

ELECTRONIC TECHNICIAN

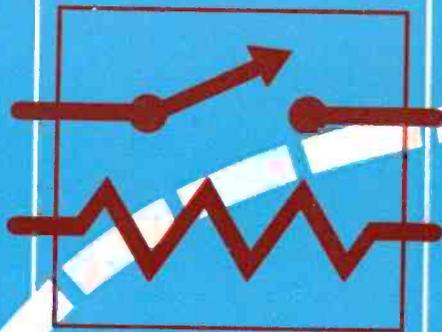
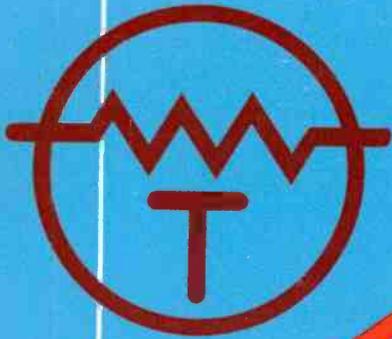
Including 16 pages of
Circuit Digests

LINE CURRENT — AMPERES

WITHOUT Surge Protection →

WITH Surge Protection →

A J DIGLIO
94 SLEEPING GIANT DR
HANDEN 18 CONN
TNS-59N AI 7E458



SURGE

PROTECTION
for Tubes

TIME — SECONDS

50¢

October • 1958

You are more apt to get
 the volume control you need
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 than from any other source

Whether you need a special exact duplicate control or a standard replacement carbon or wire-wound control, you are almost sure to find it at your IRC Distributor.

He carries the most versatile line of controls in the industry. He offers you better, more complete replacement coverage. He can supply an almost endless variety of combinations of resistance elements and shafts.

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Wherever the Circuit Says



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ELECTRONIC TECHNICIAN

Including
Circuit Digests

TELEVISION • ELECTRONIC • RADIO • INDUSTRIAL AUDIO

October, 1958

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FRONT COVER The initial current surge when a receiver is turned on can be a real tube killer. The sharp current peak can be held down and kept under control by any of a variety of tube surge protection devices which use the heat of the surge current to provide automatic current limiting. For details, see article starting on page 32.

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CIRCUIT DIGESTS

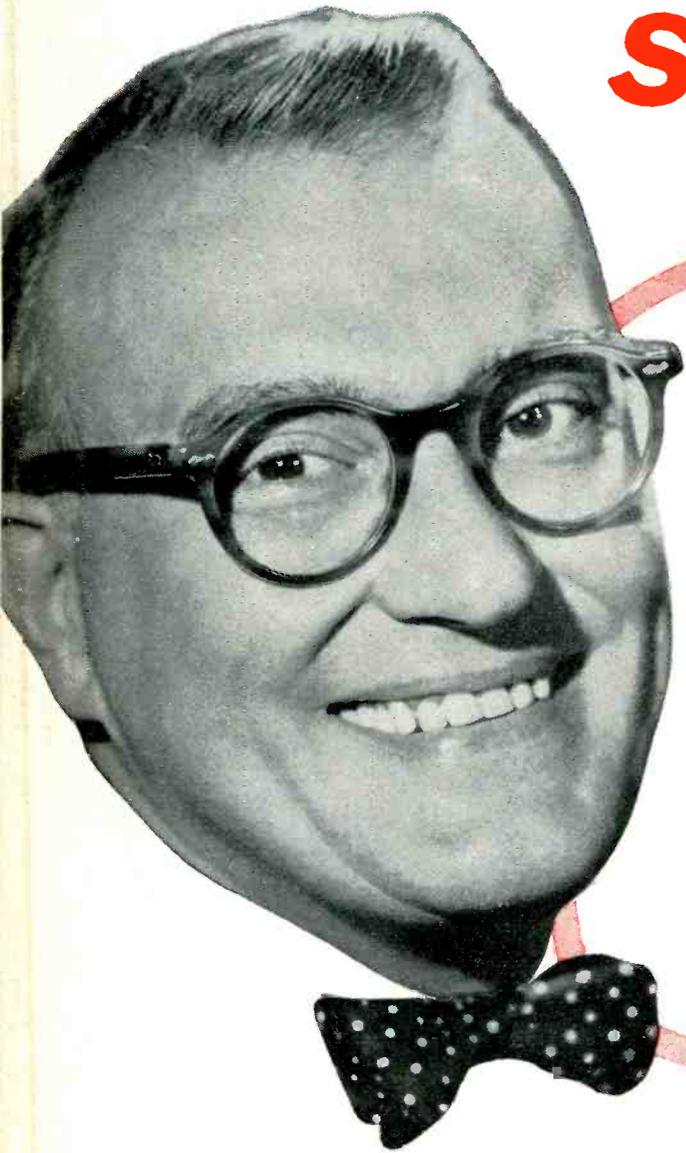
ALIGNMENT

- Turn user channel on
- Connect sweep generator shortest and most direct
- Apply -3 volts bias to
- Connect a detector and
- Adjust mixer plate coil
- Remove detector and
- Connect oscilloscope
- Adjust remaining thru

PARTS LIST

- C-124 - 170 ohm 500V ceramic
- C-125 - 210 ohm 500V ceramic
- C-126 - 3000 ohm 500V ceramic
- C-127 - 1000 ohm 500V ceramic
- C-128 - 1000 ohm 500V ceramic
- C-129 - 50 ohm 500V ceramic
- C-130 - 50 ohm 500V ceramic

CHANNEL MASTER **Sells Antenna**



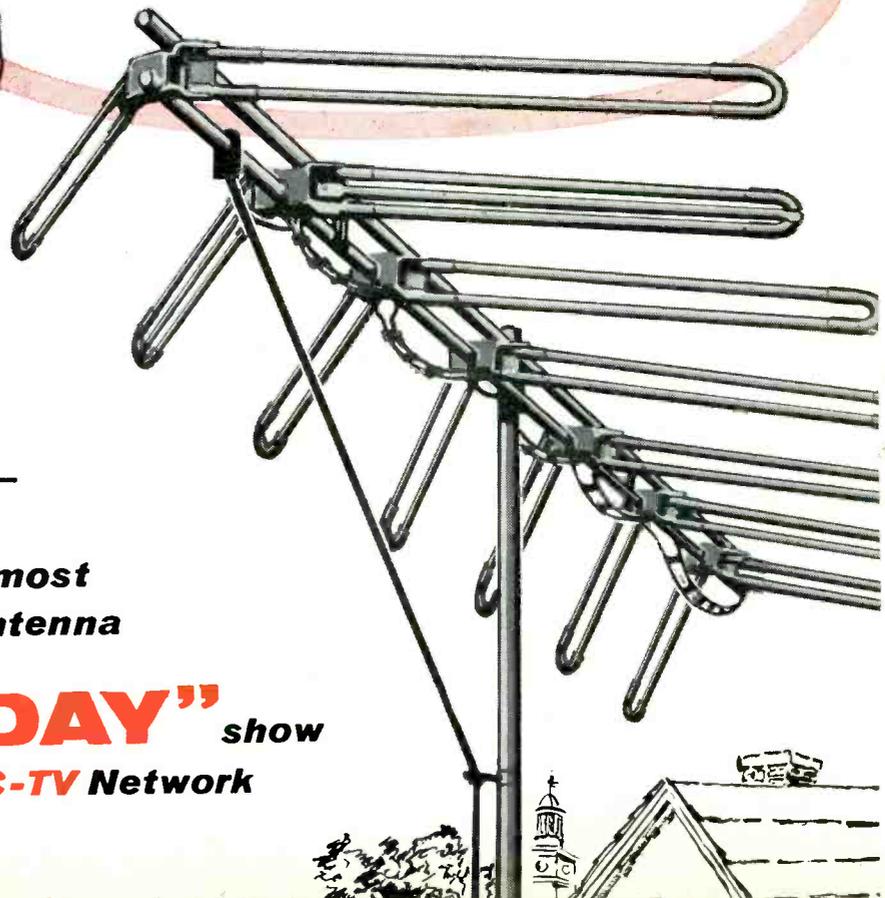
**Dave
Garroway**

TEAMS UP WITH THE

T-W

ON NETWORK TV

**One of America's
most persuasive**



nce—
t—
's most
antenna

DAY" show
BC-TV Network



AD BLITZ

Replacements

New
CHANNEL MASTER Campaign
in America's Largest
Circulation Magazines...

Puts new **LIFE** into your antenna business

POSTS your customers on the need
for antenna replacements

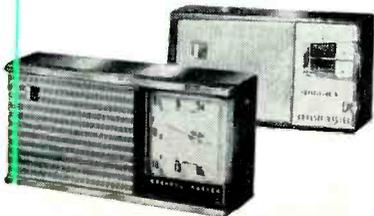
Gives set owners a **LOOK** at better
reception with the T-W antenna

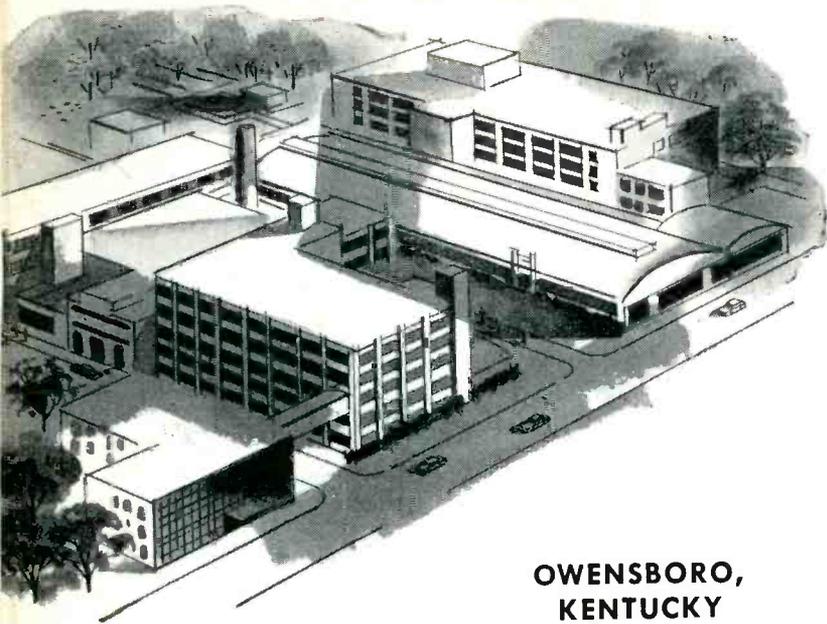
GUIDES prospects to your door
for an antenna check-up

Helps you **FARM** fertile new
fields of antenna profits

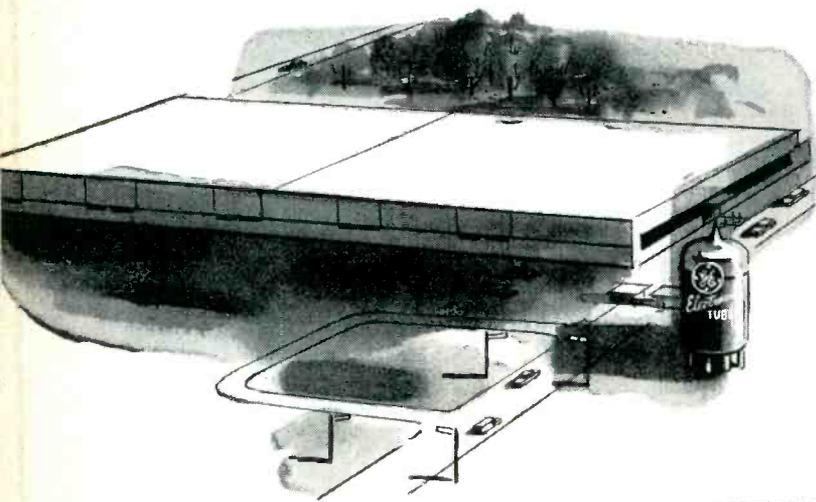
and now
CHANNEL MASTER
TRANSISTOR RADIOS

America's #1
RADIO Value

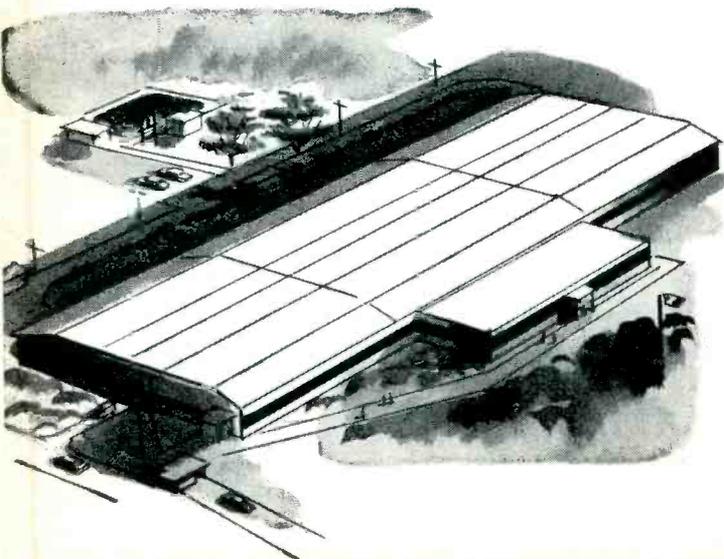




OWENSBORO,
KENTUCKY



ANNISTON, ALABAMA



BROAD NEW CUTS

FIRST IN TUBE MANUFACTURING FACILITIES!

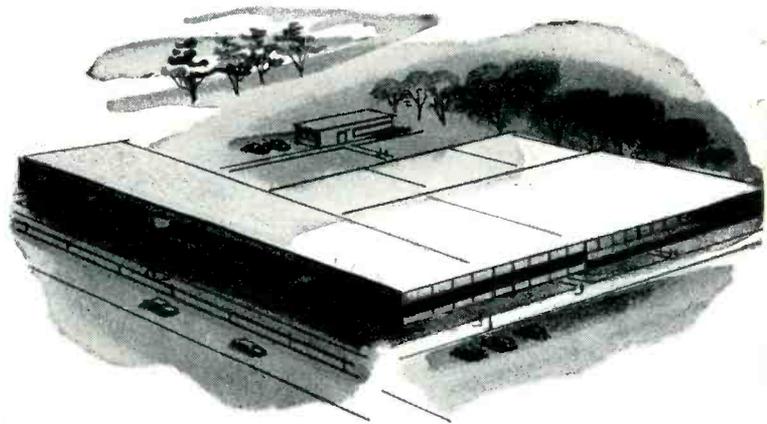
General Electric's four large and ultra-modern receiving-tube plants back up your replacement sales with a product that is uniform in high quality.

Pace-setting General Electric tube research and design go hand in hand with manufacturing and test facilities that are the most advanced in the industry.

"Snow White" cleanliness is found throughout. Lint-free workers' garments; filtered and conditioned air; floors cleaned many times daily—these help to make G-E Service-Designed Tubes the best, most dependable you can install.



TELL CITY, INDIANA



G-E SERVICE-DESIGNED TUBE PROGRAM YOUR CALLBACK TIME AND COSTS!

Over 1000 design, manufacturing, and test improvements add to the reliability of 70 General Electric types!

So that you will have fewer complaints and callbacks—so that your customers can enjoy still finer set performance—General Electric has increased the number of Service-Designed Tubes to 70. More than 1000 improvements have been made in these 70 G-E types. Their quality is outstanding. They are the most reliable tubes you can install in television receivers, regardless of make.

Yet they cost no more! They're completely interchangeable with other tubes. For no extra investment you can have their benefits—less complaint calls, your working time saved for profitable repair jobs, pleased customers. Check the list below! Then phone your G-E tube distributor! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Kentucky.*

*

*

*

The needs of both today's and tomorrow's TV sets are met by these 70 G-E Service-Designed Tubes. They outperform all others!

1B3-GT	3CB6	5EU8	6AU6-A	6CD6-GA	6EU8	12AT7
1H2	3DT6	5U4-GB	6AX4-GT	6CG7	6EW6	12AU7-A
1J3	4BN6	5U8	6BK7-B	6CG8-A	6J6	12AX4-GTA
1K3	4BU8	5V3/5AU4	6BN6	6CL8-A	6SN7-GTB	12BY7-A
1X2-B	4BZ6	5Y3-GT	6BQ6-GA	6CX8	6T8-A	12BQ6-GA
2AF4-A	5AQ5	6AF4	6BQ7-A	6CY5	6U8-A	12DQ6-A
2CY5	5BK7-A	6AF4-A	6BU8	6DN7	6V6-GT	12SN7-GTA
3BN6	5CG8	6AL5	6BZ6	6DQ6-A	7EY6	17AX4-GT
3BU8	5CL8-A	6AQ5-A	6BZ7	6DT6	8CG7	17DQ6-A
3BZ6	5EA8	6AU4-GTA	6CB6-A	6EA8	8CX8	19AU4-GTA

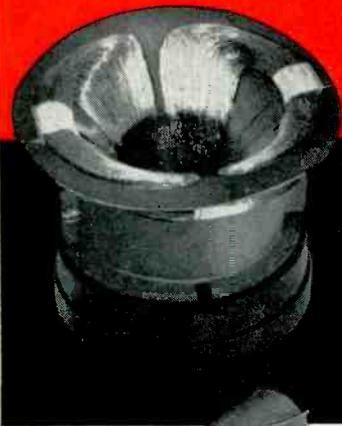
Progress Is Our Most Important Product

GENERAL  ELECTRIC

Mr. Service Dealer

PHILCO

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Your Philco Distributor has available for you a complete new line of universal parts that fit not only all Philco receivers but every competitive make and model. Eliminate your inventory problems and stock the one line of completeness . . . Philco.

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- Coils
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• Heavy-Duty Rotors • Star-Bright 20/20
Picture Tubes • Long-Distance Antennas •
Appliance Parts • Laundry Parts • Univer-
sal Parts and Accessories

Editor's Memo



It's surprising how many occupations are considered glamorous by folks not connected with the field. The people in a particular profession live too much with the realities of their work to hold any grand illusions.

There are individuals (but not editors themselves) who see the newspaper and magazine editor in a haze of glamour, conveying their thoughts to many thousands of people via the printed word. The truth is that while editorial glamour does not exist in reality, what does exist is more wonderful and more substantial. That is the remarkable and never-ending series of challenges offered to an editor to learn something new every day, to tell his readers about it, and to try to do a still better job in the current issue than the one before.

I for one wake in the morning and look forward with pleasurable anticipation to another day's work. If I were worth a fortune, I would still continue to do what I'm doing now, regardless of the occasional frustrations that crop up in every type of work.

And the electronic technician, believe it or not, he too is a glamour boy in a sense—certainly not to himself or his coworkers—but in the eyes of many non-technical beholders. After all, isn't there some sort of magic in masterfully delving into the innards of that complex enigma called an electronic circuit?

The consumer-beholder may not see the unglamorous long hours of work, straining with heavy chassis, squinting at schematics, etc, but he does see you tread where he fears to go.

Here is the important point: Electronic technicians should get satisfaction out of their work. Every new tough dog, irritating though it may be, should be greeted as a challenge to test your ingenuity and know-how. Each troubleshooting job is a chance to learn a bit more. And most attractive of all, electronics is changing and progressing as no other field is, offering so many diversified opportunities. The electronic technician can be delighted with new things constantly coming his way. Just think of those skilled trades where everything is so uninterestingly the same year after year. There's nothing boring about electronics.

So before you gripe too loud, consider your blessings and the observation: "I complained because I had no shoes . . . until I met a man who had no feet!"

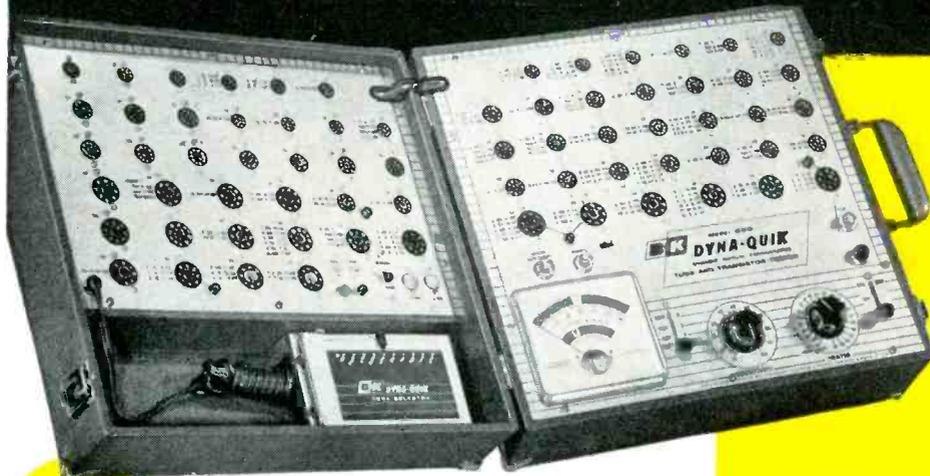
Al Foran

Simply by checking

all the tubes in the TV set with

B&K DYNAL-QUIK

YOU CAN INCREASE YOUR INCOME



\$50*
PER WEEK

*ACTUAL EXPERIENCE SHOWS
TV SERVICEMEN AVERAGE

2 extra tube sales per call
5 calls per day in
5 days equal \$50.00

**NEW
MODEL
650**

Fastest, Most Complete, Portable DYNAMIC MUTUAL CONDUCTANCE TUBE & TRANSISTOR TESTER

Checks over 99% of the tubes most widely used in television receivers, plus popular home and portable radio tubes. Tests over 500 tube types. Lists over 125 tube types, with settings, on socket panels for maximum operating speed. Complete listing in fast telephone-index type selector. Includes 16 spare sockets and sufficient filament voltages for future new tube types. Tests each section of multiple tubes separately for Gm—Shorts—Grid Emission—Gas Content—and Life. Provides instantaneous Heater Continuity check. Shows tube condition on "Good-Bad" scale and in micromhos. Special bridge assures automatic line compensation. No multiple switching—No roll chart. Includes pin straighteners. Transistor Tester checks junction, point contact and barrier transistors, germanium and silicon diodes, selenium and silicon rectifiers. Net, **\$169⁹⁵**

- Each Dyna-Quik Tube Tester completely tests each tube in seconds
- Eliminates substitution testing
- Shows customer true condition and life expectancy of tubes
- Sells more tubes right on-the-spot
- Cuts servicing time, wins customer confidence
- Saves costly call-backs, brings more profit

**FAST AND ACCURATE
Quickly Pays
for Itself**



NEW MODEL 500B Money-Making Portable DYNAMIC MUTUAL CONDUCTANCE TUBE TESTER

Thousands of the famous B&K Dyna-Quik are in profitable use today by service technicians everywhere. Servicemen say: "Best tube tester I've ever owned for speed and dependability!" "Makes money. Really indispensable!" "Have two...one for the shop and one for house calls!"

Now, with more tube sockets, the new Model 500B makes it easy to test more tubes faster and make more money. Accurately quick-checks most of the TV and radio tubes usually encountered in everyday service work. Tests tubes for shorts, grid emission, gas content, and leakage. Measures true dynamic mutual conductance with laboratory accuracy in the home or shop. Makes complete tube test in seconds, tests average TV set in a few minutes. Quickly detects weak or inoperative tubes. Shows tube condition on "Good-Bad" scale and in micromhos. Life Test shows customer the tube life expectancy. Makes it easy to sell more tubes right-on-the-spot.

One switch tests everything. No multiple switching. No roll chart. Automatic line voltage compensation. 7-pin and 9-pin straighteners. New tube reference charts are made available by the factory at regular intervals. Net, **\$129⁹⁵**

See your B & K Distributor,
or write for Bulletin AP12-T

B&K

B&K MANUFACTURING CO.

3726 N. Southport Ave., Chicago 13, Illinois

Canada: Atlas Radio Corp., 50 Wingold, Toronto 10, Ont.

Export: Empire Exporters 458 Broadway, New York 13, U S A

"Silver runs in veins,
GOLD is where you find it."

THE GOLD RUSH

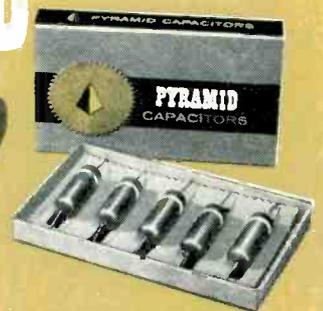
to PYRAMID'S new "Gold Standard"
Mylar® Capacitor, $\pm 10\%$ Tolerance, is on!

For the first time in the radio and TV replacement market, Pyramid offers the Service Technician for his everyday use, a new high reliability capacitor with a critical tolerance factor of ± 10 , featuring non-hygroscopic Mylar® dielectric. This construction, additionally, provides extreme high resistance to moisture plus high insulation resistance.

The Pyramid "Gold Standard" Mylar capacitor absolutely guarantees the reliability that makes other types of by-pass and coupling capacitors obsolete.

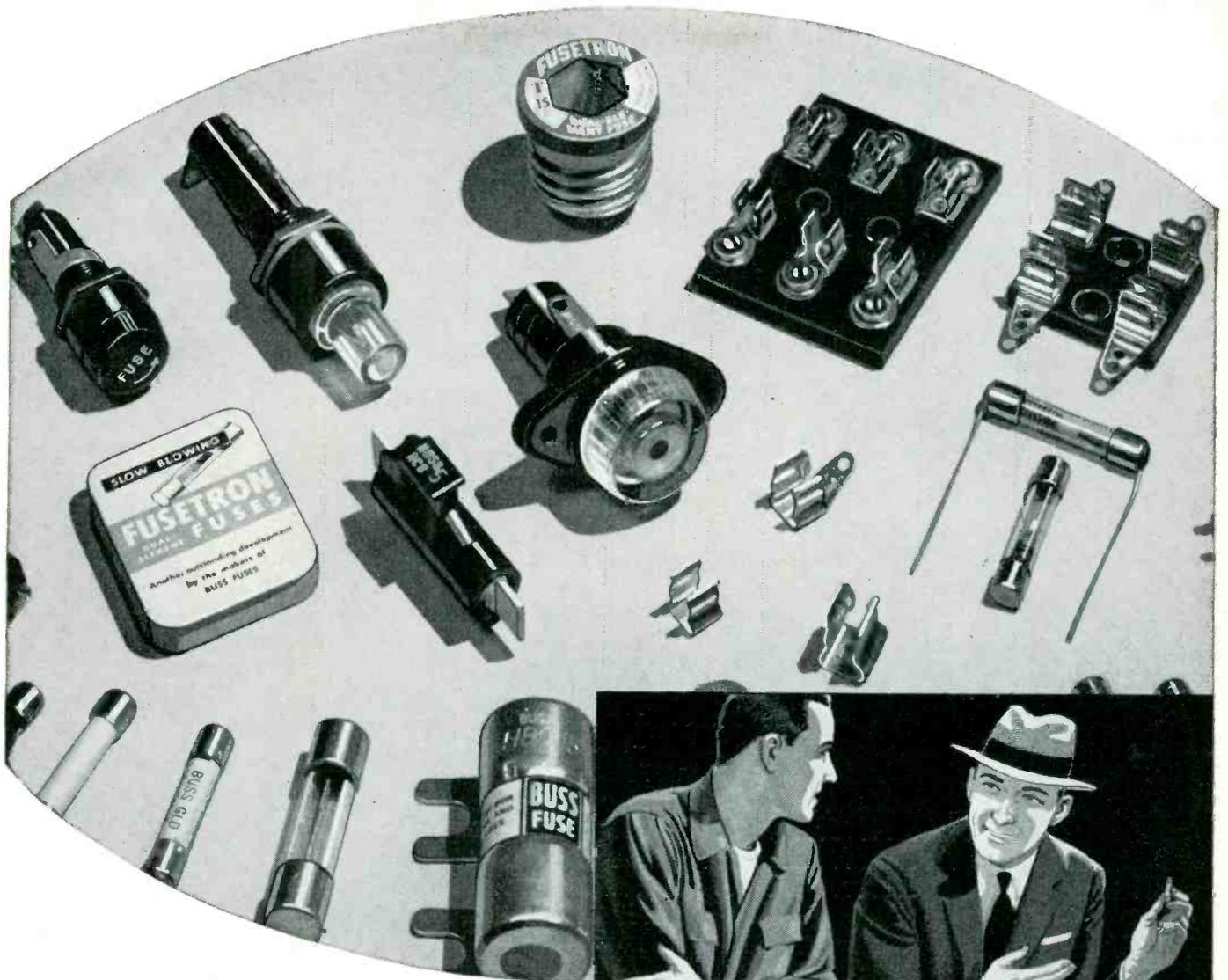
Now at a price competitive with paper capacitors currently in use, Pyramid's new "Gold Standard" Mylar capacitor is available in (1) standard capacity values (2) standard voltage ratings (3) standard capacity tolerance of $\pm 10\%$, formerly available only on special orders at premium prices.

PYRAMID



The Gold Rush is on at your
Pyramid distributor or for information,
write to "Gold Standard" Assayers Office,
Pyramid Electric Company, North Bergen, N. J.

Burton Browne / New York



How BUSS fuses help protect your profit and reputation

There are no time-consuming call-backs or adjustments or customer complaints when you sell or install BUSS fuses. BUSS fuses stay sold and your customers stay satisfied because . . . BUSS fuses are trouble-free. They open only to protect — never needlessly.

Every BUSS fuse you sell or install is tested in a sensitive electronic device. Any fuse not correctly calibrated, properly constructed and right in all

physical dimensions is automatically rejected.

BUSS fuses have ready customer acceptance

Over the past 43 years, millions upon millions of BUSS fuses have provided dependable electrical protection in homes, industries and on farms. As a result, BUSS quality is unquestioned. Furnishing BUSS, the Known brand of fuses, saves you time and

helps you build your reputation for service and reliability.

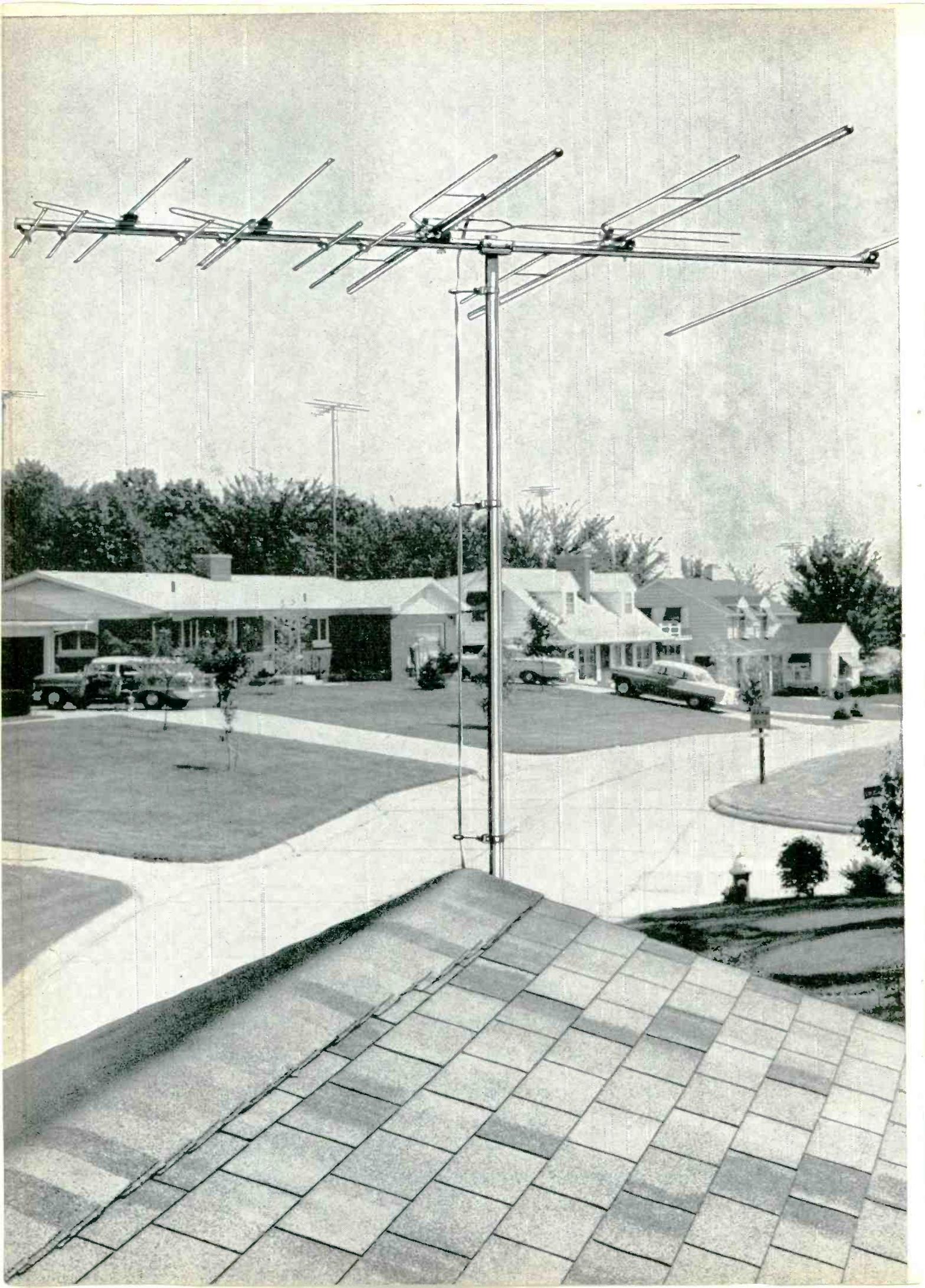
For more information on BUSS and FUSETRON Small Dimension fuses and fuseholders, write for bulletin SFB.

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

BUSS fuses are made to protect — not to blow, needlessly



BUSS MAKES A COMPLETE LINE OF FUSES FOR HOME, FARM, COMMERCIAL, ELECTRONIC, AUTOMOTIVE AND INDUSTRIAL USE.



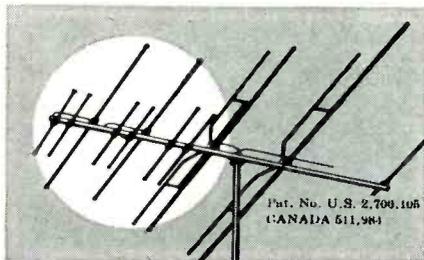
Why Technicians, Like Yourself, Find Winegard Gold Antennas Easiest to Sell!

Superior performance and appearance of Winegard Color'Ceptor—backed by unique factory sales helps—speed up your replacement business

Discover for yourself the profit and personal satisfaction that come from selling the very finest antenna that can be installed on your customers home. You can solve your reception problems with the gold anodized Color'Ceptor. Here's how:

If you live near strong stations, install Color'Ceptor, not for its power but because of its ghost-cutting, unilobe directivity. Get clear, high definition pictures, free of fuzz.

If you live a great distance from stations, your installations need the tremendous all channel gain of the Color'Ceptor that knocks the snow out of those weak signals. Color'Ceptor has highest, all channel gain of any antenna made, is the most efficient antenna you can install.



The patented Electro-Lens director design builds up weak signals then concentrates these signals on the driven elements—works the same way a powerful magnifying glass focuses light.

For maximum power, try a pair of Color'Ceptors with Power Packs stacked. Power Pack is a plug-in unit that adds 7 extra elements to the 11 element Color'Ceptor, makes it a super-powerful 18 element all channel yagi.

If you want to solve your co-channel problems, use a Color'Ceptor with Power Pack. This gives you one regular reflector plus two additional reflectors (total 3), really blocks out signals from the back and sides. It gives you a smooth yagi type response lobe on every channel—completely free of minor lobes. Unlike antennas composed of mostly driven elements, Color'Ceptor has

zero side pick-up. If needed, the back two reflectors can be tuned to give a rear null on any one low band channel without affecting the gain on the other channels.

If you are selling and installing color sets, the Color'Ceptor meets all the rigid requirements for a perfect color antenna. It has high gain, sharp directivity, low VSWR (less than 1.5 to 1 any channel), high immunity from off angle signals and flat frequency response. It has no suckouts or resonance peaks and does not have the usual all channel antenna frequency fall-off on end channels 2, 6, 7 or 13.

If you want the best looking, strongest installations, Color'Ceptor is loaded with appeal, built to last and made as precisely as a fine watch. All the elements are perfectly aligned, made from reinforced high tensile aluminum. The hardware is an exclusive Winegard design, for fast easy assembly, keeps your installation straight, neat and streamlined

Winegard Exclusive *Bright Gold Anodizing Process*

Color'Ceptor's distinctive *Bright Gold Anodized Finish* is more than a beauty treatment. Plain aluminum won't rust but does corrode and corrosion not only ruins an antenna's performance but weakens an antenna so that elements droop and eventually break. ANODIZING won't corrode, chip or peel like plastic coatings or paint. ANODIZING is actually part of the metal itself, stays new many times longer than raw metal antennas.

Winegard bright gold anodizes the Color'Ceptor elements and boom, inside and out—not a quick dull dip process. This is the most expensive weather protection that can be given aluminum but it is worth every penny of manufacturing cost. The Color'Ceptor goes through 7 electro-chemical baths, takes 42 minutes for a complete cycle. It's the only antenna made that is *bright gold anodized*, won't fade or rub off.

... no droop or sag on any element. Color'Ceptor is engineered to be lightweight, yet super-strong. Wind tested to 100 m.p.h. Not bulky, easy to install. Perfect balancing at the mast clamp puts no strain on rotor when used.



To help you sell Winegard Color'Ceptors, you can have full color displays with a miniature 1/3 scale model of the Color'Ceptor, silk wall banners, giant full color posters, hang tags, counter cards, decals, newspaper mats, radio commercials, spec sheets, full color stuffers, and postcards—plus unlimited co-op advertising to tie-in with Winegard's big national magazine program... ads in LIFE... BETTER HOMES AND GARDENS... HOUSEHOLD... TV GUIDE... SUCCESSFUL FARMING... SUNSET. *More national advertising than all other antenna manufacturers combined... more dealers sales helps.*

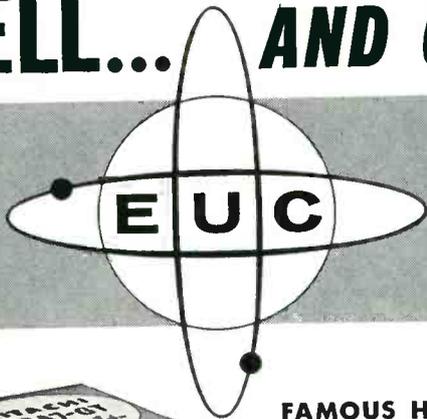
Only Winegard gives a written guarantee of 100% satisfaction on every Color'Ceptor you sell. If your customer isn't happy, Winegard will satisfy his complaint or return list price. You still get your full profit from the sale.

If you want to make money—and who doesn't—switch to Color'Ceptor. Get your fair share of the big antenna market... have satisfied customers who will sell for you by word of mouth. This fall, join Winegard's Dealer Double Profit program. Ask your jobber or write for full details, today.

Down with the old! Up with the Gold!

Copyright 1958—Winegard Co., 3019-10 Scotten Blvd., Burlington, Iowa. Cable address JRWCO.

YOU CAN PROFITABLY SELL... AND GUARANTEE



QUALITY IMPORTS



FAMOUS HITACHI RECEIVING TUBES

It pays to replace now with EUC *guaranteed* HITACHI tubes. You give your customers top quality and better value. You protect your service and your profit. You're safe, too—because HITACHI tubes are world-proved for reliable efficiency, fully meet *American standards*, and are being used in American original equipment. Most popular types are available from your EUC Distributor.



PROFIT WITH THESE OTHER E-U-C QUALITY IMPORTS

Make your replacements more profitably and dependably with these EUC quality components: CAPACITORS in Tubular By-Pass, Tubular Electrolytic, Miniature Tubular, Miniature Electrolytic, and Ceramic Disc types; High-efficiency MINIATURE TRANSISTOR TRANSFORMERS; Poly Varicon VARIABLE CONDENSERS; Quality-controlled CARBON RESISTORS; Exceptionally stable TRANSISTORS; and other widely used units. All are fully guaranteed to meet American standards and are available in the most popular ranges.

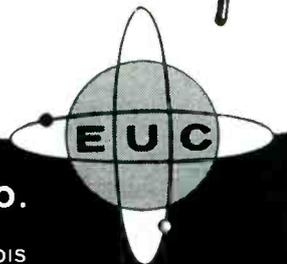
TRANSISTOR RADIO EARPHONES

Exceptional quality and value have earned nationwide acceptance for these small, compact, lightweight earphones. Magnetic type receiver provides remarkably fine reproduction. Plastic and metal case is designed for comfortable fit. Available in 3.2 ohm, 15 ohm, 2000 ohm, and 4000 ohm models.



See Your EUC Distributor or
write for Catalog No. 558-T

ELECTRONIC UTILITIES CO.
DIVISION OF THE SAMPSON CO.
2244 S. WESTERN AVE. • CHICAGO 8, ILLINOIS



LETTERS

To the Editors

Index Info

Editor, ELECTRONIC TECHNICIAN:

Did you recently publish a cumulative list of features and articles? I think you did, but can't seem to find it. I look forward to my copy of *Electronic Technician* each month.

BERT'S TV & RADIO REPAIR
Denver, Colo.

• *Cumulative article index, pages 42-44, Jan. 1958 issue, covers features from Nov. 1955 through Dec. 1957. Cumulative index of Circuit Digests, May 1958 circuit section, covers all schematics previously published.—Ed.*

Pro-Factory Service

Editor, ELECTRONIC TECHNICIAN:

Concerning your August Editor's Memo [opposing captive service], I believe captive service is advantageous to the professional service operator. Here in Canada, service is usually considered an "extra," and may or may not be purchased by the consumer at his option. However, when the receiver breaks down during the warranty period, where no service policy is in force there is a hue and cry directed to the manufacturer and dealer. This can lead to considerable discussion of the merits or demerits of the manufacturer's product. As an independent service operator, I feel that captive service, if used intelligently by the manufacturer, can only relieve the technician from a lot of nuisance calls and arguments with the customer for repair charges on relatively new merchandise. True that this is submitted to the public as "free," but I believe that any person of average intelligence knows that he is buying it somewhere along the line. It is included in either the initial cost or as an extra. The lesser evil is with the built-in service clause, where the product is assured of competent service and the professional service operator can realize a fair profit after warranty. There are enough instances of unethical or unreliable service operators to possibly justify the captive service trend. I agree that initially there is a loss of competitive advantage, but it does establish the more important "greater degree of reliability." We are not in the "lemon" business. Possibly the solution is the establishment of authorized service agencies, which will place the professional service operator in a better position in his community, and create the vote of confidence needed by the public, manufacturer and dealer.

E. P. REALE

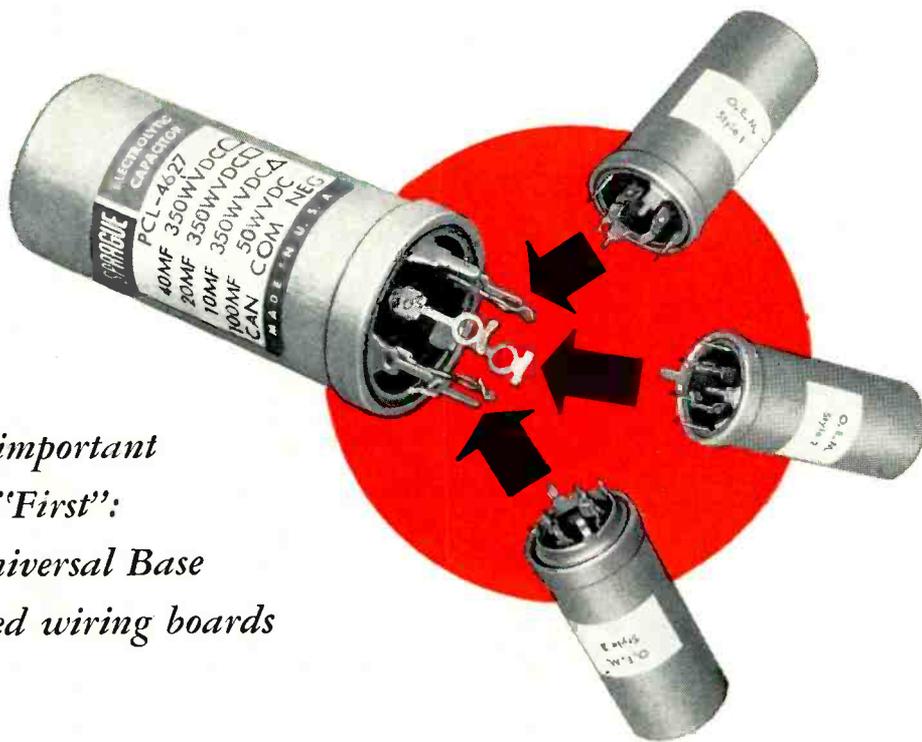
Reale & Goldman Ltd.
Electronic Service Labs.
Toronto, Ont., Canada

(Continued on page 18)

Sprague **PRINT-LOK*** 'lytics

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

*Another important
Sprague "First":
3-in-1 Universal Base
for printed wiring boards*



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

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

*Trademark

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

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

don't be vague...insist on

SPRAGUE®

world's largest capacitor manufacturer

SPRAGUE RESEARCH IS CONSTANTLY PRODUCING NEW AND BETTER CAPACITORS FOR YOU



Westinghouse
announces
its
amazing
new

GOLD STAR PICTURE TUBE

Built 3 ways better to put customer confidence in your selling picture!

Call-backs . . . replacements . . . now you can control all the things that have plagued your profits for years! New Westinghouse Gold Star Picture Tubes have been designed and built with *3 great advances* which will enable them to outperform any standard picture tube on the market today!

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

New Aluminizing Method provides absolute maximum

reflection . . . more usable light from the screen . . . a 20% brighter, sharper picture with greatly improved contrast.

More Rigid Testing. Before this amazing new design was approved for distribution, a stock model Gold Star Tube actually underwent 25,000 hours of continuous operation in the famous locked TV "Torture Test." It was still 80% as good as new when checked!

Build customer confidence now with new Westinghouse Gold Star Tubes. Call your Distributor today.

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

THE VOICE OF MUSIC



NATIONAL ADVERTISING MEANS LOCAL BUSINESS FOR YOU!

V-M 'Stere-O-Matic' Record Changer, Model 1201 \$50 list.*
 Model 1202 has 4-pole motor and plug-in head for G-E and other magnetic
 monaural and stereo cartridges at the same price. Both available on matching
 bases as Models 1226 and 1228. *Slightly higher in the West

This is the *new* Voice of Music Stere-O-Matic® stereo/high-fidelity automatic record changer your customers will be reading about from now through Spring in an integrated series of hard-hitting advertisements in POPULAR MECHANICS, POPULAR SCIENCE, HI-FI & MUSIC REVIEW and SATURDAY REVIEW.

Cash-in on the demand these national ads will create in *your* market. Feature this newest and finest V-M changer. Stress its nation-wide acceptance by nearly all major phonograph manufacturers. Promote it, display it, *sell* it.

SELL THESE FEATURES: • COMPLETELY WIRED FOR STEREO WITH STEREO CARTRIDGE INSTALLED! • FURNISHED WITH DUAL OUTPUT JACKS AND STEREO-MONAUROUS SWITCH. • RUMBLE: -45 DB. • WOW AND FLUTTER: ¼ RMS. • TURNTABLE BALANCED FOR CONSTANT SPEED. • MINIMUM NOISE AND FRICTIONAL DRAG. • CONSTANT, POSITIVE MOTOR SPEED FOR TRUE PITCH. MAXIMUM 2° TRACKING ANGLE VARIATION. • AUTOMATIC SHUT-OFF. • RECORD INTERMIX. • PLAYS ALL SIZES, ALL SPEEDS.

See, hear, order and **SELL** the quality stereo/high-fidelity automatic changer with transcription turntable performance!

V-M CORPORATION • BENTON HARBOR, MICHIGAN • WORLD FAMOUS FOR THE FINEST IN PHONOGRAPHS, TAPE RECORDERS AND RECORD CHANGERS

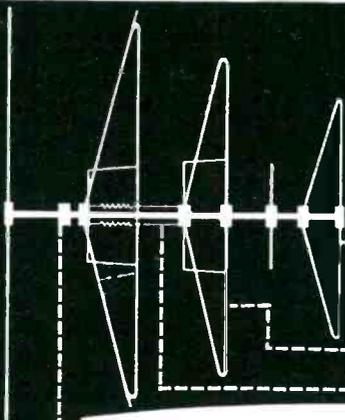
The Most Advanced TV ANTENNAS in the World!

TRIO®



ZEPHYR AND COLOR SERIES ANTENNAS

Look for these 4 Great Features in 1959



Wing Dipole

Today's most powerful dipole! Contains three active elements on the high—forward Vee to the low band section—plus integrated director.



Wing Director

Today's most powerful director! A composite director designed to obtain results from the powerful Wing Dipole.



no-strip lead-in connector

Requires no stripping, no soldering, or wire holders—holds the complete insulated wire.



dyna-coil phasing

Increased performance from uniform transmission of signal strength of each active dipole in a multi-dipole system—AND MAKES POSSIBLE COMPLETE FACTORY ASSEMBLY.

Choose from . . . TRIO'S COMPLETE LINE

COLOR ROYAL—The ultimate in color television reception—or black and white.

ZEPHYR ROYAL—Extraordinary power and sensitivity.

ZEPHYR PIONEER—For extreme distance.

COLORITE—For color and black and white in areas formerly using conicals.

Sharpshooters, Conicals and Yagis

Patents: U.S. 2772413—Canada 541670

Copyright 1958, Trio Mfg. Co.



TRIO® Manufacturing Company GRIGGSVILLE, ILL.

Mr. Dealer
PHILCO

offers you a Complete and Universal line of
FULL FIDELITY NEEDLES

- DIAMOND
- SAPPHIRE
- OSMIUM

Now, one complete line of precision-engineered and custom-designed needles to fit every make and model phonograph and High Fidelity receiver. Every Philco needle measures up to the highest quality and life test standards. All Philco needles are individually packaged for absolute protection.



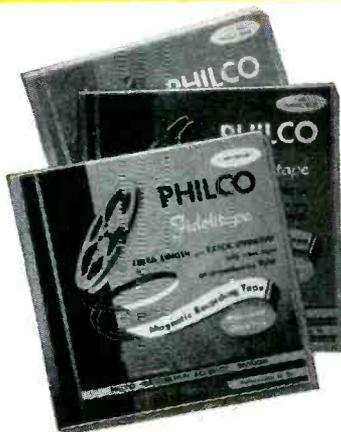
FREE! NEEDLE COUNTER DISPLAY!

Ask your Philco Distributor how you can get this sparkling, jewel case needle dispenser free. It's a sales-maker for you right on your counter at the point of sale.



COMPLETE PHILCO NEEDLE CATALOG

The most accurate, up-to-date, easy-to-read needle catalog in the industry. Cross references are complete... Illustrations are big... Makes selling easy.



PHILCO FIDELITAPE

will bring new customers into your store. Unequaled in uniformity of output. Guaranteed splice free. Extra strength and extra length.

See Your Philco Distributor Today!



World-Wide Distribution

Service Parts • Power-Packed Batteries • Universal Components • Long-Life Tubes • Heavy-Duty Reters • Star-Bright 20/20 Picture Tubes • Long-Distance Antennas • Appliance Parts • Laundry Parts • Universal Parts and Accessories

(Letters. Continued from page 12)

Modest? Not Us!

Editor, **ELECTRONIC TECHNICIAN:**

Thumbing through the past two years issues of your magazine I noticed that you printed almost as many letters knocking you as praising you. Is that half-and-half about the same proportion you receive them? Or are you modest?

ED THOMPSON

Atlanta, Ga.

• We're far from modest, as our promotion material will attest. But the fact is that we get more than 50 unsolicited letters of generous praise for every one that is even mildly critical. Each letter is welcome, and a personal reply is sent. We don't load the Letters column down with proportionate heaps of praise for two reasons: (1) We want our critics to have a voice that is not drowned out; (2) After a while, too many hip-hip-hoorahs would make dull reading.—Ed.

The Real Cost

Editor, **ELECTRONIC TECHNICIAN:**

What is the cost of putting a serviceman into the home of a TV set owner? This information is to be used in approaching local Chicago papers with the idea of eliminating bait advertising. The papers appear to be sympathetic to giving it consideration, and I have been asked to prepare some data. Your information will be very helpful.

HOWARD WOLFSON
CHAIRMAN

Associated Radio & TV Servicemen
Chicago, Ill.

• Our findings indicate that on a true accounting basis, it costs the service operator between \$3 and \$5 for a basic house call, depending on various conditions. This amount includes labor and overhead, but does not cover parts, profit or substantial repair work.—Ed.

Electronic or Electrical?

Editor, **ELECTRONIC TECHNICIAN:**

Could you furnish me with a definition of the term "electronic," and whether it is correct to apply this term to certain electrical appliances which merely use a transformer? I particularly refer to electrified insect screens consisting of a wire grid energized by a high voltage, low amperage transformer. These devices are occasionally offered as "electronic insect control devices," but it seems this term is incorrect, and possibly misleading.

A. F. WEISGERBER

Pleasant Valley, N.Y.

• Though all electrical energy utilizes electrons one way or another, it is generally understood that the term "electronic" relates to components and equipment functioning by or associated with the passage of electron charge through vacuum, gas or semiconductor. As applied to the insect control, electrical is the better word; electronic may be stretching it a bit.—Ed.

CASH IN ON **ZENITH'S**
Tremendous Customer Acceptance
AND PERFORMANCE



**USE
 ZENITH
 QUALITY
 PARTS**

**IT'S ZENITH FOR
 DEPENDABILITY
 YOU CAN COUNT ON!**

There's a reason...

Universally designed parts are of necessity manufactured to broad tolerances... and they may not give the maximum in performance and reliability.

Components in a Zenith Radio, Television or High Fidelity Instrument are built to be perfectly matched and balanced for superior performance. To keep Zenith sets operating at original performance, use Zenith quality service components.

When you use Zenith components in Zenith sets, it's a custom repair that both you and your customers can depend on.



*You can safely guarantee Zenith repairs when you use dependable Zenith components.
 Buy parts by Zenith... backed by 40 years of leadership in radionics exclusively. The quality goes in before the Zenith name goes on.*

SEE YOUR ZENITH DISTRIBUTOR



**MEANS
 QUALITY**

ZENITH RADIO CORPORATION • PARTS AND ACCESSORIES DIVISION
 6001 W. Dickens • Chicago 39, Illinois

News of the Industry

TUNG-SOL ELECTRIC, INC. has named DANIEL J. WEBSTER as General Sales Manager.

WINEGARD CO. announces that the biggest consumer campaign in the history of the firm's TV antennas will be underway this fall.

P. R. MALLORY & CO. INC. has established a new semiconductor department to manufacture silicon rectifiers developed especially for use in radio & TV receivers.

PHILCO CORP. has named WILLIAM H. BRADBURY as Manager of field operations. He will assist the firm's independent distributors and aid in the establishment of new distributorships.

AUDIO DEVICES, INC. reports that ALAN H. BODGE has assumed management of the firm's silicon division in Santa Ana, Calif., replacing GEORGE EANNARINO who has resigned.

JFD ELECTRONICS CORP. reports the launching of the heaviest advertising and sales program in the firm's 28 year history. Consumer magazines, newspapers, trade papers and direct mail will be utilized in this "Harvest of Profit" program.

CBS-HYTRON announces the following appointments: FRANK A. SULLIVAN as semiconductor General Sales Manager; LINDSEY R. PERRY, Product Manager, special purpose tubes and hi-fi components; and NORMAN L. HARVEY, Vice Pres., engineering, electronic manufacturing division.

WELLER ELECTRIC CORP. announces the appointment of ALFRED P. WERTZ as European Sales Manager, with headquarters at the firm's Easton, Pa. offices and at their European sales office in Dusseldorf, Germany. ROCKE INTERNATIONAL, New York, N.Y., will continue to handle the firm's exports in all countries other than Canada, Europe and the U.S.

GENERAL ELECTRIC CO., Owensboro, Ky., reports the following appointments: HENRY B. NELSON, Jr., Manager of trade relations and electronic components distributor development, succeeding GEORGE O. CROSSLAND, recently named Chicago regional equipment sales manager for receiving tubes; and WALTER F. GREENWOOD, Manager of marketing, receiving tube department. Also, the opening of an expanded electronic tube and components sales office at 442 Peninsular Ave., San Mateo, Calif.

(Continued on page 22)

Convert ANY Phonograph to STEREO with FANON LOW-COST Conversion Kits

- Adapts Phono for both Stereo or Monaural.
- Improves Sound Quality of Monaural Records.
- Second amplifier-speaker system adds depth.

With the big boom in stereo records and stereo phonographs, you can bring any hi-fi record player up to date to play both monaural and the new stereo records. Simple to install, the new Fanon Kits offer you top fidelity for the most economical changeover today. Speaker-amplifier unit alone can be used with tape recorders, tuners, etc. Your customers get more for their dollars with Fanon.



FANON STK-4

Complete high fidelity three tube amplifier system with two 4" phased speakers in handsome two-tone fashion-fabric cabinet. Separate bass, treble and volume controls for second channel. Kit includes hi-fi ceramic turnover stereo cartridge, mounting accessories, phono jack and 15 feet of extension cable to unit.

ONLY \$39⁹⁵ List
Speaker-amplifier-cable unit
(Model ST-4) \$31.95 List

FANON STK-5

High fidelity 5-tube push-pull amplifier with one 8" woofer and one 3" tweeter in smartly designed two-tone cabinet. Separate bass, treble and volume control for second channel. High fidelity ceramic turnover Stereo cartridge, mounting accessories, phono jack and 15 feet of extension cable included in kit.

ONLY \$49⁹⁵ List
Speaker-amplifier-cable unit
(Model ST-5) \$41.95 List



FANON STK-10

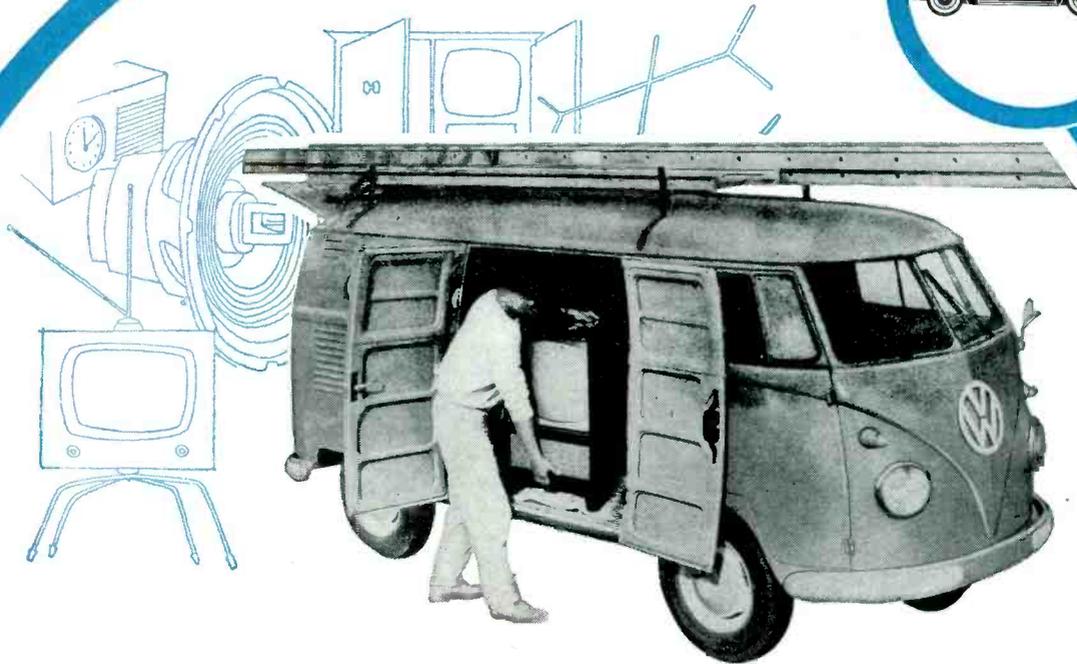
Beautifully finished, hand-rubbed mahogany, walnut or blonde cabinet complete with same quality components as in STK-5 above. Kit includes high fidelity ceramic turnover stereo cartridge, accessories, phono jack and 15 ft. extension cable. Ideal for converting consoles.

ONLY \$59⁹⁵ List
Speaker-amplifier-cable unit
(Model ST-10) \$51.95 List



See your electronic parts distributor now for complete specifications and installation information. Ask him about Fanon's new line of Stereo Phonographs too . . . or write to

FANON ELECTRIC CO., INC.
Dept. E-10, 98 Berriman St., Brooklyn 8, N. Y.
In Canada: Active Radio & TV Dist., 58 Spadina Ave., Toronto



Timesaving trip saver

And that means money-saver, too. The Volkswagen Panel Delivery Truck has 170 cu. ft. of easily accessible load space, and carries 1830 lbs. You can easily install a complete shop inside for tools, parts and test equipment. You can get more done on every call and save unnecessary trips. And, of course, Volkswagen's gas economy and low maintenance costs put more profit in your pocket.

The economy and dependability of Volkswagen performance are backed up by the  service organization. Every mechanic is kept up-to-date through a continuous factory service training program. Speed in servicing is assured by immediate availability of Genuine  Spare Parts through 370 completely-equipped service centers covering all 49 states.

Ask your Volkswagen dealer to show you operating costs for a Pick-up Truck, Panel Delivery, or Kombi Station Wagon. He will prove that Volkswagen savings add up mile by mile and year by year.



VOLKSWAGEN

VOLKSWAGEN DELIVERS THE GOODS...FOR LESS!

A must
for TV and
radio
service
technicians



with built-in MAGNASTAT
temperature control

... automatically maintains correct soldering temperature



MODEL TC-40—40 watts.
Controlled lower temperature for
printed circuits, etc.

\$8 00
list price



MODEL TC-60—60 watts.
Controlled temperature for light
to medium electrical soldering.

\$9 00
list price



MODEL TC-120—120 watts.
Controlled temperature for me-
dium to heavy electrical soldering.

\$10 50
list price

Here's another "first" from Weller, long time leader in the soldering field. New soldering irons with built-in MAGNASTAT temperature control for more reliable soldered connections. Never any overheating. Proper soldering temperature automatically remains constant. Plus these other exclusive features:

- Saves current when idling
- Reaches full heat quickly
- Approximately 1/2 the weight of uncontrolled irons
- Delicate balance—cool handle
- All structural parts are stainless steel
- Cord plugs into handle
- Guaranteed against defects in material and workmanship



Sensing device is in the tip

... fully protected by a sheath of stainless steel. Tips are tapered for heat efficiency and screw on simply and securely.

Order NOW from your Electronic Parts Distributor
or write direct for catalog bulletin

WELLER ELECTRIC CORP. 601 Stone's Crossing Rd.
Easton, Pa.

(News. Continued from page 20)

THOMAS ELECTRONICS, INC. announces the appointment of JESS E. DINES to the new post of sales engineer, components parts division.

VIS-U-ALL PRODUCTS CO. reports that, for the first time, a service convention speaker spoke in favor of self-service testers. The talk was made at the recent convention of the National Alliance of Television and Electronic Service Associations, in Chicago.

WELLER ELECTRIC CO. announces a price reduction of \$1.95 on model D-440 dual-heat soldering gun. New list price is \$12.95.

Reps & Distributors

MEL SCHWARTZ, manufacturers rep., Fair Lawn, N. J., reports the addition of **PARAMOUNT PAPER TUBE CORP.** to the list of firms he represents.

COLMAN TOOL & MACHINE CO. announces the appointment of **MORRIS F. TAYLOR CO.**, Silver Spring, Md., as their sales rep for western Penna. and W. Va.

INTERNATIONAL TELEPHONE & TELEGRAPH CORP., Components Div., reports the appointment of **ANDERSON SALES CO.**, Boston, Mass., as sales reps for New England.

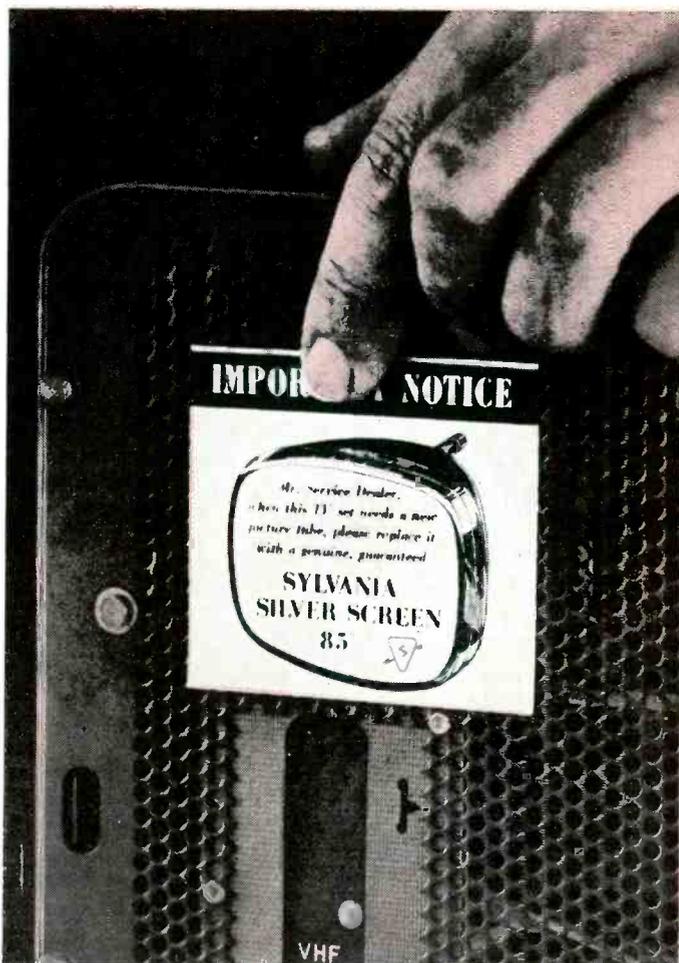
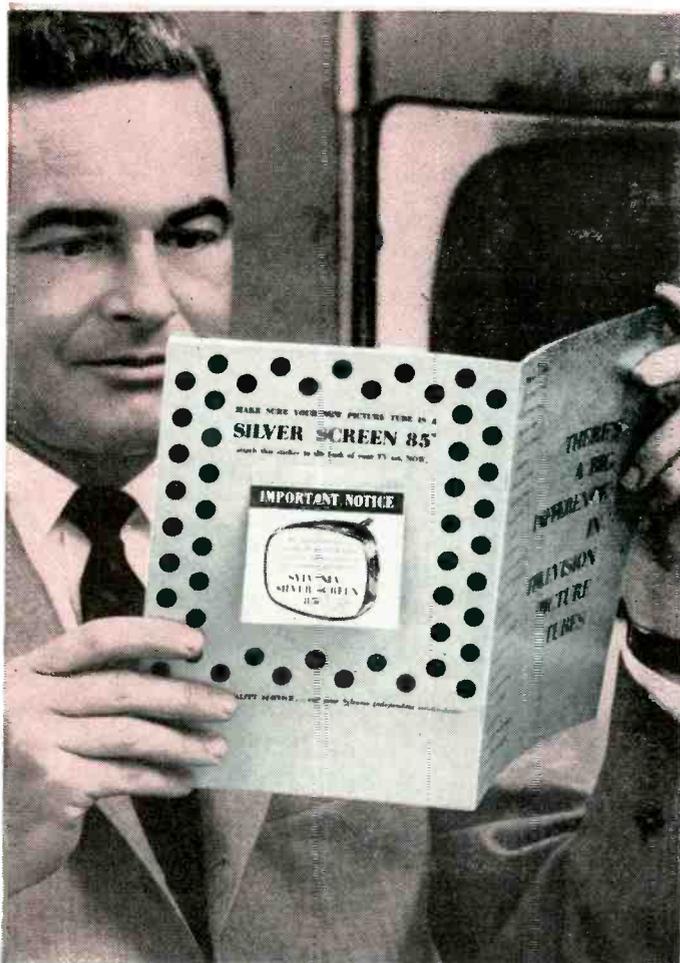
THOMAS H. BEIL, manufacturers rep., Reading, Pa., announces that **JOSEPH F. WHITAKER** has joined his firm. The organization will now be known as **BEIL & WHITAKER**.

BAUME-MILLER ASSOCIATES, manufacturers rep. firm, has been dissolved. It has been succeeded by **GILBERT E. MILLER ASSOCIATES**, 47 Birchwood Park Drive, Jericho, L. I., N. Y.

BACH SALES CO. is a new manufacturers rep. firm, headed by **ROBERT BACH**, formerly associated with **FAIRCHILD RECORDING EQUIPMENT CO.** The new rep firm is located at 26 Mahan Road, Old Bethpage, N. Y.

JERSEY SPECIALTY CO. INC. has announced the following rep appointments: **MARTIN & DIAL, INC.**, Richmond, Va., for Va.; **ALBERT LEVINE**, Pittsburgh, Pa., for western Penna. and W. Va.; and **ROBURN AGENCIES INC.**, New York, N. Y., as exclusive export agents.

(Continued on page 24)



This label is your signal that a value-minded customer has been sold up to Silver Screen 85.

New consumer booklet from Sylvania helps you

SELL UP TO SILVER SCREEN 85

Free booklet tells the story of Silver Screen 85's superior performance—
detachable sticker lets the consumer tell you he's *presold* on Silver Screen 85

Leave a copy on every service call or make a complete mailing to your customers and prospects. Either way, Sylvania's new booklet, "There's A Big Difference In Television Picture Tubes," can help you sell up to more profits through more Silver Screen 85 sales.

In layman's language, this booklet details the difference between Silver Screen 85 and cut-rate off-brand tubes. It's chock-full of facts as they were revealed in Sylvania's recent test of a

nationwide sample. What's more, there's a handy sticker on the back of each booklet for the customer to attach to the back of his TV set. This is your signal that he's *presold* up to Silver Screen 85.

Get on the bandwagon. Let Sylvania help you sell up. Give each of your customers and prospects a copy of this new booklet. It's available free, complete with mailing envelope, from your Sylvania Distributor. Or write for a sample copy.



Bill Shipley's your No. 1 Salesman in the industry's biggest consumer advertising campaign.

 **SYLVANIA**

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

LIGHTING • TELEVISION • RADIO • ELECTRONICS • PHOTOGRAPHY • ATOMIC ENERGY • CHEMISTRY-METALLURGY

ELECTRONIC TECHNICIAN • October, 1958

"SURE, I use CLEAR BEAM Antenna Kits...they've doubled my installation business!"

Using Clear Beam Antenna Kits makes sense right from the start! Attractive packaging and do-it-yourself label creates customer interest in a new or replacement antenna—makes it a cinch to sell complete installations on regular service calls.

Servicemen installing Clear Beam Antenna Kits have eliminated "loose stock" inventory problems and are now able to price installation jobs accurately and profitably due to fixed material costs!

Start doubling your installation business with Clear Beam Antenna Kits now. Display them in your shop—show them from your service truck—let Clear Beam's self-selling antenna kits clinch extra installation sales for you!



CLEAR ANTENNA CORP.,
BEAM CANOGA PARK, CALIF.

Kits for Conicals, Arrows, Yagis, Dipoles, UHF, VHF complete with mast, lead-in and all necessary hardware ready to install!

(Reps. & Dists.)

Continued from page 22)

RAYTHEON MFG. CO. has named J. MALCOLM FLORA, INC. to represent the firm's distributor products in the Michigan trading area.

PEERLESS PRODUCTS INDUSTRIES has appointed RAY R. HUTMACHER ASSOCIATES, Chicago, as the firm's rep for Ill. and Wis.

THE REPRESENTATIVES of Electronic Products Mfrs. Inc. has announced the following committee appointments: JACK BERMAN, Head, Program & Planning; RUSS DIETHERT, Head, Industry Relations; FRANK LEBELL, Chairman, By-Laws; GRADY DUCKETT, Head, Publicity; and MORRIS TAYLOR, Chairman, Membership.

Catalogs & Bulletins

ANTENNAS: Colorful posters reading "Sell It Now" are available to the firm's antenna distributors. Designed as reminders for countermen and servicemen customers. Technical Appliance Corp., Sherburne, N. Y. (ELECTRONIC TECHNICIAN B10-8)

ELECTRIC DOOR OPERATORS: Bulletin F5685-2 covers the Barcol Model L Electric Operator for commercial and light industrial overhead type doors. Operates standard doors up to 19 ft. 2 in. wide, with up to 240 sq. ft. area. Barber-Colman Co., Rockford, Ill. (ELECTRONIC TECHNICIAN B10-1)

RECEIVING TUBES: A 24-page booklet, ETR-1541-2, describes manufacturing techniques including discussions on the use of gold and silver in grids, anti-lint and dust measures, testing procedures, etc. General Electric Co. Owensboro, Ky. (ELECTRONIC TECHNICIAN B10-2)

CAPACITORS: The 9th edition of a TV Replacement Capacitor Manual consists of 56 pages, giving listings of replacement capacitors used in TV sets manufactured from 1946 through 1957. Listings give manufacturers' names with original part numbers, cross-referenced to the replacements. Free from the firm's distributors, or by sending 10¢ for Manual K-103 direct to Sprague Products Co., 65 Marshall St., North Adams, Mass.

(Continued on page 42)

HOW TO CREATE MORE CONFIDENCE IN YOUR SERVICE BUSINESS

FREE! Colorful comic books, window streamers, window display to help tell your customers all that goes into servicing TV sets!

It takes a lot of work, costly equipment and know-how to be a radio and TV serviceman. No one knows this better than you. But, chances are, your customers *don't!*

But now you can give them an insight into your work with this free "The Story Behind TV Service" kit that tells how complicated your job is . . .

how much study it required to learn . . . and how expensive it was getting started. Told in interesting cartoon technique, the booklets are something everyone will read—and understand!

So put these good-will ambassadors to work building consumer confidence for you.

CALL YOUR WESTINGHOUSE DISTRIBUTOR

YOU CAN BE **SURE**... IF IT'S **Westinghouse**

Electronic Tube Division • Elmira, New York

New! from

Simpson

MODEL 311 VTVM



Compare these features before you buy!

- 22 MEGOHM Input Impedance
- Peak-to-Peak Readings of Complex AC Voltages
- Accessory RF Probe with High Frequency Response and Accuracy
- New "TIMESAVER" Probe Tip
- Unbreakable Metal Case
- AC Balance Adjustment



This new Simpson VTVM has all the capabilities you need to run highly accurate tests on practically any job. Note its timesaving features, too—slimline probe; special two-way probe tip; and Adjust-A-Vue Handle. You might expect Model 311 to cost a good deal more than it does, but the price complete with probe, lead, ground cable, clips, and Operator's Manual is a sensible

\$64⁹⁵

DC VOLTS: 0-1.5, 5, 15, 50, 150, 500, 1500
(±3% accuracy)

AC VOLTS: 0-1.5, 5, 15, 50, 150, 500, 1500
(±5% accuracy)

AC PEAK-TO-PEAK: 0-4, 14, 40, 140, 400, 1400, 4000 volts
(±5% accuracy)

OHMS: X1; X10; X100; X1000; X10,000; X100,000; X1 megohm (meter can be set for center zero for FM alignment)

AC FREQUENCY RANGE: 30 to 100,000 cycles per second

INPUT IMPEDANCE: 22 Megohms

SIZE: 7½" x 5⅝" x 4½" deep

WEIGHT: 4½ lbs.

RF PROBE: 50 cycles to 100 megacycles, ±5%; 0-150 volts maximum, RMS. Input capacitance, 10 mmf **\$10.95**

HIGH VOLTAGE PROBE: Gives measurements from 0-30,000 volts, DC **\$10.95**

SEE YOUR ELECTRONIC PARTS DISTRIBUTOR, OR WRITE

SIMPSON ELECTRIC COMPANY

World's Largest Manufacturer of Electronic Test Equipment



5208 West Kinzie Street
Chicago 44, Illinois
Phone: ESTebrook 9-1121
In Canada:
Bach-Simpson Ltd.
London, Ontario



BOGEN announces a battery-operated PA system, variable 25 to 200 watts.

HEATH Pres. Robert Erickson has moved to BECKMAN INSTRUMENTS as exec VP.

PICKERING has published a 12-page booklet, "It Takes Two to Stereo."

ORRADIO names John M. Leslie, Jr., ex-Ampex, as general manager.

FISHER has just published a folder on its 14 component models, plus a 12-page phono package catalog.

GENERAL ELECTRIC has appointed Stephen J. Welsh to the new position, manager of marketing for high fidelity components.

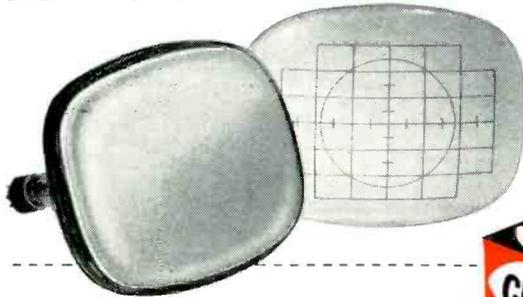
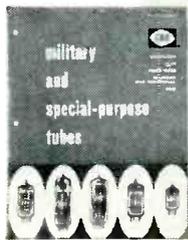
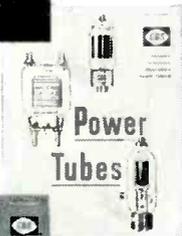
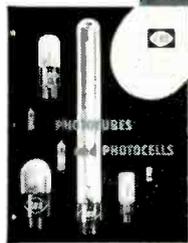
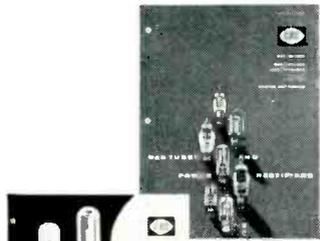
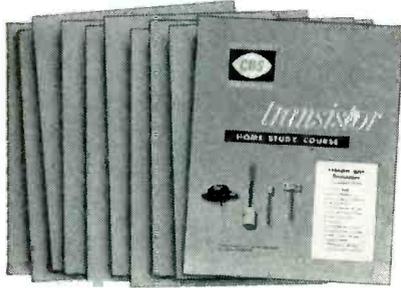
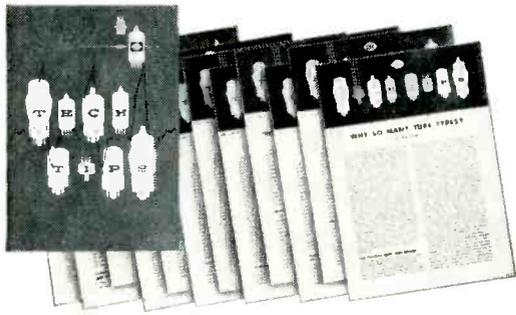
ATLAS SOUND has released the SS-4 loudspeaker telescoping support stand, which extends over 6 ft. in height.

BELL SOUND appoints Andrew Lorant ad manager and director. The firm is also making available a 4 channel head conversion kit for any of its stereo tape transports.

UNIVERSITY LOUDSPEAKERS fills several positions, reports Larry Epstein, director of sales and merchandising. Michael Neglia, production and shipping coordinator; Althea Fraioli, sales administrator; Robert Miller, head of the new Technical Service section; Frederic Zeller, manager of advertising and promotion; Paul Samuel, ad asst.

HOME FURNISHINGS DAILY report of Aug. 18th states that consumers know little about stereo, and the first person consulted is the local TV store. The small retailer with service department will evaluate existing equipment, and recommend and install equipment required for stereo. Stereo is looked upon as a promising adjunct of their business.

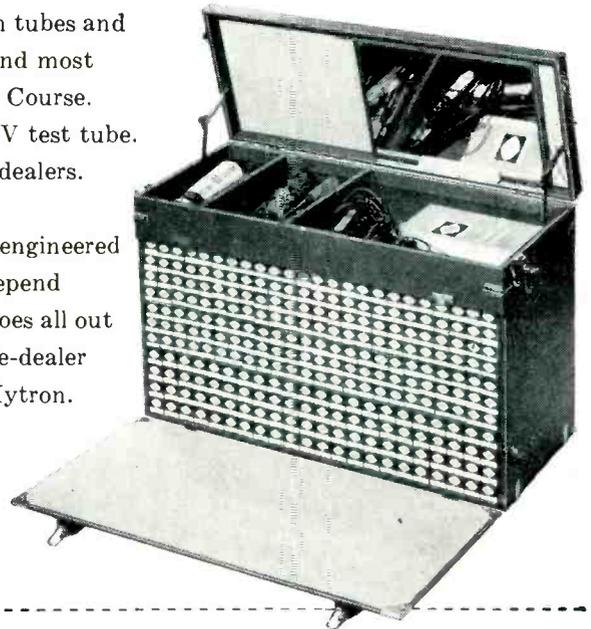
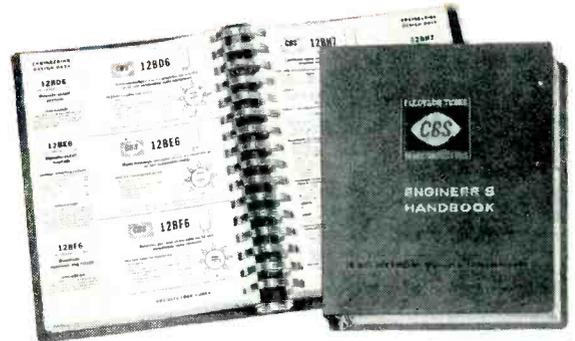
(Continued on page 67)



CBS-HYTRON GOES ALL OUT FOR THE SERVICE-DEALER

There's a reason for those awards to CBS-Hytron from dealer associations. CBS-Hytron has the welfare of the independent service-dealer at heart. And has proved it again and again: With a complete program promoting the independent service-dealer . . . including TV (Arthur Godfrey and Garry Moore) and national magazine advertising. With more CBS-Hytron time-effort-and-money-saving service tools. With scores of sales-promoting Business Builders. With two modern technical handbooks. With the most comprehensive and forward-looking line of replacement industrial tubes. With "inside" Tech Tips on tubes and semiconductors. With the original and most economical home-study Transistor Course. With a new aluminized 110-degree TV test tube. With illustrated technical talks for dealers. With much more to come.

And then tops them all with the advance-engineered tubes and semiconductors you can depend upon . . . products of the company that goes all out to serve the service-dealer most . . . CBS-Hytron.



*More reliable products
through Advanced-Engineering*

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

On just ONE finger*..

I offer you the industry's
most modern TV chassis!

SYLVANIA

S-110 CHASSIS *performance proved*

Robert L. Shaw
General Marketing Manager, Sylvania Home Electronics

Remember the prewar 14-tube radio chassis? Heavy, bulky and troublesome, wasn't it? Today's hand-size table radios perform better and are practically trouble-free. We can thank automation and circuit refinement for this advantage.

Yesterday's 35-tube TV chassis that required two men to lift can't compare in performance, reliability and ruggedness to this trim instrument I hold on one finger.

Sylvania is proud to have pioneered in automation manufacturing. We have reduced the margin of human error some 70%, thereby also reducing your cost to service and sell.

Sylvania has pioneered circuitry refinement. Our participation in government missile electronic

programs, as well as our own intensive research, has allowed great strides in circuitry design. For instance, missile electronics, where absolute standards of performance are required, specify rectifiers, rather than old-fashioned transformers.

Sylvania is the only national television manufacturer to completely convert to this new high reliability rectifier system.

Sylvania's advanced printed circuitry and techniques used in its manufacture are as much a part of progress as the space age itself.

I claim that this S-110 field-proven chassis is the industry's finest in performance and reliability. I challenge you to test it.

Watch for a man carrying a TV chassis on just one finger— he'll be calling on you

He'll explain the following proven facts on the SYLVANIA S-110 Chassis.

- Better performance under the extremes of line voltage variation.

The advanced high-voltage design of the SYLVANIA S-110 Chassis adjusts automatically for maximum performance at both high and low voltage extremes.

- Better performance under heat, humidity and freezing conditions.

The rigid specifications for reliability of components in the SYLVANIA S-110 Chassis assure better performance and longer trouble-free life under extremes of humidity and temperature conditions.

Alkyd Resin in the high-voltage socket of the S-110 Chassis withstands moisture, dirt and even frost accumulation without permanent damage, even if these conditions are severe enough to cause arcing. Top performance is assured regardless of warehouse locations.

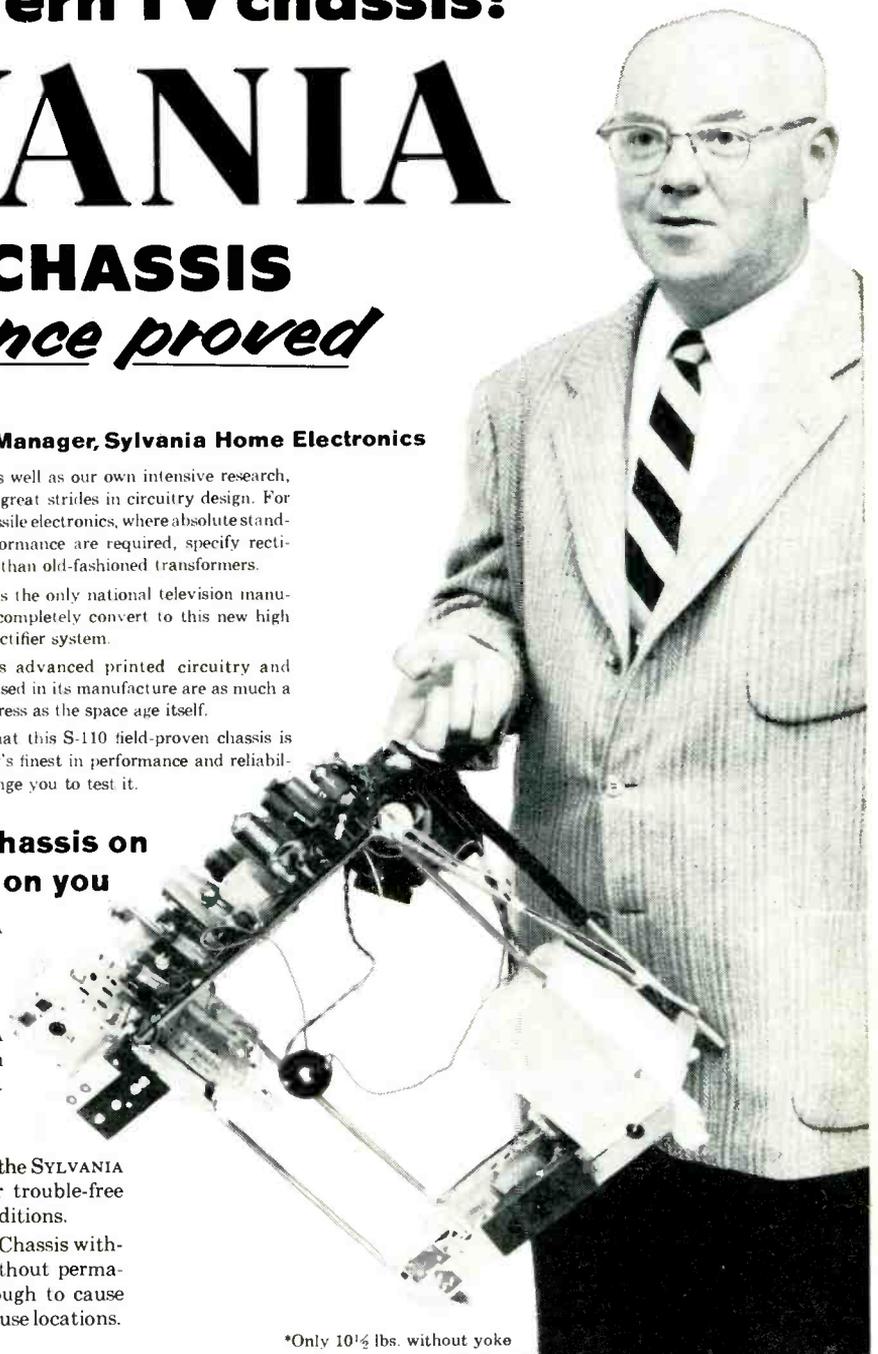
- Cuts repair time by 60%.

The orderly arrangement of components in the SYLVANIA S-110 Chassis means that most defects can be located in seconds. Circuit can be traced easily from either side by shadow graph method over your bench light.

- Designed for maximum strength and minimum weight.

The SYLVANIA S-110 Chassis has all-round girder frame construction which gives it the most favorable strength to weight ratio in the industry. This means easier handling and faster servicing because of its light weight. Yet, the S-110 is sturdy and rigid when mounted in the cabinet.

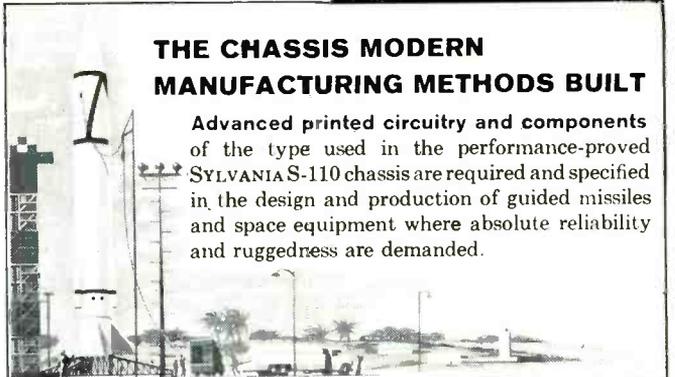
SYLVANIA TV
Pioneers in modern manufacturing methods



*Only 10½ lbs. without yoke

THE CHASSIS MODERN MANUFACTURING METHODS BUILT

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



ELECTRONIC TECHNICIAN

Including
Circuit Digests

ELECTRONIC TECHNICIAN Buys SERVICE

Magazine purchase reflects dynamic growth and new opportunities of electronic maintenance industry

There have been three trade magazines serving the electronic maintenance field. Two are recognized by the Audit Bureau of Circulations (ABC), the "policeman" of the publishing field, as audited business publications: *Electronic Technician*, the largest magazine, and *Service*, the oldest magazine in the field.

Effective with the November 1958 issue, *Electronic Technician* buys *Service*, and merges the two in an effort to do a still better job for the industry. *Service* will no longer be published as a separate magazine. From now on, it's *Electronic Technician*, including *Service*.

The Scope—From Home Repair to Field Maintenance Engineering

This combination of two major publications reflects the new dimensions in professional electronic maintenance. No longer is it a mere sidelight to radio-TV manufacturing. It is a fast-growing \$2.6 billion industry in its own right. The scope of electronic technician activities has expanded beyond the most optimistic forecasts of a decade ago.

Servicing radio-TV is the foundation. Installing and selling hi-fi and stereo has been added. Repairing communications gear and industrial controls is in the ascent. And much more is in prospect.

Remember, over \$4 billion worth of new electronic gear going to consumers and industry each year—in addition to the multi-billion investment already in use—requires skilled maintenance attention.

That is the new dimension—from home servicing to field maintenance engineering—a bright horizon of enhanced opportunities.

Benefit for Readers

Electronic technicians will gain from this combining of publications. Readers who subscribe to *Service* will receive *Electronic Technician* for a period equivalent to the dollar value of the unexpired portion of their subscriptions. Readers of both magazines will have their *Electronic Technician* subscriptions automatically extended.

An attractive aspect of this purchase and merger is

that a still stronger single magazine can serve its readers more effectively, and act as a central clearinghouse of industry information. And of course, those electronic technicians who subscribed to only one of the two publications no longer need miss the informative articles found in the other.

From here on, there's a two-in-one magazine package for all professional technicians and service dealers, and at no price increase.

Benefit for Advertisers

Advertisers get a real break with the newly combined magazine. For one thing it eliminates the duplicate coverage of many thousands of subscribers. Another point is that per-page advertising rates will go up only a moderate amount, while the cost per thousand to advertise to professional technicians and dealers will actually decrease substantially. This is due to the tens of thousands of new subscribers added to our readership.

And very important, now for the first time, advertisers get complete industry coverage with just one magazine.

Looking Forward

Now that *Electronic Technician* attains a circulation far beyond its own former record of the largest number of subscribers achieved by any electronic trade magazine, we feel more keenly than ever our solemn responsibility to serve the industry first and foremost.

We are deeply grateful to our many friends—a record number of subscribers and advertisers—who have made our success and this expansion possible.

In another sense, we are also indebted to the extensive demands of the vigorous, growing maintenance industry. It has become a big-time industry, requiring publishing services on a major scale. This too has given us the opportunity for expansion.

And this same opportunity offers new vistas of growth for the electronic service technician . . . to play a still more important role in the nation's economy by maintaining all kinds of electronic and related devices . . . in the home, in commerce and in industry.

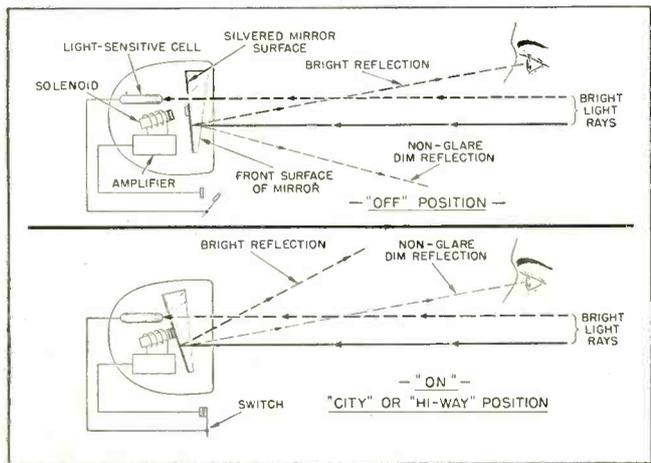
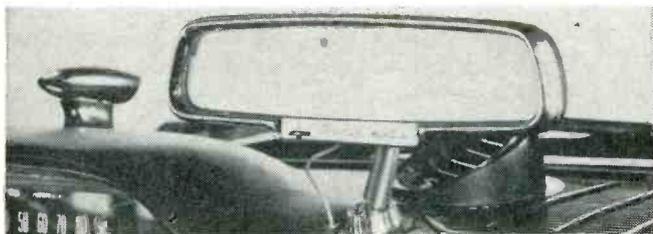
Tuning In the

INDUSTRIAL RADIO rules, which were very substantially revised by the FCC, and adopted effective August 1, should be of considerable interest to two-way radio technicians. Communications Company urges dealers to study the New Business Radio Service and other details in the Federal Register for Saturday, June 28, 1958. It's available for 15¢ from the Supt. of Documents, Government Printing Office, Washington 25, D. C.

CARS OF THE FUTURE will be loaded electrical/electronic gear, and electronic technicians will have maintenance opportunities of a new and challenging nature. In addition to radios, electronic headlight and mirror dimmers, etc., there will be electronic guidance and safety systems. For example, the experimental gas turbine GM Firebird has over 300 wires running from front to rear along the chassis spine . . . over two miles of wire.

PHONO NEEDLE wear is kept under control with the help of GE's Telechron Need-L-Minder electric timer which registers time in use up to 1000 playing hours.

ELECTRONIC REAR VIEW MIRROR CONTROL



Drawings show how automobile rear view mirror is automatically dimmed with this new 1959 optional accessory. Light from headlights of trailing car pass through tiny opening in mirror surface, striking photoelectric cell, and actuating electromagnet to flip mirror prism. Mirror has off position for daytime driving, and city position to prevent response to street lights. Unit to left of mirror in photo is electronic headlight dimmer. Control was developed by Chrysler.



"Never mind that—just fix the set!"

NOISE QUIETS NOISE. An earphone system which enables combat soldiers to hear communication messages is being developed by RCA. The device sends counter-irritant noise into the GI's ears. This noise is equal in intensity, but out of phase with the battle racket, resulting in substantial cancellation of both sounds . . . and the message comes through.

LIGHTNING, which kills over 600 people in the U. S. each year, and causes more than \$100,000,000 in property damage, should be of particular interest to technicians who install antennas. An informative booklet, "Lightning Facts and Figures," covering how lightning functions and safety procedures, is available free from Lightning Protection Institute, 53 W. Jackson Blvd., Chicago 4, Ill.

SIGNS OF THE TIMES: 77% of department store customers prefer to do their own buying without the aid of clerks, according to a nation-wide survey by the Better Packaging Advisory Council. Self-selection saves stores 42% in sales time. The study utilized tagged and untagged goods in four departments of 41 leading stores in 32 states: radio-TV-hi-fi, appliances, women's clothing, and children's clothing.

SIBYL is the name of Bell Labs' computer-like machine which simulates a variety of future communications systems. (The name Sibyl is taken from the women of ancient Greece who were inspired by Apollo to see the future.) In a typical test, a pushbutton phone with special instrumentation would be linked with Sibyl, which would perform the required switching, and transfer the pushbutton information into conventional dial pulses relayed to the telephone exchange. Sibyl would collect data comparing pushbutton operation with rotary dialing.

Picture



PICTURE TUBE production for original equipment has been curtailed by DuMont, though some will continue to be made for replacement purposes.

SOLAR POWERED ham transmitter operated by Hoffman engineer Major Gilbert, K6LMW, had made a 2000-mile voice contract on the 10-meter band. Bank of 72 silicon solar cells, which convert light into electricity, provided power for the 75-milliwatt transmitter output.

FEDERAL TRADE COMMISSION has approved a consent order prohibiting Stanley Electronics, Paterson, N.J., from selling radio-TV tubes without disclosing whether they are used or not of first quality.

MEDICAL TELEMETERING may become more important as a remote diagnostic technique. Recently, two Kansas City physicians diagnosed the heart conditions of three patients in Bethesda, Md., by examining telemetered data recorded from an electronic device strapped to the patient's body. Information covered electrocardiogram, heart sounds, pulse rate, and respiration rate and volume. The distant doctors made the same diagnosis as the doctors who examined the patients on the spot.

LICENSING for TV service businesses is getting increasingly vigorous support from a number of associations, heartened by licensing in Louisiana for larger towns, and favorable reports from ordinance controlled cities.

CALENDAR OF COMING EVENTS

- Oct. 13-15: National Electronics Conference, Hotel Sherman, Chicago, Ill.
- Oct. 19-21: Electronic Industry Unity Conference, The Concord, Kiamesha Lake, N. Y.
- Oct. 20-24: Society of Motion Picture & Television Engineers 84th Convention, Sheraton-Cadillac Hotel, Detroit, Mich.
- Oct. 27-29: Radio Fall Meeting, Sheraton Hotel, Rochester, N. Y.
- Oct. 30-31: Electron Devices Meeting, Shoreham Hotel, Washington, D. C.
- Nov. 20-22: 56th Meeting Acoustical Society of America, Chicago, Ill.
- Dec. 3-5: Eastern Joint Computer Conference, Bellevue Stratford Hotel, Philadelphia, Pa.
- Dec. 9-11: Mid-America Electronics Convention, Municipal Auditorium, Kansas City, Mo.
- Mar. 2-6: Western Joint Computer Conference, Fairmont Hotel, San Francisco, Calif.
- Mar. 23-26: IRE National Convention, Coliseum & Waldorf-Astoria Hotel, New York, N. Y.

Hi-Fi Shows

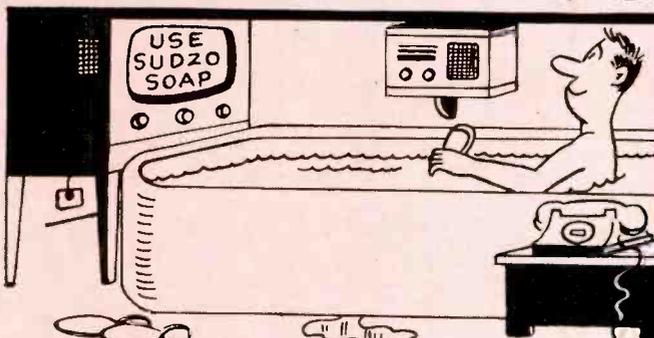
- Oct. 10-12: Philadelphia. (Institute Hi-Fi Mfrs.) Benjamin Franklin Hotel.
- Oct. 17-19: Boston. Hotel Touraine.
- Oct. 24-26: Milwaukee. (Institute Hi-Fi Mfrs.) Wisconsin Hotel.

Rigo Enterprises Hi-Fi Shows

- October 10-12, Cincinnati; October 17-19, Detroit; Nov. 7-9, Omaha; Nov. 14-16, Kansas City, Mo.; Nov. 21-23, Seattle.

RESENTMENT toward captive service operations by TV manufacturers continues unabated. Responsible service leaders caution against any action by technicians which will alienate consumers from independents.

RANDOM NOISE



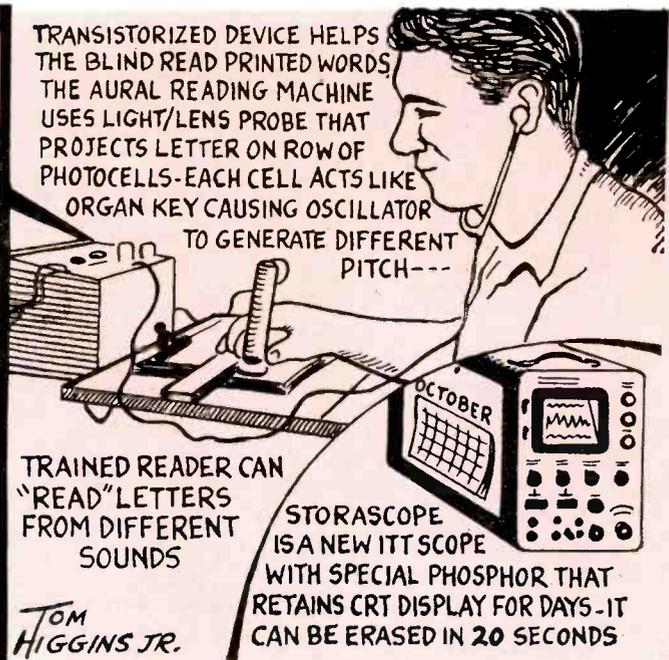
42,400,000 U.S. HOMES 84% OF TOTAL, HAVE ONE OR MORE TV SETS, REPORTS TELEVISION DIGEST. --- ONLY 41,500,000 HOMES HAVE BATHTUBS, 39,000,000 HAVE PHONE SERVICE-TOTAL 47,549,000 TV SETS IN USE OUT-NUMBER 43,000,000 WASHING MACHINES. BUT RADIO DOMINATES -- 161,000,000 IN USE.

TRANSISTORIZED DEVICE HELPS THE BLIND READ PRINTED WORDS. THE AURAL READING MACHINE USES LIGHT/LENS PROBE THAT PROJECTS LETTER ON ROW OF PHOTOCELLS-EACH CELL ACTS LIKE ORGAN KEY CAUSING OSCILLATOR TO GENERATE DIFFERENT PITCH---

TRAINED READER CAN "READ" LETTERS FROM DIFFERENT SOUNDS

TOM HIGGINS JR.

STORASCOPE IS A NEW ITT SCOPE WITH SPECIAL PHOSPHOR THAT RETAINS CRT DISPLAY FOR DAYS-IT CAN BE ERASED IN 20 SECONDS



Current Surge Protection for

"The Surgistor," A Combination Resistor And Relay, Can Increase

SUMMARY

The need for current surge protection is gaining recognition. Tests show that tube life can be tripled, components safeguarded, and call backs reduced.

Methods include the use of relays, resistors or a combination of these to delay B+, limit current flow, or both. They are variously termed Fuse Resistor, Glo-Bar, Surgistor, Thermistor, Tube Protector, Tube Sentry, etc.

Use in all types of electronic equipment subject to current surge is advocated. Lamps in film projectors, pilot lights, tubes, selenium and silicon rectifiers, and capacitors, in TV, audio, and industrial gear can be protected.

Modifying existing equipment not only provides another area of business activity, it will promote consumer confidence, as well as establish a higher standard of reliability.

Robert G. Middleton

• Shortened life and excessive damage are often the result of surge currents. Current within the first second of operation in a properly operating TV set could exceed more than twice the normal flow. Tests have shown that tubes, capacitors

and rectifiers have a much better chance of survival if these current surges are eliminated or at least minimized. In some industrial applications the equipment is never completely shut down for that reason. Some electronic equipment has provisions for reducing filament current while in a standby position, still others have facilities for disabling B+.

Most consumers would take objection to the concept of leaving their TV sets turned on all the time; also, many manufacturers would balk at the increased cost of controls, switches and relays in spite of the arguments for the benefits of more dependable service. However, there are several solutions to this problem. Some manufacturers are using resistors, thermistors, relays, and controlled warm-up heater tubes; some are using nothing.

Relays are used mostly to delay the application of B+ to the load. This assures at least a partial heater and cathode warmup before the tubes are required to go to work. Cathode stripping and other harm-

ful effects to tubes are thus minimized, but filter capacitors and rectifiers still see a fairly sharp current peak when the relay closes. This can be particularly troublesome in capacitor input filter circuits and where selenium and silicon rectifiers are used.

Resistors when placed in series with the receiver's line voltage input do much to relieve the problem of current surge by reducing the voltage applied to rectifiers and filters, as well as to tube heaters. Thermistors and other negative temperature coefficient resistors are used in many applications quite successfully. Initial resistance of these resistors is high, and as they warm up the resistance reduces considerably. Two inherent difficulties are present in many of them; there is always a certain amount of resistance in the circuit, and ageing has a tendency to increase the warmup time considerably. At times portions of a set, particularly oscillator circuits, may remain dead for an indefinite period. However, an advantage of having some resistance in the circuit is that in the event of

Fig. 1—Dotted curve shows damaging surge currents. Solid line indicates that these surge currents can be controlled by a Surgistor.

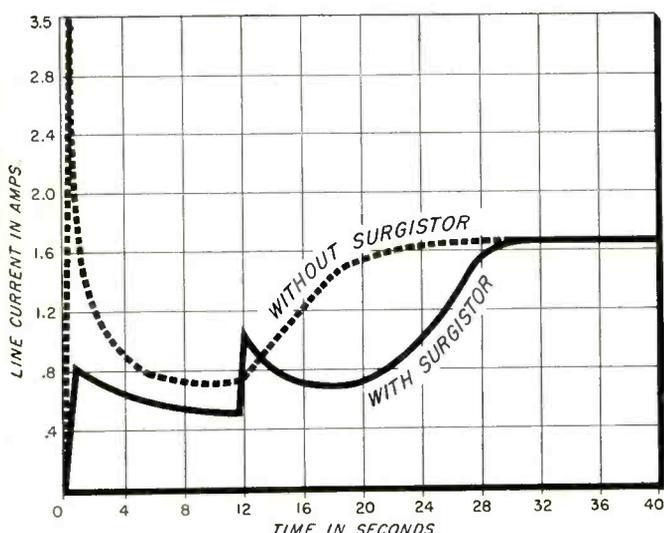
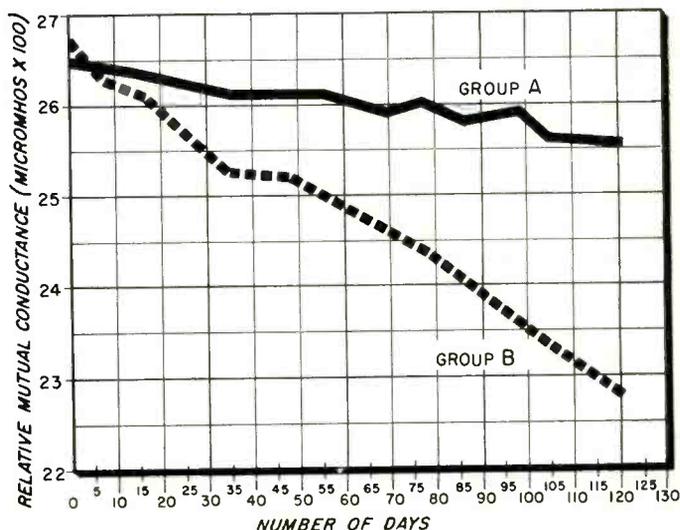


Fig. 2—Mutual conductance declines faster in unprotected tubes. Group A was protected by a Surgistor. Group B had no surge protection.



Electronic Equipment

The Life Of Tubes, Rectifiers, And Capacitors.

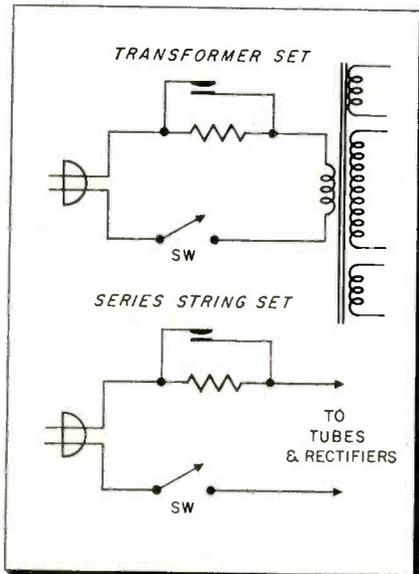


Fig. 3—A Surgistor in the line circuit of a TV set affords current surge protection.

a short or other abnormally heavy load, sufficient voltage drop and current limiting usually takes place, preventing damage to other components. It is not unusual to design resistors so that they will purposely burn out when subjected to excessive current demands. In this case the resistor also acts as a fuse.

Most TV sets and other electronic equipment are designed to operate as released from the factory. It isn't always a simple matter to change the value of one component in one circuit. Side effects, some directly related and others quite remote, usually develop when only one parameter is modified. In some cases all these effects are desirable, but in others only one undesirable situation could very easily negate any benefits. In one specific case a fairly small increase in B+ resulted in the desired increase in picture size, but horizontal AFC circuits were upset immediately, and about a week later filter capacitors had to be replaced because they had been forced to operate at higher voltages. The reverse situation of reduced B+ could cause difficulties in frequency sen-

sitive circuits, limiters, AGC, etc. It therefore becomes a problem of how to provide current surge protection without upsetting the design of those TV sets already released and not equipped with this safeguard. A simple rule to follow is not to modify normal operating conditions.

A solution then would have to consider that if there is no resistor in the power supply circuits, none should be added. On the other hand if there is a resistor, its value when hot should be determined and an

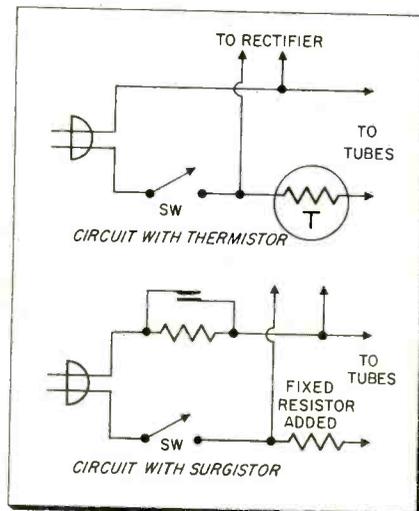


Fig. 4—Circuit resistance values should be maintained when replacing a thermistor, glo-bar, or other negative temperature coefficient resistor. A fuse resistor or other fixed resistor of the proper value should be installed with the Surgistor.

equivalent amount of resistance left in the circuit, when a change is made.

The Surgistor by itself, or in combination with another resistor can be used in most TV set applications to alleviate the difficulties due to current surge. It is a fairly new component which combines the functions of a resistor and a relay. When connected in series with the power supply circuit of the receiver, it offers many advantages. The solid line in Fig. 1 shows that at no time

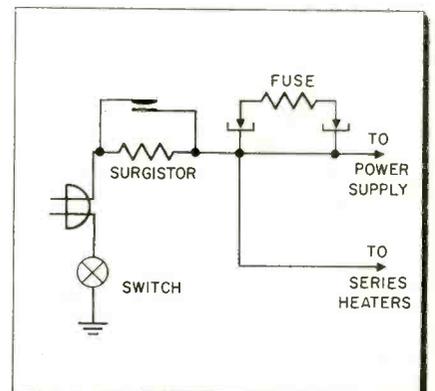
does the value of surge current exceed the normal current demand of the TV set when the Surgistor is used. On the other hand the damaging surge currents which normally occur when no protection device is used is shown by the dashed line. Another advantage of surge limiting resistors is a more gradual development of B+ voltage, which helps prevent cathode stripping and eases the shock on rectifiers.

In addition to cathode flaking and heater-to-cathode shorts, an early decline of mutual conductance can be attributed to heavy surge currents. It is interesting to note the sustained mutual conductance obtained when the protective unit is used in electronic equipment. Fig. 2 shows an evaluation of tests with two groups of tubes, which were operated with and without surgistor protection for four months. The dotted line shows a steady decline of Gm suffered by the unprotected tubes. The solid line depicts the much slower decline of Gm which results when tubes are protected against starting surges. Field tests show that surge protection more than triples tube life and provides a new standard of reliability.

Operation of the Surgistor is simple, as is its appearance and

(Continued on page 78)

Fig. 5—Fuse resistors should be left in the circuit when adding a Surgistor.



Precautions In Using The

No Other Meter Is So Successfully Employed

V O M

Functions

- Voltmeter
- Ohmmeter
- Ammeter
- Output Meter

Characteristics

- Accuracy Factor
- Meter Sensitivity
- Loading Factor
- Battery Condition

Extended Applications

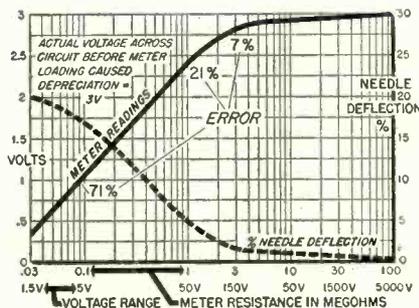


Fig. 2—As accuracy increases, needle deflection decreases on the higher voltage range. Circuit upset due to meter loading may increase error factor even more.

AL DIAMOND

• The Volt-Ohm-Milliammeter, also referred to as a Multimeter of just plain VOM is probably the most popular of all test instruments. No other single instrument has been pressed into as many varied applications and troubleshooting procedures. By the same token most technicians know more and can do more with this meter than with any other. In spite of this, there are enough peculiar characteristics to trap the best benchman, either because it was never covered in any of the literature furnished with the instrument,

or was studied so long ago that it has since been forgotten.

The basic functions, a-c and d-c voltmeter, d-c ammeter, ohmmeter, and output meter are well known. The loading effects of the instrument are also familiar to most technicians, particularly on the voltmeter function. However, often overlooked is the loading characteristics of the ammeter function, the ohmmeter inaccuracies as the internal battery drops in voltage, and even the different loading characteristics of different voltmeter ranges. On the other hand, some ranges of the VOM have a higher input resistance than a 11-megohm VTVM and will load a circuit under test even less.

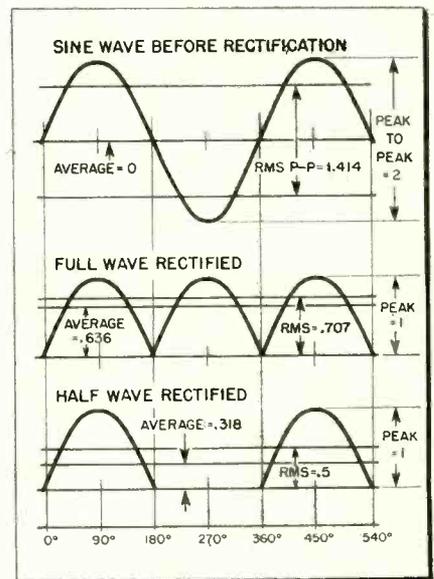


Fig. 3—Most a-c voltmeters read average current and are calibrated in RMS values. Different waveforms have different sets of values.

Fig. 1—Input resistance of 20,000 ohms-per-volt voltmeter ranges from 0.03 to 100 megohms. Depending upon the ratio of load to meter resistance, the error factor varies from 89% to 0.7%.

20,000 Ω/V VOLTMETER

RANGE VOLTS	RESISTANCE MEGOHMS	READING VOLTS	DEFLECTION %	ERROR %
1.5	0.03	.32	20	89
5	0.1	.86	17	71
50	1	2.38	5	21
150	3	2.78	1.8	7
500	10	2.90	0.6	3
1,500	30	2.96	0.19	1
5,000	100	2.98	0.06	0.7

The heart of the instrument is a single ammeter; upon its sensitivity and internal resistance depend the values of shunts, load resistors and overall characteristics. The amount of current necessary to cause full scale deflection in the meter is its sensitivity rating. Early VOMs and some of the less expensive type units use a 1 ma meter.

The more modern and better instruments are equipped with 50 μa meter movements, and still more sensitive units have a 10 μa meter. Increased ammeter range and increased resistance in the voltmeter function are two of the benefits derived from the more sensitive movements. For example to achieve a full scale deflection on a 1 ma meter, when measuring 1 volt, it is necessary to have 1,000 ohms in the circuit. In other words 1,000 ohms must be added for each volt to be measured in order to maintain full scale deflection. Still another way of saying this is 1,000 ohms-per-volt. This

"The Technician Who Needs
New Test Equipment... Is
ALREADY PAYING FOR IT!"

Volt-Ohm-Milliammeter

In So Many Different Ways Has So Many Error Factors.

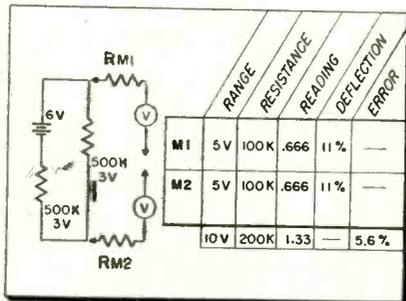


Fig. 4—Two 20,000 ohms-per-volt meters on the 5 volt range provide a 30% improvement in accuracy and only a 6% loss of deflection as compared to the same test conditions using only one meter.

is ohms law at work in its simplest form.

$$R = \frac{E}{I} = \frac{1}{0.001} = 1,000 \text{ ohms}$$

Thus, the ohms-per-volt rating is determined by meter sensitivity. A 20,000 ohms-per-volt VOM uses a 50 μ a meter movement ($\frac{1}{0.000050} = 20,000$), and a 10 μ a

unit would have a 100,000 ohms-per-volt rating. Another point to keep in mind is that the total resistance in the voltmeter circuit for any given range is determined by the maximum voltage that can be read and the ohms-per-volt rating. The E over I formula could be used or the ohms-per-volt rating can be multiplied by the maximum voltage. For example, the 500 volt scale on a 20,000 ohms-per-volt meter has a total resistance of 10 megohms. It is generally believed that a VTVM with its flat 11 megohm input on all its ranges presents the least amount of circuit loading. From the example just given it can be seen that even the 20,000 ohms-per-volt VOM ranges in excess of 500 volts will do better. At 1,500 volts the 20,000 ohms-per-volt VOM presents a 30 megohm load. In this respect the 100,000 ohms-per-volt VOM is out-

standing in that the 150 volt range has a 15 megohm circuit loading factor. However, the loading factor on the low-voltage ranges must be taken into consideration especially when taking readings in a high impedance circuit. The 5-volt range on a 20,000 ohms-per-volt meter has a total of 100,000 ohms resistance. When placed across a 500,000 ohm circuit having a potential of 3 volts, the meter will read 0.86 volts, an error of 71%. Reducing the range to 1.5 volts will increase the error to 89% and render a reading of only 0.32 volts. Fig. 1 and its associated table indicate the voltage readings that could be expected on the various ranges, as well as the percent of error and percent of needle deflection for the test conditions just described. Fig. 2 graphically illustrates this situation. These statistics are based upon no error in the

meter and its associated circuitry, which of course is rarely so. If it were considered the error-factor would be larger. Under these conditions a meaningful reading on the low voltage range is virtually impossible. Even though the error on high range is reduced to negligible proportions, the reading is also of no value. The amount of deflection on a 3-volt source will cause on the high voltage range is insignificant, and if meter accuracy is taken into consideration on the low end of the dial, any hope for a usable reading will be abandoned. Circuits having still higher impedance aggravate this situation. However, in actual practice when servicing a radio or TV set and it is desired to quickly determine if a grid is positive or negative it is possible to see a small amount of needle deflection. Meter

(Continued on page 68)

Fig. 5—Accuracy of the series type ohmmeter circuit depends upon battery voltage.

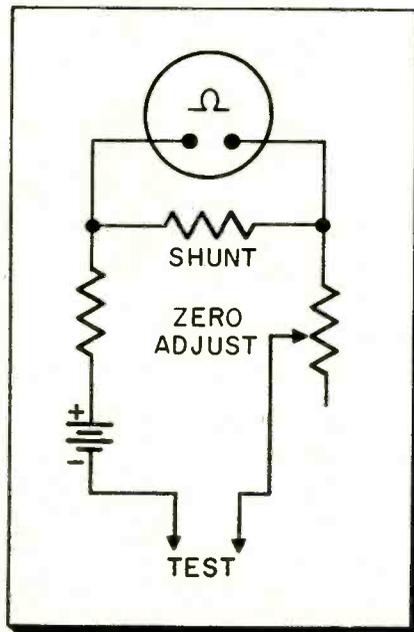
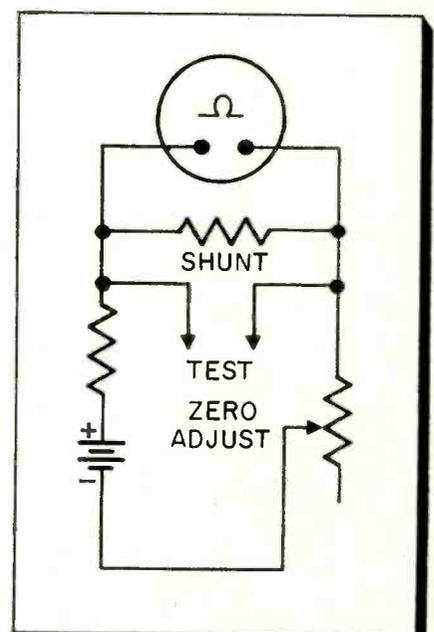


Fig. 6—Shunt type ohmmeter circuit's accuracy is not affected by battery voltage, but high resistance in an old battery is a factor.



TV Outlet Gets Into 2-Way Radio Service

Careful Planning Opened Way To First Big Job. Sales Rose 400%

PHIL SIGNORINI

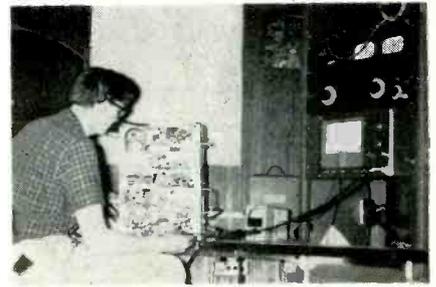
• Sales volume increased over 400% in two years for the Denman Electronics Corp., 515 Broadway, Somerville, Mass., as the result of this TV repair and service firm's entry into the field of servicing and installing fleet radio systems, according to James Denman, president, and Clifford Harnish, vice president.

Approximately two years ago, Denman and Harnish went into servicing fleet radio systems, because they believed it was a lucrative business, offering good growth possibilities. They made plans three years ago, when The Massachusetts Turnpike Authority announced that bids were open on a contract for the installation and servicing of a two-way, microwave radio system, with

UHF and VHF, for 120 new mobile units in the Pike's police, maintenance and administrative vehicles.

Realizing that this contract could be the first step toward successfully entering the field, Denman and Harnish began estimating costs and drawing up plans for the contract well in advance of bidding. After a year of extensive work and careful research, during which they also maintained their TV business, Denman and Harnish completed their bid estimate. The result of their painstaking calculations and extra effort won them the contract.

"Getting that contract gave us a firm foothold in a new area," affirms Denman. "Being under contract provides year 'round work and enables us to plan our work months in advance. Because we know exactly what type of unit we are working with, where it is and what tools and



One of three benchmen troubleshoots two-way mobile communications unit.

parts are required for servicing, we set up a schedule and route for our technicians to follow.

"At the present time, 60% of our work is on a contract basis. An accurate estimate of costs is possible because each job is with the same type of unit. This helps to stabilize the work load, increase efficiency and keep bookkeeping costs at a minimum."

Denman Electronics utilizes six station wagons, each fully stocked with replacement parts, tools, and the latest test equipment. Four of

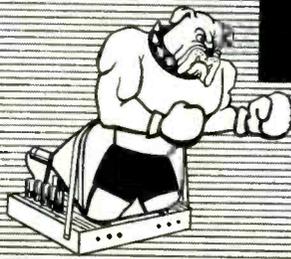
(Continued on page 75)

Denman (l) and Harnish examine auto radio and 2-way mobile units. This work eventually replaced TV servicing; business volume rose 400%.



One of six "repair shops on wheels" used by Denman technicians on servicing routes.





"Tough Dog"

Corner



Difficult Service Jobs Described by Readers

Too Much B+

The new silicon rectifiers are great for perking up the performance of an old TV set but let the installer beware—they can get you into a whole lot of trouble. Because silicon has a lower internal resistance than selenium, a gain of 30 to 40 volts may be realized from the B+ supply. Unfortunately, many old sets have not been designed to handle that extra voltage.

Several years ago I converted a ten-inch Emerson TV set model 571 to drive a 20CP4. The conversion turned out highly successful and had been giving excellent service. A few months ago I had an opportunity to give it a general shop overhaul. I installed four new silicon rectifiers in place of the four original selenium rectifiers. The set performed better than ever. B+ remained the same, 150 volts, but B- rose sharply from 180 to 250—an increase of 70 volts. After checking the electrolytics and feeling satisfied that they were in no danger of break down, the set was delivered.

Several weeks later the set developed vertical sync trouble. There was no vertical lock whatsoever. A quick check revealed that not one but both capacitors C68 and C69 in the integrator network were shorted. Studying the schematic revealed that the coupling capacitor C67 would prevent B+ from being applied across the components in the integrator circuit. I therefore assumed that the trouble could have been caused by a higher signal voltage. Both 400-volt capacitors

C68 and C69 were replaced with 600-volt units.

The set again worked fine for several weeks, then another call had to be made. This time the receiver was out completely. The ballast tube was open. A new one was installed and everything seemed to be normal again. Still I expected more trouble, so I examined the new ballast tube rather carefully while in operation. By peeking through the vent holes it was possible to see that the wire-wound resistances had an excessive glow to them. It was obvious that the life of the new unit was going to be limited. I left the set in operation but returned a few days later with a heavy duty unit which I had to make by installing higher wattage resistors in an old tube base.

Again the set worked perfectly for several weeks, but another call came in. This time it sounded serious—horizontal deflection slowly decreased and disappeared, and as if matters weren't bad enough already, the set gave off an awful lot of smoke. This time the set was taken

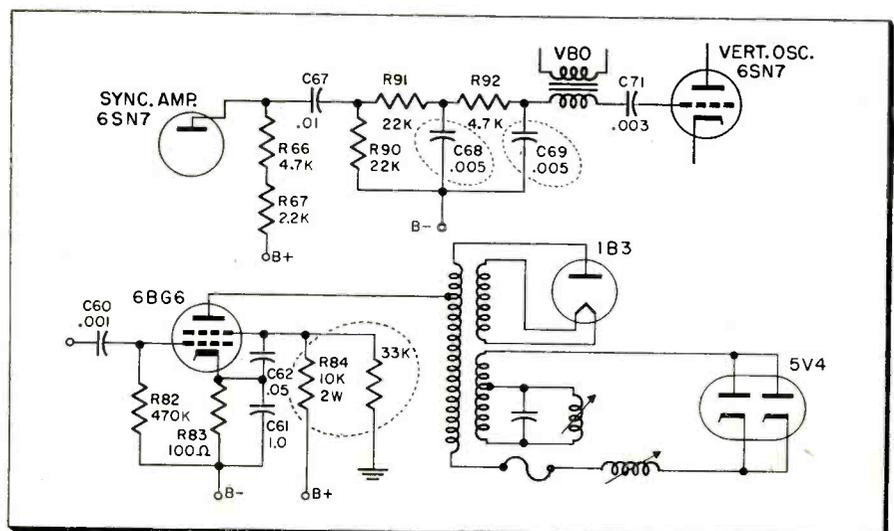
back to the shop.

The flyback showed signs of having been overheated. The sweep tubes were good. I turned the set on, but kept one hand on the switch ready to shut it off immediately. Much to my surprise the picture came on as pretty as you please—but it didn't last long. Fifteen minutes later, it slowly faded away and the flyback started to smoke.

After checking through the entire sweep section I concluded that there were no defective parts, and that because of the higher operating voltages excessive current was being forced through the flyback. To remedy this situation, I removed the 10,000 ohm resistor on the screen of the 6CD6 and replaced it with a 33,000 ohm resistor to ground. This trick reduced current drain sufficiently to prevent the flyback from overheating.

The set has been going along now for some weeks and still on the old flyback. Wonder what's going to break down next.—Frank A. Salerno, Long Island City, N. Y.

Excessive B+ on this converted Emerson TV set Model 571 developed sync trouble, burned out the ballast tube, and almost burned out the flyback transformer. Wondering what's next.

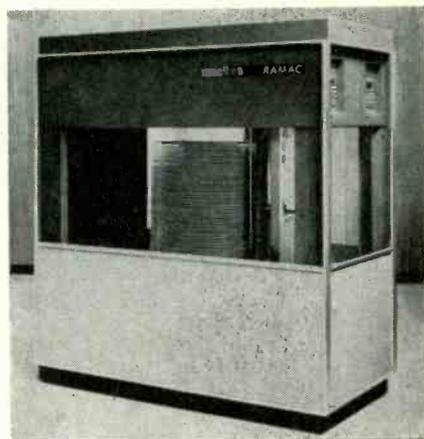


TOUGH DOGS WANTED!

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



Electronic data processing machine combines the ability to calculate at unbelievably high speeds with a vast electronic memory. A central processing unit performs calculations in millionths of a second, and has the ability to make logical decisions.



5,000,000 characters of information can be recorded on, or read from each side of the 50 memory disks by a rapidly moving arm.

Introduction To Digital Computers

Progress In Industrial, Business, Medical & Scientific Research & Development Depend Upon The Modern Electronic Brain.

ALLAN LYTEL

• A modern digital computer is an intricate assembly of switching circuits whose active elements may be vacuum tubes, transistors, or magnetic cores. The total number of circuits may be very high. One machine may have 6,000 diodes and 4,500 tubes. These are arranged in a large number of basic circuits, which in themselves are not too complex. A typical computer has five basic sections as shown in the block diagram in Fig. 1. These sections and their functions are: 1. arithmetic and logic, performs actual mathematical operations; 2. memory or storage, retains the program, the problem, and the results; 3. control, directs the overall computer operation; 4. input, translates all input

information to a form usable by the computer; and 5. output, changes the computer output into a usable form.

Arithmetic & Logic

The arithmetic and logic unit can add, subtract, multiply, divide and compare numbers in a manner similar to a desk calculator, but at a very rapid speed. It can make logical decisions, distinguish positive, negative, and zero values, and transfer this information to other units of the computer. The most complex calculations can be broken down to an arithmetic process. For example, multiplication and division can be accomplished by a series of additions and subtractions respectively.

Memory

The memory has a large number of locations or addresses all of which can store the information until

needed. Information in storage can be obtained or the location for new storage can be indicated at high speed. Reading out information from the memory may or may not destroy the data, depending upon instructions. If the information is not destroyed, it can be referred to many times. Storage can be accomplished by electronic, mechanical, photographic, and combination devices. They may be magnetic tape, wires, discs, drums, and cores; punched cards and paper tape; ferroelectric; electrostatic; capacitive; and delay line. Once the information is placed in the memory, the computer can operate independently until a solution is reached.

Input & Output

The computer can transfer the final results to the memory or make it available through the output device. Results may be punched into

DIGITAL COMPUTERS

Functions

Input
Arithmetic & Logic
Memory or Storage
Control
Output

Binary System

Addition
Subtraction
Multiplication
Division

cards, recorded on magnetic tape, or printed in report form. High-speed output is facilitated by printing an entire line of information at one time. Input and output devices are similar but they perform opposite functions. An input unit reads information from punched cards, magnetic tapes or special keyboards and codes this data so that the computer can handle and use the information.

Control

The control unit can select a stored program. It observes the coded instructions and can direct an entire sequence of operation. Special instructions enable the processing unit to make logical decisions based on intermediate results. These decisions allow the system to select the proper course among several alternatives for solving a problem.

Binary System

Arithmetic originated by counting digits. Probably because man has ten fingers the decimal system is universal. Had there been but two digits, the binary system might have become more popular. Fig. 2 shows a comparison between the two systems. An apparent drawback may be noted that as the count increases, more places are required. Decimal 8 is equal to binary 1,000. In spite of this, some of the fastest electronic devices use the binary system. Since only two digits are required, binary numbers may be represented by an on or off condition, a state of up or down, right or left, presence or absence, etc. mechanical and electronic devices can readily accomplish and indicate these two conditions at high speed.

Any on-off device can be used with the binary system. Information is not restricted to numbers. Numbers can represent letters, and combinations of letters make words. Complete sentences can be stored.

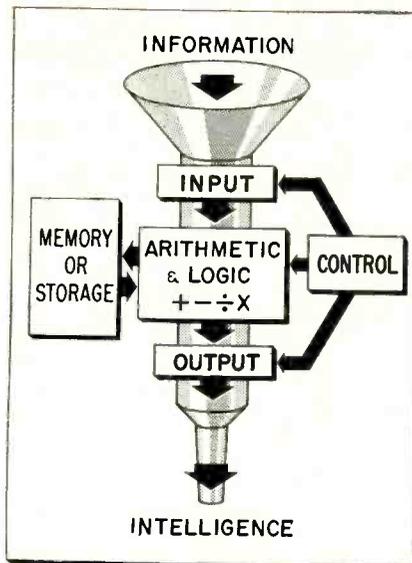


Fig. 1—The five basic sections of a digital computer can convert assorted bits of information, into usable form at high speed.

By the same token other information and instructions may be coded in terms of the binary system. To convert binary notations to decimal values it is only necessary to add the appropriate power of two according to the on indication. Decimal 63 is equal to the sum of $2^5 + 2^4 + 2^3 + 2^2 + 2^1 + 2^0$.

Binary numbers are fairly easy to handle. In the beginning it may be a little confusing, but it can be readily mastered. The basic rules follow.

Addition

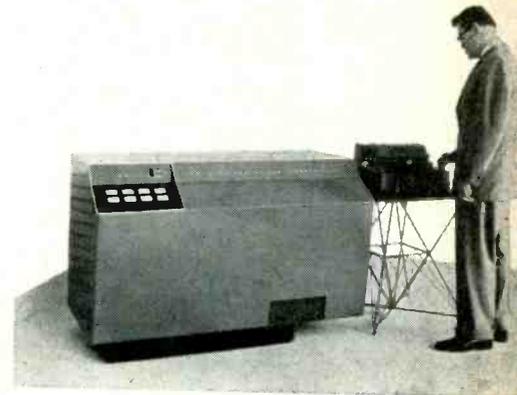
0	0	1	1	10	11
+0	+1	+0	+1	+1	+1
0	1	1	10	11	100
Decimal	46	=	Binary	101110	
+59	=	+111011			
105	=	1101001			

Addition may be accomplished in

Fig. 2—Comparison between decimal and binary counting systems. Use of only two digits instead of ten requires more places, but high speed machines more than make up for it.

DECIMAL VALUE	BINARY VALUE					
	$2^5=32$	$2^4=16$	$2^3=8$	$2^2=4$	$2^1=2$	$2^0=1$
0 =	○	○	○	○	○	○
1 =	○	○	○	○	○	●
2 =	○	○	○	○	●	○
3 =	○	○	○	○	●	●
4 =	○	○	○	●	○	○
8 =	○	○	●	○	○	○
16 =	○	●	○	○	○	○
32 =	●	○	○	○	○	○
53 =	●	●	○	●	○	●
63 =	●	●	●	●	●	●

● = ON ○ = OFF



No larger than an office desk, this digital computer is designed to provide automatic control of industrial processes, data logging, and test facility operation.

series or parallel. Series addition is the conventional method used by individuals wherein first one column is added, and then the next plus the carry over, if any. Parallel addition involves separate operations. First all the columns are added at the same time, as though there were one person for each column, without regard to carry over. After this step is completed, another addition is performed to include the carry.

Multiplication

Decimal multiplication and binary multiplication are similar.

0	0	1	1	0	0	1	1
×0	×1	×0	×1	0	0	0	1
0	0	0	1	Decimal	=	Binary	1111101
125	=	1111101		12	=	1100	
250	=	0000000		125	=	0000000	
125	=	1111101		—	=	1111101	
1500	=	1111101		1500	=	1111101	
							= 10111011100

Multiplication by Addition

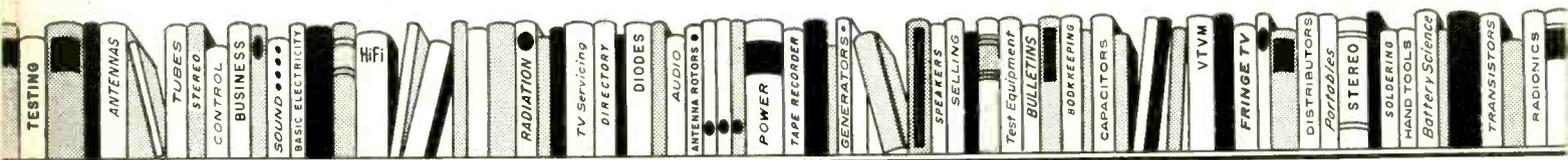
Decimal	Binary
125 × 12	1111101 × 1100
125	1111101**
125	1111101*
125*	—
1500	10111011100

In the decimal example, the sum of 1500 could have been arrived at by actually adding 125 twelve times. Shifting the number 125 to the left one space is the equivalent of adding ten times. Thus reducing the actual number of steps to, add twice, shift to the left once, and add once. The equivalent binary notation requires two shifts, one addition, one shift, and another addition.

(Continued on page 74)

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By Eugene Ecklund. This practical manual on the repair of record changers covers mechanical elements, such as drives, tripping and dropping mechanisms, change actions and spindles. It also explains pickups, needles and motors. Amplification compensation, fault location and tests are included. Hard cover, 278 pages. Price \$5.95.

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By George Chute. How various electronic devices operate, and how they are employed in industry is clearly explained with little use of mathematics. Subject matter includes rectifiers, time delays, gas tubes, welding controls, ignitrons, heat and light relays, thyatrons, motors, servos and others. Hard cover, 431 pages. Price \$8.00.

OBTAINING & INTERPRETING TEST SCOPE TRACES

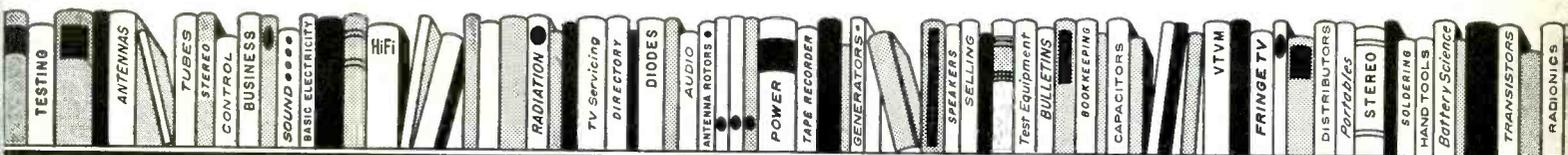
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(Catalogs & Bulletins
Continued from page 24)

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for magnetizing or demagnetizing special instruments and small tools such as screwdrivers, hammers, small wrenches, etc. Perma-Power Co., 3100 N. Elston Ave., Chicago 18, Ill. (ELECTRONIC TECHNICIAN B10-6)

DIODES: Bulletins SR-201, SR-163, and RN-858 cover respectively industrial silicon power diodes, subminiature selenium diodes, silicon stud mounted diodes and other data. Technical details given include ratings and characteristics. International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif. (ELECTRONIC TECHNICIAN B10-4)

POTENTIOMETERS: A new 6-page engineering bulletin, #40, discusses the comparison between sine-cosine and linear potentiometer methods of phase dividing. Graphs and schematics are included. Technology Instrument Corp. of Calif., 7229 Atoll Ave., N. Hollywood, Calif. (ELECTRONIC TECHNICIAN B10-7)

SEMICONDUCTOR COMPONENTS: Technical data on diodes, transistors, rectifiers, and capacitors is available in colorful literature designed to serve as a guide to failure-free service in military and commercial installations. Hughes Products, International Airport Station, Los Angeles, 15, Calif. (ELECTRONIC TECHNICIAN B10-3)

TUBE TESTERS: A new flip chart kit, designated as part #FC-2-958, enables owners of model 107 tube tester to bring their equipment up-to-date. It consists of a complete set of cards and a new index panel and data on all tubes including late releases. Price \$2.00. Order direct from Seco Mfg. Co., 5015 Penn Ave. South, Minneapolis 19, Minn.

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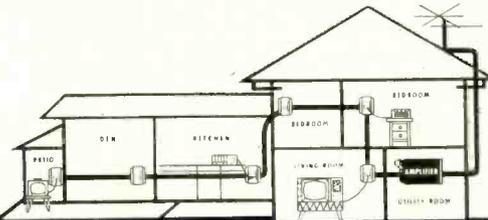
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—P. Barlow

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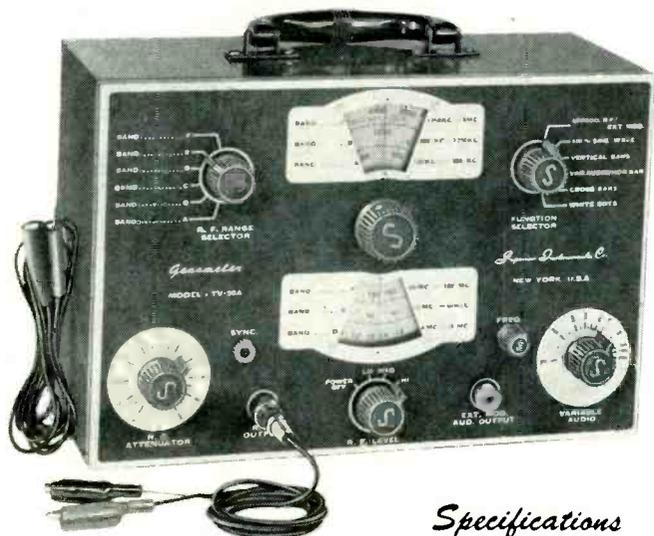
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Model TV-50A

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- ✓ R.F. Signal Generator for F.M.
- ✓ Audio Frequency Generator
- ✓ Bar Generator
- ✓ Cross Hatch Generator
- ✓ Color Dot Pattern Generator
- ✓ Marker Generator



Specifications

R. F. SIGNAL GENERATOR:

The Model TV-50A Genometer provides complete coverage for A.M. and F.M. alignment. Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics. Accuracy and stability are assured by use of permeability trimmed Hi-Q coils. R.F. is available separately, modulated by the fixed 400 cycle sine-wave audio or modulated by the variable 300 cycle to 20,000 cycle variable audio. Provision has also been made for injection of any external modulating source.

VARIABLE AUDIO FREQUENCY GENERATOR:

In addition to a fixed 400 cycle sine-wave audio, the Model TV-50A Genometer provides a variable 300 cycle to 20,000 cycle peaked wave audio signal. This service is used for checking distortion in amplifiers, measuring amplifier gain, trouble shooting hearing aids, etc.

BAR GENERATOR:

This feature of the Model TV-50A Genometer will permit you to throw an actual Bar Pattern on any TV Receiver Screen. Pattern will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars. A Bar Generator is acknowledged to provide the quickest and most efficient way of adjusting TV linearity controls. The Model TV-50A employs a recently improved Bar Generator circuit which assures stable never-shifting vertical and horizontal bars.

CROSS HATCH GENERATOR:

The Model TV-50A Genometer will project a cross-hatch pattern on any TV picture tube. The pattern will consist of non-shifting, hori-

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zontal and vertical lines *interlaced* to provide a stable cross-hatch effect. This service is used primarily for correct ion trap positioning and for adjustment of linearity.

DOT PATTERN GENERATOR (For Color TV)

Although you will be able to use most of your regular standard equipment for servicing Color TV, the one addition which is a "must" is a Dot Pattern Generator. The Dot Pattern projected on any color TV Receiver tube by the Model TV-50A will enable you to adjust for proper color convergence. When all controls and circuits are in proper alignment, the resulting pattern will consist of a sharp white dot pattern on a black background. One or more circuit or control deviations will result in a dot pattern out of convergence, with the blue, red and green dots in overlapping dot patterns.

MARKER GENERATOR:

The Model TV-50A includes *all* the most frequently needed marker points. Because of the ever-changing and ever-increasing number of such points required, we decided against using crystal holders. We instead adjust each marker point against precise laboratory standards. The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc. (3579 Kc. is the color burst frequency.)

The Model TV-50A comes absolutely complete with shielded leads and operating instructions. Only

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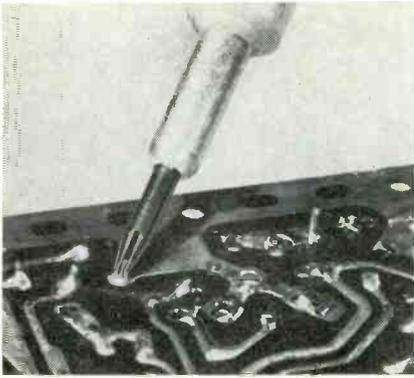


Fig. 1—Slotted tip straightens bent leads and picks up excessive solder at the same time.

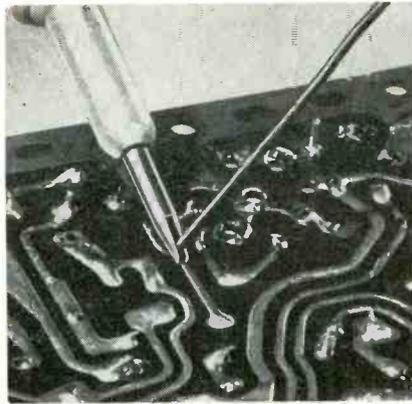


Fig. 2—Printed wiring can be reinforced by laying down a path of smooth flowing solder.

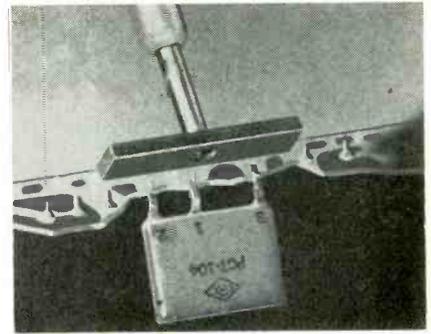


Fig. 3—Multiple, inline-terminated components can be removed and replaced quickly and without damage by using a bar-type tip.

Printed Circuit Repairs

Components Can Be Replaced In 70% Less Time

• There are some repair jobs many technicians don't like. Repairing printed circuits is one of them. Perhaps it's because the components, the wires and the terminals are too small for easy handling with standard tools, and perhaps it's because the right tools have not been available up to now.

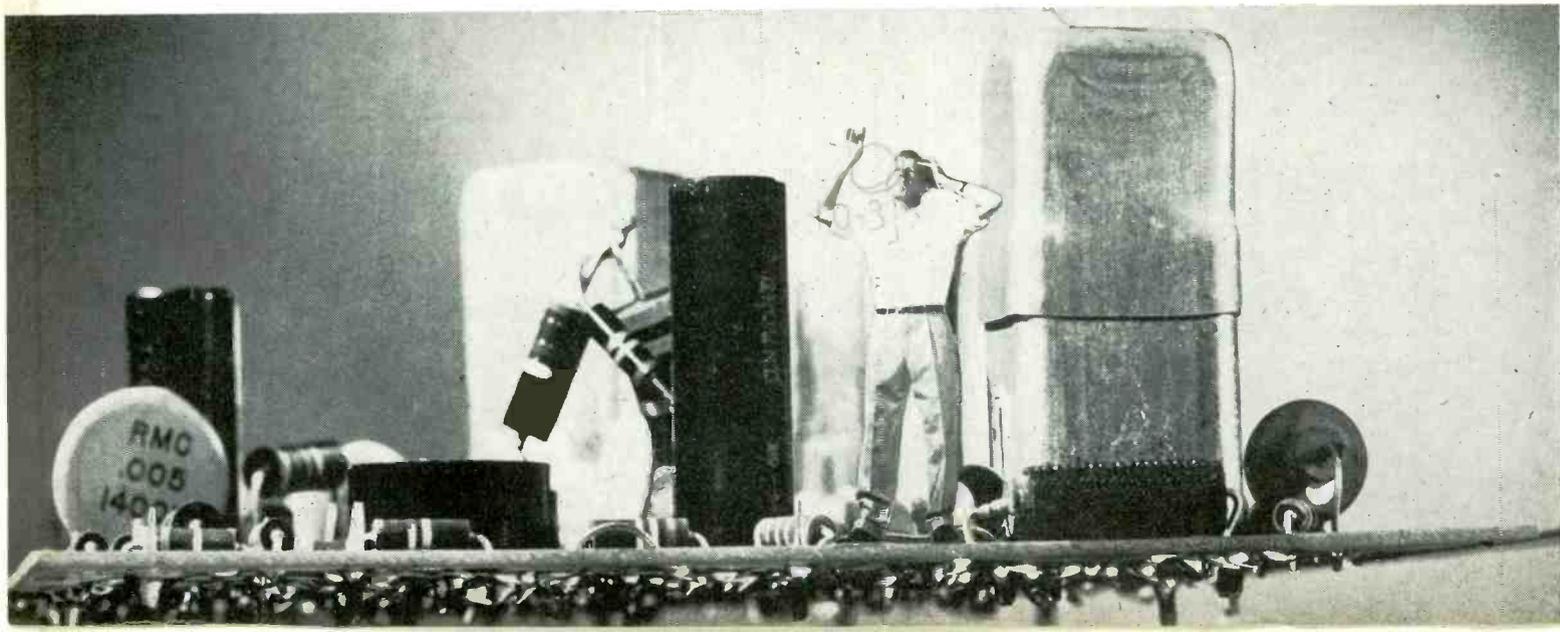
Anyone who has ever tried to remove solder from terminals on printed boards is aware of the problems of using ordinary soldering irons and guns. Most irons radiate so much heat, that the loosened solder runs across the small spaces on the board, contacts other circuits and causes wiring shorts. In many cases, so much heat is given off, that

the printed board actually ruptures and makes repair even more difficult.

Essentially two factors are important in a nondestructive soldering or desoldering operation—the right amount of heat and applying only where needed. Specially designed soldering iron tips have been developed to comply with these requirements. Controlled heat (47½ watts) plus a special plating process confines the heat to a specific area. Damaging heat radiation is kept to a minimum. The tips draw up the loose solder so that there is no danger of running.

Studies of the problems involved have shown that it is impractical to

chase around a tube socket or i-f transformer trying to loosen one terminal at a time. More than one board has been damaged by impatient tugging at an electrolytic. To disconnect a 7 or 9-terminal printed component assembly without first cutting the unit into as many parts as there are terminals, is enough to cause many technicians to wish for a coffee break instead. So in addition to controlled heat, it is desirable to unsolder all the terminals at one time. Even when inserting a new component, it is desirable to apply heat to all the pertinent openings at one time, so that the component can be slipped into position without damaging stresses. Once a multi-



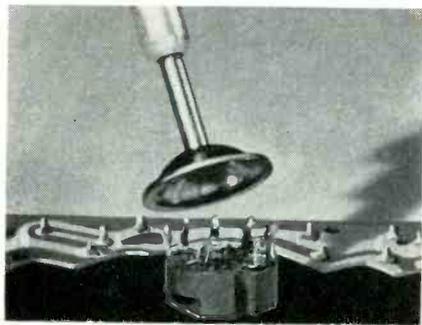


Fig. 4—Cup shaped tips are suitable for removing and installing tube sockets and i-f transformers. Heat and solder are confined to the area within the cup.

terminal component is in position, the usual individual point-to-point soldering can be accomplished.

Because different shapes and sizes of tips may be required from time-to-time, and often on the same job, it is convenient to have interchangeable tips which can screw into one heating element or holder.

The slotted tip shown in Fig. 1 simultaneously melts solder and can be used to straighten component leads bent against the board. Resistors and capacitors and other two-terminal components can be removed, one terminal at a time. Excess solder runs up the slot in much the same manner as capillary action holds ink in a penpoint. Fig. 2 shows how it is possible to reinforce a printed circuit by tracing over the line and applying a small amount of controlled free-flowing solder.

The bar type tip shown in Fig. 3 is specifically designed to remove straight line multiterminal components. It can if necessary be used to tackle an individual terminal, rather than change tips when in a rush.

Cup-shaped tips can as shown in Fig. 4 melt the solder on all tube socket terminals as well as the center pin in one easy operation. Different diameter cups are used for the different size tube sockets and i-f transformers. When the cup is placed in position around the component, the excess solder is picked

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Another ELMENCO "first" is announced with the introduction of the new dipped tubular capacitor. The "DP" series is designed for use in a variety of circuits ranging from TV by-pass to critical industrial applications requiring stringent electrical and environmental characteristics. New high levels of ruggedness, stability, and reliability have been achieved. The new ELMENCO DP Tubulars are miniaturized for transistor circuitry yet compare favorably in price with commercial general purpose units.

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corresponding to the items of interest. Cut out and mail to ELECTRONIC TECHNICIAN.

- 1 Parts & Equipment:** A new 1959 General Catalog of electronic parts and equipment consists of 452 pages listing over 32,000 items. Included are: electronic kits; industrial equipment; hi-fi & stereo components; stereo records and pre-recorded tapes; public address systems; and a TV section on boosters, rotators, towers, antennas, etc. (1B10: Allied Radio Corp.)
- 2 TV Products:** A new dealer price list, covering the firm's entire line, is available. Illustrated in two colors, the 4-page brochure gives descriptions, specifications and prices for such consumer and industrial TV products as: amplifiers; installation accessories, UHF-VHF converters, master TV components and systems; and closed circuit TV systems. (2B10: Blonder-Tongue Labs.)
- 3 Capacitor Kits:** A new catalog sheet itemizes the contents of 4 new ceramic capacitor service dealer kits. Ratings and quantities of all of the capacitors in each kit are given. These new kits are: disc (Kit DDK-400); tubular (Kit D6K-200); high voltage (Kit HVK-150); temperature compensating (Kit TCK-80). The sheet also includes listings of the 40 PEC packaged circuits in Kit PCK-40. (3B10: Centralab)
- 4 Capacitors:** Bulletin 532 provides full description and diagrammatic sketches of new special aluminum can capacitors, with terminal and mounting studs, adaptable to virtually every printed circuit requirement. (4B10: Cornell-Dubilier Electric Corp.)
- 5 Transformers:** The new 1959 catalog consists of 32 pages, in two colors, and covers 750 transformers for industrial, communications, TV, and radio applications. Electrical and physical specifications, charts, performance curves, a special section on mounting styles and a new improved indexing system are included. (5B10: Chicago Standard Transformer Corp.)
- 6 Stereo Recorders:** Literature is available describing the new British-made Model 3S Ferrograph stereo recorder. Features include: stereo replay without sacrificing recording and playback monaurally; and an upper track erase head combined with a micro limiting switch which turns the instrument off automatically. Available in 2 alternate speed ranges: $3\frac{3}{4}$ - $7\frac{1}{2}$ ips and $7\frac{1}{2}$ -15 ips. (6B10: Ercona Corp.)
- 7 Receiving Tubes:** A pocket-size interchangeability chart, ETR-1749, lists 122 replacements for 180 popular TV and radio types. Designed as a timesaver for technicians who may be in immediate need of a tube for which they have no direct replacement on hand. (7B10: General Electric Co.)
- 8 Speakers:** Bulletin JH-1 covers the firm's enclosures and speaker kits for stereophonic and monophonic sound. Detailed descriptions, illustrations, diagrams and prices are included. Emphasis in this 8-pager is on "Stereo Director" design for wide choice of speaker placement. (8B10: Jensen Mfg. Co.)
- 9 Circuits:** Transistorized electronic circuits are covered in a 6-page circular. Schematics and descriptions show how to build such transistorized units as audio power amplifiers, power controls, battery chargers, DC to DC converters, etc. (9B10: Motorola Semiconductor Div.)
- 10 Hi-Fi Components:** Three colorful pieces of literature are available. Descriptions, illustrations, technical specifications, and prices are included for cartridges, speakers, enclosures, microphones and tape recorders. (10B10: North American Philips Co.)
- 11 Rheostats:** Bulletin 157B is a 2-page circular on the model E, $12\frac{1}{2}$ -watt miniature wirewound power rheostat. Full description, illustrations, diagrams, specifications and a listing of stock values from 1 to 5000 ohms are included. (11B10: Ohmite Mfg. Co.)
- 12 Tubes:** A new 30-page "flip-style" chart, T-24, shows electrical and physical characteristics for the most important electron tubes having industrial, special purpose and military applications. Printed on heavy duty coated stock in two colors. Tubes are indexed by class with brief explanation of each class. Technical information for each type is provided. Covers power tubes, thyratrons, and many others. (12B10: Tung-Sol Electric, Inc.)



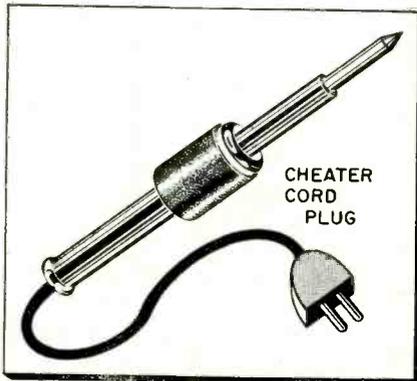
SHOP HINTS



Tips for Home and Bench Service

Space Saver

To save space in my already overcrowded tube caddy, I cut off all but a short length of the line cord on a small soldering iron and installed a male interlock type of plug.



Cheater cord plug attached to shortened line cord on soldering iron, saves space.

I can now connect the iron directly to the cheater cord. A small iron helps to conserve space, and is suitable for work on printed circuits.—*Tom Davenport, Bellevue, Ohio*

Record Changer Fails To Cycle

If the turntable of any of RCA's Record Changers, models RP-197, RP-198 and RP-205 Series, should be turned backward, it may cause the trip pawls on the cycling gear to go into a position where the trip slide lever will not actuate them to start cycling. This condition can occur during shipping. There are three methods by which normal operation may be restored:

Method #1. Reach underneath the mechanism and turn the cycling gear

in the direction opposite to turntable rotation. This engages the cycling gear with the gear on the turntable hub.

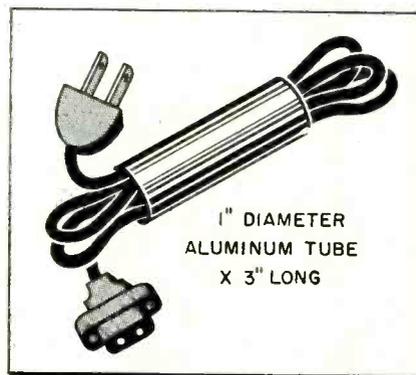
Method #2. Remove the turntable and turn the cycling gear in the direction opposite to turntable rotation, so that this gear will engage with the gear teeth on the turntable hub when the turntable is replaced.

Method #3. Turn the entire instrument on its left side, as viewed from the front. Allow the pickup arm to rest against the center spindle. Turn the turntable by hand through one change cycle. If mechanism does not cycle, bump the Record Changer slightly while it is in this position. Turn instrument upright.

Having the mechanism go through one change cycle will reset the trip pawls to their normal position. If the conical spring on the cycling gear has insufficient tension or if the pawls have excessive lubrication, the "fail to cycle" condition may happen very easily. On the other hand, if the spring has too much tension, the mechanism may fail to trip automatically.—*RCA Service Co., Camden, N. J.*

Cheater Cord Storage

A piece of 1-inch aluminum tubing about 2½ inches long makes a handy holder for cheater cords and



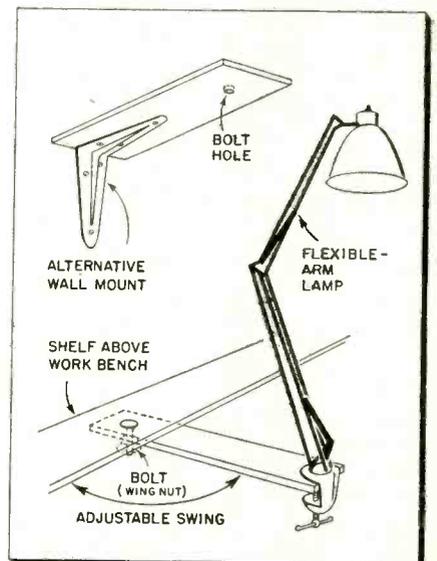
Aluminum tube provides a neat and rapid storage facility for cheater cords.

test leads. It can keep cords in good condition and in place in the tube caddy. Time can be saved by not having to tie a hangman's noose each time the cord is put away.

The ends of the tube should be reamed smooth, so that the cord, fingers and furniture are not snagged.—*Donald Schnell, Noble, Ill.*

Bench Lamp Extension

To extend the usefulness of the adjustable lamp over the bench, install on the wall or shelf above the work area an extension arm about 2-feet long and 6-inches wide. A hole through the extension and shelf to accommodate a bolt will permit the entire assembly to swivel from



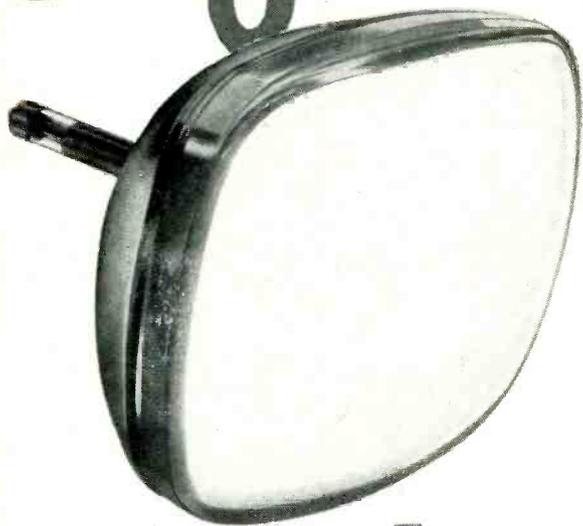
Extension for flexible bench lamp increases the area of coverage and usefulness.

one side to the other and extend the range of the lamp. Large washers with a small amount of lubricant placed on either side and between the board and shelf will enable easy action for a long time. The lamp can be secured to the end of the extension arm in the usual manner.—*Tom Davenport, Bellevue, Ohio.*

SHOP HINTS WANTED!

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

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Mobile Radio

FM or SSB

Can SSB Solve Problem

Of A Tight Spectrum?

Richard P. Gifford

• Once more, the Land Mobile Radio Services have taken the lead in spectrum conservation. Through the combined efforts of the users, the manufacturers and the FCC, the channels have been split once more. What next? From data filed by EIA, it is clear that 41 Mc more will be needed over the next 10 years in the 25 to 890 mc region, even with these new channel splits. Some of the most pressing problems are: Interference—both co-channel and off-channel; reduced intelligibility and range due to ignition noise; finding places to mount the equipment; and reducing initial and maintenance costs. There are, at present, three classic forms of modulation, amplitude modulation (AM), frequency modulation (FM) and single side band modulation (SSB). Over 30 years ago, someone got the bright idea that it was not necessary to transmit both sets of sidebands and the carrier, since one set contained all the information. With a suitable filter, he chopped off one set and even the carrier. Then, in the receiver he found that he had to effectively restore the carrier and the other sidebands before removing the information from the carrier. But, when he was all done, he had effectively communicated in one-half the spectrum space with one half the power (or even less, depending on how far he reduced the carrier). This would seem to lead to better maximum range performance—more power with less bandwidth—and at the cost of less spectrum. All this sounds good, but there are some “hookers.”

In SSB operation all the power of the transmitter is used to transmit the intelligence; there is nothing in the radiated energy which is unessential. In addition, when no modulation is impressed, no power is radiated; therefore cluttering up the ether is at the absolute minimum. However, to eliminate one sideband the carrier requires some relatively complex circuitry. To raise the power of the remaining sideband to useful levels requires amplifiers with very high linearity. Harmonics and distortion in the slightest degree will have an extremely deleterious effect, primarily in causing out-of-channel splatter which will interfere with other users. Distortion in the amplifiers would have to be less than 0.1% to avoid generating other unwanted sidebands that would be less than 60 db down. The carrier must be accurately located with respect to the side-band. Listening tests of voice indicate that the restored carrier must be within 50 to 100 cycles of its proper location; for signal-

ling work, it would have to be much closer. This is ten times better than the current 0.0005% stability required on FM split channels. The problem of frequency stability in SSB at 150 mc is so severe that complete elimination of the carrier is out of the question. Therefore, a technique of transmitting a pilot carrier which furnishes a reference point for extracting the intelligence in the sidebands in its original form is used. Because of the frequency stability problem, the next best thing is to suppress the carrier as much as possible yet within the capabilities of the receiver restoration circuits. In general, this carrier suppression is in the order of 10 db, meaning that a 25 watt carrier would be reduced to 2.5 watts. It is a formidable problem to design a receiver that can choose the attenuated carrier in the presence of noise and stronger sideband components which are as little as 300 cycles removed. At the start of a transmission, the passband must be great enough for the receiver to find the carrier and then cause a local oscillator to lock on to it. The locally generated carrier then is used in performing the demodulation function to restore the desired intelligence to a useable form.

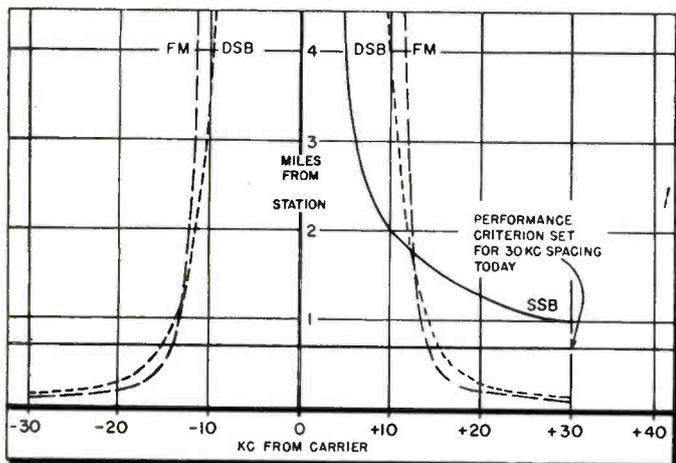
Analysis Condition

This analysis of AM, FM and SSB was done in terms of the commercial mobile radio industry, and what best suits these requirements may be least desirable for fixed point-to-point service and vice-versa.

1. Frequencies from 25 mc to 960 mc.
2. Rapid and large changes in signal strength.
3. Operation of the equipment in rapidly changing and wide extremes of environment including temperature, humidity, vibration, and source voltage.
4. Operation in a crowded spectrum.
5. Operation in fields of severe impulse noise.
6. Operation without daily adjustment and service.

The best criterion for measuring spectrum space used is to measure the interference produced in similar equipment. Data was taken on the basis of each system being equal in maximum performance. Modulation used was simulated voice with sufficient redundancy to yield consistent readings. The FM curve was taken with a ± 2.5 kc swing. The curves in Fig. 1 show that if a two-mile interference radius is satisfactory, then the use of SSB should permit frequency spacings of only 10 kc. But, with ± 5 kc systems an interference radii of 0.7 mile can be just barely tolerated. If this is set as a requirement, SSB would occupy more than twice as much frequency

Fig. 1—SSB transmission requires more than twice as much frequency space as FM at a 0.7 mile interference radius. At two miles SSB operation can be held to 10 kc.



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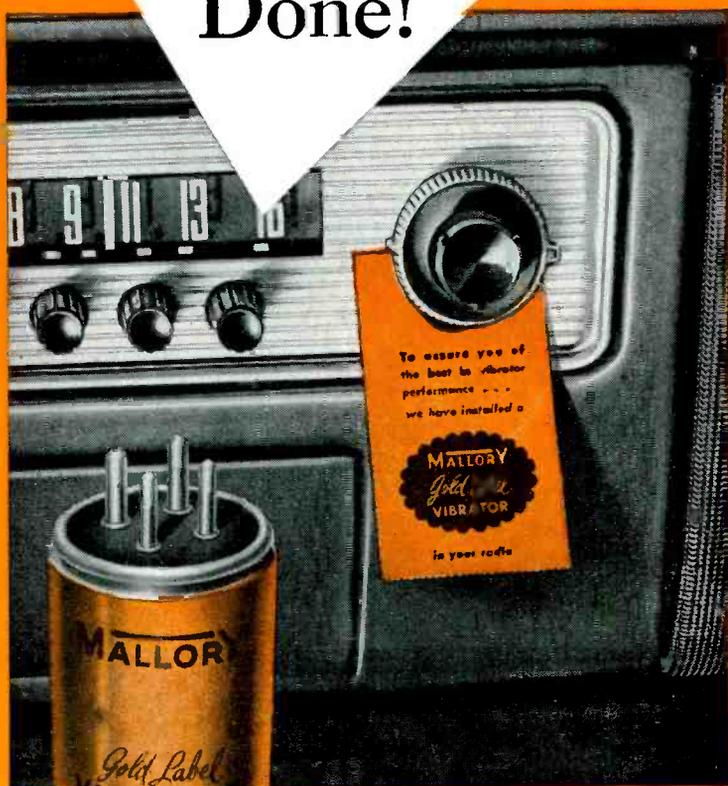
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space as FM.

At what distance can the same frequency be used without being bothered by co-channel interference (assuming no skip)? Here FM shows considerable advantage, even at these low swings. Assuming two FM systems or two SSB systems each designed to have a maximum range of 30 miles and located 50 miles apart, the co-channel interference in the SSB systems would be about twice that for the FM systems, as shown in Fig. 2. Actual field conditions vary widely in terms of co-channel and adjacent channel problems, but as a first approximation on an overall basis, it would appear that very little would be gained through use of SSB on 5 kc channels as compared to FM on 10 kc channels.

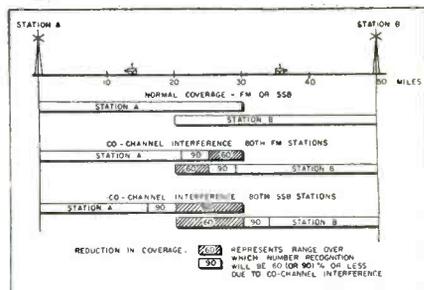


Fig. 2 Co-channel interference for two FM and two SSB stations located 50 miles apart. Greater interference in SSB operation would require a greater distance between stations.

Mobile radio equipment must perform in the presence of serious ignition interference. With the compression ratio on engines going higher and higher, spikes have become an even more formidable opponent. The desire to operate in more and more narrow spectrum does not make the problem any easier. Narrow bandwidth leads to high Q circuits which will "ring" when given a wallop equivalent to a 30,000 μ v spike at the receiver input. It is quite obvious that any amplitude detecting circuits, as in SSB and AM, will detect these bangs. An FM receiver can wipe out the amplitude changes by heavy limiting, but unfortunately, that does not solve the problem. Consider a tuned circuit in the low i-f stages receiving a weak signal. Along comes a steep wave-front of energy many times that already being handled. The impact will set the coil ringing; except under perfect conditions, the ringing frequency will most likely be different from the i-f frequency being handled at that instant. Therefore, although all the amplitude limiting circuits following the filter function perfectly, a pulse of frequency shift

will be detected at the discriminator. Although spike noise does disturb FM, the effect is only one tenth to one hundredth of what happens in SSB. Noise blanking circuits must be added to SSB receivers to get them into the same ball park as FM and these circuits are not just series or shunt noise limiters in the audio. To do an effective job on SSB the noise pulse must be gated out of the i-f amplifiers before it gets to the filter.

Extensive tests were conducted to determine the maximum range capabilities of FM, AM and SSB equipment in terms of the readability of random number series. No man made noises or spikes were injected. The results shown in Fig. 3 indicate some advantage for SSB if the user is willing to tolerate readability of less than 50%. Many emergency services would, of course, consider anything less than 90% readability to be unreliable communications. Note that at the higher readability figure, there is a definite advantage in favor of FM.

The FM and AM transmitters are about a stand-off in size and cost. In AM, the audio must be amplified to higher power for modulation of

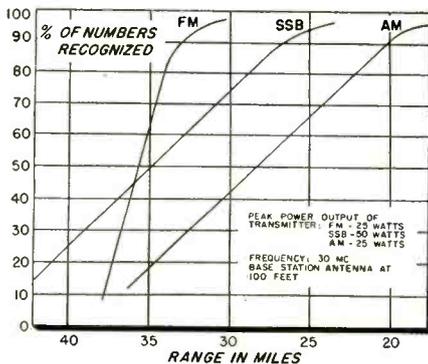


Fig. 3—Number recognition vs operation range. 90% of the numbers transmitted can be recognized at a distance of 33 miles on FM, 27 miles on SSB, and 20 miles on AM transmission.

the final, but in FM, the frequency generating chain may have to be one multiplier longer to obtain the required swing with low cost phase modulation circuits. Recent developments in this area indicate that FM may become simpler—particularly for ± 2.5 kc swing. The SSB transmitter is considerably more complex in that such new items as a balanced modulator, sideband filter, power supply regulation and one or two extra oscillator circuits must be used. Estimated size and cost of the SSB transmitter is about two times that of a comparable FM unit.

(Continued on page 70)

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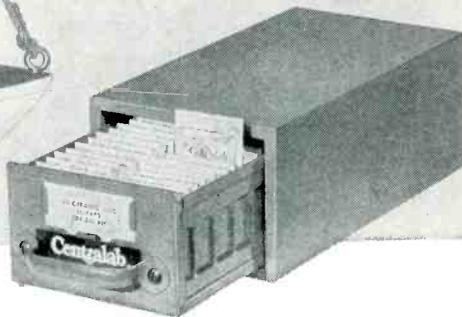
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Kits



No delays! It's always smooth sailing when you use Centralab ceramic capacitor kits. No extra trips to your distributor, no wasted time. The units you need are on hand when you need them.

To keep you on an even keel, these heavy gauge steel kits contain balanced inventories of the most frequently used values. Individual values are prominently and clearly labeled, so you can locate the Hi-Kap you need, instantly. The new rigid plastic package permanently separates and protects the units—yet is easily opened to remove a single capacitor.

So don't be left at sea. Ask your distributor about these four time-saving kits—and while you're at it, be sure to get your free copy of Catalog 30, listing the full line of Centralab capacitors and other quality components.

FREE: \$4.75 cabinet (4"x7"x11") with each kit.

D6K-200 Kit—200 Tubular Ceramic BC Hi-Kaps (27 values)
DDK-200 Kit—200 Standard Ceramic Disc Hi-Kaps (31 values)
TCK-80 Kit—80 TC (Temp. Compensating) Hi-Kaps (40 values)
HVK-150 Kit—150 High Voltage Disc Hi-Kaps (19 values)

Centralab products are listed in COUNTERFACTS, PHOTOFACTS, and THE RADIO-ELECTRONIC MASTER.

Centralab
*Trademark
D-5829

A DIVISION OF GLOBE-UNION, INC.
902K E. KEEFE AVE. • MILWAUKEE 1, WIS.
In Canada: 804 Mt. Pleasant Rd. • Toronto, Ontario

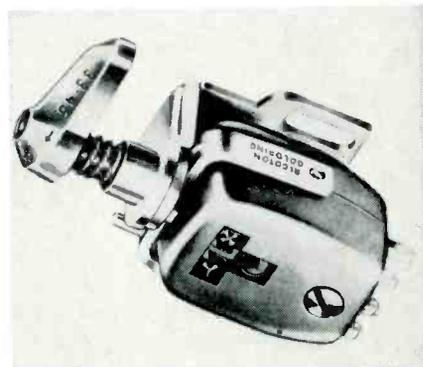
**SWITCHES • PACKAGED ELECTRONIC CIRCUITS • CERAMIC CAPACITORS
CONTROLS • ENGINEERED CERAMICS • SEMI-CONDUCTOR PRODUCTS**

NEW AUDIO PRODUCTS

For more information, write in **ELECTRONIC TECHNICIAN's** new product code number on coupon on page 46.

Recoton **STEREO CARTRIDGE**

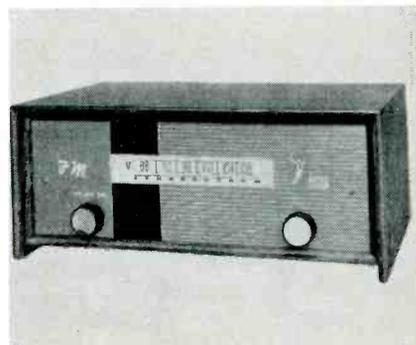
Series RG745 magnetic stereo turn-over cartridge can be used on all turntables and changers for stereo or monophonic pickup. Two new models are available: RG745-ISD, known as the "Piggy Back" model, has 0.7 mil diamond stylus on one side, 1 mil sapphire on the other, in essence, providing a



standby monophonic cartridge. Model RG745-3SD contains a 0.7 mil diamond and a 3 mil sapphire. It may be used with monophonic or stereo records. Recoton Corp., 52-35 Barnett Ave., Long Island City 4, N. Y. (ELECTRONIC TECHNICIAN 10-1)

Altec **FM TUNER**

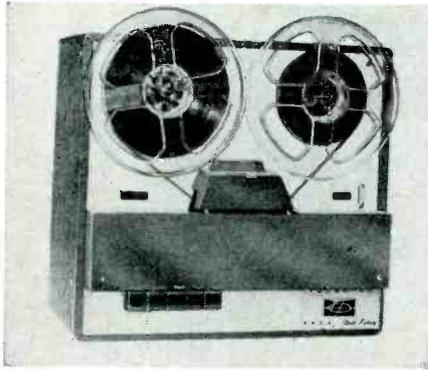
The 307A FM tuner, priced at \$96, features three i-f stages, between-station silencing and afc. Full limiting maintains constant levels for receiving signals from 5 to 1,000,000 μ v. Specifications are: max sensitivity, 1.5 μ v; selectivity, 6 db bandwidth 170 kc, 20 db



bandwidth 260 kc; image rejection, 40 db; squelch quieting, 20 db; frequency response ± 2 db, 20-20,000 cps; distortion, less than 2% at 100% modulation and at 1 volt output. Altec-Lansing Corp., Anaheim, Calif. (ELECTRONIC TECHNICIAN 10-2)

Telectro TAPE DECK

Tape transport, Series 900, will record and play back stereo, with a 4-track head that will accommodate both 2 channel and 4 channel stereo tapes. It has three speeds: 1 7/8 ips, 3 3/4 ips, and 7 1/2 ips. Automatic shutoff. Flutter and



wow is less than 0.25%; s/n 50 db. Frequency response is: 40-15,000 cps at 7 1/2 ips, 40-12,000 cps at 3 3/4 ips, and 40-6,000 cps at 1 7/8 ips. \$89.95 to \$114.95. Telectrosonic Corp., 35-18 37 St., Long Island City, N. Y. (ELECTRONIC TECHNICIAN 10-3)

Atlas CONE-PROJECTOR

Model W-6 cone projector loudspeaker is especially designed for use with juke box extensions, industrial music systems, outdoor installations of all types—where good musical reproduction is desired but where the ultimate in high frequency response is not necessary.



Has 6" cone type driver. Power rating 15 watts; frequency range 140 to 8,000 cps; impedance 8 ohms; dispersion 120°; bell opening 15", depth 12". Atlas Sound Corp., 1451 39th St., Brooklyn 18, N. Y. (ELECTRONIC TECHNICIAN 10-4)

Alpha STEREO WIRE

Complete line of stereo wire for all stereo cartridges and tone arms consists of 7 constructions of extremely flexible, lightweight, miniature cables, having 2, 3, and 4 conductors, with and without shielding, all designed for extremely low hum and noise pickup. Alpha Wire Corp., 200 Varick St., New York 14, N. Y. (ELECTRONIC TECHNICIAN 10-8)



in Astatic cartridge line

ASTATIC Takes Positive, Extensive Action Against Cheap, Imported Cartridges

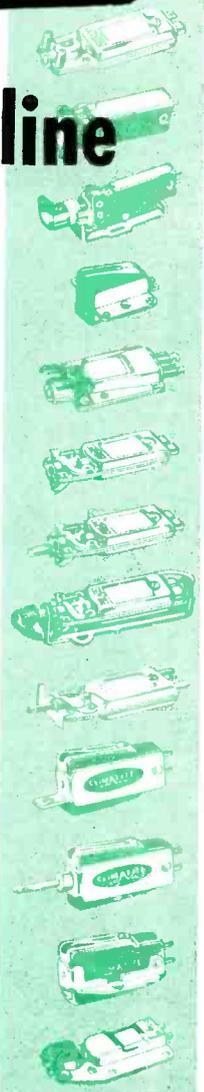
SWEEPING, DRASTIC PRICE REDUCTIONS EFFECTIVE SEPT. 1, 1958

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

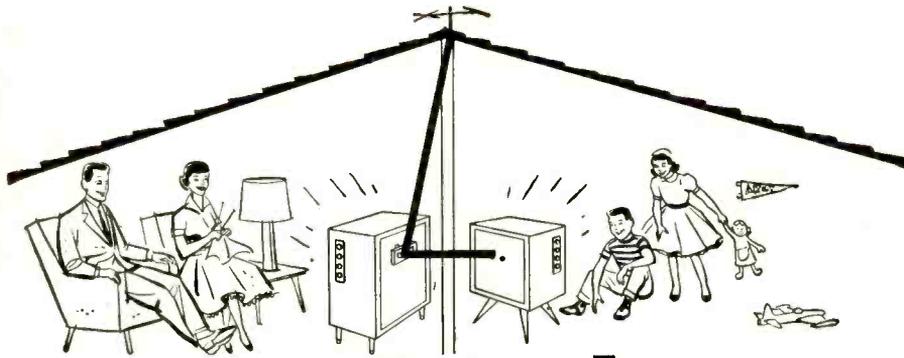
Astatic's answer to inferior cartridges is also YOUR answer. More than ever, the Astatic Cartridge line merits your first preference.

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

Leader with originals — first with replacements



THE **Astatic** CORPORATION, CONNEAUT, OHIO 
ASTATIC IN CANADA: CANADIAN ASTATIC LIMITED, TORONTO, ONTARIO

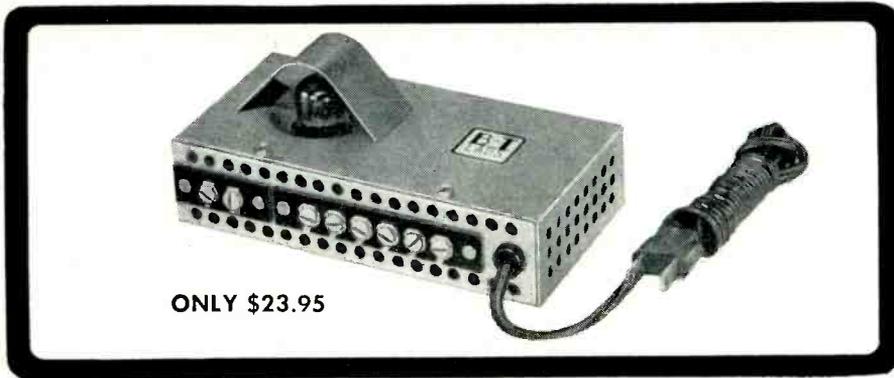


NOW!

sharper, clearer pictures on 1, 2 or 3 tv sets with 1 antenna

NEW B-23

TWO-SET BOOSTER



ONLY \$23.95

From B-T comes the most important step forward in better TV reception for 1958—a broadband TV amplifier that boosts signal strength on all VHF channels 2-13 and operates 1 or 2 or 3 TV sets with one antenna. No tuning is required.

combines two functions in one
A single B-23—

- **BOOSTS** signal strength on 1 or 2 or 3 TV sets—up to 6 db gain operating two TV sets from one antenna.

- **COUPLES** 2 or 3 TV sets—using the present antenna. Outperforms non-powered couplers in any reception area by more than 2 to 1.

check these B-23 features:

- Ideal for color—add a color TV set and keep present black-and-white set, use the same antenna—the result, sharper, clearer pictures on both sets.
- Low noise figure—designed to work with new VHF sets.
- Reduces interference.
- Easily installed at antenna terminals of set. Can be mounted out of sight at the rear of the receiver.
- Automatically amplifies channels 2-13.
- Ideal small TV system (motels, multiple dwellings, TV showrooms).

FOR OPERATING 3 TO 8 TV SETS, USE THE B-T LABS DA8-B—MORE THAN 10 DB GAIN ON ALL VHF CHANNELS.

The DA8-B Distribution Amplifier is a broadband, all-channel unit that requires no tuning, impedance matching devices, pre-amps or other special fittings. Ideal for all small TV systems including garden apartments, motels, TV showrooms serving more than 3 sets. Approved for color. only \$94.50.

The B-23, the DA8-B, and a host of other B-T quality engineered products to improve television reception, are available at electronic parts distributors.

For further information, use coupon.

 **BLONDER-TONGUE LABS., INC.**
9 Alling Street, Newark 2, New Jersey

Please send me literature covering:

B-T B-23 B-T TV Accessories

Name _____

Address _____

City _____ Zone _____ State _____

ET-10

Dynakit DUAL POWER SUPPLY

PS-1 dual power supply kit furnishes power for two preamplifiers used in stereo. It includes provision for maintaining constant voltage regardless of whether one or two preamplifiers are operated from it. Two independent heater windings permit minimizing the hum level from each preamp individually. The unit includes substantial filtering. Assembly time of the dual power supply kit is reported as less than one hour. Price \$8.95. Dyna Co., 617 N. 41st St., Philadelphia 4, Pa. (ELECTRONIC TECHNICIAN 10-7)

Bib TAPE SPLICER

British-made splicer can be used for mending broken tapes and for editing. Made of nickel-plated brass, it comes mounted on a flock-sprayed base, or can be mounted directly on any tape deck. The body of the splicer has two pivoted clamps which lock into position to hold the sections firmly in a channel. Both vertical and diagonal mitres are provided. Horizontal mitres are also provided for use in trimming off surplus mending tape. A razor-type cutter is included. Price \$3.95. Ercona Corp., 16 W. 46th St. New York, N. Y. (ELECTRONIC TECHNICIAN 10-6)

Stentorian CONTROL & AMPLIFIER

Specifications of the W.B. 12 Major Control Unit are: Input sensitivities for a 1 volt rms output, Microphone—25 mv; auxiliary—50 mv; pickup—10 mv nom.; radio—100 mv; and tape—100 mv. Variable roll-off at 5, 7, and 11 kc. Price \$103.00. The W.B. 12 Amplifier specifications are: Distortion, 0.2% at 400 cps; 0.12% at 1,000 cps; 12 watts; frequency response, ±0.15 db from 20 cps to 20,000 cps; hum and noise, —80 db relative to 10 watt output. Price \$96.50. Barker Sales Co., Dept. T, 339 Broad Ave., Ridgefield, N. J. (ELECTRONIC TECHNICIAN 10-5)



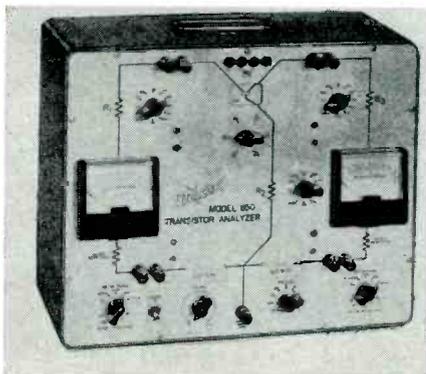
"Wait—I think I like that one best."

LATEST TEST EQUIPMENT

For more information, write in **ELECTRONIC TECHNICIAN's** new product code number on coupon on page 46.

Hickok TRANSISTOR ANALYZER

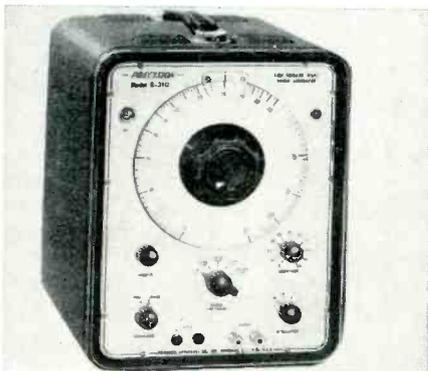
Transistor analyzer 850 provides evaluation of a transistor under specific circuit conditions. Accuracy is limited only by the indicating meters which are $\pm 2\%$ of full scale. Wide range of voltages (within ratings) substitute for "breadboard"—common base,



emitter and collector. Checks cover the following: Collector leakage, C base or C emitter; beta (current) gain; alpha gain; input resistance; output resistance; power gain; linearity. Hickok Electrical Instrument Co., 10523 Dupont Ave., Cleveland 3, Ohio (ELECTRONIC TECHNICIAN 10-9)

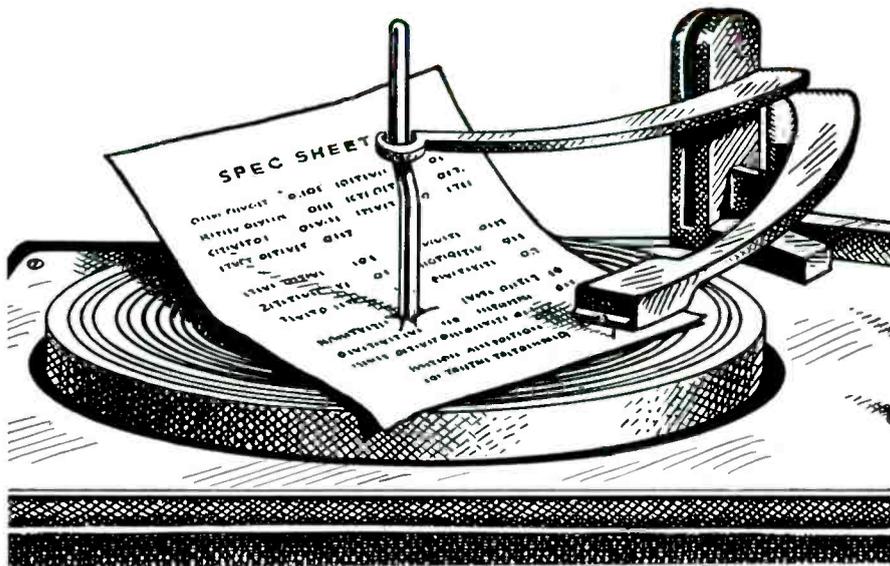
Precision GENERATOR

Model E-310 generator features both sine and square wave output for industrial testing, radio and TV service and hi-fi. Specifications are: sine and square wave, 5 cps to 600 kc in five bands, $\pm 1\%$ direct reading accuracy (or 1 cycle); output, ± 1 db; distortion, less than 1%



at 10 volts into 600 ohms; output level, sine wave, 10 volts rms into 600 ohms, square wave, 10 volts p-p, 0.15 μ sec rise time. Net price is \$165.00. Precision Apparatus Co., Inc., 70-31 84th St., Glendale 27, L. I., N. Y. (ELECTRONIC TECHNICIAN 10-10)

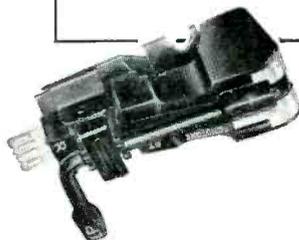
YOU CAN'T HEAR A 'SPEC' SHEET!



Sonotone's stereo cartridge has more than just good specs... it gives brilliant performance! More phono makers specify Sonotone for the top of their line—here's why:

Only Sonotone gives true sound *without* distortion... high frequency response *without* record cutting! Sonotone stereo gives a performance so superior you can truly *hear* the difference. The secret? Sonotone's four exclusive *operating* features:

1. Extremely high compliance.
2. Amazingly clean wide range frequency response.
3. Wide channel separation, due to Sonotone's pantagraph yoke.
4. Rumble filter to screen out vertical turntable noise.



SPECIFY... STOCK... SELL...

Sonotone®

Electronic Applications Division, Dept. JT-108

ELMSFORD, NEW YORK

CORP.

THE NEW HEAVY DUTY, 1/4"
American Beauty
ELECTRIC SOLDERING IRON
#3125 FOR *out-of-*
this-world
PERFORMANCE!



Plug-type tip of rickel-coated copper.

Rigid tubular steel casing provides lightweight support between heating element and handle.

Easily replaced heating element—thick mica insulation cuts current leakage.

Lead-wire insulator, screwed to element assembly for added strength.

New design lead-tube insulator protects and separates lead wires.

Super-flexible 6-foot cord.

Rugged terminal connector assembly provides cord-strain relief.

Cool, comfortable, safety-flare handle.

Available with diamond or chisel point; straight or angled casing, as shown. 60 or 75 watts.

American Beauty soldering irons have led the field in quality and production performance since 1894. There is a model to meet every soldering requirement.

Write for our 16 page catalog, showing our complete line, their use and care.

AMERICAN ELECTRICAL HEATER COMPANY



176-H

DETROIT 2, MICHIGAN

Heath TUBE CHECKER KIT

TC-3 tube checker sockets are provided for 4-pin, 5-pin, 6-pin, 7-pin, large, 7-pin miniature, 7-pin subminiature, octal, loctal, and 9-pin miniature tubes. Kit has multiple filament voltages, adjustable cathode current, variable meter sensitivity, individual element switching with 10-lever switch.



Tube condition is indicated on illuminated 3½" meter. Neon bulb shows filament continuity and leakage or shorts between elements. Roll chart runs freely. Suited for portable applications. \$39.95. Heath Co., Benton Harbor, Mich. (ELECTRONIC TECHNICIAN 10-11)

Kingston POWER SUPPLY

Accurate source of pure dc from 0 to 67.5 volts is known as the model BB-1 variable dc source. It is battery-driven and will produce dependable negative bias voltages for agc troubleshooting, alignment and experimental work. A two-scale meter insures accurate set-



ting. Battery life, when discharged four hours per day to an end point of 45 volts, is approximately 80 hrs. and is greatly extended when use is intermittent. \$14.95 less battery. Kingston Electronic Corp., Medfield, Mass. (ELECTRONIC TECHNICIAN 10-12)

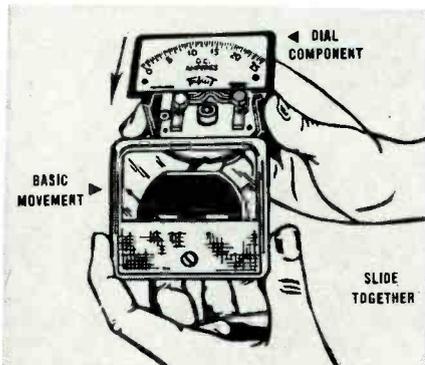
For more information, write in ELECTRONIC TECHNICIAN's new product code number on coupon on page 46.

H-P MICROVOLT-AMMETER

New dc microvolt-ammeter 425A measures dc voltages from 1 μ v to 1 volt and dc currents from 1 μ a to 3 ma. Use of a photoconductive chopper in place of the conventional mechanical vibrator helps achieve high sensitivity and reduces drift to less than 2 μ v/hour after warm-up. Full-scale sensitivity is $\pm 10 \mu$ v and 10 μ a. It may be used as 100 db amplifier to provide up to 1 volt output from signals as small as 10 μ v. Overloads of 1,000 volts cause no damage to the instrument. Model 425A weighs 20 pounds and has cabinet mount dimensions of 7½" wide, 11¼" high and 14" deep. Hewlett-Packard Co., 275 Page Mill Rd., Palo Alto, Calif. (ELECTRONIC TECHNICIAN 10-14)

Triplet "UNIMETER"

Unimeter affords a new way to have a variety of panel meters at low cost combining any number of dial component sections with a separate basic movement section. The assembly process is error-proof and requires only five to six seconds. Simply slide the two sec-



tions together and lock with a thumb-screw on the back. Other features include self-shielded bar-ring movements, ac and dc linear scales. Available in three standard kits. Triplet Electrical Instrument Co., Bluffton, Ohio (ELECTRONIC TECHNICIAN 10-13)

American Transistor METER

New type of high input impedance voltmeter, the Model 300E Precision Probe, measures currents of less than 60 electrons per second. It is useful in insulator and semiconductor work. Sensitivity and stability are achieved by direct-coupled amplifier, utilizing 5 transistors and 2 tubes. Eleven scales cover 1-250 volts full scale, $\pm 2\%$ accuracy. An output terminal provides a replica of input voltage for external oscilloscopes. 7 x 11½ x 4 in. American Transistor Products Co., 1540 Cassil Place, Hollywood 28, Calif. (ELECTRONIC TECHNICIAN 10-15)

Save tube sales for yourself!

NEW, LOW-COST S-18

TEST-O-MATIC®

ONLY \$149.95!

dealer net

NOW . . . at this amazing low cost for a quality self-service tube tester you can have that business that's been getting away from you. Over 5,000,000 tubes a year are sold thru self-service machines. Why not get your share.

An S-18 in your store allows "do-it-yourself" customers to test their own tubes. Saves bench time and effort. When you place a Test-O-Matic in the corner drug store or your friendly supermarket, more business comes your way. Now's the time to ask your jobber about the new S-18 Test-O-Matic.

18 sockets test over 800 tube types. Test each side of multi-purpose tubes. Tests 6 and 12 volt vibrators. Three controls . . . Full emission test. Colorful unit takes only 15" x 19" of floor space. 6 feet high. Holds over 400 tubes in handy sliding drawers.

TEST-O-MATIC
MAKES AND SELECTS TUBE TYPES
FREE! TEST YOUR OWN
1.000 RADIOS TUBES /
DO IT YOURSELF and
SAVE MONEY!
SEE YOUR NEW TEST KIT



NEW PORTABLE P-18 TUBE TESTER FOR SERVICE CALLS

Handsome, lightweight (12 lbs.) portable tester contains same testing panel as S-18. Available in black-grained finish attaché case. Operates 110V AC.



HANDY MODEL C-2 TEST-O-MATIC ALL PURPOSE TESTER

Only 6" x 3¾" and battery operated. Test all tubes for filament continuity. High Voltage tester indicator. Check picture tubes, appliances, any tube or circuit. Contains own flashlite.



For complete information on New Shell Products, see your parts distributor or write to

SHELL ELECTRONIC MANUFACTURING CORP.

Dept. E-10, 1688 Utica Avenue, Brooklyn, New York
Export: RIISE International Corp., 204 East 38th Street, New York, N. Y.

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\$28⁹⁵
 buys in
 high fidelity
 equipment!

HEATHKIT

Manufacturer
 of the finest
 electronic equipment
 in kit form



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

\$28.95

BOOKSHELF 12-WATT AMPLIFIER KIT

An amplifier and preamplifier in one compact unit. The EA-2 has more than enough power for the average home hi-fi system and provides full range frequency response from 20 to 20,000 CPS within ± 1 db, with less than 1% harmonic distortion at full 12 watt output over the entire audio range (20 to 20,000 CPS). IM distortion is less than 1.5% at 12 watts with low hum and noise. EL84 tubes are used in a push-pull tapped-screen output circuit. Inputs consist of crystal phono, tuner, and mag phono with RIAA equalization. Separate bass, treble and hum balance controls are featured. Taps provided for 4, 8 and 16 ohm speakers. Add this unit to your present system for simple stereo conversion. Complete instructions and pictorial diagrams show where every part goes and assures you of quick, easy assembly. Handsome vinyl clad steel cover measures 12 $\frac{1}{2}$ " W. x 8 $\frac{3}{16}$ " D. x 4 $\frac{3}{8}$ " H. Neon pilot light on front. Shpg. Wt. 15 lbs.

NEW PRODUCTS FOR TECHNICIANS

For more information, write in ELECTRONIC TECHNICIAN's new product code number on coupon on page 46.

Comco 2-WAY RADIO

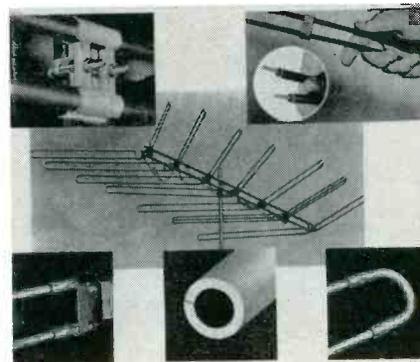
Series "580" Fleetcom two-way mobile radio combines the control head, speaker, and transistorized power supply in one small case. The single transmitter/receiver chassis can be mounted under the dash. 25-50 or 144-174 mc. The "easy-to-install" VHF-FM package is especially designed for the new Busi-



ness Radio and Local Government Radio Services where "split-channel" performance is required at a moderate cost. They are on the approved FCC list. Communications Co., Inc., 300 Greco Ave., Coral Gables, Fla. (ELECTRONIC TECHNICIAN 10-16)

Channel Master TV ANTENNA

Redesigned version of the T-W VHF fringe area antenna, the 350A series, has a new weatherproof 300 ohm harness with extra-thick insulation and 16 gauge copper protects impedance match. New mast bracket installs faster. Three extra-strength element features are seamless $\frac{1}{2}$ " diameter external



sleeves, seamless $\frac{1}{2}$ " U-bend to reinforce dipoles, and 20% heavier wall thickness. "Traveling wave" design remains intact. In 7, 5 and 3 element models, \$54.95, \$39.95 and \$23.50. Channel Master Corp., Ellenville, N. Y. (ELECTRONIC TECHNICIAN 10-17)

many more kits to choose from!

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



HEATH COMPANY

Benton Harbor 18, Mich.

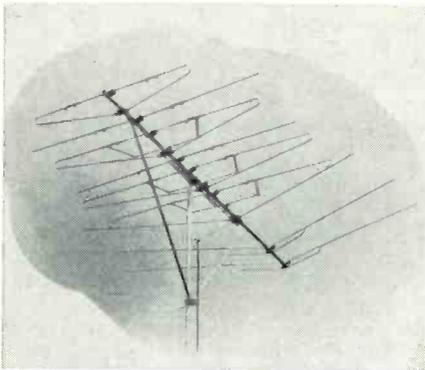


a subsidiary of Daystrom, Inc.

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Trio ANTENNAS

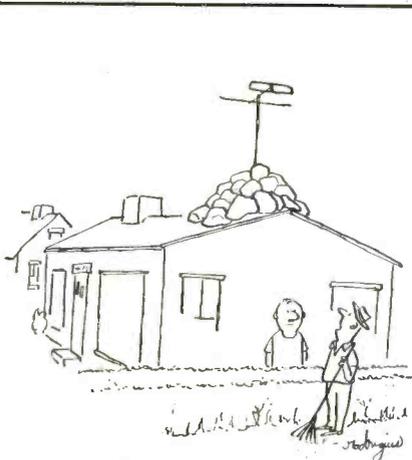
New features for 1959 found in the Zephyr, Wing and Color series antennas include the no-strip lead-in connector, dyna-coil phasing, braced reflectors, and Quik-Lok clamps. Quik-Lok clamps in the Wing Dipole and Director eliminate bolts and nuts. Tightening the U-bolt and setting the thumb screw on



the no-strip lead-in connector completes the installation of a Zephyr or Color antenna; no stripping is required. Terminals are weather protected. Shown is Trio Color Royal all-channel antenna, \$44.95. Trio Mfg. Co., Griggsville, Ill. (ELECTRONIC TECHNICIAN 10-18)

Gulton TRANSIENT ELIMINATORS

A new instrument protects transistor circuits from high-voltage transients, Model EM446 for airborne applications, and EM472 for use in laboratory and ground equipment. When placed in series with power sources, they absorb high-voltage transients and prevent their appearance at the output of the eliminator thus protecting the transistor load. Previously high-voltage transients had to be filtered out, causing inefficiency. The new models cause only the very slightest decrease in power supply voltages. Initial applications are in military and industrial equipment. Engineered Magnetics Div., Gulton Industries, Inc., 13030 Cerise Ave., Hawthorne, Calif. (ELECTRONIC TECHNICIAN 10-23)



"Install that antenna yourself, Frank?"



TV TUNERS REBUILT \$9.95 NET

ALL MAKES & MODELS

THOUSANDS OF TUNERS IN STOCK
ALIGNED TO ORIGINAL STANDARDS
ALL WORK PERFORMED BY TUNER EXPERTS
WITH YEARS OF EXPERIENCE IN THE TUNER FIELD

UHF/VHF UNITS
\$19.90

90 Days Warranty

EXCHANGE TUNER SHIPPED SAME DAY (OTHERWISE DEFECTIVE TUNER OVERHAULED AND RETURNED: WITHIN 48 HOURS IN MOST CASES.)
Price includes WORN parts only.

Replacement tubes and smashed or missing parts are charged extra.

Forward Tuner with All Smashed Parts: Quote Make and Model

F.O.B. Chicago or Toronto
We will ship C.O.D.

Castle Television Tuner Service

1723 W. LUNT AVE.,
CHICAGO 26, ILL.

U.S.A.

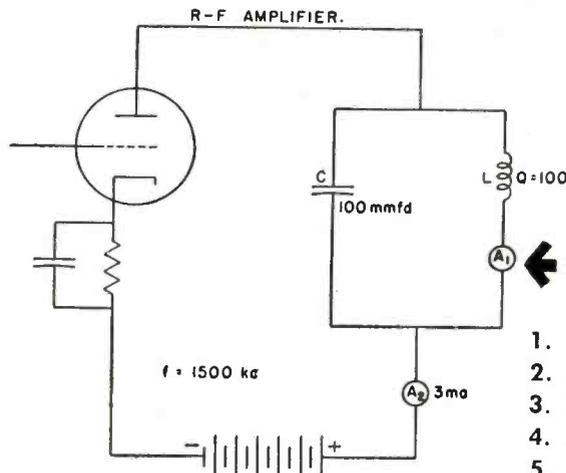
152 MAIN ST.,
TORONTO 13, ONT.

CANADA

Suppliers of rebuilt TV Tuners to leading manufacturers, technicians & service dealers, coast to coast.
Original and Only Complete TV Tuner Service covering the North American Continent.

No. 5 of a series of questions for progressive technicians.

Can You Handle This Problem?



What Will
RF Meter

A₁ Read?

(Answer printed below)

1. Zero, or nearly so.
2. A little less than 3 ma.
3. 3 ma.
4. A little more than 3 ma.
5. Many times more than 3 ma.

How'd you do on this one? Was it easy . . . middling hard . . . or tough?

It was easy or tough depending on how well you know your electronics fundamentals.

That's the way it is on the job too. Day after day we get the same kind of reports from ambitious men like yourself in the field. "I was interested in these problems . . . your training gave me the principles . . . I solved the problems . . . I got a better job . . . and now I make more money."

Why put a ceiling on your income . . . and on the satisfaction you can get out of doing the more challenging jobs. Get your fundamentals more solidly—then take off and really go!

The answer to our little problem is given below. If you want a complete solution, just fill out and mail the coupon.

5. Many times more than 3 ma (approximately 300 ma).

Cleveland Institute of Radio Electronics

4900 Euclid Avenue, Dept. T-14, Cleveland 3, Ohio

Please send me detailed solution to problem above and information on how I may prepare for the increasing opportunities in electronics. There is no obligation.



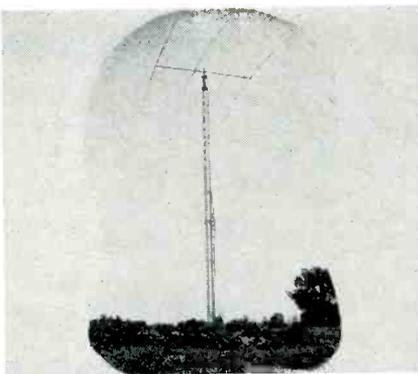
NAME _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

Accredited by The National Home Study Council

T-14

Rohn ANTENNA TOWER →

New "fold-over" antenna tower for communication and general purposes allows working on the ground whenever servicing of antenna or rotator is required. It is available up to 70 ft. high, and is designed to handle practically all sizes and types of antennas. Tower sections 12½" equiangular triangle design with "zig-zag" steel cross bracing, all electric welded. Sections are 10 feet in length for easy installation. Includes boom, cable, windlass and special hinged section. Rohn Mfg. Co., 116 Limestone, Peoria, Ill. (ELECTRONIC TECHNICIAN 10-19)



Walsco GLASS REMOVER

An unusual device to aid in removing of glass panels is called the Safety Glass Remover. It works on a suction cup principle to permit the safe, quick and easy removal of glass panels, without fingerprint smudges and without damage to the glass. It consists of a curved handle with suction cups on both ends. Walsco Electronics Mfg. Co., 100 W. Green St., Rockford, Ill. (ELECTRONIC TECHNICIAN 10-22)

Clear Beam FM ANTENNAS

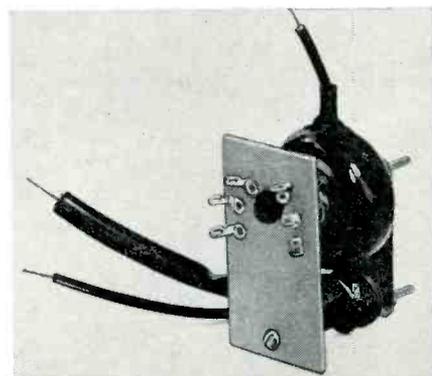
New point of purchase packaging for the line of FM antennas has been designed to keynote a high fidelity music theme. It utilizes royal purple lettering on a pure white carton. Purpose of the packaging is to remind audio enthusiasts that an FM antenna is of key importance in the reception of FM broadcasts. Clear Beam Antenna Corp., Canoga Park, Calif. (ELECTRONIC TECHNICIAN 10-21)

Peerless INDOOR ANTENNA

Mark II Silver Wand antenna features full length 3 section aluminum dipoles and fool proof external friction adjustment. It is packaged in an eye appealing see-thru package. This package enables the customer to see and inspect the product, yet provides protection for the antenna before it is sold. List price \$9.95. Peerless Products Industries, 812 N. Pulaski Road, Chicago 51, Ill. (ELECTRONIC TECHNICIAN 10-40)

Stancor FLYBACK

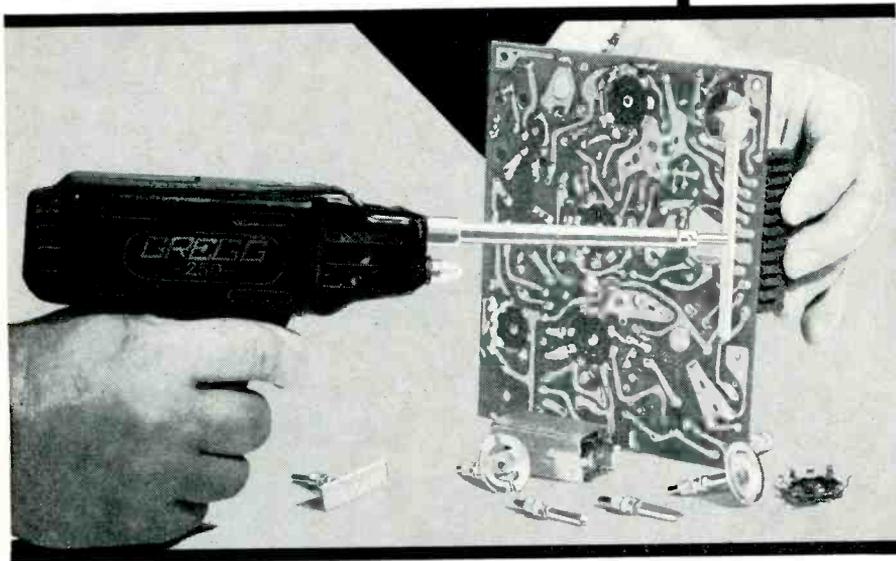
A flyback transformer now available as an exact replacement for General Electric and Hotpoint Part No. RTO-196 is a new unit, numbered HO-288. It requires no chassis or circuit alterations since it is an exact duplicate electrically and physically. The unit is used in T



series chassis in six different models covering almost an entire year's production of GE sets. No. HO-288 is described in Bulletin 548. Chicago Standard Transformer Corp., 3501 W. Addison St., Chicago, Ill. (ELECTRONIC TECHNICIAN 10-24)

GREGG

SOLDERING GUNS



REPLACE PRINTED CIRCUIT COMPONENTS IN A FLASH

Gregg's Solder Tip Kit* is a must for printed circuit repairs! It is invaluable to unsolder several terminals simultaneously, removing components safely and quickly. Kit has four interchangeable tips for tube sockets, IF transformers,

electrolytic condensers and two sizes for condenser resistor boards. Each tip contains its own heating element which distributes the proper heat over its entire surface. Pays for itself on the first job!



MODEL 250A

AMERICA'S FINEST GUN

- Two second heating — no waiting. Heat is generated right at the soldering point.
- Permanent alloy tip does away with filing and cleaning — just a wipe and it's ready. Outlasts copper tips 5 to 1.
- Single barrel construction — reaches into deep places without damage to wiring or components. Rigid tip makes it easy to remove wires and clean terminals while hot. Other barrels available in 6", 8", 10" and 12" lengths.

WRITE FOR FREE
BOOKLET ON REPAIRING
PRINTED CIRCUITS

GREGG electric sales, co.
620 essex st., lawrence, mass.

*Pat. Appl'd for.

Westinghouse POWER PENTODE

Production of a new 9-pin miniature power pentode (6/8BQ5) for audio output use in hi-fi and television receivers has been designed to provide medium power output with very low distortion. It is particularly suited for circuit designs requiring a maximum power output with limited driver voltages. Westinghouse Electronic Tube Div., Elmira, N. Y. (ELECTRONIC TECHNICIAN 10-30)

ITT RECTIFIERS

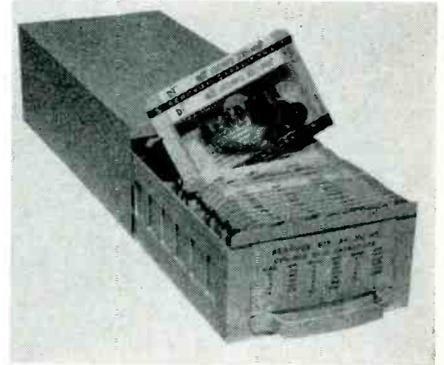
A 60 volt selenium rectifier cell enables the design of smaller and more efficient rectifiers particularly for industrial applications. The "Federal Selenium 60" line includes cell sizes of 1", 1 1/4", 1 1/2" and 2" with single phase bridge rating of 150 ma, 300 ma, 600 ma and 1 amp. The features of the line are miniature size, high efficiency, low temperature rise, and reliable operation at high temperatures. Miniaturization with improved electrical characteristics are made possible by vacuum deposition processes. ITT Components Div. of International Telephone and Telegraph Corp., Clifton, N. J. (ELECTRONIC TECHNICIAN 10-20)

CBS-Hytron DIODE

Type IN699 is an indium-bonded junction-type germanium diode for use in computers, magnetic amplifiers, modulators, demodulators and low-power rectifier circuits. It features high resistance to catastrophic failures (shorts and opens), and improved high-temperature performance. The hermetically sealed glass diode measures only 0.300 in. long by 0.110 in. diameter, and has flexible leads for soldering or welding. Resistance to shock and vibration is provided by its sturdy, spring-loaded, 0.005-in. tungsten whisker and its indium-bonded junction. Data in bulletin E-286. CBS-Hytron Semiconductor Operations, Lowell, Mass. (ELECTRONIC TECHNICIAN 10-29)

Aerovox CAPACITOR KITS →

Two new ceramic capacitor kits include an assortment of general purpose ceramic disc capacitors. All are packaged in the "Vue-Pack" 3 x 5 cards. Cards are housed in a free, attractive metal file cabinet measuring 5 7/16" wide x 11" long. Kit AK-200 consists of 135 ceramic disc capacitors in 24 popular values. Kit AK-201HS consists of 95 ceramic disc capacitors in 16 values. Values are selected according to common use. Distributor Div., Aerovox Corp., New Bedford, Mass. (ELECTRONIC TECHNICIAN 10-25)



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**FREE
STANCOR
SERVICE
REFERENCE
BOOKS?**

AVAILABLE WITHOUT CHARGE TO
PROFESSIONAL SERVICEMEN.
JUST FILL OUT THE COUPON
BELOW FOR YOUR COPIES.

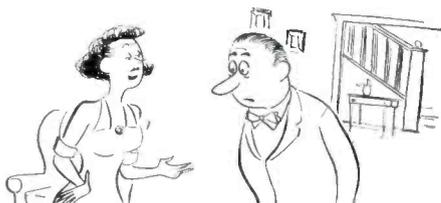
TV TRANSFORMER REPLACEMENT GUIDE: A 120 page book listing detailed transformer replacement information on almost 20,000 models and chassis of over 100 manufacturers.

AUTO RADIO REPLACEMENT GUIDE: Lists over 800 models of 39 manufacturers, including private label brands and new transistor auto radios.

POPULARITY TABLES: Provides essential information on relative popularity of TV flybacks and yokes, by set manufacturer, to simplify inventory problems.

CROSS-REFERENCE CHARTS: Cross-reference information to aid in determining yoke and flyback equivalents from other replacement manufacturers' parts.

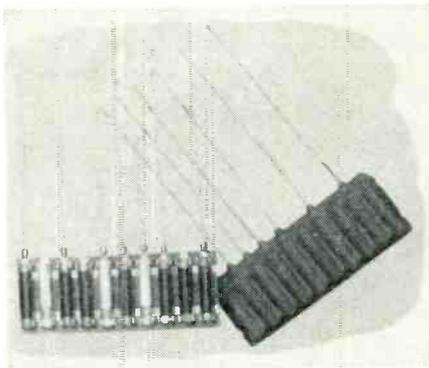
GENERAL CATALOG: Detailed electrical and physical specifications on over 700 stock units for radio, TV, public address, communication and industrial use.



Erie COMPONENTS



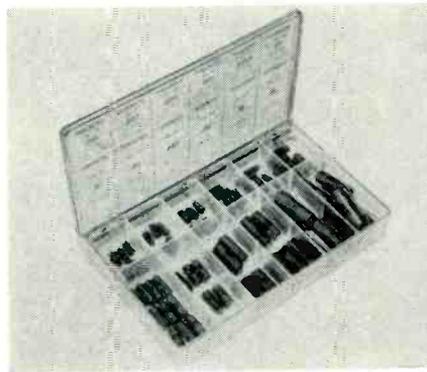
"PAC" (Pre-Assembled Components) units with wire leads for universal wiring permit wide application for this versatile module. Formerly only for printed wiring, the new "PAC" permits use of point-to-point wiring methods to employ "PAC" without circuit redesign. Capacitor-resistor networks will offer capacitance values of 10 μf to 0.01 μf in ceramic dielectric, and from 0.01 to 0.1 μf in the mylar dielectric. Resistance range is 10 ohms to 50 meg. Erie Resistor Corp., Erie 6, Penna. (ELECTRONIC TECHNICIAN 10-26)



Tobe CAPACITOR KIT



Kit of 76 fast-moving molded plastic tubular capacitors are intended for use by service technicians. The Tobemites are all tested at twice their rated capacity for capacitance stability. Applications include replacement in TV sets, auto radios and other compact electronic equipment. These compact capacitors are 50% smaller in size than certain units of equal ratings. The kits are now available through all Tobe distributors. Tobe Deutschmann Corp., Service Div., 2900 Columbia Ave., Indianapolis, Ind. (ELECTRONIC TECHNICIAN 10-27)



CD MOLDED MYLAR CAPACITORS

New line of mylar dielectric molded tubular capacitors. Type PM series, may be used to replace paper units where space must be saved, or close capacitance tolerance and higher insulation resistance are vital circuit requirements. These molded tubulars are especially useful in radio and TV. Capacitance values run from 0.001 to 0.1 μf at 100 through 600 volts dcw. Temperature range is from -55 C to $+85\text{ C}$ at full-rated voltage, and to $+130\text{ C}$ at derated voltage. Cornell-Dubilier Electric Corp., S. Plainfield, N. J. (ELECTRONIC TECHNICIAN 10-28)

Rogers TRANSFORMER

A new high voltage and horizontal output transformer is designed as an exact replacement for transformers in CBS chassis 1012,-2. Designated EFR 200, this flyback replaces CBS parts numbers PC10147 and PC10161. Included with each EFR 200 flyback is a schematic showing connection of this exact replacement in the CBS circuit between the IB3GT high voltage rectifier, 6AX4 horizontal damper and 6CD6 horizontal output. Hermetically sealed in plastic containers. Rogers Electronic Corp., 43-49 Bleecker St., New York 12, N. Y. (ELECTRONIC TECHNICIAN 10-31)

SO SAFE!



NEW! IMPROVED!

SENCORE

TRC4

TRANSISTOR CHECKER

Another Sencore Time-Saver

Only tester that checks car radio power transistors

NOW CHECKS:

- ★ **Transistors** for opens, shorts, leakage and current gain. Includes new gain test on power transistors.
- ★ **Crystal Diodes** checks forward to reverse current ratio on all diodes.
- ★ **Selenium Rectifiers**



SIMPLE TO OPERATE

ONLY \$17.95

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Cannot be less

Tips On Rumble Reduction In Stereo

High Fidelity Sound Requires Quality Components & Workmanship.

• There is every reason to believe that the next major area of activity for electronic technicians will be in the conversion of record players to accommodate the stereo disc. Fortunately, most of the turntables and changers in use can be converted. Certainly all the newer equipment will be able to go stereo. It has long been recognized that a hi-fi system is no better than its weakest component, and the better the system the easier it will be to detect certain defects. The classic example is the one in which a 60-cycle hum became objectionable only when a

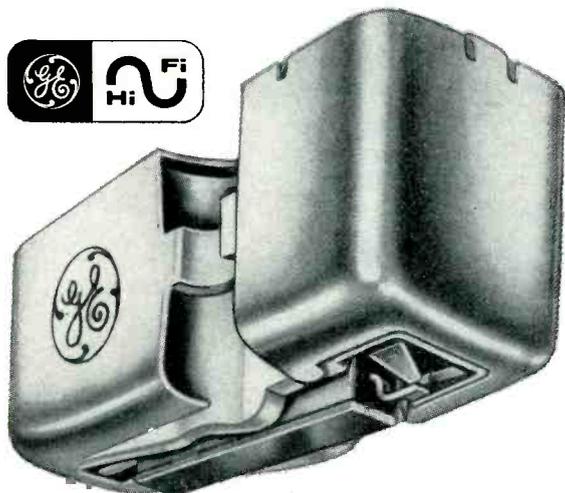
good woofer was added. Noise, hum and distortion can fatigue the listener, even though he is not aware of its existence. All the more reason to obtain quality materials and equipment.

The technician's job is even more challenging, when he is called upon to modify a piece of electronic gear which never was intended for the new and broadened stereo application. Rumble suppression is not new. Many amplifiers are equipped with appropriate filters which can be switched in or out. Record players and associated components have

been designed to keep rumble at a minimum. Shock mounting of one type or another is used almost universally. Rumble suppression is successfully handled in monophonic equipment. While stereophonic applications present some new problems, there is no reason why this problem cannot be licked. As a matter of fact, all of the tricks used in monophonic play can be successfully employed.

As was pointed out in the September 1958 issue of *Electronic Technician*, the stereo cartridge is sensitive to vertical components of motion. Whereas the monophonic

STEREO PROFITS START HERE



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

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

Stereo installations and conversions can open up a whole new field of profitable business for you. And you can start your customers converting to stereo *right now*—with G.E.'s new "Golden Classic" stereo-magnetic cartridge (fully compatible with LP monaural records). It's easy when you tell them how a magnetic cartridge can best provide the high compliance, low distortion, and channel separation required by the new stereo discs. Just as important, General Electric is the name *all* your customers know and trust.

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

GENERAL  ELECTRIC

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

MORE ACTIVE! EFFECTIVE!



KESTER "RESIN-FIVE" CORE SOLDER

THE BEST FOR TV-RADIO WORK . . . EVERYTHING ELECTRICAL—Kester "Resin-Five" Core Solder is better and faster than any solder ever developed. It has an activated flux-core that does a perfect job on all metals including zinc and nickel-plate. The flux residue is absolutely non-corrosive and non-conductive.

Available in all practical Tin-Lead Alloys; 40/60, 50/50 and 60/40 in diameters of $\frac{3}{32}$ ", $\frac{1}{16}$ ", $\frac{3}{64}$ ", $\frac{1}{32}$ " and others.



Printed Circuit Soldering
On Copper-etched boards use 60% Tin-40% Lead Alloy . . . for those that are Silver-surfaced use 3% Silver-61½% Tin-35½% Lead

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XCELITE Tools are
the Finest!*

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

Use the Tools the Professionals use!



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cartridges are essentially sensitive to lateral motion only. This fact alone is the main reason for increased attention to rumble suppression. Many listeners hesitate to use the rumble filter built into their amplifier because they have no desire to attenuate even a few cycles of response after paying out some hard earned cash to catch the low frequencies.

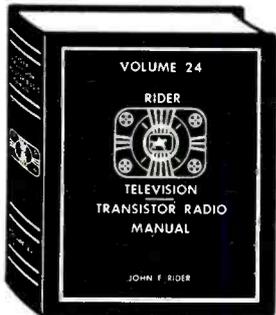
The Westrex stereo disc standard specifies that in-phase signals cause horizontal stylus motion. The signals referred to here are those coming from each of the two 45° channels in the stereo disc. It is also a fact that low frequencies are picked up as in-phase signals. When the relatively long waves of the low frequency signals are compared to the relatively short distance between microphones during the recording process, it will be seen that essentially the same portion of a low-frequency wave front strike both pickups. For this reason low frequencies below 300 cycles do not materially contribute to the stereophonic effect. Therefore it is possible to reduce the vertical sensitivity of the cartridge enough to reduce the effect of vertical rumble at least to the point where it existed before conversion without losing the stereo effect, and without sacrificing the low-frequency response characteristic.

Some stereo cartridges already have mechanical or electrical vertical suppressors incorporated in their design. Mechanical suppression consists of a small bumper placed between the stylus and cartridge body to retard some of the vertical motion. Electrical suppression consists of mixing a portion of the output from one element with a portion of the output from the other element in a stereo cartridge. It is important that these two portions of the signal be equal and out of phase when the stylus is moved in a vertical direction. Most cartridges have their elements so arranged as to have an out-of-phase signal condition during vertical stylus motion; therefore, it is only necessary to place a $\frac{1}{2}$ to 1 megohm resistor across the hot leads. The exact value of the resistor is not critical. It can be determined by trial and error. The smaller the resistor, the more signals due to vertical stylus motion will be cancelled. This is of particular advantage when using monophonic records and a stereo cartridge. By completely paralleling both elements (use jumper instead of resistor), the signals due to

(Continued on page 77)

Something New Has Been Added to the World's Finest TV Service Information

... the finest transistor radio service information



Rider's Combination TV 24 and Transistor Radio Manual

With the sales boom in transistor radios comes the need for accurate, factory service information in one reliable source to save you servicing time. Now, Rider's TV 24 includes a complete compilation of service information on TRANSISTOR RADIOS (home and portable types) ... the whole story under one cover. This, of course, is in addition to the complete presentation of manufacturers' service data on television receivers.

Rider TV Manuals are the only bound source of *unabridged*, accurate TV receiver and transistor radio servicing information prepared by receiver manufacturers.

COMPLETELY CURRENT WITH TV AND TRANSISTOR RADIO PRODUCTION

TV 24 covers 20 TV receiver manufacturers and 23 transistor radio manufacturers (1956-7-8) and includes the latest color TV sets, portables and 110° slim sets. It covers the factory-approved and factory authorized data of TV and Transistor Radio manufacturers including VHF-UHF tuner data; production runs and changes; cumulative index—volumes 1 to 24; manufacturers' circuit descriptions; current information on private label brands; printed circuit layouts; installation data; signal waveforms for trouble shooting; alignment; voltage charts; test equipment setups; tube layouts; printed circuit bottom views; frequent component callouts.

SAVES SERVICING TIME

No more hunting down of hard-to-get schematics... no more guesswork... no more trial and error! Factory accuracy and factory coverage. With Rider's TV 24 you get the most accurate and most reliable service information on television and transistor radio receivers. All in one place—instantly available—a permanent file of dependable service information at an economical price.

Keep your Rider TV manual library up to date with TV 24. If you currently do not use Rider TV manuals, why not start your TV manual library today with TV 24 and see how you will save time and money. Place your order with your jobber today—limited printing. Only \$27.00.

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

New Books

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

TRANSISTOR MANUAL. Prepared and published by General Electric Semiconductor Products Dept., Syracuse, N.Y. 168 pages. Soft cover. \$1.

This information-packed handbook is the third edition of a book that has sold close to a quarter million copies to technicians, engineers, students and experimenters. 104 pages are devoted to applications, including circuits and construction information for amplifiers, hi-fi, radio, power supplies switching, etc. Specifications, tetrode transistors and silicon controlled rectifiers are also presented. Here is up-to-date data of real value to electronic specialists.

***INDUSTRIAL ELECTRONICS HANDBOOK.** Edited by William D. Cockrell. Published by McGraw-Hill. 1408 pages. Hard cover. \$22.50.

Industrial electronics is becoming an increasing power in our industry, and this impressive handbook—practically an encyclopedia—should be the permanent reference work in the libraries of advanced technicians and engineers. The wealth of data contributed by over 100 leading authors is imposing indeed. Among the many subjects covered are computers, instrumentation, regulators, relays, transducers, amplifiers, geiger counters, multi-phase power rectifiers, switches, controls, automation and process controls.

TELEVISION FACTBOOK. Prepared and published by Television Digest, Wyatt Bldg., Washington 5, D.C. 492 pages. Soft cover. \$5.

This is the 1958 fall-winter issue number 27 in the semi-annual series, listing TV stations, community antenna systems, consulting engineers, FCC, hi-fi producers, publications, set manufacturers and industry statistics. Greatest emphasis is on TV broadcasting, with the address, ownership, personnel, facilities and advertising rates of each station presented. A giant map of station locations and interconnecting network routes is included. This directory is most comprehensive.

CLOSED-CIRCUIT TELEVISION SYSTEMS. Prepared and published by Government Service Dept., RCA Service Co., Camden 8, N.J. 348 pages. Hard cover. \$4.50.

Here is a thorough and practical presentation of closed-circuit monochrome and color TV. It is a complete education in the subject for installers, engineering planners and field maintenance technicians. Industrial applications and commercial equipment are described. Such technical details as video signal distribution, intercoms, resolution, distortion, noise, stability environmental problems, projectors, cameras, and switching are discussed. This is a major reference for anyone interested in the growing field of closed-circuit TV for hotels, factories, banks, etc.

KEY TO BETTER SERVICING GREATER INCOME

RIDER BOOKS AND MANUALS

PORTABLE AND CLOCK RADIOS, by Ben Crisses and David Gnessin. You can learn all about portable and clock radios—their circuitry, their repair, in this modern book. Beginning with typical portable radio circuits, emphasis is placed on filament circuitry and how major problems of current dispersion are handled. Transistor circuitry is covered. Stress is placed on portable radio power supplies for battery circuits and battery and AC-DC circuits. Numerous battery testing techniques explained. Covers repair, replacement and alignment plus a detailed discussion of probable mechanical troubles, replacement procedures and short-cuts. Tips on extending the life of the set are discussed. Clock radios, their circuitry, a wide variety of clock movements, how to adjust them and locate defects also covered. Tips on cleaning and lubricating clock mechanisms. #224. \$2.75.

HOME AIR CONDITIONING—Installation & Repair by J. Derman, F. Makstein, H. Seaman. This modern, completely practical text by three experts in the field of home air conditioning, enables anyone to understand the organization, operation, installation and repair of all types of home air conditioners. Starting with the principles of the process of cooling air, it covers all facets of home air conditioners.

Both electrical and mechanical components are fully identified, described and illustrated, permitting instant recognition of the parts. Function of each part, its contribution to the entire unit is explained in detail. Troubleshooting and repair techniques are completely covered plus information on how to pinpoint specific troubles by their symptoms. Typical window and package installations are discussed in detail.

Tells how to select the proper unit to meet the requirements set by windows, walls, floors, ceilings, the cubic dimensions of the space to be served and the number of people for which the unit will be used. An extremely practical and useful guide for all who seek entry into the lucrative air conditioning field. #211. \$3.50.

REPAIRING TELEVISION RECEIVERS, by Cyrus Glickstein. The most modern completely practical book, written by an expert with long experience in television receiver repair. Devoted to troubleshooting and repair techniques which are modern, yet down-to-earth. Covers the use of simple as well as elaborate test equipment of all kinds. Profusely illustrated. Soft Cover, 212 pp., 5½" x 8½", illus. #191, Only \$4.40.

3rd SUPPLEMENT to the RECEIVING TUBE SUBSTITUTION GUIDEBOOK, by H. A. Middleton. A must for every technician! Contains more than 830 latest receiving tube substitutions • more than 200 picture tube substitutions • more than 230 American to European tube substitutions • more than 200 European to American tube substitutions • a cumulative index listing the tube types treated in the basic book and all 3 supplements. It pays for itself almost immediately! #139-3—Soft Cover, 72 pp., 8½" x 11", illus. Only \$1.35.

RECEIVING TUBE SUBSTITUTION GUIDEBOOK, by H. A. Middleton. #135—Soft cover, 224 pp., 8½" x 11", illus., \$3.00.

FIRST SUPPLEMENT, #139—Soft cover, 48 pp., 8½" x 11", illus., \$.99.

SECOND SUPPLEMENT, #139-2—Soft cover, 48 pp., 8½" x 11", illus., \$.99.

ADVANCED TV SERVICING TECHNIQUES, by Zbar and Schildkraut. A complete advanced TV servicing course, developed by the Radio-Electronics-Television Manufacturers Association. Shows how to use every conceivable type of test equipment, how to service every part of a TV receiver. Explains latest techniques. Soft cover, 8½" x 11". **MAIN TEXT,** 192 pp., illus. #161, \$3.60.

LABORATORY WORKBOOK, 32 pp. #161-2, \$.95. **TV PICTURE TUBE-CHASSIS GUIDE,** by Rider Lab Staff. This easy-to-use TV tube type chassis guide covers all picture tube types used in TV receiver production from 1946 to February 1957—over 7,000 listings. Organized by chassis number, and in some cases, by models so that the technician can immediately locate the correct picture tube type simply by knowing the chassis number, #204, Only \$1.35.

Rider Books are sold by parts distributors and bookstores. Look for the familiar Rider Bookseller. It carries a wealth of electronic know-how in the many titles covering every phase of radio, TV, audio and electronics. There's a Rider Book that will make servicing more profitable, increase your income. If these books are not available, order direct: ET-10



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POWER TRANSISTOR for AUTO TRANSISTOR RECEIVERS

This new Raytheon PNP alloy-junction germanium transistor helps Service Dealers do more auto transistor receiver servicing. Designed especially for the output stage in automobile receivers, the 2N155 is used in the Ford receiver, and is an ideal replacement transistor for the power units in many other car receivers. Here is a list of the many transistor types this one, high quality, low cost Raytheon 2N155 transistor can be used to replace:

AR5	2N242
2N176	2N250
TS176	2N257
2N235	2N285
2N235A	2N301

For the complete service dealer profit picture on Raytheon Transistors, get in touch with the Raytheon Tube Distributor nearest you.

RAYTHEON

Excellence in Electronics

RAYTHEON MFG. CO.

Receiving Tube and Semiconductor Operations
Newton 58, Massachusetts

Association News

California

TV Service Dealers of San Mateo County reports the successful operation of its Ethics and Grievance Committee. Customer complaints are being satisfactorily handled and irate customers made happy. In only one case was a dealer—not an association member—at fault, due to incorrect diagnosis. The problem was resolved. No cases involved unethical practices. "Most troubles," reports Committee Chairman Dan Trojak, "have been the result of just plain sloppy customer relations."

Florida

Radio-TV Technicians Guild, Miami, encourages its members to set up a stereo demonstration for customers in anticipation of substantial interest in this new development . . . or else lose a chance for future business.

Illinois

NATESTA closed its 10th annual convention in Chicago with over 600 representatives of the electronic service business attending from the 112 affiliated local associations. Vincent Lutz of St. Louis was named president for the coming year. Other officers are: Mac Metoyer, sec'y general; Nelson Burns, treasurer; Bert Bregenzer, Eastern vp; Irving Toner, Eastern sec'y; Cordell Britt, Central vp; Albert Mirus, Central sec'y; Wayne Lemons, W. Central vp; W. E. Johnson, W. Central sec'y; Winston Haines, Western vp; O. W. Andrews, Western sec'y; Frank Moch, executive director.

Indiana

Indiana Electronic Service Association sec'y Robert Sickels has been named by Chairman Charles Conwell to spearhead a drive for funds to promote the Indiana TV Service License Bill. Contributions will be solicited from Indiana service dealers, with a goal of \$5,000. Money received will be used to lobby for the bill in the 1959 session of the legislature.

Michigan

Television Service Association of Michigan reports that Detroit's TV licensing ordinance is working successfully. Changes have been written into the law, new inspectors

have been added, and more efficient methods of enforcement have been put into practice. TSA urges a similar state law.

Missouri

Electronic Service Council of the Ozarks' Raster says the service industry is badly in need of licensing, citing several cases of incompetence. "We need technical examinations, apprenticeship periods and a standard of ethical conduct."

TESA News, St. Louis, cheers its favorite son, Vince Lutz, on his election to the NATESTA presidency.

TSE *Supreme Effort*, Kansas City, takes jobbers to task for opposing a licensing law. Emphasis is on the need for service technicians to serve on any board administering such a law.

Pennsylvania

TSA of Delaware Valley states that there has been a decline in the income of independent service shops. Among those blamed are factory service manufacturers, part timers, chain store tube tester operators and jobbers selling retail. Greater support of the association's program is noted as a means to combat these problems.

NEW! ON THE SPOT CHECK OF HORIZONTAL OUTPUT CIRCUIT!
—ends most common cause of callbacks!



SECO HC-6 CURRENT CHECKER

- PLACE IN CIRCUIT IN SECONDS — NO DISCONNECTING OF CATHODE
- FAST, ACCURATE WAY TO ADJUST HORIZONTAL DRIVE AND LINEARITY

This new, low-cost current checker provides a positive, on-the-spot method of checking and adjusting TV horizontal output circuits — eliminates one of the most common causes of callbacks. Can be placed in circuit in seconds — without disconnecting cathode — immediately indicates whether horizontal output tube cathode current is within manufacturer's recommended limits. Insures proper picture focus, width, and stability with minimum cathode current — helps prevent premature failure of horizontal output transformer and in some cases failure of power transformer and rectifiers. HC-6 is valuable as a fast, accurate indicating device when adjusting horizontal drive and linearity. A "must" on all TV horizontal tube, transformer, or yoke replacement jobs — may also be used to balance hi-fi audio output tubes. Compact — inexpensive — easy to use — the HC-6 is a time-saving, money-making addition to your service kit. **\$12.95** Complete, ready to use. NET

See your distributor . . . or write to:

SECO SECO MANUFACTURING CO.
5015 Penn Ave. S., Mpls., Minn.

(Continued from page 26)

AMERICAN MICROPHONE appoints Maury Farber, Buffalo, as upstate N. Y. rep.

JENSEN MFG. appoints Samuel N. Strom, Seattle, as rep in the Northwest.

GRAY appoints Gramercy Sound, New York, as national sales rep.

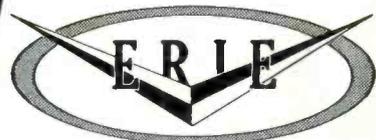
PENTRON appoints RAYTHEON International Div. as exclusive overseas distributor.

AUDIO DEVICES reports first-half tape sales of \$3,055,000, against \$2,350,000 for the first 6 months of 1957, a 31% rise.

REEVES SOUNDCRAFT executive offices are now operating in the new Danbury, Conn. plant. Production will start in early autumn.

BRITISH INDUSTRIES appoints Ed Cornfield sales manager for Wharfedale speakers and Riveredge cabinets. Cornfield was previously executive secretary of IHFM.

WHAT'S WATT? Too many hi-fi manufacturers caught up in the "battle of the specs" are treading on thin ice with their amplifier power ratings. Though within the letter of the law, some claims are not within the spirit of responsible merchandising. Examples: (1) "Peak power" is a neat way of doubling normally stated rms power ratings, but the intent is too obvious. (2) Amplifiers promoted as stereo should state watts per channel in stereo performance, not monophonic operation. (3) Concocting high power ratings for special program sources is stretching a bit. (4) Power ratings beyond specs for the tubes involved in a particular class of operation means either overworking the tube, with resulting shorter life, or getting watts out of whole cloth. Fine print disclaimers are not the answer. To retain consumer confidence a touch of conservatism is in order.



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Highest quality components combined with careful engineering make this instrument extremely reliable and useful for laboratory and service applications.

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"TRULY A VARIABLE BATTERY"

SPECIFICATIONS

Input: 115 Volts 50/60 cycles
Output Voltage: 0-15 Volts and 0-30 Volts
Output Current: 0-15 MA and 0-60 MA
Accuracy: 2% on both voltage and current
Ripple: Less than 500 microvolts (0.002% at full output)
Regulation: 1.2 Volts Maximum; Zero to full load current
Internal Impedance: Less than 20 ohms DC to Radio Frequencies (including 7.0 ohm Meter Fuse, optionally removable)
Terminals: 5-Way Binding Post
Size: 10" x 6 1/2" x 5 3/4"
Weight: 16 pounds

FEATURES

- Continuously adjustable output using variable autotransformer control.
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- Two output current ranges monitor current for single transistor or entire set.
- Extremely low ripple for testing lowest level transistor circuits.
- Very low internal impedance providing excellent regulation.
- Precision D'Arsonval meters provide laboratory accuracy.
- Milliammeter protected by front panel fuse; additional internal line fuse.
- Output isolated from line and case.
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Using the VOM

(Continued from page 35)

polarity should of course be taken into consideration. Loading conditions can be suspected when the needle deflection seems to be about the same on all ranges. In some cases the circuit under test will become so upset that other voltage changes will be introduced, and increase the error still more.

A-C Voltage

When measuring a-c voltages many other things happen to trap the unwary technician. Loading conditions are even more of a problem. What was 20,000 ohms-per-volt on dc, usually does not exceed 5,000 ohms-per-volt on ac. In addition the frequency response and wave shape of the signal being measured become significant factors. In most instances the meter actually reads average current, and the dial is calibrated in rms and sometimes also in peak-to-peak values. These readings usually apply only to a relatively low-frequency sine wave. Usable frequency range is from approximately 50 to 20,000 cycles, but meter sensitivity at different frequencies, may be anything but equal. Fig. 3 shows the relative values as they exist in a sine wave and how the average voltage is affected by full-wave and half-wave rectification. While the average value of a sine wave is equal to 63.6% of the peak value, in a tri-

angular wave form the average value is down to 50% of its peak. In pulsed wave forms this figure is considerably less.

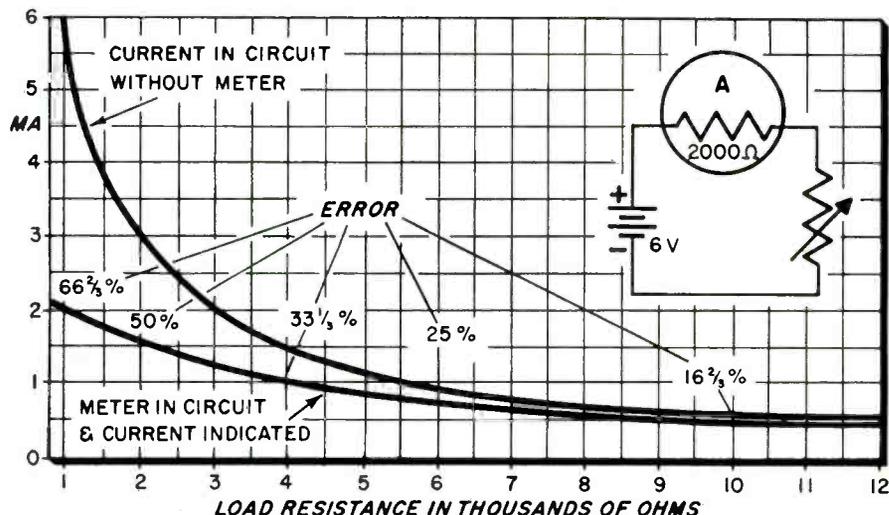
Some meters have a voltage doubler configuration built-in or a special external probe for peak-to-peak readings. In this case the p-p readings can usually be relied upon, and are not dependent upon an interpretation of a sine wave. Here again this is only true if the frequency response and time constants are within desirable limits.

It is possible to stretch the voltmeter's capabilities by using two in series. Assuming that two 20,000 ohms-per-volt units were available, and they were placed across the same circuit as before, the 5 volt range on both units would place 200,000 ohms across the 500,000 ohms as shown in Fig. 4. The readings on each meter would now be 0.666 volts for a total of 1.33 volts. This now represents a 56% error. As compared to the 86% error obtained with 1 meter, a 30% improvement is realized. Needle deflection dropped from 17% to 11% of full scale. The gains in this case exceed the losses. As a general rule if circuit loading is a problem two meters are better than one.

Ohmmeter

Next to the voltmeter, the ohmmeter function is most widely relied upon. The ammeter can be set up in a series or shunt circuit to measure resistance. In the series hook-up shown in Fig. 5, the unknown resistor is placed in series with the meter and battery. In this application the meter reads full scale when

Fig. 7—Ideal ammeter would have no internal resistance. Error factor depends upon ratio of load-to-meter resistance. Significant 16-2/3% error exists when the ratio is 5 to 1.



the test leads are shorted. Maximum accuracy is obtained at center scale. Reasonably correct readings can be had from 0.1 to 10 times the center scale indication. The value of the battery, shunt and series resistors and meter sensitivity determine the ohmmeter range. More sensitive meter movements make higher resistance ranges possible without increasing voltage requirements.

A quick glance shows this to be a simple circuit, and accordingly nothing much should upset meter readings. The zero adjust control which compensates for battery voltage and other variations, indexes the meter to indicate zero resistance when the leads are shorted, adds to this illusion. Unfortunately such is

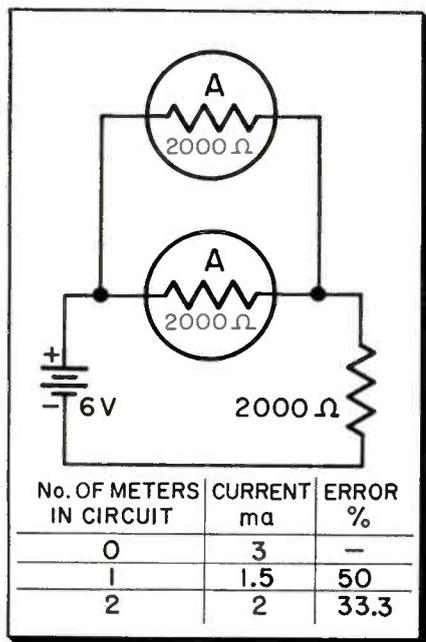


Fig. 8—Two ammeters in parallel can provide a more accurate indication and less loading.

not the case. The 20,000 ohms-per-volt VOM with its 50 μ a meter movement requires 60,000 ohms in the meter circuit when using a 3 volt battery. A 60,000 ohm resistor in the external circuit would cause a mid-scale reading. Should the battery voltage drop to 2.5 volts, the meter circuit would require 50,000 ohms for a zero reading and a like amount in the external circuit for a half scale reading. Under the circumstances a 60,000 ohm resistor would read approximately 70,500 ohms, an error of 17.5%. Note that this error exists at center scale, a point of maximum accuracy. The weaker the battery becomes the greater will be the error. A quick check of any ohmmeter circuit, is to compare readings obtained

from resistors of known values.

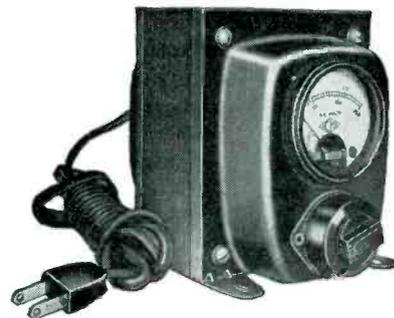
The shunt type ohmmeter circuit can be recognized by a scale which reads upwards from left to right, and that full scale deflection is obtained when the test leads are open. The resistor under test is placed in parallel with the meter as shown in Fig. 6. Increased current drain, sometimes enough to damage components under test and shorter battery life can be expected from this arrangement. Midscale deflection occurs when the unknown resistor is equal in value to the combined resistance of the meter and its shunt. From this circuit it can be seen that resistance readings do not depend upon battery voltage, providing of course that the battery can deliver all the current needed. Unfortunately as the battery ages, its internal resistance increases and can limit current flow enough to cause inaccuracies particularly on the lower ranges. Here again, a resistor of known low value can serve as a calibration check.

Ammeter

One advantage the VOM has over the VTVM is its ability to measure direct current. True, ohm's law can be brought into play and by noting the voltage drop across a known resistor on a voltmeter, current flow can be determined. The VOM can measure current directly. The current function is probably the least used because it involves cutting a lead to insert the meter into the circuit. With the advent of transistorized electronic equipment and the awareness of staying within current tolerances in other circuits such as the horizontal output tube and series string filament arrangements, the VOM's current function is due for even greater use.

Meter sensitivity is also of vital importance in this application. It should be clear that the more sensitive meters can measure smaller quantities of current. Loading is another consideration here too. The more resistance the meter and its associated circuits have, the more it is going to reduce the current flow in the circuit under test. Fig. 7 shows a simple d-c circuit with a 50 μ a meter whose internal resistance is 2,000 ohms. When the load resistor is equal in value to the meter resistance, only half the current will flow with the meter in the circuit. This represents an error of 50%. If the meter resistance were zero, there would be no error, but this is not possible. If the meter resistance is greater than the load resistance, the error introduced is even greater than

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Service: transistor auto and portable radios, "hybrid," auto and marine radios.

Also: charge batteries, operate relays for electroplating and laboratory work.

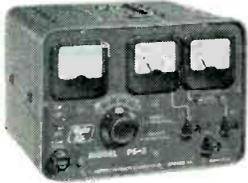
MODEL PS-2

2 ranges: 0-20 volts for transistor circuits; 0-16 volts for 12/6 volt auto and "hybrid" radios.

0.15% ripple up to 75 milliamperes. 0.5% ripple up to 5 amperes.

Separate milliammeter detects variations in transistor current.

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

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

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50%. The curves indicate the percentage of error which can be expected for different ratios of load resistance to meter resistance. It is significant that a 16 $\frac{2}{3}$ % error exists even when the load resistance is equal to 5 times the meter resistance.

Circuit loading conditions can be alleviated and meter accuracy can be improved if another VOM is available. Just as in the voltage measurement function the advantage of two meters can be demonstrated. Fig. 8 shows two like ammeters connected in parallel. The 2,000-ohm internal resistance of each meter now looks like 1,000 ohms to the circuit. In the original circuit without any meters inserted, current flow is 3 ma; with one meter in the circuit, current dropped to 1.5 ma, and with two meters, current dropped to 2 ma. Thus a 50% error is reduced to 33 $\frac{1}{3}$ %. The indications in both meters are added to determine the current flow in the circuit.

Output Meter

Still another function of the VOM is the output meter. This is essentially the same as the a-c voltmeter operation except that a capacitor, usually on the order of a 0.1 μ f is placed in series with the a-c voltmeter circuit. The purpose is to block dc while reading a-c voltage. This application is readily appreciated when trying to measure audio signal voltages at the plate of an amplifier tube. The same loading and error factors are involved as for the a-c voltmeter function, plus the additional effects introduced by the capacitive reactance. Fortunately, in most cases these readings need be only relative. In alignment work it is usually necessary to tune for minimum or maximum. Signal tracing procedures do not require absolute indications.

Many other uses have been found for the VOM, some by accident, others by clever innovation. In some cases while attempting voltage readings, the inoperative radio or TV set begins to function. If VOMs were less expensive some do it yourselfer would be bound to leave the meter permanently in the circuit. The VOM's blocking capacitor and leads may be used as a capacitor probe for signal injection or tracing procedures. External probes can extend the application of the VOM so that it can reach into high voltage and high frequency circuits.

In spite of the error factors, experience has taught the technician how to interpret the readings and do just about everything with a VOM. •

From SSB to FM

(Continued from page 51)

Some day, this might come down to 1.5 times, but the extra signal processing basically required in SSB will always make it bigger and more expensive than an FM unit designed at the same instant in time. There actually has been some good derived from the re-introduction of the SSB subject. Studies on SSB have led to an even better understanding of the real capabilities of FM and have stimulated further improvements in simplifying FM equipment at no loss in performance. Complacency that FM had gone as far as it could has been shattered. •

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You Could Die Laughing

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• Although the radio and TV service business is a serious one, and involves serious technical achievements, it would be inhuman indeed if it did not have its humorous side as well. Legion is the saga of the technician who, while servicing an ac-dc radio, had his wife come in out of the rain, and greet her unsuspecting husband with a kiss on the back of the neck while he was touching the set. We close the curtain on the rest of this affair.

Defocus

Many are the tales brought back by the outside men. One of our group had to make a call back on a set just after a rather extensive repair job. Arriving at the customer's home, he found nothing wrong with the set, and proceeded to ask the customer just what was her complaint. She pointed out to the technician that her set had numerous lines in the picture which were never there before. He explained to her that the raster lines, 525 of them, were necessary to make the picture, but all his explanation would do no good. The lines were never there before, and she did not want them there now. Upon making a slight adjustment to the focus control, the customer suddenly explained, "That's how I want it." The set was left slightly out of focus, just enough to blend the raster lines into a continuous sheet of light. The remark placed on the service report was "defocused set."

Loud Noise

Sometimes a humorous situation borders on the disastrous. A simple case like this happened to our antenna crew. Called upon to make an

antenna installation on a rather aged building, and mounting the roof, the leadman found that a rather obvious place to mount the antenna was on the chimney. Calling his helper, he instructed him to install the chimney mounts, while he put the antenna together.

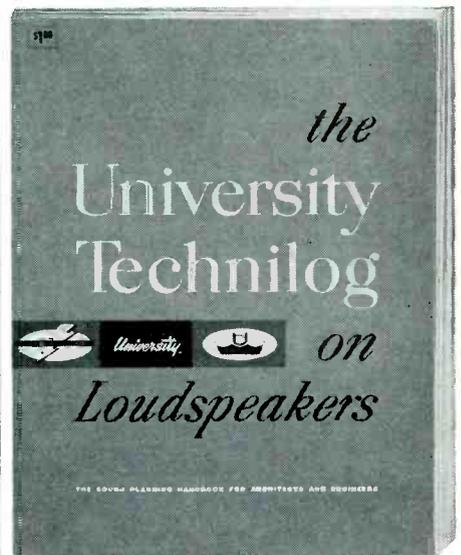
After a short pause, a loud noise attracted his attention. Lo and behold, neither the chimney nor the helper were there. It seems that the helper leaned on the chimney, and down it went, carrying him with it. Fortunately, it was only a short five-foot drop to the top of a flat-roofed porch. There was the helper in a pile of bricks. Unhurt, but discommoded.

Sparks

Thinking about what you are doing sometimes helps to do a job right. One of our men, after delivering a set, was called back by the customer as he was about to leave. No, nothing was wrong with the set, but would he mind cutting the cord plugged into the wall outlet, it was a few feet too long, and looked simply awful dragging around. Without a second thought, he pulled out his dykes and immediately cut the cord. Sparks flew—he forgot to pull the cord out of the wall. The customer and the serviceman were scared stiff for a few seconds.

No Ladder

Then there's the old story of the cat on the roof. Ours really happened. One of our antenna men, while on a roof repairing an antenna, suddenly shouted to his helper to bring up a roll of tape. The helper did so, and remained on the roof to finish the job. A few minutes later, both men started to climb down, and upon reaching the



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place where the ladder was supposed to be, well, what do you know, no ladder. The neighborhood children had it propped up against a tree in an empty lot next door. We close the curtain on this one, too.

Horse play usually involves the damaging and inadvisable practice of placing charged capacitors where they will be picked up by the unwary. This situation is seldom humorous to anyone but the practical joker himself. Here's one that had the shop in a quandary for hours before it was discovered. A set on the bench for repairs was placed on its side, and turned on. A raster showed up, with a rather peculiar bend in the picture. Checking waveforms and voltages for hours and finding no clue, the benchman finally decided to replace the deflection yoke.

The same situation prevailed even after the yoke was changed. Another man tried the set on another bench. It worked perfectly. Another set was placed on the first bench and it displayed the same peculiar bend in the picture. After a few hours of this, the boys were ready to throw in the towel. The trickster finally came forth with a smile and pointed to a large magnetron magnet fastened to the underside of the workbench. Don't try it, if you are flooded with work, especially with metal picture tubes.

Stick-Up

Of course, we have our little morons—the TV men with juvenile minds. One of these pulled a gun on a customer, thinking he was playing cops and robbers (a soldering gun, of course). The customer threw the joker out of the house.

Good customer relations were not exactly maintained when a technician, with a peculiar liking for brand A, and a peculiar dislike for brand B, walked into a customer's house to install and demonstrate a set just purchased. Immediately catching sight of the set, he exclaimed: "Oh, you have a B, that's too bad, you should have bought an A." Needless to say, his paycheck was awaiting him. When last heard from, he was engaged in another kind of business.

'Tis said that, "Where ignorance is bliss, 'Tis folly to be wise." No greater proof of this was obtained than when a technician was called upon to take a small spot off the face of a picture tube. Removing the CRT from the cabinet, and wiping the face, it was soon discovered that the spot was on the phosphor, inside the tube. To that, the customer re-

marked, "Well, take the tube apart and wipe it off." No amount of explanation could convince the customer that it was impossible for him to take the tube apart and get it back together again.

Inside Job

While on the subject of picture tubes, one of the daytime comedians on TV once pulled a trick of telling his viewers that while their servicemen could wipe the face of the picture tube, only he could wipe the inside. He then proceeded to take a cloth and of course, the viewers saw the cloth moving back and forth across the screen. It was at this point that a customer's set decided to break down. When she called for service, she insisted that we write her a duplicate bill, so that she could present it to the station for breaking her set. As a matter of fact, she was even willing to take the matter into court.

Coincidence

Then there was the nationally known brand of TV set that advertised highly that it was the "set that amazed even the experts." Once just after this advertisement was on the air, a customer's set decided to take that moment to start smoking. A small resistor was given a hot-foot by a shorted capacitor, but what a coincidence. The set was the exact one the announcer was advertising.

A strange situation exists when the customer complains of one thing, and the technician finds quite another. Example: a customer calls up and states that her picture is jumping; the trouble found was no raster, due to no high voltage. How could the customer tell if the picture is jumping?

Tube Per Station

In our fair city we had (once) five radio stations. One of these was WSMB. With all fairness to the rest, this situation is not humorous unless I mention at least the way it was put to me. Well, this nice Saturday afternoon, in comes a customer to the store, and asks for a WSMB tube. Not to be outdone, I asked just what did he mean? He stated that there were five stations in the city, and that his radio could get only four, and the one that was missing was WSMB. Therefore, he thought he would just replace the WSMB tube. (He had a five-tube radio.) I sympathize with this individual. If he buys an 82-channel

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TV set—it must have 82 tubes in it
—naturally.

Aerial Grease

A rather middle-aged lady called a certain service shop to complain of radio trouble. The radio technician who went to her house could find nothing wrong with the set, so he brought it to his shop. After a few days the set was returned to the lady, with a small bill for checking only, as no work was indicated. A few days later, the lady complained again that the set was still not working properly, so please send the serviceman back. Again the set was pulled and thoroughly checked, and again nothing wrong was found. The set was returned no charge, and the matter promptly forgotten. Finally, the customer phoned the shop and spoke to the manager. "What kind of men do you hire? They can't repair a simple thing like a radio." And so forth and so on. The manager agreed to check the set himself, having it on his technicians only in the subject of human relations, he could not find anything wrong with the set. He did not tell the customer this but pointed out that there was nothing wrong with the set itself, but that there was something wrong with her outdoor radio antenna. Unfortunately, however, his shop did not do antenna work, but he would see what he could do to try to make the customer happy.

A few days later, the manager of the shop brought a small bottle of a greasy substance to the customer and instructed her to have her husband climb on the roof, and grease the antenna so that the radio waves could slide down to the set in a more efficient manner. Weeks later, the customer called to congratulate the manager on being such a good diagnostician; her husband had followed his advice and greased the antenna, and now the set was working perfectly. Please let her have another bottle of aerial grease in case it happened again.

Naturally, the men in the shop wanted to know what was this magic aerial grease. The manager simply told the rest of the story: After leaving the customer's house, he went to a drug store and bought a small jar of vaseline and a small prescription bottle. After placing the vaseline in the prescription bottle, he gave it to the customer.

As a famous song puts it, "Look for the silver lining." Some of the problems that are a "pain-in-the-neck" may have a humorous side and cause you to laugh or at least smile. ●

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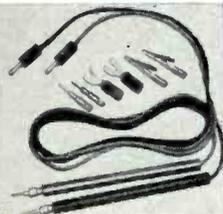


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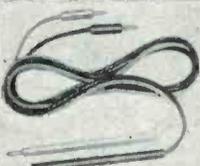
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Digital Computers

(Continued from page 39)

Subtraction

There are two ways to subtract.

					Method I				
0	1	1	10	11					
-0	-1	-0	-1	-1					
—	—	—	—	—					
0	0	1	1	10					
Decimal				Binary					
14	=			1100					
-9	=			-1001					
—				—					
5	=			0101					

Method II

Convert the negative number to its complement and then add to the positive number. The digit on the extreme left in the sum is discarded. If it is a one, the answer is positive. To complement a negative binary number change its sign to plus, change the zeros to ones, and ones to zeros, and add one.

Negative 1001 becomes positive

0110 + 1 = 0111
Decimal Binary
14 = 1110
-9 = +0111
—
5 = 10101 = 101

Division

Decimal division and binary division are similar.

Decimal		Binary
12		1100
125)1500	= 1111101)	10111011100
125		1111101
—		—
250		1111101
250		1111101
—		—
0		000

Division by Subtraction

Decimal		Binary
1500 ÷ 125	10111011100 ÷ 1111101	
1500		10111011100
-125	1	*1111101 1
—		—
025		01111101
-*125	*1	*1111101 *1
—		—
125		00000000
-125	1	*0000000 *0
—		—
0	12	00000000
	=	*0000000 *0
		—
		0 1100

The reverse of the multiplication by addition takes place in division by subtraction. Either method I or II could have been used to perform the subtraction. Method I is used in the example. Many computers use the complement subtractive method.

In the decimal case, a shift to the right is the equivalent of subtracting ten times. In binary notation each shift to the right halves the value, and each shift to the left doubles the value. Thus 2³ is half the value of 2⁴. The decimal point and expression of negative powers can be used in multiplication, division and other arithmetic processes.

Modern computers have made a tremendous impact in the fields of business and science. Mathematical computations heretofore considered to be too lengthy for practical consideration, are now routine. Guess work and intuition have given way to mathematical analysis. •

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From TV to 2-way Radio

(Continued from page 36)

these wagons are assigned to routine service and repair of the Turnpike's mobile units, and are routed from Boston to the New York state line. Two station wagons are used for the Turnpike's emergency repair work.

To handle its work volume, the firm employs nine full-time technicians, six of whom work the Pike with the station wagons. The remaining three technicians repair damaged units brought back to the shop for extensive overhaul. These three employees also perform all the non-contract or retail work, which includes repairing such units as two-way taxi radios and standard car radios. This type of work constitutes a profitable portion of the firm's gross business, because facilities are provided for cars to drive in and have their radios serviced immediately.

The only problem confronting the company is lack of adequate work space in the building it rents. "Converting to car radio repair work necessitated a large building," explains Harnish, "so that cars could drive in for repairs. Though our building provides 3,000 square feet of space and can accommodate eight cars at one time, it is improperly laid out for efficient use of test equipment. To redesign the interior would be impractical, because eventually we will need more space."

The firm's building houses \$10,000 worth of test equipment, according to Denman and Harnish. They plan to solve their problem by having a building constructed in the near future, with workrooms designed for better utilization of equipment and greater work output.

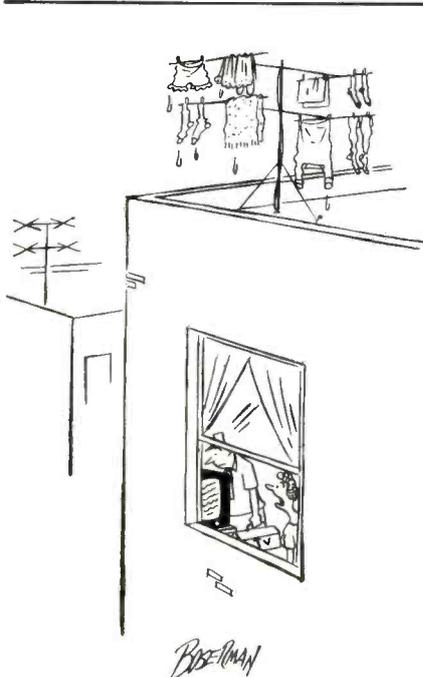
Because Denman and Harnish have both had extensive military and formal training in electronics, and have earned a good reputation under the Turnpike contract, several subsequent contracts were obtained, and have proved equally profitable. Among these was the installation and servicing contract for Boston's first radio-controlled traffic light system. By means of radio the sequence of traffic light changes is controlled to allow passage of unexpectedly heavy flows of traffic. Formerly operated by a timing device, this system was inflexible and often ineffective because traffic conditions were subject to rapid, radical change in some areas.

Denman Electronics recently has gone into servicing nuclear radiation detection devices, and foresees servicing radar and sonar apparatus as well. The company also services and repairs teletype and three dial telephone systems interconnecting a series of state police barracks. The firm has given up its retail TV business, but it does service industrial closed circuit TV systems under short term contracts.

"Though our original plans did not envisage ending up in the present business," says Denman, "we know that it offers us more opportunity for business growth. Soon after we had entered the TV repair business in this area, we discovered that it was a tough one, for numerous reasons. For one thing, competition was stiff because TV technicians were not required to be licensed, we found ourselves competing with many part-time dabblers in repair work, who could charge low rates because their main source of income came from other jobs."

"Because of the ups and downs of the TV business," continues Harnish, "we were constantly hiring and laying off employees. We knew that eventually we would have difficulty in hiring good technicians when we needed them, because we offered them no security—this was another reason for our switch."

These two enterprising technicians not only have boosted their sales and profits, but have gained greater security for themselves and their employees. •



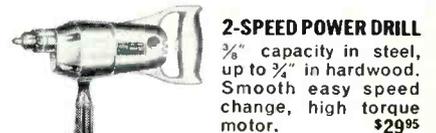
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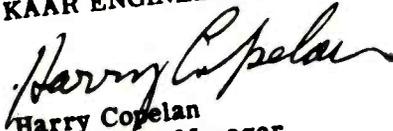
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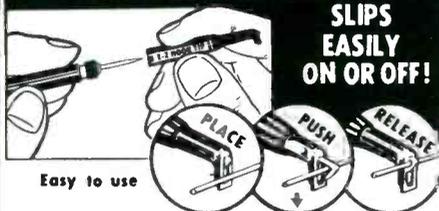

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Rumble Reduction

(Continued from page 64)

lateral motion are reinforced, while the noise in the vertical component is cancelled.

One of the problems may be—how to detect and if necessary how to demonstrate rumble in a record player. Silent groove test records may be used. Even then other noise may obscure or mask the rumble. On most record players it is possible to place a small block of iron or wood under the stylus just alongside but not touching the rotating table. The stationary arm and cartridge will now pick up any noise or rumble. If the volume control of the amplifier is turned up enough it will make all vibrations transmitted to the record player quite audible. However, for practical purposes, it should not be necessary to advance the volume level much beyond its normal setting.

Defects in rotating mechanical parts which contribute to undesirable vibration and noise can also be picked up in this manner. Sometimes defects can be isolated by trying different speeds. If the same amount of noise is present on all speeds, the chances are that the idler wheel, motor or turntable itself may be responsible. On the other hand noise at one speed and not another would indicate a defect in that part of the drive mechanism which controls the noisy speed. As usual rubber components are the most likely suspect. Particular attention should be paid to motor and table shock mounts. The difference in noise level between a stationary and running turntable can be quite dramatic, when the volume control is advanced.

Increased insulation from noise can be realized by using a foam rubber mat on the turntable. Acoustic feedback, especially where the speaker is housed in the same cabinet as the record player, may become particularly troublesome. This can be readily detected when playing certain records having loud passages or a group of frequencies which are not too loud, but excite a resonant condition in the cabinet.

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Surge Protection

(Continued from page 33)

installation. Depending upon circuit values, starting surge limits are usually held to within approximately 25% of normal by the resistive element. The relay contacts are normally open when the unit is cold. After about 10 seconds, enough heat is generated in the resistive element to cause the bi-metallic armature in the relay to move and close the contacts. The relay shorts out the resistive element, and full line voltage is applied to the receiver. The resistive

thermal shock, magnetic shock is another major cause of tube damage. The starting surge generates a heavy magnetic field about the heater wires, which subjects them to excessive mechanical force, and is responsible for many cathode-to-heater shorts. Field tests have shown that cathode welds open up three times faster when the initial surge current is permitted to flow. It has been found that a tube with a poor weld may last as long as a tube with a good weld, when the starting surge current is suitably limited.

Full Line Voltage

To modify existing receivers not equipped with any type of surge limiting device, the Surgistor can be placed in the line voltage circuit as shown in Fig. 3. Because there is practically no voltage drop across the Surgistor when the relay is closed, full line voltage is available to the receivers. The bi-metal strip has a resistance of only 0.065 ohms. This is particularly advantageous where low-line voltage problems make it desirable to introduce as little additional resistance as possible. In those circuits already equipped with thermistors and other resistive devices, the normally hot resistance is already allowed for by the set manufacturer. Therefore, in addition to the Surgistor, an additional resistor should be added as shown in Fig. 4. Where a fuse type resistor is used, it can be left in the circuit as shown in Fig. 5. Thermal sensitive relays such as the Tube Sentry and Tube Protector delay the application of B+ only. The reactance of the power transformer is relied upon to retard current surge. Increased protection can be provided by the addition of a Surgistor. If for some reason it should become necessary to remove the original B+ delay relay, a suitable resistor, usually in the order of 3 ohms, should be installed, and the B+ circuit completed as shown in Fig. 6. Most schematics reveal the nature of the surge protection provided. By inspection of the circuit and from the history of a particular receiver, it can be readily determined if a set needs surge protection.

Evaluation of callbacks reveal that an 8% rate can be reduced to as low as 1% when Surgistors are installed. •

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G-C Electronics Mfg. Co.
Wuerth Tube-Saver Corp.

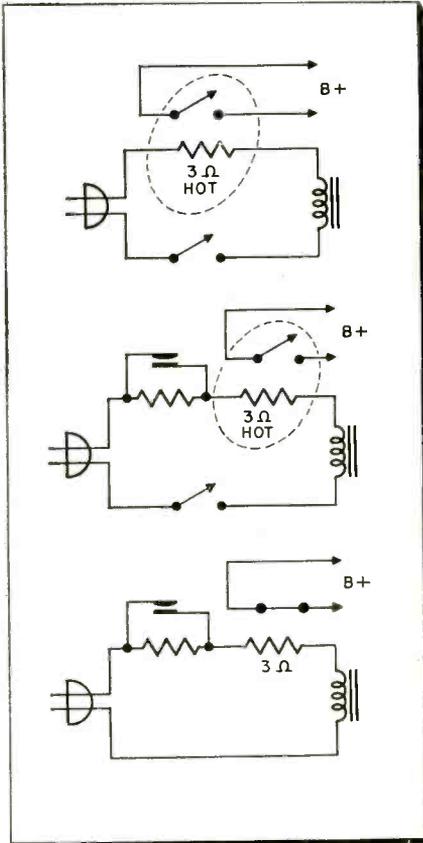


Fig. 6—Transformer set equipped with B+ delay relay, can accept a Surgistor. If for some reason the original relay device is removed, a suitable resistor and jumper should be used.

element is effectively out of the circuit, and cools off. However, the relay remains closed because of the heat generated by the current flow through the bimetal armature. When the receiver is turned off, the relay cools, and the contacts open. The cycle is repeated when the set is turned on again.

It is not generally realized that in addition to excessive voltage and

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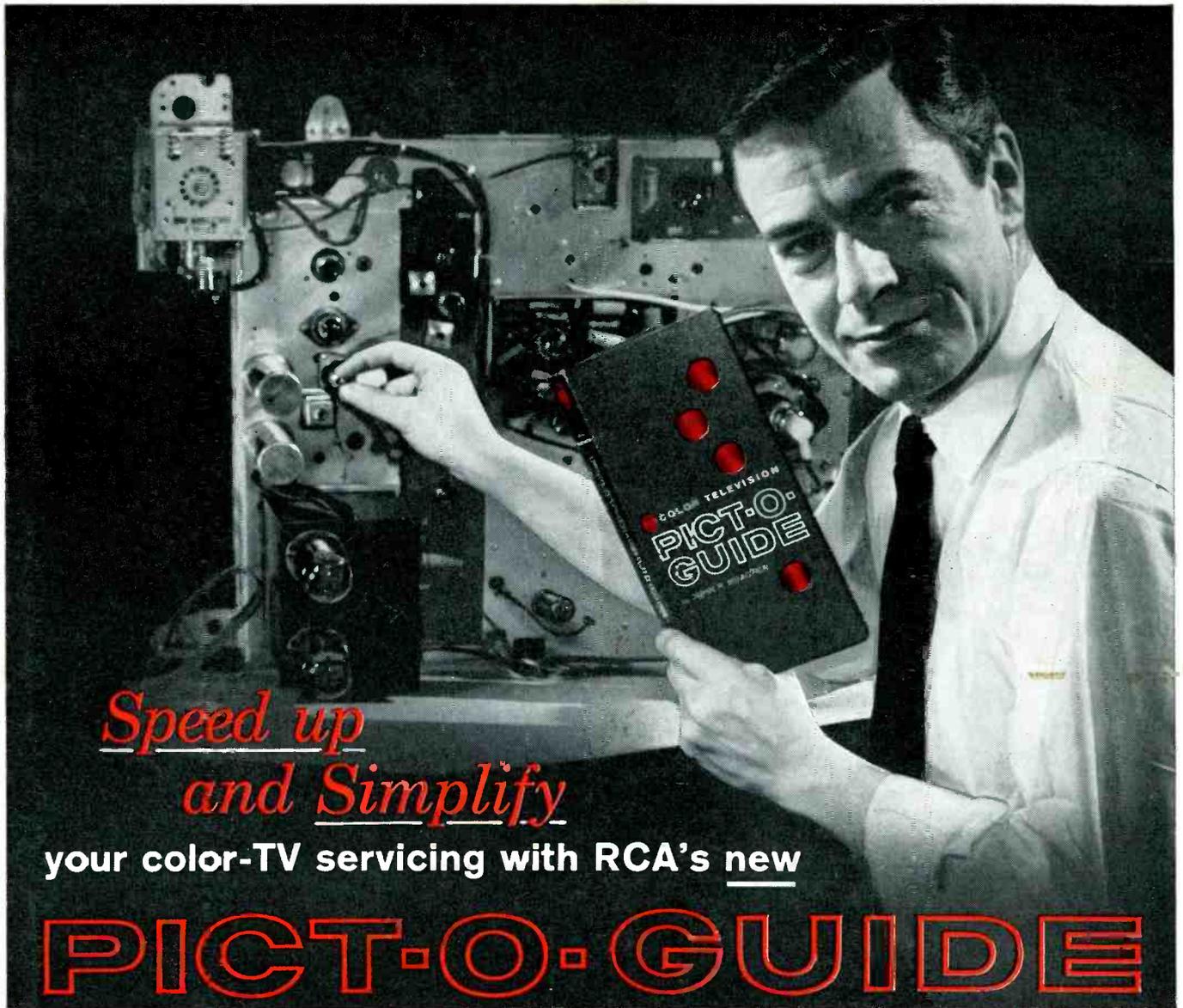
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