.0
0.005	0.002	531,000	0.015	80,000	0.03	32,000	6	65.0
0.01	0.004	265,000	0.026	40,000	0.06	16,000	32	32.0
0.02	0.008	133,000	0.05	20,000	0.15	8,000	62	16.0
0.05	0.02	53,000	0.15	8,000	0.3	3,000	155	6.5
0.1	0.04	27,000	0.25	4,000	0.6	1,600	320	3.2
0.25	0.1	10,600	0.65	1,600	1.6	640	800	1.3
0.5	0.2	5,300	1.5	800	3.2	300	1,600	0.65
1.0	0.4	2,700	2.5	390	6.2	160	3,200	0.3
2.0	0.75	1,300	5.0	200	12.5	80	6,200	0.
4.0	1.5	660	10.0	100	25.0	40	12,500	0
5.0	1.8	525	15.0	80	32.0	32	16,000	
8.0	3.0	330	20.0	50	50.0	20	23,000	
10.0	3.8	260	25.0	40	62.0	16	32,000	



# "Tough Dog"



## Corner

### Difficult Service Jobs Described by Readers

#### Dynamic Voltage Divider

This particular tough dog, a Westinghouse TV chassis V-2216-1, was brought in with a complaint that, "it loses the picture when the channels are changed."

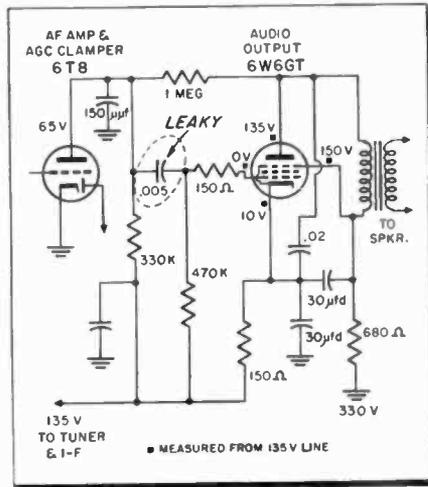
Our three operating channels were checked. Good video, audio and sync were present. Tubes were tapped and visual inspection was made, but no trouble symptoms showed up. After about fifteen minutes of operating, the set was checked again. This time when another channel was switched in, a severe case of overload with complete loss of sync developed. Tubes were substituted along the video signal path without improvement. When the 6T8 audio amplifier and agc clamper tube was removed from its socket the picture became normal.

A new tube was installed and the picture still remained normal. I thought that was it; that is until I tried changing channels—the trouble came right back again. At this point the schematic was studied. A keyed agc is used, and the audio output tube acts as a B+ voltage divider. The 135 volt line from the cathode of the 6W6 supplies the i-f and tuner stages. The 6T8 was removed and again the picture recovered. Suspecting a defect in the delay circuit, I monitored the tuner agc voltage with the tube in and out. There was no change. From past

experience I have learned the merits of the oscilloscope and waveform measurements when everything seems to be normal, and still a trouble persists, and so I put it to use in this problem.

The scope showed a normal keying pulse at the plate of the agc tube but the composite video signal at the control grid was barely 25 volt peak-to-peak instead of 30 volt

a greater than normal voltage drop existed across the tubes. A bias measurement next showed 30 volts instead of the normal 10 volts. A search for defective components in the grid circuit paid off by finding a leaky 0.005  $\mu$ f coupling capacitor. Replacing the capacitor cured the trouble. As to why the picture seemed to behave with the 6T8 removed—the excessive bias was the result of direct current from the plate of the 6T8 tube through a parallel path around the plate load resistor through the leaky coupling capacitor and the 470,000 ohm grid resistor. Reduced B+ voltage to the tuner and i-f stages was just enough to make this an excellent borderline case.—Robert Samodell, Cleveland, Ohio.



Defect in grid circuit of audio output tube was cause of intermittent loss of video.

peak-to-peak. Going back to the output of the video detector a 3 volt peak-to-peak signal was present instead of the normal 5 volt signal.

Assuming that the signal strength at my bench is normal and if agc is below normal, an even greater output at the detector would occur rather than smaller. Proceeding further, B+ voltage checks were made in the i-f stages which led to what was supposed to be the 135 volt line from the cathode of the audio output tube. It was down to 110 volts. The plate and screen voltages on the 6W6 tube were normal which meant

#### Screw Loose Hum

A 17-inch Admiral model 21F1 had a 60-cycle hum bar in the picture. At times it would upset both horizontal and vertical sync. All tubes including the CRT were checked for shorts and leaks—none existed. The scope indicated the presence of hum as far back as the cathode of the first video i-f stage. This modulated the current flow through this tube and was amplified at each succeeding stage. Hum was also present at the low end of the 47-ohm cathode resistor, which meant that the i-f chassis itself had a hum potential. Further inspection showed that the i-f string was mounted on a copper-plated steel sub-chassis secured to the main chassis by four self-tapping screws; two at the detector end and two at the first i-f end. First I tightened the screws at the output end, but these were already down solid. The other two screws did give some, enough to eliminate the hum.—Max L. Levy, Alexandria, Va.

#### TOUGH DOGS WANTED!

Send your entries to "Tough Dogs" Editor, ELECTRONIC TECHNICIAN, 480 Lexington Ave., New York, N. Y. For acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Photos are desirable. Unacceptable items will be returned. Your entries to "Tough Dogs" Editor, ELECTRONIC TECHNICIAN, 480 Lexington Ave., New York, N. Y. subject to our arrangements.

# Radio-Frequency Induction And

*Industrial Electronics Employs RF Energy To Apply Controlled*

ALLAN LYTEL

• Radio frequency energy is used in industry for heating materials, both conductors and insulators. Induction heating is employed when working with conductive materials, and dielectric heating is used when the work is a non-conductor.

### Induction Heating

Induction heating is a method for obtaining localized and controlled heat by induced currents. Because the metallic work piece has both eddy-current and hysteresis losses the temperature increases in it in much the same manner as heat is produced in a transformer core. Typical advantages of induction heating over other methods are: controlled areas of heating, rapid application of heat, precise control of the amount of heat, and uniformity of heat application. The principle disadvantage is high cost. This may limit applications to specialized cases which can not be done

Frequency	Application	Equipment
60 CPS—10 KC	Low-temperature heating, annealing, and melting.	Rotating A-C Generators
10 KC—500 KC	Surface heating metals.	Vacuum Tube Oscillators and Spark-gap Converters
500 KC—50 MC	Surface heating of small objects.	Vacuum-tube Oscillators

Table 1—Frequencies used in induction heating, 60 cps to 50 mc, are selected according to work and equipment requirements.

in other less convenient or less expensive ways. Applications include: surface hardening and other types of metal heat treating, soldering, and brazing, paint drying, etc. The intensity of a magnetic field depends upon current, number of turns, and core material. Fig. 1 shows a cross-section of a work-coil heating a metallic bar. Magnetic materials heat up faster than non-magnetic ma-

terials because they have both eddy-current and hysteresis loss; non-magnetic materials have only eddy-current loss.

Induction heating encompasses a wide range of power and frequency. Frequencies extend from 60 cycles to 50 megacycles. Table 1 shows a course breakdown of this range, its uses, and sources. Use of different frequencies provide for a variation

Fig. 1—Electromagnetic field around load coil used in induction heating penetrates work to varying depths depending upon frequency.

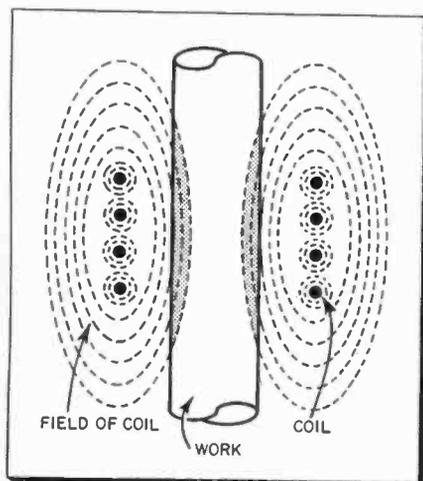
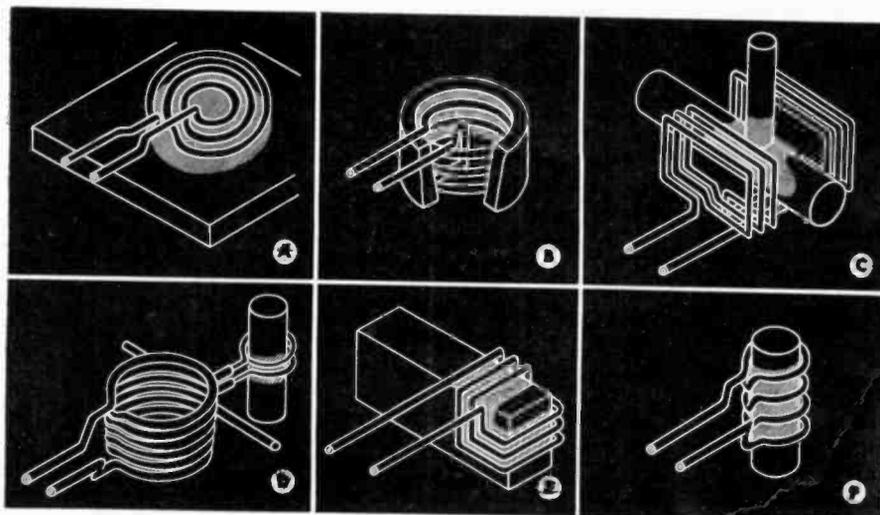


Fig. 2—Different shaped work coils are specifically designed for each application. Shapes include: pancake, round internal and external, square, rectangular, combination, transformer type, etc.



# Dielectric Heating

Heat For Bonding, Sealing, Drying, Etc.

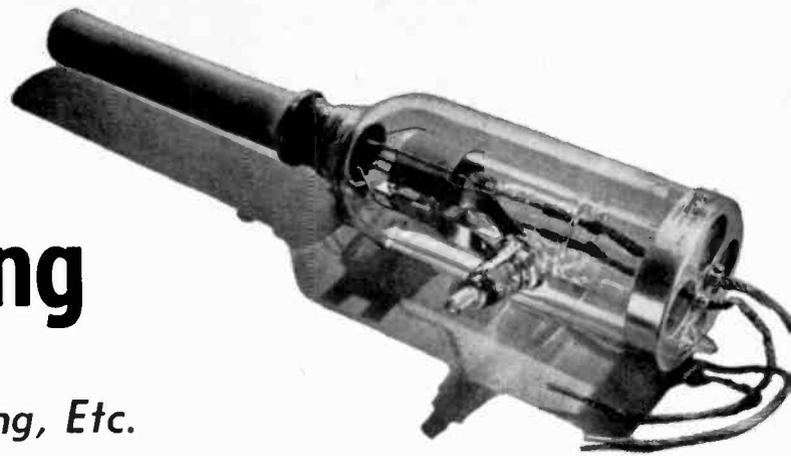


Fig. 5—Induction heating type tubes are designed to pass large amounts of current.

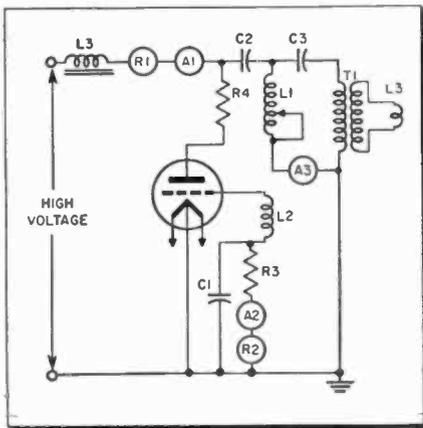


Fig. 3—Vacuum tube r-f generator. As resonance grid current increases, B+ plate current decreases, and r-f output current increases.

in depth of electronic heating. Skin effect causes high-frequency current to travel on the surface. This same effect also manifests itself somewhat at lower frequencies where some of the current flow is on the surface, and some is below. This effect can be used to control the depth of induction heating. For example, heating with a 2 kc current will cause a penetration of about 0.125 inches but a frequency of 200 kc will only heat a layer 0.020 inches deep. The thinner the layer desired, or the more shallow the penetration, the higher the operating frequency. The depth of penetration varies as the square root of the frequency. Heating depends upon several other factors; the characteristics of the metal work, the amount of power used, and the design of the shaped coil surrounding the work.

The work-coil is inductively coupled to the oscillator tank circuit, and acts like the primary of a transformer. The work-piece acts like the secondary. Cooling is used to prevent the work-coil from melting. Single-turn coils are used to heat narrow areas. The size and shape of the work determines the number of

turns and shape of the coil. Fig. 2 illustrates some of the common types of coils.

## Generators

Motor-generators, vacuum-tube oscillators and spark-gap converters may be used to develop a-c energy

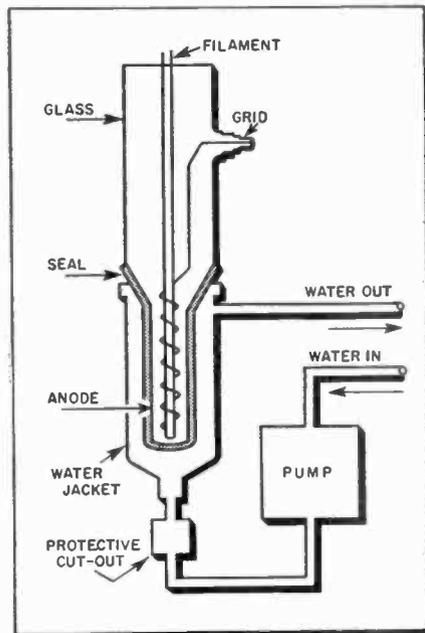


Fig. 4—Water cooling system maintains proper tube operating temperature. Anode portion fits into a specially constructed jacket.

for induction heating. Motor generators are usually used at frequencies between 2 kc and 10 kc, with power ratings from 5 kw to 500 kw. Their prime use is for deep heating. Spark-gap converters have a frequency range from 25 kc to 250 kc, with power ratings ranging from 5 kw to 50 kw. This is power input and because efficiency is only 50% these units are comparable to other types of generators rated at 2.5 kw to 25 kw. Vacuum-tube oscillators have frequency capabilities ranging from 100 kc to 1 mc and higher,

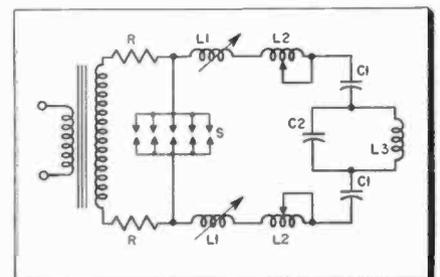
with power outputs from 1 kw to 400 kw or more. Their greatest use is in the range from 150 kc to 500 kc at 5 kw to 50 kw.

A simplified vacuum-tube oscillator type generator circuit is shown in Fig. 3. A power triode is connected in a plate-to-grid inductive feedback circuit. Resistor R3 and capacitor C1 provide grid leak bias; T1 is the r-f output transformer; the work-coil is L3; blocking capacitor C2 prevents the high plate voltage from reaching the output and ground; capacitor C3 and inductors L1 and T1 form a resonant tank circuit; and choke L3 prevents rf from getting into the plate power supply. Component values depend upon operating frequency.

Variations in the work-coil load are reflected back into the tank circuit. Adjustments of the tank inductance set the oscillator at the desired frequency. At resonance, grid current increases, B+ plate current decreases, and r-f output current increases. Ammeters A1, A2, and A3 are used to monitor circuit operation and also help trouble-shoot when trouble sets in.

Protective devices form a large part of the circuit as they do with many industrial circuits. In the plate supply a series resistor R4 limits current, relay R1 opens if the current rises to an excessive value. In (Continued on page 56)

Fig. 6—Up to 1,000 amperes can flow through the work coil in the spark-gap oscillator. Tungsten Disk gaps must be carefully adjusted.



# Heterodyning Sine And

## Harmonic Content Of A Square Wave Can Be Determined By

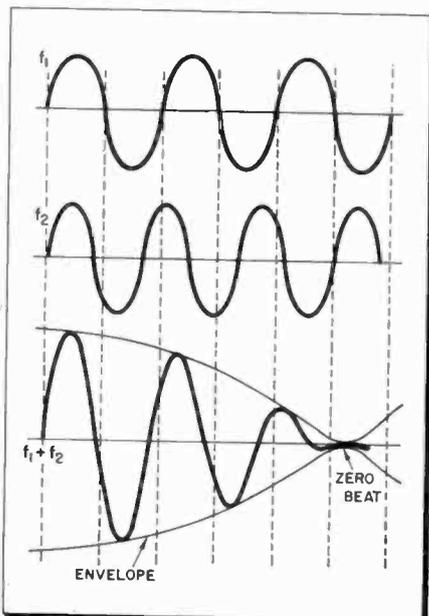
1. What harmonics are contained in a square wave?
2. How can these harmonics be seen on a scope?
3. Does a square wave possibly contain many more frequencies than is commonly supposed?
4. Is the indicated harmonic content of a square wave, a function of the response characteristics of the test circuit?
5. Does a square wave seem to contain all frequencies under some conditions?

ROBERT G. MIDDLETON

• Modern electronic equipment would not exist, if it were not for the phenomenon of heterodyning. In its most elementary forms, heterodyning is a simple process. On the other hand, when complex waves, such as square waves or pulses heterodyne with sine waves, an interesting and sometimes surprising domain is entered.

Heterodyning two sine waves, as shown in Fig. 1, is well known. They are in phase at one time, and out of phase at another. The resultant peak voltage variations or envelope fre-

Fig. 1—Varying phase conditions when mixing two sine waves results in a zero-beat.



quency is equal to the difference in frequency between the two sine waves. If these waveforms are passed through a demodulator probe, half of the envelope would be displayed on a scope screen, as shown in Fig. 2.

The output from a sweep generator is an f-m voltage. When it is mixed with a sine wave as from a marker generator, and passed through a demodulator probe the beating voltages appear as a marker on the scope as shown in Fig. 3. The marker occurs at the point where the FM voltage and the marker voltage have the same frequency. At this point, a low-frequency envelope is formed.

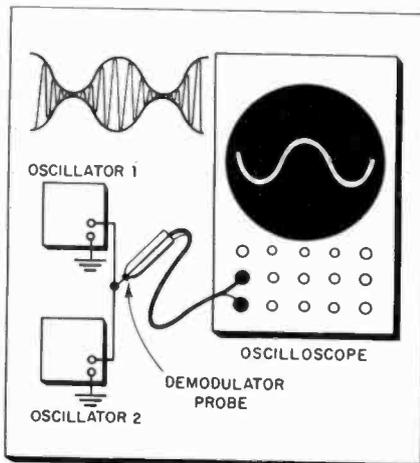


Fig. 2—A demodulator probe removes half the signal and high frequency component.

Since the probe passes low a-c frequencies only, the zero beat point appears as a "bug marker" on the scope. If more than one cw frequency is mixed with the swept frequency more than one marker will appear on the scope, as shown in Fig. 4. This illustration should be kept in mind when the beating of sine waves with complex waveforms is discussed.

It is generally recognized that a square wave can be built up or synthesized by adding together a large number of sine waves. Fig. 5 shows how a square wave can be developed by adding a fundamental, a third harmonic at one-third voltage, a fifth harmonic at one-fifth voltage, etc. If enough odd harmonics are added, the results will be a reasonable facsimile of a square

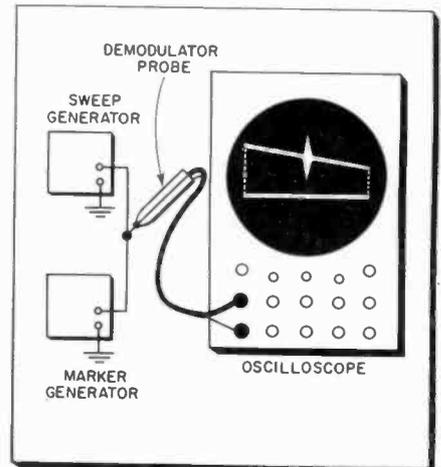
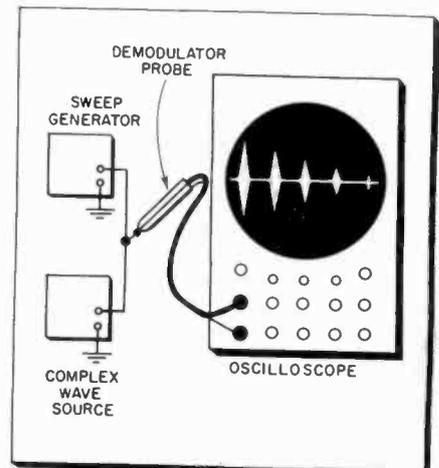


Fig. 3—Marker appears at the point where the two signals are of the same frequency.

wave. A perfect square wave requires the addition of an infinite number of odd harmonics. However, in practice, the voltages of the higher harmonics eventually become less than the errors of observation and circuit response, and are not too essential for their study and application. If a square wave can be built up by adding different frequency sine waves, it can be stated that a square wave contains these sine waves. If a square wave contains these different frequency sine waves, it follows then that it should be possible to find beats at these frequencies if a cw signal voltage is mixed with a square-wave signal voltage. This is true, not only of

Fig. 4—One method of mixing an FM search voltage for waveform analysis.



# Complex Waveforms

Several Methods Of Interpretation — Some Of Them Conflicting

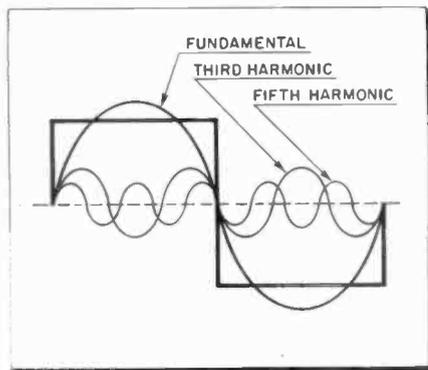


Fig. 5—Square waves can be developed by adding many odd harmonic sine waves.

square waves, but of any complex wave form. For example, Fig. 6 shows the harmonic content and relative amplitude of a complex wave when it is mixed with a swept frequency. This is the principle used in the electronic spectrum analyzer.

How does this beating out process take place? Consider the fundamental frequency of a square wave, as depicted in Figs. 7 and 8. As the f-m search voltage changes in frequency, it passes through the square wave's fundamental frequency. As it nears zero beat it will be out of phase with the square wave, and a bit later it will be in phase. These situations are shown in Fig. 7. As the search voltage falls out of phase, the peak beat voltage falls to a minimum value. Then, as the search voltage comes into phase the peak beat voltage rises to a maximum value.

If the square wave is regarded as an approximation of a sine wave, the beating process may be easier to understand. It is clear that heterodyning generates an envelope voltage which will have zero frequency at

Fig. 6—Multiple markers identify harmonic content of complex waveforms.

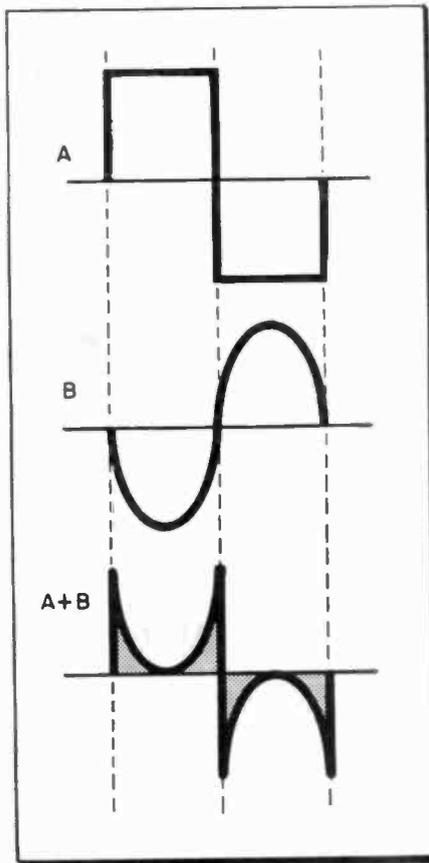
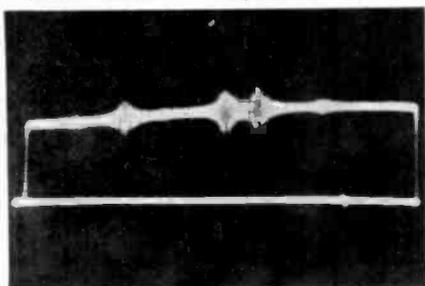


Fig. 7—Out-of-phase search voltage causes minimum average peak voltage. See Fig. 8.

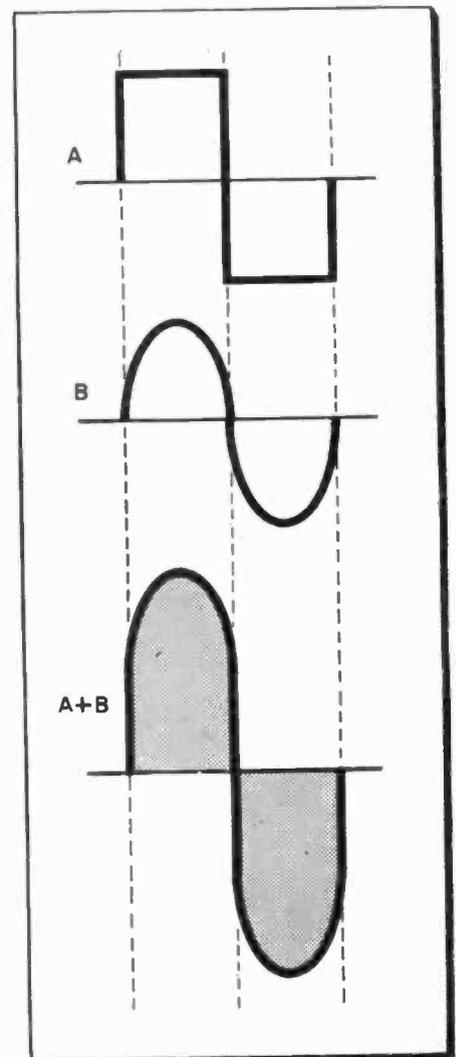
the zero-beat point, when the search voltage has a period which is identical to the square-wave period. Since a square wave has no even harmonics, zero beat should not be expected when the search voltage passes through the second-harmonic frequency of the square wave. To understand why this is so, examine Fig. 9 which shows the result of mixing a second-harmonic with a square-wave voltage, first in phase, and then  $180^\circ$  out-of-phase with the leading edge. It is evident that the rms voltage of the mixed waves does not vary, as the second harmonic passes from  $0^\circ$  through  $180^\circ$  of phase change, since it is proportional to the area under the mixed waveform. Because this area is the same, regardless of the second-harmonic's phase, no beating process can take place.

Just as the absence of the second harmonic failed to provide a beat

note, the presence of the third harmonic will result in a beat signal in a search-voltage test. This is demonstrated in Fig. 10. The rms voltage is higher when the third harmonic is in phase with the square wave's leading edge, and lower when it is out of phase. This difference in rms voltage is evident from the difference in areas under the waveforms. A demodulator probe responds to the difference of these rms voltages, and provides a bug-marker indication. This analysis can be continued in the same manner for the fourth, fifth, and other harmonics.

(Continued on page 43)

Fig. 8—When signals are in phase, maximum average of peak voltages develops. Difference results in a marker indication.



# Cumulative Article Index

All feature articles appearing in **ELECTRONIC TECHNICIAN**

From January through December 1958

## AUDIO, HI-FI, PA

Hi-Fi Test Report on "Consumer Reports" .....	A. J. Forman & Robert Cornell	1/58-32
Wear on Tape Recorder Heads .....	A. R. Clawson	2/58-32b
Public Address Installation Tips .....		2/58-44
Hi-Fi Stereo in Single Groove Discs .....	N. H. Crowhurst	3/58-28
Stereo Sidelights .....		3/58-30
Report on Stereo Cartridges .....		3/58-35
Test Equipment for Third Echelon Hi-Fi Servicing .....	N. H. Crowhurst	4/58-32
How to Replace Needles .....		4/58-60
Columbia Stereo Disc System .....	Herman Burstein	5/58-52
The Voices of the Organ .....	Jack Darr	6/58-32
New Design Trends in TV and Hi-Fi .....		7/58-23
Stabilizing Hi-Fi Amplifiers .....	N. H. Crowhurst	7/58-41
Servicing Tape Recorders .....	Al Diamond	8/58-32
The Meaning of Stereo .....		9/58-47
Stereo Discs—Two Channels in One Groove .....		9/58-48
Master Control for Stereo .....		9/58-50
Converting to Stereo .....		9/58-52
The Stereo Cartridge .....		9/58-54
Needles for Stereo .....		9/58-56
Multiplex Stereocasting .....		9/58-60
Stereo Tape and Tape Recorders .....		9/58-64
Speaker Arrangements for Stereo .....		9/58-66
Changers and Turntables for Stereo .....		9/58-71
Stereo Product Catalog .....		9/58-75
Stereo Buyers Directory .....		9/58-88
Stereo Manufacturers .....		9/58-91
Stereo Glossary .....		9/58-98
Standards for Stereophonic Disc Records .....	Record Industry Ass'n.	9/58-122
Tips on Rumble Reduction in Stereo .....		10/58-63
Hi-Fi Product Rating Organizations .....	A. J. Forman	11/58-41
What's New about Stereo? .....	N. H. Crowhurst	11/58-77
How to Interpret High Fidelity Specifications .....	Gary Wayne	12/58-32

## BUSINESS

Test Your Tax I. Q. ....	American Institute of CPA's	1/58-64
Do You Appreciate the Dilemma of Depreciation? .....	Irving Elbaum	2/58-32d
Should You Cater to the Do-It-Yourself Antenna Trade? .....	Howard Shavelson	2/58-34
Extra Service Pays Off .....		2/58-59
Case History: How to Raise Service Charges .....	Rudolph Malkin	4/58-58
Have You Checked Your Credit Rating? .....	American Institute of CPA's	5/58-65
Small Firm Cracks Industrial Market .....	L. Germany	6/58-38
How Do You Handle Callbacks? .....	Roving Reporter	7/58-28
How to Handle Direct Mail Response .....	E. W. Fair	8/58-33
TV Outlet Gets into 2-Way Radio Service .....	Phil Signorini	10/58-36
Do You Want A Partner? .....	E. W. Fair	11/58-89
Competitors—Devils or Angels? .....	E. W. Fair	12/58-34

## CIRCUITS

Characteristics of Printed Circuit Panels .....		3/58-66
Understanding and Troubleshooting AGC Circuits .....	Sol Libes	7/58-30
Servicing 110° Vertical Sweep Circuits .....	Jesse Dines	9/58-32
Current Surge Protection for Electronic Equipment .....	R. G. Middleton	10/58-32
Printed Circuit Repairs .....		10/58-44

## COMPONENTS—TUBES—TRANSISTORS

Power-Resistor Decade Box .....		1/58-35
The Twistor .....		1/58-54
Silicon Unijunction Transistors .....		1/58-55
Thermistors for Control and Testing .....	A. W. Turner	2/58-28
Even Good Electrolytic Capacitors May Ruin Transistors .....	W. J. Smith	2/58-32b
Honeycomb Screen .....		2/58-46
How NOT to Use Transistors .....		2/58-49
Current Surge Protection for Silicon Rectifiers .....		3/58-38
Effective Use of Electrolytic Capacitors .....	Abe Kosakowsky	6/58-30
Semiconductor Electronics .....		8/58-36
Silicon Diode Used as a Variable Capacitor .....		8/58-50
Raise Standards for TV Receiving Tubes .....		9/58-11
Current Surge Protection for Electronic Equipment .....	R. G. Middleton	10/58-32
Detecting Pulsed Damaged Components in TV Receivers .....	Allen Kinckiner	11/58-38
New Standards, Capacitance .....		11/58-74
Self-Service Tube Merchandiser .....		11/58-94
How to Prolong the Life of Radio & TV Tubes .....	Robert Cornell	12/58-36

## EDITORIALS

What's Ahead for '58! .....	Pulling No Hi-Fi Punches	1/58-29
Do-ers and Wishers .....		2/58-25
The Swing to Hi-Fi .....		3/58-25
It's Time to Enforce the Law! .....		4/58-25
The Recession's Impact on Manufacturers & Technicians .....		5/58-27
"The Technician Who Needs New Test Equipment Is Already Paying for It" .....		6/58-25
Appliance Servicing: Opportunity and Opposition .....		7/58-21
The Printed Word—A Tool to Improve Your Skills .....		8/58-21
Stereo—New Opportunity for Technicians .....		9/58-27
ELECTRONIC TECHNICIAN Buys SERVICE .....		10/58-29
Fighting Mad over Captive Service .....		11/58-29
Respite, Prostice .....		12/58-27

## GENERAL

1957 TV-Electronic Industry Statistics .....		1/58-35
Cumulative Article Index, Nov. 1955 through Dec. 1957 .....		1/58-42
1958 ELECTRONIC TECHNICIAN BUYERS DIRECTORY .....		5/58-31
1958 Parts Show Preview .....		5/58-50
Government Regulation of Radio Devices .....	Jules Deitz	6/58-28
TV Servicing in Russia .....	Staff Report	7/58-24
A Progress Report on Electroluminescence .....		7/58-50
Atomic Radiation and Television X-Rays .....	A. J. Forman	9/58-30
Industry Associations .....		9/58-93
You Could Die Laughing .....	C. R. Maduell, Jr.	10/58-71

## INDUSTRIAL ELECTRONICS & COMMUNICATIONS

Installation Techniques for Two-Way Mobile Radios .....	Jack Darr	1/58-36
Double-Barreled Squelch in Two-Way Radios .....	Jack Najork	2/58-32
Routes of Bell System Microwave Relay .....		2/58-32d
Radio Telemetering for Industry .....	Allan Lytel	3/58-36
Pocket-Radio Signaling .....	W. Strack	3/58-64
"Citizen's Radio" for Home & Industry .....	V. E. Stineman & R. S. Lukenbill	4/58-36
Conelrad for Emergencies .....		4/58-50
Industrial Counting & Frequency Measuring Devices .....	Allan Lytel	5/58-46
Automatic Machine for Sorting Letter Mail .....		6/58-50
Switching & Control Devices in Industrial Electronics .....	Allan Lytel	7/58-38
Utilizing the New Split Channel Mobile Frequencies .....	C. J. Schultz	8/58-24
Maintaining 2-Way Mobile Radio .....		9/58-114
Introduction to Digital Computers .....	Allan Lytel	10/58-38
Mobile Radio—FM or SSB .....	R. P. Gifford	10/58-48
Understanding Industrial Closed-Circuit TV Systems .....	E. M. Noll	11/58-32
Application of Industrial Meter Switching & Control .....	Allan Lytel	12/58-30
Electronic Snow Gauge .....		12/58-44

## SHOP HINTS

Alignment Jig .....	Richard Prestia	1/58-46
CRT Measurements .....	Obert Thomley	1/58-46
Metered Cheater Cord .....	J. P. Huard	1/58-46
Agitation or Snow .....	RCA TV Service Tips	2/58-33
Hot Shot .....	Richard Prestia	2/58-33
Remove & Replace Tubes .....	Al Bimstein	2/58-33
No Alignment Jig .....	Bob Eldridge	3/58-39
No Low Stations .....	J. A. McRoberts	3/58-39
Record Changer Mounting .....	Olympic Radio & TV	3/58-39
Handy Capacity Probe .....	Sid Schildkraut	4/58-35
Transistor Radio .....	RCA Service Co.	4/58-35
Allen-Wrench Driver .....	H. J. Miller	5/58-56
CRT Base Replacement .....	J. D. Ducharme	5/58-56
Hook-On-Probes .....	Bob Eldridge	5/58-56
Beam Aligner .....	RCA Victor Co. (Canada)	6/58-36
Power Tuner .....	General Electric	6/58-36
Shunt Control .....	Howard Newcombe	6/58-36
Soldering Aid .....	J. A. Costock	6/58-36
Caddy Conversion .....	C. J. Deering	7/58-44
Line Voltage Control .....	A. J. Krukowski	7/58-44
Portable TV Access .....	J. L. Barry, Jr.	7/58-44
Installing Nuts and Washers in Inaccessible Places .....	H. C. Garrett	8/58-38
Neutrode Tuner Neutralization Adjustment .....	Admiral Corp.	8/58-38
Cartridge Removal Stereo Record Changer .....	RCA Service Co.	9/58-38
Vertical Compression .....	R. E. Davis	9/58-38
Yoke Support .....	Paul Katz	9/58-38
Bench Lamp Extension .....	Tom Davenport	10/58-47
Cheater Cord Storage .....	Donald Schnell	10/58-47
Record Changer Fails to Cycle .....	RCA Service Co.	10/58-47
Space Saver .....	Tom Davenport	10/58-47
Color TV Focus .....	RCA Service Co.	11/58-40
Hidden Sputter .....	M. G. Goldberg	11/58-40
Sliding Rack for Test Equipment .....	C. R. Williams	11/58-40
Hi-Fi & Stereo Hum Reduction .....	Olympic Radio & Television	12/58-40
Replacing Selenium Phase Detectors .....	A. J. Krukowski	12/58-40

TELEVISION, RADIO

Sunspot Activity and TV Reception Problems	J. R. Johnson	1/58-40
Servicing Color TV in Fringe Areas	J. E. Weddle	2/58-30
Should You Cater to the Do-It-Yourself Antenna Trade?	Howard Shavelson	2/58-34
Debugging TV Alignment with Proper Test Equipment	R. G. Middleton	3/58-32
Deciphering TV-Radio Model & Chassis Numbers	Robert Cornell	4/58-28
Trade School Unveils Portable Studio for Closed Circuit TV		5/58-72
New Design Trends in TV and Hi-Fi	Staff Report	7/58-23
TV Servicing in Russia		7/58-24
Understanding and Troubleshooting AGC Circuits	Sol Libes	7/58-30
Servicing the Hybrid Auto Radio	L. B. Hoffman	8/58-28
Test Equipment for Color TV	R. G. Middleton	8/58-30
Servicing 110° Vertical Sweep Circuits	Jesse Dines	9/58-32
Integrated Test Equipment Speeds TV Alignment	Victor Robinson	9/58-34
Multiplex Stereocasting		9/58-60
Current Surge Protection for Electronic Equipment	R. G. Middleton	10/58-32
Understanding Industrial Closed-Circuit TV Systems	E. M. Noll	11/58-32
Detecting Pulsed Damaged Components in TV Receivers	Allen Kinckiner	11/58-38

TEST EQUIPMENT

Metered Cheater Cord	J. P. Huard	1/58-46
Debugging TV Alignment with Proper Test Equipment	R. G. Middleton	3/58-32
Measuring the Standard Ampere		3/58-52
Test Equipment for Third Echelon Hi-Fi Servicing	N. H. Crowhurst	4/58-32
Handy Capacity Probe	Sid Schildkraut	4/58-35
Understanding the Dot Generator & Oscilloscope	R. G. Middleton	5/58-44
Hook-on-Probes	Bob Eldridge	5/58-56
"The Technician Who Needs New Test Equipment Is Already Paying For It"		6/58-25

Oscilloscope Waveform Distortion	R. G. Middleton	6/58-34
How to Repair Your Oscilloscope	R. G. Middleton	7/58-25
Test Equipment for Color TV	R. G. Middleton	8/58-30
Integrated Test Equipment Speeds TV Alignment	Victor Robinson	9/58-34
Precautions in Using the Volt-Ohm-Milliammeter	Al Diamond	10/58-34
Troubleshooting Non-Linear Waveforms in Oscilloscopes	R. G. Middleton	11/58-36
Sliding Rack for Test Equipment	C. R. Williams	11/58-40
New Standards, Capacitance		11/58-74

"TOUGH DOG" CORNER

Intermittent Hum	Americus Molinara	1/58-39
Poor Contrast	A. F. Kinckiner	1/58-39
Excessive Gain	Alfred Consiglio	2/58-32c
Hot & Cold Sync	Paul Wolf	2/58-32c
"Sound" AGC	C. R. Maduell, Jr.	3/58-31
Too Many Rejects	Donald Jones	3/58-31
Intermittent Oscillator	F. A. Salerno	4/58-42
Intermittent Vertical	G. M. Augustine	4/58-42
Horizontal Drift	F. A. Salerno	5/58-54
Intermittent Grid Circuit	Bob Eldridge	6/58-37
Tunable Hum	M. G. Goldberg	6/58-37
Berserk TV	E. F. Tylicki	7/58-37
Hot Ground	B. F. O'Connell	7/58-37
AGC Unkeved? Look to AFC	J. H. Berg	8/58-29
Hi-Fi Oscillator	Elmer Woods	8/58-29
Saturated Flyback	Ivan White	9/58-33
Too Much B+	F. A. Salerno	10/58-37
High Voltage Filter	D. E. Tucker	11/58-35
Tough Cat Needed for Industrial Electronics	Paul Boller	11/58-35
Inoperative UHF	A. J. Krukowski	12/58-35
Intermittent Fading Hybrid Auto Radio	Peter Campione	12/58-35

(Continued from page 41)

Harmonic Interpretation

Many interpretations as to the harmonic content of a complex waveform are possible. Mathematicians discovered many years ago that complex waveforms can be theoretically built up from sine waves. Hence, there is a mathematical interpretation. Later, it was discovered that tuned circuits can pick out the harmonics from a complex wave, and thus indicate these harmonic frequencies and voltages on a meter or a scope. This electrical interpretation is based upon the the ringing

properties of tuned circuits. From the basic material just presented, it can be seen that complex waves can also be electrically analyzed or interpreted by heterodyning with an f-m search type voltage. There are still other methods of electrical interpretations—some of them often overlooked.

It is easy to demonstrate that a square wave has only odd harmonics. It is also surprisingly easy to show that a square wave seemingly has all frequencies including even harmonics. If a square wave is applied to a tuned circuit having a very high Q, it will develop a sustained ringing voltage which will last all the

way across the top and bottom of the square wave. The flywheel effect of the tuned circuit carries over the ringing voltage from one leading edge to the other, past the trailing edge of the square wave. Under these circumstances the square wave will ring the high-Q circuit only for the fundamental and odd harmonics.

On the other hand, if this test is repeated with a low Q tuned circuit where the ringing is damped and dies away in the interval between the leading and trailing edge, an entirely different response is obtained. The lower Q circuit can now

(Continued on page 72)

Fig. 9—Different phase condition obtained by mixing a second harmonic sine wave with a square wave shows no marker because the average of the peak amplitudes remains constant.

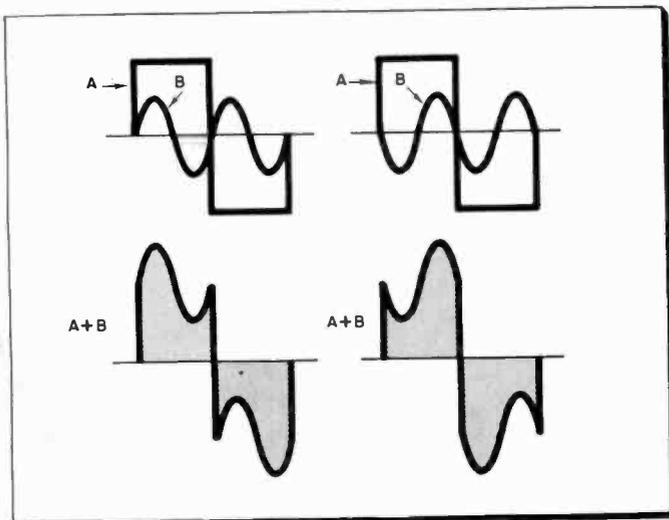
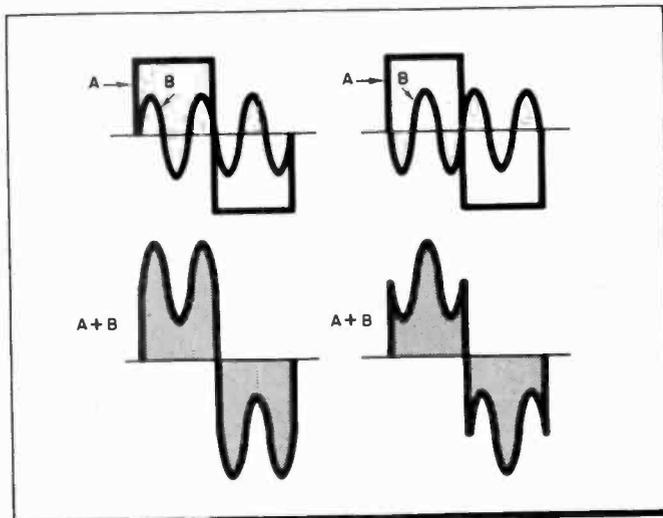


Fig. 10—Markers can be obtained by using the 3rd and other odd harmonic search voltages. As in the case of the fundamental, differences in resultant voltages cause the beat notes.



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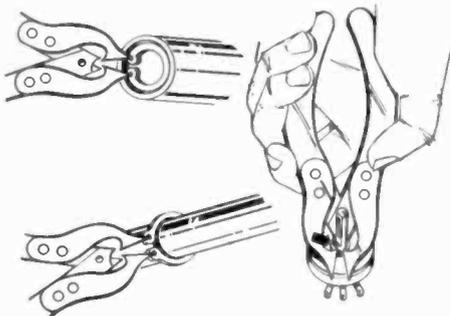
Resistance - Capacity - Ratio Bridge, Model RC-1, is a portable tester designed for radio-TV service. It features special 3 volt amplifier for checking electrolytics used with transistors; ranges from 10  $\mu$ f to 2000  $\mu$ f; 0.5 ohm to 200 megohms; ratio test ranges from



0.05 to 20. It also tests leakage of micas, papers and electrolytics. Size: 7" x 11½" x 5". Continuously variable capacitor test voltages, 0 to 500 v. dc. 117 volts, 60 cps. ac only. Dealer net, \$44.95. Pyramid Electric Co., 1445 Hudson Blvd., N. Bergen, N. J. (ELECTRONIC TECHNICIAN 1-3)

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- 7 Yokes:** Service aid PTM No. 3 points out time-savings in servicing horizontal sweep components. Contains a discussion of yoke problems, with photos of the raster. A two-color double page explains the yoke in photos and diagrams. (7B1: Triad Transformer Corp.)
- 8 Tubes:** A new, 4-page, 6" x 9", substitution guide lists approximately 150 tubes and shows the possible substitutions. Designed to be used in conjunction with the firm's test equipment, testers, and merchandiser. (8B1: Vis-U-All Products Co.)
- 9 Transceiver:** New literature describes model CUB-1-MT-1 remote controlled citizens band transceiver. Designed to eliminate the signal losses incurred when operating series JRC citizens band transceivers with a base station antenna. Details on specifications, controls, tubes, dimensions, and weight are given. (9B1: Vocaline Co. of America)

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# SHOP HINTS



## Tips for Home and Bench Service

### TV Oscillator Alignment

When aligning the lower channels of some wafer type tuners using series-type inductors it is sometimes necessary to compress or expand the oscillator coils to obtain the correct frequency. It is quite easy to mutilate the coils after a few attempts of first expanding and then compressing. I have found the following method to be quick accurate and minimizes manipulation. Loosely couple a marker generator to the antenna or oscillator tube, center the set's fine tuning control and leave it there. Connect a wire from the grid of the mixer tube in the tuner, to the top of the set's volume control, and tune for zero beat. Start with the highest channel, and work down. It is important that the generator be properly set to the oscillator frequency of the channel being aligned. It is also desirable to disable the sound i-f section. This can be done by pulling one of the sound i-f tubes, or shorting the sound i-f signal to ground if the set is of the series string type.—Adam Adams, Williamsport, Pa.

### Test CRT Yoke Support

I have always had trouble holding the yoke coil against the test CRT on the service bench. I have seen many ideas on this and have tried them all but this, in my opinion, is the best. The clamp shown is a wooden clothes pin, used by telephone men and electricians for holding cables while connecting and soldering. The opening is about the

same size, when closed, as the neck of the tube. It is made of hard wood and the spring tension is about right for holding the yoke without breaking the neck of the tube. Enough of the clothes pin sticks out past the yoke to serve as a rest for the CRT, and in most cases just at the proper angle. If desirable two clothes pins may be used to prop up the tube at other angles. They can be easily modified to suit most situations by



Large wooden clothespins, such as used by electricians and linemen may be modified to support both the yoke and test CRT.

cutting down, or by adding small rubber tack bumpers to the ends. If the opening is too large, it can be built up with felt, if it is too small, or if spring tension is too great, the opening can be enlarged and then lined. Harlan Dewitz, Wisner, Nebr.

### Tape The Complaints

A customer relations manager in the form of a tape recorder serves most effectively as a check on the service work our men do on TV, radio, tape recorders, appliances, etc. When a customer comes in to make a complaint, we flip on a tape recorder as soon as he begins his tirade. Not that there is any objection to his knowledge that his remarks are being recorded. Sometimes they

welcome the idea. However, the average customer won't talk as freely when he knows his words are being recorded.

The recording then becomes a valuable asset in preventing future complaints, on pinpointing the responsibility for an inefficient repair job, etc. It is played back to the technician who serviced the job. Many of the recordings offer valuable information when holding sales meetings to help reduce complaints.

Our whole idea is to satisfy our customers so they will continue to do business with us.—Stan Clark, East Bradenton, Fla.

### Remote Control Jammed Channel Selector

The channel drive motor armature may become engaged in the gear train during shipment. When this condition exists, the channel selector knob cannot be turned and breakage may result if forced. Normally, the armature will release or dis-engage the first time the remote drive is used. If the unit does not free itself when the remote drive is used, it will be necessary to remove the cabinet back and inspect the armature to determine what is preventing it from releasing. On some receivers it has been found that the switch on the end of the motor was twisted. This causes the switch leaf to ride on the side of the armature shaft and causes the armature to bind. Be sure the switch is positioned so that the insulated part of the switch leaf rides on the end of the armature shaft, and the two screws through the switch stack are tightened securely.

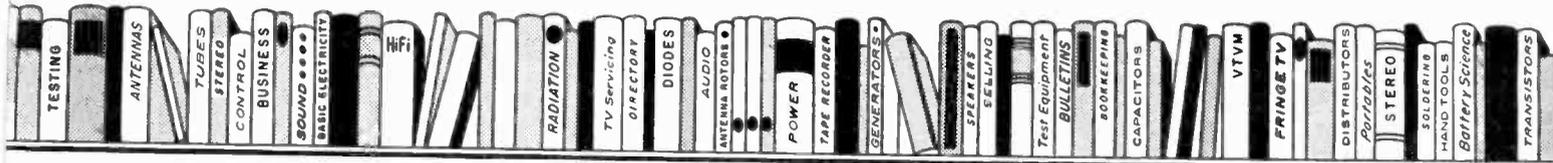
Caution: The switch is connected to the a-c power line and, if the uninsulated part of the switch touches the armature, the chassis will be at a-c line potential. RCA Service Co., Camden, N. J.

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\$3 to \$10 for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Photos are desirable. Unacceptable items will be returned. Send your entries to "Shop Hints" Editor, ELECTRONIC TECHNICIAN, 480 Lexington Ave., New York 17, N. Y.

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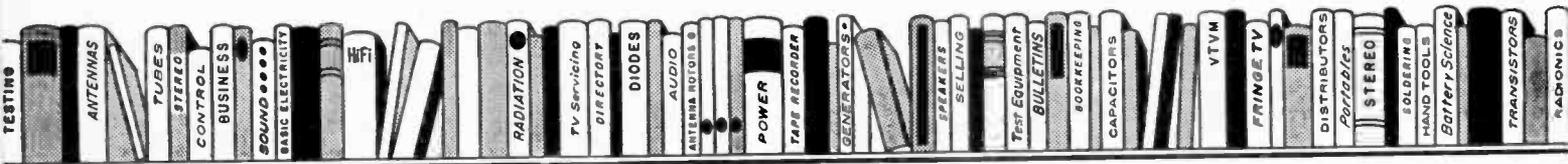
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#### OUTSTANDING FEATURES

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- Will not blow fuses even when connected to a dead short.
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- Separate meter scales for in-circuit and out-of-circuit tests.
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Just clip SRT-1 test leads across rectifier under test right in the circuit without disconnecting rectifier from circuit. Press test switch and get an instant indication on the easy-to-read three-color meter scales . . .

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#### OUTSTANDING FEATURES

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- All tests can be made even if manufacturers' rated gain is not available
- Less than half a minute required for tests of either transistors or diodes
- Large 3" meter is extremely sensitive yet rugged . . . with multi-color scales designed for quick easy readings
- Power is supplied by an easy to replace 6-volt battery — current drain so small, service life almost equal to shelf life. Battery cannot be drained due to accidental shorting of test leads
- Cannot burn-out its own meter or damage transistor or diode under test
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- Comes complete with replaceable transistor set-up chart that fits into a special rear compartment.

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- ✓ Checks for inter-element shorts and leakage.
- ✓ Checks for gas content.
- ✓ Checks for life-expectancy.

### IMPORTANT FEATURES

- No time consuming multiple switching . . . only two settings are required instead of banks of switches on conventional testers
  - No annoying roll chart checking . . . tube chart listing over 700 tube types is located inside cover. New listings are added without costly roll chart replacement
  - Checks each section of multi-section tubes and if only one section is defective the tube will read "Bad" on the meter scale
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  - Large 4 $\frac{1}{2}$ " D'Arsonval type meter is the most sensitive available, yet rugged — fully protected against accidental burn-out
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  - 12 filament positions
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  - Line isolated — no shock hazards
  - Long lasting etched aluminum panel.
- NOTE: The Fast-Check positively cannot become obsolete . . . circuitry is engineered to accommodate all future tube types as they come out. New tube listings are furnished periodically at no cost.

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SIZE: W: 9"  
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### OUTSTANDING FEATURES

- Checks emission, inter-element shorts and leakage of over 600 tube types. This covers OZ4s, series-string TV tubes, gas regulators, auto 12 plate volt, hi-fi and foreign tubes
- 3 settings enable a test of any tube in less than 10 seconds
- Employs dynamic cathode emission test principle
- 3 $\frac{1}{2}$ " D'Arsonval type meter — most accurate type available . . . its greater sensitivity means more accuracy . . . its jewel means longer life
- 17 long lasting phosphor bronze tube sockets
- Combination gas and short jewel indicator
- 9 filament positions
- Handy tube chart contained in special back compartment
- New tube listings furnished periodically at no cost
- Detachable line cord

plus these **BONUS FEATURES . . .** found in no other low price tube tester

- ✓ Checks for cathode to heater shorts
- ✓ Checks for gas content
- ✓ Checks all sections of multiple purpose tubes . . . will pickup tubes with one "Bad" section
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- ✓ Positively cannot become obsolete as new tube types are introduced.

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Name . . . . . Please print clearly

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City . . . . . State . . . . .

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

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### *Which type replaces which?*

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

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### *The broken mica washer*

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



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## Harmonic Distortion

(Continued from page 34)

tion switch in the read harmonic position. This places a tunable-notch filter in the circuit. Adjust the frequency control and balance control for minimum reading on the meter. As the reading decreases, adjust the range switch to read the lower voltages accurately. Rock the frequency and balance controls to be certain that the reading will not go any lower. The filter circuit inside the analyzer has now removed all of the fundamental frequency from the meter circuit, and only the harmonics, or other spurious components are left. To ascertain that the bridge does balance out the fundamental, make sure that both the frequency and balance controls cause the reading to increase when they are moved either way from the null position. The meter reading now indicates the total harmonic content.

Caution: If something in the amplifier, or the signal generator setting is changed to take another reading, be certain that the range switch is returned to the 100% scale, otherwise the meter needle will fly hard against its end stop.

Remember that the analyzer controls were set for null under a given set of conditions and if only 2% distortion is indicated, 98% of the original signal is being kept out of the meter circuit. Change any of the conditions and the chances are that the signal will come out of the null position with a bang. Once the range switch has been turned up, then the frequency, output level, or some other amplifier adjustment can be made, and another reading obtained by repeating this sequence.

Nothing difficult about the procedure, but some snags may be encountered when trying to obtain distortion measurements on the order of 0.1%, or other very low figure. If the reading indicates 1.5% or so, not all of it may be due to the amplifier under test. Check the audio signal generator by transferring the connection to the distortion meter from the output of the amplifier to the output of the generator, and follow the same procedure. An almost identical reading suggests that the amplifier is performing according to specification.

There are several ways to overcome this problem. Of course a

(Continued on page 54)



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This tower is a special one utilizing sections of the "SS" tower and is suitable for installations of guyed heights up to 450 feet.

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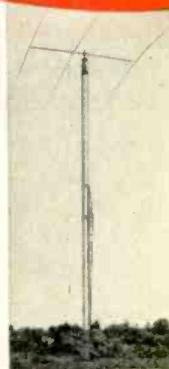
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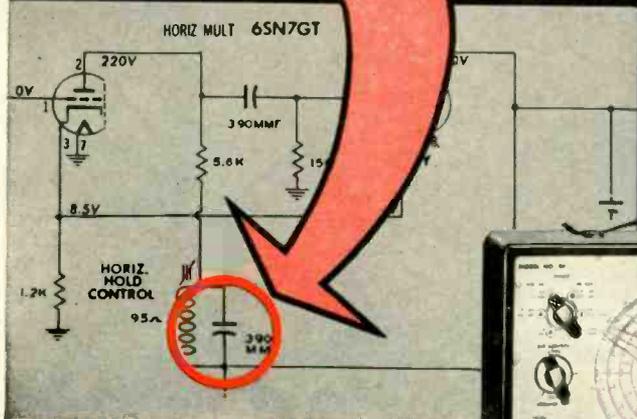
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(Continued from page 52)

cleaner signal to start with would be a solution. As mentioned earlier a band-pass filter can be placed between the generator and the amplifier to clean up most of the generator's residual distortion. To use the filter, it is necessary to tune the generator to the proper frequency of the filter. Then only the fundamental passes through at maximum level. Another method employs an oscilloscope waveform interpretation technique. For a rapid overall distortion check of the amplifier without trying to verify the minimum factory or rated specification, it isn't necessary to resort to the finer techniques. The chances are that if the distortion readings from the generator and the amplifier are almost the same it is usually an indication that the amplifier distortion is well below the amount measured even though it may or may not be at, or below the rated value. Most of the time when the readings are this low, the distortion is low enough. Occasionally, the presence of hum presents another problem when trying to measure low distortion at maximum output. This is one very good reason for using the scope on the output. Not only because it enables the observation of the signals being measured, but the presence of hum can be readily detected. The pattern will dance up and down quite rapidly, instead of remaining steady. Some hum at a low-level distortion measurement is usually not serious enough to worry about, but it does invalidate the readings. This can be overcome by estimating from the scope how much of the reading is hum and how much is distortion.

For example, suppose the meter reading on the analyzer is 1.5%, and the scope shows the harmonic waveform to be  $\frac{3}{4}$ ", and the "hum bounce"  $1\frac{3}{4}$ ", for a total height of  $2\frac{1}{2}$ ", as shown in Fig. 4. This indicates that the hum component is about 0.7 and the harmonic about 0.3 of the total peak-to-peak amplitude. The harmonic distortion then is only 0.45%, and hum is 1.05%. If the output is 1 volt, the hum voltage is only 10.5 millivolts, which is acceptable even though it may look bad in this test.

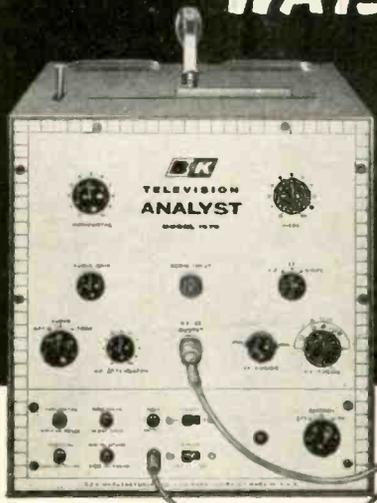
Another advantage of using the scope connected to the meter's output terminals is that it can be used for troubleshooting purposes. Proper interpretation of the display produced can help locate the source of abnormal distortion. It can also be used to monitor the adjustment for balance or matching of push-pull output tubes. •

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Make Twice The Profit!

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SIGNAL INJECTION  
POINT-TO-POINT  
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MODEL 1075



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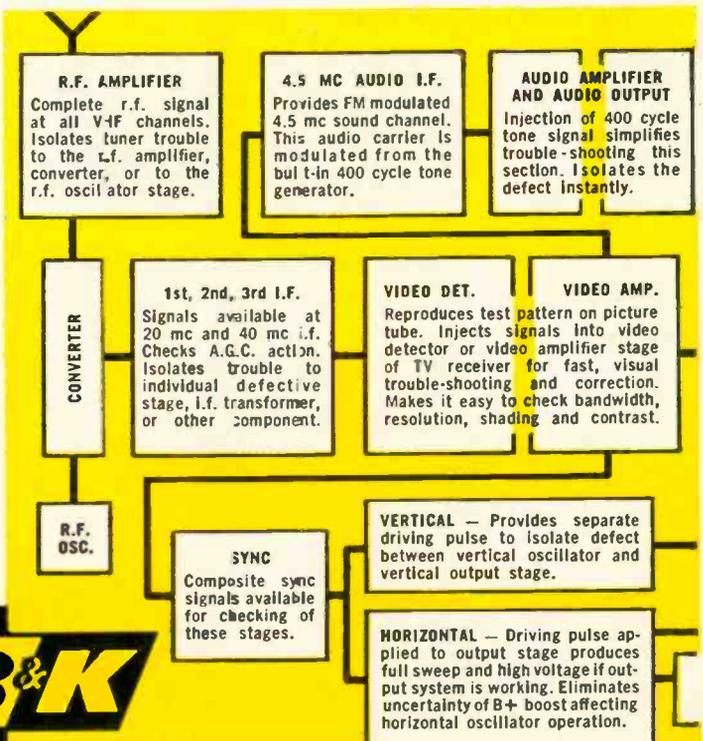
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It was a dark dreary night when the phone jangled me out of my evening cat-nap—  
"Watson," I cried, "pick up the line."

Within ten minutes we were off on another problem case. Our old friend "Jack the Ripple" had struck again. As Mrs. Blueberry babbled, I checked the TV set for some clues—  
Watson in the meantime was fumbling with the controls . . . he looked up and said,  
"It's Jack the Ripple's work all right, Holmes, but I don't know how he did it. I've checked everything out but I haven't found the trouble yet."

A moment of silence followed—Holmes gave a slight tug on his unlighted pipe and then exclaimed, "I have it . . . it's the capacitors."  
"How do you know, Holmes; you've barely looked at the set."

"Elementary, my dear Watson—  
they are not Astron's."

Not everyone can be fortunate enough to have a Holmes on their staff, BUT everyone can get the best in capacitors—buy and insist on Astron capacitors every time—they're "Staminized."

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TYPE BP MOLDED PLASTIC  
TUBULARS



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## RF Heating

(Continued from page 39)

the grid circuit an over-current relay R2 is used. The tank-coil, capacitor, work-coil, tube and other parts which carry heavy r-f currents may be water-cooled. Fig. 4 shows a water-cooled jacket arrangement for a vacuum-tube triode. The tube can be seen in Fig. 5.

### Spark-Gap Oscillator

A spark-gap oscillator or converter resembles a very early radio transmitter. The simplified schematic in Fig. 6 shows the major components of this type of r-f generator. The input line voltage is stepped up by a transformer, resistors R limit the current flow, and S is a series of spark gaps and inductors. L3 is

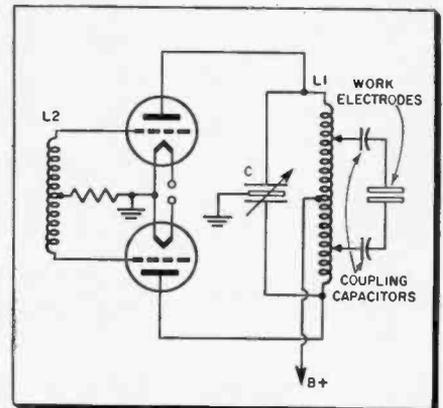
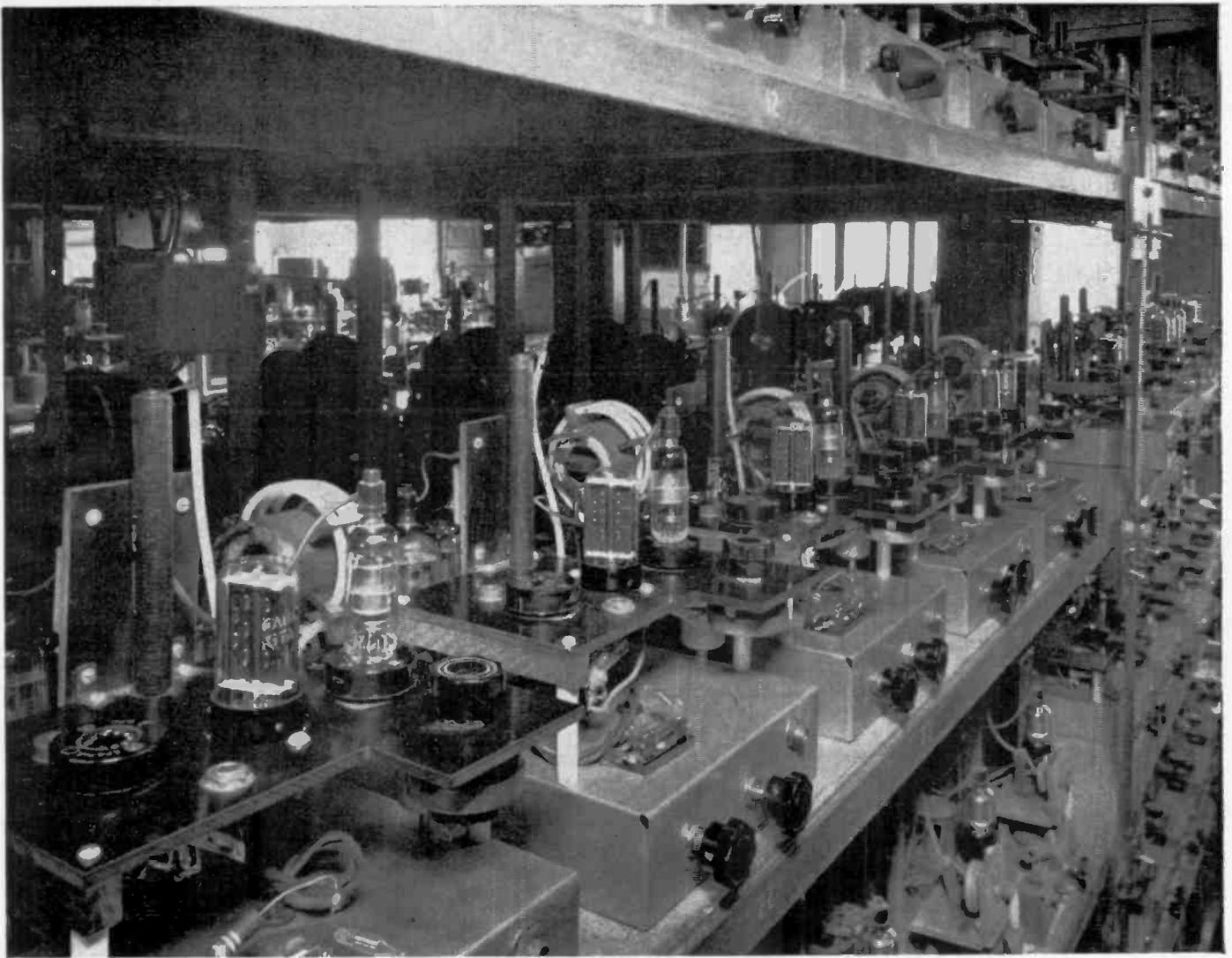


Fig. 7—Dielectric heating generator's frequency range is from 5 mc to over 100 mc. Work load consists of insulator type of materials.

a work-coil which forms a parallel resonant tank circuit with capacitors C2. This tank is in turn connected into a series resonant circuit which includes inductors L1 and L2, and blocking capacitors C1.

The spark-gaps are a series of air-cooled or water-cooled gaps, or combinations of both. Tungsten disks about one-inch in diameter are used to form the gaps. Gap clearance must be carefully adjusted with a feeler gauge. Variable coils L1 and tapped coil L2 are adjusted for the desired frequency. An r-f ammeter is coupled to the output circuit to observe tuning adjustments for maximum r-f current in the work-coil. The blocking capacitors are used to keep the high voltage from the output coil. These capacitors are made up of several capacitors in parallel, as are the capacitors in the tank circuit. The work-coils are at

(Continued on page 58)



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**...HELP PINPOINT AND CORRECT FAULTS**  
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**...CUT YOUR CALL-BACKS.** This new controlled dynamic life testing is your answer for dependable, universal replacement tubes for all TV sets. It is a big reason why CBS-Hytron tubes can cut your call-backs. Be sure to ask for CBS-Hytron tubes.

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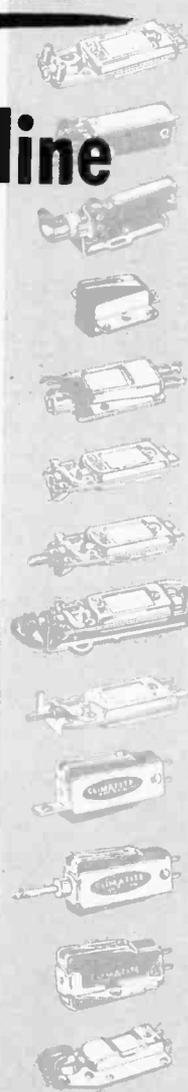
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(Continued from page 56)

ground potential for safety. They are made of copper tubing to permit water to circulate through them, even while current is applied. In some cases currents as high as 1,000 amperes can flow through the work-coil. Greatest output is obtained when both circuits are resonant at the same frequency. If a different frequency is desired because of the depth of penetration requirements, the series tuning inductances are adjusted to this frequency. The work-coil and tank capacitors would then be operated off resonance. To correct this condition it is possible to change either L or C, or both to bring the parallel tuned circuit back to resonance.

### Dielectric Heating

In dielectric or electrostatic heating the equipment is used to heat plastics, rubber, wood, paper, ceramics, and other non-conductors. The work is placed between two electrodes. The electrodes act like the plates of a capacitor, and the work behaves like a dielectric. Charging and discharging the capacitor causes a re-arrangement of the molecules in the dielectric. The opposition to these changes results in heat. In a capacitor it is referred to as dielectric losses. In a capacitor these losses are undesired but in dielectric heating they represent the output of the equipment.

The frequency of operation depends upon the power factor of the work material. Frequencies range from 5 mc to 100 mc and even higher. While dielectric heating equipment resembles induction heating devices, it requires higher frequencies and a different type of output. Fig. 7 is an example of the circuit used for dielectric heating. The output from the oscillator is capacitively coupled to the work electrodes. The resonant frequency is determined by the inductor L1, capacitors C, and the loading effect of the work. Adjustment of capacitors C compensates for different dielectric constants of different materials.

Dielectric heating has many applications; two important ones are sealing plastic and glueing plywood. The widespread use of plywood is due, in part, to the speed and economy of this type of heating. Sheets of thin wood are placed one on top of the other with the grain going in alternate directions, glue is spread between each sheet, pressure is used to hold the sheets together until the glue sets and dielectric heating is

(Continued on page 60)





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(Continued from page 58)  
used to raise the temperature to hasten drying.

Bonding thermoplastic sheets can be accomplished by an “r-f sewing machine.” Thermoplastic materials melt when they are heated and can be joined or welded when conditions of heat, feed and pressure are controlled. Pliofilm, Koroseal, Saran, etc., are synthetic materials produced in thin film forms, and lend themselves to these bonding techniques. About 150° C of heat is applied to the sheets to be joined by rotating electrodes which also apply proper pressure and maintain proper feed.

### Servicing Caution

The FCC requires a strict control to prevent excessive r-f radiation. All induction and dielectric heating generators and oscillators produce large amounts of r-f power which could cause interference. Commercial equipment is well shielded to prevent radiation interference with radio and TV receivers. The servicing technician must be sure that this shielding remains intact after any repairs have been made. •

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—ends most common cause of callbacks!



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Books marked with an asterisk (\*) may be obtained prepaid from Electronic Technician

**LOUDSPEAKERS.** By Gilbert A. Briggs. R. E. Cooke, Technical Editor. Published in England by Wharfedale Wireless Works. Available in U.S. from British Industries Corp., 80 Shore Rd., Port Washington, N.Y. 336 pages. Hard cover. \$4.50.

This fifth edition authored by a renowned audio engineer has been expanded and brought up to date. The text contains a wealth of practical data, made all the more lively by the personal touch of the author. Among the many topics covered are magnets, housings, cones, coils, impedance, phase angle, frequency, distortion, db, power, resonance, cabinets, transients, electrostatics, cross-overs, feedback and lots more. There are some 190 informative illustrations. Coverage of stereo is brief, and more on this would have been welcome. For any technical man interested in audio, this book is a valuable—and interesting—source.

**\*A-C CIRCUIT ANALYSIS.** Edited by Alexander Schure. Published by John F. Rider Publisher. 104 pages. Soft cover. \$1.80.

Here is a fine basic book on a fundamental electronic function, alternating current. After discussing principles and sinewave values, the text explains resistance, inductance, capacitance, series and parallel circuits. Of notable value is the clear explanation of the "j" operator in vectorial a-c presentations. Review questions and answers at the end of each chapter show how technicians can work out a-c circuit problems.

**TELEVISION ANALYZING SIMPLIFIED.** By Milton S. Kiver. Published by B&K Mfg. Co., 3726 N. Southport Ave., Chicago 13, Ill. 104 pages. Soft cover. \$1.

This detailed explanation of how to troubleshoot TV receivers by using the B&K "Television Analyst" is slanted entirely from the technician's practical viewpoint. This instrument a kind of miniature broadcast station, generating test patterns and r-f, i-f and video signals. After explaining limitations of conventional signal tracing techniques, the text goes on to tell how the Analyst is used to troubleshoot the audio, i-f system, front end tuner, sweep sections and agc. Other uses include servicing intermittents and color, as well as auxiliary functions covering linearity, size, r-f sensitivity and use for display. This book offers worthwhile information for every TV service technician.

(Continued on page 66)

Specially Selected

List of Electronic Books

See Pages 48 & 49

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**RADIO RECEPTOR**  
**Selenium**  
**RECTIFIERS**

Don't be fooled by an "all or nothing at all" approach. Selenium and Silicon rectifiers both have a place in today's TV sets . . . and General Instrument supplies the very best!

Radio Receptor "Safe Center" selenium rectifiers have proved their reliability and long life in millions of circuits through the years. When your replacement calls for *selenium* there is no better rectifier.

**AUTOMATIC** PT5 Silicon rectifiers are the first choice of leading TV set manufacturers switching to silicon in their new models. When replacing or converting to *silicon*, install the PT5 for maximum performance and picture brightness.

Both these outstanding rectifiers are brought to you by **GENERAL INSTRUMENT**, your finest source of semiconductor components!

*General Instrument Distributor Division*  
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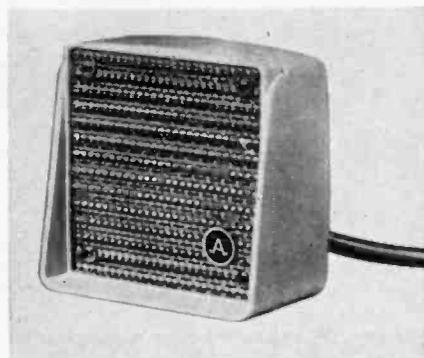


## NEW AUDIO PRODUCTS

For more information, write in **ELECTRONIC TECHNICIAN's** new product code number on coupon, on page 45

### Astatic MICROPHONE

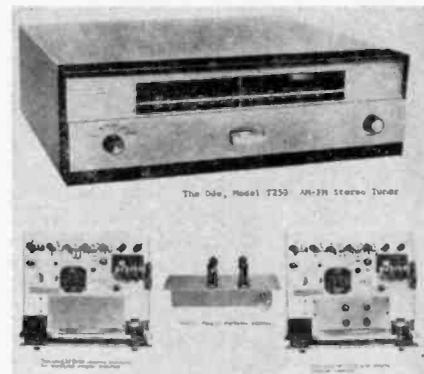
"Recorder Mike" Model M-150 is claimed to be the "lowest priced American-made microphone on the market today." List price is \$6.50. Primary market for the new microphone is as replacement mike for tape recorders. The



Model M-150 has a -44 db output, frequency range of 30 to 10,000 cps. It employs a crystal element. It has a high impact, ivory plastic body with gold, rigidized metal grille. It comes equipped with five feet of flexible, single conductor, shielded cable. Astatic Corp., 250 Harbor St., Conneaut, Ohio. (ELECTRONIC TECHNICIAN 1-28)

### Harman-Kardon MULTIPLEX TUNER

A new AM/FM tuner, the Ode, Model T250, is an integrated multiplex receiver providing space for the MA250 multiplex adapter to plug directly into the chassis. The FM front end is a new "shaded grid" VHF tetrode which combines the low noise characteristics of a triode with the great sensitivity of a



pentode. Included are a "gated beam" limiter with zero time constant grid circuit and wideband Foster-Seeley discriminators. A new electronic tuning bar functions on AM and FM. Price of the T250 is \$149.95; enclosure TC50 is optional at \$12.50. The new MA250 Multiplexer Adapter is \$49.95. Harman-Kardon, Westbury, N. Y. (ELECTRONIC TECHNICIAN 1-30)

# 25,000 HOURS

..and  
still  
like  
new

LOOK FOR THE  
GOLD STAR  
ON THE  
NECK!



## New Westinghouse **Gold Star** Picture Tube

**"Torture-Tested"** an amazing 25,000 hours to prove it is ready to build customer confidence in your selling picture!

The most grueling test in TV history. To prove that this amazing new tube would live up to our engineers' predictions, a stock model Gold Star Tube actually underwent 25,000 hours of continuous operation . . . was still 80% as good as new! Then—and only then—was it approved for distribution, to make it the most reliable, most profitable tube you can sell.

In addition to testing standards never matched before, you'll find two other great advances in new Westinghouse Gold Star Tubes—advances which will greatly curtail call-backs and replacements that have dimmed

your profit picture so long. They are . . .

**40% More "Getter"** in Electron Gun. Revolutionary design distributes 40% more protective material over inside of tube. Greatly reduces aging . . . keeps picture brighter longer.

**New Aluminizing Method** affords absolute maximum reflection . . . more usable light from the screen . . . a 20% brighter, sharper picture with greatly improved contrast.

Start rebuilding your profits now. Call your Westinghouse Distributor about new Gold Star Tubes today.

YOU CAN BE **SURE**...IF IT'S **Westinghouse**  
Electronic Tube Division • Elmira, New York

## Auto Radio Control Replacement is Child's Play

with new **Centralab**®

## Exact Replacement Controls



Now one source can fill all your needs for auto radio replacement controls. CENTRALAB has a new line of exact replacements for every popular radio in use today. This is the first time in history that you have been able to get the auto radio control you need—from a control manufacturer.

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A complete and thorough guide listing all auto radio controls in use today, and their CENTRALAB equivalents, is now available. Pick up your free copy from your distributor—or write direct to CENTRALAB.

# Centralab

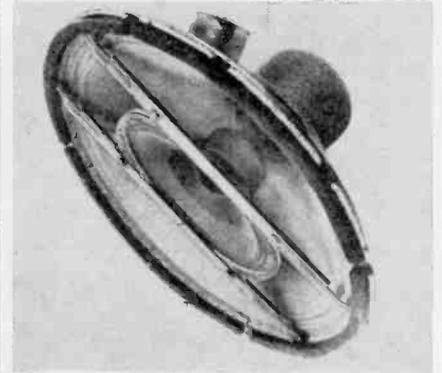
® B-5902

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

### Sonotone LOUDSPEAKER

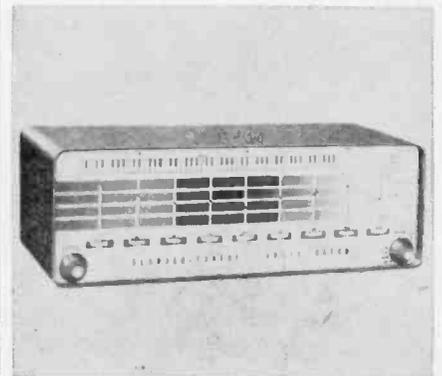
CA-12A 12" coax speaker provides reproduction of 35 to 20,000 cycles. List price is \$27.50. It combines a woofer and new tweeter with crossover frequency of 2,000 cycles. The crossover network, built-in and preset, is an inductor-capacitor design. The woofer magnet developed a high flux density, 12,000 gauss,



in the gap. For multiple speaker systems, this woofer, the W-12, is available separately for \$16.00 list. The light-weight tweeter voice coil works in a 9,500 gauss flux density. The CA-12A, an improved version of the CA-12, is rated to handle 40 watts of average program material. Electronic Applications Div., Sonotone Corp., Elmsford, N. Y. (ELECTRONIC TECHNICIAN 1-31)

### Blonder-Tongue "AUDIO BATON"

The Audio Baton, Model B-9, provides a tone control for each of the nine octaves in the sound spectrum, from 20 to 20,000 cycles. Controls allow the user to amplify or reduce any sound in any octave. It is useful for eliminating some forms of noise and distortion, and for an infinite number of compensation settings. In PA systems, reducing the level



of the proper octave control virtually eliminates feedback. Colorful front panel. The nine octave control knobs turn up or down to display an overall response curve. Two function switches are provided. It is easily installed between the preamp and amplifier stages of the user's present system. Audiophile net \$119.50. Blonder-Tongue Labs., 9 Alling St., Newark 2, N. J. (ELECTRONIC TECHNICIAN 1-27)

# Reactance Measurements

(Continued from page 36)

total applied voltage that would theoretically be indicated on the meter. It is only necessary to multiply the applied a-c voltage by the indicated percentage. The same results could be obtained by substituting a resistor for the standard; rounded slide-rule values are shown in Table 2. Caution: do not attempt to apply low inductive reactance and low value resistors across the lower line. Also,

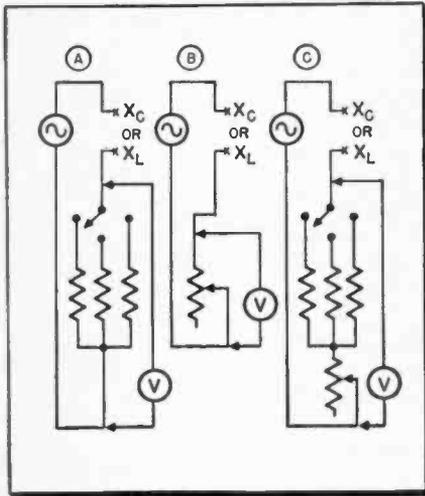


Fig. 2—Different resistors and a potentiometer may be switched in to extend the range of measurements. The control may be calibrated to compensate for meter loading characteristics.

do not test electrolytic capacitors in this manner. Electrolytics will pass excessive currents when polarity is reversed. Small inductors may be measured at higher frequencies and lower voltages, whereas larger capacitors are easier to measure at the lower frequencies.

Most a-c meters draw enough current to load down the circuit, and make many of these readings invalid, particularly on the low range scales. Should such be the case with a particular instrument on hand, it is possible to calibrate and compensate for this condition by measuring known capacitors and inductors, and noting the reading.

Substituting resistors can be carried one step further by utilizing a switching arrangement, a potentiometer, or both, as shown in Fig. 2. The combination hookup is convenient for extending and spreading the range. Use of the potentiometer enables a slightly different technique. By adjusting the potentiometer so that the meter indicates the same voltage

(Continued on page 66)

## SENCORE "Fuse Safe" CIRCUIT TESTER

Save Time with SENCORE

Save costly call backs by testing the circuit before replacing fuse, fuse resistor or circuit breaker.

Individual scale for each value fuse resistor—no interpretation, just read in red or green area.

- ★ Measures line current and up to 1100 watts of power at 115 volts using line cord and socket. ★ Two convenient current ranges—0 to 20 amps and 0 to 10 amps. Test leads clip in place of fuse or fuse resistor. ★ 5 ohm, 10 watt resistor prevents TV circuit damage, simulates operating conditions.

SENCORE

As Recommended by Leading Manufacturers  
Service Instruments Corporation  
121 Official Road, Addison, Illinois  
See other SENCORE ads in this issue



Announcing . . . A BRAND-NEW Home Study Program  
— Equips you to enter the exciting, new and booming field of

**A U T O M A T I O N**

## and Industrial ELECTRONICS Engineering Technology

Automation: "Second industrial revolution" . . . latest and most exciting development in our amazing world of electronics. Current needs: 3,000 specialists per year, well-trained in automation and industrial electronics . . . to fill new jobs and draw top pay.

CREI's new complete home study course covers all phases of automation and industrial electronics, including fundamentals of electronic engineering technology and a specialization in: Machine control systems . . . Data processing systems . . . Instrumentation techniques . . . Digital and Analogue Computers . . . Servomechanism systems . . . Telemetry systems . . . Industrial processes.

Leads to jobs like these:

NOW A TELEMETRY TECHNICIAN AT RCA MISSILE TEST PROJECT . . . "On December 31 I will be working for RCA at the Missile Test Project in Florida as a Telemetry Technician. I don't mind telling you that CREI

and your encouragement helped a lot in getting this job."—John S. Trefl, Box 133, Beulah, Mississippi

NOW ASSISTANT CHIEF ENGINEER OF RADAR INSTRUMENTATION STATION . . . "Five years ago I started to work for my present employer as a Radio Repairer and Installer. I also started my CREI course at this time. Three years later I was a supervisory electronic engineer and a year later I was promoted to the position I now hold as assistant chief engineer of a large radar instrumentation station at White Sands Proving Grounds."—Ralph Leo Gagnon, 1255 Gardner Ave., Las Cruces, N. M.

If you have had a high school education, and experience in electronics—and realize the need of high-level technical knowledge to make good in the better electronic jobs — you can qualify for this brand-new CREI Home Study course. Write to Capitol Radio Engineering Institute, Dept. 321-F, 3224-16th St., N.W., Wash. 10, D. C.

### MAIL THIS COUPON FOR FREE BOOKLET!

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Please send me without cost or obligation your brochure describing your brand-new home study course in Automation and Industrial Electronics Engineering Technology.

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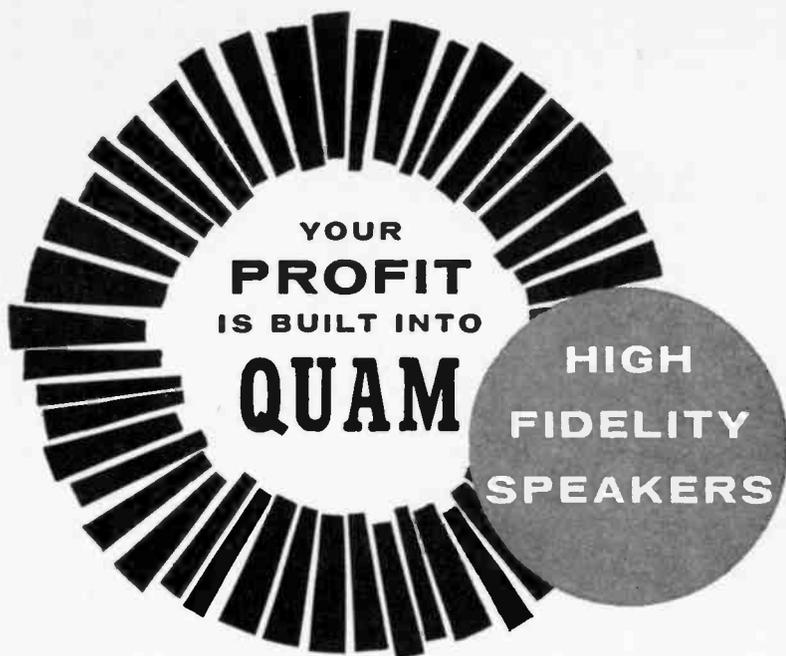
Employed By.....

Type of Present Work.....

Education:  
Yrs. High School.....

Other.....

Electronics Experience.....



Quam Hi-Fi Speakers are the List Price line. They are never promoted to the public at "audiophile net," or some similar phrase which deprives you of the opportunity to make your legitimate profit. When you sell and install Quam High Fidelity speakers, you come out way ahead on the deal.

So does your customer. The speaker he buys from you at list compares favorably with any other hi-fi speaker at the same dollar cost net. *That's because*

1. The design of Quam speakers emphasizes performance rather than non-functional decorative features.
2. Quam Hi-Fi Speakers represent the accumulated skill and experience of thirty years of fine speaker manufacturing.
3. Quam's position as the world's largest exclusive speaker manufacturer permits many production economies to be passed along to you and to your customer.

See your Quam distributor for complete information about the full line of Quam Hi-Fi Speakers—extended range, tweeters, woofers, coaxials. *Quality* is built into every one of them—and so is your profit!

## QUAM-NICHOLS COMPANY

226 East Marquette Road • Chicago 37, Illinois  
CANADA:

A.T.R. Armstrong, Ltd., 700 Western Road, Toronto 9, Ontario  
D. Eldon McLennan, Ltd., 1624 W. Third Avenue, Vancouver 9, B.C.

### YOUR BEST BUY!

# FUSE RESISTORS

FROM THE ORIGINATOR

Your jobber has them or can get them for you.

**MILWAUKEE RESISTOR CO.**

700 W. Virginia Street

Milwaukee 4, Wis.

(Continued from page 65)

drop across the reactance, as appears across the resistance, the resistance will then be equal to the reactance, and the loading effect of the meter can be disregarded. From the formulas:

$$x_L = 2\pi fL$$

$$x_C = \frac{1}{2\pi fC}$$

the value of inductance or capacitance can be readily determined. For convenience, Table 3 lists rounded values for various reactances at different frequencies. To save time, a knob pointer and dial on the potentiometer can be calibrated to indicate direct readings in terms of capacitance and inductance, and the meter used to indicate when a condition of balance exists. Of course, the reading would only be correct if the tests are made at the same frequencies as those used for calibration. Some VOM and VTVM instruction manuals do show specific applications of these concepts. •

For more information on the loading effects of the VOM, see author's article on page 34 of the October 1958 edition of *ELECTRONIC TECHNICIAN*—Ed.

(New Books. Continued from page 61)

**\*VACUUM TUBE CHARACTERISTICS.** Edited by Alexander Schure. Published by John F. Rider Publisher. 96 pages. Soft cover. \$1.80.

With far more than a billion vacuum tubes in use today in the U. S., a thorough understanding of these basic electronic building blocks would appear essential. This book on fundamentals does an excellent job of telling how diode, triode and multi-element tubes function. Electron emission, characteristic curves, amplification factor, plate resistance, transconductance and much more are fully explained. If the experienced technician thinks this volume cannot teach him plenty, he is wrong. Could you plot a load line on a family of curves? And plot harmonic distortion by this method? And understand variable- $\mu$  pentodes? This compact book is to be well recommended.

**\*TRANSISTORS, THEORY & PRACTICE.** By Rufus P. Turner. Published by Gernsback Publications. 160 pages. Soft cover. \$2.95.

This informative second edition has been expanded to include thyristors, four-layer diodes, spacistors, double-based diodes and phototransistors. As with the first edition, semiconductor theory, various circuits, applications and tests are presented.

installments, including interest on the unpaid balance. General business loans may be for as long as 10 years, loans under the limited loan participation plan for a maximum of 5 years, and pool loans for a maximum of 20 years.

The interest rate on the SBA's direct business loans has been set by the Agency's loan policy board at 5½% per annum. In participation loans, the private lender may set the rate of interest on the entire loan, provided it does not exceed 5½ per cent per annum.

**Q.** How long must I wait, normally, for action on a loan?

**A.** The SBA acts promptly on all applications and in most cases a decision can be given within about three weeks. However, the time required to process a particular application depends in part upon the care with which the businessman has prepared his loan request, the completeness of the information he has furnished, and the amount of work necessary for the SBA to give full consideration to all elements of the application.

**Q.** How can I determine whether I qualify as a small business?

**A.** There are two important considerations here. First, as defined in the Small Business Act, your firm must be independently owned and operated and not dominant in its field. Second, you must meet the SBA's criteria in regard to dollar volume of business. In general, the Agency classifies a wholesale concern as small if its yearly sales are \$5,000,000 or less, and a retail or service trades firm as small if its yearly sales or receipts are \$1,000,000 or less.

**Q.** What sort of records and information will I need to present?

**A.** In considering an application for either a participation or a direct loan, the SBA will want the same kind of information that a bank needs when weighing a loan request. The Agency will want to know the proposed purpose of the loan; your financial condition; how you propose to repay the loan, and the available collateral.

**Q.** Where do I go to apply for an SBA loan? Whom do I see?

**A.** You should first see your local bank about a bank loan, or a bank-SBA participation loan. If the bank cannot extend the financing on its own, or in participation with the SBA, you may then apply to the Agency for a direct Government loan. The local bank most likely can  
*(Continued on page 71)*

## DESIGNED FOR THE NEW BUSINESS RADIO SERVICE

# COMCO'S ALL NEW "580 FLEETCOM" VHF-FM MOBILE RADIO

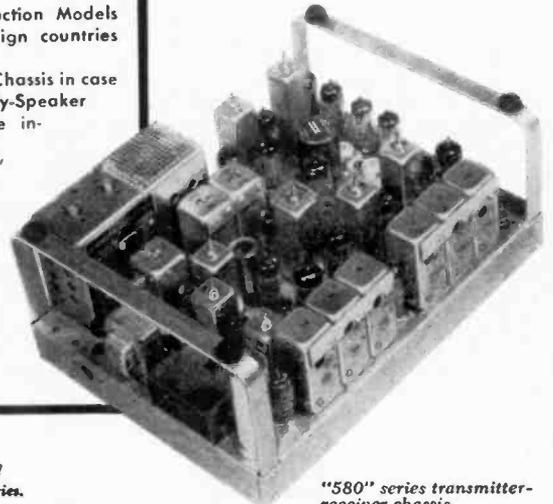


The new "580" is compact, light weight, has high performance, and features an original concept in Mobile equipment packaging by combining the control head, speaker, and transistorized power supply in one small easily mounted case assembly.

**\$398** f.o.b. factory

### FEATURES

- ★ **HIGH PERFORMANCE**... meets "split channel" technical requirements, all FCC and FCDA requirements.
- ★ **FULL POWER OUTPUT**... 35 Watts in 25-50 Mcs. 25 Watts in 144-174 Mcs.
- ★ **BUILT-IN RELIABILITY**... Preproduction Models field tested in 5 states and 3 foreign countries before starting production.
- ★ **SMALL AND LIGHT WEIGHT**... Chassis in case 13"x9½"x5½". Control-power Supply-Speaker case 5"x5"x3½". Complete Mobile installations 24 lbs.
- ★ **EASY TO INSTALL**... "Two-unit" package so small most installations are under dash.
- ★ **EFFICIENT**... Transistor power supply gives high efficiency. Total standby drain 5.25 amp.
- ★ **INTERCHANGEABLE CHASSIS**... Mobile transmitter-receiver chassis instantly interchangeable with base stations in simplex systems.



"580" series transmitter-receiver chassis.

**ATTENTION DEALERS!**  
Write for available territories.

DESIGNERS AND MANUFACTURERS OF RADIO COMMUNICATIONS EQUIPMENT

## COMMUNICATIONS COMPANY, Inc.

FOUNDED 1938 CORAL GABLES, MIAMI 34, FLORIDA

SAVE TIME with

**SENCORE**



**NOW CHECKS:**

- ★ **Transistors** for opens, shorts, leakage and current gain. Only tester that tests power transistors as used in car radio outputs.
- ★ **Crystal Diodes** checks forward to reverse current ratio on all diodes.
- ★ **Selenium Rectifiers** checks forward and reverse currents.

Service Instruments Corp., 121 Official Road, Addison, Ill.

See other SENCORE ads in this issue.

### New! Improved! TRANSISTOR CHECKER

America's newest, most popular test instrument

Simple to Operate. Controls are accurately set for each transistor by referring to replaceable set-up chart on rear. Test leads or socket provides for fast hook-up.



MODEL TRC4

**\$17.95**

DEALER NET

Cannot become obsolete. Approved by leading manufacturers.

**SPECIAL  
PRE-PUBLICATION OFFER  
SAVES YOU \$3.00**

## ENCYCLOPEDIA ON CATHODE-RAY OSCILLOSCOPES & THEIR USES

(2nd edition)

by JOHN F. RIDER &  
SEYMOUR USLAN

On May 1st, 1959, the second edition of this famous book—completely revised, updated and expanded—will be available. The price will be \$21.95 for this 1100 page (8½x11") 'bible' of oscilloscopes. However you pay only \$18.95—a savings of \$3.00 by reserving your copy at your bookstore, jobber or direct from the publisher before April 30, 1959. The second edition of the fabulously successful book—the first was considered a classic of useful oscilloscope information by thousands of service technicians—has been greatly expanded to include many new types of oscilloscopes and their applications. It is completely up-to-date!

Whatever your field—geophysics, aviation, automotive, medical research, television, audio, computers, automatic control or any other branch of industrial and communication electronics—you'll find the cathode-ray oscilloscope today's basic instrument. The newly revised 2nd edition of this best-selling classic begins with cathode-ray tube construction and theory, then carries you through a thorough analysis of modern oscilloscope circuitry, commercial scope types and maintenance, to a detailed treatment of how the scope is operated for all applications.

The 2nd edition includes more than twice as many new scope applications. It covers the latest in special purpose cathode-ray tubes, new data on probes, related information on scope photography. A new section on pulse measurements has been added and also a new illustrated section on square wave testing. The chapter on "Commercial Oscilloscopes and Maintenance" covers the latest commercial types.

### COVERS EVERY PHASE OF OSCILLOSCOPES

Cathode-ray tubes—theory of operation and basic construction—

Basic Characteristics of Cathode-Ray Tubes; Principles of Focusing and Deflection; Deflection Systems in Cathode-Ray Tubes; Screens of Cathode-Ray Tubes.

### Oscilloscope Circuitry and Operation—

The Basic Oscilloscope; Vertical and Horizontal Amplifiers; Time Bases; Sweep Circuits; Synchronization; Power Supplies; Auxiliary Equipment and Accessories; Commercial Cathode-Ray Oscilloscopes and Maintenance; Special Purpose Cathode-Ray Tubes.

### Oscilloscope Applications—

Basic Signal Observation and Pulse Measurement; Phase and Frequency Measurements; Audio Frequency Circuit Testing; Transmitter Testing; Visual Alignment of A-M, F-M, and Television Receivers; Waveform Observation in Television Receivers; Electrical Testing: Medical, Scientific and Engineering Applications; Oscilloscope Photography.

### Waveform Analysis—

Complex Waveforms; Square Waveforms.

Reserve your copy by April 30th at your jobber, bookstore or at the publisher—and pay only \$18.95, a saving of \$3.00.

**JOHN F. RIDER PUBLISHER, INC. ET-1**  
116 West 14th Street, N. Y. 11, N. Y.

Enclosed is \$\_\_\_\_. Please send me \_\_\_\_ copies at \$18.95 each.

ENCYCLOPEDIA ON CATHODE-RAY OSCILLOSCOPES & THEIR USES (2nd edition, revised) by Rider & Uslan

Pre-publication price of \$18.95 good until April 30, 1959. After that date, \$21.95. All books returnable within 10-days for full refund.

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

In Canada 5% higher; add state & city taxes where applicable

## Association News

### California

Los Angeles Area Appliance's attend vital licensing hearing. APA is trying to obtain approval for its members to make connections off a gas line from the wall side out only, to replace and repair a garbage disposal, to install moisture exhausts on dryers and combinations, and similar work. APA officials made it clear that they are not asking for a blank check for their members. They themselves insist that any appliance must pass rigid tests, set up and supervised by City officials, and including questions relating to the code itself, before a license can be issued.

### District of Columbia, Washington

The Service Committee of the Electronic Industries Association concluded a Dec. 16 meeting in New York City by approving a program designed to stimulate and achieve overall industry cooperation with the nation's independent electronic technicians. The plan was contained in a report of the Service Industry Relations Subcommittee, under chairman S. R. Mihalic, of General Electric Co. The EIA Service Committee stands ready to work and cooperate with all segments of the electronic service industry, in the knowledge that mutual benefits and improvements can come by working together.

For its part, the EIA Service Committee plans, within its limits as a trade association, to supplement its basic and advanced vocational training program, now widely accepted by the technical and vocational schools of the nation, with a program of:

1. Welcoming opportunities for discussion of mutual problems with electronic service leaders.
2. Being represented at service association conventions.
3. Promoting press articles and public relations publications which will enhance the prestige, reputation, and public understanding of the independent service industry.
4. Providing and distributing articles of technical, professional and business interest to independent service.

### Florida

The Radio-TV Technicians Guild reports that a new service group is being formed in Broward County. Those interested in becoming associated with the new group should

# NEW

# HICKOK

## Low-Cost VOM



Model 457

- High Hickok Quality at a New, Low Price
- Latest Design, Single Control Function and Range Selector

This new, portable reliably provides the latest engineering advancements for versatile use in all VOM applications. The attractive, modern design features ease of use with maximum readability. Quality-built with a full-wave rectifier circuit. Batteries are housed in a special compartment that is accessible without removing case. No soldering required—just "snap" batteries in or out.

SENSITIVITY: 20,000 ohms per volt DC.  
1,000 ohms per volt AC.

A.C. VOLTS: 0 to 1200 in 6 ranges.

D.C. VOLTS: 0 to 1200 in 6 ranges.

RESISTANCE: 0 to 100 megohms in 4 ranges.

### CENTER SCALE

RANGES: 5, 50, 500, 500,000 ohms.

CURRENT: 50 microamperes; 1, 10, 100, 1000 milliamperes; 10 amperes.

DB RANGE: -18 to +57 in 5 ranges.

Frequency compensated for accurate readings over the entire audio range.

High Hickok-quality at a new low price.

**\$43<sup>95</sup>  
NET**

Now is the time to...  
**TRADE UP TO A HICKOK**

Ask for a demonstration of the new 457 from your Authorized Hickok Distributor.

**THE HICKOK ELECTRICAL INSTRUMENT CO.**  
10514 Dupont Ave. • Cleveland 8, Ohio

contact Bob Austin, Community TV, 711 South 21st Ave., Hollywood, Fla.

The Better Business Bureau of Tampa has been and is still conducting an "Operation Test Pattern" such as was done locally by the Miami-Dade County Better Business Division several years ago and the Radio Television Technicians Guild in which fraudulent practices by a few service shops were exposed through the local press and TV stations. In the Tampa operation, two men were recently found guilty on two counts of petty larceny involved in TV repair practices and were sentenced to pay fines of \$600 each or 90 days in jail. According to the BBB in Tampa, a list of 15 names was submitted to the police about persons advertising TV repairs in the newspapers and telephone book, who had no occupational license to conduct such businesses. The BBB in Tampa is still receiving complaints at the rate of 125 or more per month and "Operation Test Pattern" will be maintained there for an indefinite period.

#### Illinois

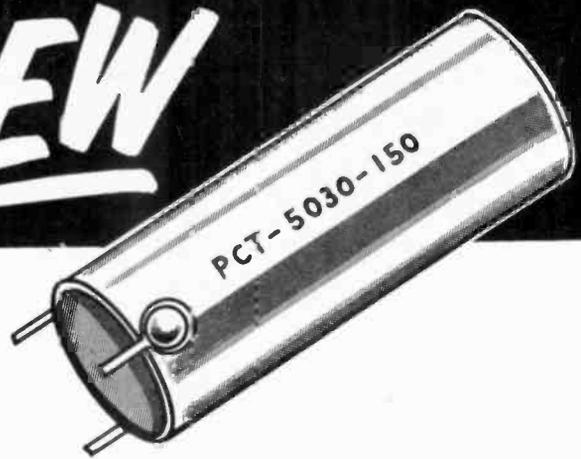
Joseph Blink, Director, TESA-Chicagoland writes—"I believe that the state association idea is the biggest obstacle we have in our efforts to keep the Independent Service Industry healthy. Too many people in our industry across the country are not only un-informed but also mis-informed as to what is going on in NATESA's effort to combat the problems in the industry. Too many sections of the country are fiddling with state groups in preference to NATESA while the industry goes down hill due to national problems. There must be a lot of 'Big fish in a little pond' thinking in the minds of those who prefer state over national groups.

"Let's consider the problem of captive and factory service which has been creeping and now has begun to gallop. How many people in the industry know the NATESA way of fighting the problem? What is NATESA doing about it?

"After a free exchange of ideas on the subject at the last NATESA convention it was unanimously agreed that the only language that the factory service competitors understand was the 'pocket-book'. Spelling it out, here is what it means to me—'Mr. Manufacturer, I refuse to be a customer of yours while you are acting as a competitor of mine. Also, I shall keep you in mind when my customers ask me for my professional opinion as to which maker's products are most desirable.'

(Continued on page 70)

# NEW



Type "PCT" . . . constructed in strong red cordboard tubes, wax impregnated, one end closed, printed circuit board terminals.

Type "PCTL" . . . has insulated lead out top providing for low voltage section.

For 65°C operation . . . recommended for table and clock radios . . . individually packaged . . . guaranteed for one year.

- ALL PLANET capacitors are
- engineered for quality
  - guaranteed for one year

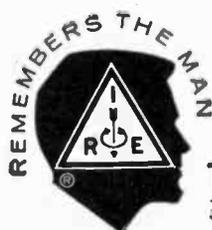
Call your DISTRIBUTOR!

**PLANET SALES CORPORATION**  
225 Belleville Avenue  
Bloomfield, N. J.

## YOURS FOR INSPIRATION, KNOW-HOW AND NEW RADIO ELECTRONICS KNOWLEDGE

Bigness has everything in the world to do with it when, each year, THE IRE NATIONAL CONVENTION and THE RADIO ENGINEERING SHOW is planned for you. Industries are only as big as you men make them. And you have created a colossus that requires a Coliseum to show itself.

Come to see, to hear and to learn. Whatever your special interests—equipment, component parts, instruments or production—these 800 exhibits representing 80% of your industry's productive capacity are an INSPIRATION IN RADIO ELECTRONICS that will take you further along your personal path of progress.



THE IRE NATIONAL CONVENTION

Waldorf-Astoria Hotel

AND THE RADIO  
ENGINEERING SHOW

Coliseum, New York City

**MARCH**  
**23 • 24**  
**25 • 26**

**THE INSTITUTE OF RADIO ENGINEERS**  
1 East 79th Street, New York 21, N. Y.

(Continued from page 69)

"I am certain that NATESA's way is the best way of fighting captive service. I am also certain that the rank and file of service people everywhere would agree and act accordingly if only they were informed of our efforts in this direction. State groups outside of NATESA are at a disadvantage in this effort. Experience with service associations indicates that we can not afford the time and money needed to support local, state, and national groups. TV Service Associations are 'poor man' associations. We should concentrate

our strength where it does the most good. Locals are a must for local problems and the national is a must for national problems. I doubt that we can afford any luxuries.

"Through the SCOPE and through the bulletins from the NATESA office to the affiliates, NATESA members are the best informed service people in the country. You have got to be informed before you can even begin to act. Time is running out while service people quibble.

"When are we going to really get together and make a fight for a healthier service industry?"

## Michigan

Aggressive national association leaders met in an Independent Dealers Emergency Action (IDEA) committee session, to map a continuing campaign to roll back captive service operations, and inboard service pricing policies of TV set manufacturers. Karl Heinzman, TSA Michigan Proxy, emerged the 1959 permanent Chairman, with the resignation of temporary chairman, Tilman Babbs. In assuming his duties, Heinzman said, "This committee is now acting for 74 independent service dealer associations. Letters are still pouring in, and although not yet tabulated, it is apparent that we can expect the support of from 50 to 100 more fighting-mad service dealer groups. These people are stirred up like a hive of bees. They are demanding to know why these manufacturers are introducing cut-throat methods to compete with the already adequate service facilities of independent service dealers." A sub committee composed of Tilman Babbs of TEA Texas; John Graham of ARTSD Ohio; and M. B. Magers of Kansas City NARDA President; and three other sub committees were created. Serving on the legislative committee are chairman: John Hemak of MINISE Minnesota; John Geoghegan Sr. of TELSA Connecticut; W. C. Pecht of TEAM St. Louis; and Wayne Cleim of TV Bureau Elkhart, Indiana. On the finance committee are Chairman Bob Steers of TELSA Connecticut; Len Smith of TEA Texas; and Don Wilson of ARTSD Columbus, Ohio. On the communications committee are Jack Barton of TSA Michigan; Bob Sickets of IESA Indiana; and Hal Chase, Editor of TSA News.

IDEA was presented to the press in New York by Connecticut and Michigan Association Leaders, Karl Heinzman, Peter Lucas, Dick Duplensky, Bob Steers, and Bill Stanek. Service associations in every corner of the country are becoming alerted to the importance of fighting captive service.

See page 29 and 83 of the November issue of *ELECTRONIC TECHNICIAN* for more information on the subject.—Ed.

At the annual stock holders meeting of Electro Service Associates, Inc., the following board members and officers were elected: Pres., E. J. Barton; V.P., Harold Chase; Sect'y., P. Fabian; and Treas., E. Brown. The balance of the board consists of E. Carozzo, and C. Hibbert. Electro was organized by the independent service dealers of TSA to pro-

(Continued on page 73)



*For my Money*  
**XCELITE Tools are**  
*the Finest!*

... Superbly made and designed for Radio, T.V. and Electronic Technicians. *See your Distributor*  
... only one quality ... the finest—whether you choose individual items or the handy kits ...

*Use the Tools the Professionals use!*

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

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

**SAVE TIME with**

**SENCORE**

**Model ES-102**  
ONLY \$15.95 DEALER NET  
Less than you pay for the individual capacitors.  
Carry it anywhere—measures only 4 3/4" H x 4 3/4" W x 2 1/4" D

**SENCORE Electro-Sub**  
Check all **ELECTROLYTIC CAPACITORS** in Seconds!

Simply select the electrolytic and substitute it. 10 big electrolytics from 4 to 350 Mfd. to safely substitute in any circuit from 2 to 450 volts.

- ... COMPLETELY SAFE—no arc or spark when connecting or disconnecting.
- ... AUTOMATIC CAPACITOR DISCHARGE—within seconds after releasing test switch by, unique surge protector circuit.
- ... NO CAPACITOR HEALING—surge protector circuit prevents accidental heating of capacitor being "bridged" in service work.

**SENCORE**  
SERVICE INSTRUMENTS CORP. 121 Official Rd., Addison, Ill.

# SIMPLIFY TEST and TROUBLE-SHOOTING PROCEDURES

with  
 **KINGSTON**  
 TEST EQUIPMENT



Models EA-1 and VS-5 Kingston Absorption Analyzers provide electrostatic signal tracing and extreme sensitivity. For trouble-shooting any equipment with wave forms. CRT displays wave-form from each stage.



Model PO-1 Kingston Absorption Analyzer allows conventional oscilloscopes to be used in trouble-shooting electrostatically. Built-in speaker for use as an audio analyzer.



Accessory Probes for miniature, sub-miniature and shielded tubes. Also Direct Probe for use with VS-5 and EA-1. Transistor Radio Probe simplifies trouble-shooting of transistorized radios.



Model BB-1 Variable DC Source, battery-driven for use wherever a pure DC voltage is desired. Voltage can be varied and metered.



Probe-Master. Built-in capacitive network allows by-passing of stages, coupling of signals from one stage to another. Most versatile testing probe on the market. Complete with two clips and neon bulb.

WRITE TODAY FOR CATALOG

 **KINGSTON**  
 ELECTRONIC CORPORATION  
 MEDFIELD, MASSACHUSETTS, U. S. A.

(LOANS . . . Cont'd from p. 67)

give you the address of the nearest of the SBA's 37 field offices, which are located in major business centers across the nation. Or, if you live in or near a large city, you might check the "U. S. Government" sections of its telephone directory to see if a SBA office is located there.

**Q.** Can I use a part of such a loan to liquidate other indebtedness against my business?

**A.** Many of the business loans approved by the SBA are used to pay off various types of indebtedness that the businessman has incurred. It often is advantageous to the borrower to consolidate all of his debt obligations in this manner.

**Q.** Is it possible, instead of obtaining a formal written refusal from a bank or insurance company, that I can have a real estate broker furnish a letter to the effect that specific banks and insurance companies have refused to accept a mortgage loan against my business property?

**A.** No. The SBA requires that the prospective borrower first visit his bank of account and discuss the possibility of obtaining a private loan before he can apply for a Government loan. In larger cities he is required to try to obtain the funds from one other bank in addition to his bank of account.

**Q.** Can I make a loan to improve my business structure, expand it, re-equip it, renovate it, or otherwise to make it more modern?

**A.** Yes. Many SBA loans are made for these purposes. Loans are made by the SBA to finance business construction, conversion or expansion, to finance the purchase of equipment, facilities, machinery, supplies or materials, and to supply working capital.

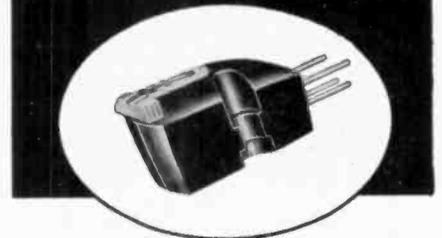
**Q.** If I am turned down by a regional office, can I appeal to the Washington headquarters office?

**A.** It is not necessary to make such an appeal since regional offices, while they have authority to approve the smaller SBA loans, do not have authority to decline them—they can only recommend to the Administrator in Washington that they be declined. Such loans are always reviewed in Washington. When a loan application is declined by the Washington office, the businessman may appeal for reconsideration if he can show that he can successfully overcome the objections that the SBA had for refusing the loan. •

# More Profits with PICKERING Stereo Conversions!

Get into the profitable stereo high fidelity business with conversions and replacements using the finest quality components at popular prices — STANTON Stereo Components by Pickering.

Original equipment manufacturers have found the practical solution to quality stereo in Pickering... why not benefit from this... use Pickering for quality stereo conversions and replacement.



STANTON Model 371 STEREO FLUXVALVE

Fully compatible for both stereo and monophonic records, the STANTON Stereo-FLUXVALVE is fully encapsulated and hermetically sealed in lifetime polystyrene. Replaceable "T-GUARD" stylus contains all moving elements and the finest quality, precision polished .7 mil diamond. Makes your installation easy, true miniature design permits mounting into all arms with standard 1/2" mounting centers. Frequency response is flat within 2 db over the entire stereo range. Two balanced outputs connect to low mag inputs of all preamplifiers... no need for transformer or gain stage device. Interchannel separation better than 20 db. Recommended tracking is 3-6 grams for changers and 2-4 grams for manual arms. Four terminal output for greatest flexibility, straps for 3 or 4 terminal systems.

## EVERYTHING YOU NEED FOR STEREO CONVERSION!

STANTON Model 603 STEREO KableKit



NEW! Low cost stereo cable assembly for converting automatic changers and manual tone arms. Prefabricated insulated and fully shielded harness assembly with all plugs and connector clips soldered... ready for instant installation! No soldering required for normal installation. Harness length 4 feet, comes complete with cable retention clips.

ASK FOR PICKERING AT YOUR JOBBER... EASIER TO SELL AND INSTALL.

FREE! Pickering Service-File, complete technical file on quality products by Pickering. Includes valuable bulletins on hum elimination, installation, maintenance, etc. Address Dept. M-19 for your free Service-File.

 For those who can hear the difference  
 FINE QUALITY HIGH FIDELITY PRODUCTS BY  
**PICKERING & COMPANY, INC.,**  
 Plainview, N. Y.  
 FLUXVALVE, T-GUARD, KableKit are registered trademarks

(Heterodyne . . . Cont'd from p. 43)

be rung by the square wave, regardless of the frequency to which it is tuned. Since the low-Q tuned circuit does not have enough fly-wheel effect to carry the ringing energy from the leading edge past the trailing edge of the square wave, it can be triggered by the trailing edge as well as the leading edge. By the time the trailing edge comes along, the tuned circuit is quiescent and can be swung into action by the trailing edge, without reference to the leading edge. Under proper circuit conditions, it is possible to sustain oscillations at any frequency including the even multiples of the square wave. From this it could be concluded that a square wave contains all frequencies.

It could therefore seem that the harmonics attributed to a square wave are in fact only the characteristics of the circuits which are energized by the square-wave voltage. Some circuits respond as if a square wave contained only odd harmonics, while others contained all frequencies. The circuit application must be known before harmonic content of a square wave can be interpreted. •

## Reps & Distributors

**JOHN F. RIDER PUBLISHER, INC.**, announces the appointment of **JAMES MALCOLM FLORA** as their new representative in the state of Michigan.

**WESTINGHOUSE** Electronic Tube Div. has appointed **MORRIS F. TAYLOR CO.** as sales rep for tubes and semiconductor devices in Fla., Ala., Ga., and central Tenn.

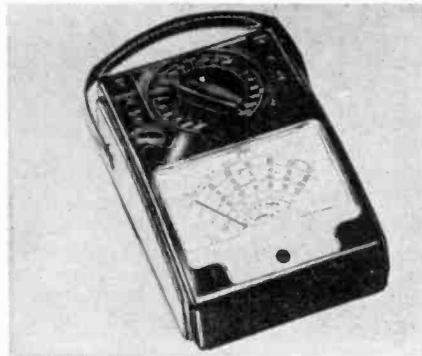
**ELECTRONIC REPRESENTATIVES ASS'N. (ERA)** has been adopted as the new name for the trade association of sales reps in the electronics field, formerly known as "The Representatives" of Electronic Products Mfrs.

**PHILCO DISTRIBUTORS, INC.**, announces the following appointments: **CHARLES HAKIMIAN**, general manager, in charge of all factory branches; and **GEORGE R. HICKMON**, general manager, Chicago.

**SERVICE INSTRUMENTS CORP.** has appointed the following sales reps: **JAMES FLORA**; **J. W. LEHNER**; and **STEVE FISHER**, to cover Michigan; Ohio; and metropolitan New York and northern New Jersey respectively.

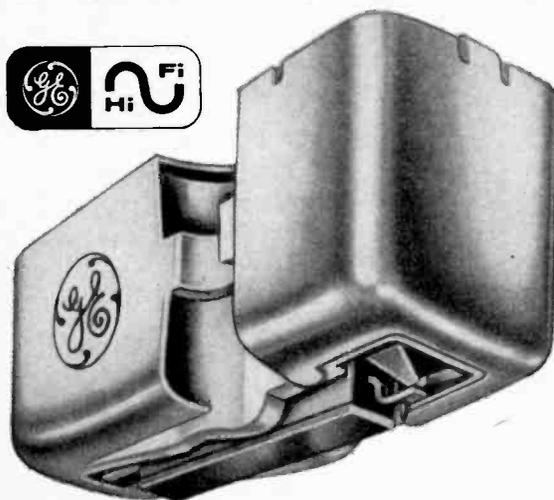
### Hickok VOM

The 5" meter of this portable VOM, Model 457, has easy-to-read scales and single Function-Range control. Improved physical design offers inclined panel so it lies flat in normal use. Specifications are: Sensitivity: 20,000 ohms per volt dc, 1,000 ohms per volt ac; 0 to 1,200 v. in 6 ranges, ac and dc; resist-



ance, 0 to 100 megohms in 4 ranges; center scale ranges, 5, 500, 5,000, 500,000 ohms; current, 50 microamperes, 1, 10, 100, 1,000 ma, 10 amperes; db range, -18 to +57 in 5 ranges. Battery operated. \$43.95. The Hickok Electrical Instrument Co., 10523 Dupont Ave., Cleveland 8, O. (ELECTRONIC TECHNICIAN 1-2)

# STEREO PROFITS START HERE



- Compatible with both stereo and monaural records
- Full frequency response, 20 through 20,000 cycles • "Floating armature" design for increased compliance and reduced record wear. Effective mass of stylus approximately 2 milligrams • High compliance in all directions—lateral compliance  $4 \times 10^{-6}$  cm/dyne; vertical compliance  $2.5 \times 10^{-6}$  cm/dyne • Recommended tracking force with professional-type tone arm 2 to 4 grams • Consistently high separation between channel signals. (Specifications for Model GC-5.)

## New G-E "Golden Classic" Stereo-Magnetic Cartridge

Easier to sell...because it's magnetic  
...and because it's G-E!

Start your customers converting to stereo *the right way*—with General Electric's new "Golden Classic" stereo-magnetic cartridge. It provides the high compliance, low distortion and channel separation required by the new stereo discs. Just as important, General Electric is the name *all* your customers know and trust.

**New Dual Stereo Preamp**—Easy, inexpensive way to convert stereo systems from ceramic to magnetic cartridges where necessary pre-amplification is not present. High sensitivity, low hum and noise, individual switching for each channel.

**FREE 16-PAGE BOOKLET**—"Application Considerations in the Use of Stereo Phono Cartridges." Tells how to convert different record changers to stereo. Write today!

**GENERAL ELECTRIC**

Specialty Electronic Components Dept., W. Genesee Street, Auburn, N. Y.

## Association News

(Continued from page 70)

mote and contract service for the independent service industry.

### Minnesota

Ever since the inception of the Minnesota Television Service Engineers, Inc. there was interest by its members to strengthen the organizations by affiliating with a national group. They report that in 1955, MINTSE was not eligible to join NATESA because it "conflicted with local associations" when in fact it supplemented local participation. On this discriminatory position NATESA kept from expanding in Minnesota. Later, in August of that year, a UNITY meeting was held in Pittsburgh and another in October in Indianapolis. The purpose was to unite the many associations that were unaffiliated into one unified body. A resolution was passed that any group wishing to affiliate with NATESA could do so upon application to the NATESA office. Once again MINTSE was discriminated against. The reason given was that the application was a day late. This was certainly not in harmony with the many associations who took the time and expense to have a National Representation.

### Missouri

TSE Officers Elected. The 1959 Slate of TSE Officers elected are: Pres., Don F. Ellis; V.P., William E. Mears; George William Walker; Sect'y., John Alex Earp; Treas., William A. Pewitt; Chairman of the Board, Earl J. Steffes; and board members Robert E. Stephan, Robert W. Hester, and Smithy Preston.

### North Carolina

The North Carolina Federation of Electronic Associations held their first meeting and elected: Pres., Garland E. Hoke; V.P., Joe Wood; Sect'y., Charles S. McBroom; Treas., Edmund F. Barbour; Board of Directors Kenneth Larue, Herbert Griffin, R. B. Corn, and Editor of the state paper, Dave Drage.

### New York

Attorney General Louis J. Lefkowitz reports that as a result of a meeting of a committee appointed by him to promote fair practices and ethical standards in the TV supply and repair industry for the benefit of the consumer as well as the legitimate businessman, three major problems facing the industry will be explored:

1—How can the industry insure greater confidence in TV servicemen?

2—How can the problem of deceptive advertising by some TV repairmen be met?

3—How can the industry cope with the problem of defective radio and TV tubes which have been rejected by manufacturers as not meeting the standards of their companies?

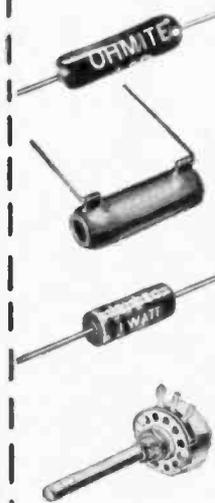
Members appointed to the committee are: Temporary Chairman, Arthur Startz of the Better Business Bureau; Robert Larsen of Empire State Federation of Electronic Technicians Assn.; Philip Fleischman of Metropolitan Electrical Appliance Dealers Assn.; Peter H. Cousins of Electronic Industries Assn.; Samuel E. Ewing of Radio Corp. of America; Harry Esdale of National Electronics Distributors Assn.; Robert Powell of Fordham Radio Supply Co.; Gerald Sohne of National Tube Testers Assn.; Martin Boxer of Associated Radio & Television Servicemen of N. Y.; and Irving Sarnoff of Bruno-New York.

# A Profitable New Field!

## INDUSTRIAL ELECTRONIC SERVICING

with  
**OHMITE**<sup>®</sup>  
QUALITY  
Components

Industrial electronic servicing is profitable new business for you. Especially when you stock and replace with dependable Ohmite components . . . the line your industrial customers know and prefer. 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.



### AXIAL-LEAD RESISTORS

Vitreous-enameled, power-type units designed to withstand high temperatures. In 3, 5, and 10-watt sizes.

### BROWN DEVIL<sup>®</sup> RESISTORS

Vitreous-enameled. In 5, 10, and 20-watt sizes.

### LITTLE DEVIL<sup>®</sup> COMPOSITION RESISTORS

Meet all MIL-R-11A requirements. Available in 1/2, 1, and 2-watt sizes in all standard EIA values.

### MOLDED COMPOSITION POTENTIOMETERS TYPE AB

Resistance material is solid-molded, noise-free. Rated at 2 watts.

Write for Stock Catalog 28

**OHMITE**<sup>®</sup>

DEPENDABLE  
RESISTANCE  
UNITS

OHMITE MANUFACTURING COMPANY  
3687 Howard Street, Skokie, Illinois

## Save Time with SENCORE LEAKAGE CHECKER

Check these outstanding New Features

The LC3 provides all these new improved features in addition to those employed in earlier leakage or "grid circuit" testers. A must for any TV service technician.

- ★ Checks 156 different tube types—more than any other "grid circuit" type checker. Includes UHF and latest type tubes.
- ★ Checks picture tubes without removing tube from cabinet or chassis.
- ★ New Roll Chart prevents obsolescence—just dial the tube type and save time. Chart is easily replaced at no extra cost.
- ★ Provides instant filament checks on "Fil-Check" position—no need to carry a second filament checker. ★ Capacitor checks simplified.
- ★ Two spare preheating sockets to cut down testing time.

In stock at your local parts distributor.



Model LC-3  
\$2895

DEALER NET  
Really Whips  
Tough Dogs

Service Instruments Corp. 121 Official Road, Addison, Ill.

# Now! SOLVE CIRCUIT PROBLEMS FAST!

Goodbye to trial-and-error methods.

Every circuit calculation you need can now be done accurately with **THE ALGEBRA OF ELECTRONICS**



**YOU'LL BE AMAZED** at how easy it is to figure resistances, load inductances, impedances, etc. for ANY part of ANY electronic circuit. With this new book, **THE ALGEBRA OF ELECTRONICS**, you will quickly gain the tools, techniques and shortcuts needed.

### Three Great Books in One!

**First, it's a textbook.** All practical mathematical techniques explained clearly step-by-step, easy to follow by those with no more math training than high-school algebra and simple differential calculus.

**Second, it's a handbook.** Graphs and tables answer common electronic problems for those not wishing to work out complex derivations themselves.

**Third, it's a review.** Every equation is discussed, along with its practical on-the-job applications. 100 problems are shown with methods and answers provided.

**THE ALGEBRA OF ELECTRONICS** was written by Chester H. Page, Consultant to the Director of the National Bureau of Standards. Dr. Page discusses basic laws and fundamental principles, practical methods of solving simultaneous equations. He develops elementary Fourier waveform analysis, shows effects of frequency selectivity, modulation, and analyzes tubes, transistors and power supplies.

**Try it FREE for 10 days** Whether you're a repairman, technician, or engineer, you'll find **THE ALGEBRA OF ELECTRONICS** both profitable and interesting. Send coupon for a **FREE 10-DAY EXAMINATION**. No obligation—unless you want to keep the book. Mail coupon today to

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Dept. 571, Princeton, N.J.  
(Established 1848)

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TOPICS**

340 Pages  
252 Illustrations

  - Nonlinear Resistance
  - Network Topology
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  - Transistors
  - Thermal Noise
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  - many more—

## New Products

For more information, write in **ELECTRONIC TECHNICIAN's** new product code number on coupon, on page 45

### Shell TUBE TESTER

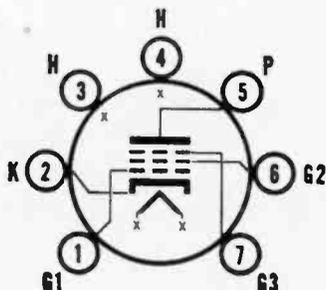
Model T-18 "Test-O-Matic" tests each side of multi-purpose tubes, and 6 and 12 volt vibrators. Uses just 18 sockets to emission test all tube types. New sockets conform to MIL spec. Assures positive contacts and longer wear.



Covers more than 800 tube types. It has three easy-to-use controls, simple directions and meter. Operates on 110-120 volt ac. Table model, \$91.85 dealer price. Also, not shown, L-18 with legs, \$99.95. Shell Electronic Mfg. Corp., 1688 Utica Ave., Brooklyn, N. Y. (**ELECTRONIC TECHNICIAN 1-5**)

### CBS PENTODE

Three heater versions of a wideband, high-frequency pentode are sharp-cut-off types 3DK6, 4DK6 and 6DK6. They are particularly suited for use as i-f amplifiers in TV receivers; they feature a high transconductance of 9800 micromhos. Plate resistance is 0.35 meg, Class A plate current 12 ma. The 3DK6



and 4DK6 are designed for use in 600-ma and 450-ma series—string sets respectively; and the 6DK6, for parallel heater operation. Plate voltage is 300 v. max., 125 v. class A. Plate dissipation 2 watts. (Bulletin E-315.) CBS-Hytron, Parker St., Newburyport, Mass. (**ELECTRONIC TECHNICIAN 1-9**)

there's  
nothing  
like the  
feel of the  
right gun...

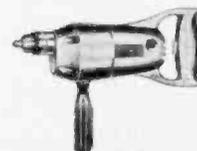
or  
the right  
**TOOL!**

**WEN**

**POWER TOOLS**  
are "job-matched" for

easier handling, trustier performance!

Pick up a Wen tool. It fits in your hand like it grew there! Lightweight, streamlined Wen designs are extra easy-handling... quality-engineered to do the job right. Ask any Wen tool user. Your best dollar-for-dollar buy, too!



**2-SPEED POWER DRILL**  
3/8" capacity in steel,  
up to 3/4" in hardwood.  
Smooth easy speed  
change, high torque  
motor. **\$29<sup>95</sup>**



**TOTER KIT**  
Perfect supplement to  
drill. 35 pieces including  
drill holder, Tote  
Box with tray. A whole  
workshop, only **\$9<sup>95</sup>**



**SOLDERING GUN KIT**  
includes 4 tips for wide  
variety of uses, solder,  
"Quick-Hot" gun  
heats in only 2 1/2 sec-  
onds. A buy at **\$9<sup>95</sup>**

Burton bromine advertising

See complete line of Wen power tools  
at your favorite dealer!

**WEN PRODUCTS, INC.**  
5810 Northwest Highway • Chicago 31, Illinois

**D. VAN NOSTRAND CO., Dept. 571**  
120 Alexander St.,  
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Send—for free examination—**THE ALGEBRA OF ELECTRONICS**. If I don't feel it can make electronic calculations clearer, easier, and faster, I may return it within 10 days; owe nothing. Otherwise, I will pay \$2.75 down, plus small delivery cost, and \$3 per month for 2 months.

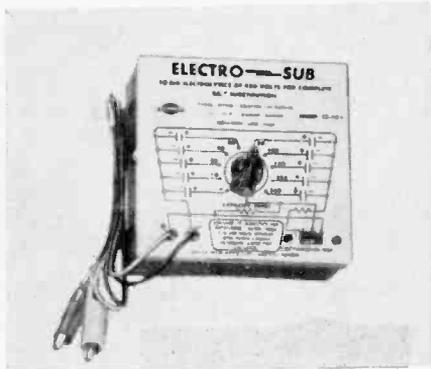
Name \_\_\_\_\_  
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Address \_\_\_\_\_  
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

**SAVE!** Enclose \$8.75 WITH coupon and we will pay all shipping costs. Same ten-day money-back privilege.

**Sencore**  
**ELECTROLYTIC SUBSTITUTION**

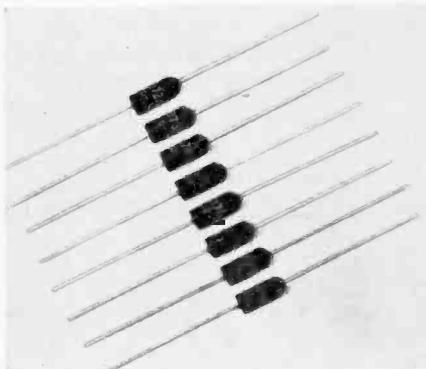
Electro-sub Model ES 102 is designed to substitute for electrolytics in any circuit between 2 and 450 v. Range includes 10 separate electrolytics from 4 to 350  $\mu$ f. New surge protector circuit prevents capacitors from arcing during charge or discharge, and prevents ca-



pacitor heating while paralleling an intermittent electrolytic. Release of surge protector switch automatically discharges electrolytic within seconds, thus insuring user protection. \$15.95. Service Instrument Co., 171 Official Rd., Addison, Ill. (ELECTRONIC TECHNICIAN 1-4)

**Tung-Sol SILICON RECTIFIERS**

A line of eight silicon rectifiers ranging from peak inverse voltage of 50 to 500 volts for radio and TV sets have been assigned type numbers 1N2072 through 1N2079. The new units are diffused junction silicon rectifiers enclosed in epoxy resin cases with flexible pigtail leads. In configuration they closely resemble small capacitors. The

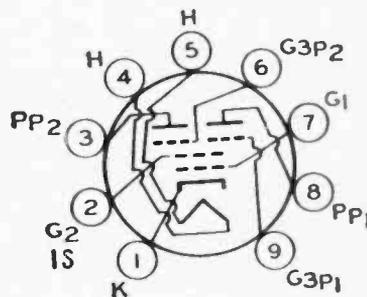


1N2078, with a peak inverse voltage of 400 v., has wide application for radio and TV. It provides the low forward voltage drop and low leakage current. Flexible leads may be soldered into any piece of equipment, no additional hardware required. Tung-Sol Electric, Inc., 95 8 Ave., Newark 4, N. J. (ELECTRONIC TECHNICIAN 1-12)

**RCA TWIN PENTODE**



The 4BU8 is a sharp-cutoff twin pentode of the 9-pin miniature type intended for use in age and sync circuits of TV receivers. The 4BU8 utilizes a common cathode, a common grid No. 1, a common grid No. 2, two grids No. 3, and two plates. Each of the grids No. 3 has a separate basepin terminal and may be used independently as a control electrode. Except for a 4.2-volt/450-ma heater having controlled warm-up time, the 4BU8 is like its companion types, the 3BU8, which also has controlled warmup time, and the 6BU8. Electron Tube Div., Radio Corp. of America, Harrison, N. J. (ELECTRONIC TECHNICIAN 1-35)



the specs are the proof...  
the BEST BUYS are **EICO**<sup>®</sup>  
for COLOR & Monochrome TV servicing



**COLOR**  
and Monochrome  
dc to 5 mc lab & tv  
5" OSCILLOSCOPE  
#460  
Factory-wired \$129.95  
Kit \$79.95

• Features DC Amplifiers!

Flat from DC-4.5 mc, usable to 10 mc. VERT. AMPL.: sens. 25 rms mv/in; input 2.3 megs; direct-coupled & push-pull thruout; K-follower coupling bet. stages; 4-step freq-compensated attenuator up to 1000:1. SWEEP: perfectly linear 10 cps-100 kc (ext. cap. for range to 1 cps); pre-set TV V & H positions (30 & 7875 cps); auto. sync. ampl. & lim. PLUS: direct or cap. coupling; bal. or unbal. inputs; edge-lit engraved lucite graph screen; dimmer; filter; bezel fits std photo equip. High intensity trace CRT. 0.06 usec rise time. Push-pull hor. ampl., flat to 400 kc, sens. 0.6 rms mv/in. Built-in volt. callb. Z-axis mod. Sawtooth & 60 cps outputs. Astig. control. Retrace blanking. Phasing control.



**TV-FM SWEEP**  
**GENERATOR**  
& **MARKER** #368  
Factory-wired \$119.95  
Kit \$69.95

Entirely electronic sweep circuit (no mechanical devices) with accurately-biased inductor for excellent linearity. Extremely flat RF output: new AGC circuit automatically adjusts osc. for max output on each band with min. ampl. variations. Exceptional tuning accuracy: edge-lit hairlines, 6:1 vernier. Swept Osc. Range 3-216 mc in 5 fund. bands. Variable Marker Range 2-75 mc in 3 fund. bands; 60-225 mc on harmonic band. 4.5 mc Xtal Marker Osc., xtal supplied. Ext. Marker provision. Sweep Width 0-3 mc lowest max. deviation to 0-30 mc highest max. dev. 2-way blanking. Narrow range phasing. Attenuators: Marker Size, RF Fine, RF Coarse (4-step decade). Cables: output, 'scope horiz., 'scope vertical.

**DYNAMIC CONDUCTANCE**



**Tube & Transistor Tester**  
#666  
Factory-wired \$109.95  
Kit \$69.95

**COMPLETE with steel cover and handle.** SPEED, ease, unexcelled accuracy & thoroughness. Tests all receiving tubes (& Color & Monochrome pic tubes with adapter). Composite indication of Gm., Gp & peak emission. Simultaneous sel of any 1 of 4 combinations of 3 plate voltages, 3 screen voltages, 3 ranges of continuously variable grid voltage (with 5% accurate pot). New series-string voltages: for 600, 450, 300 ma types. Sensitive 200 ua meter. 5 ranges meter sensitivity (1% shunts & 5% pot). 10 SIX-position lever switches: free-point connection of each tube pin. 10 pushbuttons: rapid insert of any tube element in leakage test circuit & speedy sel. of individual sections of multi-section tubes in merit tests. Direct-reading of inter-element leakage in ohms. New gear-driven rollchart. Checks n-p-n & p-n-p transistors: separate meter readings of collector leakage current & Beta using internal dc power supply.

See the 50 EICO models  
IN STOCK at your neighborhood distributor.  
Write for  
**FREE Catalog ET-1**  
33-00 Northern Boulevard, L. I. C. 1, N. Y.

Prices 5% higher in West

SERVICE MEN KNOW THERE IS JUST ONE

**HUSH**

Reg. U. S. Pat. Off.

Chemically engineered for tuners and switching mechanism

Hush comes in a 6 oz. pressure can with sufficient pressure to reach all contacts to wash-away that dirt, leaving clean and positive contacts, protected with a lasting lubricant film. Hush also available in 2 oz., 8 oz. and 32 oz. containers. \$2.25 net

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Reg. U. S. Pat. Off.®

Since 1949 the Original Volume Control and Contact Restorer

EVER-QUIET is a free-flowing liquid that leaves no powder residue. Scientifically designed to seep around the shaft and penetrate the control or potentiometer, cleaning and contacts and leaving a safe protecting film. Harmless to metals, wire or carbon. Will not affect inductance, capacitance or resistance.

2 oz. bottle with handy dispenser (32 oz. size available) 79¢ net

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CHEMICAL ELECTRONIC ENGINEERING, INC. Matawan, New Jersey

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**TO HANDLE  
ANY SERVICING**

... is one reason why  
more servicemen  
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**POWER SUPPLIES**

Other reasons . . .

Out-serves all others  
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. . . transistor, "hybrid" and  
tube auto radios, transistor  
portable radios, aircraft and  
marine radios. Also charges  
batteries, operates relays;  
used for electroplating, lab-  
oratory work, other uses.

**Lowest ripple**

Less than 1/2% up to 5 amps.  
Less than 2% up to 10 amps.

**2 Continuously variable  
ranges**

0.8 and 0.16 volts, 10 am-  
peres continuous duty up to  
12 volts; 20 amperes inter-  
mittent current rating.

**Patented conduction cooling**

Lowers cost per ampere out-  
put. Adds years of trouble-  
free service.

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LABORATORIES**

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

**AS YOU LIKE IT**

**WIRED**



D-612T  
**\$4995**

**KIT**



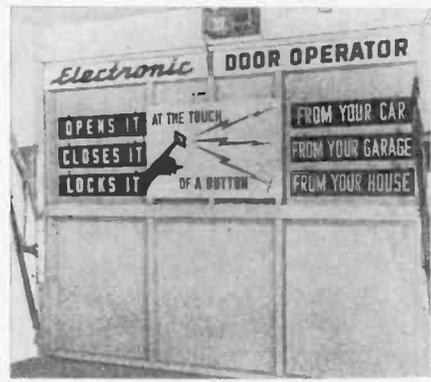
K-612T  
**\$4495**

Backed by Certified  
Proof-of-Performance Charts



## Paxton GARAGE DOOR OPERATOR

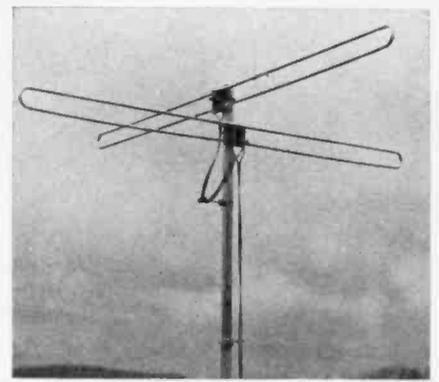
Electronic garage door operator is designed to operate all types of overhead doors. It is controlled from the car transmitter or pushbuttons in house or garage, combined with a radio receiver in a compact unit no larger than a portable radio. Installation is simple, with only three lag screws used to se-



cure the unit to the header beam above the garage door. No tracks, rods, or posts are required. System employs frequencies in FCC approved 200 to 400 kc band, with triple-lock r-f/a-f and burst coding between transmitter and receiver. Five-year warranty. Paxton Products, 929 Olympic Blvd., Santa Monica, Calif. (ELECTRONIC TECHNICIAN 1-20)

## Taco FM ANTENNA

A modernized version of the "Turnstile" type FM antenna is gold-anodized for improved life and appearance. The G 666 has two folded-dipoles mounted at right angles to each other. The terminal boards of the two dipoles are made of high dielectric, high tensile strength material. The terminals are



connected electrically by means of a tuned transmission line for maximum efficiency throughout the FM spectrum. Terminal impedance of the antenna assembly is 300 ohms. The G 666 is designed for omnidirectional reception in strong to medium signal areas. \$9.25 list. Technical Appliance Corp., Sherburne, N. Y. (ELECTRONIC TECHNICIAN 1-21)

## DEPENDABLE TV-RADIO TUBES

**ZALYTRON**

Tubes for TV-Radio Service-  
men, Dealers, Experimenters.



**1-YEAR  
GUARANTEE**

Nationally sold ZALYTRON Tubes are BRAND NEW Quality Tubes, priced low to help you meet competition in your area — and guaranteed to perform as well and as long as tubes much higher priced. Why pay more? Try them once, you'll buy them always. Every tube we ship is covered by our Full Refund Guarantee . . . YOU be the judge! Send today for new Price List "ET"

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with "Package Deal" order for nationally sold ZALYTRON Quality-Brand Receiving Tubes. We'll show you how to start a successful Tube Tester Route, and get YOUR share of today's Big Profits in Self-Service Tube Sales! This is no "Get-Rich-Quick" scheme but a solid, proven business that will reward you well — if you WORK at it. But, INVESTIGATE before you INVEST! Get full details on the best "Deal" now being offered, send today for our Booklet "ET"



**ZALYTRON TUBE CORP.**  
220 West 42nd St.,  
New York 36, N. Y.

**SAVE  
TIME  
with**



## SENCORE Handy "36"

### R C-Substitution Unit

"36"—Most Often Needed Components at YOUR Fingertips!

3 Pole, 12 position switch individually selects one of the "36" components for direct substitution.

Contains:

- ★ 12—1 watt 10% resistors from 10 ohms to 5600 ohms
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- ★ 1—10 mfd., 450V Electrolytic ★ 1—40 mfd., 450V Electrolytic
- ★ For Shop, Lab, or outside service

See other SENCORE ads in this issue.

Service Instruments Corp. 121 Official Road, Addison, Ill.



ONLY  
**\$1295**  
DEALER NET

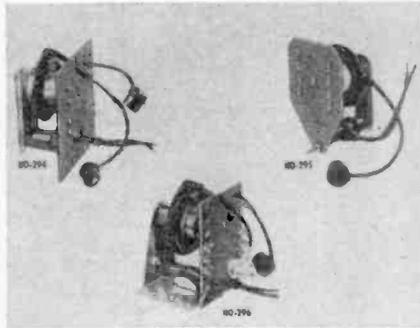
Completely Isolated  
Available at all  
Parts Distributors



"He was *not* trying to steal your new JENSEN CARTRIDGE. He was just *admiring* it."

### Stancor FLYBACKS

Transformer line has been expanded to include exact replacement flybacks for use in Emerson TV sets (see photo). HO-294 is a replacement for Emerson part numbers 738103 and 738109 in 32 chassis and 65 models. HO-295 replaces Emerson numbers 738106, 738107, and 738111 in 16 chassis and 71 models. HO-296 replaces Emerson 738119, 738122, 738128, 738129, and 738140 in 16 chassis and 31 models. (Bulletin 550.) Also, not



shown, two replacement flybacks for Hoffman sets are flyback HO-291 for Hoffman part 5118A in 65 models of 6 chassis, and Stancor HO-292 to replace Hoffman part numbers 5154A and 5154-3 in 49 models of six chassis. (Bulletin 549.) They require no chassis or circuit alterations. Chicago Standard Transformer Corp., 3501 Addison St., Chicago 18, Ill. (ELECTRONIC TECHNICIAN 1-10)

### G-C AUTO RADIO CONTROLS

A new line of exact factory auto radio replacement controls has just been made available to the electronic parts replacement market. It was developed in response to requests from service technicians to secure original factory replacements, reports the company. 98 different controls are being offered, which



the first claims will service 199 different automobile makes and models. To make the service job easier, a handy replacement guide folder gives full replacement information such as part numbers, car makes, and list prices of each control. G-C Electronics Mfg. Co., (div. G-C Textron Inc.), 400 S. Wyman St., Rockford, Ill. (ELECTRONIC TECHNICIAN 1-25)

**FAST!  
ACCURATE!**

**SECO Test Equipment**

**Saves time . . . makes more money for you!**

WRITE TODAY FOR COMPLETE SPECIFICATIONS AND FEATURES!

- Outstanding Reliability and Performance!
- Unique, Time-Saving Features!
- Low First Cost Makes You Money From the Start!

**107 TUBE TESTER**—Outstanding performance and accuracy—provides 3 important tests: amplifier types tested for gain by Dynamic Mutual Conductance method—power types tested for cathode current by Cathode Emission method—all types tested for shorts and grid error by Grid Circuit Test developed and patented by Seco. Dynamic Mutual Conductance Test pre-wired to eliminate elaborate set-up. Cathode Emission Test done by free point pin-selector method—will not be obsoleted. Completely self-contained in portable carrying case. Furnished with handy flip chart for fast tube set-up data.



**MODEL 107 . . . \$139.50 NET**



**GCT-8 GRID CIRCUIT TUBE TESTER**—Perfect companion to any tester—checks critical "control grid" condition of vacuum tubes fast, accurately.

Electron eye tube indicates faults at a glance. As many as eleven simultaneous checks—automatically.

**MODEL GCT-8—Kit . . . \$19.95 NET**

**MODEL GCT-8—Wired & tested . . . 29.95 NET**



**208 VTVM**—"Fool-proof"—many new features! Easy-to-read 4½" 200 microamp meter mounted on sloping panel—7 DC, 7 AC, 7 ordinary Ohm ranges, plus RETMA (EIA) Ohm scale to check standard color-coded resistance values and tolerance limits.

Specially designed "shift-lever" type function switch identifies and automatically connects proper probe. With stand, 40" leads, and common lead with clip.

**MODEL 208 . . . \$74.50 NET**

Leather, felt-lined carrying case. **\$9.95 NET**



**PS-2 BATTERY ELIMINATOR**—Compact unit takes place of battery normally used to operate and service low-powered transistorized equipment. Supplies clean, filtered DC—can't be damaged

by a short. Quickly spots faulty batteries by substitution. Output continuously variable from 0 to 15 V.—ideal for experimenters. Complete with jacks, leads, and clips.

**MODEL PS-2 . . . \$13.95 NET**

**FB-4 FLYBACK CIRCUIT AND INDUCTANCE ANALYZER**—Quick "yes" or "no" answer on condition of flyback transformer and yoke—100% accuracy!

**MODEL FB-4 . . . \$38.95 NET**

#### NEW! HC-6 CURRENT CHECKER

Provides positive, on-the-spot method of checking TV horizontal output circuits—fast, accurate way to adjust horizontal drive and linearity. Easy to use—can be placed in circuit in seconds—compact size. Complete, ready to use.

**MODEL HC-6 . . . \$12.95 NET**

Get the complete story on Seco's exciting line of test equipment. See your distributor—or write for complete information today!

**SECO MANUFACTURING CO.**



**5015 Penn Avenue So.  
Minneapolis, Minn.**

**NEW**

**ELECTRO-MAGNETIC SET COUPLER WIZARD 300\***

BRILLIANT RECEPTION ON AT LEAST 20 TV/FM SETS INCLUDING COLOR FROM ONE ANTENNA WITHOUT AMPLIFICATION IN NORMAL SIGNAL AREAS

EASY TO INSTALL

SLIDES APART

SLIDES TOGETHER

CONNECT TO SET

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Operate your...

- tape recorder
- P. A. system
- portable TV set
- hand tools

FROM YOUR CAR, Boat or Plane!

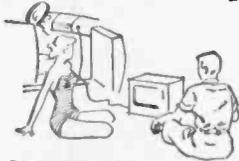
with



## INVERTERS

FOR CHANGING YOUR STORAGE BATTERY CURRENT TO

A.C. HOUSEHOLD ELECTRICITY ANYWHERE...in your own CAR, Boat or Plane!



**OPERATES**  
PORTABLE TV SET  
directly from your car!

**OPERATES**

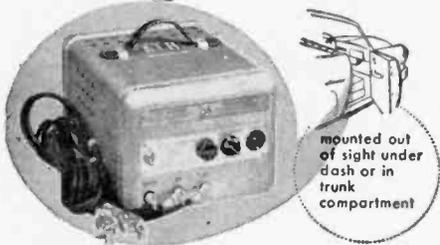
- TAPE RECORDERS
- DICTATING MACHINES
- PUBLIC ADDRESS SYSTEMS
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MAKE YOUR CAR, BOAT OR PLANE  
"A ROLLING OFFICE!"



**OPERATES**  
• RADIOS  
• RECORD PLAYERS  
• MIXMASTERS, ETC.  
directly from your car!



mounted out of sight under dash or in trunk compartment

## ATR UNIVERSAL INVERTERS

Especially designed to change 6 or 12 volt D.C. to 110 volt A.C. 60 cycles. for...

- EXECUTIVES
- POLICEMEN
- SALESMEN
- REPORTERS
- OUTDOOR MEN
- FIREMEN
- PUBLIC OFFICIALS

MODELS 6U-RHG (6 volts) 125 to 150 watts. Shipping weight 27 lbs. List price.....\$89.95

DEALER NET PRICE.....\$59.97

12U-RHG (12 volts) 150 to 175 watts. Shipping weight 27 lbs. List price.....\$89.95

DEALER NET PRICE.....\$59.97

Write for literature on other Sizes and Models of ATR INVERTERS, priced as low as \$9.95 list.

**SEE YOUR JOBBER OR WRITE FACTORY**

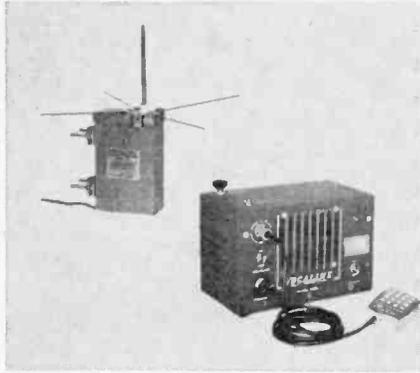
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**AMERICAN TELEVISION & RADIO CO.**  
Quality Products Since 1931  
SAINT PAUL 1, MINNESOTA, U. S. A.

### Vocaline TRANSCIVER

This 465 mc remote controlled Citizens Band transceiver is designed to eliminate the signal losses incurred when operating series JRC Citizens Band transceivers with a base station antenna. The CUB-1/MT-1 delivers the full power to the antenna because the antenna is built into the remote transceiver. The CUB-1 control unit (r) can be placed up to 500 feet from the MT-1



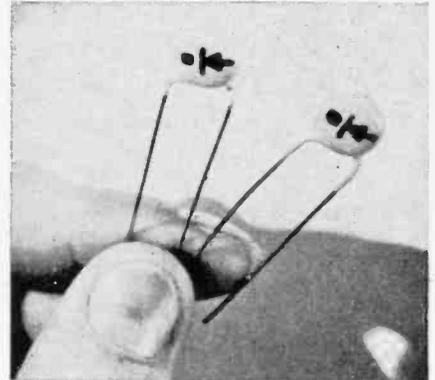
transceiver (1), allowing the transceiver to be mounted as high as possible for maximum performance. The weather-proof MT-1 remote transceiver is supplied with 100 feet of 6 conductor control cable. Up to 400 feet of cable may be added if required. Incorporates a variable squelch control. \$179.50 complete. Vocaline Co. of America, Inc., Old Saybrook, Conn. (ELECTRONIC TECHNICIAN 1-22)

### Centralab CONTROL

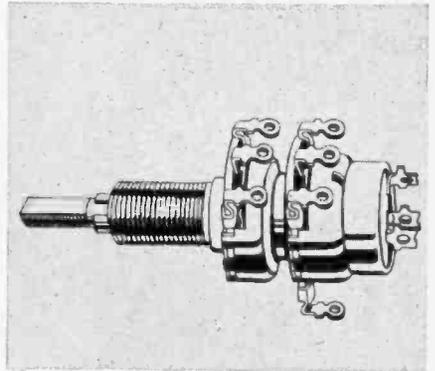
A new line of auto radio exact replacement controls covers all popular makes and models of auto radios in use today. Private label brands are included, as well as auto manufacturers' brands. In announcing the new line, it was stated, "Auto radio repair is a very lucrative field, in which many of our electronic technicians have not previously attempted to be active. With this new exact replacement control line, however, the technicians can go after more of this profitable business." Centralab, 900 E. Keefe Ave., Milwaukee 1, Wis. (ELECTRONIC TECHNICIAN 1-33)

### Mallory SILICON RECTIFIERS

A new silicon rectifier gives service technicians a commercial unit with high quality at prices claimed to be substantially lower than comparable silicon rectifier types. Type TSR has a diffused junction and is designed for 85°C ambient temperature. PIV is 400 v.; 500 ma max. dc load; 0.5 v. forward drop; 0.2 ma reverse leakage. In addition, a plug in unit, Type PSR is a low cost unit



for sets already converted to silicon rectifiers; a top hat, Type ESR for severe industrial applications; and a stud, Type SSR, also for industrial and military applications. Convenient conversion kits for replacing selenium rectifiers in radio and TV are available in both Type TSR and PSR. P. R. Mallory & Co., 3029 E. Washington St., Indianapolis 6, Ind. (ELECTRONIC TECHNICIAN 1-34)



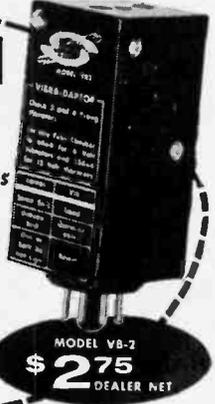
SAVE TIME with SENCORE

2 Adaptors in 1 SENCORE "VIBRA-DAPTOR"

NOW - Check Vibrators in ANY Tube Checker

Checks Both Three and Four Prong Vibrators

- Merely plug into any tube checker. Set for 6AX4 (or 6SN7) for 6 Volt Vibrators and 12AX4 (or 12SN7) for 12 Volt Vibrators.
- Two lamps viewed through top of adaptor indicate whether or not Vibrator needs replacing. Rugged—Made of steel.
- Replaceable but unbreakable #51 indicating lamps. Operates easily with Sencore LC-3 Leakage Checker. Complete instructions screened on front.



In stock at your local parts distributor.

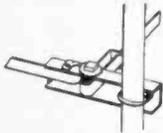
Service Instruments Corp. 121 Official Road, Addison, Ill.

MODEL VB-2 \$275 DEALER NET

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ask the  
"Man-on-the-Roof"  
why he prefers

*South River*



TWO  
TO A  
SET

**RATCHET TYPE  
CHIMNEY MOUNT**

Model RT (Galv. Banding)  
Model RT-ST  
(Stainless Banding)

FASTEST, SIMPLEST, MOST  
CONVENIENT EVER MANU-  
FACTURED — Mounts in 2  
simple steps. Completely fac-  
tory assembled with no eye-  
bolts, banding clips, nuts, etc.,  
to handle. Furnished with  
flat-lay, non-coiling banding,  
heavy gauge embossed, welded  
steel construction. Forged  
heat treated Alum. ratchets.

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METAL PRODUCTS CO., INC.  
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*pioneer &  
outstanding  
producer of  
finest line  
of antenna  
mounts*

Canada: Len Finkler & Co., Toronto



you'll find  
the right replacement  
faster in the

**'59 MASTER**

Complete descriptions, illustrations,  
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sell and bill direct from the MASTER  
—world's largest electronic catalog at  
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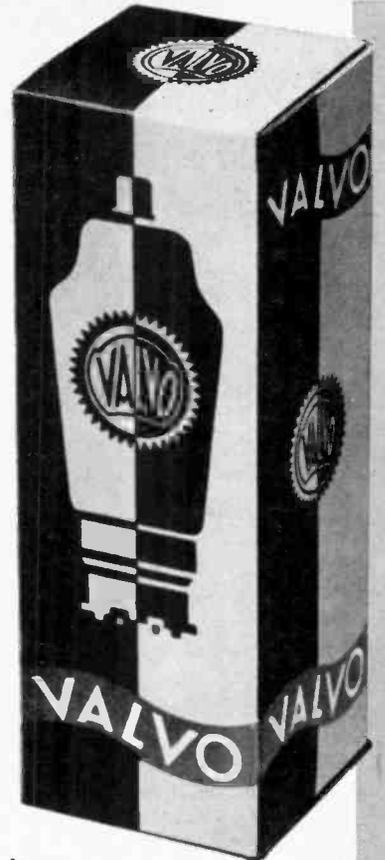
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CHART at your jobber, or send 10c to:

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

**INDEX TO ADVERTISERS**  
January, 1959

Aerovox Corp. . . . .	54
American Microphone Manufacturing Co. . . . .	24
American Television & Radio Corp. . . . .	78
Amperex Electronic Corp. . . . .	79
Astatic Corp. . . . .	58
Astron Corp. . . . .	56
B & K Manufacturing Co. . . . .	55
Blonder-Tongue Laboratories, Inc. . . . .	4
Bussmann Manufacturing Co. . . . .	46
Capital Radio Engineering Institute . . . . .	65
CBS-Hytron . . . . .	57
Centralab Div., Globe-Union, Inc. . . . .	64
Century Electronics Co., Inc. . . . .	50, 51
Channel Master Corp. . . . .	23
Charles Engineering, Inc. . . . .	77
Chemical Electronic Engineering, Inc. . . . .	75
Communications Co., Inc. . . . .	67
Cornell-Dubilier Electric Corp. . . . .	25
Delco Radio Div., General Motors . . . . .	20
Deutschmann Corp., Tobe . . . . .	26
EICO . . . . .	75
Electro Products Laboratories . . . . .	76
Electro-Voice, Inc. . . . .	Cover II
General Electric Co. . . . .	12, 13, 19, 72, 80
Greyhound Corp. . . . .	17
Heath Co. . . . .	18
Hickok Electrical Instrument Co. . . . .	68
Institute of Radio Engineers . . . . .	69
International Resistance Co. . . . .	2, 3
Jensen Industries, Inc. . . . .	77
Jerrold Electronics Corp. . . . .	14
JFD Electronics Corp. . . . .	Cover III
Kingston Electronic Corp. . . . .	71
Mallory & Co., Inc., P. R. . . . .	6, 7
Milwaukee Resistor Co. . . . .	66
Moss Electronic Distributing Co., Inc. . . . .	59
Ohmite Manufacturing Co. . . . .	73
Philco Corp. . . . .	11, 22
Pickering & Co., Inc. . . . .	71
Planet Sales Corp. . . . .	69
Precision Apparatus Co., Inc. . . . .	10
Quam-Nichols Co. . . . .	66
Radiart Corp. . . . .	27
Radio Corporation of America . . . . .	16, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100
Radio Receptor Co., Inc. . . . .	62
Raytheon Manufacturing Co. . . . .	28
Rider Publisher, Inc., John F. . . . .	61, 68
Rohn Manufacturing Co. . . . .	53
Seco Manufacturing Co. . . . .	60, 77
Service Instruments Corp. . . . .	65, 67, 70, 73, 76, 78
South River Metal Products Co., Inc. . . . .	79
Sprague Products Co. . . . .	5
Sylvania Electric Products, Inc. . . . .	8, 9, 15, 52
Tung-Sol Electric, Inc. . . . .	21
United Catalog Publishers . . . . .	79
Van Nostrand Co., Inc., D. . . . .	74
V-M Corp. . . . .	44
Wen Products, Inc. . . . .	74
Westinghouse Electric Corp. . . . .	63
Xcelite, Inc. . . . .	70
Zalytron Tube Corp. . . . .	76

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An  
exclusive  
service  
by

**Amperex®**  
distributors:

**VALVO**  
RECEIVING TUBES

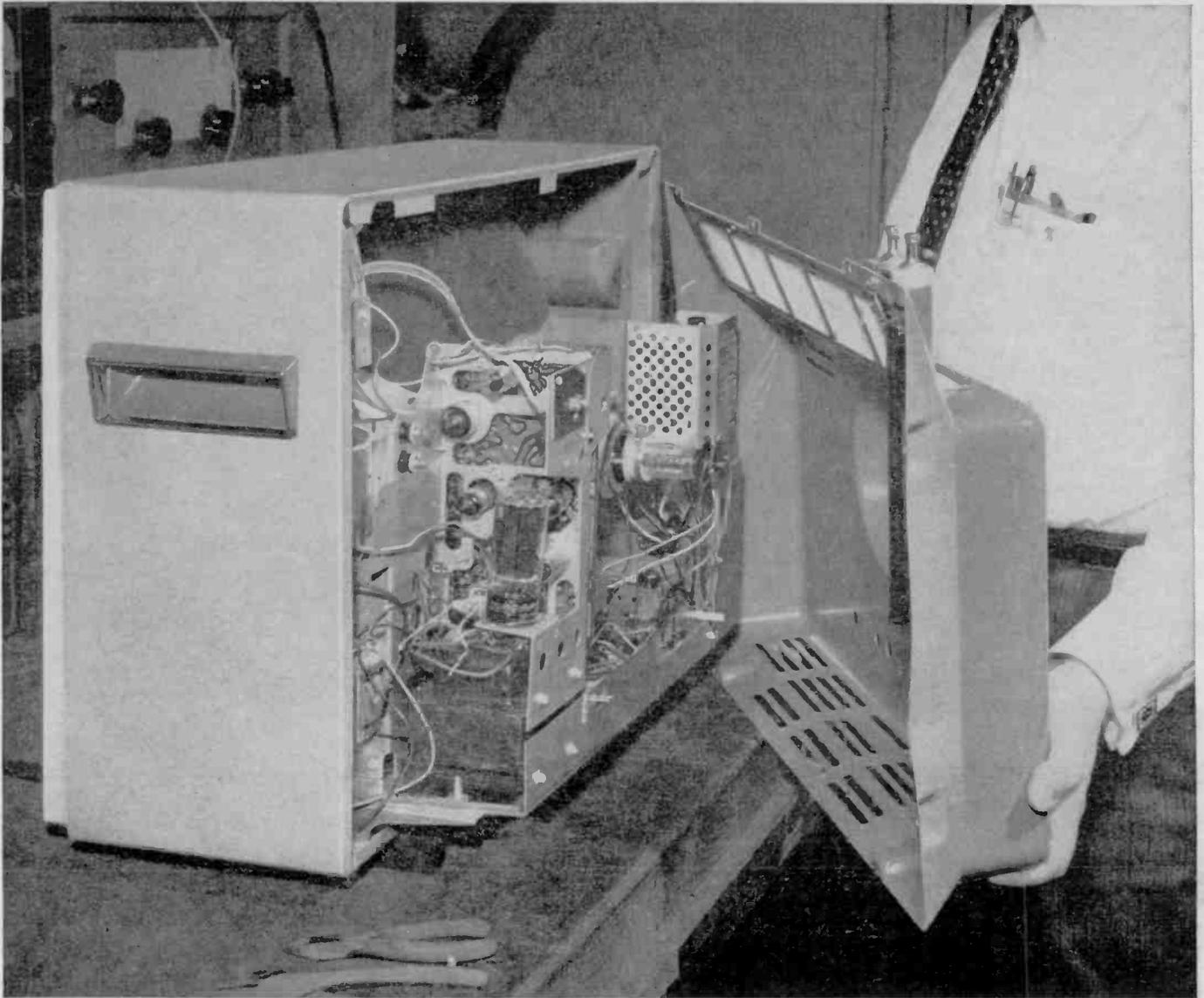
for replacement in  
European radios

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



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

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



Take the back off the General Electric "Designer" TV set and you can do 85%-90% of service jobs without pulling the chassis

*You cut your time-per-repair by up to 40% . . . make more calls—and money—in the same amount of time!*

Take off the back and there you are—in easy reach of up to 90% of service jobs. Look at the chart!

Look inside! Both sides of the reliable printed circuit boards are easy to reach for service.

No series string filaments—no extension cables needed . . . the new "Designers" are certainly the easiest-to-service sets in all television. You'll wish every set was a General Electric "Designer."

*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**

TEN TYPICAL JOBS THAT CAN BE DONE WITHOUT REMOVING THE CHASSIS				
JOB	G-E "Designer"	Set A	Set B	Set C
Replace most resistors	yes	no	no	no
Replace most capacitors	yes	no	no	no
Replace deflection yoke	yes	no	no	no
Replace video detector	yes	yes	no	no
Replace audio detector	yes	no	no	yes
Replace horizontal phase detector	yes	no	yes	yes
Replace power rectifier	yes	no	no	yes
Adjust tuner oscillator	yes	no	yes	yes
Replace inter-stage transformers	yes	no	no	no
Replace size and linearity controls	yes	no	yes	yes

General Electric Co., Television Receiver Dept., Syracuse, N. Y.

# ELECTRONIC TECHNICIAN 466

## CIRCUIT DIGEST

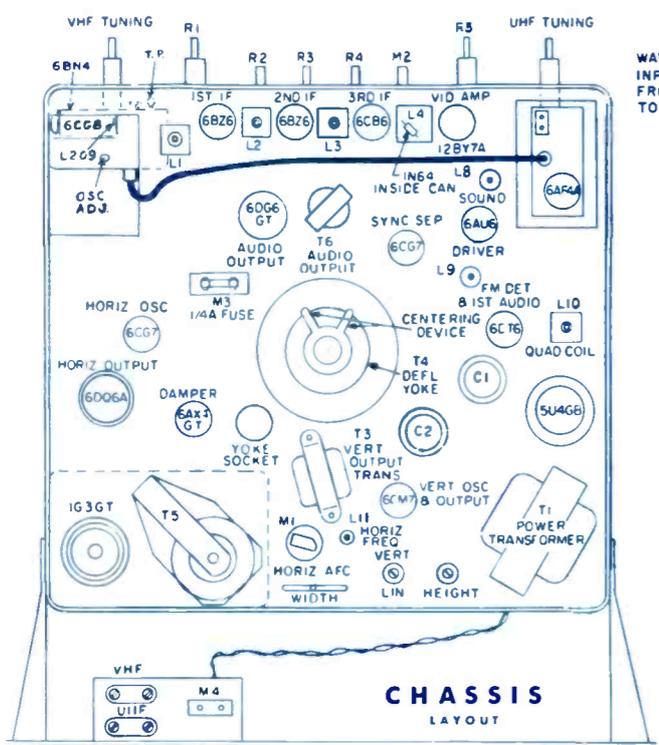
### MAGNAVOX

Chassis 28 Series

January • 1959

Model 1-MV/U121L; 1-MV/U160L

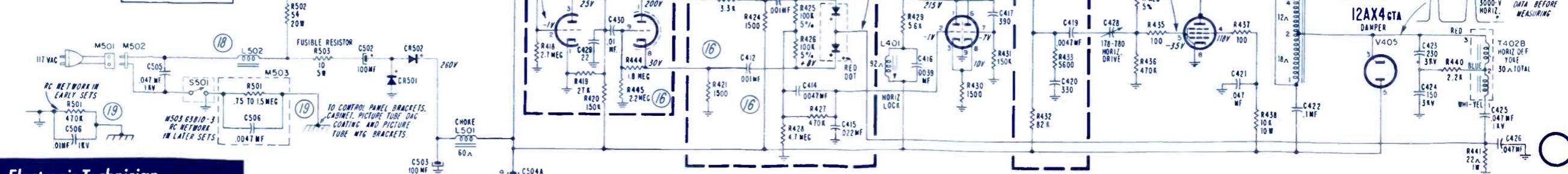
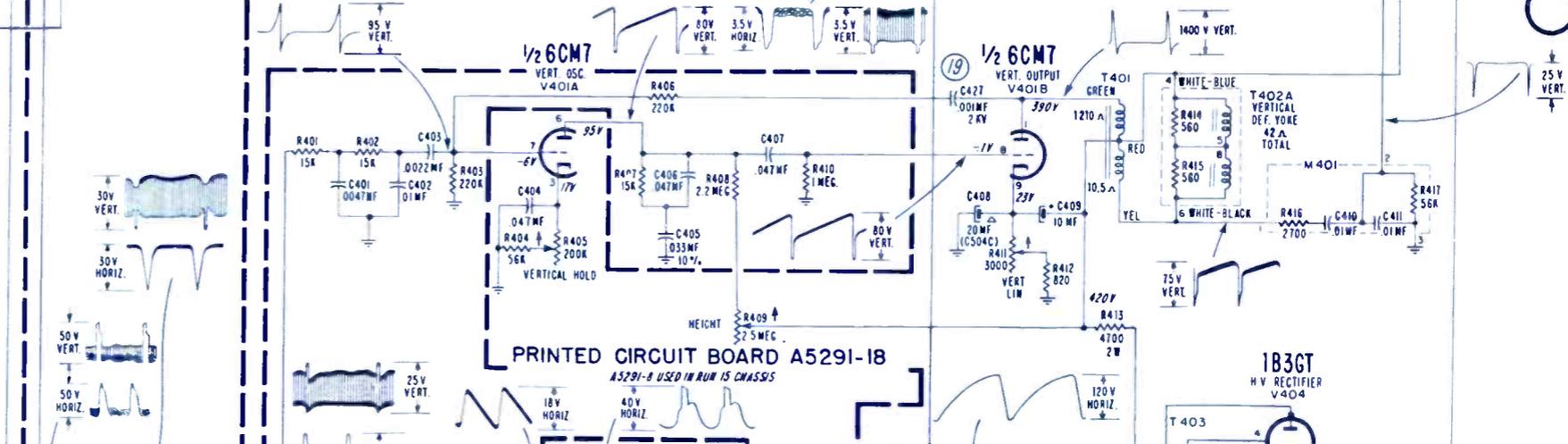
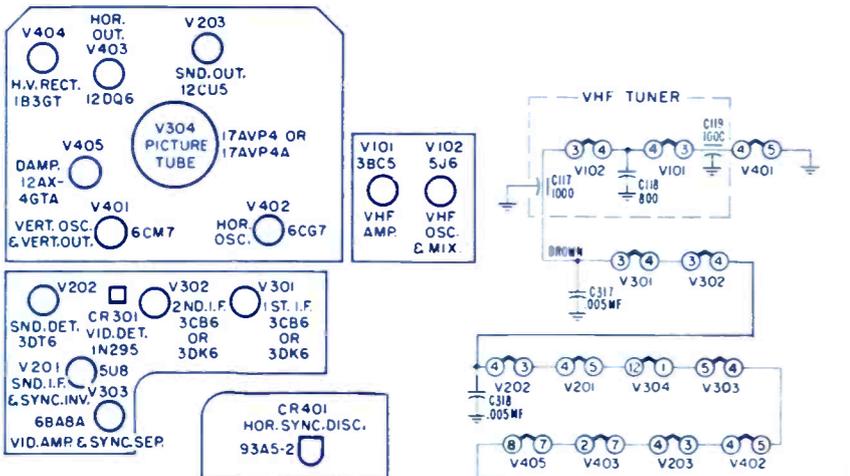
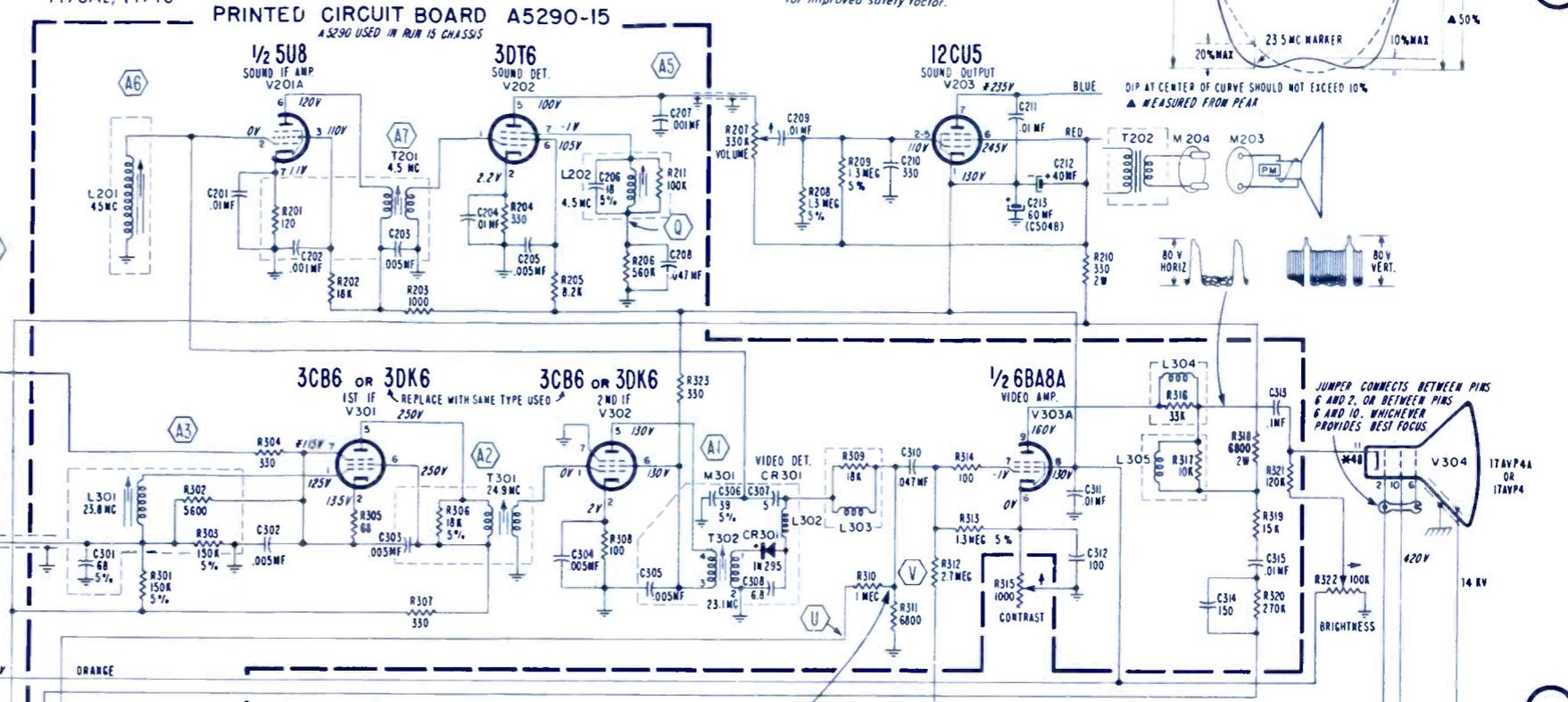
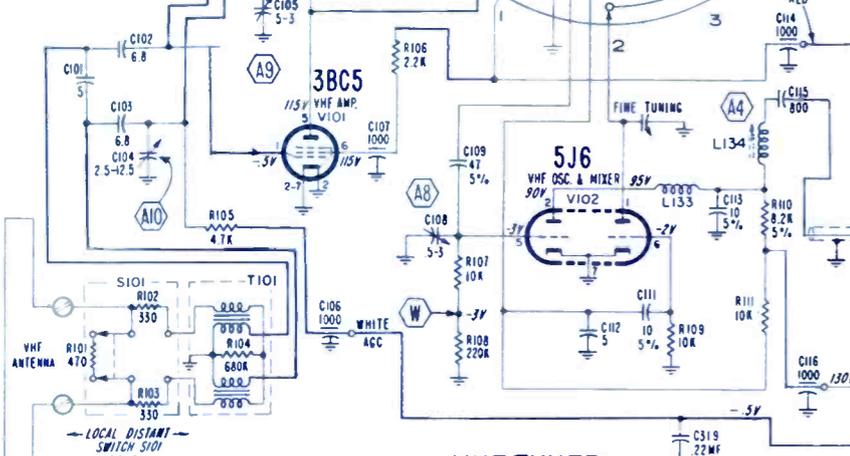
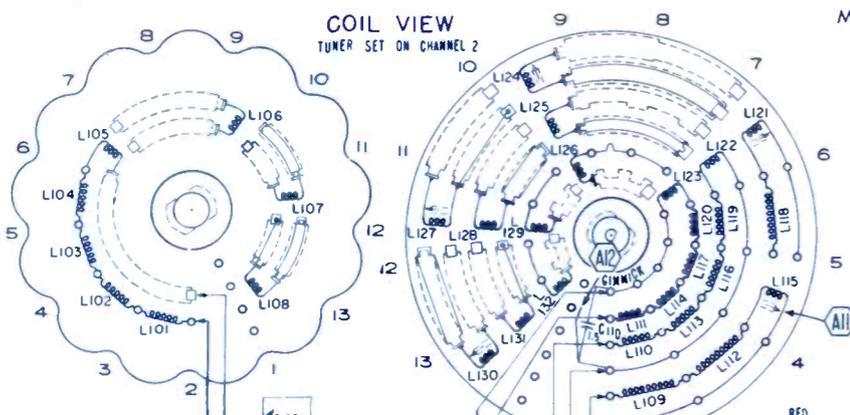
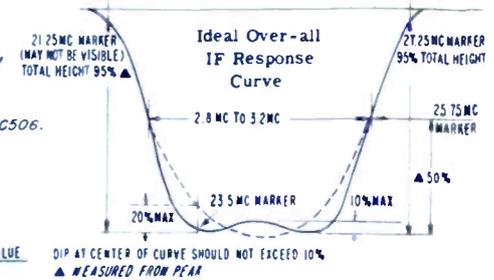
WAVEFORMS & P/P VOLTAGES MEASURED WITH AVERAGE SIGNAL INPUT, CONTRAST CONTROL AT MAX.; D.C. VOLTAGES MEASURED FROM CHASSIS GROUND WITH V.T.V.M. LINE VOLTAGE 117V. TOLERANCE OF ±20% NORMAL ON ALL READINGS.



Model T170, T171, T172AL, T173AL, T1710

#### RUN CHANGES

- (16) For improved sync, C429, C430, R444, and R445 were added, R419 changed from 47K to 27K, R420 changed from 330K to 150K, R421 changed from 3300 to 1500, R423 changed from 6.8K to 3.3K, R424 changed from 3300 to 1500, R422 was removed. Printed circuit boards A5290 and A5291-B used in Run 15 sets.
- (17) No changes made.
- (18) To conform with FCC regulations for reduction of horizontal sweep frequency radiation, C501 was omitted. C505 and L502 were added.
- (19) Complete M503 used for RC network. R501 & C506. C427 rating changed from 1.6 to 2kv for improved safety factor.

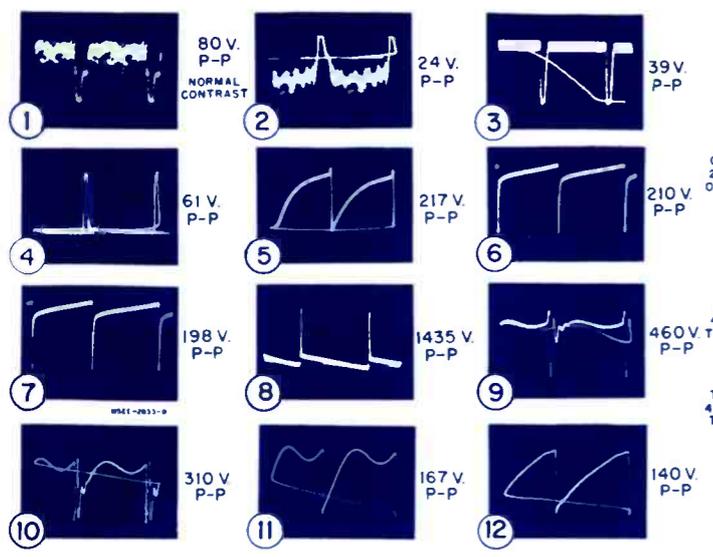


# ELECTRONIC TECHNICIAN 468

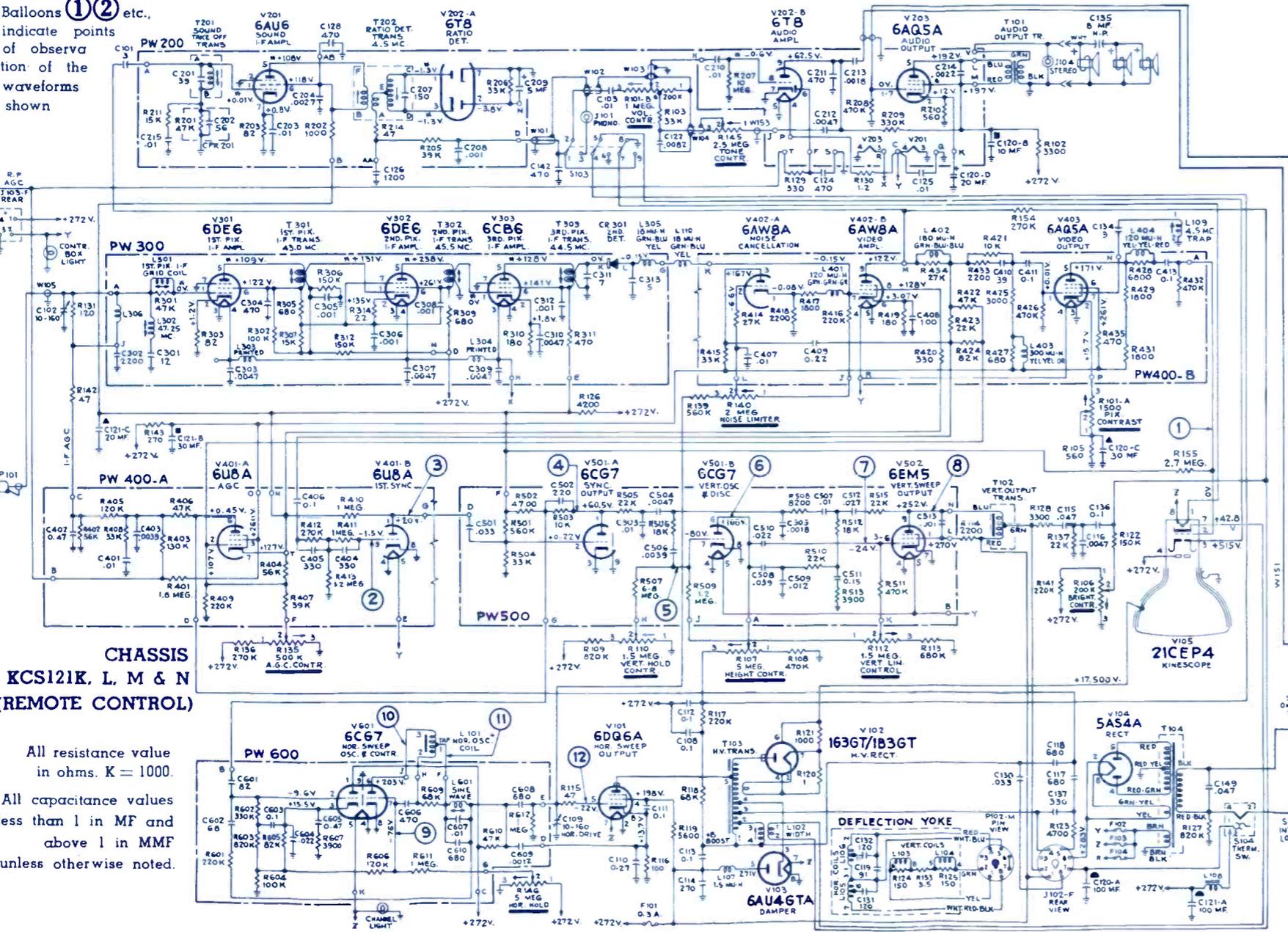
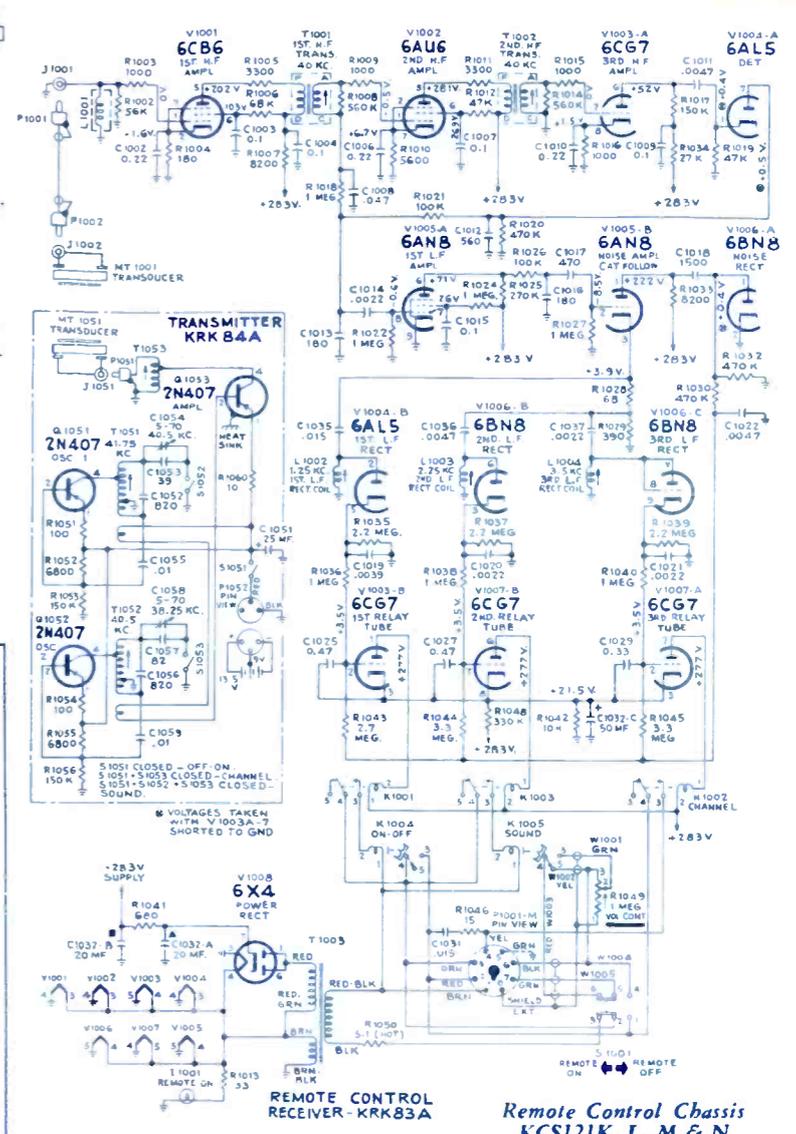
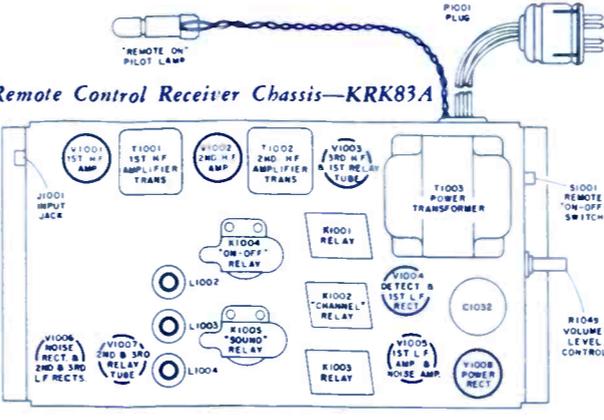
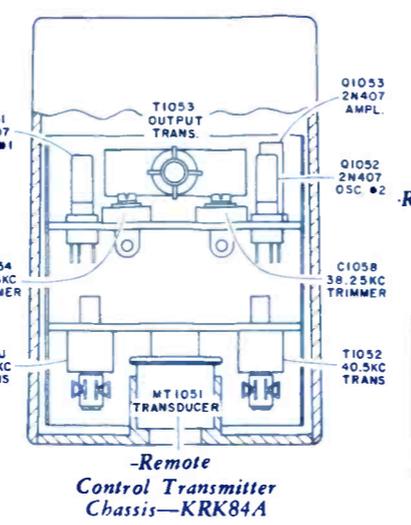
## CIRCUIT DIGEST

RCA TV  
Chassis KCS121K, L,  
M, N

January • 1959



Balloons ① ② etc., indicate points of observation of the waveforms shown



All resistance value in ohms. K = 1000.  
All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within  $\pm 20\%$  with 117 v. a-c supply.

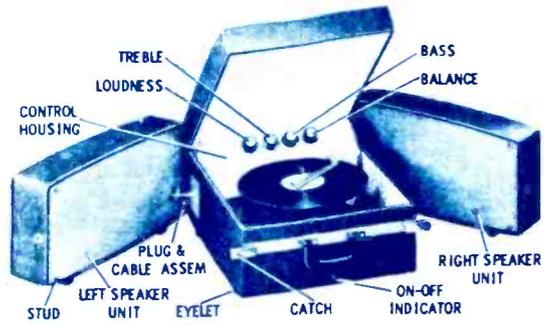
\*Measured with 1 megohm, 1/2 watt resistor in series with meter probe.

Electronic Technician  
**CIRCUIT DIGEST 468**

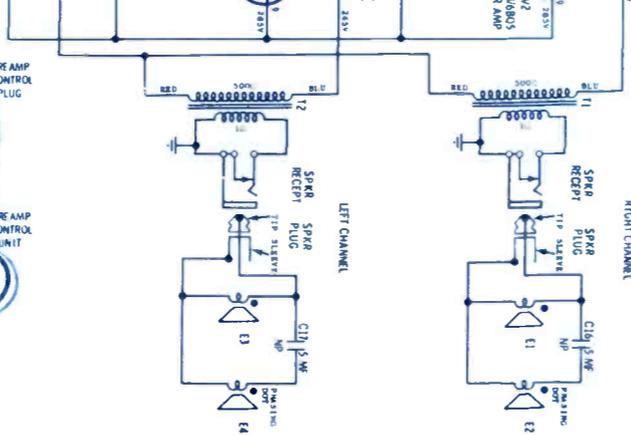
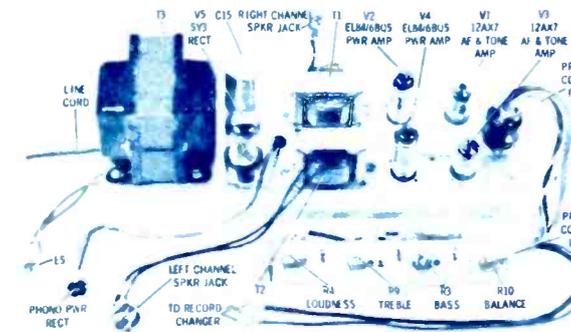
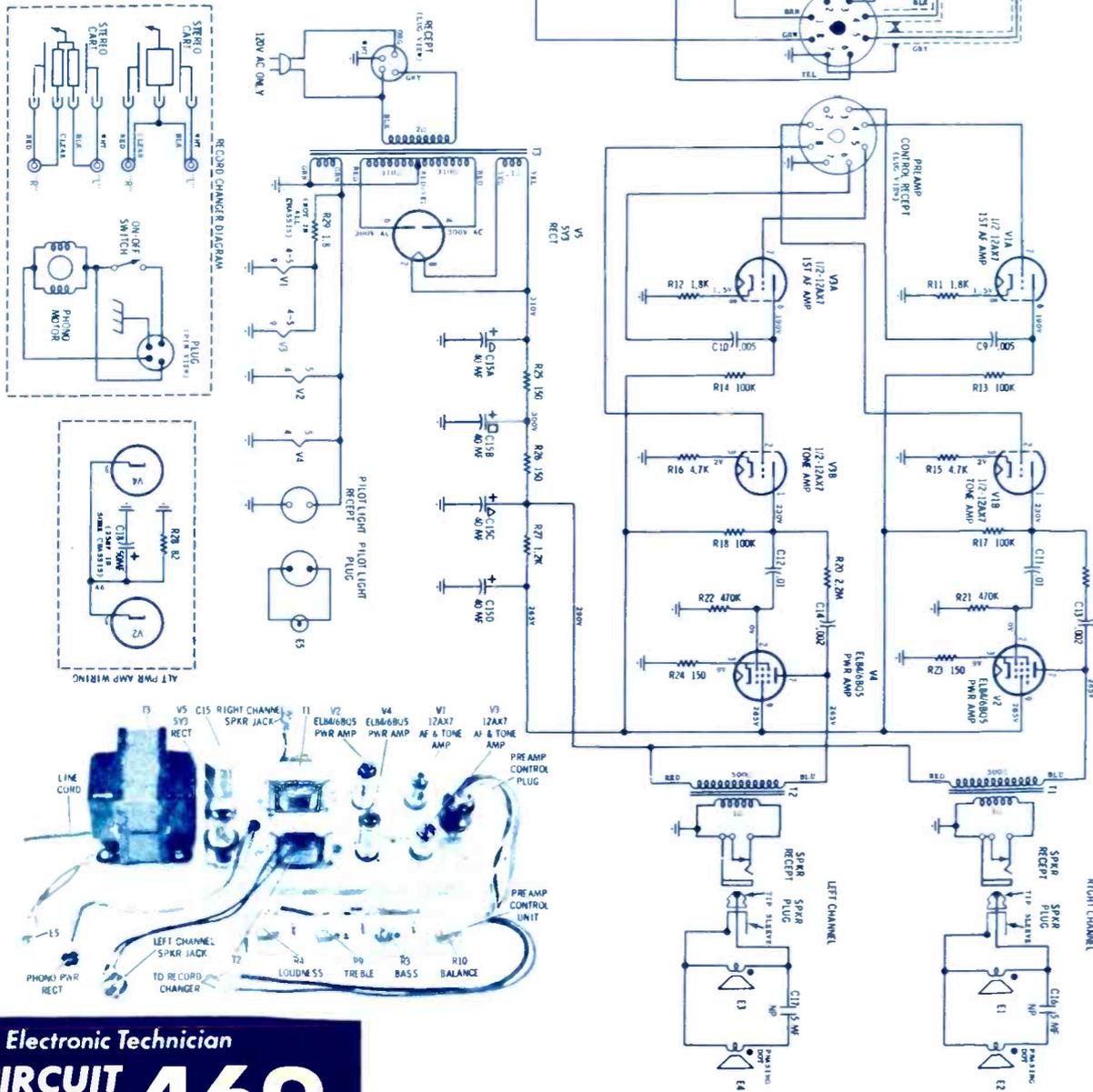
Model 21-RD-9675-6, 21-RD-9677,  
21-RD-9675U-6U, 21-RD-9877U,  
21-RD-9690, 21-RD-9699,  
21-RD-9690U, 21-RD-9699U

January • 1959

Model SH12E, SH12N, SH12S

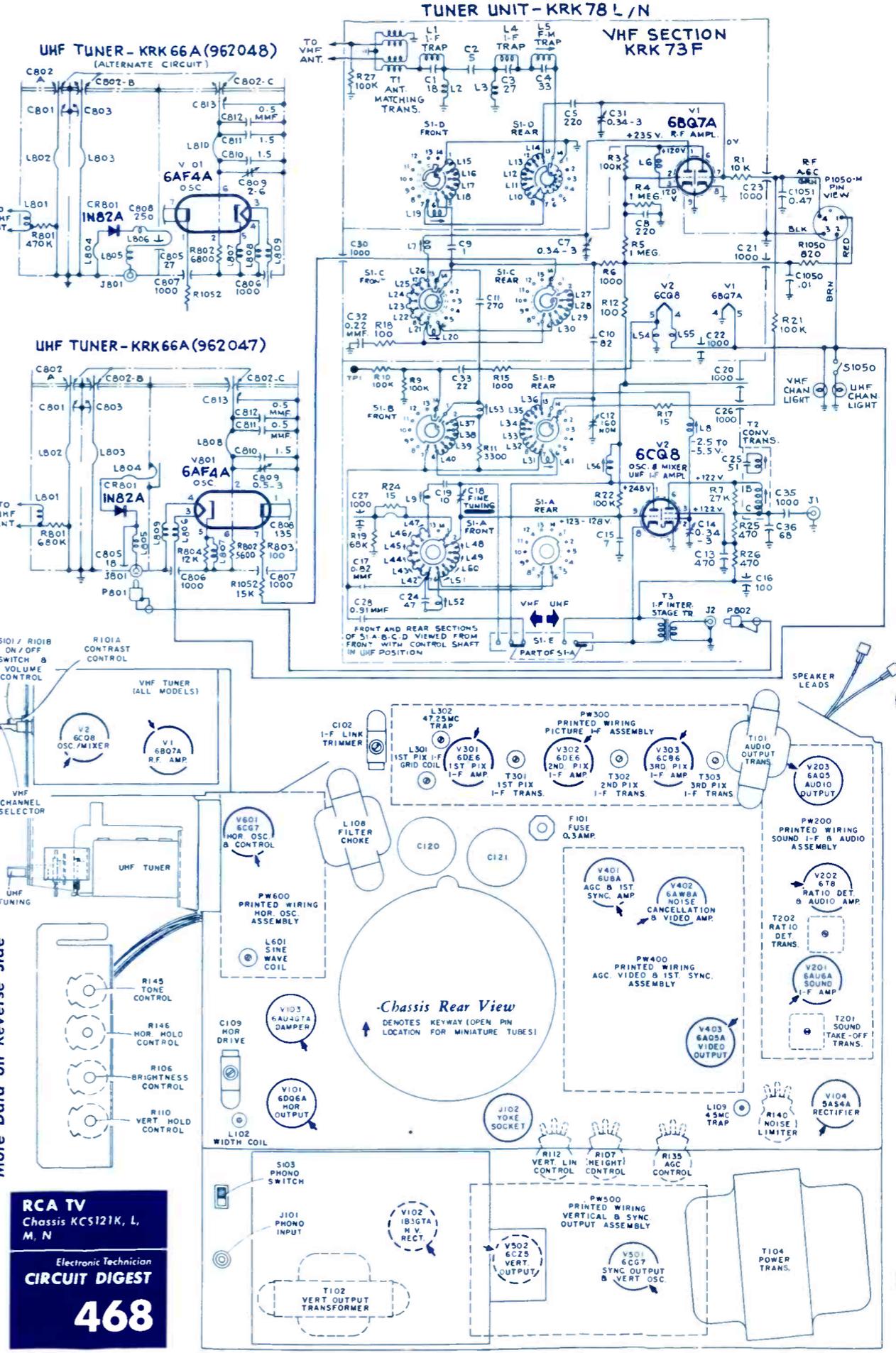


NOTES:  
 CAPACITORS - Decimal values in MF, all others in MMF unless otherwise specified.  
 VOLTAGES - Measured from point indicated to chassis with a VTVM.  
 ±10% No signal in. Preamp connected.



More Data on Reverse Side

**RCA TV**  
 Chassis KCS121K, L, M, N  
 Electronic Technician  
**CIRCUIT DIGEST**  
**468**

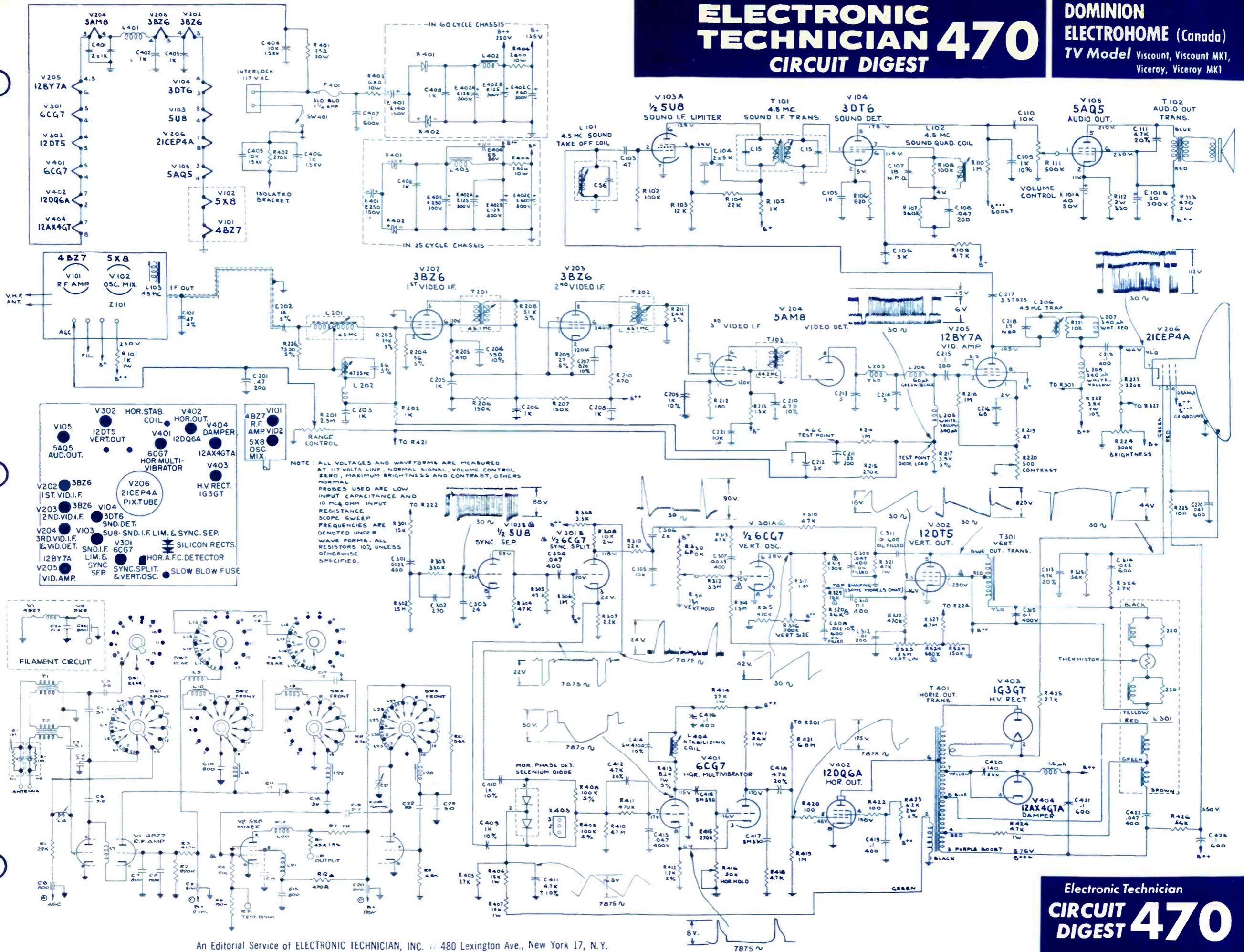


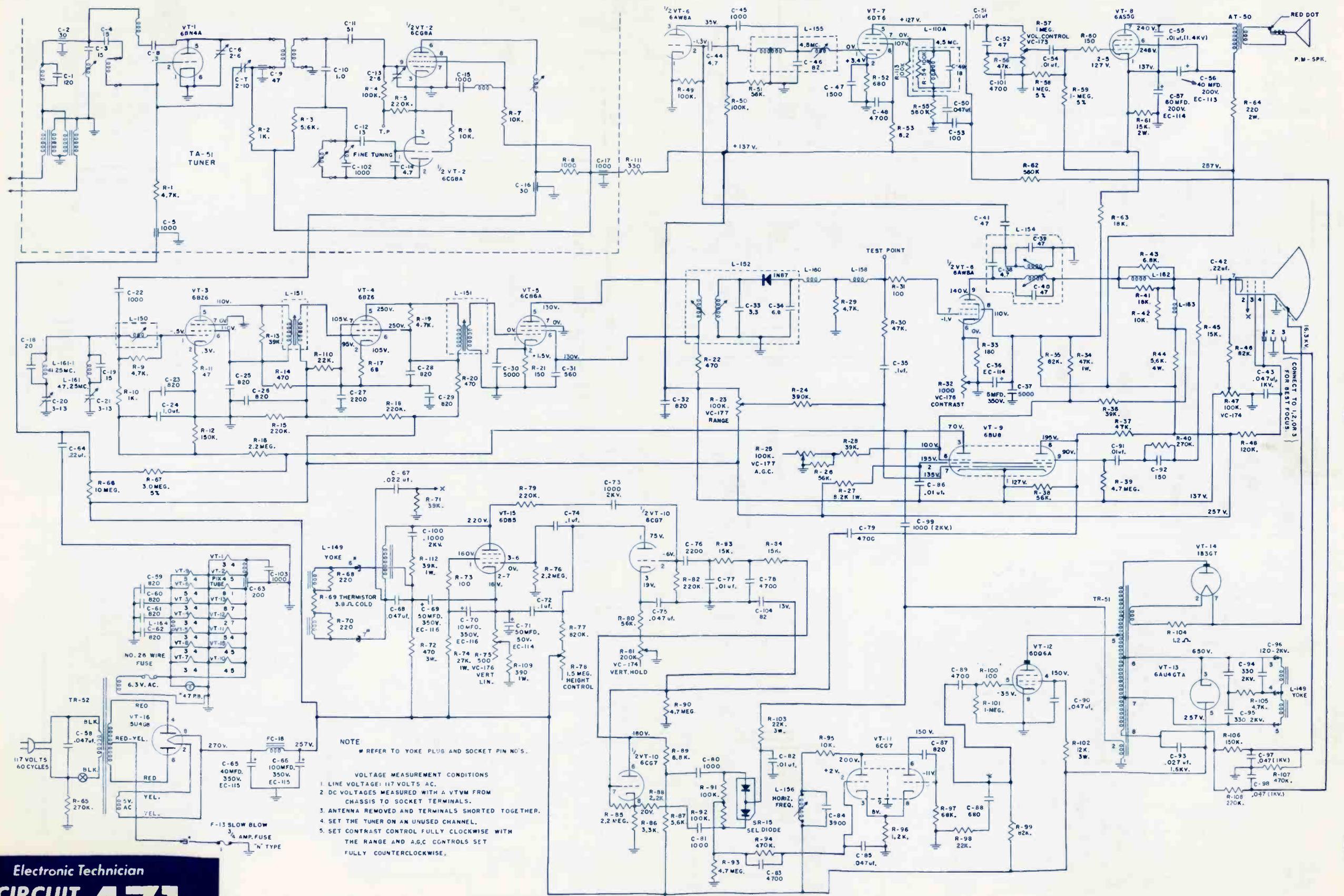
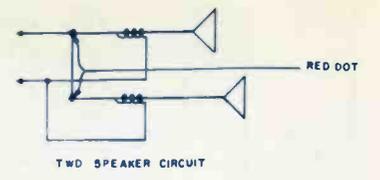
**Chassis Rear View**  
 DENOTES KEYWAY (OPEN PIN LOCATION FOR MINIATURE TUBES)

# ELECTRONIC TECHNICIAN 470

## CIRCUIT DIGEST

**DOMINION ELECTROHOME (Canada)**  
 TV Model Viscount, Viscount MK1,  
 Viceroy, Viceroy MK1





**NOTE**  
 \* REFER TO YOKE PLUG AND SOCKET PIN NO'S.

**VOLTAGE MEASUREMENT CONDITIONS**

1. LINE VOLTAGE: 117 VOLTS AC.
2. DC VOLTAGES MEASURED WITH A VTVM FROM CHASSIS TO SOCKET TERMINALS.
3. ANTENNA REMOVED AND TERMINALS SHORTED TOGETHER.
4. SET THE TUNER ON AN UNUSED CHANNEL.
5. SET CONTRAST CONTROL FULLY CLOCKWISE WITH THE RANGE AND A.G.C. CONTROLS SET FULLY COUNTERCLOCKWISE.

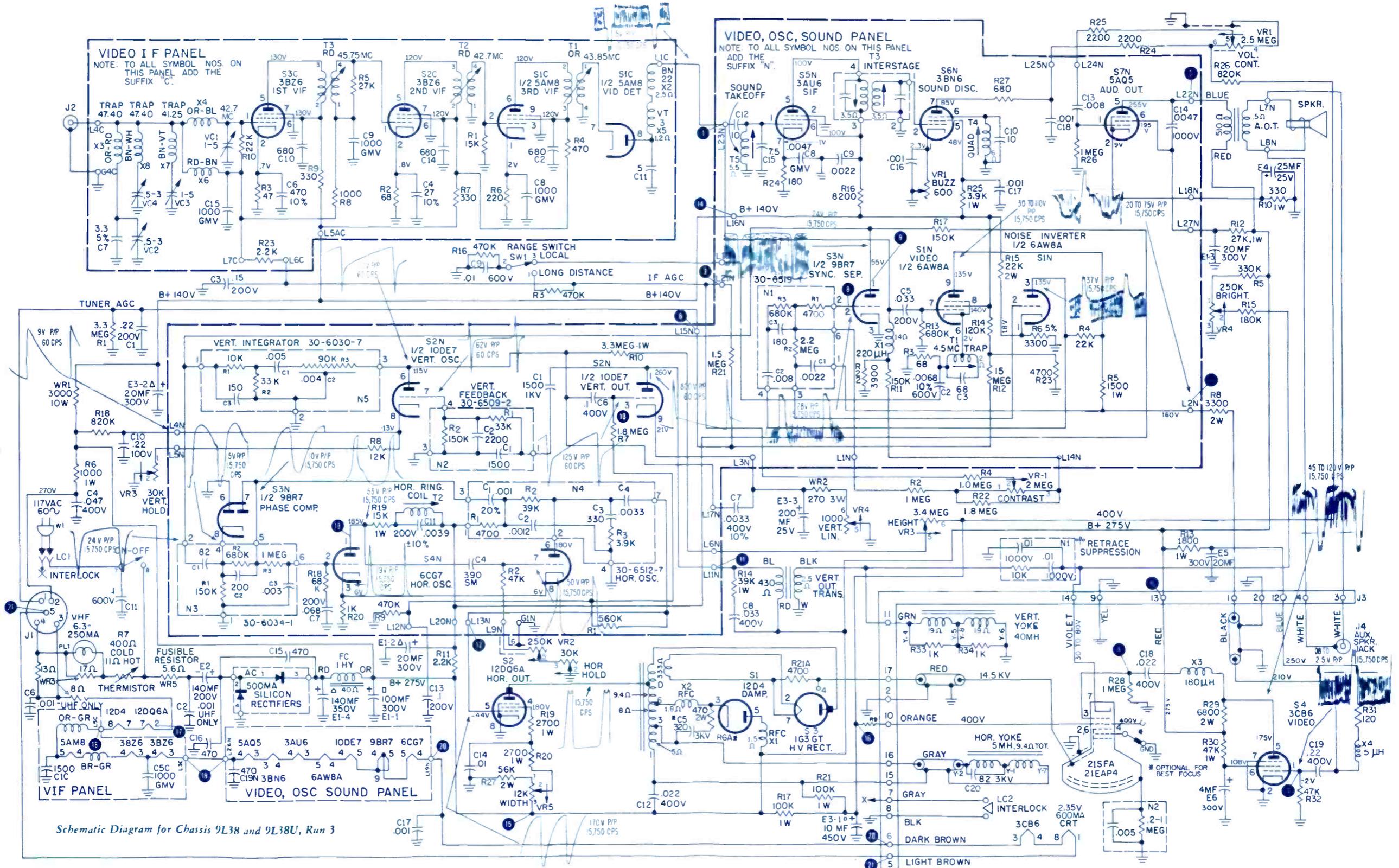
NOTES: All capacitor values greater than 1 are in MMF unless otherwise noted.  
 All capacitor values less than 1 are in MFD unless otherwise noted.  
 All resistors are 1/2 watt, 10%, carbon unless otherwise noted.

January • 1959

# ELECTRONIC TECHNICIAN 472

PHILCO  
 Chassis 9L38, 9L38U

## CIRCUIT DIGEST



Schematic Diagram for Chassis 9L38 and 9L38U, Run 3

Arrow through control indicates clockwise rotation.  
 Voltages are DC from point shown to chassis unless otherwise noted.  
 Voltages were read using a V.T.V.M. Voltages were taken with no signal.

The receiver was adjusted for a good quality picture; i.e., normal contrast, brightness, width, height, vertical lin. and sound, picture in sync, then removed signal.

Coil resistances read with coil in circuit.  
 \* Indicates a coil resistance of less than 1 ohm.  
 \* Run 2 change  
 † Run 3 change } More Data on Reverse Side





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1	TA155	Zenith-Admiral	11.50
1	TA359	RCA, Motorola, Magnavox	12.95
1	TA360	GE, Hotpoint, Westinghouse	11.75
1	TA442	Emerson, GE, Olympic	10.95
			Total List \$58.10
1	1959 catalog of all Portable TV Sets by brand, model and JFD Exact Replacement Indoor Antenna.		
1	"Exact Replacement Portable TV Antenna Headquarters" streamer.		
1	Outline of complete dealer sales promotion plan.		

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