ELECTRONIC
TECHNICIAN

Now Including
SERVICE
Magazine

1959 - YEAR for SERVICE BUSINESS
EXPANSION ACROSS THE NATION

January • 1959
one of these Electro-Voice microphones will meet your needs best

Choose from the world's most complete line:

ELECTRO-VOICE THE CHOICE OF PROFESSIONALS

Whatever your microphone problem, Electro-Voice has the solution. Because only Electro-Voice offers you such a wide selection to choose from, and only Electro-Voice has spent years of painstaking research to bring you microphones which rate BEST in every category.

Choose from carbon, crystal, ceramic or dynamic E-V microphones; choose any pickup pattern: non-directional, cardiod, or differential.

Electro-Voice has them all. Look at this chart... and choose the BEST.

And, for detailed information regarding special applications, write Dept. ET-1 INC., BUCHANAN, MICHIGAN

Electro-Voice INC., BUCHANAN, MICHIGAN

ELECTRO-VOICE MICROPHONES FOR EVERY PURPOSE

PUBLIC ADDRESS, RECORDING AND GENERAL PURPOSE MICROPHONES

COMMUNICATION MICROPHONES

SPECIAL PURPOSE MICROPHONES

Model Nu
Model Nu
Model Nu
Model Nu
Model Nu
Model Nu
Model Nu
Model Nu
Model Nu
Model Nu
Model Nu
January, 1959

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.

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ADMIRAL: TV Chassis 14YP3D

DOMINION ELECTROHOME Canada:
TV Model Viscount, Viscount MK1, Viceroy, Viceroy MK1

MAGNAVOX: TV Chassis 28 Series

MOTOROLA: Stereo Phonograph Chassis H5704

PHILCO: TV Chassis 9L38, 9L38U

RCA: TV Chassis KC5121K, L, M, N

TRAV-LER: TV Chassis 1051-19
NOW from IRC ... the first new

The amazing new wire wound
MULTI-RANGE RESISTOR

COMPLETE 10-WATT COVERAGE
... in a fraction of the space
... at a fraction of the cost!

You need only
5 TYPES to cover
200 VALUES!
(1/2 to 50,000 ohms)

Brace yourself for the most welcome resistor news in the last quarter of a century, the sensational IRC Multi-Range Resistor! With only 5 types you have complete 10-watt coverage. Never again will you need to delay set servicing to order an odd resistance value. Neither will you have to tie up inventory dollars on slow-moving types. Just 5 Multi-Range resistors cover all your 10-watt needs.

In addition to their amazing convenience IRC Multi-Range resistors are setting new standards of performance and reliability for power resistors.

- Revolutionary design—4 separate 10 watt elements are sealed in a single steatite housing.
- All types are one size—for easier handling.
- Axial leads speed servicing.
- Special steatite housing provides superior insulation.
- Conservatively rated—10 watts or more.

Quick! Simple!
Only 10 basic terminal interconnections...all with axial leads. Connection diagrams included in package.

Here's IRC's Solution

<table>
<thead>
<tr>
<th>Type</th>
<th>Watts</th>
<th>Resistance</th>
<th># of Values</th>
<th>Dealer Net</th>
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<tr>
<td>MR-1</td>
<td>10</td>
<td>10 to 15 ohms</td>
<td>47</td>
<td>60c</td>
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<tr>
<td>MR-2</td>
<td>10</td>
<td>5 to 150 ohms</td>
<td>47</td>
<td>60c</td>
</tr>
<tr>
<td>MR-3</td>
<td>10</td>
<td>50 to 1,500 ohms</td>
<td>47</td>
<td>60c</td>
</tr>
<tr>
<td>MR-4</td>
<td>10</td>
<td>30 to 15,000 ohms</td>
<td>49</td>
<td>60c</td>
</tr>
<tr>
<td>MR-5</td>
<td>10</td>
<td>3,000 to 50,000 ohms</td>
<td>17</td>
<td>90c</td>
</tr>
</tbody>
</table>

all types 10% tolerance

Another Multi-Range Feature! Supplied in exclusive IRC HANDY-PAKS
For greater convenience and ease of stocking and handling, MR Resistors are supplied in Handy-Paks only...2 of a type to a Pak.

Handy-Pak Prices

<table>
<thead>
<tr>
<th>Handy-Pak of 2</th>
<th>Handy-Pak of 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR-1, 2, 3, and 4</td>
<td>$120 dealer net</td>
</tr>
<tr>
<td>MR-5</td>
<td>$180 dealer net</td>
</tr>
</tbody>
</table>
Here's SUPER Convenience
New! Compact! Efficient!

MULTI-RANGE RESISTOR KIT!

Now you can have complete 10-watt power resistor coverage at your fingertips...in a stock so compact it occupies no more space than 2 packs of cigarettes. Your entire stock is always visible. Identification of type, value, etc. shows through the plastic case. You always know what you have, and have what you need with an IRC Multi-Range Resistor Kit.

- Kit gives complete 10-watt coverage of 200 values.
- Contains 5 Handy-Paks—2 of each Type MR resistor...10 Multi-Range units.
- Rigid, clear-plastic box with hinged lid.
- Measures only 5¼ x 1¼ x 3¼".

FULL 10-WATT POWER RESISTOR COVERAGE IN STURDY PLASTIC KIT!

Assortment #55
Contains 5 Handy-Paks
10 MR Resistors
dealer net $6.60
PLASTIC CASE FREE!

Available now from your IRC distributor. Order yours today!

INTERNATIONAL RESISTANCE COMPANY
401 North Broad Street, Philadelphia 8, Pa.
In Canada: International Resistance Co., Ltd., Toronto, Licensee
this exclusive
feature spells
hi-fi profits for you

NEW BLONDER-TONGUE MODEL A-1
HIGH FIDELITY AMPLIFIER

A unique B-T development - a deluxe audio amplifier with 4 separate tone controls, provides unlimited control of frequency response. These controls divide the audible spectrum into its four significant segments (BASS, LO-MIDDLE, HI-MIDDLE, TREBLE) and permit the user to boost or attenuate any frequency ranges,tune out feedback and improve speaker and equipment performance. The result - a degree of tonal selectivity unobtainable anywhere...at any price in the hi-fi amplifier field. The A-1 also offers full function selectivity, uniform frequency response within ½ db. from 30-15,000 cps, harmonic distortion below 1% at 10 watts. The exclusive control feature is just one reason why the A-1 and other B-T high fidelity components will rack up big sales for you during 1959. List 77.50

YOU CAN SELL A COMPLETE B-T SYSTEM - FM-AM TUNER, TWIN SPEAKERS & A-1 AMPLIFIER - FOR LESS THAN $160

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 Forma

Electronic Technician
Sprague PRINT-LOK* 'lytics

with universal bases for printed wiring boards

simplify servicing  reduce inventory

Another important Sprague "First":
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.

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

Sprague® world's largest capacitor manufacturer

SPRAGUE RESEARCH IS CONSTANTLY PRODUCING NEW AND BETTER CAPACITORS FOR YOU
New Mallory Diffused

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.

Type E... for higher reliability. Military grade "top hat" rectifier, hermetically sealed for jobs where you want the absolute peak in life and dependability. Two to a pack; rating is 400 volts, 0.75 ampere. Also available from 50 to 600 P.I.V. inclusive.
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

Three different models, each designed for specific service applications, are now available to fit all television and radio circuits as replacements for metallic rectifiers.

See this display on your Mallory distributor's counter—a complete assortment—in handy see-through packs—of the full line of Mallory silicon rectifiers.
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.
New concepts in tubemaking, which have been in development for the past decade, are put into high-speed production facilities at Altoona. The new concept bulb, in the making here, adds new tube reliability.

in Altoona

The new double-turret sealex is an important new development. Oil-diffusion pumps work in series with mechanical pumps to produce the most nearly perfect vacuum possible.

New Transistor Servicing Course

Now you can get a thorough grounding in servicing transistor-ized equipment with Sylvania's new 12-lesson transistor Servicing Course. Specially prepared by Sylvania engineers and the Radio-Television Training Association, it will help you cash in on the fastest growing segment of the electronics industry.

Now is the time to prepare for your share of this fast-growing business. See your authorized Sylvania Distributor or mail the coupon below for complete information on the Sylvania—RTTA Transistor Servicing Course.

Sylvania Electric Products Inc.
Dept. C35P
1740 Broadway
New York 19, N.Y.

☐ Please send me full details on the new Sylvania—RTTA Transistor Servicing Course.

Name________________________

Service Co.____________________

Address_______________________

City___________________________State_________
Whatever you want in a VTVM, PRECISION has it!

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
- 5 Hi-impedance RMS AC Ranges: 0-12-60-300-1200 volts
- 5 Resistance Ranges Up to 10 Megohms
- 5 Zero-center Reference Ranges
- Extra-Large, 5½" Wide-Angle PACE Meter
Model 68: blue-grey ripple-finished steel cabinet, 5½" x 7½" x 3½". 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 = 15, 30, = 150 = 600, = 1500 volts; 15½ Megs Input
- 5 Ohmmeter Ranges to 100 Megohms
- 5 Hi-impedance RMS AC Ranges: 0-3-12-60-300-1200 volts
- Extra-Large, 5½" Wide-Angle PACE Meter
Model 78: blue-grey ripple-finished steel cabinet, 5½" x 7½" x 3½". Complete with tubes, batteries and instruction manual. Net Price: $62.50

for Wide-Range Laboratory Quality—

the Model 88 Compact, Lab-Type VTVM
- More Functions—More Ranges—More Sensitivity:
  7 functions ... 40 ranges ... 26½ meg input
- 6 Peak-to-Peak Voltage Ranges: to 3200 volts
- 6 Zero-center DC Voltage Ranges: 0 = 1, 5, = 15, = 30, = 150 = 600, = 1500 volts; 15½ Megs Input
- 5 Electronic Ohmmeter Ranges: to 100 Megohms
- Extra-Large, 5½" Wide-Angle PACE Meter
Model 88: molded phenolic case, 5¼" x 7" x 3¼". 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 and TV wave forms
- 6 True-Zero-Center DC Voltage Ranges: 20/25 Megs Input to = 1200 volts
- 6 Electronic Ohmmeter Ranges to 1000 Megohms
- 6 Minus and Plus DC Voltage Ranges: to 1200 volts; 12½ Megs Input
- 6 Hi-impedance RMS AC Ranges to 1200 volts
- 8 DC Current Ranges: from 0-300 microamps to 12 Amps
- 6 Decibel-Output-Meter Ranges: —20 to + 63 DB

PRECISION VTVM ACCESSORIES AVAILABLE

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Net Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF-10A</td>
<td>High-Frequency Vacuum Tube Probe (for Models 88 and 98)</td>
<td>$14.40</td>
</tr>
<tr>
<td>RF-21</td>
<td>High-Frequency Crystal Probe (for Models 68 and 78)</td>
<td>$10.95</td>
</tr>
<tr>
<td>TV-4</td>
<td>High-Frequency Crystal Probe (for Models 68 and 78)</td>
<td>$14.75</td>
</tr>
<tr>
<td>TV-4</td>
<td>High-Voltage Safety Test Probe (for Models 68 and 78)</td>
<td>$14.75</td>
</tr>
<tr>
<td>TV-4</td>
<td>High-Voltage Safety Test Probe (for Models 68 and 78)</td>
<td>$14.75</td>
</tr>
<tr>
<td>LC-1</td>
<td>Leather Carrying Case (custom-designed for Model 88)</td>
<td>$59.50</td>
</tr>
<tr>
<td>ST-1</td>
<td>Retractable Snap-On-Tilt Stand for Model 88</td>
<td>$1.00</td>
</tr>
</tbody>
</table>

PRECISION Apparatus Company, Inc.
70-31 84th Street, Glendale 27, L. I., N. Y.
Export: 458 Broadway, New York 13, N.Y.
Canada: Atlas Radio Corp. Ltd. • 50 Wingood Ave. • Toronto 19, Ont.
Available and on display at leading electronic parts distributors.

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)
YOUR PHILCO DISTRIBUTOR IS HEADQUARTERS FOR A COMPLETE SELECTION OF GENUINE PARTS

Automatic Electric Washers • Automatic Electric Dryers • Duomatic Washer-Dryer Combinations • Automatic Gas Dryers • Gas Duomatic Washer-Dryer Combinations.

Radio • Television • Refrigerators • Ranges • Freezers • Air Conditioners • Automatic Dishwashers.

Automatic Electric Washers • Automatic Electric Dryers • Duomatic Washer-Dryer Combinations • Automatic Gas Dryers • Gas Duomatic Washer-Dryer Combinations.

Radio • High Fidelity • Stereophonic High Fidelity • Television • Refrigerators • Electric Ranges • Freezers • Air Conditioners • Automatic Electric Washers • Automatic Electric Dryers • Duomatic Washer-Dryer Combinations • Automatic Gas Dryers • Gas Duomatic Washer-Dryer Combinations.

Don't Settle for Less than Genuine Replacement Parts
A BRIGHTER, CLEANER CITY owes much to Bryce McNoel'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.

A 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.

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 runaway 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 paralytics. 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.

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.

All-American TV Technicians
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.

HINDS TO PROMOTE EDUCATION. Out of his own pocket, A. George Cavolo, 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 30 radios, plus his time, to teach boys electronics.

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.

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.

SPENDS TO PROMOTE EDUCATION. Out of his own pocket, A. George Cavolo, 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 30 radios, plus his time, to teach boys electronics.

WIN GENERAL ELECTRIC AWARDS

People 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.

Winners received this trophy, $500 for community benefit, and a trip to Wash., D.C., for luncheon with Senator John Sparkman.
Its two year record speaks for itself!

SYLVANIA S-110 CHASSIS

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 Kit—WV-77E(K) for only $29.95*

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

*User Price (Optional)

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 indication for discriminator alignment
Accuracy—±3% of full scale on dc ranges
±5% of full scale on ac ranges
Frequency Response—flat within ±3%, 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...

SHIP BY
GREYHOUND
PACKAGE EXPRESS

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
$28.95
buys in
high fidelity
equipment!

A complete 12-watt hi-fi ampli-
plier-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 fre-
quency response from 20 to 20,000 CPS within -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 4½" H. Neon pilot light on
front. Shpg. Wt. 15 lbs.

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 Min-
nepolis. The products will be marketed
under the ATR label.

INT'L CORRESPONDENCE
SCHOOLS has named JOSEPH A.
RISSE as Director of the School of Elec-
trical Communications.

PHILCO CORP. reports the appoint-
ment of JOHN R. HOWLAND to sales
manager, Closed-Circuit Television and
Product Control Equipment, Govern-
ment and Industrial Div.

JOHNS-MANYVILLE Dutch Brand
Div. reports the opening of a new
plant in south Chicago; and the pro-
motion 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 lan-
guages and publication in the respec-
tive countries.

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

RADIO CORP. OF AMERICA reports
the following appointments: L. HARRI-
SS ROBINSON, manager of market-
ing, Surface Communications Dept., De-
fense 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
CONOSCENTE, CONCERTO ROOM
INC., Pittsburgh, Pa.; and to DENNIS
E. WOON, BOYD-WOON HI-FI SHOP,
Vallejo, Calif. The Consumer Sweep-
stakes were won by RICHARD MIN-
DEL, 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
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!

DELCO RADIO
DIVISION OF GENERAL MOTORS, KOKOMO, INDIANA

Available everywhere through Electronic Distributors associated with...

DELCO RADIO DIVISION OF GENERAL MOTORS, KOKOMO, INDIANA

IRON CORES
RESISTORS
CAPACITORS
CONTROLS

TUBES
COILS
VIBRATORS
TRANSISTORS
TUNER PARTS
TRANSFORMERS

ELECTRONIC TECHNICIAN • January, 1959
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.

<table>
<thead>
<tr>
<th>1N2078 Maximum ratings (100°C) capacitive load:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Inverse Voltage ................................ 400 Volts</td>
</tr>
<tr>
<td>Continuous D.C. Reverse Working Voltage ........ 400 Volts</td>
</tr>
<tr>
<td>Average D.C. Output Current ....................... 500 mAdc</td>
</tr>
<tr>
<td>Peak Recurrent Forward Current .................... 5 Amps.</td>
</tr>
<tr>
<td>½ Cycle Surge Current .............................. 30 Amps.</td>
</tr>
<tr>
<td>Full Load Voltage Drop @ 25°C ..................... 1.1 Volts</td>
</tr>
<tr>
<td>RMS Input Voltage ..................................... 130 Volts</td>
</tr>
<tr>
<td>Minimum Series Resistance (for capacitive filter) 5 ohms, 10 watt</td>
</tr>
</tbody>
</table>

ELECTRONIC TECHNICIAN • January, 1959
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

RECORD BRUSHES
Eliminate harmful dust from precious records.

ANTI-STATIC SPRAY
Minimizes surface noise and insures needle glide.

45 RPM INSERTS
Custom-built for long wear.

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.

PHILCO® Famous for Quality the World Over

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

UNIVERSAL TRANSISTOR PRODUCTS CORP. has appointed GEORGE L. ZIFF as sales engineer.

MORAN PRODUCTS CO. is the new
name of ROTOR SERVICE CO., Cleveland, 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. Christiansen was formerly assistant general sales manager.

HOFFMAN ELECTRONICS CORP. reports the following promotions: HENRY F. SCHÖMEHEL to general sales manager; and ROY J. IERTER to assistant director of marketing, Semiconductor Div.

QUAM NICHOLS states that their special ninety-day promotion on hi-fi speakers is winning warm acceptance by distributors and dealers. The promotion 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 announced the appointment of LEWIS E. GILLINGHAM as marketing director and advertising manager. Also the resignation of ROBERT J. CARRINGTON, advertising manager. The firm includes ALTEC SERVICE CO., ALTEC LANSING CORP., PEERLESS ELECTRICAL PRODUCTS, and NEWPATHS, INC.

SERVICE INSTRUMENTS CORP. announces the following: Registration of their trade mark, SENCORE, has been officially granted; SENCORE reports test equipment will be featured in ELECTRONIC TECHNICIAN magazine, in at least six different advertisements appearing in each monthly issue during 1958; and ED FLAXMAN has been appointed Vice Pres.

For more information on new products described in this issue, fill in coupon on page 45.

ELECTRONIC TECHNICIAN • January, 1959
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.
<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Impedance</th>
<th>Frequency Response</th>
<th>Price List</th>
</tr>
</thead>
<tbody>
<tr>
<td>DR330</td>
<td>Dynamic Cardioid and Ribbon</td>
<td>Low-medium</td>
<td>40 to 15,000 cps</td>
<td>$250.00</td>
</tr>
<tr>
<td>DR332</td>
<td>Dynamic and Ribbon Cardioid</td>
<td>Low-medium</td>
<td>40 to 10,000 cps</td>
<td>$162.50</td>
</tr>
<tr>
<td>R331</td>
<td>Ribbon-Bi-Directional</td>
<td>Low-high</td>
<td>20 to 15,000 Hz</td>
<td>$99.50</td>
</tr>
</tbody>
</table>

**TRC Series** Push Button Styles

<table>
<thead>
<tr>
<th>Description</th>
<th>Impedance</th>
<th>Frequency Response</th>
<th>Price List</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low or high impedance, wide response. For recording, conference, P.A.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D324 Dynamic Types</td>
<td>Low</td>
<td>40 to 20,000 cps</td>
<td>$17.00-$24.30</td>
</tr>
<tr>
<td>D204 Ceramic Types</td>
<td>Medium</td>
<td>20 to 12,000 cps</td>
<td>$16.00-$17.30</td>
</tr>
<tr>
<td>824 Crystal Types</td>
<td>High</td>
<td>40 to 15,000 cps</td>
<td>$16.00-$18.30</td>
</tr>
</tbody>
</table>

**Your All-AMERICAN Line of MICROPHONES...**

**AMERICAN MICROPHONES**

**FOR EVERY BROADCAST, P.A., MOBILE OR RECORDING NEED**

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Impedance</th>
<th>Frequency Response</th>
<th>Price List</th>
</tr>
</thead>
<tbody>
<tr>
<td>D4G Lecturer's Dynamic</td>
<td>Low</td>
<td>40 to 7,500 cps</td>
<td>$49.00</td>
<td></td>
</tr>
<tr>
<td>D4T similar, but high impedance</td>
<td>High</td>
<td></td>
<td>$51.00</td>
<td></td>
</tr>
<tr>
<td>D9A Dynamic Cardioid</td>
<td>Low</td>
<td>40 to 7,000 cps</td>
<td>$82.50</td>
<td></td>
</tr>
<tr>
<td>D4AT similar, but high impedance</td>
<td></td>
<td></td>
<td>$86.50</td>
<td></td>
</tr>
<tr>
<td>D6 Dynamic Public Address</td>
<td>Low</td>
<td>50 to 7,000 cps</td>
<td>$46.00</td>
<td></td>
</tr>
<tr>
<td>D7 Dynamic General Purpose</td>
<td>Low</td>
<td>50 to 7,000 cps</td>
<td>$49.00</td>
<td></td>
</tr>
</tbody>
</table>

**D7PR Dynamic... Handle Type**

<table>
<thead>
<tr>
<th>Description</th>
<th>Impedance</th>
<th>Frequency Response</th>
<th>Price List</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>150 to 10,000 cps</td>
<td>$52.50</td>
<td></td>
</tr>
<tr>
<td>D7P similar, but high impedance</td>
<td></td>
<td></td>
<td>$55.00</td>
</tr>
</tbody>
</table>

**D7H Dynamic General Purpose**

<table>
<thead>
<tr>
<th>Description</th>
<th>Impedance</th>
<th>Frequency Response</th>
<th>Price List</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>150 to 10,000 cps</td>
<td>$46.00</td>
<td></td>
</tr>
<tr>
<td>D7T similar, but high impedance</td>
<td></td>
<td></td>
<td>$49.00</td>
</tr>
</tbody>
</table>

**Tape Recorder Microphone**

<table>
<thead>
<tr>
<th>Description</th>
<th>Impedance</th>
<th>Frequency Response</th>
<th>Price List</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>150 to 5,000 cps</td>
<td>$8.35-$9.65</td>
<td></td>
</tr>
<tr>
<td>8203 Crystal Types</td>
<td></td>
<td></td>
<td>$11.50-$12.80</td>
</tr>
</tbody>
</table>

**D801 Miniature Dynamic**

<table>
<thead>
<tr>
<th>Description</th>
<th>Impedance</th>
<th>Frequency Response</th>
<th>Price List</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low or high impedance</td>
<td>150 to 10,000 cps</td>
<td></td>
<td>$46.00</td>
</tr>
<tr>
<td>D801 similar, but high impedance</td>
<td></td>
<td></td>
<td>$49.00</td>
</tr>
</tbody>
</table>

**Crystal Microphones**

<table>
<thead>
<tr>
<th>Description</th>
<th>Impedance</th>
<th>Frequency Response</th>
<th>Price List</th>
</tr>
</thead>
<tbody>
<tr>
<td>C7H...stand type</td>
<td>Low or high impedance</td>
<td>300 to 3,000 cps</td>
<td>$31.00</td>
</tr>
<tr>
<td>C12...lapel type</td>
<td></td>
<td></td>
<td>$37.50</td>
</tr>
<tr>
<td>RC...desk type</td>
<td></td>
<td></td>
<td>$39.50</td>
</tr>
</tbody>
</table>

**501 Series...Mobile Types**

<table>
<thead>
<tr>
<th>Description</th>
<th>Impedance</th>
<th>Frequency Response</th>
<th>Price List</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low or high impedance</td>
<td>300 to 3,000 cps</td>
<td></td>
<td>$25.50-$34.00</td>
</tr>
<tr>
<td>8201 Ceramic Types</td>
<td></td>
<td></td>
<td>$31.00-$38.00</td>
</tr>
</tbody>
</table>

**504 Series...Mobile Types**

<table>
<thead>
<tr>
<th>Description</th>
<th>Impedance</th>
<th>Frequency Response</th>
<th>Price List</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low or high impedance</td>
<td>300 to 3,000 cps</td>
<td></td>
<td>$24.50-$33.00</td>
</tr>
</tbody>
</table>

**Dynamic Hand Sets**

<table>
<thead>
<tr>
<th>Description</th>
<th>Impedance</th>
<th>Frequency Response</th>
<th>Price List</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low impedance</td>
<td>250 to 6,000 cps</td>
<td></td>
<td>$23.00</td>
</tr>
</tbody>
</table>

**ALSO—**

**ACCESSORIES AND REPLACEMENT PARTS**

**PHONO PICKUP ARMS AND CARTRIDGES**

**NEW American TONE ARM ADAPTER**

Converts standard tone arm to stereo. Wiring adapter with output jack. No. 1101. LIST $2.15

Write Today for free Catalog 58

**American Microphone MFG. CO.**

Division of G-C-Texttron Inc.

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

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.
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 84

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.

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


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.

*DuPont trademark

TOBE DEUTSCHMANN CORPORATION, NORWOOD, MASSACHUSETTS
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

Radiant Vibrators are unaffected by bounce, jounce, heat, cold, moisture. There's a replacement type for every 6- and 12-volt application. Ask your Radiant Distributor for a free Radiant Vibrator Replacement Guide or write The Radiant Corporation, 2900 Columbia Avenue, Indianapolis 5, Indiana.
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 to overhead, rent, taxes, insurance, 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 bond issued through one of America's largest insurance companies. 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, he increases the life and lasting operation of your TV! Raytheon Tubes are designed for the same rigid standards of quality and precision that are custom-made into the major electronic components we produce. The result is performance you can depend. Raytheon has a world of experience in TV and Radio construction and production. That's why you can count on the performance you can depend on your TV and Radio Tube.
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 (CircuitDigests, 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.
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 7/4% 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.
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 Levyt 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.

ONE YEAR SERVICE guarantee on its "Steno Tape" 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.

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

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.
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.

\[
\% \text{ Distortion} = \frac{\text{Output Signal - Fundamental}}{\text{Output Signal + Fundamental}} \times 100
\]

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 picture; when properly made, the finished product represents the best of interest. The chain-like 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 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)
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

TUBES MANUFACTURED

Picture Tubes
Number made (including 3.4 million
rebuids) ........................................... 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%

TV - ELECTRONIC TECHNICIANS

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

(Continued from page 33)

position of the function switch, and
the proper range. Sometimes a sepa-
rate 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
tension, turn the function switch to
the “calibrate,” or “set-level” posi-
tion, 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 volt-
age reading. Next place the func-

(Continued on page 52)
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 a bank. It is designed especially to assist small retailers, wholesale distributors and service establishments. Under this plan, the SBA will participate in a loan to a business with a creditable record with local banks for meeting their obligations. Under this plan, the SBA will participate in a loan to a business with a creditable record with local banks for meeting their obligations.

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 potential borrower has been granted a Request for Loan 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 firms in the manufacturing, wholesaling, retailing and service fields, which are familiar with a small firm’s earnings record, competent management, and a creditable record with local banks for meeting their obligations. Under this plan, the SBA will participate in a loan to a business with a creditable record with local banks for meeting their obligations. Under this plan, the SBA will participate in a loan to a business with a creditable record with local banks for meeting their obligations. Under this plan, the SBA will participate in a loan to a business with a creditable record with local banks for meeting their obligations.

A Disaster loan is made to businesses, 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 terms of repayment on a loan?

A. SBA’s business loans usually are repayable in regular monthly payments. 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.

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 $330,000.

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

A. SBA’s business loans usually are repayable in regular monthly payments.
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 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, and the more voltage is impressed across the standard. The converse is true of inductors and resistors. Table 1 contains a series of percentages (Continued on page 65)

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

<table>
<thead>
<tr>
<th>Unknown Xc in µf</th>
<th>0.01 C</th>
<th>0.1 L</th>
<th>1.0 C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.001</td>
<td>0.015</td>
<td>0.09</td>
<td>0.09</td>
</tr>
<tr>
<td>0.002</td>
<td>0.03</td>
<td>0.17</td>
<td>0.17</td>
</tr>
<tr>
<td>0.004</td>
<td>0.06</td>
<td>0.34</td>
<td>0.34</td>
</tr>
<tr>
<td>0.006</td>
<td>0.09</td>
<td>0.51</td>
<td>0.51</td>
</tr>
<tr>
<td>0.008</td>
<td>0.13</td>
<td>0.68</td>
<td>0.68</td>
</tr>
<tr>
<td>0.010</td>
<td>0.17</td>
<td>0.85</td>
<td>0.85</td>
</tr>
<tr>
<td>0.020</td>
<td>0.034</td>
<td>0.17</td>
<td>0.17</td>
</tr>
<tr>
<td>0.040</td>
<td>0.068</td>
<td>0.34</td>
<td>0.34</td>
</tr>
<tr>
<td>0.060</td>
<td>0.102</td>
<td>0.51</td>
<td>0.51</td>
</tr>
<tr>
<td>0.080</td>
<td>0.136</td>
<td>0.68</td>
<td>0.68</td>
</tr>
<tr>
<td>0.100</td>
<td>0.170</td>
<td>0.85</td>
<td>0.85</td>
</tr>
</tbody>
</table>

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Table 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. and C.

<table>
<thead>
<tr>
<th>L in mh</th>
<th>C in µf</th>
<th>60 cps</th>
<th>400 cps</th>
<th>1,000 cps</th>
<th>500 kc</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.001</td>
<td>0.0004</td>
<td>2,600,000</td>
<td>0.0005</td>
<td>2,650,000</td>
<td>0.0006</td>
</tr>
<tr>
<td>0.005</td>
<td>0.0020</td>
<td>531,000</td>
<td>0.005</td>
<td>530,000</td>
<td>0.006</td>
</tr>
<tr>
<td>0.010</td>
<td>0.0040</td>
<td>265,000</td>
<td>0.010</td>
<td>264,000</td>
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</tr>
<tr>
<td>0.020</td>
<td>0.0080</td>
<td>133,000</td>
<td>0.020</td>
<td>132,000</td>
<td>0.020</td>
</tr>
<tr>
<td>0.050</td>
<td>0.0200</td>
<td>53,000</td>
<td>0.050</td>
<td>53,000</td>
<td>0.050</td>
</tr>
<tr>
<td>0.100</td>
<td>0.0400</td>
<td>27,000</td>
<td>0.100</td>
<td>27,000</td>
<td>0.100</td>
</tr>
<tr>
<td>0.200</td>
<td>0.0800</td>
<td>10,600</td>
<td>0.200</td>
<td>10,600</td>
<td>0.200</td>
</tr>
<tr>
<td>0.500</td>
<td>0.2000</td>
<td>2,600</td>
<td>0.500</td>
<td>2,500</td>
<td>0.500</td>
</tr>
<tr>
<td>1.000</td>
<td>0.4000</td>
<td>1,000</td>
<td>1.000</td>
<td>1,000</td>
<td>1.000</td>
</tr>
<tr>
<td>2.000</td>
<td>0.8000</td>
<td>1,000</td>
<td>2.000</td>
<td>1,000</td>
<td>2.000</td>
</tr>
<tr>
<td>5.000</td>
<td>3.9000</td>
<td>1,000</td>
<td>5.000</td>
<td>1,000</td>
<td>5.000</td>
</tr>
<tr>
<td>8.000</td>
<td>6.4000</td>
<td>1,000</td>
<td>8.000</td>
<td>1,000</td>
<td>8.000</td>
</tr>
<tr>
<td>10.000</td>
<td>8.0000</td>
<td>1,000</td>
<td>10.000</td>
<td>1,000</td>
<td>10.000</td>
</tr>
</tbody>
</table>

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

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(Continued on page 65)
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 damper 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 age 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 age 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 vol

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 age 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 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 uf 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.

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.
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 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 materials 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

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

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

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

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

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.

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 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 r-f 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.

(Continued on page 58)
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 frequency 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.

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 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

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 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° 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° through 180° 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.

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### 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-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

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**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 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.

**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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- New or unknown condensers ... transformer, socket, component and wiring leakage capacity

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- Ultra-sensitive 2 tube drift-free circuitry
- Multi-color direct scale precision readings for both quality and value ... (in-circuit or out-of-circuit)
- Simultaneous readings of circuit capacity and circuit resistance
- Built-in high-resistance indicator sensitive to over 300 megohms
- Cannot damage circuit components
- Electronic eye balance indicator for even greater accuracy
- Isolated power line

Every day more and more manufacturers are using transistors in home portable and car radios ... hearing aids, intercoms, amplifiers, industrial devices, etc. Since transistors go bad, the need for TRANSISTOR TESTER is great. They can develop excessive leakage, poor gain, shorts or opens.

TRANSISTOR TESTER Model TT-2

Model TT-2 — housed in sturdy hammer-tone finish steel case complete with test leads ... only $24.50 Net

OUTSTANDING FEATURES
- Checks all transistors, including car radio, power output, triode, tetrode and unijunction types for current gain, leakage, opens, shorts, cut-off current
- Checks all diodes for forward to reverse current gain
- All tests can be made even if manufacturers' rated gain is not available
- Less than half a minute required for test of either transistors or diodes
- Large 3" meter for quick and accurate indications
- Multi-color scales designed for quick easy readings
- Current drain so small, service Power is supplied by an easy to replace 6-volt battery
- Battery cannot be drained due to accidental shorting of life almost equal to shelf life
- Battery cannot burn-out its own meter or damage transistor or diode under test
- Low test leads and insulated test clips enable tests without entirely removing transistors from circuit
- Test leads are identified by E.I.A. color code so that connection to the side of circuit is simple
- Comes complete with replaceable transistor set-up chart that fits into a special rear compartment

IMPORTANT FEATURE: The TT-2 cannot become obsolete as the circuitry is engineered to enable you to check all new type transistors as they are introduced. New listings will be furnished at no cost.

Check all power rectifiers in-circuit whether SELENIUM, GERMANIUM, SILICON, etc.

THE SRT-1 CHECKS ALL POWER RECTIFIERS IN-CIRCUIT AND OUT-OF-CIRCUIT WITH 100% EFFECTIVENESS FOR:
- Quality / Fading / Shorts / Opens / Arcing / Life Expectancy

OUTSTANDING FEATURES
- Checks all types of power rectifiers rated from 10 ma. to 500 ma. (selenium, germanium, silicon, etc.) both in-circuit or out-of-circuit
- Will not blow fuses even when connected to a dead short
- Large 3" highly accurate multi-color meter ... sensitive yet rugged
- Separate meter scales for in-circuit and out-of-circuit tests
- Cannot damage or overhear rectifier being tested

SIMPLE TO OPERATE
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 ...

ALL CENTURY INSTRUMENTS ARE GUARANTEED FOR ONE FULL YEAR
The extremely low prices are made possible because you are buying direct from the manufacturer.

EASY TO BUY IF SATISFIED
see order form on facing page
FOR 10 DAY FREE TRIAL
try them for 10 days before you buy...only then, when satisfied, pay in easy-to-buy monthly installments—without any financing or carrying charges added.

STILL THE BEST SELLING TUBE TESTER IN THE FIELD

FAST-CHECK TUBE TESTER
Model FC-2

The greatest testimonial ever paid an instrument...over 20,000 sold in a little more than a year—and still selling as fast as we can produce them. See for yourself at no risk why so many servicemen choose the FAST-CHECK above all other tube testers—regardless of price.

$69.50

Just 2 settings on the FAST-CHECK TESTER tests over 700 tube types completely, accurately—AND IN SECONDS!

PICTURE TUBETEST ADAPTER INCLUDED WITH FAST-CHECK
Enables you to check all picture tubes (including the new short-neck 110 degree type) for cathode emission, shorts and life expectancy—also to rejuvenate weak tubes. No other tube tester made at any price can match the value of the FAST-CHECK.

RANGE OF OPERATION

- Checks quality of over 700 tube types, employing the time-proven dynamic emission test. This covers more than 99% of all tubes in use today, including all series-string TV tubes, auto 12 plate-volt tubes, OZ4s, magic eye tubes, gas regulators, special purpose hi-fi tubes and even foreign tubes.
- Checks for inter-elementary 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 tubes is annealed and can be used without costly roll chart
- Automatic roll chart checking...
- Checks each section of multi-section tubes and if only replacement is necessary
- Checks for cathode emission, shorts and life expectancy. In this case, the tube will read "BAD" on the meter scale.
- New tube listings are added to the tube chart listing over 700 tube types. This covers OZ4s, series-string TV tubes, gas regulators, auto 12 plate-volt, hi-fi and foreign tubes...3 sets are available.
- Detachable line cord...no shock hazard
- Separate gas and short jewel indicators
- Line isolated positions
- Compartment...soldering and short testing...12 filament positions...Separate gas and short jewel indicators
- Line isolated positions...
- Long lasting etched aluminum panel.
- No shock hazards...
- New tube listings are added to the tube chart listing over 700 tube types. This covers OZ4s, series-string TV tubes, gas regulators, auto 12 plate-volt, hi-fi and foreign tubes...3 sets are available.
- Line isolated positions...
- Long lasting etched aluminum panel.
- No shock hazards...
- New tube listings are added to the tube chart listing over 700 tube types. This covers OZ4s, series-string TV tubes, gas regulators, auto 12 plate-volt, hi-fi and foreign tubes...3 sets are available.
- Line isolated positions...
- Long lasting etched aluminum panel.
Here are two problems you won’t have to face when you replace with Sylvania

Problem No. 1:

Which type replaces which?

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

Sylvania’s Auto-radio Transistor Line

<table>
<thead>
<tr>
<th>Type</th>
<th>Type</th>
<th>Type</th>
<th>Type</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2N155</td>
<td>2N301</td>
<td>2N236</td>
<td>2N401</td>
<td>2N268</td>
</tr>
<tr>
<td>2N176</td>
<td>2N301A</td>
<td>2N524</td>
<td>2N419</td>
<td>2N677</td>
</tr>
<tr>
<td>2N235</td>
<td>2N307A</td>
<td>2N250</td>
<td>2N255</td>
<td>2N677A</td>
</tr>
<tr>
<td>2N235A</td>
<td>2N350</td>
<td>2N351</td>
<td>2N256</td>
<td>2N677B</td>
</tr>
</tbody>
</table>

Problem No. 2:

The broken mica washer

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

(Continued from page 34) Harmonic Distortion

(Continued from page 34) Harmonic Distortion

...
GENTLEMEN: Please send me the catalog and information on the following:

- TV Towers
- Amateur Towers
- Communication Towers
- Full line of Rohn products

NAME
ADDRESS
CITY, STATE

MAIL THIS COUPON NOW!
can your present test equipment check this capacitor in circuit?

- the All New Aerovox Model 97 LC-CHECKER will do this and much more!

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

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

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

...at your local Aerovox Parts Distributor. Write for free literature and address of your nearest distributor.
SAVE 1/2 THE TIME
Make Twice The Profit!

THIS EASY SIGNAL INJECTION POINT-TO-POINT DIRECT VIEWING WAY...

B&K TELEVISION ANALYST

MODEL 1075

New Technique Makes TV Servicing Easier, Faster, More Profitable

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

MODEL 1075 TELEVISION ANALYST. Complete with standard test pattern, white dot, and white line crosshatch pattern slide transparencies, and one clear acetate. Net, $259.95

See your B&K Distributor or Write for Bulletin ST21-T

B & K MANUFACTURING CO.
3726 N. Southport Ave. - Chicago 13, Illinois
Export: Empire Exporters, 458 Broadway, New York 13, U.S.A.

ELECTRONIC TECHNICIAN • January, 1959
HOW ASTRON SOLVED . . . .

THE CASE OF "JACK THE RIPPLE"

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."

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 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)
NEW CONTROLLED

Dynamic Life Tests...

ASSURE UNIVERSAL TUBE REPLACEMENTS
Testing tubes in sets is good...but not the best way. We life-check tubes dynamically in TV sets...in addition to many other extensive tests for materials, production, design and static life. But there are interaction problems in set testing which obscure the causes of tube failure. And some models of TV sets operate tubes conservatively. CBS-Hytron has, therefore, developed controlled dynamic life tests to examine all important characteristics under the most stringent TV set conditions.

HELP PINPOINT AND CORRECT FAULTS
Day in, day out, tubes are cycled and checked under accelerated conditions at low (105 v) and high (140 v) line voltages. Components and dynamic operating conditions are controlled to point the finger unrelentingly at the exact nature of tube failures. They may be opens, shorts, gas, gradual deterioration of electrical characteristics, etc. Once the tests locate the fault, the correction is invariably the same: improvement of tube design or manufacturing techniques.

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.

More reliable products through Advanced-Engineering

CBS-HYTRON, Danvers, Massachusetts
A Division of Columbia Broadcasting System, Inc.
ASTATIC Takes Positive, Extensive Action Against Cheap, Imported Cartridges

SWEEPING, DRASTIC PRICE REDUCTIONS EFFECTIVE SEPT. 1, 1958

Astatic's answer to inferior, cheap foreign cartridges is a SENSATIONAL SLASH of prices in its famous cartridge line. The drastic reductions make the price differential of the imported cartridges either non-existent or insignificant. Of course, the design and fine performance qualities of the Astatic Cartridges remain unchanged. Cheap, foreign-made cartridges have never come close to competing on a performance basis. Thus, Astatic's action strips them of their single previous advantage—low cost.

Astatic's answer to inferior cartridges is also YOUR answer. More than ever, the Astatic Cartridge line merits your first preference.

SEE YOUR ASTATIC DISTRIBUTOR OR WRITE FOR YOUR COPIES OF ASTATIC'S NEW GENERAL CATALOG 33-3 AND NEW CARTRIDGE CROSS-REFERENCE AND REPLACEMENT CHART CRC-58.

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 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...
Superior's New Model 80

20,000 OHMS PER VOLT ALLMETER

THE ONLY 20,000 OHMS PER VOLT V.O.M. SELLING FOR LESS THAN $50 WHICH PROVIDES ALL THE FOLLOWING FEATURES:

- **6 INCH FULL-VIEW METER** provides large easy-to-read calibrations. No squinting or guessing when you use Model 80.
- **MIRRORED SCALE** permits fine accurate measurements where fractional readings are important.
- **CAPACITY RANGES** permit you to accurately measure all condensers from .00025 MFD. to 30 MFD., in addition to the standard volt, current, resistance and decibel ranges.
- **HANDSOME SADDLE-STITCHED CARRYING CASE** included with Model 80 Allmeter at no extra charge enables you to use this fine instrument on outside calls as well as on the bench in your shop.

**Features:**

- A built-in Isolation Transformer automatically isolates the Model 80 from the power line when capacity service is in use.
- Selected, 1% zero temperature coefficient metalized resistors are used as multipliers to assure unchanging accurate readings on all ranges.

**Specifications**

**7 D.C. VOLTAGE RANGES:**
(At a sensitivity of 20,000 Ohms per Volt)
0 to 15/75/150/300/750/1500/7500 Volts.

**6 A.C. VOLTAGE RANGES:**
(At a sensitivity of 5,000 Ohms per Volt)
0 to 15/75/150/300/750/1500 Volts.

**3 RESISTANCE RANGES:**
0 to 2,000/200,000 Ohms. 0-20 Megohms.

**2 CAPACITY RANGES:**
.00025 Mfd. to .3 Mfd., .05 Mfd. to 30 Mfd.

**5 D.C. CURRENT RANGES:**
0-75 Microamperes, 0 to 7.5/75/750 Milliamperes, 0 to 15 Amperes.

**3 DECIBEL RANGES:**
-6 db to -13 db. +14 db to +38 db
+34 db to +58 db

Model 80 Allmeter comes complete with operating instructions, test leads and portable carrying case. Only $42.50

**SHIPPED ON APPROVAL**

**NO MONEY WITH ORDER — NO C.O.D.**

Try it for 10 days before you buy. If completely satisfied then send $12.50 and pay balance at rate of $6.00 per month for 5 months—No interest or Finance Charges Added. If not completely satisfied, return to us, no explanation necessary.
RCA is the leading manufacturer of thyatron types 2050 and 2D21. These types have an enviable record of performance in demanding industrial applications. RCA-2050's and -2D21's, as well as all RCA Thyatrons, are available at your RCA Industrial Tube Distributor.

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.

New! On the Spot Check of Horizontal Output Circuit!

-ends most common cause of callbacks!

HC-6 Current Checker

• Place in circuit in seconds—no disconnecting of cathode
• Fast, accurate way to adjust horizontal drive and linearity

This new, low-cost current checker provides a positive, on-the-spot method of checking and adjusting TV horizontal output circuits—eliminates one of the most common causes of callbacks. Can be placed in circuit in seconds—without disconnecting cathode—immediately indicates whether horizontal output tube cathode current is within manufacturer's recommended limits. Ensures proper picture focus, width, and stability with minimum cathode current—helps prevent premature failure of horizontal output transformer and in some cases failure of power transformer and rectifiers. HC-6 is valuable as a fast, accurate indicating device when adjusting horizontal drive and linearity. A “must” on all TV horizontal tube, transformers, or yoke replacement jobs—may also be used to balance hi-fi audio output tubes. Compact—inexpensive—easy to use—the HC-6 is a time-saving, money-making addition to your service kit.

$12.95

See your distributor...or write to:

SECO MANUFACTURING CO.
5015 Penn Ave. S., Mpls., Minn.
New Books
Books marked with an asterisk (*) may be obtained prepaid from Electronic Technician


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 frequency, distortion, dh, power, resonance, cabinets, transients, electrostatics, crossovers, feedback and lots more. There are some 190 informative illustrations. Coverage of stereo is brief, and more on overs, feedback and lots more.

The clear explanation of the "j" operator and transients and color, as well as auxiliary functions covering linearity, sensitivity and use for display. This book offers worthwhile information for every 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.


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 age. 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

ELECTRONIC TECHNICIAN • January, 1959
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 Receiver "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
RADIO RECEPTOR COMPANY, INC.
Subsidiary of General Instrument Corporation
240 Wythe Avenue, Brooklyn 11, N. Y. Evergreen 8-6000

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)
"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.

It's easy to handle more auto radio repair business—and handle it profitably—when you install exact replacement controls bought from your regular supplier. No need to run all around town looking for the right unit—you can now be sure that your CENTRALAB distributor has it!

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.

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 lightweight 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, 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 reverse. Small inductors may be measured at higher frequencies and lower values are shown in Table 2. Caution: do not attempt to apply low inductive reactance and low value resistors across the lower line. Also, 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)
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, coxials. 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.

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**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:

\[
x_L = \frac{\pi f L}{2}
\]

\[
x_C = \frac{1}{2\pi f C}
\]

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 Gemsback Publications. 160 pages. Soft cover. $2.95.

This informative second edition has been expanded to include thyristors, four-layer diodes, spacers, 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)
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 $18.95, for this 1100 page (6 3/4 x 11") 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 oscilloscope photography, and a new illustrated section on square wave testing. 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 Encyclopedia on Cathode-Ray Oscilloscopes & Their Uses—"Encyclopedia of the Industry"—is the classic model of all electronic service books. It is the first complete, comprehensive treatment of oscilloscopes and their uses. It is the only book available today which completely covers oscilloscopes and oscilloscope maintenance. The Encyclopedia on Cathode-Ray Oscilloscopes & Their Uses is the only book of its kind which covers every phase of oscilloscopes. It does so in complete detail. It is a must for anyone in the electronic service field.

This new, portable reliability 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, 500, 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.

**NEW Hickok Low-Cost VOM Model 457**

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

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

Association News

California

Los Angeles Area Appliance service technicians are conducting regularly scheduled meetings and conferences to plan and coordinate service, sales, and marketing efforts. The group, which is composed of representatives from all aspects of the appliance industry, meets on a regular basis to discuss the latest trends and developments in the industry.

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 Committee, 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 segments of the electronic service industry, in the knowledge that mutual benefits and improvements can come by working together.

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 group should...
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 uninformed but also misinformed 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)
(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 cutthroat 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. Mengers 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 Duplersky, 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 Telesto 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. Telesto was organized by the independent service dealers of TSA to pro-
SIMPLIFY TEST and TROUBLE-SHOOTING PROCEDURES

with

KINGSTON TEST EQUIPMENT

Models EA-1 and VS-S
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 oscillographs 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-S 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.

ELECTRONIC TECHNICIAN • January, 1959

(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. If it is not necessary to make such an appeal since regional offices, which 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.
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 flywheel 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.

Retro Heterodyne...Cont’d from p. 43

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-

STEREO PROFITS START HERE

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!

ELECTRONIC TECHNICIAN • January, 1959
Association News

(Continued from page 70)

tome 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 A. Z 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. McBroome; 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 service?

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?


A Profitable New Field!

Industrial electronic servicing is a 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-enamedled, power-type units designed to withstand high temperatures: In 3, 5, and 10-watt sizes.

BROWN DEVIL® RESISTORS

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

LITTLE DEVIL® COMPOSITION RESISTORS

Meet all MIL-I-11A requirements. Available in 1/4, 1, and 2-watt sizes in all standard EIA values.

MOLDED COMPOSITION FENTI-OMETERS

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

Write for Stock Catalog 28
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.

Cover 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)

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 microhms. Plate resistance is 0.35 meg., Class A plate current 12 ma. The 3DK6 and 4DK6 are designed for use in 600- 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)
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 jf. New surge protector circuit incorporates 10 separate electrolytics from 2 to 450 v. Range in...ELECTROLYTIC SUBSTITUTION

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)

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 1N2076 through 1N2085. 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)

SERVICE MEN KNOW THERE IS JUST ONE

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

EVER-QUiET

Since 1949 the Original Volume Control and Contact Restorer
EVER-QUiET is a free-blowing liquid that leaves no powder residue. Scientifically designed to keep around the shaft and terminals of volume controls and leaves 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
See your distributor or write to

CHEMICAL ELECTRONIC ENGINEERING, INC. Matawan, New Jersey

ELECTRONIC TECHNICIAN • January, 1959

The specs are the proof... THE BEST BUYS are...

COLOR

And Monochrome de to 5 mc lab & tv 5" OSCILLOSCOPE

Features DC Amplifiers!

Flat from DC-4.5 mc, usable to 10 mc. VERT. AMPL.: sens. 25 rms mv/in; input 2.3 mgs; direct-coupled & push-pull output; K-follower coupling bet. stages; 4-step freg-compensated attenuator up to 1000:1. SWEEP: perfectly linear 10 cps-5 khz (at cap. for range to 1 cps), pro-set TV v & h positions (5 & 7875 khz). 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 eqpt. High intensity trace CRT. 0.6 sec rise time. Push-pull hor. ampl. flat to 400 kc; sens. 0.6 rms mv/in. Built-in vol. calls 2-axis mod. Sawtooth & 60 cps outputs. Astig. control. Retrace blanking. Phasing control.

TV-FM SWEEP GENERATOR & MARKER $369

Factory-wired $695

COMPLETE with steel cover and handle.

See the 50 EICO models in STOCK at your local distributor. Write for FREE Catalog ST-1

1110 50th Street, Oakland 12, Cal. L. C. I. N. Y.

Prices 5% Maher to West.
**Reserve Power**

**To Handle Any Servicing**

... is one reason why more servicemen buy ELECTRO-D-612T POWER SUPPLIES

Other reasons ...

Out-serves all others in its price class

- transistor, "hybrid" and tube auto radios, transistor portable radios, aircraft and marine radios. Also charges batteries, operates relays; used for electroplating, laboratory 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 amperes, continuous duty up to 12 volts; 20 amperes intermittent current rating.

Patented conduction cooling

Lowers cost per amperage output. Adds years of trouble-free service.

See your Jobber • Write for Folders

**ELECTRO PRODUCTS LABORATORIES**

4501-T Ravenswood, Chicago 40, Ill.

Canada: Atlas Radio Ltd., Toronto

---

**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 secure 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)

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**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)

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**DEPENDABLE TV-RADIO TUBES**

Nationally sold ZALYTRON TUBES are BRAND NEW QUALITY TUBES, priced low to help you perform competition to 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".

**BE YOUR OWN BOSS**

Run a Self-Service Tube Business

Get This Modern Sturdy Tube Tester

**FREE**

With "Package Deal" order for nationally sold ZALYTRON Quality-Brand Receiving Tube Tester. We'll show you how to start a successful Tube Tester Route, and get YOUR Service Tube Sales! This is no "Gold-Rush" scheme but a solid, proven business that will reward you well if you WORK at it. But, INVESTIGATE before you INVEST! Get full details and the best "Deal" now being offered, send today for our booklet "ET".

**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 5000 ohms
- 12-\(\frac{1}{2}\) watt 10% resistors from 10K ohms to 3.5 megohms
- 10-600 volt capacitors from 100-mfd. to .5 mfd.
- 1-10 mfd., 450V Electrolytic
- 1-40 mfd., 450V Electrolytic
- For Shop, Lab, or amateur service

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

**DEALER NET**

Completely isolated Available at all Parts Distributors
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-293 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 55E.) 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. 88 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. To make your distributor or write:

20 TV FM SETS INCLUDING COLOR

THE

ENGINEERING, INC.

SLIDES APART

CONTACT YOUR DISTRIBUTOR OR WRITE:

CHARLES

SLIDES TOGETHER

ENGINEERING, INC.

CONNECT TO SET

8053 MELROSE AVENUE

LOS ANGELES, CALIFORNIA

ELECTRONIC TECHNICIAN • January, 1959

"He was not trying to steal your new JENSEN CARTRIDGE. He was just admiring it."
\[\text{Vocaline TRANSCIEVER}\]

This 465 mc remote controlled Citizens Band transceiver is designed to eliminate the signal losses incurred when operating series IRC 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 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 weatherproof 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)

\[\text{Centralab CONTROL}\]

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)

\[\text{Mallory SILICON RECTIFIERS}\]

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)
you'll find the right replacement faster in the '59 MASTER

Complete descriptions, illustrations, prices for more profitable TV-radio-audio-industrial servicing. You can buy, sell and bill direct from the MASTER - world's largest electronic catalog at your jobber... only $3.50. $4.50 in Canada

FREE - 24-page PANEL LAMP CHART at your jobber, or send 10c to:
THE RADIO-ELECTRONIC MASTER
607 Madison Ave. New York 2, N.Y.

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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.

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for the name and address of your nearest distributor

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

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---

**Progress is Our Most Important Product**

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

---

<table>
<thead>
<tr>
<th>JOB</th>
<th>G-E “Designer”</th>
<th>Set A</th>
<th>Set B</th>
<th>Set C</th>
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<td>Replace most resistors</td>
<td>yes</td>
<td>no</td>
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<td>Replace most capacitors</td>
<td>yes</td>
<td>no</td>
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<td>Replace deflection yoke</td>
<td>yes</td>
<td>no</td>
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<tr>
<td>Replace video detector</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>no</td>
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<tr>
<td>Replace audio detector</td>
<td>yes</td>
<td>no</td>
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<td>Replace horizontal phase detector</td>
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<td>no</td>
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<tr>
<td>Replace power rectifier</td>
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<tr>
<td>Adjust tuner oscillator</td>
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<td>no</td>
<td>yes</td>
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<tr>
<td>Replace inter-stage transformers</td>
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<tr>
<td>Replace size and linearity controls</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

General Electric Co., Television Receiver Dept., Syracuse, N.Y.
DID YOU SAY $11.95 PUTS ME IN BUSINESS?

Yes, $11.95 Puts You in the BOOMING EXACT REPLACEMENT PORTABLE ANTENNA BUSINESS!

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51 McCormack Street  15 Moore Street
Toronto, Ontario, Canada  New York, N.Y.

JFD Exact Replacement Portable TV Antenna Merchandising Kit
No. PA500 Contents: $11.95 Dealers Net

<table>
<thead>
<tr>
<th>No.</th>
<th>JFD Antenna Model</th>
<th>Exact Replacements for</th>
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<tr>
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<td>TA154</td>
<td>Admiral-Westinghouse</td>
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<td>TA155</td>
<td>Zenith-Admiral</td>
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<td>TA359</td>
<td>RCA, Motorola, Magnavox</td>
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<td>TA360</td>
<td>GE, Hotpoint, Westinghouse</td>
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<tr>
<td>1</td>
<td>TA442</td>
<td>Emerson, GE, Olympic</td>
<td>10.95</td>
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</table>

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<tbody>
<tr>
<td>Total List</td>
<td>$58.10</td>
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</table>

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.
They know
he's good
because he's using the best...

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The public doesn't look behind a TV set very often. But when they watch you at work, it's reassuring to see the familiar red and black carton with that RCA trademark. The one thing the public does know about electronics and electronic products is that RCA is the outstanding name and company in the field. To benefit from the confidence that lesser known brands could never instill in your customers, latch on to RCA's "built-in" reputation — your calling card to customer goodwill. Your RCA Distributor carries a full line. Next time you order tubes, specify... RCA.

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Electron Tube Division
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