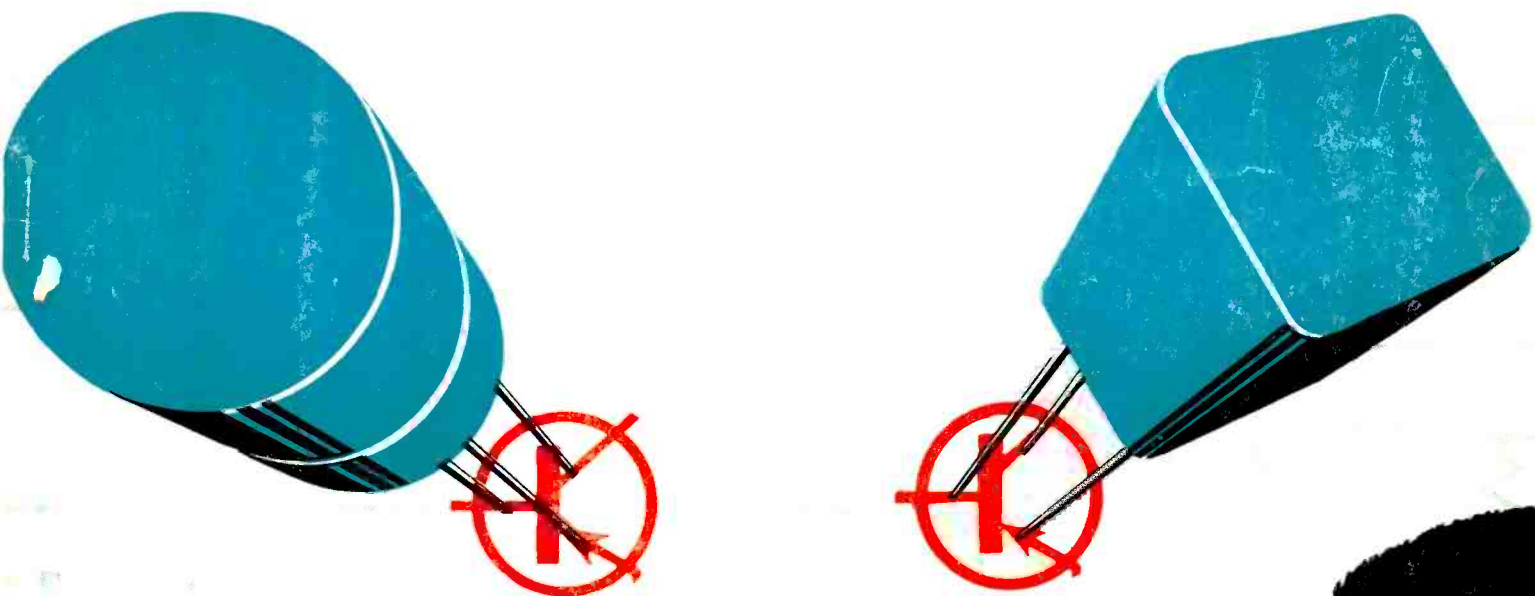


TECHNICIAN

& *Circuit Digests*



708

Servicing Transistor Circuits

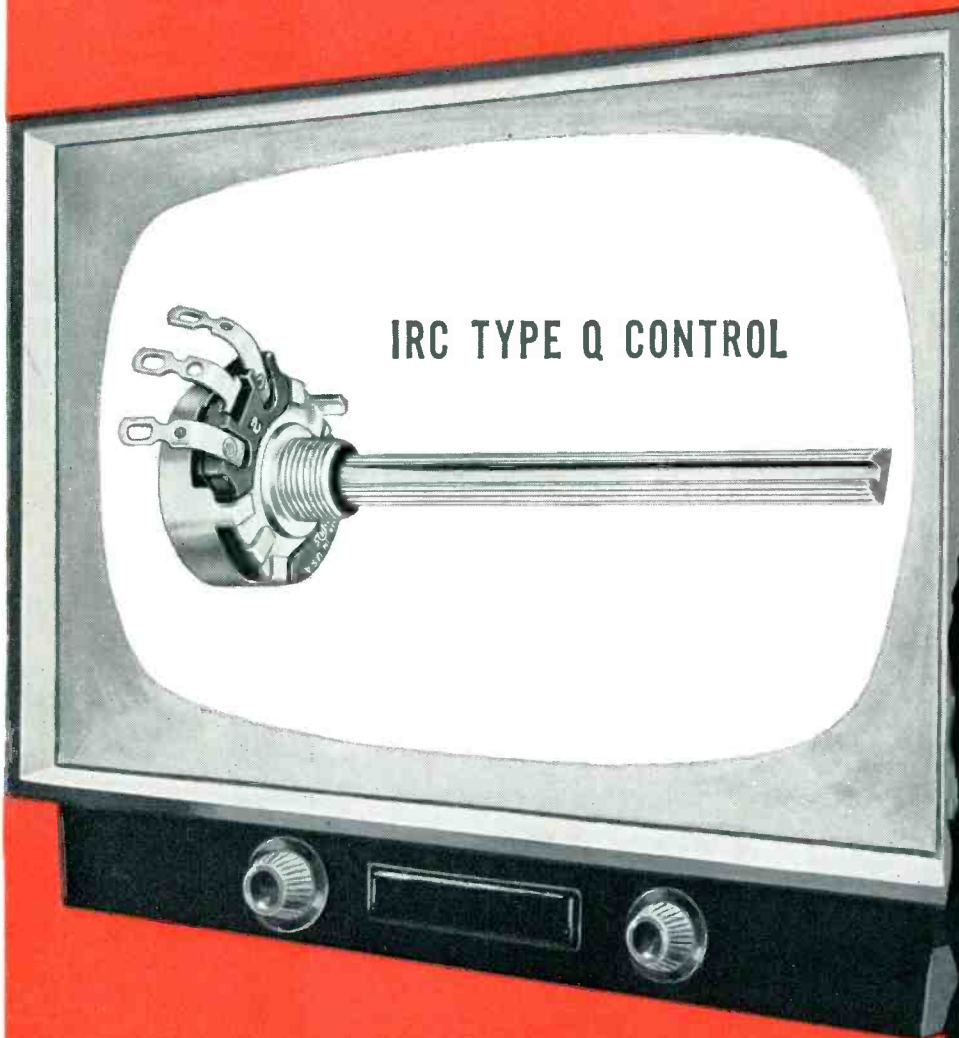


50¢

April • 1956

Caldwell Clements

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IRC TYPE Q CONTROL

Service technicians get greater coverage with less investment; more practical service features; and easier, faster installation with the IRC Type Q Control. Here's a dependable, basic control that is directly designed for modern set servicing. For appearance, performance and price . . . there's none better. So why settle for less? Tell your Distributor you want Q Controls . . . most servicemen do.



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Send me Q Control Catalog DC1D.

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Q Control standard shaft is knurled, flatted and slotted —fits most knobs without alteration.

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Exclusive IRC convenience feature—provides fast conversion to "specials", with FIXED shaft security. 15 types available.

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TECHNICIAN

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APRIL, 1956

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TECHNICIAN & CIRCUIT DIGESTS, Apr. 1956, Vol. 63, No. 4, \$.50 a copy. Published monthly by Caldwell-Clements, Inc. Publishers also of MART including Price-Fax. Publication office, Emmett St., Bristol, Conn. Editorial, advertising and executive offices, 480 Lexington Avenue, New York 17. Telephone PLaza 9-7880. M. Clements, President; John J. Borghi, Vice President and Treasurer; M. B. Clements, Secretary.

Entered as second class matter at the Post Office at Bristol, Conn., June 10, 1954. Subscription rates: United States and Canada, \$4.00 for one year; \$6.00 for two years; \$8.00 for three years. Pan-American and foreign countries: \$7.00 for one year; \$10.00 for two years; \$14.00 for three years. Copyright 1956 by Caldwell-Clements, Inc., New York. Title registered in U. S. Patent Office. Reproduction or reprinting prohibited except by written authorization of publisher. Printed in U.S.A. by Hildreth Press, Inc., Bristol, Conn.

FRONT COVER Servicing transistor circuits is becoming an increasingly important aspect of the TV-electronic technician's work. Many transistorized portable radios, auto radios and audio amplifiers are now on the market, and the number is growing. Transistors will find their way into TV receivers before long. Don't miss the articles on pages 38, 46, 48, plus two complete schematics in this month's Circuit Digests section.

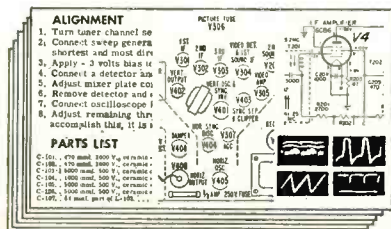
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PACKARD-BELL: TV Chassis V8-1
RAYTHEON: Transistor Portable Radio, Chassis 7RT4

Philco breaks National Campaign to replace "Tired" Picture Tubes



Don't let a
"Tired" Picture Tube
spoil half of your TV enjoyment



Now, Get a better picture than ever before!
PHILCO Star Bright 20/20
ALUMINIZED PICTURE TUBE
Bond plus Warranty

Regardless of the make or model of your TV set, you will get the best picture ever when you change to the Philco Star Bright 20/20. And it's the only TV picture tube made that gives you double protection with both bond and warranty.



Bonded to be built with all new picture making parts to the same rigid standards as tubes in newest Philco TV sets. Plus full year warranty.

Authorized Philco Service Dealer now. Ask about his allowance for your old picture tube.

Millions of TV Set owners get the call to action — to phone you immediately for a new picture tube

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Invest in your future in Color TV Service and equip your shop **FREE** during the fabulous

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AND PROFIT**
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Now, an Exclusive Double Edged Selling Tool...

Bond plus Warranty

ON EVERY

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Star Bright 20/20



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Miss America 1956

**SUPER ALUMINIZED! CLEAREST,
MOST LIFELIKE PICTURE POSSIBLE**

Regardless of the make or model of a TV set, a Philco Star Bright 20/20 Aluminized Picture Tube gives your customers a clearer, brighter, more lifelike picture than ever before... and builds confidence in you.

**PHILCO PICTURE TUBE
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Bonded by a leading Indemnity Co. to be built with all new picture making parts, to the same rigid standards of tubes in the newest Philco TV models.

**PHILCO PICTURE TUBE
WARRANTY**
Covers the picture tube for one full year. Combined with the new Philco bond, it offers the purchaser guarantees never before matched in television history.

Yes, Philco gives you a double-edged selling exclusive to boost your replacement tube business. In addition to the one year warranty, the Philco Star Bright 20/20 Aluminized Picture Tube is BONDED to have all new picture making components. This bond protects your customers against counterfeit tubes and assures a picture tube that's built to the same rigid standards as those in original TV receiving equipment. The Philco Star Bright 20/20 is the only picture tube made that is backed by such a bond.

PHILCO CORPORATION

ACCESSORY DIVISION

PHILADELPHIA 34, PA.



Philco puts you in the color service business with this one compact instrument

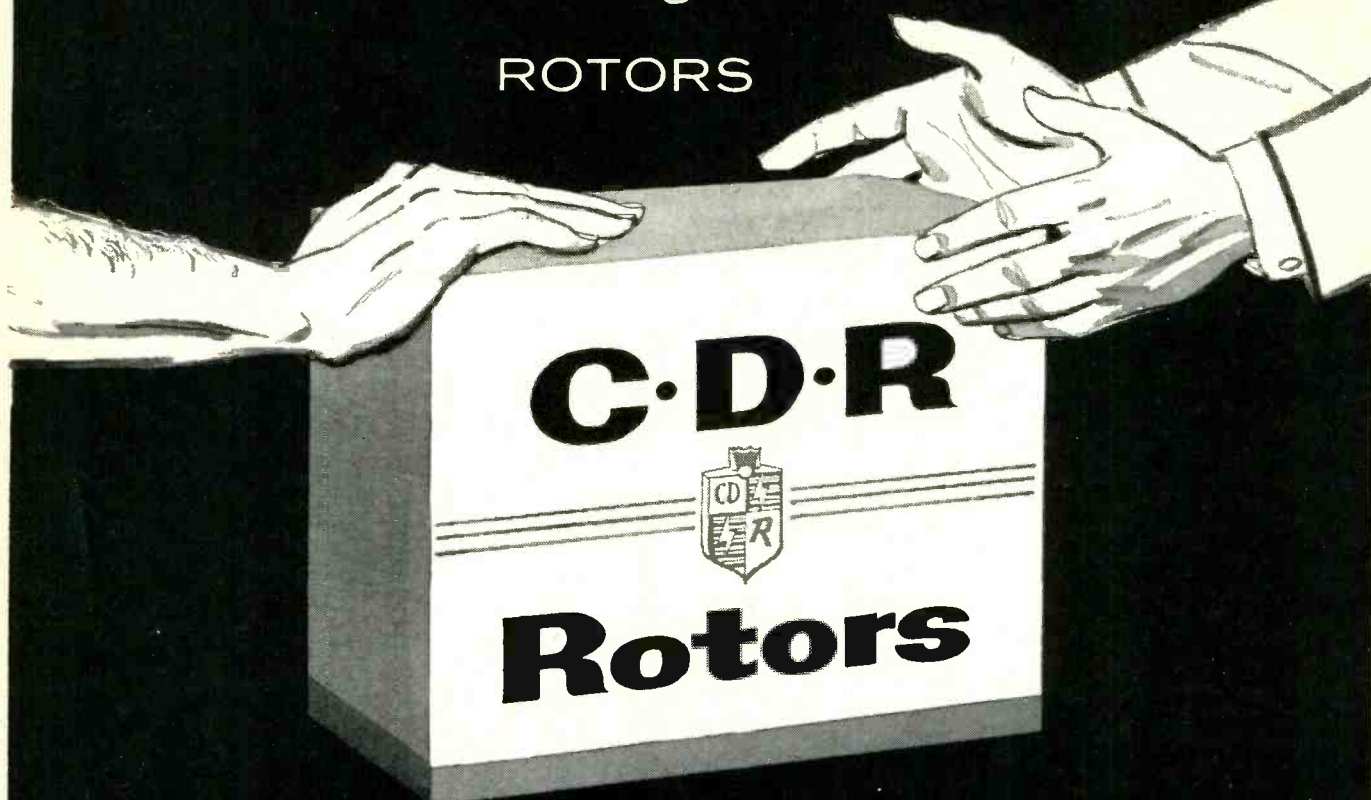
PHILCO Universal COLOR BAR and DOT BAR Generator

It's new... highly efficient... designed to provide the widest possible variety of functions in the minimum amount of space. PHILCO MODEL 7100 is used to

completely trouble-shoot circuits associated with color reproduction and make accurate convergence adjustments in any color television receiver on the market.


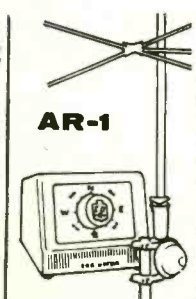
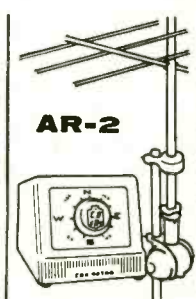
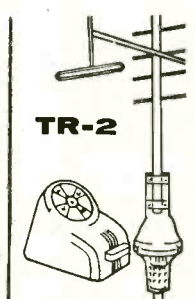
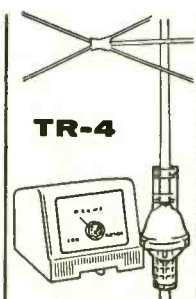
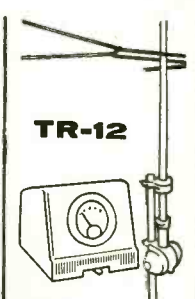
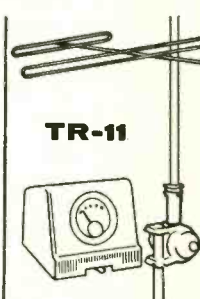
Model 7100

the fastest selling
ROTORS



because ...

- ✓ Pre-Sold to millions every week on TV
- ✓ The Most Complete Line ... A Model for Every Need
- ✓ Superior Engineering ... they're Tried-Tested-Proven

 <p>AR-22</p>	 <p>AR-1</p>	 <p>AR-2</p>	 <p>TR-2</p>	 <p>TR-4</p>	 <p>TR-12</p>	 <p>TR-11</p>
<p>Completely AUTO-MATIC version of the TR-2 with all the powerful features that made it famous.</p>	<p>Completely AUTO-MATIC rotor, powerful and dependable. Modern design cabinet. 4 wire cable.</p>	<p>Completely AUTO-MATIC rotor with thrust bearing. Handsome cabinet, 4 wire cable.</p>	<p>Heavy-duty rotor with plastic cabinet, "compass control" illuminated perfect pattern dial, 8 wire cable.</p>	<p>Heavy-duty rotor, modern cabinet with METER control dial, 4 wire cable.</p>	<p>Combination value ... complete rotor with thrust bearing. Modern cabinet with meter control dial, uses 4 wire cable.</p>	<p>Ideal budget all-purpose rotor, new modern cabinet featuring meter control dial, 4 wire cable.</p>



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THE RADIART CORP.
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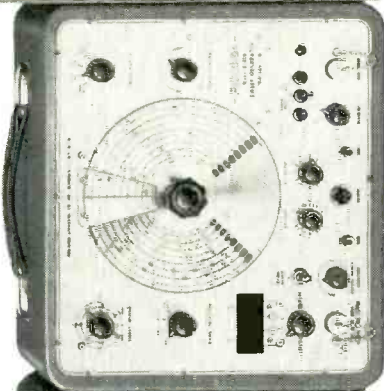
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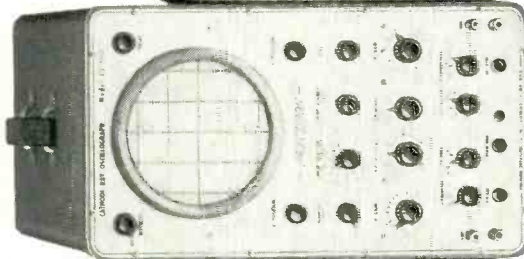
(monochrome and color)



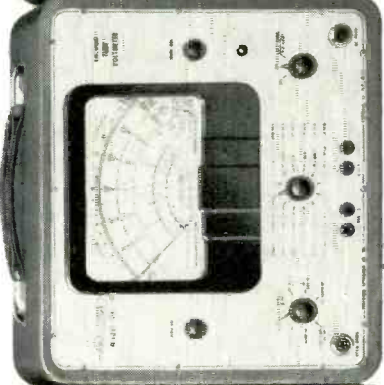
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SIGNAL-MARKER GENERATOR
Direct Reading to 240 MC.
for AM-FM, and TV Alignment
Deluxe Model Net Price \$95.00
Standard Model Net Price \$90.00



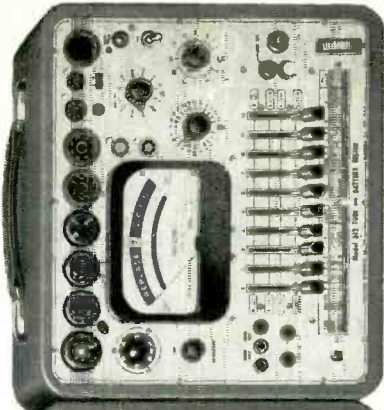
MODEL E-400
SWEEP SIGNAL GENERATOR
Narrow and Wide Band Sweep
Direct Frequency Reading to 900MC
Deluxe Model Net Price \$160.00
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MODEL ES-550
5" OSCILLOSCOPE
5MC Bandwidth
10MV per inch Sensitivity
Deluxe Model Net Price \$235.00
Standard Model Net Price \$230.00

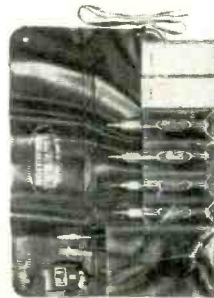


MODEL 98-MCP
VTVM and ELECTRONIC OHMMETER
7" Full View Meter
P-P Voltage Ranges to 3200 Volts
Deluxe Model Net Price \$119.50
Standard Model Net Price \$114.50



MODEL 612-MCP
CATHODE CONDUCTANCE TUBE TESTER
and
Dynamic A-B-C Battery Tester
Deluxe Model Net Price \$94.75
Standard Model Net Price \$89.75

MODEL SP-5 — OSCILLOSCOPE TEST PROBE SET



for TV Signal Tracing,
Alignment, Trouble-
Shooting and Waveform
Analysis.

For use with all *PRECISION* Oscilloscopes, ES-500, ES-500A, ES-520 and ES-550. In vinyl carrying case with four different, detachable probe heads, universal coaxial cable and operating instructions. Net Price: **\$26.50**



PACE

THE METER OF PRECISION

PRECISION Apparatus Company, Inc.

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In Canada: Atlas Radio Corp., Ltd., 50 Wingold Ave., Toronto 10

MODEL TV-8 — HIGH VOLTAGE SAFETY TEST PROBE

PRECISION-engineered to solve the high voltage test problem with utmost safety to operator and equipment.

Incorporates custom-molded high voltage head and barrier plus internal and external flashshield. Extends range of Model 98 (above) to 60 KV D.C. Also available for use with other *PRECISION* VTVM's and 20,000 ohms per volt test sets.



Net Price \$14.75

PRECISION Test Equipment is available and on display at leading electronic parts distributors.

Write Directly to Factory for New 1956 Catalog.

How you can make \$50 or more a day in extra profits...with Bogen Complete Public Address Systems



Cash in on PA rentals to clubs, sports events, dances, church bazaars

Almost every day some activity in your area rents a public address system at a cost of twenty-five to fifty dollars or more. Are you letting this business get away from you? Maybe it's because you think installing PA systems presents too many problems...



You don't have to be a 'sound engineer' with Bogen PA. Bogen complete PA systems are the ultimate in easy installation. All you do is connect the microphone, amplifier and speakers and the system is ready to go. Keep both an indoor and outdoor Bogen Complete Public Address System on hand...and start rolling up those extra profits.



J330P Portable 30 watt public address system: J330 Amplifier, microphone, two 12" speakers mounted in snap-together carrying case.

J623TJ 23 watt mobile outdoor public address system: Works on auto battery (for sound trucks) or regular AC current. J623 amplifier with built in phono and shock-mount base, 1 trumpet, microphone.



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Bogen engineers are ready to help you draw up plans and specifications for any type job—at a moment's notice... and the Bogen PA catalog can tell you at a glance which system goes where for most installations. Also, don't overlook the profit possibilities in servicing existing PA and intercom installations in your community.

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Send for the Bogen complete public address system catalog. Mail this coupon today!

Bogen

"BECAUSE IT SOUNDS BETTER"

David Bogen Co., Inc., Dept. 3D
29 Ninth Ave., New York 14, N. Y.

Send me the Bogen Complete Public Address System catalog right away.

name _____

company _____

address _____

city _____ zone _____ state _____

Editor's Memo

Many years ago my dad operated a retail store, and like all members of the hardy breed of store owners he fought his share of battles with suppliers, big competition, city inspectors and irate customers. Sure, he made a living, but sometimes he was asked whether it was worth all the trouble.

His answer seems to symbolize the wonderful spirit of the small store owner, then and now, and his healthy ability to laugh at himself without losing sight of the practical realities. Instead of quoting facts and figures, he would tell this story, smilingly claiming it was true—but it should be noted that he was always a good storyteller.

One cold winter day when the snow was piled high outside the store, a man came in and offered to clear the snow for 50¢. Dad agreed, and the man went out. A minute later he returned, requesting the temporary loan of a chair. Dad said sure, but his curiosity prompted him to follow the man out of the store to find out why a chair was needed at all.

Outside the store, dad found the man sitting back on the chair, smoking a big black cigar, supervising the snow shoveling efforts of another fellow.

"Say," remarked dad, "I agreed to pay you 50¢ to clear the snow. Now you have someone else doing the work."

"He's my employee," replied the man. "How much are you paying him, 35¢?"

"No," answered the man with the cigar. "I'm paying him 60¢."

This startled dad. "If I pay you 50¢, and you pay him 60¢, how do you make any profit?"

"I don't make any profit," replied the man. "But isn't it worth 10¢ to be a boss?"

Out of World War II came the story of a soldier—we'll call him Jack Brown—who was the foul ball of the regiment. Everything Pvt. Brown did was wrong. His bunk was messy, he faced the wrong direction in formation, his shoes were unshined, and he couldn't aim his rifle.

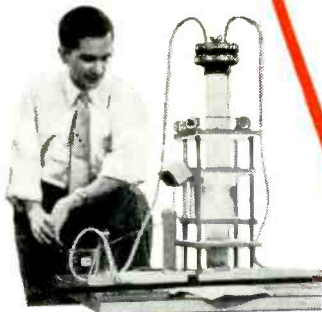
In desperation, the colonel called on a wise old sergeant to try to remedy the situation. The sergeant walked into Brown's tent, came out ten seconds later, and from that time Brown became a model soldier.

Brown now had the neatest bunk, was held up as the example to all men on the parade grounds, had the brightest shine, and became an expert marksman.

The colonel was pleased at the change, but very curious as to how it came about. So he called in the old sergeant and asked him to explain what he had done in Brown's tent during those ten seconds.

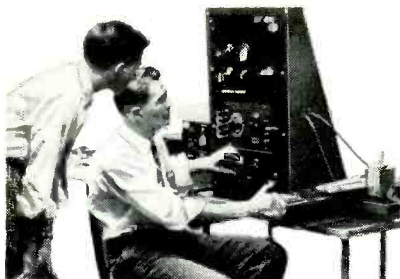
"It was very easy," said the sergeant. "I simply handed him his rifle and said: 'Brown, you're in business for yourself!'"

Al Forman



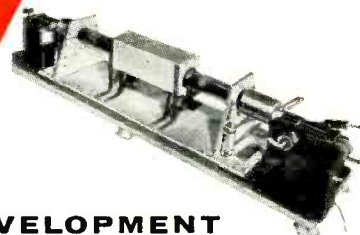
RESEARCH

Solid state devices for not-so-distant future applications command continuous study by Tung-Sol engineers. In this instance the purifying of silicon is under close scrutiny.



DESIGN

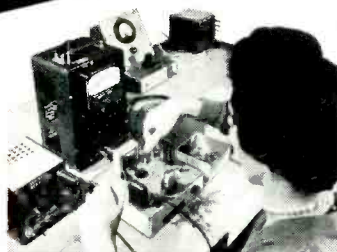
Efficiency and utility are among the foremost considerations of all Tung-Sol semiconductor blue-printing. Here the resistivity of single germanium crystals is being measured.



DEVELOPMENT

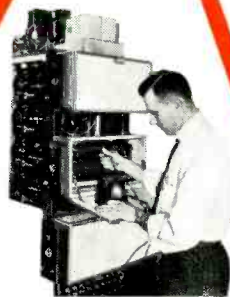
Ever alert to the intensified and varied demands made by transistorizing, Tung-Sol provides full-scale development of new semiconductor types. Here the latest techniques of germanium diffusion are explored.

New Production Facilities for Tung-Sol Semiconductors



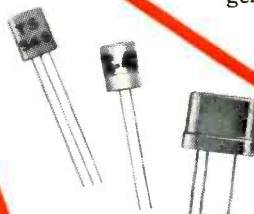
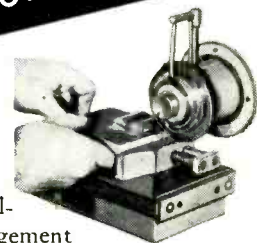
TESTING

100% testing—life, mechanical and electrical—characterizes the Tung-Sol manufacturing program. In this illustration, transistors are 100% checked for noise factor.



PRODUCTION

A complete manufacturing division—with its own full-time engineering and management staffs—handles every phase of the critical production process from metal refining to finished product. Here germanium ingots are being sliced into 15/1000" blanks.



QUALITY CONTROL

Every step of Tung-Sol semiconductor manufacture is subjected to intensive quality control that permits no compromise with premium quality. Here transistors are life-tested under conditions in excess of their ratings.

ts TUNG-SOL[®]
SEMICONDUCTORS



For technical information write to Commercial Engineering Division

TUNG-SOL ELECTRIC INC., Newark 4, N. J.

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Signal Flashers



Radio And TV Tubes



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Special Purpose Tubes



Semiconductors



Color Picture Tubes

MAKE MORE MONEY on every service call



NET \$109⁹⁵

B&K

DYNA-QUIK MODEL 500

DYNAMIC MUTUAL CONDUCTANCE TUBE TESTER

Tests over 95%

OF ALL POPULAR TV TUBES*—IN SECONDS

You can cut servicing time—eliminate repeat calls—make more on-the-spot tube sales—give a better service guarantee—make new profits in minutes with DYNA-QUIK. This top quality, low cost, portable dynamic mutual conductance tube tester enables any serviceman to locate weak and inoperative tubes quickly and easily with laboratory accuracy right in the home.

DYNA-QUIK creates greater customer confidence because your customer sees for himself the true tube condition on "Good-Bad" scale. In just a few minutes you can check all the tubes in a TV set for shorts, grid emission, gas content, leakage, dynamic mutual conductance and life expectancy under the dynamic heavily loaded conditions that are the actual operating conditions of the set. Used in the shop or in the home—DYNA-QUIK will make money for you every day!

- Fast—a complete tube test in as little as 12 seconds.
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- Accurate—large 4½" plastic meter has two scales calibrated 0-6,000 and 0-18,000 micromhos.
- Always up to date—test procedure instructions for new tubes supplied by factory at regular intervals.
- Automatic line compensation—special bridge continuously monitors line voltage.
- 7-pin and 9-pin straighteners mounted on panel.
- Portable—luggage style carrying case with removable slip-hinged cover.
- Lightweight—15½ x 14½ x 5½ in. Weighs only 12 lbs.

*Including new 600 mil series tubes.

B&K

Send for article on "Profitable TV Servicing
In the Home" and Bulletin 500—T

Also makers of
the famous CRT 400

B & K MANUFACTURING CO.
3726 N. Southport Ave. • Chicago 13, Illinois

LETTERS

To the Editor

NATESA Award

Editor, TECHNICIAN:

It gives us great pleasure to invite you to our Spring Board of Directors meeting which will be held at the Blackstone Hotel in Omaha, Nebraska, on April 22, 1956. A full day's program is planned, topped by a banquet in the evening, during which we are prepared to award to TECHNICIAN the Friends of Service Management plaque which is symbolic of our appreciation for service you have rendered to the cause of independent service in 1955.

FRANK J. MOCH
President

NATESA
Chicago, Ill.

Raps Pay TV

Editor, TECHNICIAN:

If it is true that the FCC is trying to shift the cost of transmitting TV to the set owners, and hand over TV repair service to coin box magnates, service technicians are in a tough spot. My customers would rather go back to radio than face such regimentation.

FRED O. STILLMAN
Carteret, N.J.

Disgusted with Us

Editor, TECHNICIAN:

All we ever get from you is commercials on test equipment. Why not publish complete data on commercial test equipment, so the users and buyers know what's what? TECHNICIAN is the least valuable magazine available to us radio-TV technicians. Disgusted.

NATE SILVERMAN
Los Angeles, Calif.

● Complete data on any new instrument described in our new products section will continue to be sent to any reader requesting same. Rather than glorify any one make of instrument in a feature article (called a publicity puff in the publishing trade), we select only those technical articles that are applicable to many makes so every tech can put the information to practical use. We regret reader Silverman's lack of support, but take consolation from the fact that TECHNICIAN has more paid subscriptions among service techs than any other magazine in the field, and has been voted the most preferred publication by techs in surveys in more than 40 trading areas conducted by organizations not affiliated with us.—Ed.

(Continued on page 12)



NEW CHASSIS PUNCHES

A complete line of precision punches, featuring Walsco-Pioneer "Taper Wedge" design to speed more accurate hole punching... any size, any shape.



NEW TEKNI-LABELS

A complete line of handy title and design decals for speedy labeling of electronic equipment



CHEMICALS

A complete line of chemical specialties, including cements, solvents, and contact cleaners in bottles and handy spray cans.



HARDWARE & SERVICE AIDS

A complete line of essential small component hardware, packaged in reusable plastic boxes. Dial cord, feed-thru bushing, and other valuable service aids.

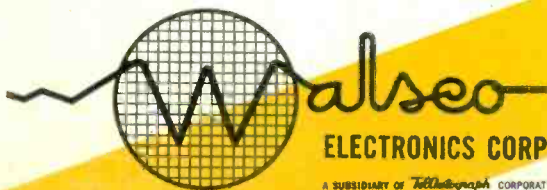
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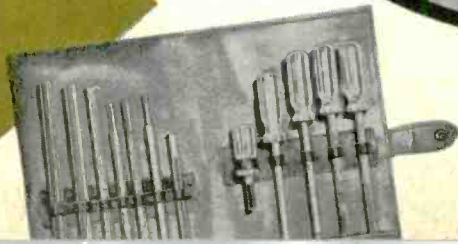
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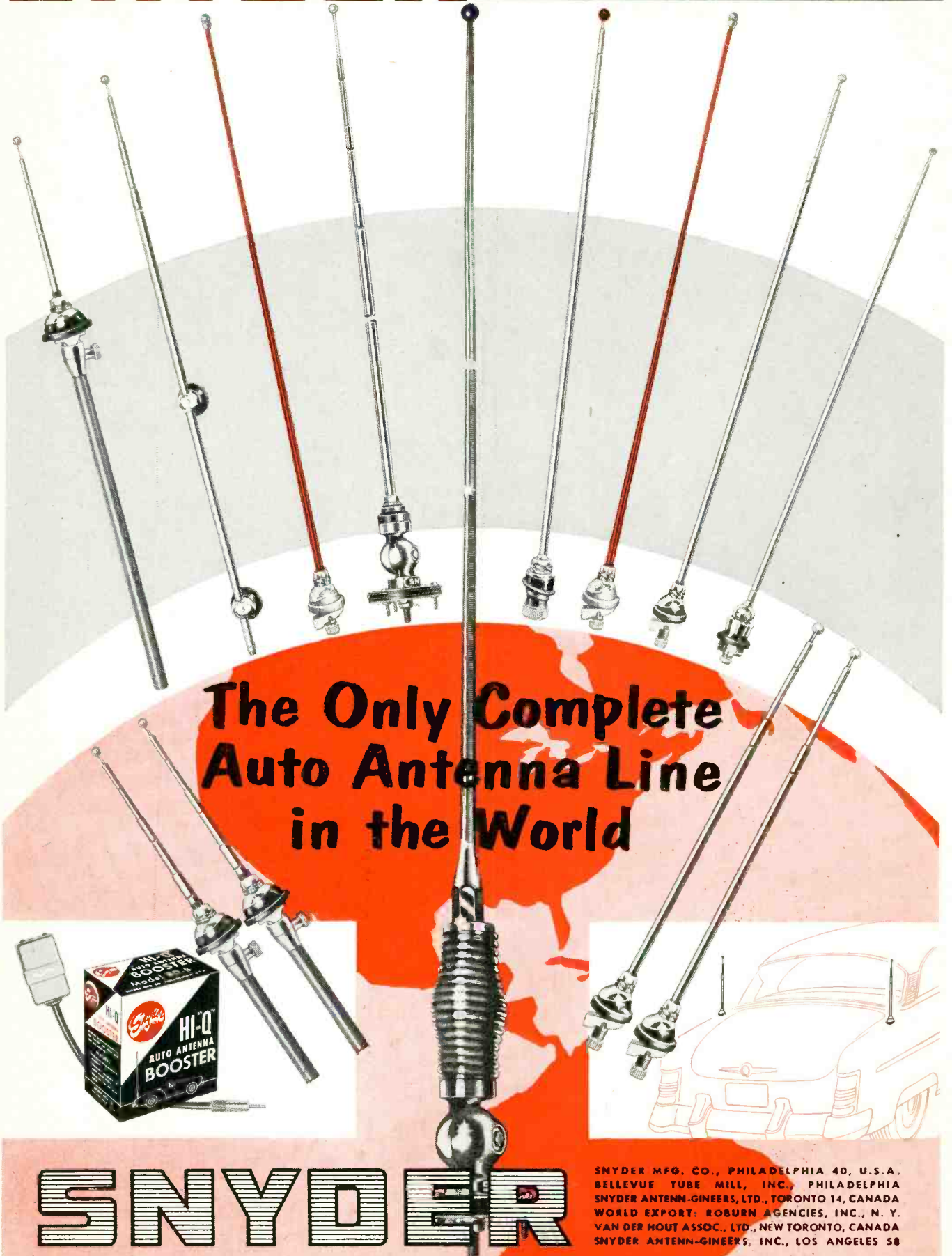


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Your customer is aware that Hi-Fi does sound better . . . that it faithfully reproduces the original sound. And you can prove by demonstration that advanced-engineered CBS Silver Vision tubes can do for video what Hi-Fi does for audio.

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- Controls
- Switches
- Rectifiers
- Filters
- Mercury Batteries

LETTERS

To the Editor

(Continued from page 8)

Who's to Blame?

Editor, TECHNICIAN:

Last week I repaired a TV-radio-phono combo. It required extensive shop work, and among other things a new 5U4GB tube was put in. It was returned to the customer, and adjusted to her satisfaction. We got paid and left. An hour later this irate customer called, and between her sobs and screams she said that no sooner had I left when the set let go billows of smoke, and lost pix and sound. In her confusion, she let it run for five minutes before pulling the wall plug. When I arrived a half-hour later, the power transformer was still hot, and the usual odor filled the rooms. The in-warranty 5U4GB was pulled, and a hole was visible on one plate. Assuming the tube itself shorted, I put in another, praying the transformer had not burnt out. It turned out fine.

The problem is, if this shorted new tube had burnt out the transformer, who would pay for it and the labor charge?

JOHN L. MANCINI

John's Radio & Tv Service
Winthrop, Mass.

• It would appear that the customer is not liable for extra charges since she contracted in good faith with the understanding no defective part would be used to cause further damage. Tech Mancini and perhaps the tube maker should be responsible to the customer. In this case the tech may have recourse to the manufacturer of the defective tube as well. From the manufacturer's viewpoint it's a question of whether the tech contributed to the damage by not testing the set out adequately. As the lawyers say, "it depends."—Ed.

Audio "Architects"

Editor, TECHNICIAN:

In commercial sound, the building architect receives his fee, usually 5 to 7%, as a percent of the cost of the structure and equipment contained for which he is responsible. Similarly, if we could have competent technical consulting services available for home hi-fi systems, the buyer faced with a confusing array of different makes and models could get an engineered system, rather than a salesman's system. The consultant would benefit from the percent-of-price income. The dealer would just have to fill the order for equipment specified, reducing sales costs. And the customer, at very little extra cost, gets the audio system planned by a professional to suit him.

OLIVER BERLINER

Hollywood, Calif.

To Pull or Not to Pull

Editor, **TECHNICIAN**:

Thoughtful technicians have rightfully said that a line must be drawn somewhere in the matter of which sets should be fixed in the home, and which pulled to the shop. Then they proceed to hack away at that line, carting sets with easily determined troubles to the shop. I have found fixing sets in the home both lucrative and instructive, and I try to let the customer decide where the repair will be made, except in the case of "dogs" and complete overhauls. Servicing the set in the home gives him prompt attention; no cherished program will be missed. For the technician, I need not dwell on the chore of dragging a heavy chassis. Today's serviceman need not sprawl on the living room floor. He works as befits his dignity, seated at a portable work table. The customer who once sees a capable technician in action, making repairs before his eyes, comes away with a new sense of respect for the know-how exhibited.

HARRY M. LAYDEN
Chief Technician

Judd-Bennett Co.
New York, N.Y.

Cost for Servicing

Editor, **TECHNICIAN**:

Could you tell us the average cost per year for servicing TV receivers in the U.S. and Canada? We subscribe to your fine magazine **TECHNICIAN**, and consider it the best.

C. F. MACHIN
Windsor, Ontario, Canada

• *The best estimate is \$40 to \$45 per year average for servicing a TV set, including parts, labor, antenna installation, etc.—Ed.*

HV Hams

Editor, **TECHNICIAN**

Please advise where I may obtain information about the process of smoking hams, using a positive and negative electrical charge. What is the voltage, method, etc?

PERCE CHRISTIANS
Sioux City, Iowa

• *Can any readers help?—Ed.*

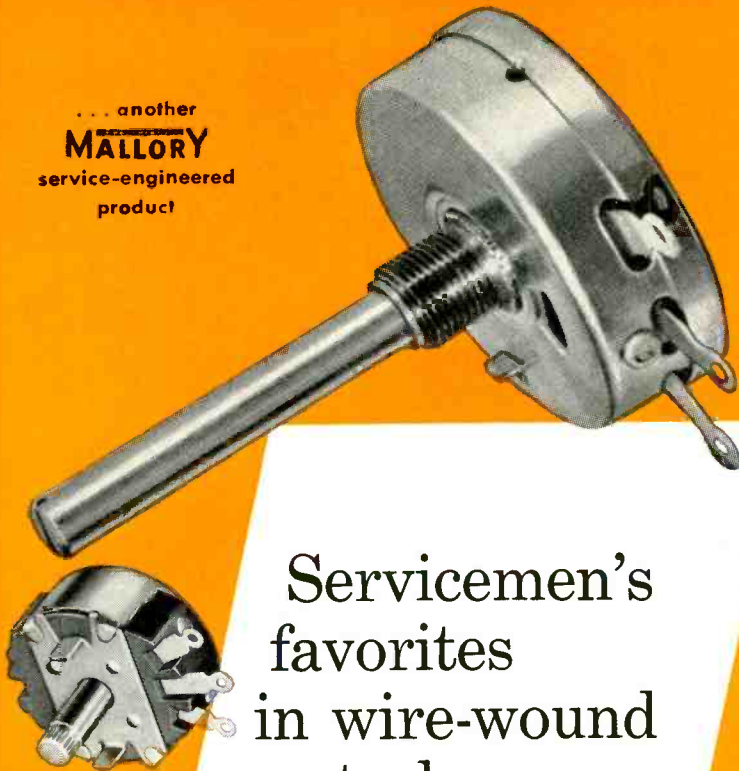
Circuit Digest

Editor, **TECHNICIAN**:

I have yet to find a TV set which is brought to my shop in which a **TECHNICIAN** Circuit Digest schematic would not work or tell me what I want to know. We use them all the time.

ROBERT HILDEBRAND
Bob's Radio Shop
Greenville, Ohio

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service-engineered
product



Servicemen's favorites in wire-wound controls

You're sure of giving your customers the best when you use Mallory wire-wound controls. The choice of servicemen and manufacturers everywhere, they have set the standards of the industry for value and performance.

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New Books

HI-FI LOUDSPEAKERS AND ENCLOSURES. By Abraham B. Cohen. Published by John F. Rider Publisher, Inc., 480 Canal St., New York 13, N.Y. 368 pages. Paper cover. \$4.60.

This authoritative text, written by a top flight audio engineer, is divided into three parts: the loudspeaker, the enclosure and the room. In careful detail, and in technician language, the author presents basic speaker types, hi-fi and multi-speaker system design, networks and characteristics such as resonance and damping. This is followed by elaboration of various enclosure types, system response, and examination of the room as part of the acoustic circuit from pickup to the listener's ear. Included among the many helpful illustrations are 20 solid pages of enclosure construction details.

RADIO HANDBOOK. Edited by William I. Orr. Published by Editors and Engineers Limited, Summerland, Calif. 766 pages. Hard cover. \$7.50 at parts jobbers; add 10% on direct orders to publisher.

One of the most comprehensive references on radio, covering both the receiving and transmitting ends, this handbook contains a wealth of data on circuits, principles, AM, FM, propagation, test gear, and radio mathematics. Much of the content is directed to amateurs, including such topics as single sideband, ham transmitters, and rotary antenna beams. Abundance of drawings and photos are included.

MULTIVIBRATORS. By A. Schure. Published by John F. Rider Publisher Inc., 480 Canal St., New York 13, N.Y. 52 pages. Paper cover. 90¢.

Another in the helpful review series, this book concisely explains the basic principle of multivibrator operation, and goes into greater detail on bi-stable, mono-stable and a-stable types. It's a helpful reference for learning more about this important circuit function.

COLOR TELEVISION STANDARDS. By Donald G. Fink. Published by McGraw-Hill Book Co., 330 W. 42 St., New York 36, N.Y. 572 pages. Hard cover. \$8.50.

Based on 18 volumes recording the work of the NTSC, this book describes the technical standards, subjective aspects of color, field tests, transmitters, films, definitions of terms and selected FCC rules.

ALTERNATING-CURRENT CIRCUIT THEORY. By Myril B. Reed. Published by Harper & Brothers, 49 E. 33 St., New York 16, N.Y. 603 pages. Hard cover. \$6.50.

This second edition of a well accepted textbook is written on an advanced college level. Among the topics covered are vector representation, circuits, transients, network equations and electric filters.

THE USE OF SELENIUM PHOTOCELLS AND SUN BATTERIES. Published by International Rectifier Corp., Product Information Dept., El Segundo, Calif. 58 pages. Paper cover. \$1.50.

Designed as a guide for technicians and engineers, this compact handbook provides over 35 illustrations, charts and diagrams detailing applications and devices in which sun batteries and other photocell products are successfully employed.

PICTURE BOOK OF TV TROUBLES, Vol. 4. By John F. Rider Laboratories Staff. Published by John F. Rider Publisher, Inc., 480 Canal St., New York 13, N.Y. 96 pages. Paper cover. \$1.80.

The fourth in the "Picture Book" series, this book is devoted to automatic gain control, including delayed agc, triode keyed agc, pentode keyed agc and amplified keyed agc circuits. Practical benefits of book in troubleshooting is enhanced by illustrated correlation of picture symptom with scope waveform for a particular component failure.

CAPEHART TV. Published by Wallace's Telaides, Inc., 134-136 Day St., Jamaica Plain 30, Mass. 52 pages Paperbound. \$2.50.

Schematic diagrams and servicing data for chassis U-12 through CX-38C, for production from 1947 to 1955.

INTRODUCTION TO COLOR TV (2nd Edition). By M. Kaufman and H. Thomas. Published by John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y. 160 pages. Paper cover \$2.70.

Though no great amount of time has elapsed since the original edition, rapid changes in the art of color TV have made this revision and expansion necessary. The chapter on picture tubes has been necessarily expanded, to cover the large-screen types using magnetic convergence and the trend toward rectangular tubes. Most enlarged is the section on the receiver itself, to cover more recent variations and simplifications in circuitry for extracting and using the transmitted color information. The section on receiver adjustment has also been elaborated.

SENTINEL TV. Published by Wallace's Telaides, Inc., 134-136 Day St., Jamaica Plain 30, Mass. 52 pages. Paperbound. \$2.50.

Schematic diagrams and servicing data for models 400 through 21145, from initial production through early 1956.

Articles Wanted!

Think you really know something about TV, radio, audio, test equipment, antennas, components, or UHF? Why not put it into an article. Emphasis, of course, should be on service technique or other practical bread-and-butter aspects. For further information, get in touch with Manuscript Editor, TECHNICIAN & Circuit Digests, 480 Lexington Avenue, New York 17, N. Y.

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GAIN—flat across every channel for better picture quality.

F/B RATIO—provides rejection of unwanted signals.

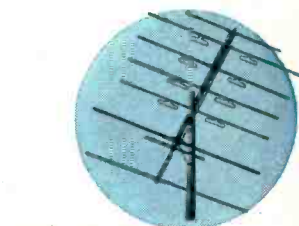
PATTERN—Minimum side lobes (kills ghosts).

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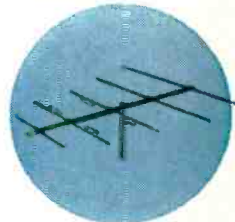
STREAMLINED—low wind resistance.

CONSTRUCTION—materials selected for permanence—reduces call-backs.

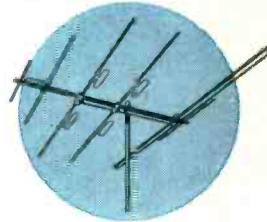
BALANCED—ideal for rotor installations.



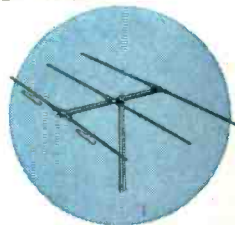
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The right tape is the *best* tape for the *best* job! So . . . you'll want to "tool up" with Dutch Brand's "Big Four" — friction tape, vinyl color tape, plastic tape and rubber tape . . . to cut installation costs.

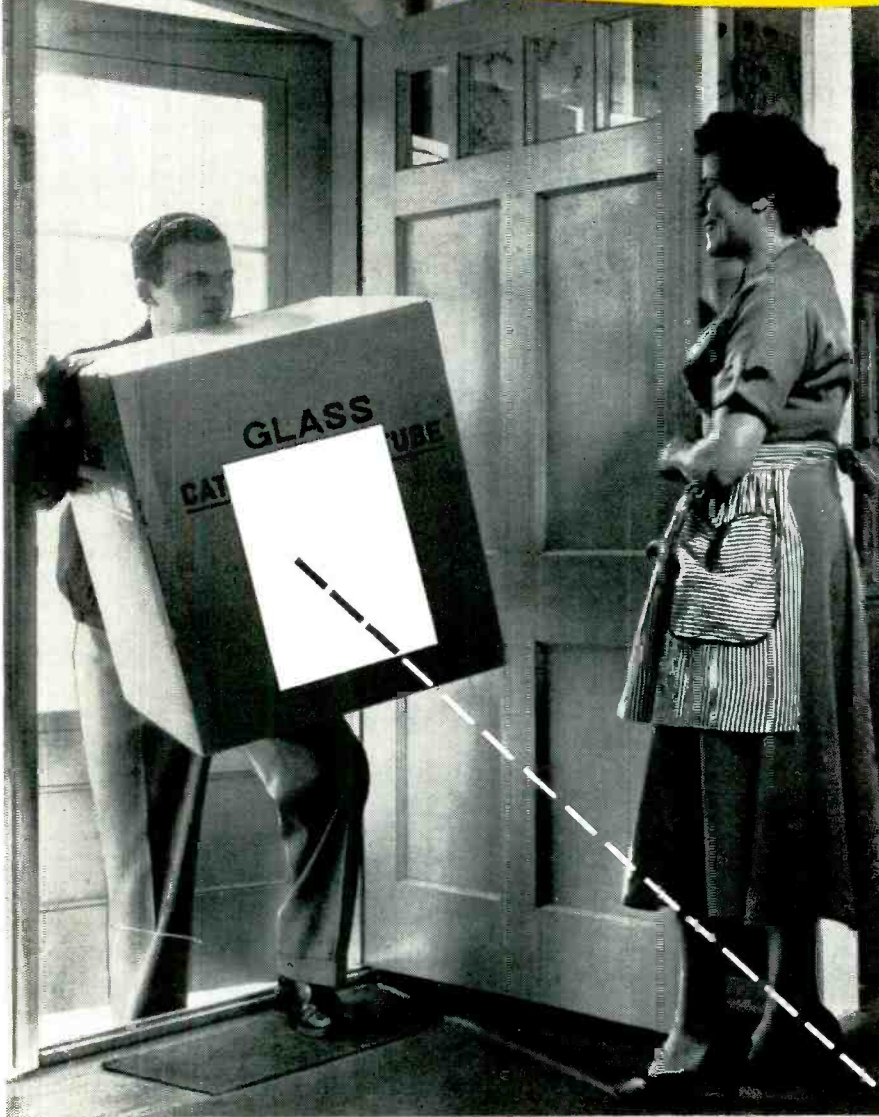
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Catalogs & Bulletins

FUSE USES, CROSS REFERENCE: "Proper Use of Fuses," 4 pages, analyzes fuse types (physical and electrical), states rules for fusing and common fusing errors. Cross reference sheet gives manufacturer's complete line of equivalents and replacements in 4 pages. Littelfuse, Des Plaines, Ill. (TECHNICIAN No. B4-2)

CLOSED-CIRCUIT TV: Specs on cameras, monitors, amplifiers, mixers, accessories, and complete systems in 16-page booklet. Dage TV Div., Thompson Products, Inc., Michigan City, Indiana. (TECHNICIAN No. B4-7)

POWER SUPPLY: Spec sheet available on continuously variable (to 16 volts) dc power supply for shop and lab use at low price, Model D-612. Electro Products Labs., 4501 Ravenswood Ave., Chicago 40, Ill. (TECHNICIAN No. B4-8)

HI-FI & TEST EQUIPMENT KITS: Winter Flyer 1956, 16 pages, describes newest kits for speaker system, AM tuner, electronic crossover, crystal receiver, as well as kits in the regular line. Heath Co., Benton Harbor, Mich. (TECHNICIAN No. B4-11)

CRT TESTER-REACTIVATOR: Spec sheet on low-cost instrument for use on pix tubes in the set also offers free trial and free tube-guide book bonus with purchase. Century Electronics Co., 111 Roosevelt Ave., Mineola, N. Y. (TECHNICIAN No. B4-12)

SERVICE PERIODICAL: New free periodical publication for radio and TV service technicians, "Tips," offers prizes for articles, service hints. International Rectifier Corp., El Segundo, Calif. (TECHNICIAN No. B4-16)

SELENIUM RECTIFIERS: Information Bulletin M1 gives physical and electrical characteristics on complete line of selenium rectifiers designed for all types of equipment using printed circuitry. Federal Telephone & Radio Co., 100 Kingsland Rd., Clifton, N. J. (Ask for B4-17)

HI-FI SPEAKERS: Envelope stuffer, No. ES-6 available, providing details on line of Hi-Fi speakers, various sizes and price ranges. Quam-Nichols Co., Marquette Rd. & Prairie Ave., Chicago 37, Ill. (TECHNICIAN No. B4-20)

ANTENNA INSULATORS: Complete line of "Standout" insulators with special double-duty features to save stock and costs, in full assortment, are described in 4-page catalog sheet. Channel Master Corp., Ellenville, N. Y. (TECHNICIAN No. B4-21)

TRIMMER CAPACITORS: Complete description of two models of miniature glass piston trimmer capacitors for printed circuits and automation. Bulletin No. 106. JFD Electronics Corp., 1462 62nd St., Brooklyn, N. Y. (TECHNICIAN No. B4-22)

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you'll find a winner in these dependable
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North, East, South, West . . . wherever there are TV customers . . . Federal's "All-Star" Lead-in Team can be depended upon to deliver *championship performance* . . . !

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Economical and Efficient

TV-1190—300-ohm heavy-duty lead-in with 90 mil. web. Has 7/#28 copper strands. Economical and highly efficient. Insulated with Federal-developed "silver" polyethylene for long life. Also available in brown.



Another Low-cost Leader

TV-2000—300-ohm dumbbell-shaped lead-in with 55 mil. web. Has 7/#30 copper strands. A high-value, low-cost type for the average installation. Cinnamon-brown color is protection against ultra-violet.

"Quality-Controlled" TV Lead-in & Cable



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Quality plus Economy

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59/U Type—73-ohm coaxial lead-in Highly efficient as a Community TV pole-to-house tap-off. Meets all needs wherever a high-grade installation is a must. Ideal for use with unbalanced input TV receivers.



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For data on other types, write Dept. D-454

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**6 MILLION
HOUR
FIELD TEST**

—now, Sylvania tests every important TV tube type under actual set conditions to give you "time-tested" protection against call-backs

—6 million hours! To date that's the grand total of tube-testing in Sylvania's newest and biggest attack against common tube troubles and costly call-backs. To simulate "home operation" Sylvania tubes were taken from inventory and tested in 139 stock TV sets of leading manufacturers.

The "6-million-hour field test" is an important part of Sylvania's continuous design and development program to give you the most dependable tubes available for servicing all TV makes and models.

By giving Sylvania tubes rugged and dynamic tests at

accelerated line voltages, the common tube troubles of modern "hard working" circuits are corrected before they start digging into your profits.

Design improvements resulting from these tests give you superior replacement tubes, which often out-perform original equipment designs.

Look for the yellow and black carton—it represents a new kind of tube dependability backed by the 6-million-hour field test.



 **SYLVANIA**[®]

SYLVANIA ELECTRIC PRODUCTS INC.
1740 Broadway, New York 19, N. Y.
In Canada: Sylvania Electric (Canada) Ltd.,
University Tower Bldg., Montreal

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY



FROM DELCO RADIO come the **speakers** with highest performance. You trust them... so do your customers!

Engineering skills of Delco Radio and General Motors combine to offer a full line of speakers for home and auto radios, phonographs, TV, and Hi-Fi. National advertising behind the Delco Wonder Bar Radio develops a bigger service market for you! For fast service call your UMS-Delco Electronics Parts Distributor.

14 Standard Models: Designed and built to R.E.T.M.A. standards with heavily plated metal parts and Alnico-V magnets. Precision felted cones give uniform response over full operating frequency range. All are fully dustproof and dependable.

Dual-Purpose Hi-Fi Model 8007: A superior speaker for custom-built audio systems and for replacements in AM, FM, TV and phonograph sets. Size 8", 50 to 12,500 CPS frequency range; Alnico-V magnet; 10-watt power rating; 4.1 v.c. impedance; 1 $\frac{3}{16}$ " voice coil.

DELCO

WONDER BAR

RADIO

DIVISION OF GENERAL MOTORS, KOKOMO, INDIANA



A GENERAL MOTORS PRODUCT — A UNITED MOTORS LINE
Distributed by Electronics Distributors Everywhere

A complete line of original equipment service parts from the

WORLD LEADER IN AUTO RADIO

News of the Industry

W. ROPP TRIPPLETT has been named president of **TRIPPLETT ELECTRICAL INSTRUMENT CO.** to succeed his father **RAY L. TRIPPLETT**, who becomes Chairman of the Board.

A special anniversary seal embossed on silver foil has been designed by **SNYDER MFG. CO.** in celebration of the firm's 25th year.

INTERNATIONAL RESISTANCE CO. has merged with three of its

wholly-owned subsidiaries, **HYCOR CO.**, **HYCOR SALES CO.** AND **IRCAL INDUSTRIES**, and will be operated under the name of **HYCOR DIV. OF INTERNATIONAL RESISTANCE CO.** at 12970 Bradley Ave., Sylmar, Los Angeles County, Calif. Officers are Pres. **W. I. Elliott**, VP **K. T. Eckardt**, Treas. **C. G. Harding**.

GENERAL DRY BATTERIES, INC., which has manufactured private label batteries for over 36 years, has entered the replacement market through jobbers and dealers under its own brand name.

HERBERT L. REICHERT has been appointed midwest regional manager,

and **LEE BALLENGEE, JR.** eastern district sales manager of **CBS-HYTRON**. **LOUIS H. NIEMANN** has been promoted to equipment sales manager of the firm.

ASTRON CORP. has purchased **SKOTTIE ELECTRONIC CORP.**, maker of ceramic capacitors.

AL. A. BOMBE is now regional sales manager of the **FINNEY CO.**

ASTATIC CORP. has appointed **FRED GLUCK** director of engineering.

WESTINGHOUSE TUBE DIV. has broken ground for an additional 120,000 sq. ft. warehouse.

SYLVANIA ELECTRIC PRODUCTS has named **GEORGE STEWART** distribution manager of the radio-TV div. The company has also reminded \$2 annual subscribers to technical service literature to sign up for the 1956 issues by writing to Service Dept., 254 Rano St., Buffalo 7, N. Y.

J. WARREN BOSIGER is now technical field rep for **SECO MFG. CO.**

PHILCO CORP. has appointed **JOHN M. PALMER** manager of the new Spring City, Pa., plant of the **LANSDALE TUBE CO.** div.

MERIT COIL & TRANSFORMER CORP. has opened a new warehouse in San Francisco.

TUNG-SOL ELECTRIC has installed **HAROLD F. COOK** in the newly created post of director of advertising and marketing. Three aids to Mr. Cook are **R. M. ANDREWS**, **E. G. HAZELTINE** and **G. A. MORGAN**.

WINEGARD CO. has named **BURTON BROWNE ADVERTISING** to handle ads and public relations. Pres. John Winegard also reports the signing of a royalty bearing license agreement with **CHANNEL MASTER CORP.**

JERROLD ELECTRONICS CORP. is locating its new research lab 20 miles from the main Philadelphia plant to give engineers privacy. **GENE REICH** has joined Jerrold-New York subsidiary as products line sales engineer.

WESTINGHOUSE TV-radio div. has appointed **RUSSELL W. JOHNSON** advertising and sales promotion manager.

MAGNAVOX CO. has purchased **SENTINEL RADIO CORP.**

TEXTRON AMERICAN has acquired all the stock of **GENERAL CEMENT MFG. CO.**

TRIO MFG. CO. announces a new product development program. A newly created evaluation board will study the market potential of new product ideas suggested by factory workers, business associates and other interested individuals throughout the country.

LOOK FOR THIS LABEL



TO BE SURE OF THIS SOLDERING PERFORMANCE



5 SECOND HEAT

Weller was first to design and patent a fast-heating soldering gun. All Weller models heat in 5 seconds.

TRIGGER CONTROL

Fingertip control brings heat instantly on— instantly off. There's no need to unplug . . . no wasted time or current.



PERFECT BALANCE

The exclusive streamlined design of Weller Guns permits easy access to tight places, comfortable handling and precision soldering.

EXCLUSIVE TIP-GRIP

Wiping action of tip-fastening nuts eliminates contact resistance and oxidation. Full, constant heat is assured.



2 SPOTLIGHTS

Pre-focused dual spotlights eliminate shadows and illuminate the work. Lights and heat come on simultaneously.

LONG-LIFE TIPS

Low cost Wellertips give long service, are designed for maximum heat transfer and can be changed in seconds.



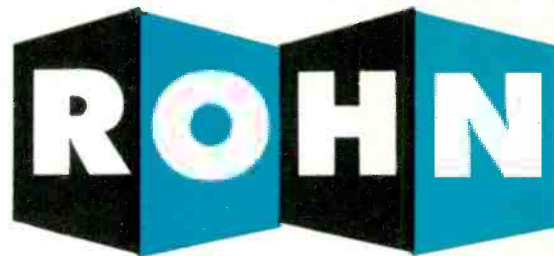
Weller

ask your distributor for a demonstration

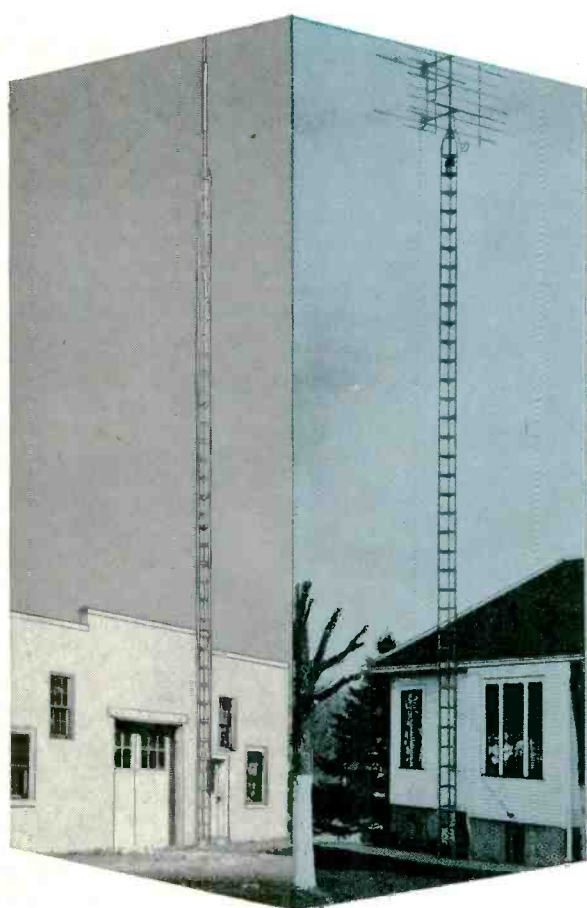
ELECTRIC CORP.

805 Packer Street, Easton, Pa.

these 3 hot dipped galvanized
towers
are exclusive with

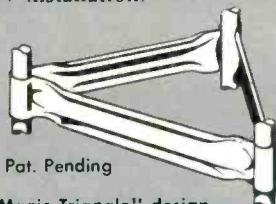


*No guying needed to 40—50—or
60 feet! Guyed heights safely
up to 200—300 feet!*



NO. 6 TOWER

Features unexcelled 12½" equilateral "magic triangle" design with electric welding throughout. Self-supporting to 50', the Rohn No. 6 is ideal for home TV installation.



Pat. Pending

"Magic Triangle" design utilizes mass production machines — means sturdier towers, uniformity and lower costs!

"PACKAGED" TOWER

Constructed for ease in shipping and storage. A 48' tower comes in six 8' sections bound together in a single 8' x 20" package! Self-supporting and available in 24' to 64' sizes.

and now, a new and completely hot-dipped galvanized, heavy duty

NO. 40 COMMUNICATIONS TOWER

For extreme heights and communication purposes of all kinds, the Rohn No. 40 gives you strength and durability on which you can depend. The time tested and proven equilateral triangle design using extra heavy duty tubing and corrugated steel cross-bracing is utilized in this new Rohn Tower. The No. 40 is structurally sound so that you can install it for heights up to 300'; and is preferred for lesser heights when considerably greater strength is required because of excessive wind or antenna loading, etc. Check this tower for your requirements of this type. You'll find it just can't be beat, neither structurally nor price-wise!

Note: For lesser heights, use the Rohn No. 20 or No. 30 Tower . . . for experimental operation, use the Rohn "Fold-Over" Tower.

All Rohn Towers are quickly erected- shipped in easy-to-handle sections; and, Rohn-Designed accessories are available with each tower.

Check the complete line of Rohn Towers, including Roof Towers, Masts and Tubing . . . plus a full line of tower and TV installation products such as bases, house mounts, brackets, service tables, guy brackets and rings plus dozens of other items.

ROHN Manufacturing Company

116 LIMESTONE, BELLEVUE
PEORIA, ILLINOIS

MAIL THIS COUPON FOR FREE LITERATURE!

Rohn Manufacturing Company
116 Limestone, Bellevue
Peoria, Illinois

Gentlemen: Please rush me complete details on the full line of Rohn Towers and Accessories.

Firm _____

Name _____ Title _____

Address _____

City _____ State _____



*Curve plotted from stock amplifier using TRIAD HSM-189 output transformer, as listed in General Catalog.

Write for Catalog TR-54K



4055 Redwood Ave., Venice, California



Reps & Distributors

WES ALDERSON has been appointed manufacturer's rep in the Los Angeles area by **GENERAL DRY BATTERIES, INC.**, to handle the industrial line of mercury cells as well as radio replacement batteries.

TODD-TRAN CORP. of Mount Vernon, N. Y. announces 2 new reps for its jobber line of authentic TV replacement transformers: **JERRY GREENBERG** of Woodmere, L. I. will cover metropolitan N. Y. C., L. I., Westchester County, and northern N. J. **HERMAN LEWIS CO.** of Philadelphia will serve southern N. J., Md., Dela., Va., Washington (D. C.) and eastern Penna.

Additional distributors for electronic parts made by **SYLVANIA ELECTRIC PRODUCTS, INC.** are: **NIAGARA ELECTRONICS CORP.**, Niagara Falls, N. Y.; **ROBERTS & O'BRIEN, INC.**, Fulton, N. Y.; **GENERAL ELECTRONICS**, Glens Falls, N. Y.; and **SANTA MONICA RADIO PARTS CORP.**, Santa Monica, Calif.

ALBERT N. KASS has been appointed vice-pres. of **RADIO ELECTRIC SERVICE CO.**, Philadelphia, Penna., distributor of parts and equipment. He will also continue in the capacity of gen. mgr.

HARRISON J. BLIND of Indianapolis, Ind., factory rep of **ELECTRO-VOICE, INC.**, was awarded a complete E-V Hi-Fi system for signing up more distributors to participate in the recently concluded E-V "Week-End with High Fidelity" contest than any other rep.

KARET-MARGOLIN, INC., new rep firm, is located at 13 W. Hubbard St., Chicago 10, Ill. In addition to **BOB KARET** and **JOHN MARGOLIN**, the firm includes **JOE RIGOR** and **KARL A. KOPETZKY**. Coverage is through Chicago, northern Illinois, eastern Wisconsin, Indiana and Kentucky.

TERMINAL RADIO INTERNATIONAL, LTD., of N. Y. C. has been named export sales agent for all countries except Canada by **CONDENSER PRODUCTS CO.**, New Haven, Conn., mfrs. of capacitors, pulse-forming networks, h-v power supplies and transformers.

WALSCO ELECTRONICS CORP., according to a recently concluded agreement, becomes exclusive distributor of all products made by the **TEKNI-LABELS CO.** This includes a complete line of decals widely used for labeling electronic equipment.

EARL T. CHAMPION of Chicago, will be jobber rep for **PYRAMID ELECTRIC CO.** in eastern Wisconsin and northern Illinois.

Association News

ARTSNY Service Clinics

A log of all bench jobs being handled by the service clinics sponsored by Associated Radio-TV Servicemen of N. Y., is being kept. These popular clinics for members are being conducted on the first and third Monday of every month in Manhattan at 405 E. 74th St., and every Wednesday evening at 220 Knickerbocker Ave. in Brooklyn. Harry Layden is clinic director of the Manhattan clinic, while the Brooklyn counterpart is under the direction of Henry Levine.

TSA, Mich.: "Play Fair"

Harold Chase, chairman of the board of TSA, Detroit, Mich., one of the organizers of the American Electronic Council for Service, scored association officers who misrepresent the numerical size of their organizations, claiming they thereby hurt the cause of independent service. He believes that best results can be accomplished by an honest presentation of the service association's story to other segments of the industry.

He also urged that cooperation with other segments of the industry (the manufacturers) should not be solicited directly, while bypassing the jobbers and distributors. Since the service businessman is the direct customer of the independent distributor, he feels all approaches for cooperation and support in carrying out programs should be made through distributors.

NATESA Spring Meeting

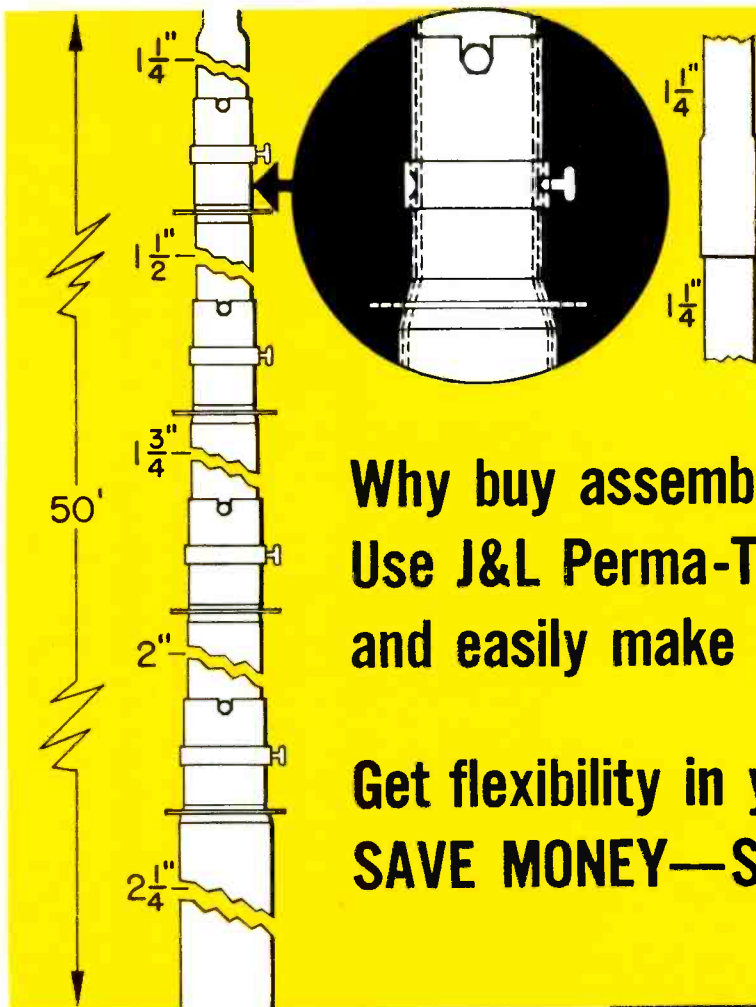
TESA-Omaha will host the NATESA Board of Directors meeting at the Blackstone Hotel in Omaha, Nebr., Sunday, April 22, 1956. All affiliates are asked to send their Directors to NATESA to the meet. A simultaneous business and technical meeting, with technical and business seminars for all service people, particularly local personnel, will also be held.

RTGLI Licensing

The Radio TV Guild of Long Island, Box 87, Bethpage, N. Y., is putting on a drive for its own licensing program. Licensees must adhere to the Guild Code of Ethics, which includes ownership of adequate test equipment, operation by competent personnel, location in a business zone, extension of a minimum guarantee of 90 days on parts and service, and the carrying of adequate insurance coverage. Technical requirements will be decided by a Board of License Examiners, to be set up by the Guild.

New ARTSD Officers

1956 officers for Associated Radio-Television Service Dealers, Columbus, Ohio, are: Pres. Jim Cumbus, Vice-Pres. Harry Walcutt, Treas. Bob Hawthorne, Sec. Jack Voigt.



Same 1 1/4-inch piece of Perma-Tube can be used for telescoping masts or with another 1 1/4-inch piece to make smaller 2-piece masts.

**Why buy assembled telescoping masts?
Use J&L Perma-Tube in 10-foot lengths
and easily make your own**

**Get flexibility in your stock
SAVE MONEY—SAVE SPACE**

Only J&L Perma-Tube offers:

- Joint design which provides instant field assembly.
- Machine-fitted joints that insure close tolerance for high strength and rigidity.
- Guy wire ring position that eliminates all binding and guy wire interference.

Buy only a carton each of five different sizes of Perma-Tube (1 1/4 to 2 1/4-inch) and make any telescoping TV mast up to 50 feet in height. Hardware—cotter keys or bolts, clamps and guy rings—may also be secured from your distributor.

You can now "tailor-make" your own TV masts up to 50 feet high by using standard 10-foot lengths of 16-gage Perma-Tube—and save money. Five diameters are available in easily-handled cartons from your local distributor. Largest base section OD is 2 1/4 inches and each telescoping section is 1/4-inch smaller, the smallest section having an OD of 1 1/4 inches.

Corrosion-resistant Perma-Tube is treated with Vinsynite—then coated both inside and outside with a metallic vinyl resin base. It's made of a special, high-strength, J&L steel tubing. A 10-foot section of 1 1/4 inch diameter by 16 gage is capable of supporting a weight at its center point of 200 pounds with a minimum of deflection and permanent set.

J&L Perma-Tube — best for strength and rust protection

Jones & Laughlin
STEEL CORPORATION · PITTSBURGH



your source of finest TV and Radio Tubes is

first in transistors...

RAYTHEON



Raytheon's pioneering in the research, development and production of Transistors has resulted in many important "firsts" — firsts that give Raytheon an unchallenged lead in the field. Here are some of these firsts:

FIRST in commercial production. Raytheon was the first company to commercially produce and sell junction transistors. These first transistors set high performance standards as they revolutionized the hearing aid industry.

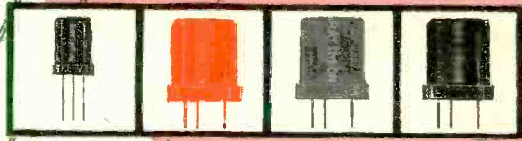
FIRST in RF Transistors. Raytheon scored another important first by leading the way in RF Transistors, too. The first commercially produced RF Transistors — Raytheons — are revolutionizing the portable radio industry, and are being used in computers and communication equipment. Many major manufacturers of portable radios use these Raytheon RF Transistors and all "hybrid" portables use either Raytheon Transistors, Raytheon Subminiature Tubes or a combination of both.

FIRST in PNP Silicon Transistors. Raytheon alone makes a line of PNP Silicon Transistors that fills the need for transistors that will operate at high temperatures.

FIRST Major Manufacturer to Break the Dollar Barrier. A most important first to you — Raytheon is the first major supplier to achieve such high production and product acceptance of their transistors that one of the line could be priced at less than a dollar — Raytheon quality transistors range in price from 99¢.

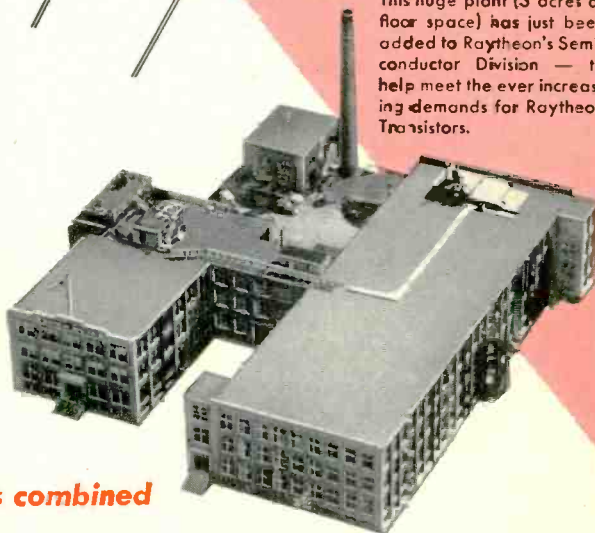
At Raytheon more than 100 engineers and scientists, plus nearly 1400 other employees are devoted to a single task — the design, development and production of the finest and best in transistors and diodes. To help them work more efficiently, and to meet increasing production schedules Raytheon recently added facilities totaling three acres of engineering and manufacturing space to its Semiconductor Division.

Raytheon Tube Distributors from coast to coast stock and recommend Raytheon Transistors.



ACTUAL SIZE

This huge plant (3 acres of floor space) has just been added to Raytheon's Semiconductor Division — to help meet the ever increasing demands for Raytheon Transistors.



RAYTHEON TRANSISTORS

more in use than all other makes combined



RAYTHEON MANUFACTURING COMPANY

Receiving and Cathode Ray Tube Operations
Newton, Mass. • Chicago, Ill. • Atlanta, Ga. • Los Angeles, Calif.

Raytheon makes all these: { Receiving and Picture Tubes, Reliable Subminiature and Miniature Tubes, Semiconductor Diodes and Transistors, Nuclear Tubes, Microwave Tubes.

Visit Raytheon Booth No. 4 at the ELECTRONICS PARTS DISTRIBUTORS SHOW
May 21-24—Badges issued only in advance—No registration at the show—

TV-ELECTRONIC

TECHNICIAN

& Circuit Digests

CALDWELL-CLEMENTS, INC., 480 LEXINGTON AVENUE, NEW YORK 17, N. Y.

Patience . . . *PUHLEEZE!*

Dear Reader:

Your editor has received over 375,000 (that's right, three hundred and seventy-five thousand) individual requests from more than 8,000 **TECHNICIAN** readers for manufacturers' literature described in the March 1956 issue . . . **DURING ONLY THREE WEEKS** following publication! And the inquiries are still pouring in.

That's not all. So far these alert readers have sent in some \$4000.00 in cash and money orders to pay for their requests for manufacturers' literature offered at nominal charge.

Frankly, we're delighted at this absolutely unprecedented demand. We're gratified that so many **TECHNICIAN** readers follow up their reading with action (in cold cash, at that). It may well set a record high in reader response for the entire publishing industry when the final count is in.

We're simply swamped. Our staff has been increased. Our Reader Service Department is working overtime. Everything possible is being done to make sure that each request is fully and accurately processed so that manufacturers will send you the literature you asked for. However, the fantastic volume of work involved will cause some delay. Rest assured that every penny sent in is being accounted for. Your patience will be greatly appreciated.

Please keep on writing. That's what we're here for . . . to keep on serving you.

Sincerely,

Al Foman

Tuning In the

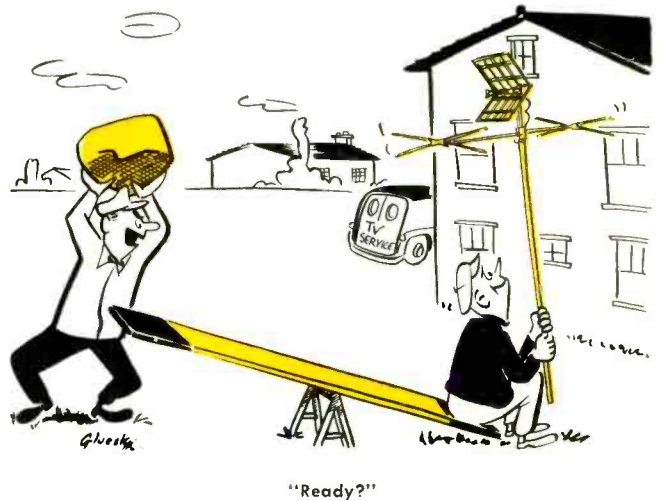
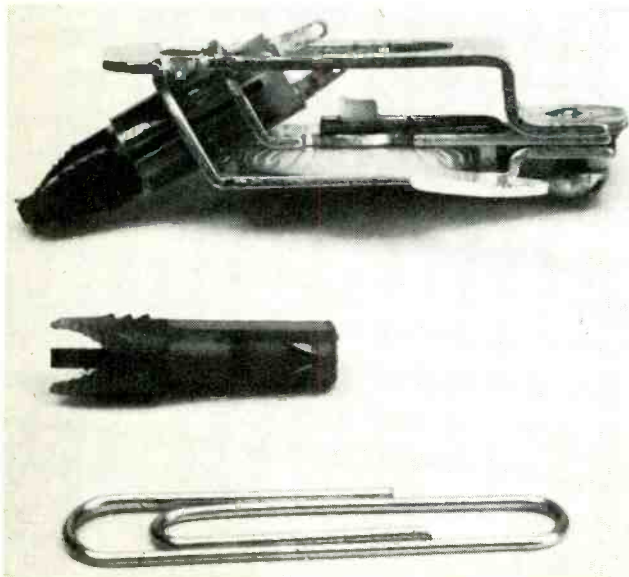
DAMAGE TO TV ANTENNAS resulting in heavy insurance claims has these companies worried because extended coverage endorsements on policies have been written to include antenna installations. Tore Lundahl, VP of Technical Appliance, notes that in many states insurance companies have eliminated liability under a \$50 deductible clause, and in other states additional premium is required to cover the antenna.

ELECTRONIC FILTER incorporated in new line of RCA Whirlpool room air conditioners filters out airborne particles one-tenth the size which can be efficiently held by ordinary mechanical filters. Particles become charged in the filter, and are attracted and held fast to a collector device.

TECHNICIAN'S DUMB GIRL FRIEND returns to the scene, saying her radio must love the water because it's always motorboating. She swears she has a crazy mixed-up speaker . . . it's really baffled. But the dear thing is always helpful. She brought her boy friend a cup with hot water and sugar when she heard he was going to test a T-pad.

THOUGH PRE-RECORDED TAPES have not hit a heavy dollar volume yet, there is much confidence in the potential growth of this field, with new companies constantly entering the market. More than 40 labels are issuing such tapes already.

New departure in ceramic phono cartridges developed by Electro-Voice facilitates replacement. Ceramic unit and 1-mil and 3-mil needles are encased in plastic cylinder with contacts protruding (center photo). To replace, simply plug into adapter (top) which mounts in arm. Four basic cartridges and three adapter types are reported to replace 75% of all cartridges. Many thousands have been ordered by manufacturers. Also, they will be sold through service technicians through a special dealer-protection plan which limits discounts offered by catalog houses.



IT COULDN'T LAST. The recent trend in prices for TV receivers has been upward, in the order of \$5 to \$15 per set, including the low-end lines. The swing, which is a healthy sign, indicates several things. Nobody raises prices in the face of a falling market—so the growth of the TV audience is far from over. The increase also shows a commendable tendency not to make the lowest price the biggest sales argument. Manufacturers continue to recognize the greater importance of quality. . . . You might think that over if you've ever contemplated trying cut-price servicing to build your business.

AUDIOFILLIES, the gals who attend Hi-Fi shows, are on the increase. Four years ago they accounted for 8% of the visitors at the Chicago Hi-Fi Show; now they number nearly half of the attendance.

APRIL 1956 NETWORK COLOR TV SCHEDULE

MONDAYS through FRIDAYS

April 2-6, 9-13, 16-20, 23-27, 30	NBC	"Matinee Theatre"	(Live)
3:00—4:00 PM (EST)	NBC	"Howdy Doody"	(Live)
5:30—6:00 PM (EST)			
MONDAY, April 2	NBC	"Producers' Showcase"	(Live)
8:00—9:30 PM (EST)			
TUESDAY, April 3	NBC	"Milton Berle"	(Live)
8:00—9:00 PM (EST)			
SATURDAY, April 14	NBC	"Max Liebman Presents"	(Live)
9:00—10:30 PM (EST)			
SUNDAY, April 15	NBC	"Sunday Spectacular"	(Live)
7:30—9:00 PM (EST)			
SUNDAY, April 22	NBC	"Zoo Parade"	(Film)
3:30—4:00 PM (EST)			
TUESDAY, April 24	NBC	"Milton Berle"	(Live)
8:00—9:00 PM (EST)			
SATURDAY, April 28	NBC	"Big Surprise"	(Live)
7:30—8:00 PM (EST)			
SUNDAY, April 29	NBC	"Zoo Parade"	(Film)
3:30—4:00 PM (EST)			
MONDAY, April 30	NBC	"Producers' Showcase"	(Live)
8:00—9:30 PM (EST)			

The above schedule is available at press time.

Picture



IF ALL TV SETS IN U.S. were lined up side-by-side along the coastline of the country, they would encircle the U. S. completely and have enough left over to stretch from New York City to Los Angeles, reports an NBC executive. (One wag with a statistical bent claims that if all the economists in the world were laid end to end they couldn't reach a conclusion!)

"PERSONAL" PORTABLE TV SETS are in the news. On March 23, General Electric announced a 13-lb. set with 9-in. tube designed to sell for less than \$100. It measures only 8½" h x 9½" w x 13¾" d, and uses 12 tubes, 1 tube rectifier, 1 selenium rectifier and 5 semiconductor diodes. This development, closely following RCA's release of an 8½" portable TV, should boost second-set market.

BERMUDA, long known for its disposition to retain a garden-like atmosphere despite technical developments (cars were not allowed before World War II), has had a bill introduced in its Parliament to prohibit the erection of TV receiving antennas outdoors. The bill would even ban indoor antennas if they were visible through a door, window or an opening in the building to persons outside.

COLOR TV RECEIVERS employing 22-inch rectangular all-glass pix tubes, are expected to start rolling off Westinghouse lines sometime in mid-year, reports general manager E. J. Kelly. Large printed circuit boards will be used.

CALENDAR OF COMING EVENTS

- Apr. 13-14: Tenth Annual Spring Television Conference, Engineering Society of Cincinnati Bldg., 1349 E. McMillan St., Cincinnati, Ohio.
- Apr. 14-27: United States World Trade Fair, New York Coliseum, New York, N. Y.
- Apr. 15-19: The 34th annual convention of the National Association of Radio & Television Broadcasters, Conrad Hilton Hotel, Chicago, Ill.
- May 21-24: 1956 Electronic Parts Distributors Show, Conrad Hilton Hotel, Chicago, Ill.
- May 22-23: RETMA Symposium on Reliable Applications of Electron Tubes, Irvine Auditorium, University of Pennsylvania, Philadelphia, Pa.
- June 27-30: Jobber-Rep-Mfrs. Conference, Breezy Point Lodge, Brainerd, Minn.
- July 22-25: 1956 National Audio-Visual Convention and Trade Show, Hotel Sherman, Chicago, Ill.
- Aug. 30-Sept. 2: 3rd Conference, Rocky Mountain Chapter of "The Representatives," Colorado Hotel, Glenwood Springs, Colorado.
- Aug. 22-Sept. 1: 23rd Annual British National Radio Show, Earls Court, London, Eng.
- Sept. 14-16: NATESA Annual Convention, Chicago, Ill.
- Oct. 1-3: Canadian I.R.E. Convention and Exposition, Automotive Building, Canadian National Exhibition Park, Toronto, Canada.

WHAT PRICE HANDWRITING? Errors and slow-downs resulting from illegible handwriting cost American business incalculable dollars every year. In recognition of this problem, the Handwriting Foundation has launched a pilot program, including manuals, charts and other self-improvement training aids, that is directed at clerks, secretaries, executives and others. Included among the 5 firms participating in the experimental project is Channel Master Corp.

RANDOM NOISE

IT'S COMING DOWN WITH A COLD

TOM HIGGINS TR

ELECTRONIC NOSE DEVELOPED AT PURDUE UNIVERSITY MEASURES AIR CONTAMINATION-IT GREW OUT OF A DISCOVERY THAT ODOROUS MATERIALS ABSORBED INTO TEST SURFACE CHANGES CONTACT POTENTIAL BY SEVERAL MV.

4,500,000 WATTS OF RADIATED UHF TV POWER, REPORTED AS THE HIGHEST CONTINUOUS WAVE POWER EVER ACHIEVED AT 537 MC (CHANNEL 23), HAS BEEN PRODUCED AT RCA, USING A 100 KW EXPERIMENTAL TUBE

DID YOU KNOW THAT THE AVERAGE TOTAL FLAT RATE FOR INSTALLING A TV ANTENNA IS \$32.60?

COLOR TV PREDICTIONS: 5,000,000 COLOR SETS WILL BE SOLD ANNUALLY BY 1960. \$500 SET PRICE WILL NOT BE REACHED BEFORE 1957, AND 850,000 COLOR RECEIVERS WILL BE SOLD NEXT YEAR. SO FORECASTS GE VP DR. W. BAKER

Wireless Remote Speaker

Chair-side Control of TV Audio Uses Old Table Radio

HARRY C. KELLER

• The current vogue among late-model TV receivers, which incorporate remote-control units with greater or less degree of control, point up a long-felt need among many TV set owners. Many have wished for some such convenience, particularly with respect to control over sound output. The notion of a chair-side speaker, for example, for such applications as late-hour or private listening without disturbing others, has been an often-expressed desire. An additional speaker with its own volume control can be hooked up without too much difficulty, it is true, but this usually involves encumbering the living room with long, unsightly wires and switches. Even this solution could be used successfully if one could count on having a rug available to run the wires under or the fact that there won't be a doorway to be bypassed by the run of wires.

The desired result can be achieved without wires or extra external paraphernalia, however, in the homes of most televiewers. Almost everyone who has a TV set, or more than one, also owns at least one small table radio that has become relatively neglected since the advent of TV. Why not press these back into expanded service as chair-side remote audio pickups for TV sound?

This can be accomplished rather simply by feeding the audio from the TV set to a small oscillator (transmitter) tuned to a quiet spot in the broadcast band that is not being used locally for commercial transmissions. The oscillator used for the purpose may be similar to or the same as those employed in the so-called wireless phonographs, which radiate signal without wires to a radio located elsewhere in the room, without the need for any connection to the radio. The sale and installation of such an item can be a lucrative extra, especially since the cost of parts is low and potential customer satisfaction high.

If the technician wishes, he can buy one of these simple phono oscillators ready-built. They are widely available from parts houses

and can be had in the vicinity of \$4.00. On the other hand, he can build one practically from spare parts that will give very satisfactory performance.

A home built one will often be preferred because it can take its operating power directly from the TV chassis itself, thus consisting only of a single, fairly simple stage, and because one so built can be easily placed out of sight inside the TV cabinet on a small subchassis made of hardware cloth, a piece of metal screening or some other such material.

In the one-tube modulator-oscillator shown here, no attempt was made at powerful operation. This would not only be unnecessary; it might even be objectionable if

cathode of the audio output tube.

If the TV set uses a 6-volt filament winding to supply filaments in parallel, it is no problem to use this source as the supply for the filament of the oscillator. If the TV set uses series-connected filaments, the 6SA7 may be added to the filament string by lowering the value of the resistor usually found in series with the filament line.

Bonding to Chassis

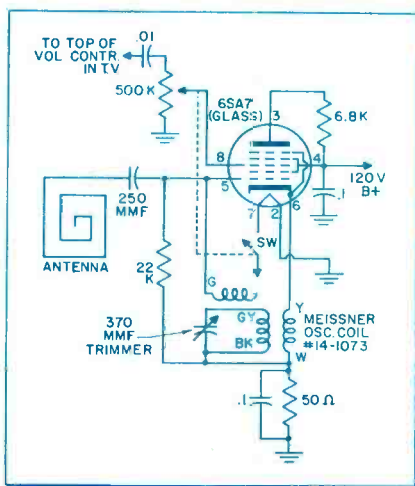
It is important to provide a good bond between the oscillator sub-chassis and the TV chassis. Where a phono oscillator with its own power supply, of the ac-dc type, is used, the audio ground return from the subchassis to the TV set should be through a 0.01-mfd capacitor.

The only part in putting together the oscillator circuit that requires special attention is the oscillator coil. A Meissner #14-1073 coil has been found to work well in this application, although others may be used. The 370-mfd trimmer is adjusted to produce output anywhere on the AM broadcast band where there will be no interference with active stations.

When chair-side listening is desired, the oscillator is switched on by a shaft extending through the back of the TV set. The TV volume control is turned all the way down to silence the main speaker. Then the TV sound is tuned in on the chair-side radio and volume adjusted as desired.

A nice added refinement to the radio is to modify it for either speaker or earphone operation. With an earphone output, listening can be made absolutely private. This can be a boon to many hard-of-hearing or hospitalized people.

Some TV sets, of course, interfere with radio reception because of radiation of harmonics from the horizontal-output circuit. Where this difficulty occurs, there is more than one way of dealing with it. The oscillator can be tuned to transmit on a relatively interference-free spot on the AM dial, or the usual corrective measures used when TV radiation interferes with AM reception can be applied with equal success here. •



Schematic of the 1-tube modulator-oscillator used to transmit TV sound to chairside radio.

radiation exceeded prescribed FCC limits for this type of device. On a short length of antenna wire, about 3 feet long, this oscillator can radiate easily across the living room.

The audio from the TV set is taken off across the volume control of the TV receiver and fed through a 0.01-mfd condenser as the modulating voltage for the oscillator. It is applied across the 500k potentiometer, which acts as the modulation level control. B-plus for the oscillator should be about 120 volts. This is usually an easy value to tap off from a voltage divider in the TV set or, in sets using a stacked B-plus system, it can be taken off at the

G-E BIG TOP COMING TO YOUR TOWN... YOUR STORE

5-Ring Circus of Service Values



1.

Now G-E Aluminized Picture Tubes with the new "100-Series" red seal for quality!

2.

Six more brand-new General Electric Service-Designed Tubes!

3.

TV-radio Tune-up Program, nationally advertised by G. E.!

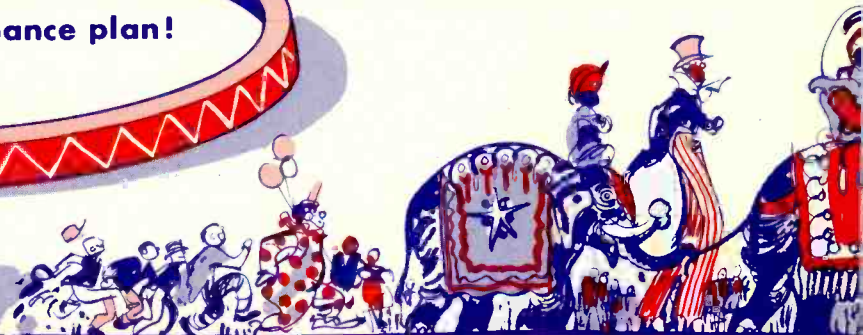
4.

Powerful local advertising support!

5.

G. E.'s great TV-service finance plan!

FOLLOW THE PARADE OF
SERVICE ATTRACTIONS...



GENERAL  ELECTRIC



GE TUBES

G-E 5-Ring Circus

now

ALUMINIZED PICTURE TUBES with the RED SEAL

NATIONALLY ADVERTISED

FIRST and FINEST ALUMINIZED TUBE

The symbol of quality found only on G-E Aluminized Tubes

GREATER PROFITS

THE SEAL'S THE DEAL

100 SERIES ★ **100% BRIGHTER 100% MORE CONTRAST**

INSTALL SERVICE-DESIGNED tubes

WORLD FAMOUS PERFORMERS

The original group of 14 that thrilled the world to top performance in all makes of TV

They positively out-perform their prototypes

G-E ALUMINIZED TUBES WITH THE RED SEAL. FINEST EVER!

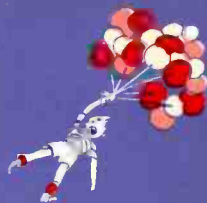
TV owners will learn about them through big G-E color ads—"100-Series" G-E Aluminized Picture Tubes with the red seal, finest ever built! The new red seal stands for top picture tube quality. Bright, sharp, clear pictures; dependable performance that lasts throughout tube life—these spell customer satisfaction, establish you as a dealer handling only the best. Large-scale G-E advertising of "100-Series" Aluminized Tubes with the red seal, soon to commence on a nationwide basis, will boost your tube and service sales. Here is a new and important business and profit-builder—with all the sales impetus behind it of a tremendous national advertising campaign!

SIX MORE NEW G-E SERVICE-DESIGNED RECEIVING TUBES!

Ready to install: new types 1X2-B, 6AL5, 6BK7-A, 6BQ7-A, 6BZ7, 6CB6. Remember the fine reception given other G-E Service-Designed Tubes—how customer goodwill increased sharply, how service business boomed for dealers handling these superior tubes, made only by General Electric? The 6 new types will cut call-backs still more, increase your sales and profits further. A revolutionary new "lightning-rod" design, new low-level tube microphonics, greater sturdiness, longer tube life—these and many other vital improvements are included. Now—in all—you will have 20 G-E Service-Designed Tubes which will out-perform and outlast their prototypes!

SURE-FIRE BUSINESS-BUILDERS, ALL 5 ATTRACTIONS!

TUBES



of Service Values

GET THE LION'S SHARE
OF SERVICE BUSINESS

TV-RADIO TUNE-UP PROGRAM

SHOOT
YOUR SALES
SKY HIGH

NATIONAL
ADVERTISING
WITH
LOCAL TIE-IN



STUPENDOUS DEALER ATTRACTIONS

- LOCAL
- ★ Newspaper Ads
 - ★ Radio Spots
 - ★ TV Commercials
 - ★ Point of Sale
 - ★ Direct Mail

tubes

Use G-E'S GREAT TV SERVICE FINANCE PLAN

RIDE
TO
GREATER
PROFITS
with this
great new
selling plan!



COMPLETE

TUBES PARTS!
SERVICE
NATIONALLY
ADVERTISED

tubes

NATIONALLY ADVERTISED TV-RADIO TUNE-UP PROGRAM!

Biggest boost to TV-radio service ever undertaken! That's G.E.'s nationally advertised Tune-up Program. Through large G-E color ads in 6 national magazines—reaching every home in your neighborhood—your customers will learn that a TV-radio tune-up now is essential to high-quality pictures and clear, clean reception. Every ad will ask that readers see or phone you, their local independent technician. This plan for TV-radio service action will greatly increase your customer list, keep your telephone ringing busily. You will sell more profitable G-E Aluminized Picture Tubes, more receiving tubes and TV-radio parts, than you have ever sold before!

MOST ATTRACTIVE DEALER ADVERTISING AIDS EVER OFFERED!

Strong local advertising tie-ins will increase your sales still more. G.E. has ready for you a real Big Top group of colorful displays and other helps. Many of them are shown on the following page. Besides wall and window-banners, they include window-stickers—TV-radio spot commercials—point-of-purchase selling aids—direct-mail pieces—other items. Vivid, fresh, new, these advertising aids underscore G.E.'s nationwide TV-radio Tune-up advertising, and focus its appeal to set-owners on your store or shop. Become the service center for your neighborhood by using these Big Top tie-ins! Your G-E tube distributor has them. Ask his salesman for details!

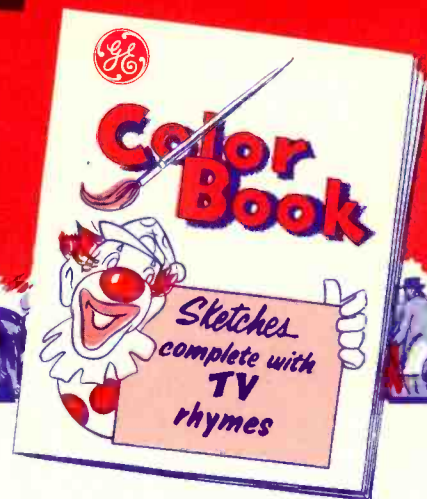
G-E SERVICE FINANCE PLAN! YOUR CUSTOMERS CAN PAY OUT OF INCOME!

Most powerful stimulus ever given to tube parts, and service sales, is G.E.'s great Service Finance Plan. Now the latest instalment methods are available for the benefit of dealers handling G-E tubes. Your customers' needs can be filled immediately and paid for out of income. They no longer will feel they must wait to replace worn-out picture tubes with new G-E Aluminized Tubes—instead, can afford, on an easy instalment basis, the best in tubes and service. Costly installation jobs will be far easier for you to sell. Your whole business will feel the beneficial effects of General Electric's pace-setting Service Finance Plan. Here is a Grade-A sales and profit-builder!

NEXT PAGE: HOW G.E. SPOTLIGHTS YOU TO REAP THE BENEFITS!



Every parent will want one or more of these fascinating books for their children's enjoyment. Amusing rhymes; appealing outline sketches to be filled in with crayons. A top-notch store traffic-builder!



G-E Big Top wall and window-banners, window-stickers, colorful tie-ins galore, will target your store as TV-radio service headquarters. All are available from your G-E tube distributor!

Television-radio service—how much it means to high-quality performance; why owners should consult their local independent technician—will be pushed from coast to coast, border to border, during General Electric's TV-radio Tune-up campaign. Giant 2-page magazine ads in color will seize and hold readers' attention, show why regular service attention is a TV-radio "must". Six big national magazines will be used, all with many millions' circulation—Life, Look, Collier's, American Weekly, This Week, and TV Guide.

Tie-in displays are ready for you. Part are shown on this page—though justice can't be done here to their many bright colors, or smart and novel appeal. Eye-stoppers, every one! These Big Top tie-ins will focus sharply on your establishment all of General Electric's gigantic TV-radio service advertising effort.

Lead the TV-radio service parade! Profit from the business-building attractions G.E.'s Big Top holds! Your G.E. tube distributor is waiting to hear from you. Tube Dept., General Electric Co., Schenectady 5, N. Y.

GENERAL  **ELECTRIC**

Low-Payment TV Contract

Monthly Plan Eliminates Impact of Single Heavy Payment

CHARLES LEE MOORE
LEE RADIO & TV

• There are several factors that can cause a repair business to go broke. Worst of them, in our opinion, is credit. Then there is the roving type of customer who is constantly looking for what he hopes will be better service at a lower price. Third, slack periods hit every shop at one time or another, causing a heavy drain on capital. There is also the matter of losing good will and real money in trying to enforce collections.

Sales of TV service contracts counteract most of these factors, but are no longer popular because of their high single-payment cost. We have counteracted this condition, and also provided ourselves with steady income, with a short-term monthly (or weekly) contract plan that also provides us with a steady income against slack periods.

A copy of our contract appears here. Under its terms, we agree "to provide all television parts, service work, time and labor necessary for the normal operation of the Television Receiver described in this contract, during the period covered by such payment: provided, however, that the Service assumes no liability for any defect due to fire, lightning, implosion, or the willful act of any person. The term 'Television Receiver' does not include television antenna, nor any device attached thereto."

The contract rate is 95 cents a week or \$3.80 per month (\$45.60 per year) for sets using 21-in. or smaller tubes. These rates, of course, will vary in different localities depending on travel time and other conditions. We make an extra mileage charge for sets beyond a certain area.

Attached to the bottom of the contract and perforated for separation are a file-card size slip identifying the customer, the set and allowing for a record of payments for our own files. Also, there is a slip to be detached and placed on the back of the set for identification.

We did not find that this contract is a big seller in the early stages. In the long run, it met with the approval of most customers. The con-

tract is explained to them at the time that a bill is being made out on a regular service call. At that time, the majority of them are happy to take it. We find we could now have many more contracts out than we can handle, with less than 1 percent of our customers failing to renew.

Another reason for making this a monthly rather than a yearly contract is that, in many states, insurance laws forbid long-term contracts of this type unless the dealer is bonded for a large sum of money. This fact, plus the necessity for making out regular reports under the

insurance laws, would make the full-year contract prohibitive. Since this is a monthly contract, our attorney assures us that it is legal and does not violate any insurance laws.

The importance of a contract of this kind, where a single outlay of a large sum of cash is not involved, could assume even greater importance as color TV, with its higher servicing and maintenance costs, continues to become a factor. With this possibility in mind, tentative weekly and monthly contract rates have been formulated for quotation on color TV receivers. •

3-part form for the monthly service contract developed and used successfully by the author.

MAINTAINANCE SERVICE CONTRACT
LEE RADIO AND TELEVISION SERVICE
1408 East Jackson Street, Macomb, Illinois.

M. S. C. N^o 1250

Lee Radio and Television Service, hereinafter referred to as the Service, agrees, when payment is made in accordance with the terms of this contract, to provide all television parts, service work, time and labor necessary for the normal operation of the Television Receiver described in this contract, during the period covered by such payment: provided, however, that the Service assumes no liability for any defect due to fire, lightning, implosion, or the willful act of any person. The term "Television Receiver" does not include television antenna, nor any device attached thereto. The Service assumes no liability in regard to the picture tube in said television receiver until 90 days after the effective date of this contract, unless such picture tube is first visually inspected and approved by the Service, in which event the liability for the picture tube shall begin at the time of such inspection and approval.

This contract becomes effective at 1:00 a.m. on the day of payment, and expires at 12 midnight on the last day of the period for which payment is made. Any payment accepted on, before, or after the expiration date renew the original contract until the time of the next expiration date. This contract may be cancelled by either party without notice on expiration date.

Name _____ Make of set _____
Address _____ Model _____
Phone _____ Serial _____
City _____ Picture Tube Inspected and approved by _____

Contract Rates

21 inch set, or under, \$.95 per week \$3.80 per month.
24 inch set, or 27 inch, \$ 1.25 per week, \$5.00 per month.
All Special Round tubes require the 24 inch rate.

Contracts sold in zone 2 and 3 must pay mileage per service call.

Record of Payment					
Effective date	Amount	Expires	Effective date	Amount	Expires

Lee Radio and Television File Card.

M. S. C. N^o 1250

Original Date	Date	Amt.	Exp. date
Name			
Address			
City			
Phone			
Make			
Model			
Serial			
P. T. I. W.			
By			
Notify when due			
Cancelled			

LEE RADIO and TELEVISION

M. S. C. N^o 1250

This card to be placed in back of television set for contract identification.

Orig. date	
Name	
Address	
City	
Make	
Model	
Serial	
P. T. I. W.	
By	

Static Meter Tests on

New Methods Required: Comparative Voltage and Current

JAMES A. McROBERTS

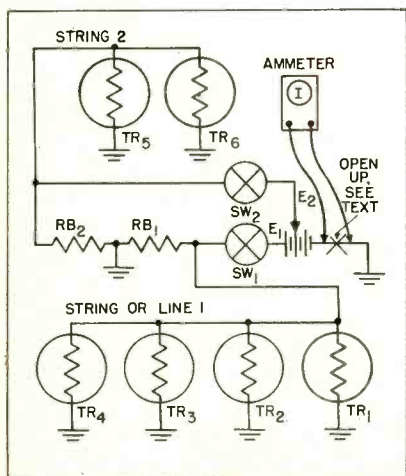
• Advent of completely tubeless radio receivers makes a new set of troubleshooting methods necessary. The mere act of testing the transistors for simple current flow is not so easy as with tubes, where the tube itself heats up or lights up, and failure to do so indicates a bad tube. A transistor does not heat up or light up—except under application of extremely high voltage!

Two distinct types of test will be considered here, the total-current test for picking out a bad transistor, and individual-stage voltage tests for defects.

In the first type of test, measurement of total current consumption and removal of one transistor at a time tells whether that transistor is open—an equivalent to checking for a tube lighting up or heating up in tube sets.

Regardless of arrangement and functions, the equivalent circuit of any transistorized radio resembles the schematic of Fig. 1. Here one side of a battery, which may be either the positive or the negative terminal, is grounded. Plus and minus signs are omitted for this reason. The battery may—or may not—be tapped to provide a lower potential, such as E_2 , or all the battery voltage may be applied to the circuit. Or, a dropping resistor—the 100-

Fig. 1—Bleeder versus transistor segments of the total current drain in a typical circuit.



ohm resistor of Fig. 4 is an example—may lower the voltage for some stages. All current flows to the battery ground in these different cases however.

Through the common ground lead of the battery passes the current of each transistor (labelled TR_1 , TR_2 , etc.) and also the bleeder current through such resistors as carry a battery current to chassis—labeled R_{B1} and R_{B2} in Fig. 1.

Lifting a transistor out of the socket, with the switch turned on, will cause a drop in the total current drain of the radio. A convenient place to insert an ammeter for measurement is at the point "X" of Fig. 1,



Fig. 2—For battery type shown, unclip one end of battery lead for current measurement.

which is the ground return of the battery.

Fig. 2 shows a convenient method of ammeter insertion for a single battery of the clip-on type of terminal. Fig. 3 depicts a way to insert the ammeter—actually a milliammeter and usually the milliammeter function on a V-O-M—into the push-in bracket clip type of battery holder. One lead to the meter is clipped onto a terminal lug. The other lead grasps a paper clip. The paper clip touches the battery terminal, temporarily separated from the holder contact by a piece of paper or other temporary insulation. The effect is to break the circuit as at point "X" of Fig. 1 and insert the milliammeter leads around "X".

A caution must be observed when using the meter: Although the meter insertion resistance is low for the typical milliammeter (one uses a scale function of 10-15 milliamperes or so), the added resistance in the

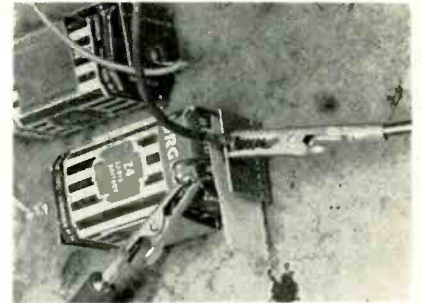


Fig. 3—How to insert milliammeter in series where another type of battery holder is used.

battery circuit may produce unexpected results. A shunt with an electrolytic capacitor of 40 to 50 mfd (observe polarity) will eliminate any such ill effects. Audio oscillation is one type of such trouble in a single ended amplifier.

A typical circuit of a commercial receiver is shown in Fig. 4. The set employs a converter, two i-f stages, a crystal diode detector, a 1st audio stage and a pair of transistors in a push-pull class B audio output stage. This circuit is typical of one utilizing NPN type transistors in the high frequency stages.

Fig. 5 is another circuit employing PNP type transistors in the intermediate frequency portion. We do not distinguish particularly in this article between the two types of circuits, excepting as to voltages and battery grounding, which are design problems in reality.

The battery drain of the circuit of Fig. 4, with all transistors in position and with each of the transistors individually removed, is listed in Table I. To set up for such a check, the volume control is rotated to maximum position and the tuning

TABLE I

Transistor	Function	Current Drain on Battery When Removed
TR1	Converter	7.6 ma
TR2	1st I-F	7.5 "
TR3	2nd I-F	7.6 "
TR4	1st Audio	7.45 "
TR5	2nd Audio	7.75 "
TR6	" "	7.75 "
No transistors removed		8.4 "

Transistorized Radios

Checks, with Transistors in and out of Circuit, Pinpoint Defects

control is moved to a position away from any active station. If the receiver is left tuned to a station during this test, current drain will increase due to operation of the Class B audio stage.

During the test, each transistor should be lifted free of its socket just enough so that contacts clear the socket, but no more. This is simply a matter of convenience. If you withdraw the transistors completely, you will have to waste time hunting to replace them.

The bleeder current, in most sets, is about 1 to 3 ma. If the individual drain by each transistor is calculated, and the sum of these is worked out, it will be noted that this sum does not come to the total current with no transistors removed. This occurs because there is frequently a change in effective voltage which may be due to a series resistor (as in Fig. 4, following the audio output stage) and to the bleeder current, which will change depending upon whether a transistor is or is not pulling its load. Nevertheless, the foregoing procedure provides a positive test to see whether a given transistor is or is not drawing current—and the drawing of current is essential if the component is to work.

PNP Circuit Similar

A similar set of values to those already tabulated hold for the circuit of Fig. 5, featuring PNP transistors in the converter and i-f stages. Values like these may be anticipated for all sets employing class B push-pull amplification in the second audio. With a single-ended stage, the drain of the last audio transistor will be somewhat greater, i.e., about a full milliamper.

The values deviate with supply battery voltages and the type and the make of the transistors employed in the circuit. For example, the Raytheon chassis 8RT1 (see Circuit Digest No. 190, in April 1955 *TECHNICIAN*) has a supply battery voltage of 6 volts, and a smaller drop in total current is anticipated whenever a particular transistor is removed from its socket.

The basic idea remains that,

whenever a transistor is removed from its socket, there will be a decrease in the total current consumed from the local battery supply. This is one of the quickest tests for a relatively good transistor. While the fact that a transistor does draw current does not definitely prove it to be good (this would not be the case with a vacuum tube, either), the failure to draw current definitely weeds out bad actors.

Voltage tests at the electrode terminals of the transistor will reveal many of the causes of defective voltage supply—the next major

cause for defective operation after old batteries and defective transistors. These troubles account for more than half of all electronic equipment trouble in transistor-operated devices.

The emitter and the base of a transistor are almost always operated at about the same voltage. The collector, however, is supplied with a voltage different from the other electrodes. It may be simple to remember that the difference is large between the output (or collector) and the input (or base, for most ap-

(Continued on page 65)

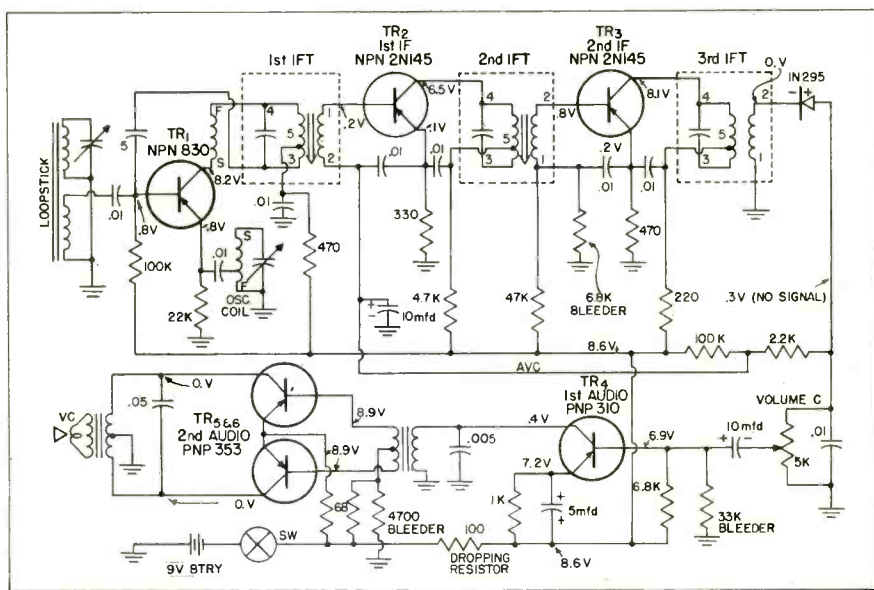
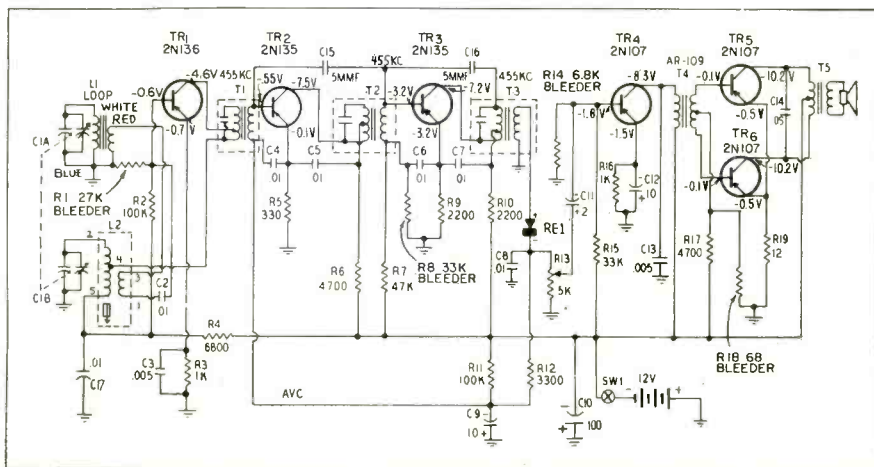


Fig. 4—Six-transistor receiver circuit, by DeWald, using NPN units in high-frequency stages.

Fig. 5—Another six-transistor superhet (Lafayette) using PNP units in the r-f/i-f section.



Earn Extra Profits by Installing

Automatic Garage

Technician skills may be easily applied to

• The largest and heaviest piece of manually moved equipment in the American home is the garage door. All too often the home owner finds the task of opening and closing these doors every day an unpleasant, even strenuous, chore. In this day of automatic appliances, many consumers are quite receptive to the idea of electrically controlled openers, and this provides excellent opportunities for service technicians. Also, many of these door operators are installed in industrial plants. The sale and installation of these devices can be a profitable sideline, particularly during months when TV repair work is slow.

The retail price for the motor, control mechanism and associated

hardware generally ranges from \$70 to \$150, plus installation charges. For this same equipment plus a transmitter in one car and receiver in the garage to actuate the operator by radio control, retail prices range between \$165 and \$225, plus installation. Extra transmitters for additional cars are \$25 to \$35. Cost to technician-dealers is usually 25% to 40% below retail, depending on the company and quantity of units.

A normal installation might take two men between 1 and 5 hours to complete; difficult jobs 5 to 10 hours. For example, an installation retailing for \$200 that requires two men for 3 hours, at \$50 installation charge, might cost you only \$130. Your gross profit and 6 man-hours

of labor would net you \$250—\$130, or \$120. A good turnover in any business.

Equipment Elements

For either a roll-up or swing-up type garage door that is already counterbalanced and mounted on a roller track, the basic equipment is a reversible motor (commonly 1/4 hp.), a drive chain or tube between the motor and door linkage, mounting hardware and actuating mechanism.

Basically, the actuating system consists of a control circuit reversing starter, and a limit switch controlling a ratchet-type lock-in relay to turn the motor on or off at the moment the door is properly posi-

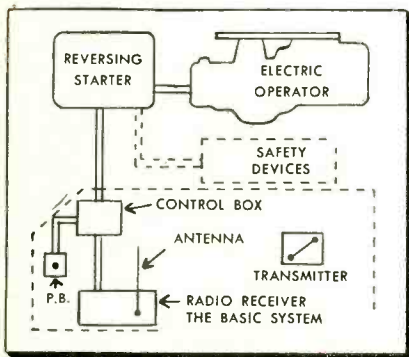


Fig. 1: Basic block diagram of remote control garage door opening system.

Fig. 2: In radio controlled system, compact transmitter (t) is installed under car hood, while receiver (r) is mounted in garage near operator.

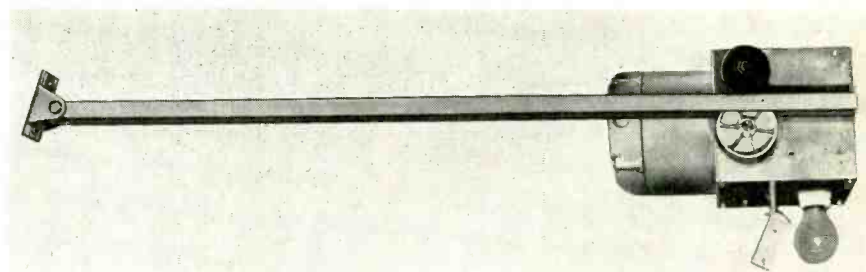
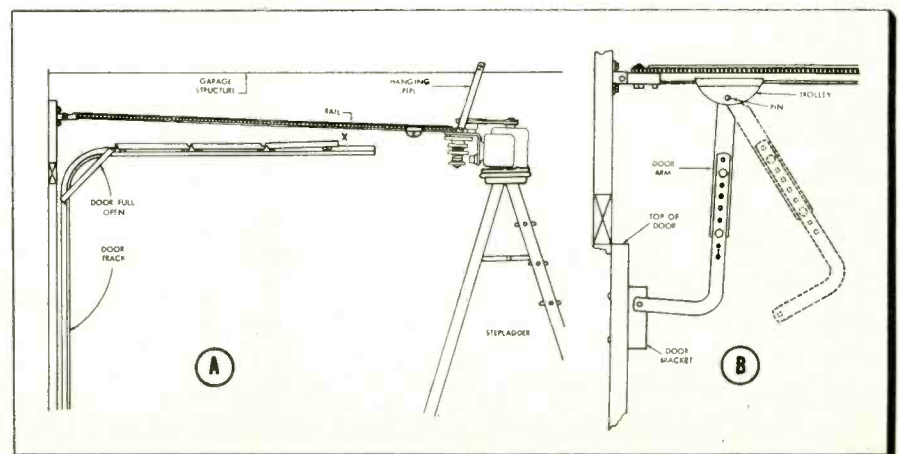


Fig. 3: Heart of the door operating system is this mechanism, designed for one-piece doors mounted on straight tracks. Bracket at left connects to door. U-shaped channel is driven back and forth between motor-driven rollers. Actuating device in housing also turns on light when door is opened.

Fig. 4: (A) Chain-driven system is first bolted to garage wall at left. Then motor is raised to proper position, and supported on ladder while permanent mount to hanging pipe is made. (B) Door arm is then connected between roll-up door and trolley driven along rail.



Door Operators

electric and radio-controlled door operators

OBTAIN MORE INFORMATION on automatic garage door operators by writing to Editor, **TECHNICIAN & Circuit Digests**, 480 Lexington Ave., New York 17, N. Y. Additional data will be sent to you free.

tioned in the opened or closed position. Door movement is generally 6 to 18 in./sec.

Numerous safety devices are incorporated to protect people and equipment alike. Among these are the safety clutch which disengages if an object impedes door movement, cutoff switch actuated by drive shaft cam responding to door stoppage, circuit breaker and belt drive to prevent motor overload.

The two types of drives are chain or cable, and tube or channel. The chain drive is something like a bicycle sprocket chain, moving a trolley connected to the door back and forth. The tube drive uses a drive roller and idler pressing against a metal shaft, shaped as a tube or U channel, driving it in the fashion that a recorder's capstan and pressure roller drive magnetic recording tape. The screw or worm drive tube is another variation.

Radio Control

To initiate operation of the door opener, the simplest device is a pushbutton or key lock switch. Another method is a photoelectric cell. But the most attractive means of all

is remote radio control, whereby a coded signal is sent from a small transmitter under the car hood, and received by a continuously operating fixed-tuned receiver in the garage to actuate the mechanism. The car may be within 75 to 100 feet of the garage.

There are two types of transmitters. The r-f type at carrier frequencies between 250 and 300 mc



Fig. 5: Installer about to insert radio receiver in housing containing motor and electrical operator controls.

employs modulation tones between 7 and 29 kc. Since any one of seven different carrier channels and 12 different tones may be used in a

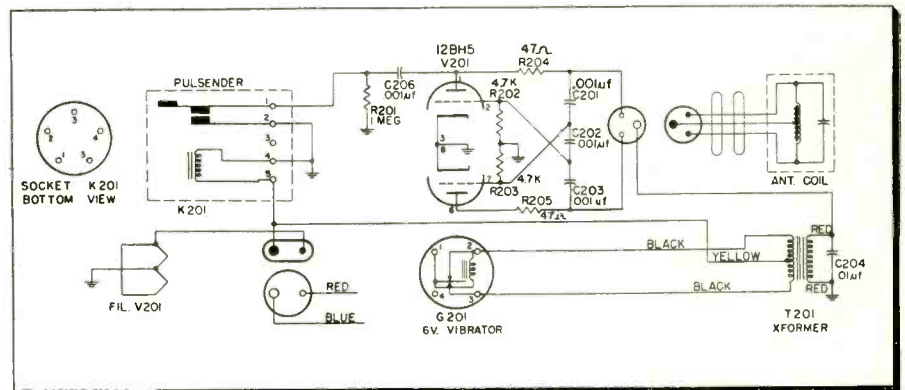
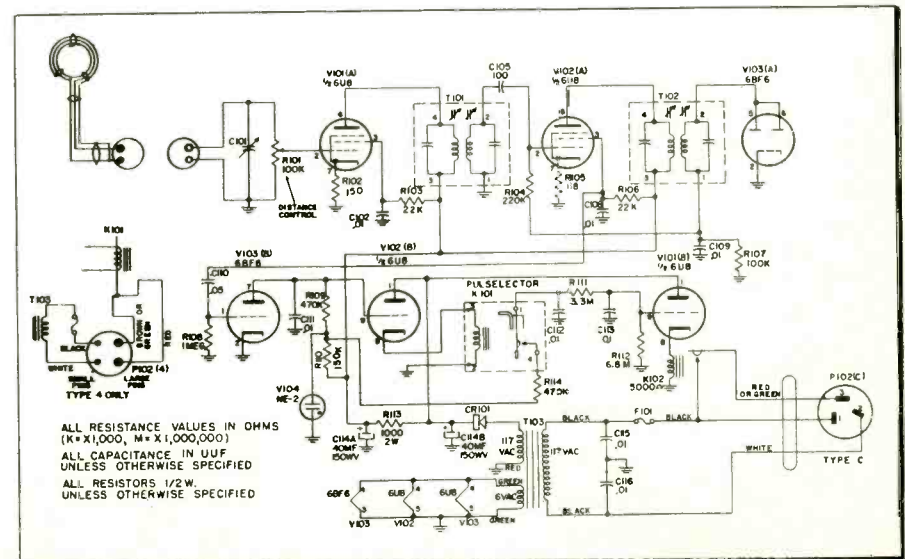


Fig. 6: Circuit of induction-type transmitter. Antenna coil radiates little energy, but r-f magnetic field around coil links unit to receiver. Pulsender mechanically keys oscillator (150 to 276 kc) at low rates (15 to 25 cps) by intermittently shunting capacitor across part of plate coil. Adaptor is used in cars with 12-v. battery.

Fig. 7: Circuit for receiving signals generated by transmitter in Fig. 6. It employs two TRF stages, diode detector, audio amplifier and neon limiter. Electro-mechanical pulseselector is activated by V102B cathode follower passing only one pulse-code frequency, thereby changing RC network to operate only K102 by V101B cathode follower action.



MANUFACTURERS

of door operators who have contributed information in the preparation of this article:

- ALLIANCE MFG. CO.
- ATLAS OVERHEAD DOOR CO.
- A. R. F. PRODUCTS, INC.
- BARBER-COLMAN CO.
- CRAWFORD DOOR CO.
- DELCO PRODUCTS DIV.
- DOOR-LIFT CO.
- DOORMASTERS, INC.
- McKEE DOOR CO.
- PERMA-POWER CO.
- RICHARDS-WILCOX MFG. CO.
- STANLEY WORKS
- UNITED STATES MOTORS CORP.

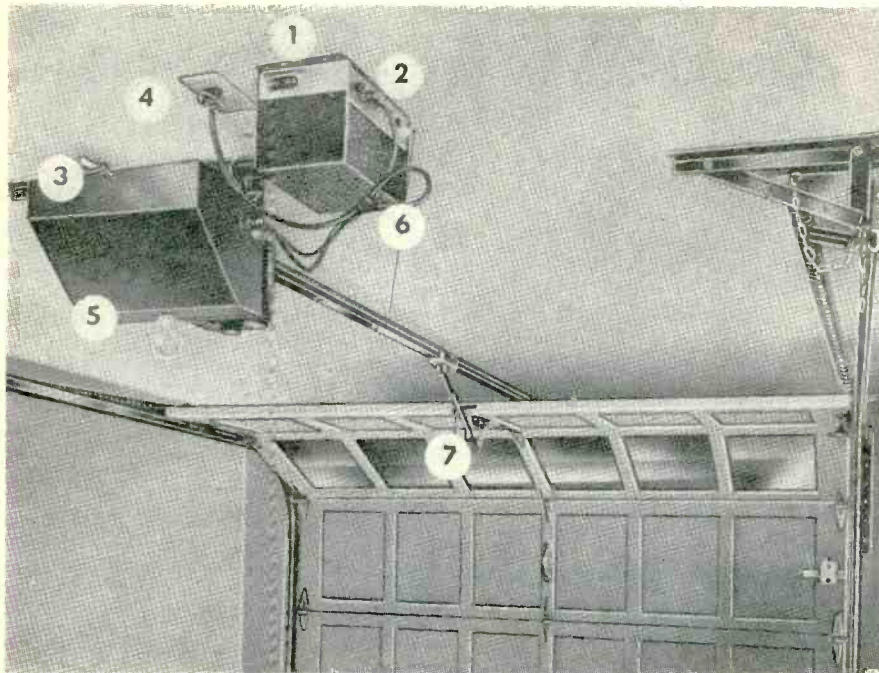


Fig. 8: Installation includes 1) receiver, 2) plug-in line to operator, 3) operator, 4) 110 v. outlet and lead, 5) bulb, 6) antenna, and 7) chain ring under trolley rail for hand operation.

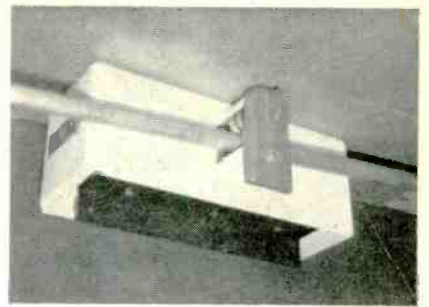


Fig. 11: Close-up of all-enclosed operator employing tube driven by neoprene roller. Wick self-oiling reduces normal maintenance checks to once every three years.

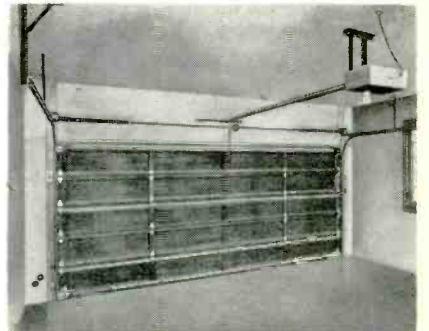


Fig. 12: Complete, neat remote control chain-type operator installation.

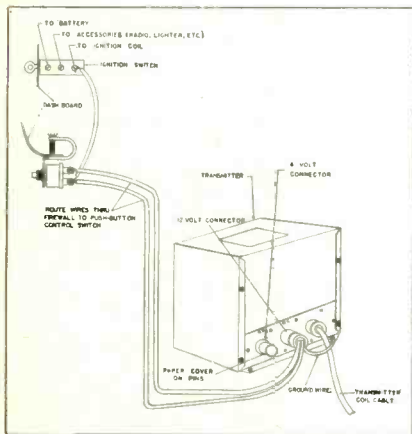
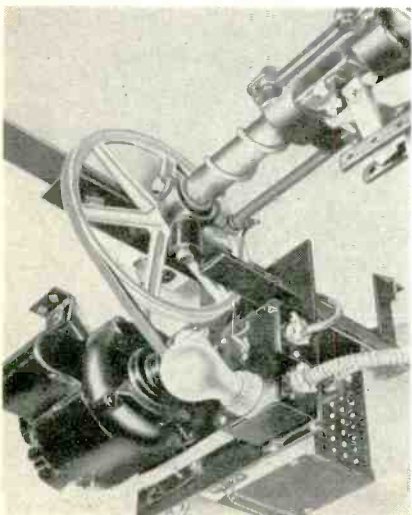


Fig. 9: Wiring arrangement for transmitter in car. Induction-type transmitter coil functioning as antenna is mounted under gravel pan deflector behind front bumper (not shown).

Fig. 10: Motor turns screw or worm-type shaft to drive door-connected trolley.



particular installation, it is unlikely, though it has happened on rare occasions, that the door opener will be set in operation by a stray signal of the exact frequency and modulation to which the receiver is tuned.

The second remote control type works on the induction principle, whereby the transmitter antenna coil acts as the primary of a transformer, and the receiving antenna as the secondary. Any one of five different frequencies between 150 and 276 kc, pulsed at 15, 17, 19, 22 or 25 cps, provide 25 different operating combinations to permit adjacent installations in a neighborhood without mutual interference. Of course, radio controlled doors may also be operated by electrical pushbutton.

For door operators requiring the installation of electrical conduit (most do not), electronic technicians should check local regulations.

Automatic garage door operators offer excellent opportunities for extra profits. Manufacturers support the sales of these units by advertising, and making available to you sales aids and promotional material.

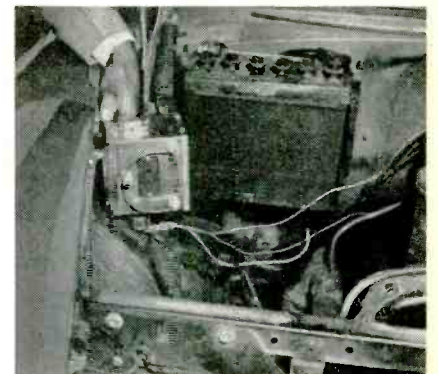


Fig. 13: Typical installation of r-f type transmitter under car hood. U-shaped antenna is mounted on transmitter case.

Fig. 14: Wiring arrangement for motor and control installation in garage.

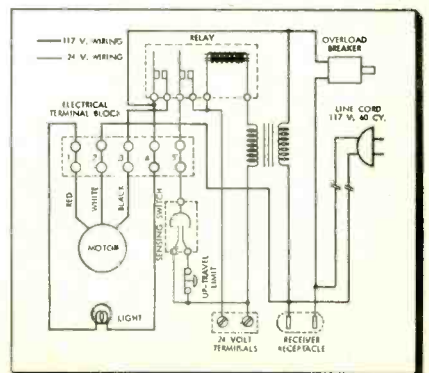


Illustration Credits

- Fig. 1: Richards-Wilcox Mfg. Co.
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- Fig. 5: Delco Products Div.
- Fig. 6: A.R.F. Products, Inc.
- Fig. 7: A.R.F. Products, Inc.
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- Fig. 11: Doormasters, Inc.
- Fig. 12: Door-Lift Co.
- Fig. 13: Delco Products Div.
- Fig. 14: Perma-Power Co.

The Col-R-Tel Converter

Accessory Delivers Color Pix on Standard Monochrome Sets

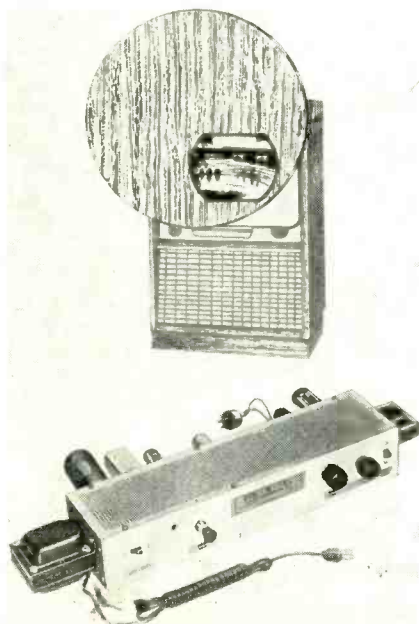
NORMAN F. MARTIN,
COLOR CONVERTER, INC.

• During the past year, a device for converting a black and white TV receiver to produce color pictures has appeared on the market bearing the trade name Col-R-Tel. It is manufactured by Color Converter, Inc., Columbia City, Indiana. In the relatively short time since its appearance, the Col-R-Tel converter has found its way into the homes of thousands of owners of black and white sets, who have accepted it as a relatively inexpensive way of enjoying the benefits of color TV.

With this device finding consumer approval, its installation and service become the problem of the service technician. This article will acquaint the technician with the general theory and operation of the Col-R-Tel unit. Details concerning installation procedure and service requirements, together with a schematic of the electronic portion of the unit, appear in the Circuit Digest section this month.

The entire converter assembly consists of a scanning wheel with color filters, the motor that drives it, and the electronic control unit.

Fig. 1—Scanning wheel unit (top) mounted on monochrome receiver, and electronic control box (bottom), for mounting on back.



These elements are shown, on and off the existing monochrome receiver, in Figs. 1 and 2 here, and also in Figs. 1 and 2 of Circuit Digest No. 264, in this issue.

The scanning wheel, measuring 31 inches in diameter, is attached to a shelf with adjustable brackets to permit centering the wheel window and the picture on the TV screen. The wheel assembly, weighing only 13 lbs., is used only for color broadcasts and is removed when viewing black and white pictures.

The revolving disc consists of 6

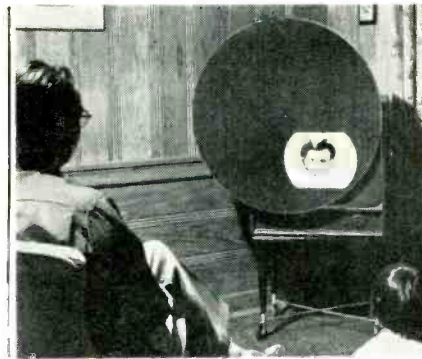


Fig. 2—The Col-R-Tel unit in operation.

filters having 2 each of red, blue and green. The disc is motor driven through a rubber belt at a speed of 600 rpm.

The electronic unit, which mounts on the rear of the TV set, employs 7 tubes and performs 2 functions.

1. Regulates the speed of the scanning wheel by controlling the voltage applied to the motor.

2. Decodes and converts the present NTSC color signal to a field-sequential system for controlling the brilliance on the picture tube for each of the three primary colors as the transparent filters pass in front of the TV picture.

A picture size control unit reduces the raster of the TV set to the size of the window in the scanning wheel housing. This unit is simply a high-Q width coil of variable inductance which connects in parallel with the horizontal deflection coil, and a variable rheostat which connects across the vertical deflection coil. Once adjusted the size is reduced each time for color viewing by simply throwing a switch.

The converter is self-powered and does not affect the black and white performance of the receiver in any manner.

The following tubes are employed:

Code	Type	Function
V1	6U8	Gated Color Burst Amplifier
V2	6U8	Color Burst Amplifier & Limiter
V3	6BC7	Phase Selection Diodes
V4	6BE6	Chroma Demodulator
V5A	12BH7	Chroma Amplifier
V5B	12BH7	Scanning Wheel Sync Control—Amp.
V6	6BL7	Scanning Wheel Motor Control
V7	6X4	Power Rectifier

For further identification of these tubes and functions, see Figs. 3 and 4 in the Circuit Digest Section.

Signal voltage for operating the converter is obtained from the picture tube grid or cathode, whichever contains the video information. This signal is fed from the yellow input lead through the smear filter, condenser C23 and R26 to the grid of the chroma detector. The tuned circuit L6-C2 is tuned at 3.58 mc for maximum signal.

Color Burst Amplifier

Video signal is also fed to the color burst gated amplifier tube V1 through C24, R29 and C7. The tuned circuit C3-L1 is tuned to 3.58 mc. The components of the gated color burst amplifier V1 are selected to hold this tube at cutoff during the horizontal sweep period. During retrace time a horizontal pulse of 15-25 volts is fed to the cathode of V1A. This pulse is obtained from the TV horizontal output tube plate through the dividing network C31, R43, R42 and R41. Between pulses the triode section of V1 is biased at saturation. When pulsed, the sudden change in plate current produces a positive pulse on the grid of V1B. This overcomes the negative grid bias developed across R4 in the cathode and permits the tube to amplify the color burst on the horizontal sync pulses.

Transformer T2 is tuned to 3.58 mc and the bursts are applied to the 3.58-mc crystal through condenser C6. The crystal being excited by the bursts has sufficient Q to produce a

(Continued on page 53)

Oscilloscope Speeds Auto

Finding Correct Value of Buffer Condenser; Trouble-shooting Faulty,

JACK DARR

• While the cathode-ray oscilloscope is very much in the public eye today as an essential adjunct to TV service, let's not overlook some of the other possibilities of this versatile instrument. For some years we have been utilizing the scope for testing and alignment work on automobile radios, and it has paid for itself many times over.

Vibrators

For testing vibrators, one of the most common sources of auto-radio trouble, the oscilloscope has no equal for speed and precision. Either the common "non-synchronous" or interrupter type, or the rarer synchro-

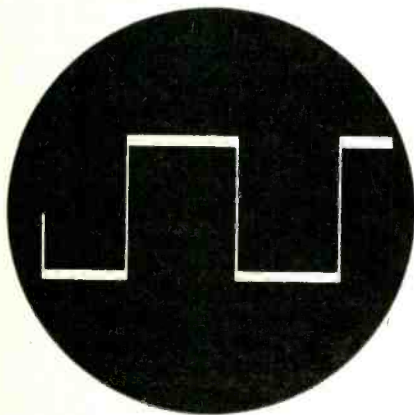
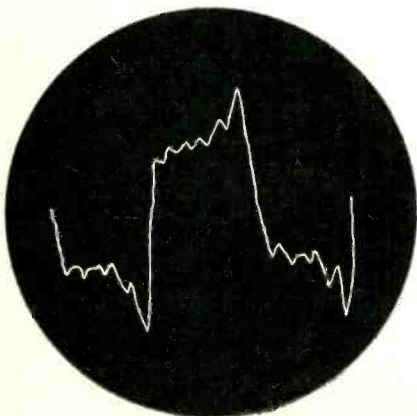


Fig. 1—Correct oscilloscope square-wave pattern for output of nonsynchronous vibrator.

Fig. 2—Point bouncing produces sharp peaks and general raggedness. Replace vibrator.



nous vibrator can be checked in a matter of minutes. A quick connection of the scope to the primary terminals of the vibrator will give you a remarkably complete picture of the condition of the vibrator, the buffer condenser, and even of the power transformer itself. This is, as in all other scope work, a matter of waveform interpretation; but fortunately, these are very simple. After one or two tests, the correct waveform is easy to identify.

A good vibrator will give you a beautiful square wave, with only a very slight "pip" at the leading edge. (See Fig. 1) The tops of the wave will be quite smooth, and the pattern should remain stationary, once locked in, with no jitter or drift. Modern vibrators, incidentally, run at around 115 cycles per second. If the tops and bottoms of the wave are jagged, or if there is a pronounced slope or rounding to the waves, there is trouble in the circuit. Raggedness or excessive peaks at the left sides of the wave indicates chatter or point-bounce. (See Fig. 2). Substitution of a good vibrator is the best test here.

Buffer Condensers

A shorted buffer condenser is easily spotted: the set will draw from 15-18 amperes, instead of the normal 6-8 amperes, and there will be no high voltage. If the condenser is unidentifiable, from dirt or old age, a correct replacement can easily be selected with the scope. Connect the scope across the primary (the two biggest pins on the 4-prong socket) and observe the pattern, first, of course, clipping the shorted condenser out. You will probably note excessively high peaks or pips at the left edges of the waves. These are high-voltage surges occasioned by the loss of buffer capacity. Select a buffer condenser, guessing at the right size, and put it in the circuit as shown in Fig. 3. If the replacement eliminates the peaks, but causes excessive rounding of the pattern, it is too large. (See Fig. 4). Try progressively smaller units until one is found which will remove the

peaks, but still leave the pattern sharp-edged and clean, as shown in Fig. 1.

The vibrators mentioned above are the non-synchronous type; some few sets are still in use with the self-rectifying or synchronous type. Patterns for these are very similar, except for a very small "pip" or spike on the leading edge of the wave, which is normal for this type. The general square shape should be the same.

Although the older type "adjustable" vibrator has just about vanished from the scene, there are still a few floating around, also some special vibrators, with adjustable points.

If a replacement vibrator is not obtainable, the old one may be adjusted and cleaned up. Disassemble the vibrator, and clean the points, getting as high a polish on the point surfaces as possible. Crocus cloth and jeweler's rouge ('plug-polish') may be used here. Reassemble, leaving the unit out of the can, and set up the radio so that the vibrator may be operated.

Connect a dc voltmeter across the output of the power supply, and the scope across the primary points. Using an insulated tool, such as an old alignment tool with a fine slot sawed in the end, adjust the points by carefully bending the reeds until the vibrator yields the proper waveform and the output voltage is at a maximum. A word of caution here: be very sure that the vibrator is well-insulated before handling, during operation; these little devils can bite!

"Break-in" Period

After the adjustments are completed, let the vibrator "run-in" for about ten minutes, then reassemble and install. We have known reworked vibrators to give satisfactory service for over two years, so be careful in the adjustments, and the results will be quite rewarding.

The scope is useful, also, in hunting obscure sources of 'hash' in auto radios. Filament wiring often will carry vibrator hash into sensi-

Radio Servicing

Vibrators; Alignment with FM Sweep

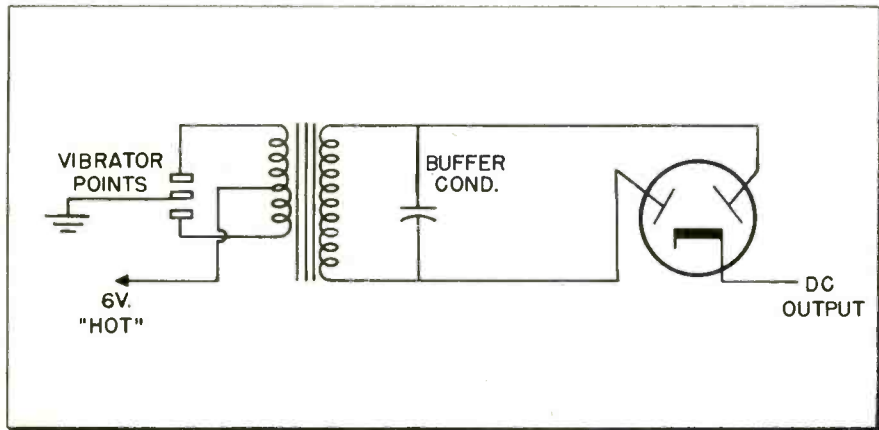


Fig. 3—Typical nonsynchronous vibrator power-supply circuit. Driving coil is not shown.

tive circuits. (See Fig. 5.) Checking the level of this hash in the wiring can often help. If too high, reduce by using heavy r-f chokes and bypass condenser (about 0.5 mfd at 100 vdc).

Alignment

Alignment of the automobile radio is, or should be, much more critical than that of the average home set. Superior selectivity accounts for the excellent performance of the average auto-radio, compared with the home set using the same number of tubes. Careful alignment, using an FM swept signal and an oscilloscope, will improve the performance of any set. Some older sets, especially the ones using triple-tuned i-f's, are very dif-

ficult to align with conventional methods: these may be easily aligned with the scope. Proper shaping of the i-f response curve will aid in reducing engine-noise pickup and increase sensitivity.

Good shaping is also invaluable in front-end alignment. Due to antenna limitations, designers are forced to make their r-f and antenna stages much more critical in alignment than home sets, to obtain the needed gain. The oscilloscope, with a swept signal, makes front-end alignment simple. By feeding the signal through the proper dummy antenna, the front end response curve can be shaped and peaked to obtain maximum performance. This curve may be taken off the second detector output com-

(Continued on page 61)

Fig. 4—Effect on pattern, buffer condenser too large. Reference output is dotted in.

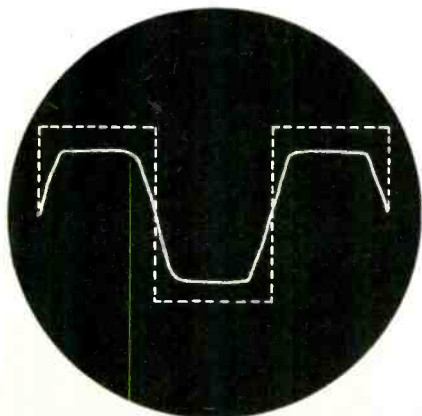
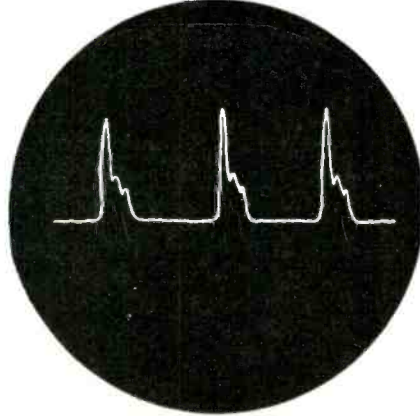


Fig. 5—"Hash" waveform in filament supply. Excessive amplitude will cause speaker noise.



New Cascode Tuner Tubes

WAYNE RIAL,
WESTINGHOUSE ELECTRIC CORP.

Two new 9-pin dual triodes designed for cascode r-f amplifier operation in VHF tuners have been announced by the Westinghouse Electronic Tube Division. The 6BS8 and 4BS8 contain two sharp cut-off triodes characterized by very high transconductance and low noise output when connected for cascode operation. Base pin connections are the same as for their predecessors, the 6BZ7, 6BQ7A, 6BK7A and their 4-volt counterparts.

The new types provide a more favorable ratio between transconductance and plate current than earlier types. An improvement in this ratio in an amplifier stage increases stage gain and, at the same time, reduces internally generated noise. This is true because stage gain is proportional to transconductance, while stage noise is somewhat proportional to plate current.

In addition, the 4BS8 and 6BS8 have interelectrode capacities very similar to the other dual triodes designed for cascode use, and they have a plate dissipation of 2 watts for each triode section. The high transconductance is accomplished by a control grid structure that is different from that used in previous types. Also, internally generated noise has been reduced by careful design and careful processing of materials.

Measurements have been made with the new cascode tubes and compared with measurements for both the 4BZ7 and 6BZ7 in two of the latest tuners made by a large manufacturer. In a tuner optimized for the 4-6BS8 compared with a tuner optimized for the 4-6BZ7, an increase of 4-5db in cascode stage gain was measured, along with an average improvement of 1½db in tuner noise figure.

By merely replacing the 4-6BZ7 with a 4-6BS8 in a tuner optimized for the 4-6BZ7, an average improvement of 3db in stage gain and an average improvement of 1db in noise figure was measured. Since typical cascode tuner amplifiers have stage gains averaging around 22db, this increase, which amounts to 4db improvement in efficiency, is significant, especially in fringe areas.

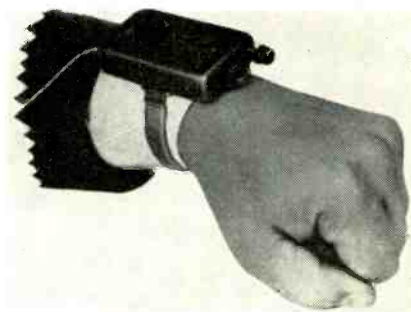
In this ability to provide improvement in tuner performance without making adjustments, lies the great value of these tubes to the TV technician. Even greater improvement is possible with slight readjustment of trimmers in the r-f stage.

Transistoradio "On the Cuff"

A miniature all-transistor broadcast-band radio now on the market comes mounted on a wrist strap so that—shades of Dick Tracy!—it can be worn like a wrist watch. A special regenerative circuit, according to the manufacturer, permits good selectivity and high sensitivity although only 3 transistors are used. Reception up to 25 miles from transmitters of average strength is claimed, with a short length of antenna wire making it possible to span even greater distances, more than 35 miles from the

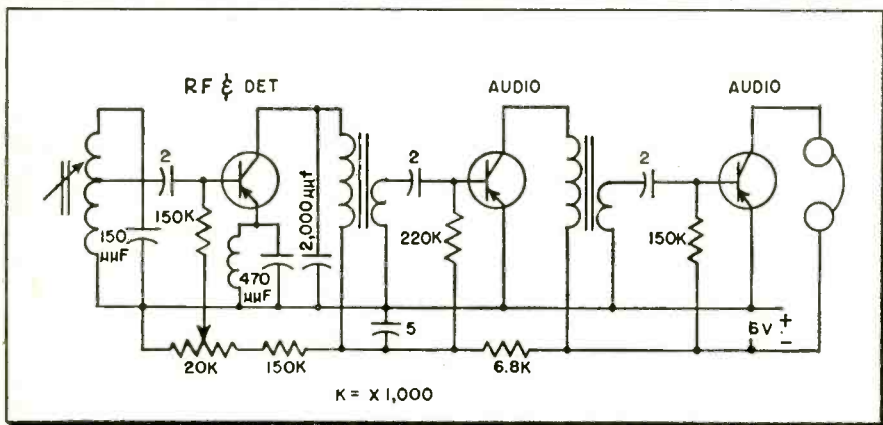
location of the AM transmitter.

A hearing-aid type 6-volt mercury battery powers the receiver for an estimated 100 hours, at a cost of about 2 cents an hour. Though ruggedized, the complete printed-circuit receiver weighs only 2½ oz. The wrist version is known as model 125. Model 130, alternatively available, is the same unit with a clip for use in a pocket instead of with an expansion wrist band. A hearing-aid type earpiece is included so that the user is free to move about unen-



The miniature wrist radio, ready for action.

Complete schematic of the LEL model 125 midget receiver, which uses only 3 transistors.



cumbered while the set is in use.

Some suggested applications include radio service for the hard of hearing; "private" listening in the presence of others, as for patients in hospitals or spectators at sports events; civil defense; and while engaging in such activities as participation sports. Length of the receiver is only 2¾ in. Although the output stage has no transformer, an auxiliary output transformer with a 2000-ohm primary can be used to drive a speaker at good listening levels, when desired.

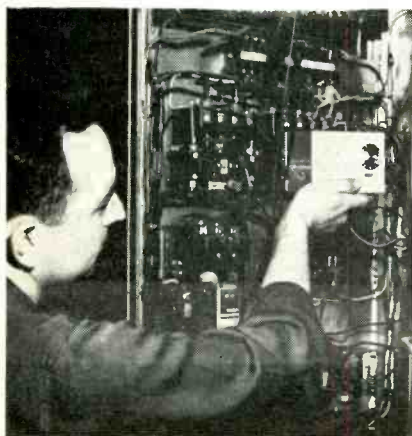
The wrist radio is manufactured by LEL, 380 Oak St., Copiague, Long Island, N. Y.

Transistor Radio Detective

Providing portable entertainment isn't the only use for small transistorized radios. They can be used to track down trouble sources in electrical equipment in the home, apartment or office.

The voltage regulation department of the Toledo-Edison Co. of Toledo, Ohio, is using the Raytheon T-500 to locate poor connections in power receptacles, defective fluorescent and

Hunting interference with transistor portable.



incandescent bulbs and fixtures, in refrigerator butter conditioners, and other sources of radio and TV interference. The company has used other portables for this application, as well as portable direction-finding devices designed for this type of work. Such equipment proved unsatisfactory from the standpoint of bulk, weight and short battery life.

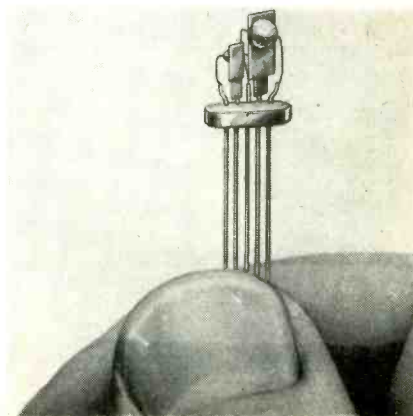
In addition to long battery life, small size, light weight, durability and ease of manipulation, the T-500 showed good sensitivity in picking up the sought-for interference in this off-beat application.

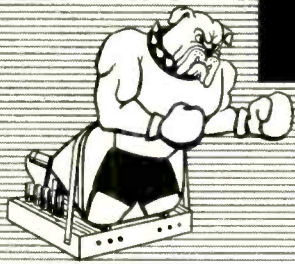
2-in-1 Tandem Transistor

A design which increases the versatility and utility of semiconductor devices has been developed by the Marvelco Electronic Div. of Nat'l. Aircraft Corp., Burbank, Calif. The model MT-1 is actually two dc-coupled transistors in two-stage cascade arrangement, housed in a single case. With one of its transistor elements acting as the input device for the second, the tandem unit features very high current and power gain.

Units of this kind may be used as oscillators, multivibrators and in many other circuit configurations. In units of this type, the collector or emitter of the first transistor is internally connected to the base of the second. Although 5 external leads are shown in the example illustrated here, only 4 are necessary in practice. The 5th lead, built on so that the 2 units may be separately tested in manufacture, can be clipped off.

Inner detail of uncased tandem transistor.





"Tough Dog"



Corner

Difficult Service Jobs Described by Readers

It Shifted for Itself

There appeared to be a simple phase-shifting problem in this Capehart CX38 chassis: though vertical sync was normal the picture kept shifting horizontally. However, tube replacements and normal checks in the sync circuit showed no cause for the symptom; the picture kept sliding one way or the other.

Critical resistors and capacitors in the horizontal afc circuit were changed with no help. I then decided to try repositioning the agc switch, but this had no effect. Changing the agc tube itself had no effect. This left only the agc winding on the width coil. It was found to be open. On removal of the coil and close examination, it was found that one of the hair-fine connections had separated from one of the terminals on this coil. The connection was re-made with a low-heat iron and the coil was replaced. That did it.—D. C. Rahe, Bartlesville, Oklahoma.

"It Didn't Work Right"

After 17 years as a repair and electronic technician, this tough dog stopped me longer than any other I have experienced. An RCA KCS81A chassis was brought into

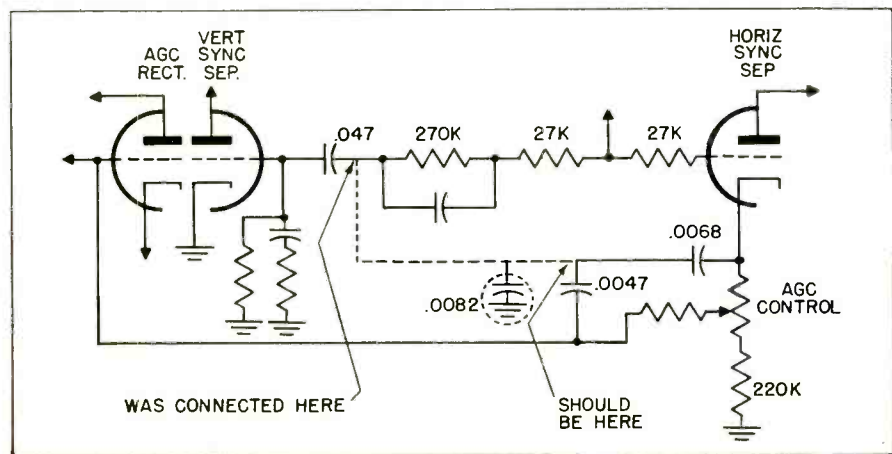
the shop for a general check. It was two years old, and had been brought into the shop previously for a minor repair. It belonged to an elderly couple whose complaint was that "it just didn't work right." The set was put on the bench and turned on.

Since everything appeared to be in order at first, the set was left running and another job was started. After about an hour of play, during which time the set looked like just another routine job, things began to happen. During station breaks, the receiver would lose horizontal sync.

The horizontal sync and agc sections were immediately suspected. Turning up the agc control made the local stations flutter and lose vertical and horizontal sync. The vtvm and scope were brought into play. All voltages and all waveforms were correct. Where was the trouble? Every condenser in the chassis was tested with a condenser checker. All resistors were carefully checked. As an added precaution, all condensers were bridged with new ones. Nevertheless, flutter and loss of sync persisted. The only apparent clue was that the trouble occurred on local stations, with more distant transmissions causing no trouble.

We thought we got our break

A factory wiring defect had resulted in a subtle deterioration of performance in this circuit.



\$10 For Your "Tough Dog Story"

Have you tangled with a difficult or obscure service problem recently? Write it up, telling us how you licked it. Use drawings to illustrate your explanations wherever necessary. A rough sketch will do as long as it can be followed. Send it to "Tough Dog" Editor, TECHNICIAN, Caldwell-Clements, Inc., 480 Lexington Ave., N. Y. 17, N. Y.

when another KCS81A chassis went bad and was brought into the shop. This second one was easily repaired and then used as a comparison set for the first one. Every voltage and waveform was measured, checked and compared on both sets, but no differences could be found. Instruments and knowledge had failed us.

Beaten and disgusted, we tried one more approach. It was decided to trace every connection in the set, wire for wire, from the schematic. After about 10 minutes work, there it was. A wiring error had been made at the factory. This set had been "just not right" for the elderly couple for two years.

The wiring error is shown in the accompanying sketch. The 0.0082-mfd capacitor was incorrectly joined to the junction of the 0.047-mfd capacitor and the 270k resistor, as shown, instead of being brought to the junction of the 0.0047-mfd capacitor with the 0.0068-mfd capacitor. This mistake was enough to introduce subtle performance changes in the agc and sync circuits that eluded close detection. Restoring the intended connection brought the set to normal operation.—F. A. Nichols, Appleton, Wisconsin.

Which Coil Is the Phony?

On the complaint of an intermittent raster, the set was taken to the shop after tube substitution failed. A vtvm was hooked to the grid of the horizontal output tube, a 6BQ6, to check for drive. It was normal—oops! It suddenly dropped to half its normal value. Then it was noticed that,

(Continued on page 55)

Ohmmeter Transistor Check

Forward and Inverse Resistance Readings Indicate Condition

An approximate check on the quality of a transistor may be made with a vacuum-tube type of ohmmeter. The transistor is checked as though it were two separate crystal diodes; that is, by measuring the forward and reverse resistance of each section individually. Figs. 1 and 2 respectively show the methods of testing PNP and NPN types of transistors.

When the negative terminal of the ohmmeter, set on its Rx10 scale, is connected to the base (B) of a good PNP transistor, as shown in Fig. 1, and the positive terminal of the meter is connected to the collector (C) or emitter (E) terminal, you should measure a low inverse resistance, in the order of 500 ohms or less, for each of these two connections.

When the positive terminal of the ohmmeter is connected to the base (B) terminal of a good PNP transistor and the negative terminal is connected to the collector (C) or emitter (E) terminal, you should measure a high inverse resistance, in the order of 50k or higher, for each of these two connections.

In the event that you obtain read-

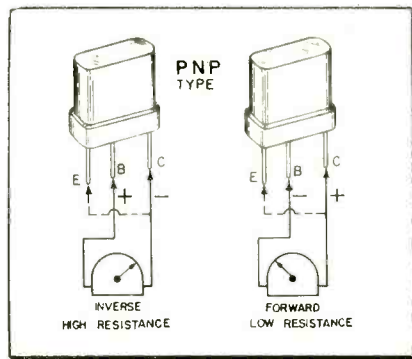
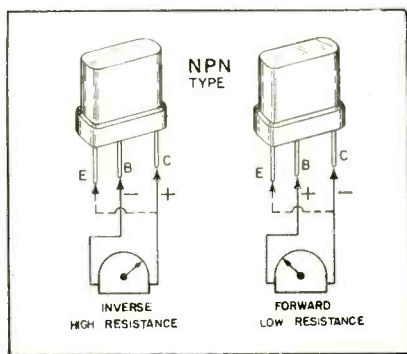


Fig. 1—Ohmmeter set to check PNP transistor.

Fig. 2—Ohmmeter set to check NPN transistor.



ings that are opposite from these, it is possible that the plus side of your meter is actually connected to the negative side of its internal battery. This should be checked.

NPN type transistors are checked in a similar manner, except that the applied polarities from the ohmmeter are reversed (see Fig. 2) to give the same inverse and forward resistance results.

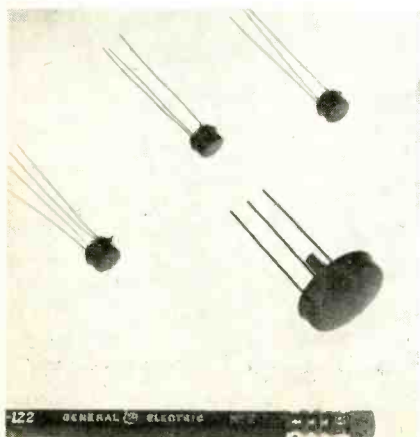
A word of caution: use only a vacuum-tube type of ohmmeter. The Rx10 scale must be used for all forward (low) resistance measurements. Do not use the Rx1 scale, as damage to the transistor could result. A shunt-type ohmmeter should not be used. If in doubt as to the type of vacuum-tube ohmmeter you have, place a 1000-ohm resistor in series with it, to protect the transistor and subtract this 1000 ohms from the reading obtained.

If these instructions are not followed, damage to the transistors may result, since some non-electronic types of ohmmeters use high internal battery voltages.—Adapted from a service note by Emerson Radio & Phonograph Corp.

New Transistor Products

GE TRANSISTORS

New units shown at the IRE convention include an h-f tetrode transistor with an alpha cutoff of 50 mc at 85°C, and 10 db gain obtainable at 30 mc with 2 mc bandwidth. The ZJ12, an NPN silicon transistor, cuts off at 6 mc, gives



15 db gain at 2 mc, will be useful in r-f amplifier applications. ZJ13 (NPN, germanium) provides at least 12 db gain at 5 mc. ZJ16 (PNP, silicon) is a power transistor capable of dissipating 8 watts at 85°C, useful in amplifier applications. General Electric, Electronics Park, Syracuse, N. Y. (TECHNICIAN No. 4-32)

General H-F TRANSISTOR

Type GT763, germanium PNP alloyed-junction transistor, has been designed for high-frequency operation in the r-f and i-f sections of broadcast receivers. Units are hermetically sealed in metal cases with glass headers. General Transistor Corp., 95-18 Sutphin Blvd., Jamaica 35, N. Y. (TECHNICIAN No. 4-37)

Motorola MIKE-SPEAKER

A microphone for mobile radio use features a dynamic element in conjunction with a built-in transistor preamplifier, provides good voice intelligibility.

The preamp boosts mike output level, overcoming the noise pickup problem inherent in mobile installations. It is interchangeable with current Motorola carbon mikes for mobile use, and is also available as a combined mike-speaker unit. Motorola Communications & Electronics, Inc., 4501 W. Augusta Blvd., Chicago 51, Ill. (TECHNICIAN No. 4-34)



SHOP HINTS

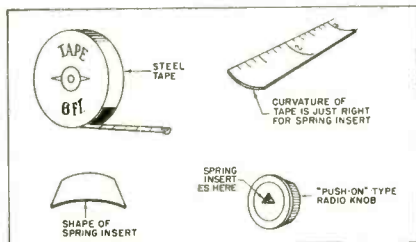


Tips for Home and Bench Service by Readers

Replacement Knob Springs

The springs out of push-on type knobs, like those found in so many radios, are lost easily and often. It is not always easy to procure new knobs that match up with the old ones. In any case, this means that valuable time must be wasted in going to the stock room or the parts supplier; even then, the trip may be fruitless.

Avoid these difficulties by keeping a steel tape on the bench at all times. From this you can, with tin snips, cut out a new spring in a minute, and you can cut it to fit any size knob, as shown in the accompanying figure. These steel tapes, inexpensively available in "dime stores," can save many times their cost by saving time used finding lost springs or going for new ones.



Knob springs can be made up from steel tape.

Another valuable use for these home-made steel-tape springs is to tighten push-on knobs which, although retaining the original spring, have become loose on the shaft. To tighten the knob, just put an extra spring insert under the original spring still in the knob. When this is done, the new spring will stay in place securely and hold the knob fast.—Joseph Amorose, Richmond, Va.

Watch Those Phony Symptoms

The design of the agc system and the use of intercarrier sound in some receivers can often work too well, in the sense that they serve to mask some symptoms that would otherwise lead clearly to antenna faults, as this case history shows:

The picture on the set would occasionally flicker, roll and pull to

SHOP HINTS WANTED

TECHNICIAN will pay \$5 for acceptable shop hints. Unacceptable items will be returned. Use drawings to illustrate your explanations wherever necessary. A rough sketch will do as long as it can be followed. Send your hints to "Shop Hints" Editor, TECHNICIAN, Caldwell-Clements, Inc., 480 Lexington Ave., N. Y. 17, N. Y.

the right. The antenna appeared in order. The set worked perfectly in the shop, and was returned to the owner. When the symptoms re-occurred, since the owner did not want to be without his TV, arrangements were made to provide him with a loan-out set. Although the latter was in good working order, it did not have an agc system, being an older set. When this set was operated from the customer's antenna, there was sputtering evident in the sound and the picture flickered snowily. Examination of the lead-in wire, which looked good externally, revealed several small breaks at different points in the separate strands once the plastic coating was stripped away. The agc network in the customer's own set had served to equalize the changes in signal level due to the break, and thus mask the condition.—Junior D. Bradshaw, Garden Grove, Calif.

Checking Open W-W Resistors

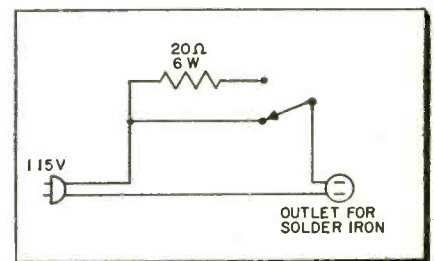
The next time you run into one of those sand-coated wire-wound resistors that has opened up, and you have no way of checking its value, try this procedure. Take a pair of diagonal cutters and use them to crumble off the coating along one edge of the resistor. This should be done with care, of course, so as to avoid any damage to the wire resistive element beside the damage that already exists, the open condition. Now connect one lead from your ohmmeter to one terminal of the resistor. Slowly slide the other probe of the meter along the wires you have just bared, beginning near the terminal to which the other probe is connected and working away from it. As you do this, the resistance reading should start at zero and increase until you reach the point of the

break, at which point the reading will shoot up toward infinity.

When you have reached this point of the break, record the highest reading obtained just before the break became evident, and then switch the fixed meter probe to the other terminal on the resistor. Now begin the same procedure from the other end of the resistor. That is, slide your free probe along the exposed portion of the resistor, beginning near the terminal to which the probe is now fixed, and moving away from it. Again, the reading will shoot up suddenly when the point of break is reached. The highest reading found on this side of the resistor just before the break is reached is added to the highest reading recorded on the other side. The sum of these gives the original value of the resistor before it became open.—Ralph E. Hahn, Glenview, Illinois.

High-Low Solder Iron Heat

The unit illustrated will save many a hand from being burned; it will also save wear and tear on the soldering iron. It is a low-cost heat control for the iron that, with the flick of a switch, will provide normal heat for regular use or a lower heat for keeping the iron in a stand-by condition on the bench, when it is not



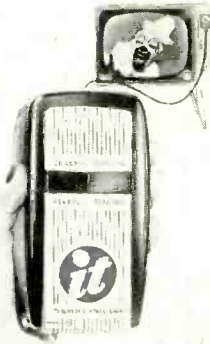
Switch for low or regular solder iron heat.

in immediate use. It is also a convenient method of reducing the heat of a conventional iron for such low-heat soldering techniques as are required on printed circuit boards. For particular applications, the value of the dropping resistor may have to be adjusted.—Dick Unger, Plymouth, Wisconsin.

New Products for Technicians

IT TV REMOTE CONTROL →

Low cost and simple TV remote control, the "it," allows the viewer to switch channels and even fine-tune the TV picture from anywhere in a room. It can be installed in three minutes right in the home, and will attach to all major sets without connecting wires or using tools. Price is \$19.95 list, and comes in self-display box, installation instructions included. Connection is made to channel selector. International TV Remote Control Co., 2310 S. La Cienega Blvd., Los Angeles 34, Calif. (TECHNICIAN No. 4-1)



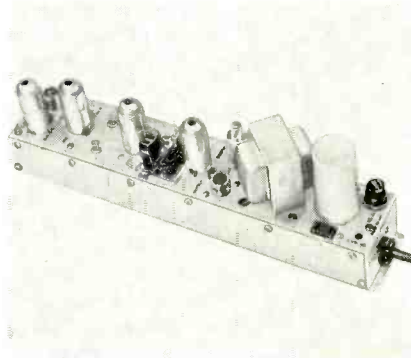
EV PAGING SPEAKER →

Model 847 CDP 12-watt Compound Diffraction Projector for high-efficiency-wide-range paging and similar applications has two coaxially mounted diffraction horns working from opposite sides of a single diaphragm. Slit diffraction gives 120° sound distribution at all frequencies up to 10,000 cps. Response is 250 to 10,000 cps. Impedance 16 ohms. Weatherproof, blastproof. Size: 11¾ in. high, 7¾ in. wide, 10¼ in. deep. List price is \$43.50. Net price is \$26.10. Electro-Voice, Inc., Buchanan, Mich. (TECHNICIAN No. 4-2)



BT MASTER TV CONVERTER →

Model MVC high channel to low channel VHF converter is crystal controlled, enables community TV installers to convert high channels at the antenna site to reduce signal loss in long lines. Unit supplies over 33 db gain thru a low-noise grounded-grid circuit. Up to 1.0 volt rms max. Output is available at either of two 75-ohm outlet fittings. A third 75-ohm fitting handles input from the high channel. Blonder-Tongue Labs., Inc., 526-536 North Ave., Westfield, N. J. (TECHNICIAN No. 4-5)



Walsco COLOR TV CHEATER →

New tool speeds servicing of color TV receivers by enabling technicians to make repairs, as well as use a high voltage probe, with complete safety when back of set is removed. This color TV interlock cheater blocks grounding of set's high voltage supply to protect against costly tube damage while work is in progress. Made of highly dielectric polystyrene, it sells for 59¢ dealer net and 99¢ list. Unit is easily applied. Walsco Electronics Corp., 3602 Crenshaw Blvd., Los Angeles 16, Calif. (TECHNICIAN No. 4-3)



UTC FILTER CHOKE

New filter choke design is effected in hermetic "H" series intended to provide reliability through low temperature rise and high insulation safety factors. Four inductance-versus-current ratings for each unit provide versatility in application. Ten units cover current values from 20 ma to 1250 ma. United Transformer Co., 150 Varick St., New York 13, N. Y. (TECHNICIAN No. 4-4)

Senco UNIVERSAL JUMPER

Universal jumper cord, designed to be plugged into the TV back after it has been removed, eliminates moving of furniture to get to the wall socket. It will fit any TV set as it has two male and two female connectors. A DPDT switch is incorporated to change over plugs, to prevent shock hazards and to turn the TV set off from the rear. Two handy power outlets are provided for a soldering iron and test equipment. The universal jumper cord, Model JC2, nets at \$1.95. Service Instruments Co., 171 Official Road, Addison, Ill. (TECHNICIAN No. 4-8)

Colman DROPPING RESISTOR

Universal 6-volt dropping resistor may, by using any one of several combinations of terminals, be used for installing a large variety of 6-volt accessories in the new 12-volt auto electrical systems. It works with 6-volt auto radios or other accessories drawing from 2½ amps to 9 amps. Colman Tool & Machine Co., P. O. Box 7026, Amarillo, Texas. (TECHNICIAN No. 4-6)

Futuramic VOM PROBE

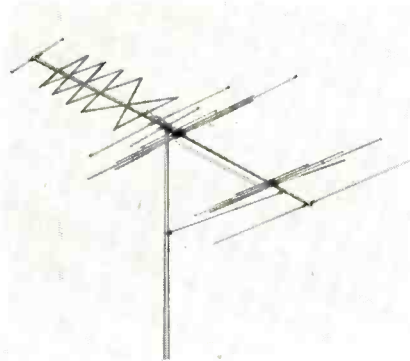
Signal-tracer probe permits checking of ac waveform voltages in horizontal and vertical oscillator circuits, drive voltage to horizontal-output tube, sweep circuit output, local-oscillator operation, sync-circuit signals, i-f output, audio signal, etc. Permits top-chassis checking of many ac waveform voltages in TV receiver. Model 262 probe is put into operation by simply plugging into 20 k/v VOM in place of conventional test lead. Futuramic Co., 2500 W. 23 St., Chicago, Ill. (TECHNICIAN No. 4-7)

More New Products
on pages 51, 52, 54, 57, 59

New Antennas & Accessories

JFD ANTENNA →

The Shut-Out Helix is custom-designed to reject co-channel interference on the channel specified by the serviceman. He simply orders by the channel number he wishes to shut-out. The antenna is factory pre-phased to eliminate rear signal pick-up on the desired channel; yet it will receive 2 through 13 off the front as a deep fringe antenna. The forward section employs the Poly-Phase dipole and helical design. JFD Mfg. Co., Inc., 6101-16th Ave., Brooklyn 4, N. Y. (TECHNICIAN No. 4-9)



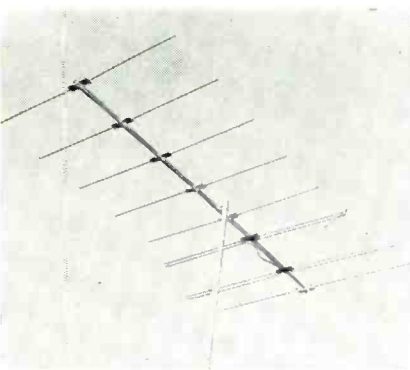
RMS INDOOR ANTENNAS →

Indoor TV antennas in 3 colors, ebony, ivory and mahogany, feature the Nevatip base. The GL-102 features a 6-position switch and 3-section brass dipoles, gold matching twin lead, lists at \$9.95. The GL-103 features aluminum dipoles and matching silver twin lead, lists for \$8.95, and is available in ebony, ivory or mahogany. The GL-104 lists at \$9.95 in ebony, ivory or mahogany, with matching gold twin lead to the brass dipoles. RMS, 2016 Bronxdale Ave., New York 62, N. Y. (TECHNICIAN No. 4-12)



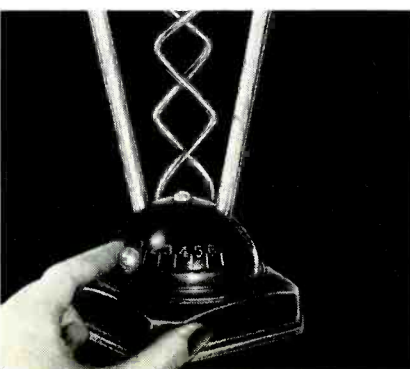
Clear Beam FM ANTENNA →

The Sonic-Tone FM antenna, Model D8FM, has been designed for high-gain FM reception. An average gain of 12 db from 88 to 108 mc is reported, with reception up to 150 miles. Impedances are matched for use with FM tuners in high fidelity equipment. Design is based on yagi principles and incorporates a tuned set of T match dipoles, 5 directors, and 1 reflector. Antenna is all aluminum and of snap-open construction. Clear Beam Antenna Corp., 21341 Roscoe Blvd., Canoga Park, Calif. (TECHNICIAN No. 4-10)



C-M INDOOR ANTENNA →

The Glide-o-Matic series 3700 provides clear indoor reception in strong signal areas. A 6-position, low-loss gliding switch helps eliminate snow, ghosts, and other problems. This type of switch is claimed to be more convenient to operate than the more conventional types, and provide high electrical efficiency. Brass models available with ivory, mahogany, and ebony bases. Aluminum models available with ebony. Retail price \$9.95. Channel Master Corp., Ellenville, N. Y. (TECHNICIAN No. 4-11)



NE AUTO ANTENNAS

Additions to the line include 4 new Tenna Twin Kits containing basic antennas plus special contour adapters for various makes of cars; fiberglass antennas in 3 popular colors (red, blue and green); rear-fender mounting kits and rear-fender contour adapters for late-model cars of all makes; flexible red fiberglass whip antennas; twin antennas finished in simulated gold fiberglass; and matching gold-finished antenna base mounting accessory. Nat'l Electronic Mfg. Co., 186 Granite St., Manchester, N. H. (TECHNICIAN No. 4-16)

S-R ROOF MOUNTS

Patented roof mountings which have the walk-up-Drop-Lock feature enable the installation man to walk antenna mast from horizontal to vertical position, without removing and replacing bolts or nuts which hold mast socket. In vertical position, this device allows mast to drop and lock securely, freeing technician for the tightening of holding bolts and nuts and guying of the mast without help. South River Metal Products Co., Inc., 377-379 Turnpike, South River, N. J. (TECHNICIAN No. 4-13)

Captain UHF ANTENNA KITS

UHF antenna kits are offered in two series. The CR-1 series includes an all-aluminum, back mount, corner-reflector antenna. The CR-3 series offers a low-cost, chrome plated steel antenna. Standard accessories including mast, UHF twin-lead wire, guy wires, guy clamp, lightning arrestor, and a choice of three types of mounts is offered. Kits are also produced with antenna, accessories and hardware as specified by distributor or dealer. Medal Mfg. Co., Sharon, Penna. (TECHNICIAN No. 4-15)

Tescon FRINGE ANTENNA

The Super Scanner features high gain with flat response from Channels 2-13. A new phasing method provides increased performance with equal efficiency on both high and low bands, superior high and low directivity. Design eliminates minor lobes from sides and rear. Top quality aluminum is used throughout, well-braced for mechanical efficiency. Lists for \$34.95. Tescon TV Products Co., Springfield Gardens, N. Y. (TECHNICIAN No. 4-14)

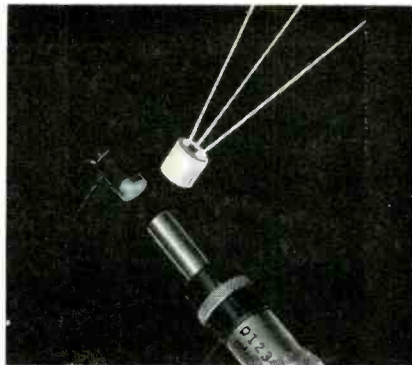
For more technical information on new products, use Inquiry coupon on page 52

New Electronic Components

Int'l. RELAY RECTIFIER



A sub-miniature selenium relay rectifier to energize dc relay coils, type 60-9267, is a full-wave center-tap rectifier, but may also be used as a half wave and "back wave" rectifier combination for compact relay power supply. It is rated for 66 v maximum ac input and will deliver 22 ma dc as center tap or 11 ma as half-wave in an ambient temperature of minus 50°C to plus 100°C. Component features high reliability. International Rectifier Corp., Product Info. Dept., El Segundo, Calif. (TECHNICIAN No. 4-26)



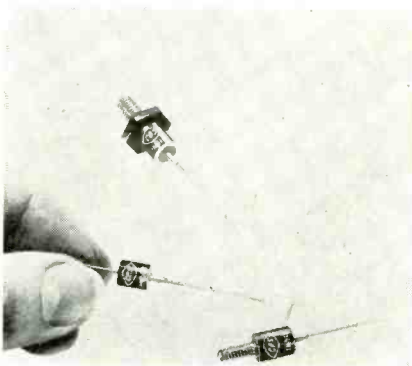
C-D MOTOR CAPACITORS

Types KNT and KXT are high-capacity ac motor capacitors. Type KNT is encased in a no-seam, solderless container. Type KXT comes in a slim, extra-deep-drawn, no-seam case. Both types are for motor-running applications in split-phase motor circuits such as in air conditioning and refrigeration equipment, voltage regulators, fan motors, business machines. They may be used also in power-factor improvement and general ac applications. Industrial Sales Div., Cornell-Dubilier Electric Corp., South Plainfield, N. J. (TECHNICIAN No. 4-28)

CBS POWER RECTIFIERS



Types 1N1503 through 1N526, feature large power handling capacity for their size, are capable of operating with extremely high reverse voltages and low reverse currents. The smallest unit is capable of handling 1/3 amp without additional heat radiator, and features pigtail construction. The second features screw-type mounting and is capable of carrying 1 amp. The third has a hex base screwstud mounting and is capable of handling 1 1/4 amp. CBS-Hytron, Danvers, Mass. (TECHNICIAN No. 4-25)



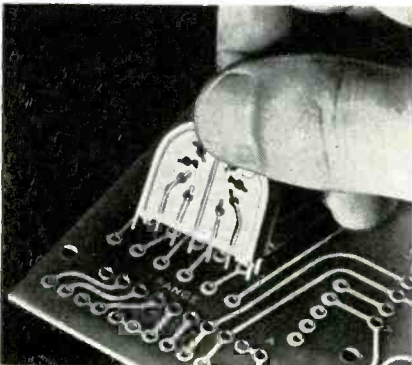
Acme PULSE XFORMERS

A new series of pulse transformers makes use of a solid ferrite core in a toroidal winding. Connections are made to a 9-pin base. These units are designed for blocking oscillator and coupling circuits, wherever a 9-pin socket can be located, feature small size and light weight. Acme Electric Corp., Cuba, N. Y. (TECHNICIAN No. 4-31)

Aerovox TUBE SOCKETS



Right-angle tube sockets provide marked reduction in height and depth of printed-wiring assemblies. The sockets are equally adaptable to hand- or machine-insertion methods. Terminals slip into printed-wiring holes for dip soldering. Available in 7- and 9-pin sockets and 4 versions: Type A for general-purpose; Type AX for extra rigidity; Type B, same as A with tube shield; and Type BX, same as AX with tube shield. Pacific Coast Div. of Aerovox Corp., 2724 South Peck St., Monrovia, Calif. (TECHNICIAN No. 4-27)



Ram FLYBACKS, COILS

The X128 is an exact replacement for RCA flybacks 78201, 78810, 79145, 78736, 79870 and 100860 (82 chassis and 194 models). The X129 replaces Admiral numbers 79C60-2, -3, -4, and -5 (16 chassis and 42 models). Yoke Y90F12/47 has horiz. and vert. inductance respectively of 12 and 47 mh; and horiz. and vert. resistance of 15 and 43 ohms. Y90F19/43 has horiz. and vert. inductance of 19 and 43 mh; and horiz. and vert. resistance of 30 and 41 ohms. Ram Electronic Sales Co., S. Buckhout St., Irvington-on-Hudson, N. Y. (TECHNICIAN No. 4-30)

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IRC POTENTIOMETER

Known as Type 2W, this variable wire-wound control provides maximum adaptability to meet rheostat and potentiometer applications within its power rating (2 watts). The deep housing is designed to provide good heat dissipation, accurate location of terminals, true location of bushings and greater rotational accuracy. In addition, the cover has been so styled that the control is, for all practical purposes, dust proof. International Resistance Co., 401 North Broad St., Philadelphia 8, Penna. (TECHNICIAN No. 4-29)

Col-R-Tel Converter

(Continued from page 43)

constant amplitude signal to the cathode of the amplifier tube V2A. The plate circuit of this tube is tuned to 3.58 mc by the "Color-Lock" control L3 and C8. The signal is then fed to the grid of V2B which serves as an amplifier and limiter to maintain constant signal across the phasing coil L2, which is tuned to 3.58 mc.

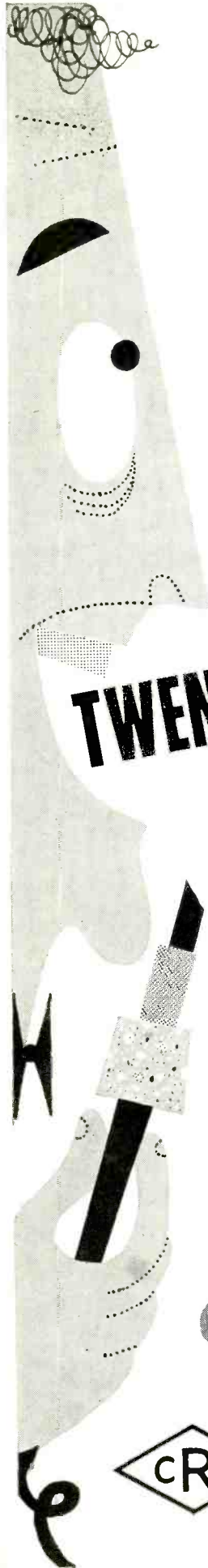
A phase shifting network consisting of R11, C17, R12 and C18 is connected across the secondary of L2. These values are selected to produce three voltages at the plates of the diodes in V3 that have a phase difference of approximately 120°. These diodes are biased to cutoff by 55 volts positive, and conduct only during the time that this voltage is grounded by the contacts on the scanning wheel commutator.

Color Selection

As the bottom outer edge of each color segment of the scanning wheel moves about 1 in. past the center of the picture window, its corresponding contacts should close, thereby selecting the proper phase signal for its particular color to be applied to the grid of chroma detector V4. The grid of V4 is tuned to resonance by L4 and C21. This signal, when mixed with the chrominance signal fed into grid 1 of V4, combines to produce a signal of proper phase and amplitude that, when mixed in the picture tube, produces the desired color picture.

The series resonant circuit L5-C2 or L7-C32 in the plate of V4 is tuned for maximum attenuation of the 3.58-mc signal. V5A serves to amplify the chrominance signal. The smear filter reduces the loading of the video output at frequencies below 3 mc, and prevents smear in the black and white picture.

In use, the converter does not take advantage of the full screen size made possible by 17-in. and larger TV receivers. Reduction of size to fit the picture window of the converter, once set at the time of installation, is achieved by a switch on the control unit whenever the converter is in use. This does not interfere with the viewing of normal size pictures during black and white reception. For further details on installation, adjustment and service, see Circuit Digest No. 264 in this issue. •



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Latest Test Instruments

B&K TUBE TESTER-STAND →

A floor stand for use with the Dyna-Quik Model 500 tube tester makes a complete, one-piece tester and vendor. The "500" tests over 95% of all popular TV tubes for mutual conductance, shorts, grid emission, gas content, leakage, and life expectancy. This, plus technical knowledge, competes successfully with "do-it-yourself" units in general stores now selling tubes to public. Stand may be purchased separately at \$89.05 net. B&K Mfg. Co., 3726 N. Southport Ave., Chicago 13, Ill. (TECHNICIAN No. 4-17)



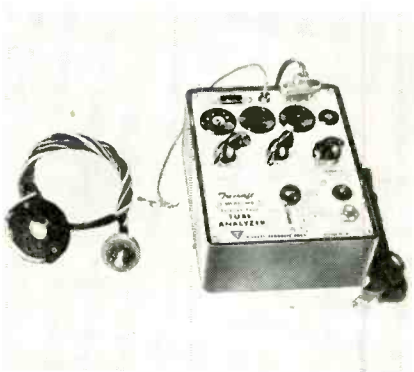
Hickok GENERATOR →

Model 295X microvolt and crystal-controlled generator is designed primarily to service receivers in the mobile and aircraft field. Sensitivity, selectivity and frequency of a receiver can be determined with accuracy. Microvolt Generator is an accurate microvolt source from 125 kc to 175 mc continuous on fundamentals. Crystal Oscillator from 400 kc to 20 mc on fundamentals and controlled harmonics up to 250 mc. Hickok Electrical Instru. Co., 10523 Dupont Ave., Cleveland 8, Ohio. (TECHNICIAN No. 4-19)



Tricraft TUBE CHECKER →

Model 200 Tube Analyzer is for daily use in the service kit. Checks all standard octal, loktal, 7, and 9-pin miniature tubes for emission, gas, shorts, opens, microphonics and filament continuity (also picture tubes). All elements are checked independently; no elements are tied together during test. It is claimed to be obsolete proof; no circuit changes are necessary to check new tubes as they are developed. Dealers net, \$32.95. Tricraft Products Corp., 1335 N. Ashland, Chicago 22, Ill. (TECHNICIAN No. 4-18)



Vis-U-All TUBE TESTER →

Model V100 (dynamic mutual conductance type) is built into a standard tube and tool case, checks over 400 tubes, including most used in current sets. The case has room for over 120 tubes, plus space for tools and a meter, is priced at \$99.50. The tester is available separately. Model V10 is set into a cabinet with fluorescent lamp, slanted shelves at \$149.50. The meter-case version is reported to be very helpful for home calls. Vis-U-All Corp., 311 East 49th St., Chicago 19, Ill. (TECHNICIAN No. 4-21)



Weston METER ADAPTER

A plug-in adapter greatly extends the use of Weston Model 749 Miniature AC Clamp Volt-Ammeter. This compact adapter has plug receptacles on either side; one of which reduces the scale range of the Model 749 by a factor of 10, permitting low current measurements. The receptacle on the other side is for reading the ampere scale directly (1:1). Weston Electrical Instr. Corp., 614 Frel-inghuysen Ave., Newark 5, N. J. (TECHNICIAN No. 4-20)

Du Mont OSCILLOGRAPH

Type 350, in the low-price range, offers identical direct-coupled high-gain X and Y amplifiers, and amplitude calibration on both channels. Stability is achieved by an internal self-regulating power transformer. Push-button amplitude calibration on both X and Y channels permits accurate quantitative measurements. The Type 5ADP crt offers excellent spot size, high light output, and excellent vertical sensitivity. Its flat-faced plate simplifies measurements. Allen B. Du Mont Labs, Inc., 750 Bloomfield Ave., Clifton, N. J. (TECHNICIAN No. 4-22)

Vidaire CRT REJUVENATOR

The Vitalyzer Model VL-55 crt short remover and rejuvenator can fit into the pocket or tool box. By just plugging into the crt and the low voltage rectifier tube socket of the TV set and flipping a switch, the Vitalyzer will remove cathode-to-filament and cathode-to-grid shorts and also rejuvenate the weak picture tube. Vidaire Electronics Mfg. Corp., Lynbrook, N. Y. (TECHNICIAN No. 4-23)

EMC OSCILLOSCOPE

Color TV oscilloscope model number 601 features full 5-mc bandwidth, positioning controls to provide instantaneous trace positioning without bounce or overshoot, push-pull vertical amplifier with sensitivity of .02 volts per inch, retrace blanking amplifier, 2-step compensated attenuator input, and phasing control. Price is \$117.90 or kit priced at \$70.90. Electronic Measurements Corp., 280 Lafayette St., New York, N. Y. (TECHNICIAN No. 4-24)

More New Products
on pages 50, 51, 52, 57, 59

For more technical information on new products, use inquiry coupon on page 52

Tough Dogs

(Continued from page 47)

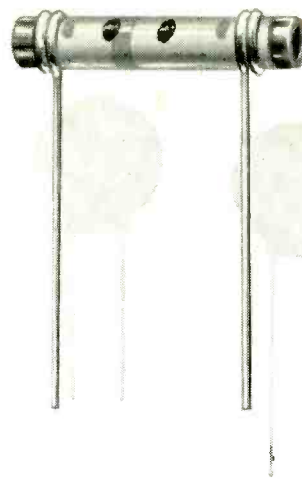
at this time, the linearity coil was beginning to get hot. Two hours later, after checking all components including the linearity coil, and all voltages, we were satisfied that everything was okay except for the fact that the boost voltage seemed to be lowered. It was also discovered that placing a piece of powdered iron slug in the linearity coil restored the drive to normal, but still did not produce a raster.

Finally, I brushed against the width coil in the course of probing, and it fell apart! Replacing this intermittent width coil cleared up the trouble. The explanation? Well, the defective width coil apparently detuned the horizontal-output transformer to such an extent that there was no step-up transformer action, and consequently no high-voltage, at what should normally have been the resonant frequency. Nor, for that matter, was boost voltage being properly developed under these conditions. And, with lowered boost, drive to the output tube was also lowered in this set. The linearity coil got hot because, with the lack of drive, there was excessive current passing through the output tube. The drive apparently could be restored to normal by placing a piece of iron in the linearity coil, even though this coil was not itself defective, because it was part of the same tuned secondary circuit along with the width coil, and could be used to retune this circuit toward resonance. What a circle of events!—*Joseph St. Johns, Baltimore, Maryland.*

SILVER AUTO ANTENNAS



Dick Morris (l), sales manager of Snyder Mfg. Co., and Gus Snyder, partner and production head, hold sterling silver plated auto antennas presented by employees. Antennas were 5 millionth produced by company.



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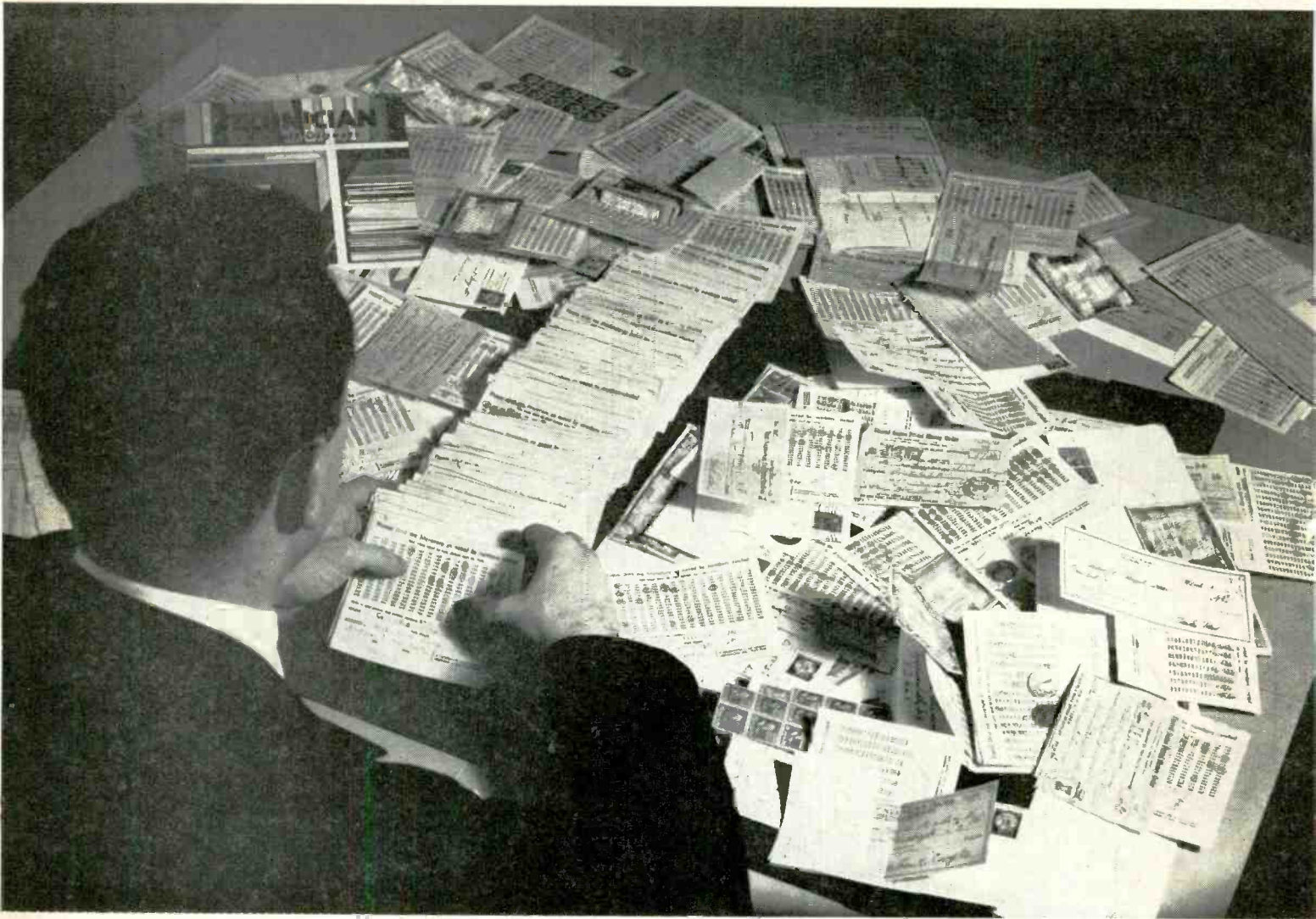
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CIRCULATION



Caldwell-Clements, Inc.,

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New Tubes & Transistors

CBS TRANSISTORS

Two PNP alloy-junction germanium transistors, types 2N180 and 2N181, are for general-purpose low-frequency use. They are suitable for medium power applications, such as in the output stages of portable radios. Typical applications: Class A amplifiers, driver for push-pull class B stage, microphone or phono preamplifier, and low-frequency flip-flop circuit. CBS-Hytron, Danvers, Mass. (TECHNICIAN No. 4-36)

Raytheon TV TUBES

The X155/6BZ8 is a heater-cathode medium-mu twin triode with a semi-remote cutoff for use in low noise VHF cascade operation. Pin basing same as 6BZ7. The 5T8 is a triple diode and high-mu triode. It is the series-string counterpart of the 6T8. The 6DQ6 is a heater-cathode power pentode for use as a horiz. deflection amplifier in 90° deflection systems. Pin basing same as for 6BQ6. Raytheon Mfg. Co., 55 Chapel St., Newton 58, Mass. (TECHNICIAN No. 4-39)

GE TV TUBES

Six more types have been added to the Service-Designed line, which now includes 20 types produced for optimum replacement service. 1X2B—alleviates filament pull-out, gives better emission. 6AL5—heater construction prevents flash burn-outs by initial surge current. 6BK7A—for maximum gain in fringe areas; safeguards against heater-cathode shorts and burn-outs. 6BQ7A and 6BZ7—greater heater reliability and freedom from shorts; improved fringe area reception. 6CB6—screen grid handles increased dissipation required in some circuits and prevents shorts. General Electric Tube Department, Schenectady 5, N. Y. (TECHNICIAN No. 4-40)

TI POWER TRANSISTOR

Type 970, a high-temperature silicon power transistor, will deliver 2½ watts in an ambient temperature of 100°C, when a pair of them is used operating in a class B circuit. Texas Instruments, Inc., 6000 Lemmon Ave., Dallas 9, Texas. (TECHNICIAN No. 4-35)

RCA BEAM POWER TUBES

Two new beam power tubes, 6CU5 and 12CU5, are intended particularly for use in the audio output stage of television receivers. The tubes, which are of the 7-pin miniature type, are similar except that the 12CU5 has a 12.0-volt/0.6-ampere heater having controlled heating time for series-heater string arrangement. High-power sensitivity and efficiency at low plate and screen voltages provide relatively high power output. RCA Tube Division, Harrison, N. J. (TECHNICIAN No. 4-38)

Sylvania INDUSTRIAL TUBES

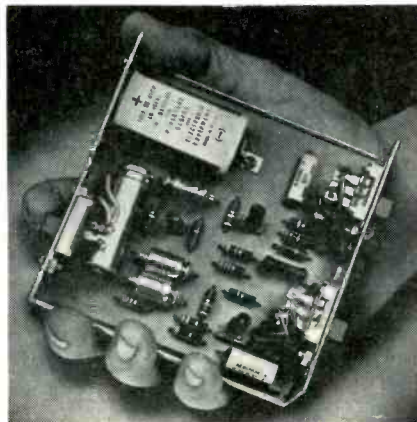
Fourteen new tubes include the 579B, a high vacuum rectifier for electronic air cleaners, classified as a diode with a heated cathode. It is used to supply low dc current at high voltages, to suppress high voltage surges and to supply the voltages necessary for electrostatic precipitation of vapor and dust. Four ignitrons, designated 5550/681, 5551A/652, 5552A/651, and 5553B/655, represent a comprehensive line to meet the requirements of every piece of welding apparatus in existence. High vacuum amplifiers 892 and 5736 (triodes) are used in broadcasting equipment and induction heating as amplifiers, modulators, or oscillators. Electronic Products Sales Dept., Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y. (TECHNICIAN No. 4-42)

RCA CONVERTER TUBES

9-pin miniature tubes 5CG8 and 6CG8 each contain a medium-mu triode and a sharp-cutoff pentode in one envelope. For use as combined oscillator and mixer tube in TV receivers with an i-f in the order of 40 mc. They also offer versatility to designers of AM-FM receivers. The pentode unit may be used in the AM section as a pentode mixer or as a triode-connected mixer depending on a signal-to-noise considerations. The triode unit of these tubes makes a satisfactory oscillator for either the AM or FM section. The 5CG8 is like the 6CG8 except that it has a 4.7-volt/0.6-ampere heater having controlled heating time for series-heater string arrangements. RCA Tube Div., Harrison, N. J. (TECHNICIAN No. 4-41)

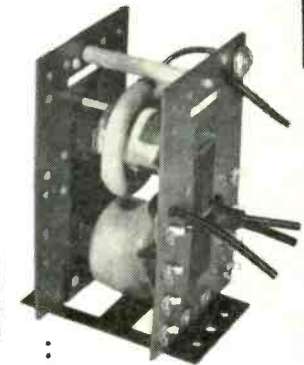
Fisher PREAMP-EQUALIZER

Model TR-1, believed to be the first all-transistor Hi-Fi product, can be used as a microphone or equalized phono preamplifier. Using 3 transistors and printed wiring, it is hum-free and non-microphonic. RIAA equalization is incorporated. 3 controls include a cartridge impedance selector to permit use



with all types of magnetic cartridges, including very-low level types, without a transformer; a phono-mike selector; and a level control. Price is \$24.95. Fisher Radio Corp., 21-21 44th Drive, L. I. City 1, N. Y. (TECHNICIAN No. 4-33)

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You too can depend on Vokar vibrators—for sure starts, longer life, silent operation. For all replacement jobs, buy Vokar Imperial or Quality Brand vibrators to be sure of satisfied customers.

Now is the time to stock up on 12-volt vibrators—ONLY TWO VOKAR IMPERIALS ARE NEEDED TO FILL ALL REPLACEMENTS!



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Unique Ad Ideas

• All too often, sales promotion, a most important element in the successful operation of a service shop, is neglected. Usually, either the shop does not advertise, or else it uses ads that fall short of selling the service as forcefully as it might.

However, there are some techs who put their imaginations boldly to work, coming up with ads of somewhat unique character. As with all unique projects, there is no proof of their suitability for other shops in different circumstances, but they should spark new ideas for your particular application.

The mildly sensational ad (with tongue in cheek perhaps?) by Acme Radio & Television in Chicago is illustrated here. It takes advantage of interest in uranium prospecting

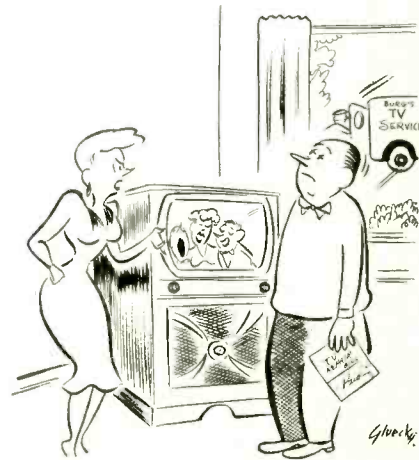
to call attention to the ad, and to sell service and geiger counters in the process

The second ad, used by John Burkitt's shop in Napanee, Ontario, Canada, is intended to compete with dealers who try to sell customers off servicing, and unnecessarily into the purchase of a new set. He reports that running this ad twice in local newspapers brought him more business than at anytime since the war. It reads as follows:

WARNING TO USERS OF RADIO and TELEVISION RECEIVERS

Burkitt's Radio and TV Service, Napanee, does NOT advertise for radio and TV repairs for the purpose of getting prospective buyers for new equipment. Many older models are better built and will give better service at lower cost than many cheaper newer ones.

Having been in the radio repairing profession SINCE RADIO BEGAN we have the manufacturers' service data on practically every radio and television receiver made in Canada, no matter how old. Patronize a shop where service and repairs are a business, not a sideline. •



"You might've at least pretended we weren't satisfied to get a little something knocked off our bill."



Hurry
Limited
Offer

Want to be a Millionaire

With every TV repair call we will survey your property

FREE with a
RCA GEIGER COUNTER
for Radio Active
URANIUM!

PU 5-4191

Headquarters for
RCA Geiger Counters

ACME Radio
& TV

27 East 112th Pl.
Between State and Michigan

Motorola HANDIE-TALKIE

New line of transistorized portable two-way radiophones, delivering up to 20 times conventional r-f power output, includes models with output ratings from 1 to 8 watts. Coincident with increased output is a decrease in weight and size. Smallest model weighs 7 lbs., 9 oz. complete. A full 8 watts is realized from a model weighing only 15½ lbs. Dry-cell, wet-cell and 117 v packs are interchangeable. The wet-cell pack employs lifetime, rechargeable nickel-cadmium cells and includes operation from 6 and 12 volt vehicular batteries. Motorola Communications & Electronics Div., Technical Infor. Center, 4545 W. Augusta Blvd., Chicago, Ill. (TECHNICIAN No. 4-51)

Stackpole SNAP-IN CONTROL

A self-supporting, snap-in variable composition resistor for printed wiring, known as the LR-70, measures only 57/64" dia. and stands 7/8" off the mounting board. It is supported by four legs—the three regular voltage taps, and a larger case ground leg. No mounting hardware is required. The LR-70 is rated at .75 watt for values above 10,000 ohms, and .50 watt below 10,000 ohms. Stackpole Carbon Co., St. Marys, Pa. (TECHNICIAN No. 4-44)

Tru-Ohm RESISTORS


Blue X-60 resistors are wound on a fibre glass core. Wire leads project axially from the resistor body. The ceramic case is of square cross section and the inserted resistance element is sealed from moisture by a silicone cement. They are offered in 5, 7 and 10 watt sizes. Tru-Ohm Products, Div. of Model Eng. & Mfg. Co., 2800 N. Milwaukee Ave., Chicago, Ill. (TECHNICIAN No. 4-45)

TrolMaster ADAPTER

Long-Shank adapter is available for TrolMaster, the tool that cleans and lubricates controls without removing chassis from set. With the adapter, TrolMaster can be used on controls with shafts up to 7 inches long. User's price for TrolMaster is \$3.95 and, for the Long Shank adapter, \$.85. Recommended for use with TrolMaster is Kleontrol Magic Solvent. This non-inflammable fluid will not harm wood, metal or acetate surfaces or finishes. User's net is \$1.95 per pint. R-Columbia Products Co., Inc., 305 Waukegan Ave., Highwood, Ill. (TECHNICIAN No. 4-57)

Xcelite PLIERS

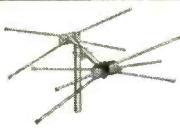










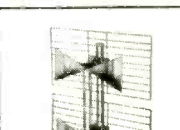
New transverse cutter plier no. 62 has the compactness of needle-nose pliers plus narrow end nippers for flush or other cutoff work in miniature and sub-miniature chassis. A spring return permits using just the thumb and a finger in close quarters too small for the hand. Xcelite, Inc. Orchard Park, N. Y. (TECHNICIAN No. 4-49)



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Cover the Mass Market—109 Styles Available
For Every TV Installation

WRITE for your TELCO Catalog or ask your supplier. FREE!

			
TELCO ALL-STAR CONICAL A-210	TELCO MASTER LINE CONICAL A-8700	TELCO SCOUT 1 CONICAL A-130	TELCO MITY-V A-9098
			
TELCO "STANDARD" GOLDEN HALO A-9000	TELCO CONICAL UHF- VHF BOW TIE A-8981	TELCO WINDOW CAN-TENNA A-9058	TELCO "KING SIZE" GOLDEN HALO A-9020
			
TELCO GOLDEN SWITCH-O-MATIC A-8140	TELCO HI-LOW DIPOLE A-250	TELCO UHF 16-ELEMENT YAGI A-325	TELCO UHF DOUBLE BOW TIE A-9004

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You have an extra store wherever you put this self-service tester.

TO FIND OUT:

- How to put a tester in a store
- How many tubes to stock and types
- How to buy and mark up tubes
- How easily this rugged tester works
- How to finance a "route"

Mail this ad or a postcard now to address below.

*Names and addresses of full-time servicemen earning this income with this tester on request.

TV 2C-5 Console Model
Complete \$189.50 at Jobbers.

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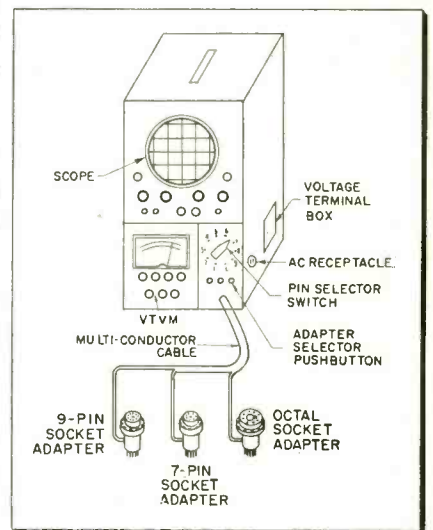
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CAPACITOR MANUFACTURER

Ideas for Test Equipment 2

Among the interesting combination of ideas for test instruments submitted by readers to TECHNICIAN's Test Equipment Contest is a combined oscilloscope and VTVM which enables the user to study many circuit functions from the top of the chassis.

This is accomplished by a special arrangement of 9-pin, 7-pin and octal socket adapters which plug into the chassis socket. The tube is then plugged into the adapter. Connected to each of the adapter pins is a cabled lead running to the scope-VTVM through a 10-position selector switch.

For example, suppose the voltages and waveforms at the pins of some octal tube is desired. The tube is removed, the adapter plugged in its place, the tube plugged back in the adapter, the octal adapter selector pushbutton depressed, and the pin selector switch rotated to the respective pins at which a measurement is required.



To use the scope and VTVM in a conventional manner, the pin selector is set at the tenth position ("L" for leads) and testing proceeds in the normal manner, with the adapter cable either unplugged from the instrument or not.

This instrument is not limited to the one representation illustrated. The adapter arrangement may be limited to a scope or VTVM. On the other hand, additional adapters to provide more comprehensive circuit tracing (loctal and pix tubes, diodes, transistors and other adapters may

be added). This whole idea is not entirely new, but readers do seem interested in this kind of instrument.

Other secondary features might include an ac power receptacle, and a small terminal box with various voltages tapped off from the internal power supplies. In an emergency, if say 6 volts are needed quickly, leads could be clipped to the proper built-in terminals in the box.

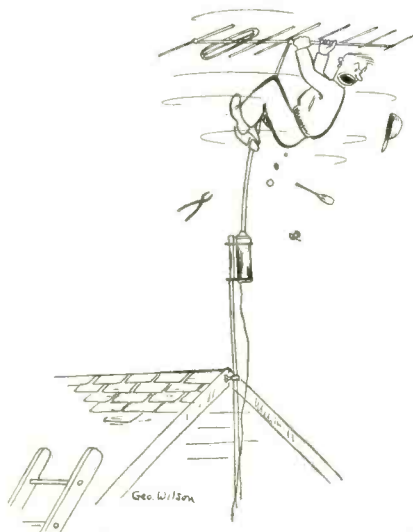
Scope for Auto Radio

(Continued from page 45)

bined with the i-f response curve, although a separate r-f curve may be taken from the mixer output, using a rectifying probe and a very sensitive scope.

With the numerous auto-sets using permeability or "slug" tuners, FM alignment is almost a must to obtain correct tracking over the entire band. Try aligning the capacitive trimmers at the low end of the band, around 600 kc; and make the slug adjustments at the high end, around 1300-1400 kc. You'll probably be surprised at the increased sensitivity and selectivity. With capacity-tuned sets using padders, adjustment with the scope is far faster. The FM signal will be visible on the display, and can easily be "walked" over to its maximum position, saving much tedious "rocking" of the dial.

The intelligent use of the oscilloscope will solve many of the problems that beset the auto-radio service technician. •



"Hey! Hey down there . . . Get that kid away from that rolok! . . . Hey . . ."



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 <p>TELCO SNAP-IN CHIMNEY MOUNT Fits masts to 1 3/4" dia. No. 8610</p>	 <p>TELCO TV PLASTIC PLIERS Rugged; insulated, shock-proof. No. 8387</p>	 <p>TELCO 300-OMM LEAD-IN TOOL Slot, strip, cut; crimp lugs. No. 9220</p>	 <p>TELCO DUPLEX LINE CONNECTOR Connects two leads to TV set. No. 8221</p>
 <p>TELCO GALV. STEEL ANTENNA MASTS Hot dipped; 1 1/4" OD x 5' crimped end. No. 9013</p>	 <p>TELCO DELUXE UNIVERSAL SWING BRACKET All aluminum; fits 1 1/4" masts. No. 8000</p>	 <p>TELCO 6-PACK LIGHTNING ARRESTORS Six for quick, handy use. No. 8642-6P</p>	 <p>TELCO 2-SET TV COUPLER Couple two sets to one antenna. No. 8920</p>

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FOR COLOR TV!

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\$695.00
Shpg. Wt. 27 lbs.

Heathkit TV

SWEEP GENERATOR KIT

ELECTRONIC SWEEP SYSTEM

② A new Heathkit sweep generator covering all frequencies encountered in TV service work (color or monochrome). FM frequencies too! 4 Mc — 220 Mc on fundamentals, harmonics up to 880 Mc. Smoothly controllable all-electronic sweep system. Nothing mechanical to vibrate or wear out. Crystal controlled 4.5 Mc fixed marker and separate variable marker 19-60 Mc on fundamentals and 57-180 Mc on calibrated harmonics. Plug-in crystal included. Blanking and phasing controls — automatic constant amplitude output circuit — efficient attenuation — maximum RF output well over .1 volt — vastly improved linearity. Easily your best buy in sweep generators.



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\$495.00
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All Units Are TV Receivers
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Chassis 2242: Models 520M15, 520M16, 520M17.
Chassis 22A2A: Models 520M11, 520M12, Chassis 22M1: Models 121M10, 121M11A, 121M12A, 121M11, 121M12, 121K15A, 121K16A, 121K17A, 121K15, 121K16, 121K17, 221K45A, 221K46A, 221K47A, 221K45, 221K46, 221K47. Chassis 22Y1: Models 321M25A, 321M26A, 321M27A, 321M25, 321M26, 321M27, 421M15A, 421M16A, 421M15, 421M16, 421M35, 421M36, 421M37, 521M15A, 521M16A, 521M17A, 521M15, 521M16, 521M17

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Circuit Digest No.
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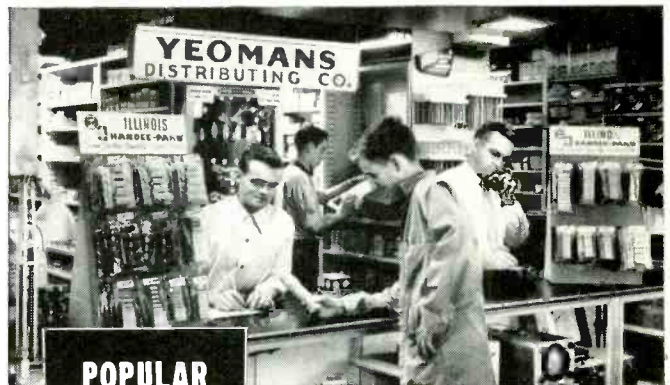
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plications), just as the voltage difference is large between grid and plate of a tube. The base resembles the grid of the typical triode vacuum tube, while the collector tends to function as a plate. The emitter tends to act like a cathode—one might think of the *emission* of electrons by the cathode as a similarity which is easy to recall.

Regardless of whether the positive terminal of the battery is grounded or not, there will be a voltage difference between the collector and the other electrodes. In NPN units the collector will be at a different voltage level than for PNP transistors. Contrast Fig. 4 with Fig. 5 (h-f stages). Also compare the audio stages with the converter and the i-f stages in Fig. 4. Note that the last audio collector is at zero volts—relatively *negative* chassis potential—while the other electrodes of these transistors are at a positive potential.

For the NPN type observe that the collector is at a *positive* potential higher than the near-chassis voltages of both base and emitter—a reversal of action.

Now the circuit of Fig. 5 employs PNP transistors in all stages. Its battery has its positive grounded. Here we have again the collectors of all transistors at a more negative value than the emitters and bases. The chassis reference point is merely shifted, just as some cathode ray oscilloscopes run the crt at a high negative voltage to the chassis for the second anode voltage. It makes no difference; this is merely a design convenience.

The voltage differences between the electrodes of each stage is an important step in the voltmeter testing procedure. The novice on transistor radios will find that this is a very helpful idea to remember, which will take care of many of his troubles. Due to the very compact size of many such miniaturized sets, it is advisable to slip a piece of spaghetti or other insulation over the test prod; you can make a hot box out of a transistor very easily by letting an exposed test prod slip. You may have to buy a new transistor as well as make other trouble for yourself.

Bleeder networks to fix voltage levels are marked on several resistors of the circuits of Fig. 4 and Fig. 5. These set a definite potential

level just as some screen and plate voltages are set in tube type radio sets and television receivers.

Make sure that the voltages at the junction of such bleeder resistances with the other resistors of the circuit are exactly what the schematic diagram calls for. This is very important. These fixed voltages must be held accurately and, if they are not what they should be, the technician should make them so with new parts at once.

Unless specifically stated otherwise in the service literature, make all tests with the volume control turned on full, and with the set detuned from any station. A station signal input may alter the voltages on the i-f stage controlled by AVC action: the first i-f, in most jobs. Sound input to the audio will cause its voltage to vary, since transistors are primarily current-operated devices drawing an appreciable relative current through their resistive and transformer loads. The variation from no-signal to strong-signal total current may be from 8 milliamperes to 50 milliamperes, with considerable effect on the static potential measured in the set.

The static voltage test should be made with a voltmeter having a sensitivity of at least 5000 ohms per volt. This value is exceeded by all vacuum-tube voltmeters and most of the volt-ohm-milliammeters in the average service shop. The low impedance and low resistance values of most transistor circuits do not require the higher sensitivity of vacuum tube circuits, as a general rule.

The total current drain test should be made with the lowest possible range of the milliammeter in order that the minimum meter resistance be inserted in series with the supply voltage. •



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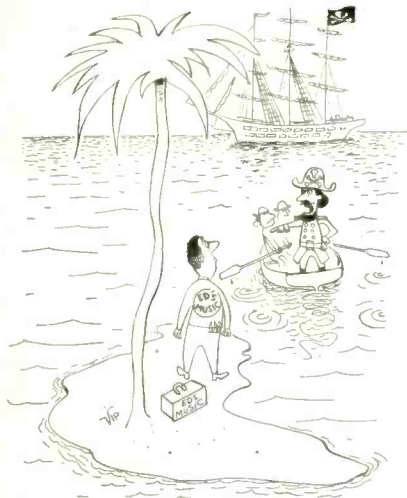
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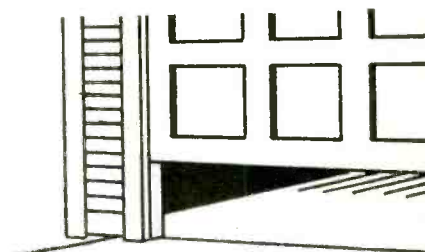
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6AK5	.75	7A6	.80	50A5	.70
6AK6	.80	7A7	.85	50B5	.70
6AL5	.60	7A8	.80	50C5	.70
6AL7GT	1.65	7AG7	1.00	50L6GT	.65
6AM4	1.55	7AH7	1.00	50M6GT	.90
6AMB	1.15	7B4	.80	50V6GT	.80
6AN4	1.50	7B5	.70	50V7	.80
6AN5	.50	7B6	.80	70L7GT	1.95
6AN8	1.20	7B7	.80	80	.65
6A05	.70	7B8	.90	117L7GT	2.50
6A06	.60	7C5	.80	117N7GT	2.00
6A07GT	1.20	7C6	.80	117P7GT	2.00
6AR5	.75	7C7	.85	117Z3	.70
6AS5	.75	7E7	1.20	117Z4GT	1.15
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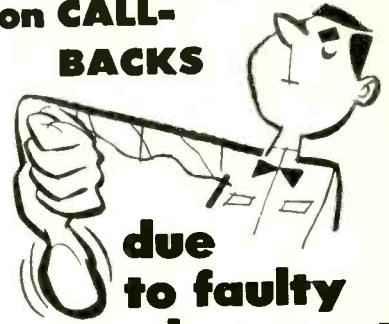
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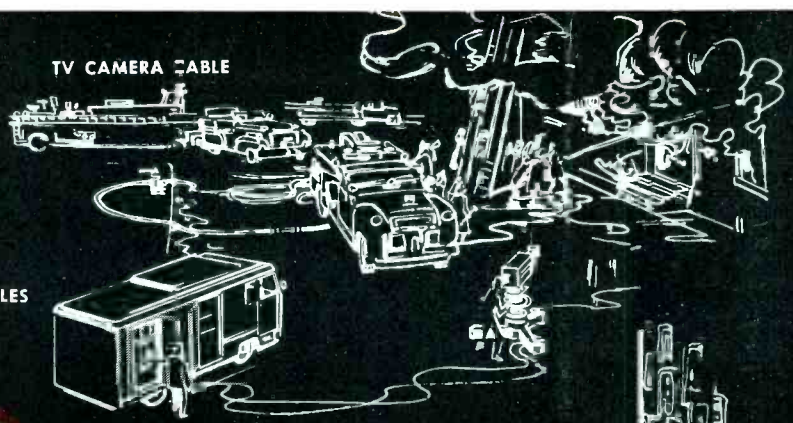
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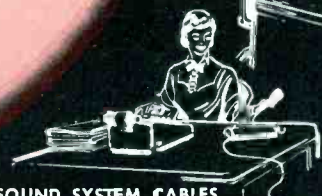
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