

ELECTRONIC TECHNICIAN

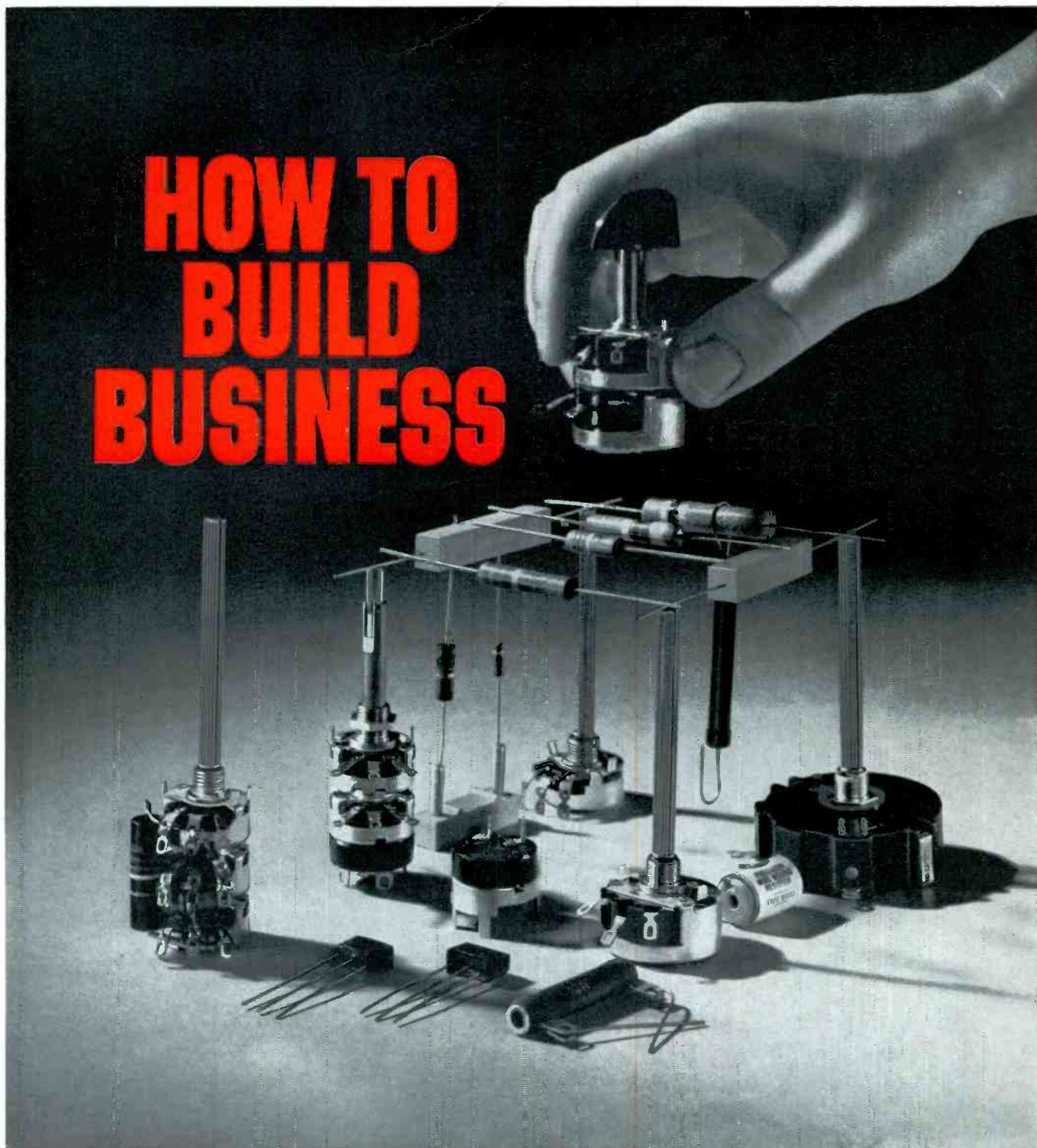
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SERVICE
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December • 1958

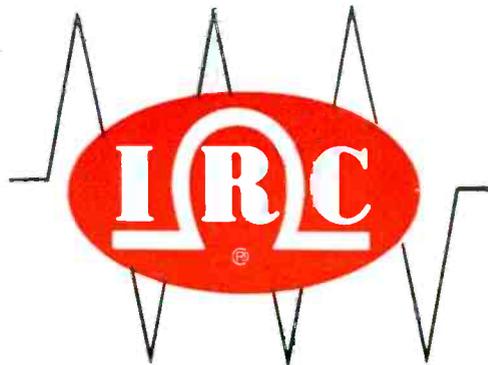
HOW TO BUILD BUSINESS



It was the head of a large Radio-TV sales-service organization talking: "Why do we replace with IRC parts? Many reasons why. I'll give you one big one. When a set is under warranty the manufacturer makes good on the parts but don't forget we're on the hook for our labor. Defective replacements could ruin our profits, drive our good customers away."

Save time wasted on unnecessary callbacks and unnecessary reordering. Build your business soundly with reliable IRC parts—sold through reliable IRC Distributors.

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ELECTRONIC TECHNICIAN

Now Including
SERVICE
Magazine

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AUDIO

December, 1958

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FRONT COVER Season's greetings—electronic style—from the ELECTRONIC TECHNICIAN staff to all readers. Our best wishes for health and success in the New Year.

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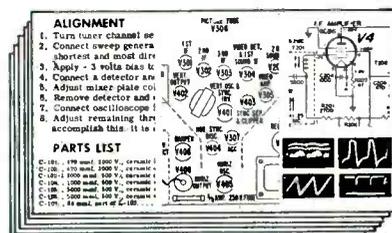
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CIRCUIT DIGESTS

73



World Famous Philco Quality and Exclusive New Chassis Construction

make

PHILCO TV

**EASIEST
TO SERVICE**

in the history of the TV industry!

Philco brings an entirely new concept to the serviceability of television receivers by conveniently placing tubes and components right at your finger-tips. Philco chassis are designed, engineered and manufactured to make your job an easier and more profitable one.

1

**What Philco means by
QUALITY**

At Philco it has been quality first in electronic products for over 20 years.

"Philco Quality" is a first consideration in the maintenance of the TV. In all plants an Inspection Specialist is in management for the control of all Philco products.

2

**What Philco means by
DEPENDABILITY**

The proven and outstanding dependability of all Philco products is acclaimed by the millions of satisfied customers who have bought and used Philco products over the years. Philco goes to the greatest lengths to build in durability and quality that guarantee superior performance, dependable operation and long life in the consumer's home. It is this built-in dependability that pays off in satisfied customers for you.

PHILCO

Famous for

Good Bye Mirrors!

Picture tube turns around
for viewing while servicing!

FILE DRAWER CHASSIS

Slides out on runners
for ease of service

ALL TUBES RIGHT ON TOP

Conveniently located
for easy replacement

ALL TEST POINTS ON TOP

No more
awkward maneuvering
to test components

ALL COMPONENTS ACCESSIBLE FOR CHECKING

DESIGNED WITH THE SERVICE MAN IN MIND

The new Philco Predicta chassis pictured above was designed with the service man in mind. It was designed to enable you to take the greatest advantage of your professional skills. It was designed to pay

off by enabling you to do your job quicker . . . make more calls and, thus, increase your profits. All Philco chassis are manufactured with the most modern automated methods in the industry insuring uniformity and dependability in your customers' homes.

IN THE PAST 30 YEARS PHILCO HAS TRAINED OVER ¼ MILLION INDEPENDENT SERVICE MEN.
GET FAST, EASY "1-2-3" SERVICE TIPS FROM YOUR PHILCO DISTRIBUTOR TODAY!



Cover Feature in December "Radio-Electronics"

Here is what they say about Philco Predicta TV.

“In the story of design for '59, it can hardly be disputed that one of the most unusual and extraordinary is that of the Philco Predicta line which includes the slide-out 'easy service' chassis and its separately and remotely mounted picture tubes.”

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QUALITY *the World Over*

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MALLORY
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**Sign of Dependable
 Auto radio servicing...**

Mallory Gold Label Vibrators

No service-dealer likes to see a job come back—especially when it means pulling the car radio out a second time.

Avoid doing "2 jobs for the price of 1"—by installing a Mallory Gold Label Vibrator. These are especially designed for an extra measure of service, even under rugged working conditions. The unique buttonless contact design by Mallory assures fast, positive starting every time... and, this is the quietest vibrator ever made.



For economy service jobs, choose Mallory Highlander vibrators... second only to Gold Label in quality. Get them in the handy 10-pack carton.

Your nearby Mallory Distributor carries a complete assortment of both these leading vibrator lines.

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

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MALLORY

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Editor's Memo



The road to hell is reputed to be paved with good intentions. Expressed another way, we might say that *wanting* to do good is not enough; we must *know how* to do good.

What brought these thoughts to mind is a booklet published by the Attorney General of the State of New York, "Guide for Consumers—10 Pointers for Careful Buying."

No doubt the sincere intent of this booklet is to enlighten consumers.

But the Attorney General should be enlightened himself on what is technically feasible.

For example, here is a verbatim copy of item 3 in the 10-point list:

Never permit a household appliance or television or radio set to be taken from your home for repairs without first receiving in writing an estimate of the probable repair cost and written assurance that no additional charge will be made without your consent and that if you do not want the "extra" repairs the article will be returned to you immediately.

Now I ask you—and I've also asked the Attorney General—how can a service technician in the home always be sure which components need to be replaced? What about the tough dog that defies rapid diagnosis and requires bench examination?

Besides the obvious technical difficulties of determining defective components with certainty in the home, there is a psychological problem which works against both consumer and technician. In order to give the customer a written estimate right on the spot, a good amount of guesswork must come into play. Suppose the estimate turns out too low? On the next call the technician would want to play it safe, so he estimates higher. The low and high estimates could average out all right for the technician, but one customer will have paid too little, the other too much.

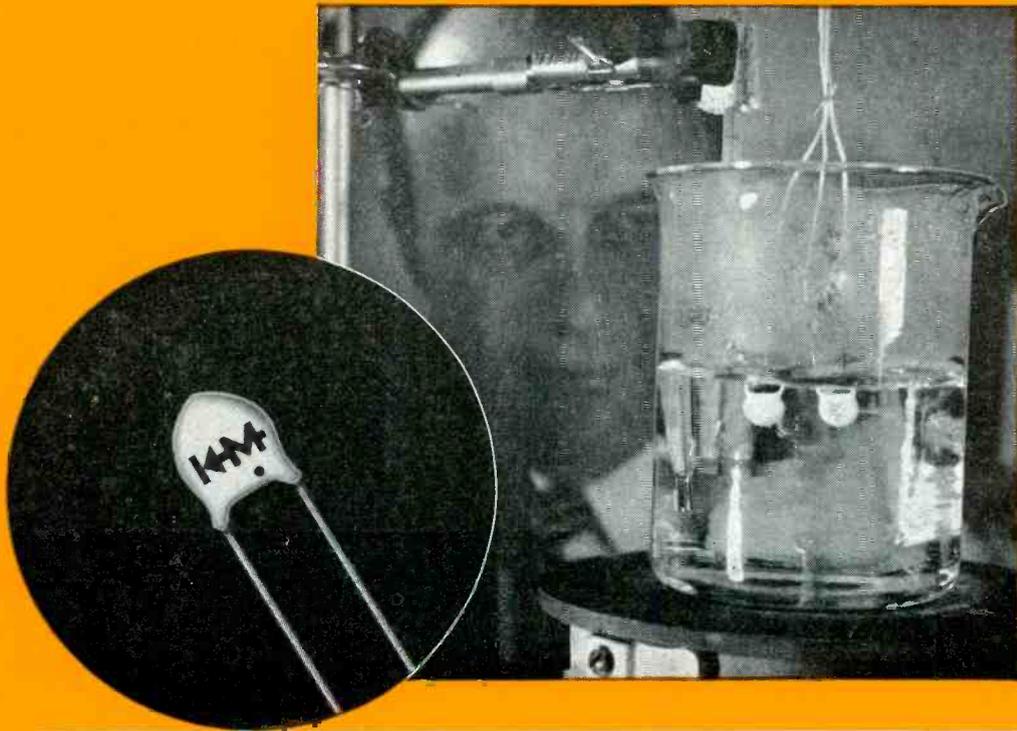
Still another problem is when the shop evaluation turns out higher than the home estimate. There's an unhappy situation for customer and technician alike when the estimate must be revised.

There's no doubt that it's unfair and bad business relations to drop an unexpectedly large bill in the lap of a customer. But at the same time, except for certain obvious failures, it's not reasonable always to expect an accurate, written estimate before the set reaches the shop.

Al Forman

NEW Silicon Rectifier

Built for Reliability—Priced for Economy



After 500 hours in boiling water, the new Mallory silicon rectifier is still going strong! That's just one of the ways we've proved that this new rectifier, product of Mallory semi-conductor research, gives you superior reliability and humidity resistance—at a price that is practical and profitable for TV and radio service jobs.

New Moisture-Proof Design, using unique Mallo-Seal* encapsulation, enables the rectifier to pass *four times* the tropical torture of military humidity tests . . . without a single failure.

New Performance. Compare these figures: reverse leakage less than 250 microamperes; forward drop less than 0.5 volt; no drop in characteristics after 2000-hour life test at 85° C ambient.

New Reliability. No premature failures, no call-backs—because 100% inspection assures quality in every rectifier.

New Economy. Highest quality and reliability at a new low price for commercial silicon rectifiers.

Several models are available: the encapsulated type for conversions, a plug-in model for sets already using silicon conversions—and a line of "top hat" and stud mounted models for military and industrial use. See your Mallory distributor soon for complete details.

*Trade Mark, P. R. Mallory & Co. Inc.

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



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Get off to a fast start with Centralab Model WW and WN Wirewound controls. They sport 5 watts power in a 2-watt size chassis—in short or long shaft styles. Now one small size takes care of 2, 3, 4 and 5 watt replacements in tv, hi-fi, home and auto radio sets. You really cut inventory and save time with these versatile Radiohm® controls.

And don't forget—you can race off to still more profits when you use Centralab Wirewounds in their many industrial applications.

Ask your Centralab distributor for your *free* copy of Centralab's Catalog 30, giving full details about these and other top quality Centralab components.

Centralab

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 CONTROLS • ENGINEERED CERAMICS • SEMI-CONDUCTOR PRODUCTS**

LETTERS

To the Editors

Captive Service

Editor, *ELECTRONIC TECHNICIAN*:

Congratulations, a million of them. Your editorial, "Fighting Mad Over Captive Service," [Nov. 1958 issue] is the outstanding editorial of all time. I am personally going to recommend you for the NATESA "Friends of Service Award" and the Pennsylvania State Federation annual award of "The one who has done the most for Independent Service in 1958." Every parts and component jobber and dealer, every set manufacturer who does not maintain their own captive service setup should go to bat for you. We of ESDA know full well that it takes guts to go to bat for service. It could well be your death warrant.

JOSEPH F. DOYLE
 President

Electronic Service Dealers
 Association
 Pittsburgh, Pa.

... Thank you for joining our cause. Your editorial shall surely help in our battle against attempts by captive service manufacturers trying to enter the service field with bait advertising and so-called "free" inboard warranties. Keep up the fine journalistic work.

MARVIN A. MILLER
 President

Television & Electronic Service
 Association
 Springfield, Ohio

... To my knowledge, your magazine is the first publication of consequence to present all of the facts with their implications to the service industry. More important, you have the courage to make a stand. This editorial should make a lot more friends for *Electronic Technician*. Congratulations.

R. M. ANDREWS
 Advertising Manager

Tung-Sol Electric
 Newark, N.J.

... You are to be congratulated on your stand. We find only one fault, and that is the improper spelling of "Unite to Fight." By capitalizing the two words you imply that a plan of much talk and little action by several Detroiters is the active force behind the campaign. It is a known fact that NATESA has been the moving spirit behind this since 1948.

FRANK J. MOCH
 Executive Director

National Alliance of TV & Electronic
 Service Associations
 Chicago, Ill.

• Our heartfelt thanks to all who have expressed their good wishes and encouragement to continue fighting against captive service. Without individual (Continued on page 8)

Sylvania comparisons point out—

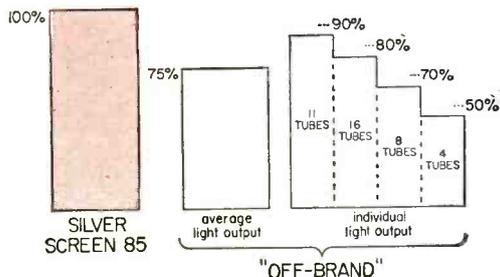
The big difference in Picture Tubes!

Here's the inside story on why local "off-brands" don't measure up to Silver Screen 85® standards

If you're like most dealers, you know off-brand tubes don't have the same quality standards as first-line tubes. To help you see how big the difference is, Sylvania purchased a nationwide sample of sixty 21YP4A's made by 19 different local tube makers. These tubes were put through the same production tests that all Sylvania tubes must pass.

Not a single local off-brand passed all 54 mechanical and electrical tests! Many of these were minor defects making little or no difference in whether or not the tube "lit up." But look how loose manufacturing controls can affect the important features of light output, focus, and life!

LIGHT OUTPUT



So far, 39 off-brand tubes have been compared with the *minimum* light output of Silver Screen 85. Five additional tubes couldn't even be tested. Eleven tubes were less than 90% as bright as the minimum for Silver Screen 85; 16 were less than 80%; 8 were less than 70%; and 4 were *less than 50%* as bright. Since most Silver Screen 85 tubes average as much as 125% of minimum standards, the difference becomes even greater. Small wonder that Silver Screen 85 is the easy way to more satisfied customers.

FOCUS

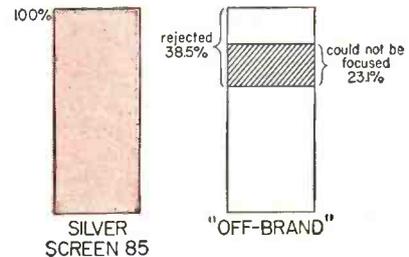
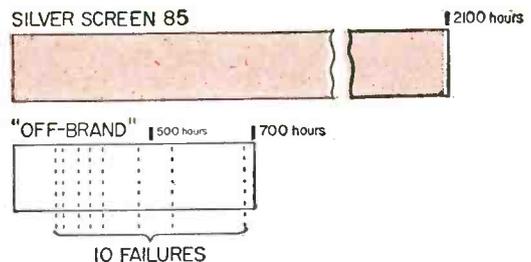


Chart 2 shows how these same 39 tubes stacked up to registered limits on focus voltage. 38.5% were rejected under these limits. Over half of all those rejected could not be focused in a TV receiver. Small wonder then that "Silver Screen 85" pictures are sharper, brighter, clearer.

LIFE TEST



Nineteen off-brand tubes were placed on Sylvania's standard 2000-hour life test. Chart 3 tells you how fast these tubes developed slow-heating cathodes. Over half, or ten units, failed to go beyond the 700-hour mark. Small wonder then that Silver Screen 85 gives you less troublesome callbacks.

Of all the off-brand tubes tested, Sylvania engineers estimate that 43% probably would not have operated properly in a TV set. Why gamble your reputation, customer satisfaction, and success. It's just *good business* to sell up to "first line" picture tubes; Silver Screen 85 picture tubes.



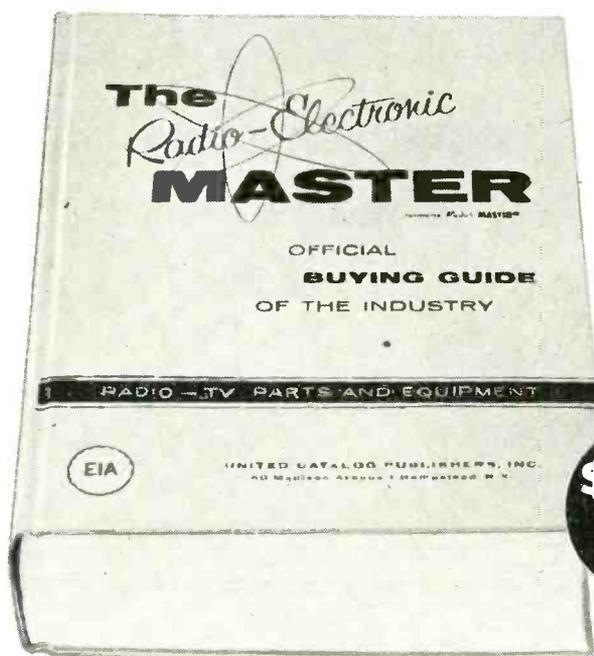
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SYLVANIA ELECTRIC PRODUCTS INC.
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of TV-Radio - Electronic - Audio Products

1536

pages of complete descriptions, specs, illustrations, prices

150,000

items including all latest products of

350

manufacturers systematically arranged in

18

product sections for easy reference

THE MASTER MEANS MORE PROFITABLE OPERATION FOR SERVICE TECHNICIANS

The MASTER covers 150,000 items necessary to radio-TV-audio servicing. It offers thousands of other products that can lead to extra income in hi-fi, sound and industrial servicing. Includes hundreds of new items that are indispensable in

servicing—new color TV test instruments, new transistor types, new subminiature and printed circuit components. Invaluable at the bench, over-the-counter, or in the field. You can buy, sell and bill direct from the MASTER... it shows list prices!

for replacement parts, installation equipment...

YOU'LL FIND IT FASTER IN THE '59 MASTER

At your local parts distributor, or write for list



FREE...Valuable 24-page panel lamp chart at your MASTER distributor, or write direct enclosing 10¢ for handling.

THE RADIO-ELECTRONIC MASTER 65 Sewell Street, Hempstead, N. Y.

(Letters. Continued from page 6)

favor, we will support everybody and anybody who acts to help curb this unfair practice.—Ed.

Tip on Needle Tips

Editor, ELECTRONIC TECHNICIAN:

In your September "Stereo 1959" you state that there actually is no dual purpose pickup needle for monophonic and stereo records. 0.5 mil which might be ideal for stereo is too small for the wider mono LP groove. 1.0 mil is satisfactory for regular LP's, but will damage stereo records. What are we to do?

MARTIN MOSS

Forest Hills, N.Y.

• 0.7 mil may be the best bet for now, even if there is no ideal compromise. It will play mono discs, and will not wear out a stereo disc as quickly as 0.5 mil in case of excessive tracking force. The added distortion of using 0.7 instead of 0.5 mil for stereo is very small. 0.5 mil should only be used in carefully adjusted, high quality arms. A flip cartridge with 0.5 or 0.7 on one side for stereo, and 1.0 mil for mono on the other side may be a good combination.—Ed.

The Urge to Surge

Editor, ELECTRONIC TECHNICIAN:

We subscribed to your magazine just to get the salesman off our necks. Now I'd like to thank him for doing us a real service. The October "Current Surge Protection" article was of considerable interest to us. In rural areas, house voltage runs over TV rated voltage, often as high as 130 volts during periods of light loads. This causes parts to pop. A "high negative temperature coefficient" resistor like Globar is a life saver. Used properly, this unit will cause an initial drop of 50 to 60 volts, and a final or hot voltage drop of 7 to 10 volts. It is doubtful if the Globar Div. of Carborundum will retail this item now. I worked for them for 25 years.

JAMES I. MILLER

Chetek Sales & Service
Chetek, Wis.

... The article says: "Thermal sensitive relays such as the Tube Sentry and Tube Protector delay the application of B-plus only." That simply is not true. Motorola's Tube Sentry absolutely prevents the application of B-plus while heating up the filaments very slowly. Incidentally, congratulations on your purchase of Service magazine.

JOHN C. PYLE
Editor

TESA of Denver Magazine
Denver, Colo.

• Reader Pyle is right. The Tube Sentry in the filament transformer primary controls both filament current and B-plus. However, the current surge heater problem is not as significant for transformer sets with parallel strings as it is for series strings.—Ed.

(Continued on page 14)

Now! 2 Silicon
Types for simplified
replacement of all
existing TV
Rectifiers!

Hermetically
sealed universal
replacement
for all silicon
types... No heat
sink required.



SD-500 KIT

IT WIRES IN!

... to directly
replace axial
lead type
units.

IT CLIPS IN!

10-second conversion
permits plug-in into
existing clip-type
sockets previously
installed. (Kit contains
all needed parts.)

Rating: 500 ma
@ 130 v. a.c



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SILICON TV REPLACEMENT RECTIFIERS

*save installation time...
reduce your
rectifier stock...
cut call-backs!*

Hermetically sealed
universal replacement for
all existing selenium types...
a direct mechanical replacement.

**NO HOLES TO DRILL;
NO CONVERSION KIT REQUIRED!**

"UNISTAC" TV 500

Eyelet construction enables
you to directly replace
selenium types without
time-consuming conversion
efforts. Improves set
performance; gives long,
trouble-free life.



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Hermetic sealing provides a
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contaminants destroying the
rectifier junction. It is the
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long, trouble-free life. Both types
are manufactured to the same rigid
requirements specified for military
and critical industrial applications.

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distributors throughout the nation.

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Constant-Capacitance Film Capacitors



**For equipment applications
where the best is none too good**

- ★ for performance far above and beyond ordinary plastic-film or paper capacitors
- ★ for unmatched capacitance and retrace stability
- ★ for highest insulation resistance

● Sprague's new ISOFARAD Film Capacitors have the best temperature/capacitance stability at the lowest cost. The Sprague patented plastic film dielectric in these capacitors has practically no capacitance change over operating temperature ranges up to +85° C . . . making them ideal for TV, radio, circuit design work in the laboratory, precision amplifiers, laboratory instruments and industrial electronic equipment.

● They're the *only* capacitors that will work every-time in synchroguide circuits in color TV receivers . . . the *only* answer to many a TV set that's a drifter.

● Here's the kind of performance you can expect with ISOFARAD Capacitors: from 25° C (room temperature) to +80° C, their capacitance will not change by more than 1%. These capacitors have such good retrace characteristics that there is prac-

tically no permanent change in capacitance even with repeated temperature cycling. As for insulation resistance, it's so high it can't be measured on ordinary service equipment.

● When used for replacement applications in TV horizontal circuits, where drift is a problem, they consistently better original set performance.

● You'll find Sprague's new ISOFARAD Capacitors cost you less and perform better in most circuits than comparable silvered mica capacitors. What's more, they're available in capacitor ratings up to .33 MF which is far beyond the silvered mica range. And every capacitor is rated at 500 volts d-c working!

● For complete listings, write for Bulletin M-755 to Sprague Products Company, 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

For ultimate quality in audio amplification

Tung-Sol audio tubes now twin-packed in matched pairs by the manufacturer

Now you can come as close to faultless sound reproduction as the design and circuitry of your hi-fi equipment will permit. Tung-Sol 5881 and 6550 beam-power amplifier tubes are factory-matched to very tight performance limits and twin-packed to help you achieve lowest distortion levels at all volume levels.

Use of Tung-Sol 5881 and 6550 tubes has long been associated with ampli-

fiers of the very finest design. These tubes have always been produced to closest possible tolerances with cathode current ranges held to an absolute minimum.

Now, in twin-packed pairs, they assure the hi-fi enthusiast and the commercial sound engineer of replacement tubes that will provide new standards of performance—a feature of special importance with the newest amplifiers

and loudspeakers, particularly binaural sound equipment.

Service dealers will find the use of these tubes for replacement a source of profitable customer appreciation. Tung-Sol Electric Inc., Newark 4, N.J.

 **TUNG-SOL®**

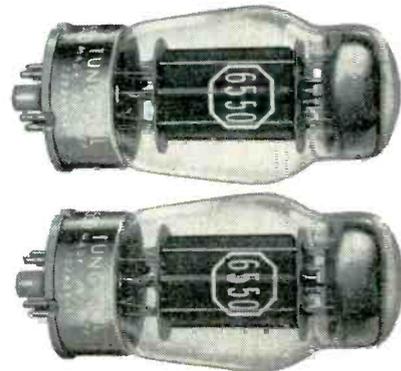


5881

For service in amplifiers of up to 50 watts.

6550

For service in amplifiers and commercial audio equipment of up to 100 watts.



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 . . .

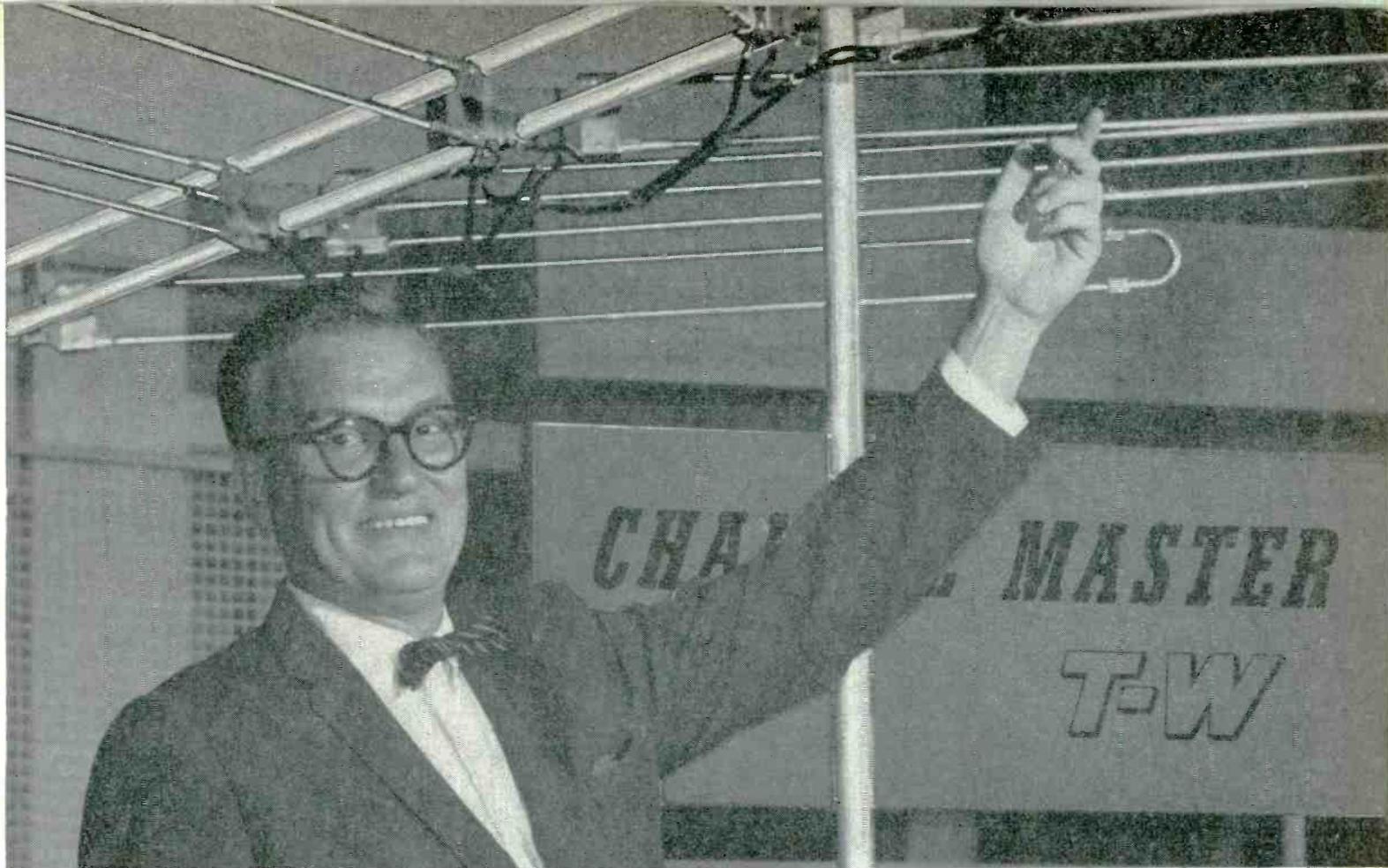
how much study it required to learn . . . and how expensive it was getting started. Told in interesting cartoon technique, the booklets are something everyone will read—and understand!

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**

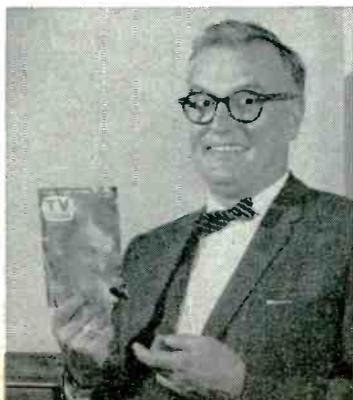
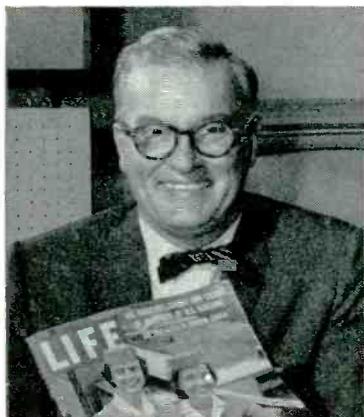
Electronic Tube Division • Elmira, New York



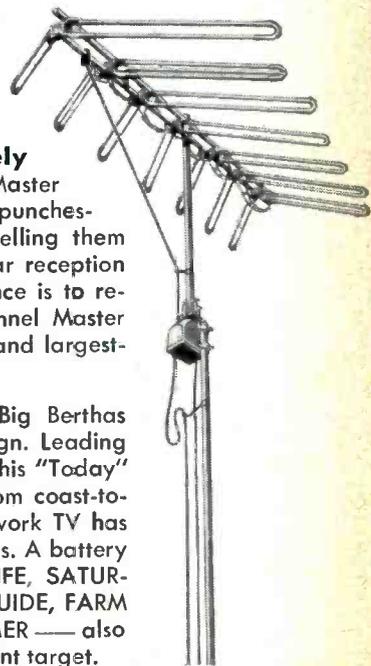
Dave Garroway, NBC-TV star, tells his viewers to replace their old antennas with T-W's.

Let Garroway show you

...how **CHANNEL MASTER** promotes antenna replacements on network TV, in national ads



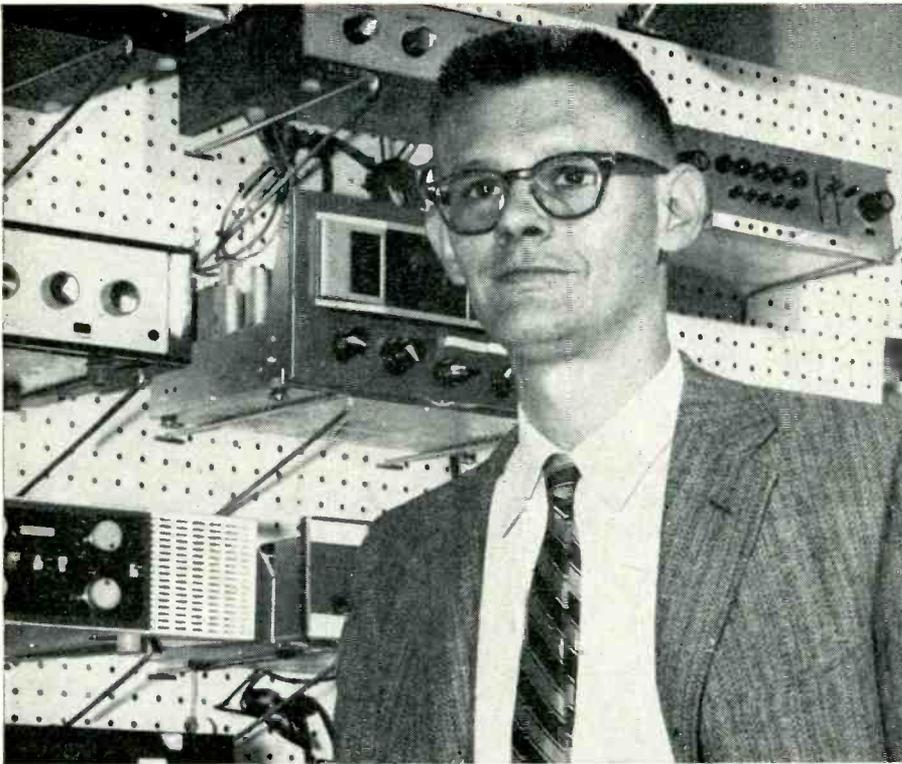
There are millions upon millions of over-aged, obsolete antennas in use today—providing weak TV reception for their owners. **These antennas must be replaced immediately**—and that's just what Channel Master has been telling the public in a no-punches-pulled ad campaign. We're also telling them that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



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

CHANNEL MASTER CORP
ELLENVILLE, NEW YORK

Copyright 1958 Channel Master Corp.



(Letters. Continued from page 8)

Die Laughing

Editor, ELECTRONIC TECHNICIAN:

The humorous incidents in "You Could Die Laughing" [Oct. 1958 issue] reminded me of a few. On a service call, the husband met me at the door and showed me the set. The back was off; he had been working on it. After he left to answer a phone call, his wife came up behind me and said: "Darling have you got it fixed yet?" She grabbed me from behind, turned me around and kissed me before she realized I was not her husband. I also had a similar incident to your chimney accident. I was tightening up the chimney strap, and before I realized it the bricks had been squeezed in, cutting the chimney in half. Fun at the work bench has also been had by placing one end of a long piece of spaghetti behind a TV set. Blow smoke in the other end when the set is turned on, and watch the consternation as the technician hurriedly yanks the cheater cord.

LOUIS C. HEBEL

H&H Radio & TV
Oakland, Calif.

"We landed a \$3500 Hi-Fi installation through our Yellow Pages advertising!"

says John H. Bloecher, Jr., Custom Music Systems, Inc., Baltimore, Maryland

"I don't see how we could do without Yellow Pages advertising. It's a permanent buyers' guide and we know for a fact that many of our customers found us through our advertising there.

"Proof of Yellow Pages' results came quite recently when we made a \$3500 custom installation for a contracting firm building an expensive new house. They came to us through the Yellow Pages!"

More jobs can come *your* way too, when you advertise in the Yellow Pages. Why not talk it over with your Yellow Pages man. Call your local Bell telephone business office today.

QUALITY SOUND SYSTEMS



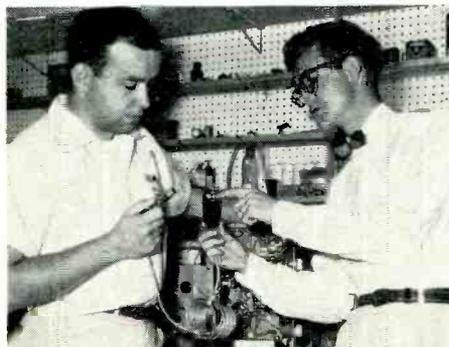
Paging - Intercom - Time Signals -
High Fidelity Music - Production Control
Private Telephone Systems - Closed Circuit TV

FOR SCHOOLS - FACTORIES - CHURCHES - HOSPITALS

Free engineering advice and estimates.

VErnon 7-1900

106 W. NORTH AVE.
BALTIMORE SOUND & ELECTRONICS
Division of Custom Music Systems



◀ THIS ¼-PAGE DISPLAY AD (shown here reduced); ads and listings under different headings (such as Sound Systems and Microphones); and trade-mark tie-ins (such as Ampex Home Music Systems and Electro-Voice Hi-Fi), bring in service and installation jobs to Custom Music Systems.

News of the Industry

RADION CORP. has moved into its new plant at 345 Terra Cotta Ave., Crystal Lake, Ill.

WELLER ELECTRIC CORP. has elected as Vice Pres.-Sales, C. R. ROBERTSON, recently named sales manager.

BLONDER-TONGUE LABS. has appointed RUDOLPH W. SELBMANN as Chief Engineer of its subsidiary BLONDER-TONGUE ELECTRONICS.

AMPHENOL ELECTRONICS CORP. has announced that their directors and those of THE GEORGE W. BORG CORP. have approved a plan to merge the two companies.

SPRAGUE PRODUCTS CO., distributors' div. of SPRAGUE ELECTRIC, celebrates its 25th anniversary this fall. SPRAGUE ELECTRIC, the parent company was founded seven years earlier in 1926.

SHELL ELECTRONIC MFG. CORP. announces a 4-month sales contest—Nov. 1958 thru Feb. 1959—open to the firm's reps and based on dollar volume. Monthly awards to be 3 prizes plus a grand prize.

MOTOROLA INC. has named IRV KOSS as director of marketing, and has promoted WILLIAM WEISZ from chief engineer to product manager. Two-Way and Portable Products, Communications & Industrial Electronics Div. Also, RICHARD H. RUDOLPH, manager of marketing, Semiconductor Div.

You get

DEPENDABILITY

when you use

ZENITH[®] QUALITY PICTURE TUBES

and you get more
customer satisfaction



You get extra dependability and extra satisfaction, too, when you sell ZENITH Quality TV Picture Tubes! The Zenith Cinébeam Aluminized Picture Tube gives the ultimate in performance...the ultimate in picture clarity.

Zenith Pioneered in the development of TV picture tubes...Cinébeam Picture Tubes, Rectangular Tubes. Zenith was first with Lo-Voltage Electrostatic Tubes and the Black Tube. Zenith's list of first in picture tubes is just one more example of Zenith's leadership in creative engineering and advancements.

Replace with the best...replace with Zenith Quality Picture Tubes

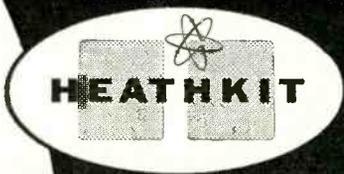
You can safely guarantee Zenith repairs when you use dependable Zenith components. Buy picture tubes by Zenith...backed by 40 years of leadership in radionics exclusively. The quality goes in before the Zenith name goes on.

SEE YOUR ZENITH DISTRIBUTOR



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

look what
\$28⁹⁵
 buys in
 high fidelity
 equipment!

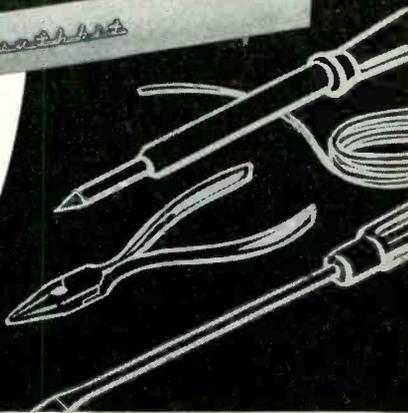


Manufacturer
 of the finest
 electronic equipment
 in kit form



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

\$28.95



BOOKSHELF 12-WATT AMPLIFIER KIT

An amplifier and preamplifier in one compact unit. The EA-2 has more than enough power for the average home hi-fi system and provides full range frequency response from 20 to 20,000 CPS within ± 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.



many more kits
 to choose from!

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

HEATH COMPANY

Benton Harbor 18, Mich.



a subsidiary of Daystrom, Inc.

name _____

address _____

city & state _____

CALVIDEO TUBE CORP. has broken ground for their new 40,000 sq. ft. plant in Los Angeles.

SAM GRODEN, INC., New York City advertising agency, has moved to expanded quarters at 10 E. 52nd St.

CBS-HYTRON reports the appointment of DR. PHILLIP N. HAMBLETON as supervisor of tube research and development.

ORRADIO INDUSTRIES INC. announces the appointment of WALTER L. BROUGH to the new position of manager, Mfg. Div.

ELECTRONIC DEVICES, INC. has named as Vice Pres., HAROLD B. ROSENBERG, who joined the firm as chief engineer in February of this year.

CONRAC, INC. has announced the appointment of CHARLES V. DICKMAN as national sales manager for the company's FLEETWOOD high fidelity home TV receivers.

INT'L TELEPHONE & TELEGRAPH CORP. reports that JOHN W. GUILFOYLE has been elected Executive Vice Pres. of FEDERAL ELECTRIC CORP., service organization of ITT.

ALLEN B. DU MONT LABS. reports that two more industrial TV specialist firms have joined a nationwide network, handling the firm's closed-circuit TV systems, which brings to 43 the number of these outlets in the U.S.

RADIO CORP. OF AMERICA reports the creation of two new units in the consumer products organization: the TV & Radio "Victrola" Production Unit, WARREN E. ALBRIGHT, manager; Consumer Products Administrative Services, P. W. Hofmann, manager.

SERVICE INSTRUMENTS CORP. reports that a free filament checker is being given with each purchase of the firm's TV Bias Supply and Vibradaptor. This special 3 for 2 offer will enable purchasers to obtain \$13.35 value for \$10.60.

CHANNEL MASTER CORP. states that participation on NBC's "Today" show will highlight their ad campaign, and that this is the first time network TV has been used to advertise TV antennas. Another "first" in antenna advertising, they state, is the appearance of the firm's ads in Life, Look and The Saturday Evening Post, and other consumer magazines, including TV Guide. The theme is replacement of out-of-date or damaged antennas.

UNIVERSITY LOUDSPEAKERS, INC. announces the resignation of SEYMOUR BLUMENFELD, head of the firm's purchasing department and director of government sales.

GENERAL ELECTRIC CO. formally dedicated their new replacement TV picture tube plant, in Augusta, Ga., on Nov. 10 and 11th. About 50 electronic parts distributors were guests of honor. The company also reports a 3.7% price increase on 2-way radio units.

RAYTHEON MFG. CO. has named KENNETH C. MORITZ sales manager of the Semiconductor Div. Earlier appointments to the Distributor Products Div. included: F. E. ANDERSON, gen'l sales mgr., J. A. HICKEY, industrial products mgr., F. H. KESWICK, dealer products mgr., WM. GREY, merchandising mgr., E. I. MONTAGUE, director personnel development and trade relations, JOHN MANCHESTER, controller, and HAROLD HENNIG, marketing research mgr.

Reps & Distributors

PERLMUTH ELECTRONIC ASSOCIATES, Los Angeles rep firm, has moved to 5057 W. Washington Blvd., Los Angeles 16, Calif.

ERIE RESISTOR CORP. has named the MICHAEL SCOTT CO., Wellesley Hills, Mass., as sales reps for ERIE, Teflon and Corning Glass Works electronic components.

GILBERT E. MILLER ASSOCIATES, rep firm of Jericho, L.I.N.Y., has added JACK GREENSPAN to their staff to cover the New Jersey and Brooklyn territory.

IRON FIREMAN MFG. CO. Electronics Div. announces the appointment of COLUMBINE SALES & ENG'G CO., Denver, as sales reps in the Rocky Mountain area.

HOFFMAN ELECTRONICS CORP. reports the appointment of A. W. BOLINGBROKE CO., Milwaukee, as TV, hi-fi and radio distributor for 42 counties in Wisc. and Mich.

CHICAGO STANDARD TRANSFORMER CORP. has announced the appointment of MOULTHROP & HUNTER, San Francisco, as sales reps for the CHICAGO line of military and industrial transformers. They will now handle both the CHICAGO and STAN-COR lines of stock transformers in the northern Calif. area.

SUPER RELIABLE!



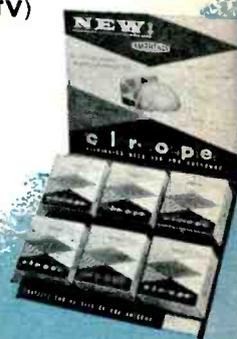
AMPHENOL

TV Color COUPLER

New design ideas in performance, appearance and mounting make AMPHENOL's Color-Couplers best for coupling of Color and/or Black & White TV sets as well as FM radio. Incorporating a super reliable resistive network, Color-Coupler provides

1. Effective isolation
2. Low insertion loss
3. Almost perfect impedance match
4. Flat signal response (a must for Color TV)
5. Built-in twin lead strain relief
6. Horizontal or vertical mounting

To Help You Merchandise this superior coupler AMPHENOL provides a free 3-color counter-top display. Included with each standard package of 9 114-097 2 set Color-Couplers, this eye-catching display mounts 6 Color-Coupler cartons for reach-and-buy action!



Color-Couplers are also available as three and four set models. Your AMPHENOL Distributor has all the data.



AMPHENOL ELECTRONICS CORPORATION
chicago 50, illinois

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



Ask your Fanon representative for complete information and installation instructions on Fanon kits and about the complete line of Fanon Hi-Fi Stereo Phonos.

FANON ELECTRIC CO., INC.
Dept. ET-12, 98 Berriman St., Brooklyn 8, N. Y.
In Canada: Active Radio & TV Dist., 58 Spadina Ave., Toronto

Catalogs & Bulletins

CAPACITORS: A 24-page cross reference chart lists 3,525 "preferred" twist prongs and tubular electronics. Tobe Deutschmann Corp., 2900 Columbia Ave., Indianapolis, Ind. (ELECTRONIC TECHNICIAN B12-11)

RECTIFIERS: Bulletin SR-162 describes a new 100 ma rated miniature rectifier which operates directly from a 230 volt line. This miniature rectifier, type 61-4037, has an overall volume of only 1.31 cu. inches. International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif. (ELECTRONIC TECHNICIAN B12-6)

MOTORS: Catalog M159 presents a new product line. About 12 fractional h.p. electric motors, ranging from 1/1000 to 1/2 h.p. are covered with illustrations, dimensional diagrams and specifications. Carter Motor Co., 2767 AW George St., Chicago, Ill. (ELECTRONIC TECHNICIAN B12-3)

INDUSTRIAL TV: A bulletin describes the 1987 industrial TV system. Features include: an automatic, built-in light control capable of compensating for light-level variations of up to 1000:1; and a white clipper circuit which minimizes the effect of extremely bright objects in the viewing field. Kin Tel, 5725 Kearny Villa Rd., San Diego 12, Calif. (ELECTRONIC TECHNICIAN B12-8)

CAPACITORS: A catalog provides information on WIMA Tropicur molded capacitors for use in printed circuits and in conventional equipment. Features are: bifilar winding for safety with a minimum of size; hot-dip fusing; and coating application by vacuum process to prevent air inclusions. Rhombic Associates, 60 W. 45 St., New York 36, N. Y. (ELECTRONIC TECHNICIAN B12-9)

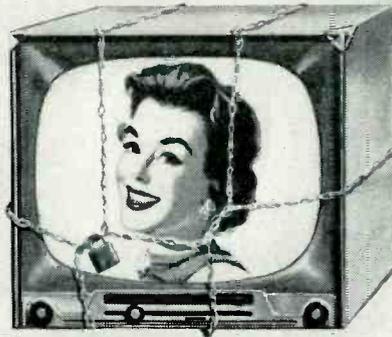
CONNECTORS: A new series of thread coupled, miniature coaxial connectors, known as the TM series, is covered in an 8-page illustrated catalog. Design features, electrical characteristics, application, and cable assembly instructions are given. Other products, such as plugs, jacks and receptacles are also included. General RF Fittings, Inc., 702 Beacon St., Boston 15, Mass. (ELECTRONIC TECHNICIAN B12-7)

TRANSFORMERS: A circular covers a new line of mu-metal shielded, epoxy impregnated, miniature transformers, the Transistor Transformattes. Features are given for 13 basic types, which can be used in 90 different impedance matching circuits. Includes performance characteristics, a formula for calculating power-handling capacity, and prices. Amplifier Corp. of America, Transformer Div., 398 Broadway, New York 13, N.Y. (ELECTRONIC TECHNICIAN B12-1)

(Continued on page 22)

25,000 HOURS

..and
still
like
new



LOOK FOR THE
GOLD STAR
ON THE
NECK!

New Westinghouse **Gold Star** Picture Tube

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

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

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

your profit picture so long. They are . . .

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

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

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

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



The aluminized picture tube was a General Electric "first." Unequaled experience in aluminizing techniques puts G-E tube quality well ahead. Example: in the picture below, a G-E inspector, using a "Q" meter, carefully checks the thickness of the aluminum coating in all areas of Black-Daylite face plates. Coating at any point must not be too heavy for a bright picture, or so thin that ion burn can result. Pays off in a superior picture over the entire screen!



BLACK-DAYLITE
ALUMINIZED PICTURE TUBE

YOUR CUSTOMERS KNOW AND WANT THIS QUALITY TUBE WITH THE FAMOUS NAME!

Best-known name in picture tubes—behind it, years of General Electric marketing effort and millions of dollars of consumer advertising!

Best-liked, most-wanted tube, because Black-Daylite brightness, sharpness, and fine contrast are familiar to television owners everywhere!

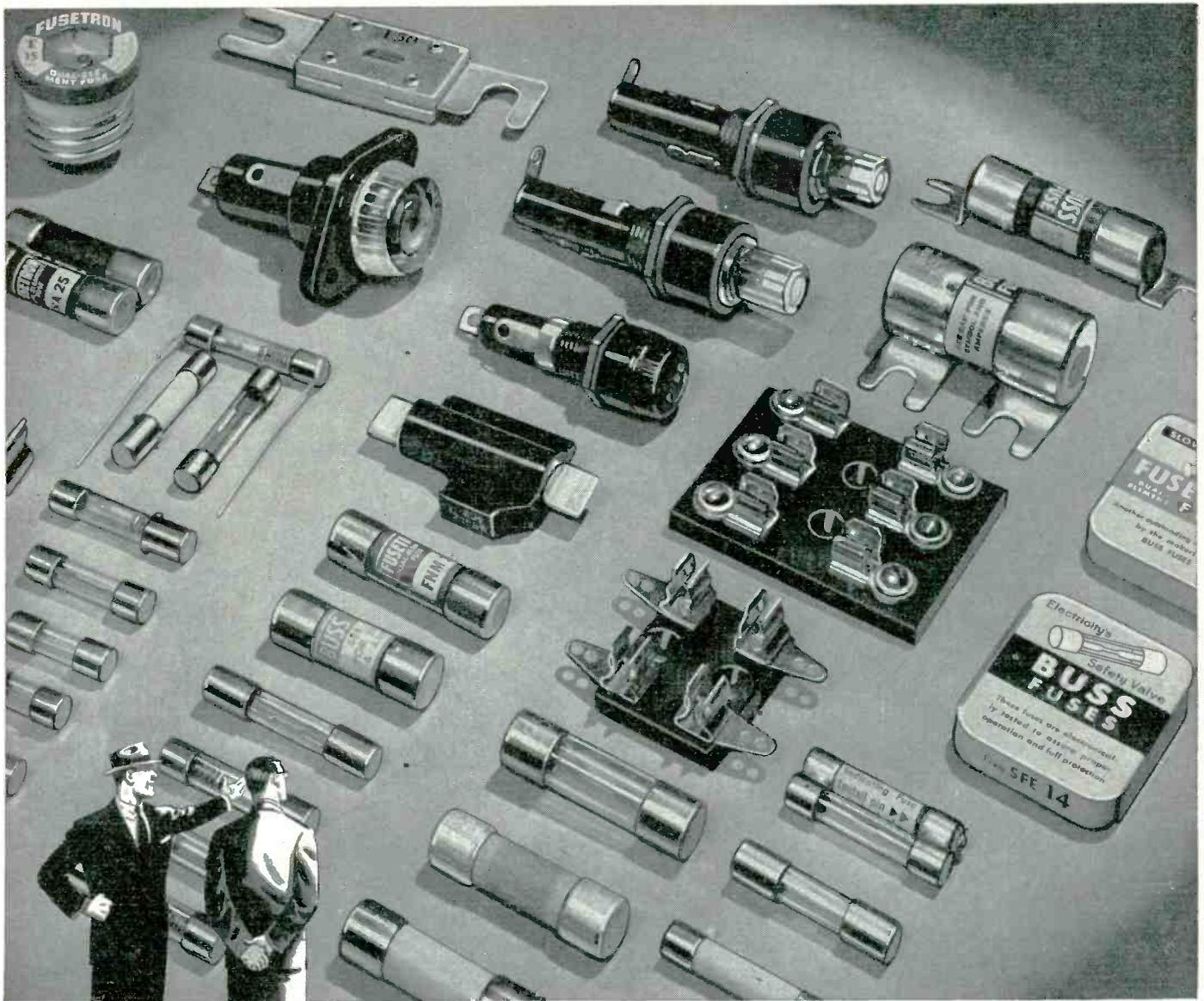
Please your customers by installing the picture tube they prefer! It's the sure way to hold present business and build new. Remember . . . you pay no

more for Black-Daylite quality! Your General Electric tube distributor has these top-performance, fast-selling tubes in a wide range of types. Phone him! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Kentucky.*

Progress Is Our Most Important Product

GENERAL  ELECTRIC

11-13-202



BUSS FUSES *help you avoid adjustments and call-backs.*

Faulty fuses can cause trouble for you and your customers by failing to protect — or by blowing needlessly . . . but, with BUSS fuses you can be sure of dependable protection under all service conditions.

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.

That's why BUSS fuses provide maximum protection against damage due to electrical faults. Users are safeguarded against unnecessary repair bills, — and your reputation for quality and service is protected.

Equally important, BUSS fuses eliminate needless blows that irritate users and require adjustments or call-backs on the part of sales and service organizations.

Protect yourself against faulty fuses causing trouble by relying on BUSS fuses. To meet service needs, there is a complete line of BUSS fuses available.

For more information on the complete line of BUSS and FUSETRON Small Dimension Fuses and Fuse-holders . . . 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.

"FELLAS—THERE'S GOLD IN THESE

C-D TWIN TREASURE CHESTS"

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



See C-D's "Treasure Chests" at your Cornell-Dubilier distributor or write to Cornell-Dubilier Electric Corporation, South Plainfield, N. J., Department ET-12.



SUGGESTED CONTENTS:

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

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

73 PM Mylar Tubulars

BOTH CABINETS ARE FREE. YOU PAY ONLY FOR THE PREFERRED C-D CAPACITORS.

YOUR COST: \$49.95

(Catalogs & Bulletins. Continued from page 18)

TUBE TESTERS: New roll charts, incorporating listings for the newest tubes, are available for models 625 and 666. Electronic Instrument Co., 33-00 Northern Blvd., Long Island City 1, N. Y. (ELECTRONIC TECHNICIAN B12-5)

SPEAKERS: A new 20-page, illustrated, 3-color catalog is available. It provides: electrical, acoustical and dimensional data; criteria for selection of a speaker system; requirements for realistic stereo; an explanation of the nature of sound; and design features. R. T. Bozak Sales Co., Darien, Conn. (ELECTRONIC TECHNICIAN B12-2)

SPEECH COMPRESSOR & MODULATOR: Circular describes the Vari-Vox. Features include: compression and expansion of frequency and time. It also slows speech for better interpretation, monitoring, etc. Data covering the Megalator, an amplitude modulator, with ranges from DC to 1,000 mc is also included. Kay Electric Co. Maple Ave., Pine Brook, N. J. (ELECTRONIC TECHNICIAN B12-10)

STEREO: E-305, "An Introduction to Stereophonic Sound" describes how a stereophonic record is produced using the 45/45 Westrex system, illustrates how the playback stylus motion is converted into separate signals, lists components needed for a disc stereo system and answers typical questions on stereo. E-306, "Hints on Using the Columbia CD Stereo Cartridge" describes the mechanics of the cartridge, recommends convenient ways of installing and using it, and discusses associated equipment. These are the first two of a series. CBS-Hytron, Newburyport, Mass. (ELECTRONIC TECHNICIAN B12-4)

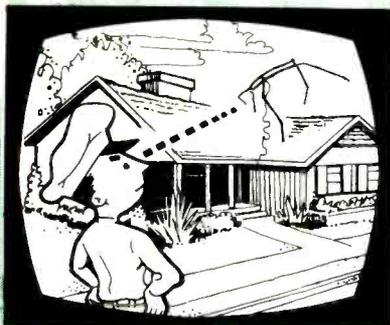


"You fellas ever finish jobs somebody else started?"

Consistently Dependable
CORNELL-DUBILIER
SERVICE CAPACITORS

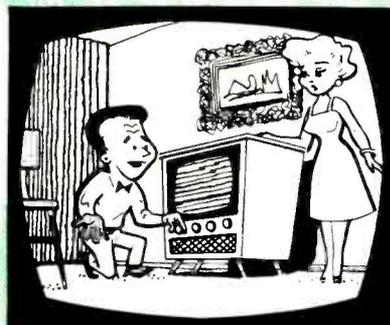
sales without selling

16 million worn out antennas are due for replacement. Here's how you can get this extra business on your regular service calls...



1 LOOK UP!

Look up at your customer's antenna before every service call. See if there are missing or sagging elements, corrosion or other signs of a worn out TV antenna.



2 TALK UP!

Tell your customer what you've seen... also how an antenna loses up to 50% of its efficiency after three years. Explain how much clearer their TV picture will be with a new antenna.



3 PUT UP!

Stock CLEAR BEAM Do It Yourself Kits on your truck. Make the installation while you're there...or sell kits outright to Do It Yourselfers. Either way you'll pick up extra profits.



Complete Installation Kits for
Every Popular Antenna
Conicals — Arrows — Yagis —
Inlines



CLEAR BEAM ANTENNA CORP.,
CANOGA PARK, CALIF.



V-M appoints John Rankin director of engineering.

H. H. SCOTT releases a 20-page hi-fi guide and catalog.

BOGEN-PRESTO names Joseph N. Benjamin president. Benjamin has been executive vice-president of PILOT.

ALLIED announces the KN-720 Bantam stereo amplifier, 10 watts per channel. Price is \$79.95.

ALTEC LANSING introduces the S41 master stereo control to connect and provide gain control for two amplifiers. Priced @ \$12.

AMERICAN ELECTRONICS announces the Concertone Mark VII professional tape recorder, 3-3/4 & 7-1/2 ips, priced at \$795.

INTERNATIONAL RADIO & ELECTRONICS is marketing the 3-motor Gold Crown Prince stereo recorder, 3 speeds, 20 to 20,000 cps within 2 db. Price is \$475.

AUDIO ENGINEERING SOCIETY issues its call for technical papers for its Los Angeles Convention in mid February. Prospective speakers should send a title and 25-word summary to Harry L. Bryant, Radio Recorders, Inc., 7000 Santa Monica Blvd., Hollywood 38, Calif.

RCA announces an experimental stereo system for AM broadcasting. Each of the transmitted AM sidebands carry one of the two stereo channels. The stereo AM receiver separates the two sidebands and feeds them to separate speakers. Conventional AM radios receive the signal in the usual fashion. Special attraction is the car radio, for which FM has not proved commercially practical.

(Continued on page 52)

YOU JUST DON'T PULL QUALITY OUT OF A HAT



You can't pull quality out of a hat! Quality is not a "sleight of hand" trick . . . it is more than a claim! Zenith's unique Quality Assurance Division is just one of many examples of Zenith's determination to maintain the highest possible quality standards.

Paying attention to the details—checking and double-checking consumer products—this goes on day after day at Zenith just to make sure there is no "sleight of hand" about Zenith quality!

In addition to Zenith's famed Quality Control Department, which is responsible for thorough checking and control of quality throughout production, there is a unique division at Zenith that started many years ago.

It is Zenith's Quality Assurance Division that virtually provides a personal or "consumer test" under the supervision of Zenith's top management. This enables Zenith to make an independent type of audit on quality.

Zenith's Quality Assurance Division was set up to formulate and guide a complete quality program from supplier to finished product. This unique division has the authority to halt production at any time if quality is judged below Zenith's standards.

Some may think that Zenith's Quality Assurance Division is a duplication of other rigid quality controls, but at Zenith the guidance of a complete quality program by Quality Assurance is a way of life—another indication of Zenith's determination to maintain the highest quality standards and to make sure that at Zenith "the quality goes in before the name goes on."

ZENITH

®

Zenith Radio Corporation, Chicago 39, Illinois



**THE QUALITY GOES IN
BEFORE THE NAME GOES ON**

40 years of leadership in radionics exclusively. The Royalty of television, stereophonic high fidelity instruments, phonographs, radios and hearing aids.

Mr. Independent Service Dealer:

These Excerpts From An Article On Self-Service Tube Testers Are Important To You...

Perhaps you remember Editor Al Forman's timely and informative article on Self-Service Tube Testers that appeared in last November's issue of Electronic Technician. We reprint it in part because it is worth a repeat reading.

These excerpts and Raytheon's reply

to this industry problem are brought to your attention because we think the Raytheon Tube Mart is the service dealers' answer to the challenge of the corner-store tube tester.

Ask your Raytheon Tube Distributor for the whole story on the revolutionary, new Raytheon Tube Mart.



By 1959 it is reasonable to expect that over 50,000 of these units will be in operation

We agree

Raytheon is ready in 1959 to place in the field many thousands of the exclusive, new Raytheon Tube Mart — the only brand name tester-merchandizer in the industry. This will be done exclusively through Service Dealers like yourself — you will get the tube sale profits.

In 1955, self-service testers accounted for 0.4% of the replacement tube market; at the end of 1957 they dominated 7% to 10% of the market. In 1958 the percentage will be still higher.

We agree

With two months to go, the tube testers have already passed the predicted 10%.

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

We agree

If only 1 in 5 testers is controlled by a Service Dealer — 4/5 of this market slips away. Raytheon is determined to get it back for you.

Public confidence in technicians is promoted by allowing customers to make their own tube tests.

We agree

Public confidence is promoted where there are direct referrals to a qualified technician when the do-it-yourself tester doesn't reveal the true cause of failure.

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

We agree

Everyone works for profit and profit comes through investment. The Raytheon Tube Mart plan offers you a realistic investment and profit plan. Check the details — you'll see why it will pay you to promote the Raytheon Tube Mart.

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

*We agree —
Wholeheartedly agree*

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

You're not interested in early life tube failures — from loose elements, shorts, gas, etc. — because these failures are covered by user warranty, eliminating any tube sale profit.

You are interested in the tube failures that occur after three months of operation — the vast majority of which are caused by heater failure.

The continuity checker in the Raytheon Tube Mart will catch these failures. It is designed as a simple go-no go unit that won't scare set-owners away — will send them to you for service. Present the Raytheon Tube Mart for what it is — an emergency service to the public — a unit that will help them unearth tube failures — a unit that assures them of finest quality, new tubes — and you'll profit from tube sales and increased service business.

Raytheon's sole interest in creating the Tube Mart is to keep the tube sale profits where they belong — in your pockets.

Ask your Raytheon Tube Distributor to show you how the Raytheon Tube Mart will do it!



**DISTRIBUTOR PRODUCTS DIVISION
RAYTHEON MANUFACTURING COMPANY
55 Chapel Street • Newton 58, Mass.**

ELECTRONIC TECHNICIAN

Now Including
SERVICE
Magazine

Respice, Trostice

Now, at year's end, is a good time to reflect upon the old saying from the Latin: "Look backward, look forward."

It's a time to review the past year—its frustrations and satisfactions, its losses and gains—and become a little wiser for the experience.

Then, armed with the added insight into what has passed, let's look forward to the coming year and its promise of better things.

1958

1958 was the year of recession—and recovery. The servicing segment of the electronic-TV industry did not decline in total dollar volume as the manufacturing segment did—people kept their old sets in repair. However, individual service dealers did feel the recession pinch during the first eight months due to collection difficulties and temporary oversupply of technicians layed off by manufacturers. By year's end, business was up, qualified technicians again in short supply.

1958 was the year of commercial stereo introduction, with service technicians playing an important role in hi-fi repair, installation, sales and stereo conversion.

1958 was another year of growing service technician activity in communications and industrial electronic maintenance.

1958 was a year of resurgence of captive service by some TV set manufacturers. Service technicians have been rallying to combat this practice.

1959

1959 is expected to be a business boom year. It promises to be an opportune time for technicians to expand their businesses, invest in new and improved equipment, and diversify into related electronic maintenance fields in addition to TV-radio.

1959 will be a critical year in beating—or being beaten by—captive service. With concerted action against captive TV receiver brands, there is a good chance offending companies will withdraw this unfair practice.

1959 will find increasing attention focused on stereo and transistorized equipment.

Look backward over the past year to learn from both your successes and mistakes. Look forward to a good business year and new opportunities in the year ahead.

Tuning In the

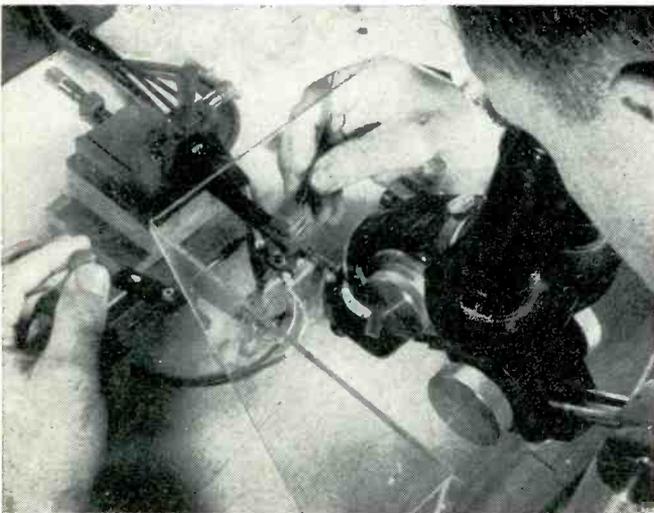
ENVIABLE SAFETY RECORD reported by Raytheon notes that more than 8,000,000 man-hours were worked without a single day's loss caused by on-the-job accidents.

"**WORLD'S MOST ELEGANT clock radio**" is the claim being made for Zenith's new Golden Triangle. Both the clock and transistor radio in the three-sided cabinet are battery powered. A flashlight D battery operates the clock up to a year; four mercury cells operate the radio up to 400 hours. List price is \$150.

NATIONAL TV WEEK, Nov. 16-23, came and went with little fanfare. Industry apathy appears to be the main culprit. Informed insiders say that influential set makers, distributors and dealers may be ready to drop the entire idea of promoting a TV week.

PERSONAL PORTABLE TV set is battery powered, has 22 transistors, and 8" picture tube and weighs only 10 lbs. It's about the size of a toaster—7¼"W x 7¼"D x 8-3/4"H. The 7.5 watt power consumption is supplied by a rechargeable silver cadmium battery. This appealing device developed by GE is not yet ready for commercial introduction. However, it does indicate the interesting new units which will be coming into service shops in the years ahead.

TRANSISTOR BONDING



Leads of high frequency transistors are compression bonded to metallized germanium surface. Bond is strong enough to withstand 100,000 g acceleration in a centrifuge. Combination of heat and pressure form bond, which is stronger than the lead itself. Technique is used at Bell Labs.



"It says 'I'm a prisoner in a printed circuit plant.'"

TRANSISTOR sales keep climbing. 1958 sales for the first nine months totaled 30,387,277, compared to only 17,842,300 units in the same period of 1957.

HOTPOINT DROPS TV operations, effective at the end of 1958. Two and one-half years after its introduction of TV, this GE product line has decided to concentrate on electrical appliances.

REPAIRING PLATED CIRCUITS: A 30-minute full-color movie demonstrating techniques and methods of repairing plated circuit chassis and even the plated boards themselves has been released by Motorola Inc. The film uses a voice-over-action type approach to show just how the technician can work with the plated circuit. The action is interrupted in several places by humorous cartoons that point up the film's message.

STEREO AM BROADCAST system announced by RCA is in the experimental stage. A single receiver with two speakers receives the signal stereophonically. Monophonic radios receive all programs as usual. In operation, two sound channels are fed to a single transmitter, each channel being carried by one of the two sidebands of the regular broadcast frequency. In a standard AM broadcast, both sidebands carry the same information. Auto radio appears to be an excellent prospect for AM stereo. Other developments announced by RCA are a portable TV tape player no larger than an ordinary audio tape recorder, a transistorized color TV pick-up system, a 30-lb. transistorized 14" TV receiver, and the Megacoder miniature decoding system which permits selective calling of any one out of more than a million radio receivers from a common transmitter.

Picture



MANUFACTURER POLICIES on industrial sales by parts jobbers has been surveyed by the Association of Electronic Parts & Equipment Manufacturers. Out of 33 member firms reporting, 12 noted that 76% to 100% of their volume was in industrials, 4 from 51% to 75%, 4 in the 26% to 51% range, 10 showed 10% or less, and 4 did not report. Average opinion was that 74% of the available business was going through industrial distributors, 26% direct from the factory. Replies showed that depending on definition, there are "about 35," "about 150" or "about 750" industrial distributors in the United States. (Editor's Note: There are approximately 2500 parts jobbers totally in the electronic field.)

ELECTRONIC "QUESTIONS & ANSWER" system developed by Bendix for oil field operation uses digital data transmission and remote control to report all malfunctions and control electric heaters in distant pipelines. Pulse beeps automatically relay an alarm signal to indicate equipment failure. The master control station can "interrogate" each of the remote station in a matter of seconds to pinpoint the trouble.

TV RECEIVER especially designed for classroom use by Motorola can be used in either closed-circuit systems or over-the-air broadcast reception. Its 500-line definition in closed systems reproduced drawings and microscope slides. This Classroom 21 model may be obtained with a tilt control stand to reduce reflections. Note: Only 3 to 4% of the nation's 1,500,000 classrooms now have TV sets, offering an attractive new market.

CALENDAR OF COMING EVENTS

- Dec. 13-16: Society of Reproduction Engineers, Visual Communications Congress, Hotel Sherman, Chicago, Ill.
- Jan. 12-14: 5th Natl. Symposium on Reliability & Quality Control, Bellevue-Stratford Hotel, Philadelphia, Pa.
- Jan. 21-23: Southwest Electronic Exhibit, Ariz. State Fairgrounds, Phoenix, Ariz.
- Feb. 5-6: Ill. Institute of Technology, Industrial Management Engineering Conference, 10 W. 33rd St., Chicago, Ill.
- Mar. 3-5: Western Joint Computer Conference, Fairmont Hotel, San Francisco, Calif.
- Mar. 23-26: IRE National Convention, Coliseum & Waldorf-Astoria Hotel, New York, N. Y.
- May 6-8: Electronic Components Conference, Ben Franklin Hotel, Philadelphia, Pa.
- May 11-13: Joint Conference on Automatic Techniques, Pick-Congress Hotel, Chicago, Ill.

Hi-Fi Shows

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

POSTMASTER ADVICE for faster mail service: Avoid delay, mail early in the day. Also, use zone numbers.

PICTURE TUBE SIZES may be increased in 1960 models. Big CRT bulb maker Corning is showing TV set manufacturers a 23" size—an attractive competitor for the 21-incher. The new bulb has a double face plate, laminated together to reduce dust and reflections, and eliminate the conventional safety glass in the process.

RANDOM NOISE

WIDE, WIDE SCREEN TV USING 7:4 OR 5:3 RATIO INSTEAD OF PRESENT 4:3 IS IN EXPERIMENT STAGE, MAY BECOME AVAILABLE IN 5 TO 7 YEARS. WIDE PROPORTIONS ARE CLOSER TO EYES' NATURAL VIEW

ULTRASONICS IS BEING USED TO TEST CATTLE AND HOGS ON THE HOOFF FOR FAT CONTENT. SIGNAL "BOUNCE" DISTANCE FROM MEAT/BONE/FAT INTERFACES ARE DISPLAYED ON CRT

DID YOU KNOW? 83.9% OF NEW CARS SOLD HAVE RADIO AS OPTIONAL EQUIPMENT

TOM HIGGINS JR.

Applications Of Industrial

Quantitative Measurements As Well As Control Of Electronic

METER RELAYS

Function

Controls
Measurements
Switching

Meter Movement

Differential
Zero Center

Locking Coil

Booster

Interrupter

Relay Contacts

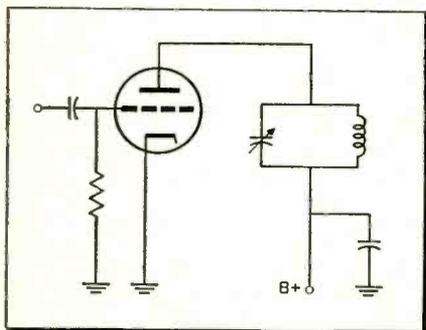
ALLAN LYTEL

• Meter switching and control devices have almost an infinite number of applications in industrial electronics. They contribute to and facilitate the protection of power equipment, process control, and measurements. Some highly efficient electronic circuits would run away to the point of self destruction if signal and other control voltages were lost or upset. The class C r-f power amplifier is a case in point.

Circuit Protection

Amplifiers whose grid bias is developed as a result of a grid signal, can make use of one or more pro-

Fig. 1—Loss of signal in a class C amplifier results in excessive current. A bias battery, cathode resistor, or fuse could protect this circuit.



TECTIVE devices. If for any reason the bias is lost the plate current could increase until the tube and other components are damaged. Fig. 1 shows a basic r-f class C amplifier. Several things can be done to protect this circuit from excessive current that do not require any special switching mechanisms. A bias battery could be placed in the grid circuit to furnish at least a minimum amount of bias in the event of a signal failure. A resistor installed between cathode and ground tends to be self regulatory. Briefly, its action

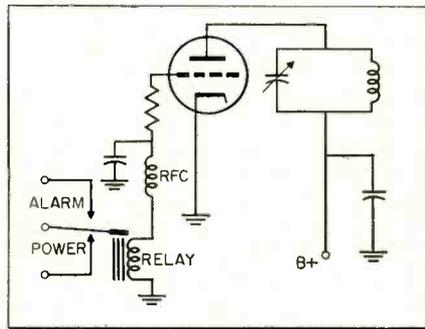


Fig. 2—Grid current develops bias and holds the relay closed. The relay opens when drive signal is lost . . . power may be disconnected, and an alarm sounded.

is as follows: as tube current increases, the voltage drop across the resistor increases; the polarity is such as to make the cathode more positive than the grid, conversely the grid becomes more negative than the cathode, and reduces current flow. Still another protection method is to install a fuse in the plate circuit.

Relays could be used to advantage in some of these applications. Fig. 2 shows a normally open relay in the grid circuit. When grid current flows, the relay is energized and closes the contacts. In the event of a loss of signal, with a resulting loss of grid current and bias, the relay armature could sound an alarm, or shut down the equipment, or even switch in an emergency circuit.

A relay with normally closed contacts placed across a resistor which

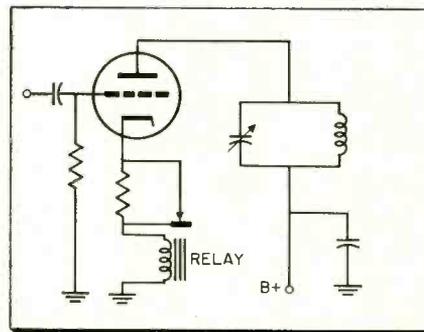


Fig. 3—Excessive current in the cathode circuit opens the relay contacts and effectively inserts a current limiting resistor.

is in series with the cathode, shown in Fig. 3, affords protection by effectively inserting the resistor only when needed. During normal operation, tube current is insufficient to attract the armature. In this position the contacts are closed and the resistor is shorted out. Should the current increase to the danger point, or other preset value, the contacts will open, and place the resistor in the circuit.

In a similar manner, a relay may be placed in series with the B+ lead going to the tube's plate. This relay is normally closed and wired in such a manner as to enable the contacts to open and close the plate current path. Should the plate current increase beyond a prescribed limit, the relay will open the circuit. A latch arrangement is required to hold the relay open, otherwise it will act like a buzzer. Except for the relay in the cathode circuit, it is necessary to reset the other relays. In some applications the buzzer action is desirable, because it does sound an alarm, and does not have to be reset when the trouble is eliminated.

Wherever relays and other forms of automatic switches are used, meter relays may be employed to perform the switching action, and to indicate a quantitative reading of current, voltage, power, pressure, temperature, speed, or almost any condition of operation depending

Meter Switching & Control

Circuits & Processes Are Provided By A Combination Meter Relay

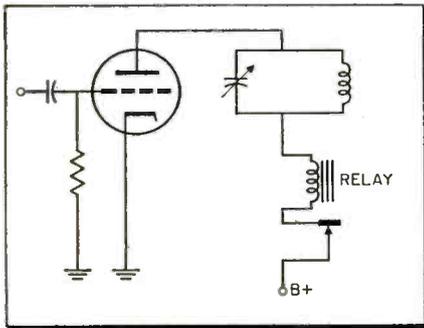


Fig. 4—Relay in plate circuit acts like a buzzer in the event of overload. Latch arrangement can hold it open, but requires reset operation.

upon application and type of calibrated scale used. Meters also lend themselves quite readily to applications requiring a series of steps, or controls. The simplest of these multiple functions is determination of maximum and minimum limits.

Limit Control

The meter relay shown in Fig. 5 is a zero-center microammeter and operates in much the same manner as any D-Arsonval type meter. In addition two adjustable arms and contacts on each are also placed in the path of the needle indicator. The indicator is equipped with a contact. When the indicator reaches either of the adjustable arms, it completes a circuit. Because of the low torque of the moving coil and low mass of

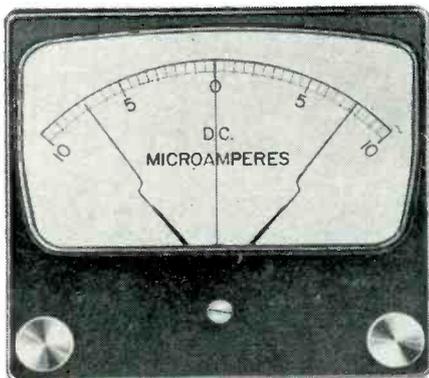


Fig. 5—Zero-center meter with two adjustable arms uses locking coils to obtain reliable connection.

the contactors, it is difficult to obtain a reliable connection. To overcome this problem, a locking coil wound on the meter coil holds the contacts together when they touch. The locking coil may be deenergized to open the contacts either by automatic or manual reset devices.

Fig. 6 is a schematic of a double-limit meter relay. One limit is high, contact A, and the other is low, contact D. Point B is common. Signal is applied between points C and B. The locking coil is in the load circuit between points A or D and point B only when the limits have been reached. In addition to meter indications, and control functions or application of different loads, visible alarm indicators in the form of neon lights are shown in Fig. 6. Other alarm devices could be used. By breaking the circuit at point X and inserting a relay or other automatic interrupter the circuit can reset itself, and respond to varying signal conditions.

Relay holding time, once the circuit is opened, depends upon the values of the inductance L, and the capacitance C. As long as the meter

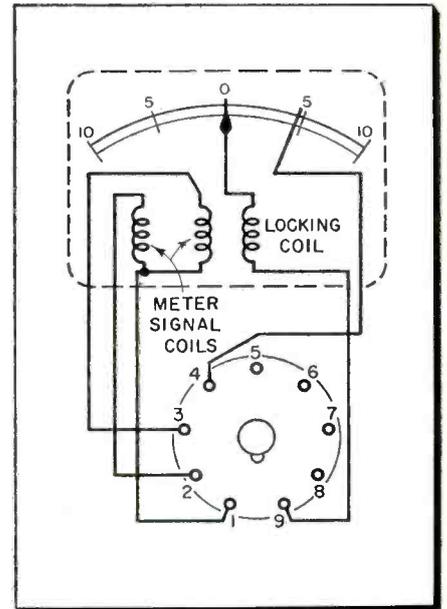
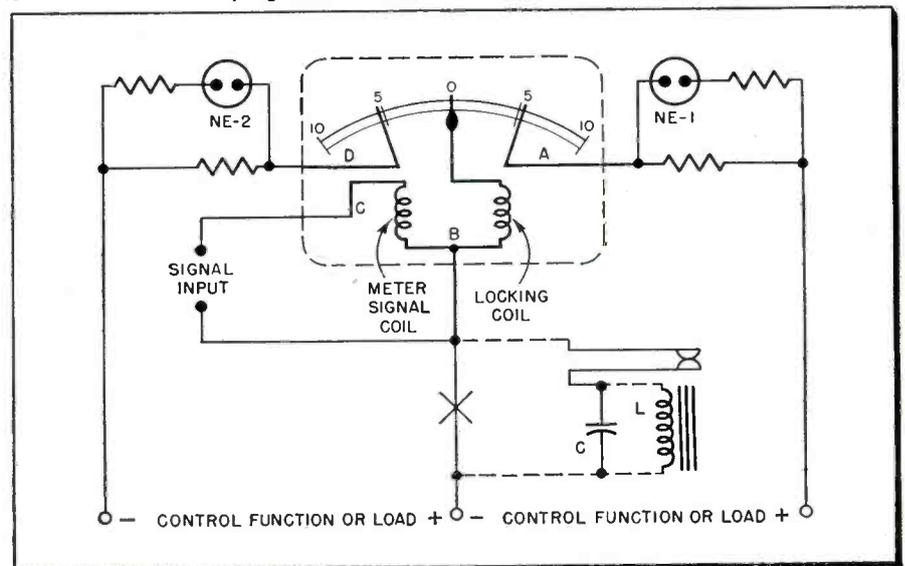


Fig. 7—Differential meter having 2 signal coils can be hooked up to respond to the sum or difference of two signals.

is at the trip point the load relay pulses in and out. A usual cycle might be about 3 seconds in and 1 (Continued on page 70)

Fig. 6—Double limit meter relay with D'Arsonval movement indicates preset limits of operations. Neon lights serve as alarm indicators. Interrupter can be used to periodically open locking coils to enable continual sampling of conditions.



How To Interpret High

Simplified Explanations Of Measurements, Tests And

SPECIFICATIONS

Power Output

Distortion

Harmonic
Intermodulation

Frequency Response

Tone Controls
Equalization Networks

Hum & Noise

Sensitivity

Damping Factor

GARY WAYNE

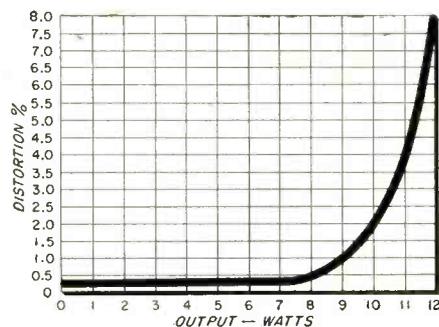
• What do the specifications on high fidelity equipment mean? How can some of the confusion be resolved? Many specifications are meaningless unless supported by reference levels and conditions of operation. It is not sufficient to say that a particular amplifier has better frequency response, or greater power. Better than what? . . . Greater than what? If it is better, how much better is it? . . . Is it a significant difference? While there are many desirable and undesirable characteristics, and tests for these—some of them quite complicated—the technician should have no difficulty in understanding and evaluating high fidelity components.

Notwithstanding all the specialized terms, the consumer is interested in only one thing—aside from price and looks—how does it sound? The technician can divide and subdivide this question into many parts. Fortunately, he need not get too deeply involved to arrive at an intelligent evaluation. However, the subject is quite fascinating and the chances are

that ultimately the fine details will be explored. Almost without exception, regardless of the type of hi-fi component, the one universal and most important characteristic to consider is distortion. No matter how it is sliced up, frequency response, harmonic content, intermodulation components, hum and noise elements, or instability, these are all distortion of one form or another. However, these factors are treated separately both in the lab and in the service shop. Other characteristics such as sensitivity, output level and impedance matching requirements are also important considerations, and invariably affect the distortion figures. In addition, there are many other features and functions not always indicated in the specification sheet, which should be evaluated. Ease of control and hookup, number and type of inputs and outputs, and effectiveness of controls. These are often thought of when it's too late, after the equipment has been purchased and installed.

As a general rule the high fidelity equipment manufacturers have devoted much engineering time to their product, and the state of the art is sufficiently advanced to enable them to produce dependable, conservatively-rated components. By and large their specifications can be relied upon. Sometimes the competi-

Fig. 1—Distortion rises sharply once the output level goes beyond 8 watts, in this case. The rated output at 1% distortion is 9 watts; at 3%, this would be called a 10-watt amplifier.



tion gets rough and the claims become vague and expansive. Even then these claims can sometimes be analyzed and the equipment pegged for what it really is.

Power Output

Power output may be expressed in several ways. Since a sine wave signal is used, when taking power measurements, several expressions may evolve, namely rms or peak power. This can also be extended to indicate momentary or steady-state

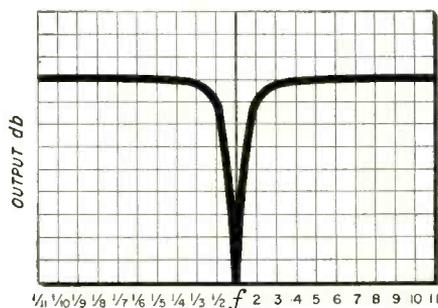


Fig. 2—A sharply tuned filter removes the fundamental and leaves only the harmonics, if any, to be measured when determining the amount of harmonic distortion.

conditions. Since program material is constantly varying in frequency, amplitude and duration, the sine wave test signal may be set at 20, 1,000, 20,000 cycles or other frequency, and applied continuously or in bursts. Where no conditions of test are stated, it can usually be assumed that the power rating is in terms of rms at 1,000 cycles and under a steady or prolonged signal application. Because distortion is of primary importance it is essential to consider the amount of distortion present at the rated power level. It is quite possible to have a much higher power rating for a given amplifier, if a higher distortion figure is permitted. Fig. 1, shows a typical distortion versus power curve for some amplifiers. The amount of distortion remains low for a fairly wide

Fidelity Specifications

Ratings Enable The Technician To Guide Consumers

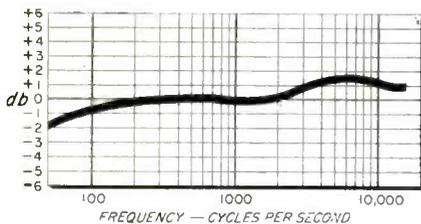


Fig. 3—Frequency response is determined by injecting different frequencies, but of equal amplitude. The output is measured and plotted.

range of power levels starting from the bottom end. As the power output approaches maximum the curve climbs rapidly. Invariably it is desirable not to sacrifice a clean signal for a larger output in high fidelity work. Where multiple taps are available at the output, it is good to know what the ratings for distortion and power are at the different taps. A properly rated unit will report the least figure. If the ratings per tap are not given, and if an 8-ohm terminal is available, it could be assumed that the ratings pertain to this tap. Some set makers may use the highest tap when rating their units.

Power ratings are determined by measuring the output voltage, and using the formula

$$P = \frac{E^2}{R}$$

where P equals power, E equals rms voltage, and R equals load resistance. To determine peak power, the rms figure is simply multiplied by two. This is valid only for a sinusoidal waveform because the peak voltage is equal to the $\sqrt{2}$ times the rms voltage. Two things become apparent where complex waveforms are concerned; the technique of multiplying the rms power value by two is invalid, and to state both figures is somewhat redundant. Worse still, some specs may show the peak power without identifying it as such.

Another way of expressing output capabilities, is in terms of output voltage. This is usually applied to tuners, cartridges, tape heads, pre-

amplifiers, and other voltage amplifiers. The amplifiers and speaker power handling qualities are expressed in watts. In either case output ratings are based upon properly matched impedance loads.

Distortion

Distortion is actually any difference between the input and output signal, with the possible exception of differences in volume level. The addition, subtraction or unequal reproduction of any portion of the signal

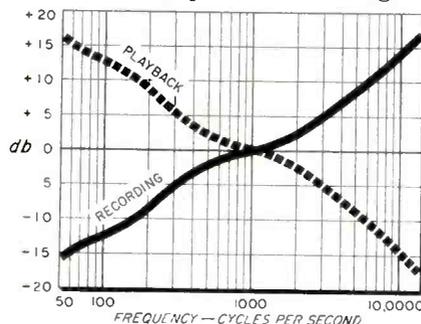


Fig. 4—Equalization playback curves compensate for recording curves to enable a flat output. Non-linear recording techniques are used to compensate for certain inherent characteristics of the material and equipment.

is essentially distortion. As was previously mentioned separate treatment is accorded to the various elements of hum, noise, frequency response, etc. Distortion measurements and ratings are usually limited to harmonic or IM content, expressed in percent. Ratings for the other characteristic elements are given under different headings. Harmonic or IM distortion is to a large degree an indication of the extent of non-linearity of operation of the various circuits in the hi-fi component. A circuit may not exhibit linear characteristics for all conditions, all frequencies, and all input and output power levels. It is therefore essential to consider a family of readings for proper evaluation.

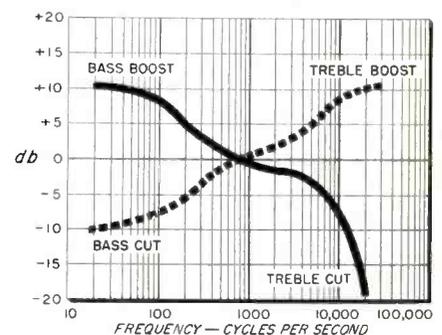
Unless measurements are made under the same set of conditions, it

is impractical to attempt comparison or evaluation of one piece of equipment over another. In the absence of a statement of conditions of operation when tests or ratings are made, the technician should by all rights be able to assume that standard or conventional test procedures were made under standard conditions. In most instances this is so, but it is well to be alert to the few gimmicks. It is usual to express the amount of distortion present at rated power. The distortion percentage figure is readily determined by dividing the amount of undesired harmonic signal (E_h) by the total signal (E_o) and multiplying by 100. This is really not too complex.

$$\frac{E_h}{E_o} \times 100.$$

To determine harmonic distortion, a clean sine wave, free of harmonics, is injected into the amplifier or other component, of sufficient amplitude to obtain the desired output. At the output only this signal is removed by a sharply tuned filter, as shown in Fig. 2, and any remaining signal is the undesirable element. When push-pull output stages are used, even harmonics tend to cancel out and a scope will usually indicate a predominance of the third harmonic. The higher the order of
(Continued on page 57)

Fig. 5—Solid line shows response when bass is boosted and treble is cut. Dashed line shows response with minimum bass and maximum treble control settings.





Competitors—Devils Or Angels?

Good Will Towards Others Leads To Good Will Towards Ourselves

ERNEST W. FAIR

• Over the past years of interviewing shop owners in every section of the country this remark has been heard many times: "The trouble with the radio-TV repair business is some of the people in it." It came from shop owners who presented long and detailed discussion of their problems of doing business among competitors they believed to be guilty of every crime in the business book.

Getting along with one's competitors is not easy. It takes lots of give and take, understanding and often outright help. But it pays off in many ways. Invariably the cities and towns where competitors do get along with each other are those in which most shop owners are prospering. During the past year a detailed study was made and a number of points were developed which should be of assistance. Even those shop owners who go so far as to not even speak to their competitors, admit that the local situation would be much better for all concerned if a program could be worked out. Invariably they insist, however, that "with the kind of competitors I have here, such an end is impossible of attainment."

No shop owner is either an "angel" or a "devil" either personally or in a business way. The sources of friction

exist everywhere. And just as surely, as good relations do exist in many communities it can be shown that cordial competition can replace the undeclared war that exists among the local trade in some other areas. Getting along with one's competitors requires both group and individual action. Sometimes it is necessary to contribute more than is received from the local program, for in many cases there is at least one individual whose stubbornness cannot be overcome except over a considerable period of time. Perhaps the "devils" can never be completely eliminated, but the practice of proven methods of promoting good will will clip their wings a bit.

Organization

Group activity is helpful toward this end. Where the community is not large enough to support an association the shop owners may benefit from informal meetings either for social activities, or for discussion of mutual business problems. In such meetings friendships and understanding are developed. This principle applies right down to the smallest communities where there may be but two shops. The better acquainted these competitors can become the less friction will develop between them. Some times it may take an enormous amount of bending over backward on the part of one to develop such a situation but the

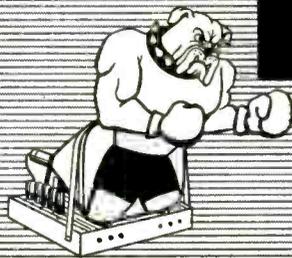
end result usually justifies such sacrifice.

Such meetings afford an opportunity to exchange experience, information and data which will contribute toward a healthier profit situation for all concerned. However, experience shows that when these meetings are limited to business problems and no effort is made to get too personal, better results are usually obtained.

Customer Provocation

Many business friendships have been ruined by customer gossip and other provocation. There are some individuals who like to stir things up and get the pot boiling. Maybe they think they can start a price war. The chances are that there may be enough truth in their story to make it stick. The chances are also very good that some extenuating circumstance has also been omitted from these tales. Often competitors will find themselves in an unhealthy situation because of jealousy or resentment of the success of another. However, in a favorable business climate most shop owners will give full credit to the good ideas their competitors have developed and instead of trying to challenge them, they will exert more effort to developing their own ideas. If a competitor has made a tremendous success of some new ideas it will hardly contribute to a

(Continued on page 38)



"Tough Dog"

Corner



Difficult Service Jobs Described by Readers

Intermittent Fading Hybrid Auto Radio

Intermittents piled on top of intermittents could be the label of this one. The culprit in this case was a Motorola model CTM57X auto radio, but it can happen on other hybrid jobs. I thought I was doing pretty good when I spotted the output i-f transformer cutting in and out. However, there still remained a tantalizing intermittent fluctuation of the sound level coming from the speaker.

Clearing the decks for action by replacing the bad i-f can, I tried to figure out the best approach to whip this thing. First I made some cold checks, then some hot ones, neither of them were informative. Everything seemed to be in order. I did succeed in isolating the trouble to the transistor output stage. The case of the transistor was running a little too hot. This of course reinforced my suspicions as to where the trouble might be.

Uncoupling the battery lines, I disassembled the transistor by removing the two self-tapping screws. The transistor checked out perfect. Nothing wrong with the transistor, nothing wrong with the circuit, still the intermittent trouble seemed to be coming from this area. I reinstalled the transistor and checked to see if it was properly insulated from ground. The ohmmeter needle acted erratically. I kept the ohmmeter be-

tween ground and the collector, and gradually started to loosen and tighten the two retaining screws. As I alternately went from one screw to the other, I kept an eye on the ohmmeter. Close to the snug point, the needle quivered. Anxiously now, I disassembled the two retaining screws again, for another look. There is a recessed hole for each screw underneath the metal heat sink. The heat sink also serves as a terminal and nut for the collector screws. Through the two holes can be seen a portion of the insulating material ringing a hollow or counter-sunk area. A waxlike substance used to help the heat escape could also be seen and it occurred to me that dirt and other particles could become imbedded in this area. Inserting a small screw-driver, I scraped the counter-sunk pattern clear around so as to clean it out. Not too much was picked up, but what there was of it, was wiped off on my thumb, and closely inspected. The culprit turned out to be a very tiny and almost invisible sliver of metal. It could only be seen by rotating the thumb back and forth under a light.

Further thought on what was happening indicates that the sliver was not necessarily making contact even when the transistor was tightened down. It is quite possible that magnetic forces and vibration caused the tiny piece of ferrous material to float around and occasionally short out part of the collector current. Moral—Clean signal depends upon clean workmanship.—*Peter Campione, Philadelphia, Pa.*

When replacing a power transistor, be sure that the transistor insulator is in place and that the mounting screws are securely and evenly tightened. If insulator is not in place

the transistor will be shorted to chassis and the set will not operate. If mounting screws are not tight, or if proper grease is not used on the insulator, the transistor will be damaged due to lack of proper heat dissipation. Coat both sides of the insulator with DC-4 grease.—Motorola Inc., Chicago, Ill.

Inoperative UHF

VHF was working fine, but UHF was completely dead. I changed the UHF oscillator tube 2AF4, trying two tubes, but still no luck. The chassis was pulled into the shop, the picture tube was left at the house as it was attached to the cabinet. The set, including UHF, worked fine when it was put on the bench and after much testing no trouble could be found. When brought back to the customer's house, still no UHF. The line voltage was checked but found to be normal. The only remaining difference in operating conditions in the shop and in the home was the use of different CRTs. The customer's set had a picture tube brightener connected, so I removed this and tried the set again, UHF worked perfectly although the picture was dim. I installed a new CRT booster and the set worked perfectly.

After a few checks were made it was found that 12 volts were being dropped across the old booster, instead of 6 volts. Since the tubes were connected in series the filament voltage across each tube dropped accordingly. The 2AF4 filament, although seeming to glow normally, was not heating up sufficiently and the tube was not oscillating.—*Albert J. Krukowski, W. Springfield, Mass.*

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.

How To Prolong The Life

Do You Just Change Tubes On A Service Call? Safeguard

Some Rules For Living With Vacuum Tubes

1. Operate tubes at rated filament voltage.
2. Use limiting resistors for series heaters.
3. Ventilate equipment to keep tubes cool.
4. Use pin straighteners on miniature tubes.
5. Don't bind socket terminals when soldering.
6. Shock mount vibration sensitive tubes.
7. Add drive control to horizontal amplifiers.
8. Observe temperature of high voltage rectifiers.
9. Check cascode amplifier's plate current.
10. Many tubes fail from abuse . . . as well as use.

ROBERT CORNELL *
TECHNICAL EDITOR

• Many books and articles have tried to convince the public that practically all electronic equipment failures are the result of poor tube quality. What better proof does the set owner need? He has his tubes tested, finds a defective one, has it replaced, a short time later he has the same trouble, and replaces the same tube. If this cycle takes place over a fairly long period of time, nothing more is said or done about it. If the tube lasts about six months, the chances are that another tube will grudgingly be placed in the set without having the set checked. Should the tube flare up within a very short time, anywhere from a

few minutes to a couple of weeks, the blame is likely to shift from the tube to the set. In this respect tubes are like fuses.

Sometimes fuses let go of their own accord and sometimes they break down because of a circuit fault. Technicians have become so conditioned to looking for other trouble when a defective fuse is encountered, that a new one is replaced with some misgivings and crossed fingers, when no other defect is found. It is a good general rule to believe that tubes and other components just don't fail by themselves. A few well placed questions will often save embarrassment and call backs. Even when replacing tubes that have been in the set for a long time, it is a mistake to take for granted that there is nothing else wrong and that the tube died of natural causes. Consider the case of a low voltage rectifier. This 5U4 had been doing its job for some time be-

fore it broke down. A new one seemingly restored the set to normal operation. The tip-off that all was not well came when the customer said, "I can't understand why the set stopped operating. It was working fine before I went on my vacation and I'm certain that no one has turned on the set since then." It is evident that if the electrolytics in this set are permitted to remain idle for any length of time, or if any further depreciation takes place, excessive leakage currents will result in premature tube failure.

Broad Tolerances

Most electronic components have fairly broad tolerances. This is an inherent characteristic of mass production and the economic need to accept a larger percentage of total production as acceptable. If closer tolerances or matched components are specified, special selection is required and the larger number of rejects would increase the cost per unit. This could price some consumers out of the market. Fortunately most electronic circuits designed for use in receivers and other appliances available to the public, have stable circuitry and can accommodate components with broad tolerance factors. Many a worthwhile circuit is still in the laboratory because it requires a special selection of tubes and other components. In spite of this, many critical circuits, such as oscillators and deflection amplifiers, are made to function properly with an average selection of tubes, by providing controls, adjustments, and other range extending devices. The mistake often made is the complete and total disregard of the need for checking the operating conditions in these circuits when a new tube is inserted. If an oscillator frequency is incorrect it will attract immediate attention, but if a

* Based on material furnished by Bud Tomer, CBS Hytron.

Of Radio And TV Tubes

Tube Life, Prevent Call Backs And Win Customers' Confidence

horizontal output tube is drawing excessive current because the drive control is improperly adjusted, or worse still there is no drive control, the chances are that this tube will go down the drain prematurely.

Cascode Tuner Tubes

Tubes used in cascode tuners, and other voltage divider circuits may suffer from breakdown between heater and cathode, open heater, or open cathode, because of excessive B+ voltages between the heater and cathode. The circuit shown in Fig. 1 is typical of this application. B+ is applied to the second half of the r-f amplifier and divides itself, in this case, evenly between both halves. Distribution of voltage depends upon the dynamic resistance of each section of the tube, and acts very much like an ordinary voltage divider. Since dynamic resistance is dependent upon bias and signal conditions, it is quite possible for voltage variations to exist. Should an upset cause excessive conduction of the second half its dynamic resistance will drop, and most of the B+ voltage will be impressed on the cathode of the second section and plate of the first section. Under these conditions, breakdown between the cathode in the second section and the heater is bound to occur. If by chance another tube is capable of withstanding the higher maximum cathode-to-heater voltage, this condition may go undetected. Above the chassis voltage check, using a vector socket is easy enough to perform and can quickly indicate if something is wrong.

UHF Tuner Tubes

Tube types that can operate at about 1,000 mc and which are within the price range of the TV set owner are few in number. Fortunately it was possible to design an oscillator

tube that would function at these frequencies. Amplifiers for TV use are yet to be developed. Therefore, gain has to be accomplished at lower intermediate frequencies. A double hetrodyne conversion actually takes place in order to bring the signal down from UHF to the set's i-f range. The 6AF4 is used almost universally in TV sets as the UHF oscillator, and in order to get it to operate at these high frequencies it is necessary to reduce the size of the various tube elements, and to bring them closer together. The reasoning behind this design is: The closer the elements get to each other, the greater is their interelectrode capacitance. To keep this capacitance down it is necessary to reduce the size of the effective area of the various elements. Closer element spacing is dictated by the time it takes the electron to pass from the cathode to the plate. At high frequencies this "transit time" becomes a significant time interval. Phasing problems and other inductive and capacitive reactances combine to form a "high-frequency loading characteristic."

In addition to the inherent qualities of this tube, the practice of some TV set producers to disable B+ only when the tube is inoperative creates other problems. The cathode builds up "interface resistance" when the heater is left on, and there is no plate current flow. The end result is a loss of mutual conductance. Also the sudden application of B+ when UHF is switched in can cause other troubles in the tube. Because of the trouble experienced in the field with these tubes, many technicians are pretesting these tubes. Unfortunately many emission testers will contribute to the early demise of this tube by drawing heavy emission current from the small cathode.

Also some of the neon type short circuit indicators may subject the

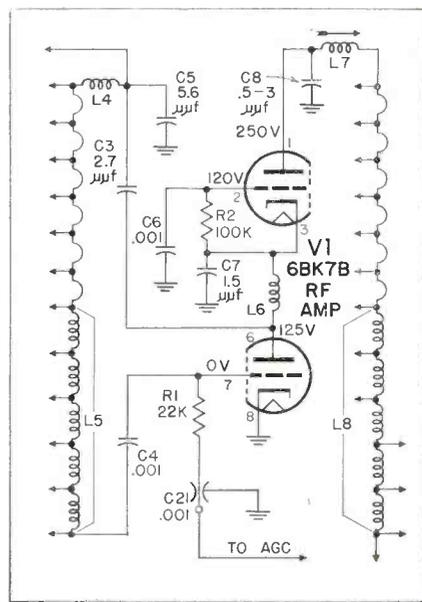
tube to damaging voltages between the grid and cathode. While mutual conductance type tube checkers may do less damage, they cannot predict how the tube will behave at the ultra high frequencies. The set itself is the best test for this tube. Further indications as to the tube's merit can be determined by dropping the line voltage to the set about 10%, and noting the tube's ability to operate on the highest channel to be received.

High Voltage Rectifiers

Electrostatic stress, arcing, ionic bombardment, and abnormal filament voltages are responsible for most of the troubles in high voltage rectifier tubes. Filament voltage variations may be as much as 100% around its design center. Good engineering practice dictates $\pm 10\%$ maximum. Line voltage, brightness control setting, horizontal drive set-

(Continued on page 54)

Fig. 1—Reduced dynamic resistance of the upper section may cause cathode-to-heater failure because of excessive B+ developed across the lower section.



NO OTHER TUBE TESTER MADE- AT ANY PRICE—can MATCH the VALUE of the CENTURY FAST-CHECK



SIZE:
H: 11 1/4"
W: 14 5/8"
D: 4 3/8"

Guaranteed for
One Full Year
\$69.50
Net

Model FC-2—housed in sturdy wood carrying case complete with CRT adapter . . . only

Special compartment accommodates line cord and Picture Tube Test Adapter

PICTURE TUBE TEST ADAPTER INCLUDED WITH FAST-CHECK

Enables you to check all picture tubes (including the new short-neck 110 degree type) for cathode emission, shorts and life expectancy . . . also to rejuvenate weak picture tubes. This feature eliminates the need of carrying extra instruments and makes the FC-2 truly an all-around tube tester.

FAST-CHECK'S low price is made possible because you are buying direct from the manufacturer.

20,000 SERVICEMEN CAN'T BE WRONG!

See for yourself—AT NO RISK—why over 20,000 servicemen selected the FAST-CHECK above all other tube testers—regardless of price. With the FAST-CHECK you will make every call pay extra dividends by merely showing your customer the actual condition and life expectancy of the tube. The extra tubes you will sell each day will pay for the FAST-CHECK in a very short time.

Just 2 settings on the FAST-CHECK TUBE TESTER tests over 650 tube types completely, accurately — AND IN SECONDS!

- **POSITIVELY CANNOT BECOME OBSOLETE**
Circuitry is engineered to accommodate all future tube types as they come out. New tube listings are furnished periodically at no cost.
- **NO TIME CONSUMING MULTIPLE SWITCHING**
Only two settings are required instead of banks of switches on conventional testers.
- **NO ANNOYING ROLL CHART CHECKING**
Tube chart listing over 650 tube types is conveniently located inside FAST-CHECK cover. New tube listings are easily added without costly roll chart replacement.

COMPARE FAST-CHECK WITH OTHER TESTERS RANGING FROM \$40 TO \$200

RANGE OF OPERATION

- ✓ Checks quality of over 650 tube types, which cover more than 99% of all tubes in use today, including the newest series-string TV tubes, auto 12 plate-volt tubes, OZ4s, magic eye tubes, gas regulators, special purpose hi-fi tubes and even foreign tubes.
- ✓ Checks for inter-element shorts and leakage.
- ✓ Checks for gas content.
- ✓ Checks for life-expectancy.

Other testers may have some of the above features . . . but only the FAST-CHECK has them all!

IMPORTANT FEATURES

- Checks each section of multi-section tubes and if only one section is defective the tube will read "Bad" on the meter scale
- Less than 10 seconds required to test any tube
- 41 long lasting phosphor-bronze tube sockets accommodate all present and future tube types . . . cannot become obsolete
- 7-pin and 9-pin straighteners mounted on panel
- Large D'Arsonval type meter is extremely sensitive yet rugged — fully protected against accidental burn-out
- Special scale on meter for low current tubes
- New tube listings furnished periodically at no cost
- Compensation for line voltage variation.

SHIPPED ON APPROVAL FOR 10 DAY FREE TRIAL

Try the FC-2 before you buy it! No obligation to buy.

PAY IN SMALL MONTHLY PAYMENTS

Easy to buy if you're satisfied. Pay at net cash price . . . no financing charges.

NO MONEY REQUIRED WITH ORDER . . .

CENTURY ELECTRONICS CO., INC.

Dept. 512, 111 Roosevelt Ave., Mineola, N. Y.

Rush the FAST-CHECK for a 10 day trial period. If not completely satisfied I will return the instrument within 10 days without further obligation. If fully satisfied I agree to pay the down payment within 10 days and the monthly installments as shown. No financing charges are to be added.

Model FC-2 . . . \$69.50 — Pay \$14.50 within 10 days. Balance \$11.00 monthly for 5 months.

Name

Address

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

F.O.B., Mineola, N.Y.

Competitors

(Continued from page 34)

cordial relationship by countering with a duplicate of the idea at a lower price. It's far wiser to develop an original program.

Readiness to help one's competitors in times of adversity or disaster has always built friendships between business men. This was graphically demonstrated some years back in two nearby cities both hit by a flood at the same time. In the first community there were four firms in the same line of business; one was badly hit by the flood. The other three got together and contributed part of their equipment and facilities to help the fourth stay in business until he could get back on his feet again. These four business men are, today, closer together than many family members. In the other city there were five, and two were hit badly. The three remaining were delighted; they did everything they could to prevent the other two from recovering. They didn't succeed and today this situation is so bitterly competitive that no one is making money and all are at each other's throats.

Repair business is a full-time proposition. Taking time out to buck a competitor usually means less time to perform some other business function. "I really started going places when I forgot about the idea of keeping an eye on my competitors and trying to outguess them," was the comment of a successful business man. "My system is to devote as much time as possible to developing new business getting ideas for my own firm. People tell me my big competitor is now worrying about me. I've come to the conclusion that's the best way to get ahead in this business."

Work with competitors wherever possible in all types of civic organizations from the chamber of commerce to service and social clubs. Such a spirit of co-operation is catching. It also discourages the tendency for some people to play one service shop against the other.

Developing cooperative promotions from time to time is an excellent way of increasing friendly relations and a cooperative spirit between competitors. It also tends to stabilize the business, and upgrade its status in the community.

The devils among our competitors can be converted to angels not by a fight, but by a handshake. •

THIS SELF-SERVICE TUBE TESTER IS YOUR STEPPING-STONE TO A BRIGHT NEW PROSPEROUS FUTURE

EARN BIG MONEY AND ACHIEVE FINANCIAL STABILITY

If you've ever longed for a business of your own . . . to be your own boss and to work your own hours, then here's your opportunity to get in on one of today's biggest money-making opportunities — *the self-service tube testing business*. It's the easiest business to get into . . . requires no experience, little time and small investment.

A basic principle for making money is to have something work for you, rather than you yourself doing the work. As an operator of a **FAST-CHECK SELF-SERVICE TUBE TESTER ROUTE** you can be the proud owner of a solid fast-growing business . . . earning money while you take life easy. Business can be started without giving up your present source of income and can be operated from home. All you do is make calls once a week to restock testers and collect profits.

WHAT IS THE SELF-SERVICE TUBE TESTING BUSINESS?

The self-service tube testing business is a take-off on the highly profitable vending machine business . . . Drug stores, luncheonettes, supermarkets, etc. welcome having a tube tester placed in their store. You place testers and tube stock in stores on consignment — the store location contributes floor space for the self-service tube tester — store patrons are offered the use of the tube tester free — they in turn buy their replacement tubes from the tube stock in the tester. The store pays you for all the tubes sold less his commission. Each tester placed can net up to \$1000 a year for you.

NO SELLING REQUIRED

Century's self-service tube testers check and sell TV and radio tubes automatically 12 hours a day — 7 days a week. Consumers do their own testing and defective tubes are replaced on the spot for highly profitable sales. *Your testers are your high powered salesmen.*

MANUFACTURER-TO-YOU PRICES

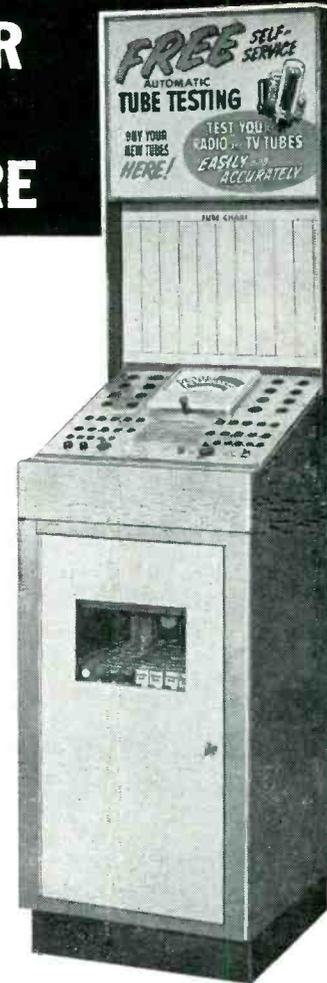
Since we are the manufacturers and sell direct to you, we have been able to price the **FAST-CHECKS** so low that they represent the greatest value in testers available. Our unusually low prices enable you to place more units with less investment.

FAST-CHECK SPECIFICATIONS

- 46 long lasting phosphor-bronze sockets accommodate all present and future tube types — cannot become obsolete.
- Attractive red and hammer-tone gray durable metal cabinet. Takes only 19" x 19" of floor space.
- Tube compartment with own lock holds 400 or more tubes.
- Removable tube storage trays with specially designed dividers separate tube cartons — make it easy to restock tubes that are sold.
- Large seven inch easy to read meter is extremely sensitive yet rugged — is fully protected against accidental burn-out.
- Completely self-service — easy to operate.
- Built-in 7-pin and 9-pin straighteners on panel for customers convenience.
- Quick reference tube chart lists over 650 tube types — conveniently mounted.
- A colorful illuminated point-of-sale display tops the cabinet — designed to attract everyone that comes into the store.
- Each unit is covered by a 3 month guarantee.

FREE BOOK TELLS ALL ABOUT THIS BOOMING BUSINESS

If you are interested in starting a lifetime business, then **ACT NOW** and send for **FREE** book to convince yourself that this is today's greatest business opportunity.



Model SS-1F (floor model) **FAST-CHECK SELF-SERVICE TUBE TESTER** \$134.50 Net

Model SS-1C (counter model) **FAST-CHECK SELF-SERVICE TUBE TESTER** \$98.50 Net
An ideal unit for shops with limited floor space.

ATTENTION SERVICE SHOP OWNERS

Put the **FAST-CHECK SELF-SERVICE TUBE TESTER** in your shop with only a \$34.50 down payment. You'll gain a valuable profit producing assistant working for you every open hour.

Do-it-yourself customers will welcome the opportunity to bring their tubes to your store where they can test tubes to their heart's content. If the tubes register "Bad" or "Weak" you are assured of profitable tube sales. And best of all you don't have to stop working when a customer brings in a bag of tubes to check. The **FAST-CHECK** does it all for you. If on the other hand a customer's tubes register "Good" you are on the spot for consultation or a service call.

Colorful window streamers and advertising material provided **FREE** by us will attract many new customers to your shop. Servicemen are not only increasing tubes sales, but are actually enlarging their service business as well, with a **FAST-CHECK** in their shop. Act now! Place a unit in your shop and double your tubes sales . . . save valuable working time.

TIME PAYMENT PLAN

Pay in small monthly payments at net cash prices.

NO INTEREST OR FINANCING CHARGES

CENTURY ELECTRONICS CO., Inc. 111 ROOSEVELT AVENUE Dept. B-12, Mineola, N. Y.

Please send the units I have indicated below on your **TIME PAYMENT TERMS**. Include a complete plan of operation — plus all advertising material needed to get started in the self-service tube testing business. I understand no interest or financing charges will be added, and they are shipped on a 10 day money-back guarantee.

Quantity	Description	Unit Price	Extend Total
	Model SS-1F (floor model) FAST-CHECK TUBE TESTER Enclose \$34.50 down payment with order for each tester. Balance payable in 5 monthly payments of \$20.00 for each tester starting 30 days after shipment.	\$134.50	
	Model SS-1C (counter model) FAST-CHECK TUBE TESTER Enclose \$23.50 down payment with order for each tester. Balance payable in 5 monthly payments of \$15.00 for each tester starting 30 days after shipment.	\$ 98.50	

All prices net F.O.B. Mineola, N. Y.

I am interested. Please send me **FREE** book and particulars about setting-up a tube tester route. No salesman will call.

Name..... Please Print

Address.....

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

Total Amount
Advance Payment
Balance

CHECK HERE TO SAVE SHIPPING CHARGES

Enclose total amount with order and Century will pay all shipping costs. 10 day money-back guarantee.

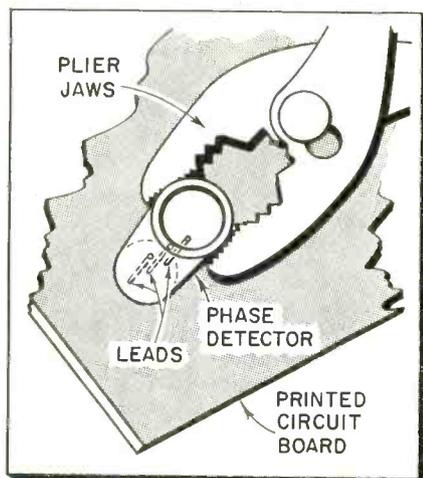
SHOP HINTS



Tips for Home and Bench Service

Replacing Selenium Phase Detectors

When G.E. and Hotpoint portable TV sets came into the shop with defective dual-diode selenium phase detectors, the chassis was always pulled, even though the unit is in full view from the rear of the set. The unit is soldered flush with the printed-circuit board. After a little experimenting we developed a technique which allows replacement of this unit without pulling the chassis,



Chassis removal may be avoided by breaking open the old diodes, and soldering the new phase detector directly to the exposed leads.

This saving a considerable amount of time.

The defective unit is crushed with a pair of pliers, by carefully applying pressure at right angles to the leads, as shown, so as not to pull them from the printed-circuit board. This exposes approximately a quarter of an inch of the leads which were incased in the unit. Original factory units are in tar filled paper cylinders and are easily crushed. A pair of longnose pliers can be used as a heat sink to prevent unsoldering the leads from the board while a new unit is soldered onto them.—Albert J. Krukowski, West Springfield, Mass.

Hi-Fi & Stereo Hum Reduction

There have been miscellaneous reports of hum in Hi-Fi and Stereo combinations. Listed below are some of the remedies on how to reduce hum. Models listed are Olympic, but some of these problems can occur elsewhere. By studying these and other solutions, a better understanding can be had of what to do when trouble develops.

1. Reverse a-c line cord plug in wall outlet.
2. Make certain shielded leads from record changer are inserted properly and firmly in chassis receptacle.
3. Stereo models using an external speaker-amplifier, check for proper insertion at each receptacle as well as reversing both a-c plugs in wall outlet.
4. Use separate ground lead to connect the changer to the amplifier.

Model #655.
Dual-Channel Stereo Phono

Symptom: Hum, at minimum or low volume.

Remedy: Connect a 50 or 60 μf electrolytic (input filter) between pin 3 of the EZ81 and chassis. Check the 12AX7 and EL84 tubes if hum is louder on one channel than on the other.

Model #696. AM-FM
Dual-Channel Stereo Phono

Symptom: Hum, at minimum or low volume.

Remedy: Check the 12AX7 and EL84 tubes. Make certain that phono plugs are properly inserted in chassis receptacles. In some cases it may be necessary to connect a 40 or 50 μf 350-v or 400-v electrolytic across the 30 μf filter section.

Symptom: Hum at maximum vol-

ume; caused by leaking terminal strip.

Remedy: The terminal strip on the underside of the chassis has a 1,000 ohm, 2-watt resistor and a brown wire connected to the end terminal. Clip the bakelite so that this end terminal and wires are separated from the rest of the strip.

Model 694. AM-FM
Dual-Channel Stereo Phono

Symptom: Hum on FM stations. Hum modulation.

Remedy: This hum may occur on certain FM stations and not on others. Remove the lead from pin 3 of the EZ81 rectifier and connect a 2.2 μh r-f choke between the lead and pin 3. Connect a 0.01 μf 1400-v ceramic capacitor from pin 3 to chassis ground. In some chassis it may be necessary to connect a 40 or 50 μf electrolytic across the 30 μf filter section.

Models SA 812-SA 813.
Speaker Amplifier.

Symptom: Transformer buzz. Hum or singing sound.

Remedy: May result from inadequate clamping of the a-c transformer or loose rivets. Insert a wedge of wood or plastic between the transformer and the chassis. Hum may be reduced by reversing the line cord in the socket, in severe cases connect a 0.01 μf , 600-v paper capacitor from one side of the a-c line to the chassis.—Olympic Radio & Television, Long Island City, N.Y.

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.

SYLVANIA TV

has always stood
behind the
independent
service man!

Recently, a spokesman for the Federation of Radio-Television Service Associations of Pennsylvania cited **SYLVANIA TV** as one of two TV manufacturers whose policies "have been favorable to the independent service industry."

In 1956—Robert L. Shaw, General Marketing Manager, SYLVANIA TV Division said:

"We have never expressed an intention of going into factory service at the local level and it is not our intention to do so. We feel that the local factory service is justified only when distributors, dealers and independent servicemen fail to meet the demands of the public. We see *no evidence* of such failure and have no intention of entering the factory service field."

Released for publication Dec. 5, 1956.

SYLVANIA has never felt the need to change this long established policy. SYLVANIA will continue to rely on independent distributors, dealers and accredited independent servicemen for post-factory service.



Recommend SYLVANIA TV—
the line that supports the independent serviceman

FREE LITERATURE

To receive the literature below without charge, simply circle the numbers on the coupon corresponding to the items of interest. Cut out and mail to ELECTRONIC TECHNICIAN.

1 UHF: Two-color bulletin, "Money-Making Methods of the Month," is offered to help the service dealer select prospects for UHF converter sales. (1B12: Blonder-Tongue Labs.)

2 Soldering Guns: Booklet on repairing printed circuits includes data covering the Solder Tip Kit. The kit has four interchangeable tips for tube sockets, IF transformers, electrolytics and two sizes for condenser resistor boards. (2B12: Gregg Electric Sales Co.)

3 Relays: Bulletin 58-3B provides information on relays, with illustrations, specifications and prices. Form S200-A is a cross-reference relay chart. (3B12: Kurman Electric Co.)

4 Switches: Literature illustrates, and gives type numbers of switches which fulfill 80% of all switching requirements. (4B12: Oak Mfg. Co.)

5 Transformers & Condensers: Brochure on English-made variable condensers and drives provides technical data and illustrations of the Partridge line. Also bulletin on audio transformers. (5B12: Partridge Transformers)

6 Garage Door Operator: Literature covers a new electronic garage door operator, which is combined with a radio receiver in one small compact unit. Installation on the header beam above the garage door requires only three lag screws. Operates on 200 to 400 kc. (6B12: Paxton Products)

7 Test Instruments: 8-page illustrated catalog, #119, describes and gives schematics with prices of the firm's full line. Includes illustrations showing products in use. (7B12: Service Instruments Corp.)

8 Transimulator: Literature describes model LF-1 transimulator, designed for fast setting up of transistor circuits. The instrument gives speedy and accurate evaluations of the operating parameters in circuit. (8B12: Sprague Products Co.)

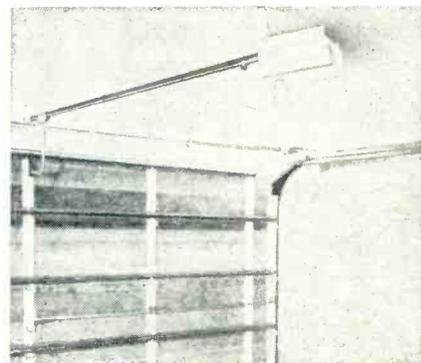
9 Recorder Drives: Wall chart and replacement guide for phono and tape recorder drives, measures 21" x 34", gives actual-size illustrations, prices, and a conversion and cross-reference chart. (9B12: Walsco Electric Mfg. Co.)

TI SILICON RECTIFIERS

Series of low cost diffused silicon rectifiers feature an average forward current of 750 ma. Typed as the IN2069, IN2070, and IN2071, the three silicon rectifiers have peak inverse voltages of 200, 400 and 600 volts, respectively. They also highlight a six ampere recurrent peak current and a surge (turn-on) current over 32 amperes for one millisecond. They have a maximum forward voltage drop of 0.6 volt and 0.2 ma maximum full cycle average reverse current with a 500 ma forward current. Texas Instruments Inc., 6000 Lemmon Ave., Dallas 9, Texas (ELECTRONIC TECHNICIAN 12-34)

Perma DOOR OPERATOR

Radio-controlled garage door operator Model G-500 incorporates major improvements. Quieter operation and greater efficiency have been made possible by a new speed reducer employing a double helix gear. It automatically turns on the garage light as the door opens. A time-delay light shut-off keeps the light on for almost two minutes



after the door closes, permitting the user to leave the garage in complete safety. Installation is a simple one-man job. The receiver has been preinstalled in the integrated unit to eliminate extra work. Perma-Power Co., 3100 N. Elston Ave., Chicago 18, Ill (ELECTRONIC TECHNICIAN 12-26)

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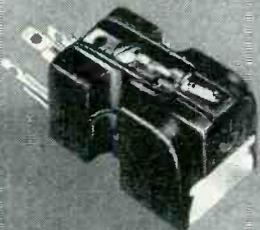
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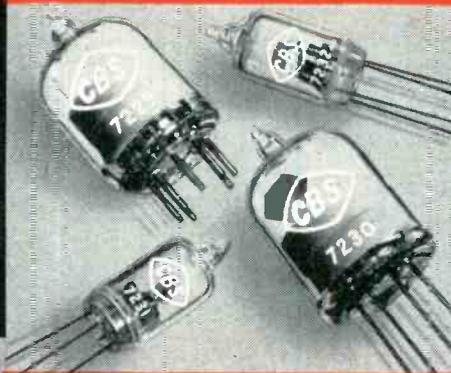
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core-driver use in computers. Watch for many more CBS-Hytron transistor developments.

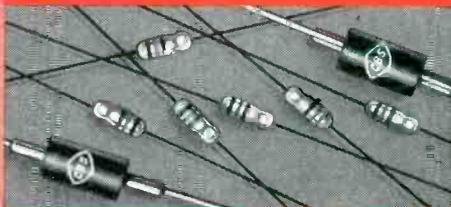


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These CBS-Hytron originals introduce a new and growing family of krytrons, reliable cold-cathode trigger tubes. They replace relays and thyratrons in simplified circuits; control up to 500 amperes with inputs of less than 20 microamperes. Krytrons present another addition to CBS-Hytron's industrial tubes... most inclusive selection in the industry.

Constant Displacement Sterec Cartridge

New Columbia CD is most linear stereo cartridge. Its constant displacement lever system assures that, regardless of frequency, the output voltage is essentially constant for a given displacement of stylus. This unrivalled cartridge, best for conversion or replacement, was designed by Columbia Records. It is first of a series of audio components from CBS-Hytron.

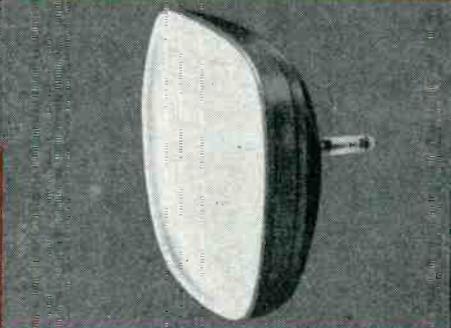


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Of particular interest for their freedom from shorts and opens are these new indium-bonded computer diodes. The CBS-Hytron diode line has become the most comprehensive, including general-purpose or computer... germanium or silicon... glass or plastic, in a wide range of types.

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Electronic Snow Gauge

Remote Radio Telemeters Data From Radiation Detector

• A newly developed electronic-telemetering system for measuring the water content of mountain snow-packs is being installed in a remote area of California's rugged Sierra Nevada mountains.

The system, developed by the U. S. Army Corps of Engineers and Sierra Electronic Corp., will be placed in operation this winter. A similar system is being installed in the Bitter-root mountain range in Idaho.

The unique snow gauging equipment, based on a radiation detector of the scintillation type, enables engineers to obtain accurate hydrological data (water content of snow) from remote, unattended areas. This information is extremely useful in the planning and operation of irrigation projects, flood control programs and hydro-electric plants. As a result, the new system has created considerable interest among utilities, agricultural specialists and government agencies.

According to the Corps of Engineers, millions of dollars can be saved in the design and construction of flood control and water conservation facilities by obtaining frequent and accurate hydrological reports. Until the development of the electronic system, these reports have been difficult and at times impossible to obtain.

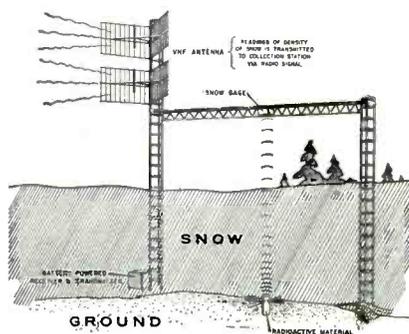
In California, for example, water content information is presently obtained by sending men and equipment into the High Sierra each winter to survey selected snow fields. These survey parties are required to travel many hazardous miles on skis or snowshoes and to weigh core samples of snow to determine water content. Often the snow fields are inaccessible because of the severe winter weather.

To supplement and improve upon these sampling methods, the Corps of Engineers devised a gauging system which automatically reports and records hydrological data. Sierra Electronic Corp., a subsidiary of Philco Corp., designed and developed all the electronic equipment at its plant in Menlo Park, California. The system is known as the Model 211A Telemetric System.

As used in the High Sierra, the system consists of a network of VHF radio antennas and towers con-

structed at six sites between Mt. Whitney, highest peak in the U. S., and the Isabella Reservoir near Bakersfield. The network includes a 20-foot H-frame tower at each of three snow gauge sites and two relay towers, all in remote, unattended areas. In addition, there is a terminal tower at the Isabella base station.

Highest gauge site is at 11,500 feet



Basic operation of new electronic snow gauging system. Radiation for measuring water content of snow is supplied by radioactive material buried at ground level. As radiation passes through snow to detector (directly above), some radiation is absorbed in proportion to the amount of water in the snow. Electrical impulses from detector, which correspond to the radiation it receives, are then transmitted by radio communications to a base station several miles away.

elevation, just 10 miles from Mt. Whitney. Greatest distance between any two sites is 43 miles, although the system in Idaho has relay stations as far apart as 70 miles.

Each gauge site contains a minimum amount of equipment. Basically it includes a radiation detector of the scintillation type, a radio transmitter, receiver, battery and control unit.

Radiation for measuring the water content of the snow is supplied by a small deposit of radio-active cobalt buried at ground level. Directly above the cobalt, at a height of 15 feet, is the radiation detector. As the radiation from the cobalt passes through the snow to the detector, some radiation is absorbed in proportion to the amount of water in the snow. Only the water content,

not the depth of the snow, affects the radiation. Special circuitry is used to discriminate against spurious radiations caused by cosmic rays and electrical noise.

By means of radio communications (telemetering), the electrical impulses from the detector, which correspond to the amount of radiation it receives, are transmitted through the two relay stations to the Isabella base station. Here the information is permanently recorded on paper tape.

The snow gauge operates in response to query messages, which are steady tones of selected frequency. These are transmitted from the base station through the relay stations. As each unattended site receives its interrogation, the battery-powered VHF radio transmitter is switched on and the hydrological data beamed to the base station.

There are two channels of communication between the base station and each of the gauge sites. One is used for transmitting queries to the gauge, and the other for transmitting water content data back to the base.

The receivers, which operate at about 170 megacycles, are transistorized to conserve battery power. The transmitters also are designed for low power consumption. All of the equipment at the gauge sites and relay stations will operate unattended for nine months.

Another interesting feature of the Model 211A system is its ability to be operated both automatically and manually. In automatic operation the radiation count can be recorded daily or can be programmed for several different time intervals. In "on call" operation, the radiation count can be obtained at any time by merely operating a switch at the base station.

For equipment servicing purposes, the system also provides a two-way voice communications circuit between any of the gauge and relay sites as well as the base station.

According to Sierra, the Model 211A system can easily be expanded to report temperature, barometric pressure, humidity, wind velocity and other weather phenomena. Its versatility can also be extended to other applications, such as stream gauging and controlling cloud-seeding equipment. •

SUPERIOR'S NEW MODEL TV-50A

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- ✓ R.F. Signal Generator for F.M.
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Model TV-50A GENOMETER... Total Price \$47.50 — Terms: \$11.50 after 10 day trial, then \$6.00 monthly for 6 months.

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.

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

BAR GENERATOR: The Model TV-50A projects an actual Bar Pattern on any TV Receiver Screen. Pattern will consist of 4 to 16 horizontal bars or 7 to 20 vertical 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, horizontal and vertical lines interlaced to provide a stable cross-hatch effect.

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.

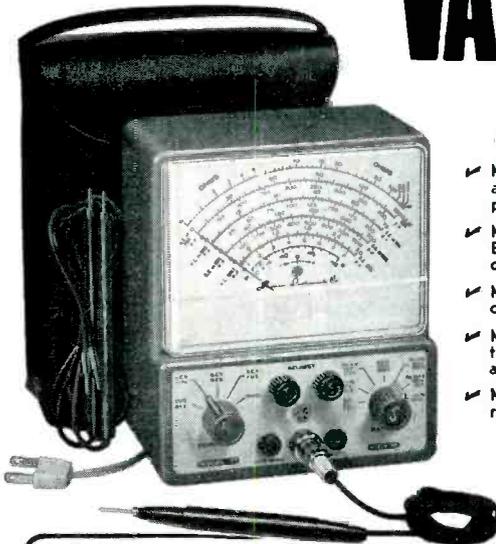
MARKER GENERATOR: The Model TV-50A includes all the most frequently needed marker points. The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1800 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 6 Mc., 10.7 Mc. (3579 Kc. is the color burst frequency).

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NEW MODEL 77

VACUUM TUBE VOLTMETER

WITH NEW 6" FULL-VIEW METER



Model 77 — VACUUM TUBE VOLT-METER... Total Price \$42.50 — Terms: \$12.50 after 10 day trial, then \$6.00 monthly for 5 months.

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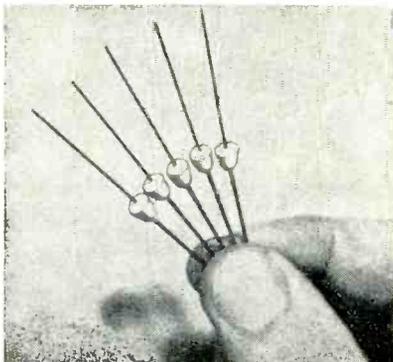
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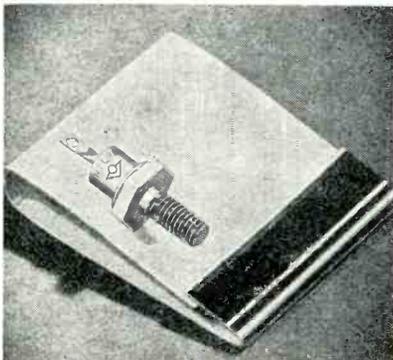
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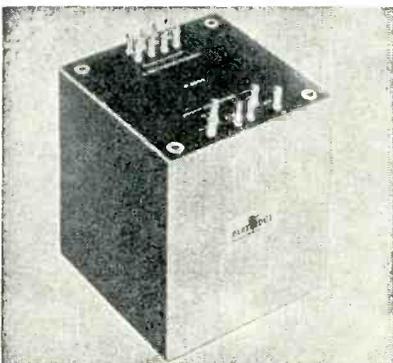
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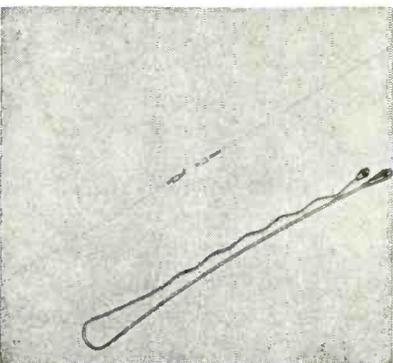
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Molded wirewound resistors at powers of 3, 5 and 10 watts have temperature coefficient of 0 ± 20 ppm/°C. Covering of the resistor is a jacket of tough silicone-ceramic material, making resistors "insulated" units which may be used next to "hot" parts. Available tolerances are: 0.1%, 0.25%, 0.5%, 1.0%, and 3.0%. Maximum resistance is: 3-watt size, 10,000 ohms; 5-watt size, 25,000 ohms; 10-watt size, 50,000 ohms. Bulletin 153. Ohmite Mfg. Co., 3697 Howard St., Skokie, Ill. (ELECTRONIC TECHNICIAN 12-6)

Tobe CAPACITOR CABINETS

The "Tobe Twins," enameled-metal merchandising cabinets speed capacitor turnover and lend a neater appearance to service areas. Twist-prong section contains 12 "preferred type twist prongs" and has room for an additional 6. Tubular section has 4 partitioned drawers. Its contents are 16 Jet tubular electrolytics and 73 TPM mylar tubulars. Both cabinets are free to the dealer when he buys them with the recommended assortments. Dealer cost is \$49.95. List prices total \$83.35. Tobe Deutschmann Corp., Jobber Div., 2900 Columbia Ave., Indianapolis, Ind. (ELECTRONIC TECHNICIAN 12-7)

ITT SELENIUM DIODES

Improved design of Type K1615 center-tap and K1616 doubler line of "Federal" encapsulated selenium diodes, retaining the same type numbers, are used in horizontal phase detector circuits of TV receivers. The improvements, which include use of a new Bakelite case and a new filler, result in components claimed to have advantages over a 6AL5 vacuum tube. These advantages include operation up to 85°C, resistance to shock, vibration, humidity and low shunt capacitance. Types K1615 and K1616 are available with straight leads or with crimped leads for printed circuit applications. Components Div., ITT, Clifton, N. J. (ELECTRONIC TECHNICIAN 12-8)

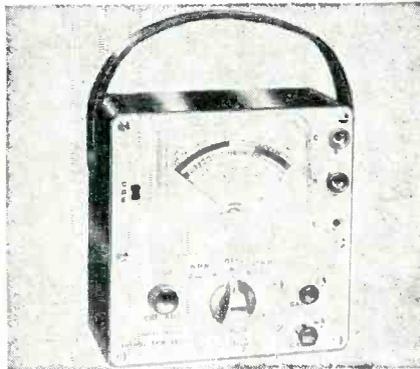
Latest Test Equipment

For more information, write in ELECTRONIC TECHNICIAN's new product code number on coupon, on page 42.



Triplet TRANSISTOR TESTER →

Transistor tester Model 690-A provides positive leakage and gain tests for PNP and NPN transistors. It measures dc beta (which is the current gain from the collector to base with grounded emitter) from 5 to infinity. The tester also affords an exact test for shorts and leakages, and checks forward and reverse leakage of diodes. Separate "Calibrate" and "Gain Buttons" eliminate errors. Triplet Electrical Instrument Co., Bluffton, O. (ELECTRONIC TECHNICIAN 12-9)

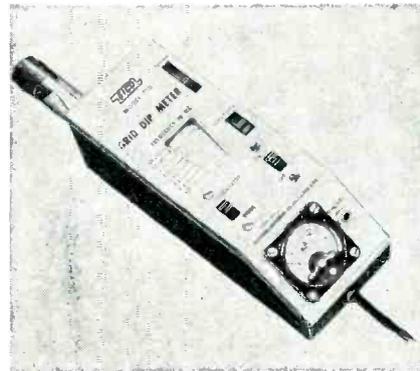


Francis POWER SUPPLY

ToroPak units are engineered to supply dc or ac power where none exists or for emergencies during power failures. Model P14-65 supplies 110 volt, 60 cycle single phase power up to 200 watts continuous output for eight hours or more. It will also provide 12 volts dc for an extended period. The unit can then be recharged. This is a portable model. It will operate small motors, tools, lights, radio, portable TV, communication and test equipment. Francis Bros., Tustin, Calif. (ELECTRONIC TECHNICIAN 12-14)

Eico GRID DIP METER →

Model 710 grid dip meter is basically a versatile, stable VFO with a microammeter in its grid circuit. It features a sensitivity control and phone jack for "zero beat" listening. It is easy to thumb-tune. Uses include: alignment of traps, filters, i-f's, peaking compensation networks, and as signal or marker generator. Frequency range is 400 kc to 250 mc. Kit is \$29.95; wired \$49.95. Electronic Instrument Co., 33-00 Northern Blvd., L. I. C., N. Y. (ELECTRONIC TECHNICIAN 12-10)

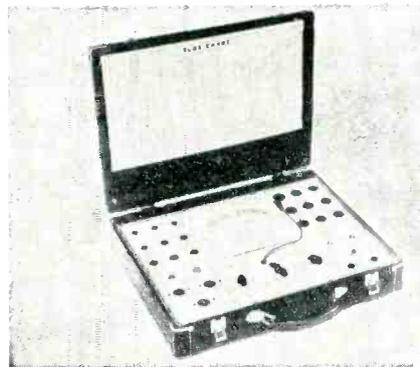


Kingston PROBES

The firm's absorption analyzer, designed to provide simple top-side signal tracing without physical connection, may now be equipped with four new electrostatic probes. The Envelope Probe (\$5.95) with top connector is for use on crowded miniature tubes. The T-Probe (\$4.95) is for use on 7 and 9 pin tubes which are permanently shielded or recessed. The Straight Probe (\$4.95) is for use on shielded dual purpose tubes or to aid in locating the burned out tube in a series string. The Sub-Miniature Probe (\$3.45) is for use on subminiature tubes and components. Kingston Electronic Corp., Medfield, Mass. (ELECTRONIC TECHNICIAN 12-15)

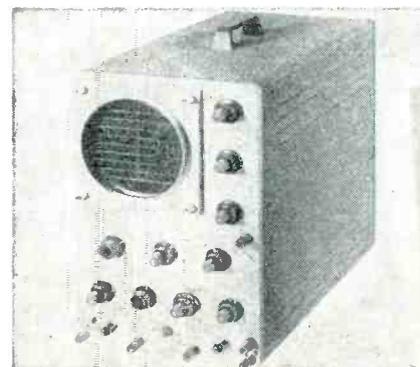
Shell TUBE TESTER →

Model P-38 Test-O-Matic is a portable emission-type tube tester using just 18 sockets. It tests more than 800 tube types, plus 6 and 12 volt vibrators. It has only three easy-to-use controls, and large meter. This unit tests each side of multi-purpose tubes. Sockets conform to military specs, assuring positive contact and long wear. Dimensions are 19" x 15". It operates on 110-120 volts ac. Shell Electronics Mfg. Corp., 1688 Utica Ave., Brooklyn, N. Y. (ELECTRONIC TECHNICIAN 12-11)



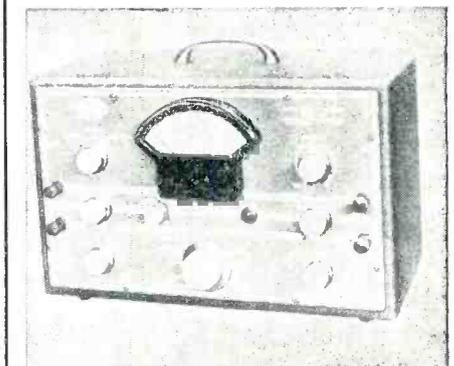
Heath OSCILLOSCOPE →

Model OP-1 Professional Oscilloscope kit features dc coupled amplifiers and also dc coupled CR tube unblanking. Triggered sweep circuit operates on internal or external signals. The sweep frequencies are provided by switch-selected base rates of 2 and .2 msec per cm, and 20, 2 and 1 μ sec per cm. Vertical frequency response is within 1 db from dc to 2.2 mc; within 6 db from dc to 4.5 mc. Rise time is less than 0.1 μ sec. \$179.95. Heath Co., Benton Harbor, Mich. (ELECTRONIC TECHNICIAN 12-12)



B & W DISTORTION METER

For accurate measurements of residual noise and harmonic content in the audio frequency ranges, a distortion meter is invaluable. This meter requires only 0.3 volt for noise and distortion measurements, and measures fundamentals from 30 to 15,000 cycles and



harmonics to 45,000 cycles. For measurements of low level audio voltages in determining noise and harmonic content, full scale readings of 0.3, 0.1, 0.03, 0.01, 0.003 volt are provided. Barker and Williamson, Inc., Bristol, Pa. (ELECTRONIC TECHNICIAN 12-13)

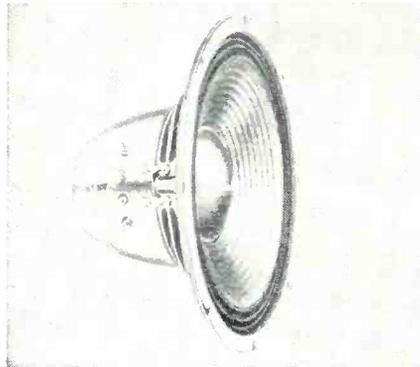
New Audio Products



For more information, write in ELECTRONIC TECHNICIAN's new product code number on coupon on page 42.

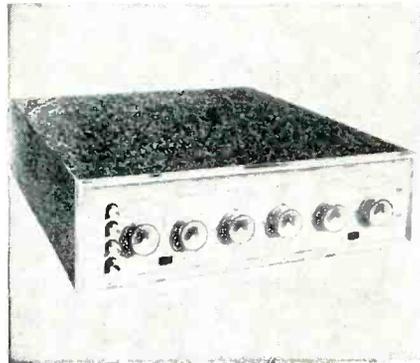
University WOOFER →

The 12" woofer, model C-12SW, connects to a limited-range second channel speaker by use of its dual voice coil, without the need for a control filter. It has 1.5 lb. all Alnico 5 Gold Dot magnet. Response: 40 to 6000 cps. Built-in adjustable response limiter can be set for 700, 2500 and 5000 cps cutoff. 25 watts integrated program. Impedance: 8 ohms. 12 $\frac{1}{8}$ " diameter. 6 $\frac{1}{2}$ " depth. \$39.50. University Loudspeakers, Inc., 80 So. Ken-sico Ave., White Plains, N. Y. (ELEC-TRONIC TECHNICIAN 12-16)



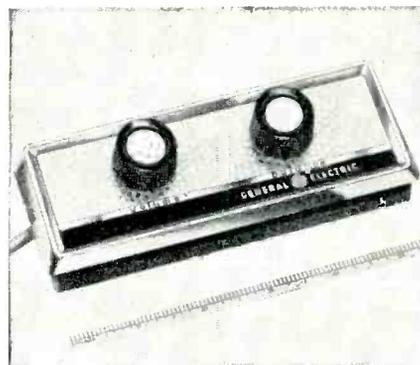
Sherwood STEREO AMPLIFIER →

Model S-5000-Stereo 20+20 watt dual amplifier and preamplifier has all dual controls; stereo normal/reverse switch; phase inversion; dual monaural; and other controls. Power output is 20 watts/channel @ 1 $\frac{1}{2}$ % IM distortion. Frequency response @ 20 watts is 20 cps to 20 kc \pm 1/2 db. Sensitivity on radio, 0.25 v; phono 2 $\frac{1}{2}$ mv. Max. hum & noise on phono, 60 db. \$189.50 less case. Sherwood Electronic Labs., 2802 W. Cullom Ave., Chicago 18, Ill. (ELEC-TRONIC TECHNICIAN 12-17)



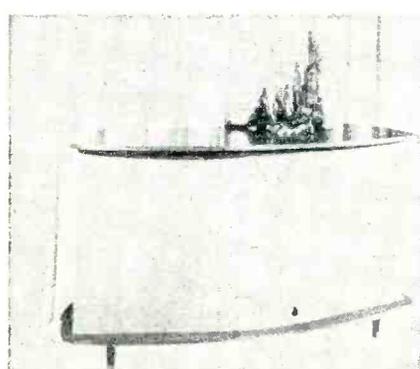
GE STEREO CONTROL →

Remote control unit for stereo amplifiers, Model RG-1000, has two knobs for adjustment of both channel balance and volume as far as 30 feet from the amplifier. Consumer price is \$14.95. The RG-1000 is designed primarily for use with the MS-4000 and MS-2000 stereo amplifiers. Its dual plugs fit into the amplifiers dual tape output jacks. General Electric Co., Specialty Electronic Components Dept., West Genesee St., Auburn, N. Y. (ELECTRONIC TECHNICIAN 12-18)



Frazier SPEAKER SYSTEMS →

"Stereorama I" and "II" speakers. Each combines two systems with 30° angular separation in one enclosure. The "II" has an 8" woofer and compression-type tweeter. Frequency response is 30 to 17,000 cps. Power is 20 watts per channel. \$295.00. The "I" has an 8" woofer, high-pass filter and cone-type tweeter. Frequency response is 40 to 15,000 cps. Power is 15 watts per channel. \$195.00. Bulletin No. ST98. (Frazier) International Electronics Corp., 2649 Brenner Drive, Dallas 20, Texas. (ELECTRONIC TECHNICIAN 12-19)



Philco NEEDLES

A total of 52 new diamond tip phono-graph needles, 16 new stereo jewel tip needles and 26 new monaural jewel tip needles have been added to the line. The new needles are not listed in the current Accessory Div. phonograph needle catalog, but will be included in the new electronic catalog soon to be issued. Philco Corp., Accessory Div., "C" and Westmoreland Sts., Phila., 34, Pa. (ELECTRONIC TECHNICIAN 12-20)

Lowell Baffles

Model FH8-A baffle is a rectangular wall baffle, designed for motel or apartment sound systems requiring 8" speaker installation. Space below the 11" x 13" grille accommodates volume control switches. Model GC8-A can be used for both wall and ceiling installations. It has a 12 $\frac{1}{2}$ " x 12 $\frac{1}{2}$ " x $\frac{1}{4}$ " grille. Model YM8-A is a baffle designed for installations in acoustical tile ceilings, replacing a regular 12" x 12" x $\frac{1}{4}$ " size acoustical tile. Model MG8-A is a square flush mounted baffle. Lowell Mfg. Co., 3030 Laclede Station Rd., St. Louis, Mo. (ELECTRONIC TECHNICIAN 12-21)

Scott ARM & CARTRIDGE

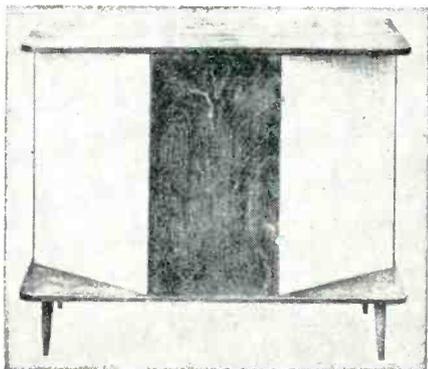
The London-Scott matched magnetic stereo arm and cartridge is called the type 1000. Frequency response is rated at 20 to 20,000 cps. Tracking force is 3.5 grams for optimum response and minimum wear. Output is 4 mv so no transformer is required. Diamond stylus tip is of 0.5 mil radius. Length of the arm from pivot to stylus is 12.5". Height of the arm is adjustable from 1 $\frac{3}{8}$ " to 2 $\frac{1}{2}$ " above the mounting board. Price is \$89.95. H. H. Scott, Inc., Dept. P, 111 Powdermill Rd., Maynard, Mass. (ELECTRONIC TECHNICIAN 12-22)

Altec SPEAKERS

A 15" low frequency speaker, the 803B, has a cone resonance of 25 cycles. Specifications are: impedance, 16 ohms; power, 30 watts; range, 30-1600 cycles; magnet weight, 2.4 lbs. Price is \$66. Also, the Monterey 834A system with small bass reflex enclosure has two new 8" bass speakers, which operate from 40 to 3,000 cycles; a 3,000 cycle dividing network with a 10 db continuously variable switch; and the 3000B high frequency speaker with sectoral horn. Specifications are: frequency, 40-22,000 cps; power, 20 watts. Price is \$165. Altec Lansing Corp., Anaheim, Calif. (ELEC-TRONIC TECHNICIAN 12-23)

Hartley **SPEAKER**

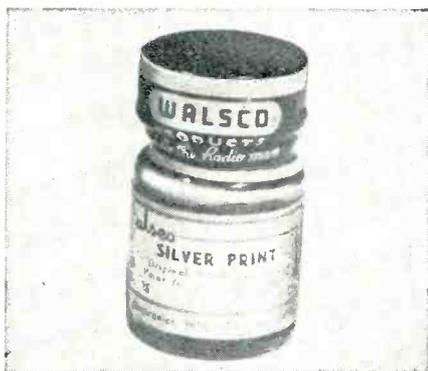
The 217-Duo, which supplies two-speaker stereo in one cabinet only 3' wide, has speakers mounted to convey both channels directly and also by reflection. By this arrangement there is a 160° diffusion of sound. The cabinet,



2' 6" high including 6" legs, is finished in walnut, mahogany or blond, or supplied in unfinished solid birch. Unfinished \$229.00; finished \$255.00. Hartley Products Co., 521 E. 162 St., New York 51, N. Y. (ELECTRIC TECHNICIAN 12-28)

Walsco **SILVER & COPPER**

To facilitate printed circuit repairs, Silver Print and Copper Print can easily be used to touch up circuits around eyelets, parts, etc. These are the same silver and copper compounds that are used in original printed circuit design.



Silver Print is available in two sizes, 1/2 Troy ounce (catalog No. 36) or a full Troy ounce (catalog No. 36-1). The Copper Print (catalog No. 37-02) is available in a 2-ounce bottle. Walsco Electronic Mfg. Co., 100 W. Green St., Rockford, Ill. (ELECTRONIC TECHNICIAN 12-27)

For more information, write in **ELECTRONIC TECHNICIAN's** new product code number on coupon on page 42. See also additional new products on pages 48, 49, 59 and 60.

Mr. Service Dealer

PHILCO

OFFERS YOU A COMPLETE LINE OF UNIVERSAL SERVICE PARTS



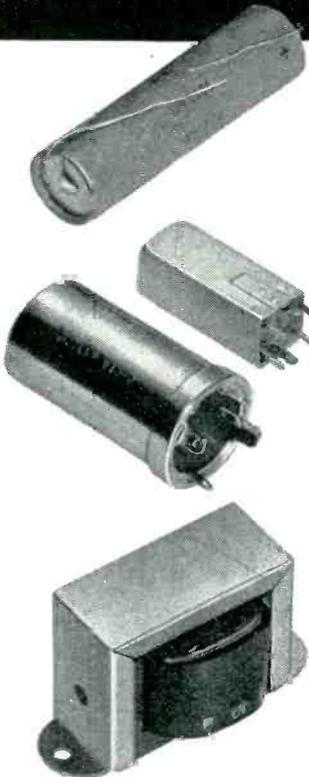
Your Philco Distributor has available for you a complete new line of universal parts that fit not only all Philco receivers but every competitive make and model. Eliminate your inventory problems and stock the one line of completeness . . . Philco.

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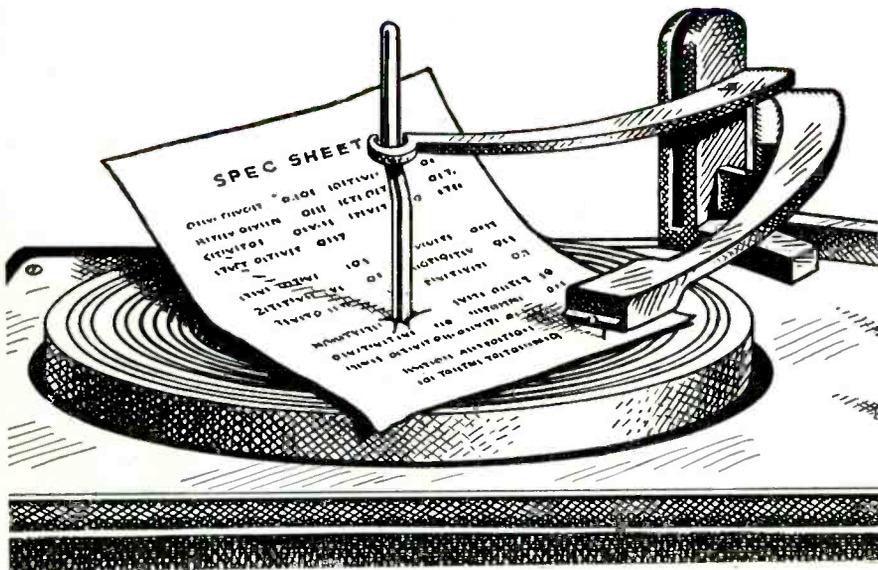


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YOU CAN'T HEAR A 'SPEC' SHEET!



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. CT-128

ELMSFORD, NEW YORK

®
CORP.

(Audio News Letter. Continued from page 24)

LIVING SOUND, INC., 5115 S. Western Ave., Los Angeles, introduces a portable stereo phono with changer and flip-over ceramic cartridge.

MINNESOTA MINING & MFG. offers a folder on how to make professional tape splices. Write to the company at Dept. M8-340, St. Paul, Minn. 27% price reduction on Scotch brand No. 200 magnetic tape has been announced. New price for a 7" reel with 2400 ft. of thin tape is \$8.75.

IHFMs San Francisco High Fidelity Show, Feb. 7-10, 1959, moves to the Cow Palace to accommodate the large attendance. Space drawings will be held Dec. 8 in San Francisco.

INTERNATIONAL ELECTRONICS, Dallas, introduces the Frazier Stereorama I speaker system with 8" woofer, cone tweeter, rated 15 watts/channel, @ \$195. The Stereorama II, also two enclosures in a single cabinet, 20 watts/channel, is \$295.

WALCO announces the Stereo/Hi-Fi DisCleaner Kit @ \$1.50.

ELECTRO-VOICE kicks off a major "Step Up To Stereo" promotional campaign with heavy advertising and point-of-purchase material. To explain stereo to consumers, a free 12" mono/stereo demonstration record and catalog will be given to all who visit EV hi-fi dealers.

IHFMs announces a nationwide direct mail program to enroll hi-fi enthusiasts in the Institute's consumer program. For \$10 annual dues, members receive a test tape or disc, 6-month magazine subscription, hi-fi book, IHFM newsletter, book discounts and free show admission.

INSTITUTE OF HIGH FIDELITY MANUFACTURERS names Sid N. Cottin show director, replacing Elliot Davis, resigned to enter rep field. Cottin was formerly Crest Records ad manager.

JENSEN INDUSTRIES' 15th anniversary promotion through name-that-tune radio programs gives dealers and consumers free bonus needles. Firm has made 50 million needles.

1959 PARTS SHOW plans include an educational program guided by a professional counseling firm, Poetzing, Dechert & Kielty, reports program committee chairman Sidney Harman. Emphasis will be on information helping distributors.

PRICE TRENDS, courtesy Audio-File Div. United File-O-Matic: WEATHERS stereo turntable K601S increased to \$111.75. SONOTONE speakers CA-15 and #22 discontinued. THORENS turntables E-53PA and PH-526 discontinued. RACON horns COB-11 & 11D increased to \$52.50 and \$58.50. Driver PM708.TR increased to \$28.50.

NASTY BUSINESS. Last week while poking our editorial noses around hi-fi sales outlets, we came upon an unpleasant bit of competitive selling. In the hi-fi showroom of a leading direct-mail and retail jobber, a salesman was demonstrating one of the jobber's private brand products to a customer. This private brand unit was being compared with a top quality unit made by a name brand manufacturer. The cunning twist was that the name brand unit was not properly adjusted for optimum performance, so it showed up poorly. Further checks with industry insiders indicate that this unfair demonstration turns up in comparing two name brands. . . . when the sales outlet gets a particularly good volume deal on one of the brands.

98 — COUNT 'EM — 98 EXACT FACTORY AUTO RADIO CONTROL REPLACEMENTS



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✓ EXACT FACTORY
REPLACEMENTS!

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Everything you need for profitable replacement is included in this new G-C CTS Auto Radio Control line. A total of 98 exact factory models makes it easy to service 199 different auto makes and models quickly. New G-C Replacement Guide tells you what to use and where. See your G-C jobber now!

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Prolong Tube Life

(Continued from page 37)

ting, and other circuit conditions contribute to these voltage variations. Excessive filament voltage tends to drive off some of the tungsten filament's oxide coating, when this material is caught in the electron stream it is readily turned to gas. Under the influence of high

voltage, gas ions are formed and are propelled toward the cathode at high velocity. The hot filament is protected by its surrounding electron space charge, but its support rods are not. It is not unusual to find the nickel support rods completely burned or fused away and a perfectly good filament without any means of support. Lower filament voltage may seem to be the solution, but too low a voltage will reduce the space charge and leave the filament unprotected. Continued bombardment will loosen more material, create more gas and eventually

cause almost complete stripping. Loss of emission results, and hot spots develop on the bare tungsten wire which light up incandescently white. It is only a matter of a relatively short time thereafter for the filament to break completely. Another common fault may be attributed to the high electrostatic field and steep wavefront which creates this field. It may cause the filament to oscillate and eventually break at one of its supports. Should the filament fly over to the plate, there will be a dead short.

The 1AX2 was designed to overcome these difficulties, and may be substituted for the 1X2 and even the 1B3. Because of the slightly higher heater power required for the 1AX2, the 3.3-ohm filament resistor, found in many sets, can be removed. In the case of the 1B3 it is necessary to either change the socket, or use an adapter. To overcome the effects of electrostatic pulling of the heater, it is wound in a spiral form and placed in the base of the tube behind an electrostatic shield. The shield is cylindrical in shape and has a relatively small aperture at one end. To provide a greater thermal tolerance, the heater is made of a coated, flat ribbon, much like that of low-voltage rectifier tubes. The electrostatic shield also tends to protect the filament from ionic bombardment. It provides a relatively large target area for the ions to land on, and a relatively small aperture which makes it difficult for them to penetrate to the filament itself.

Other Substitutions

As set designers attempt to extract more work from the existing supply of tubes, their life expectancy goes down. Sometimes not enough to be too objectionable, and at other times to warrant improved tube designs. The 6CU6 was developed with this in mind. The 6BQ6 had been overworked. Electrically both tubes are the same, but the larger plate and larger bulb permit the 6CU6 to run cooler. No changes are required. Some sets may have a retainer clip to hold the 6BQ6 tubes in place. This clip will prevent the larger based 6CU6 from sitting all the way down in the socket. It is a simple matter to bend the clip back and forth a few times; it will break at the rivet points and can be easily removed, without disturbing the socket. A hot shot type of replacement for the 6CU6 is the 6DQ6. It may be able to deliver that little extra width needed in some of the older sets.

Damper circuits have also contributed to the large annual con-

CRT 400 PROVES REAL MONEY-MAKER

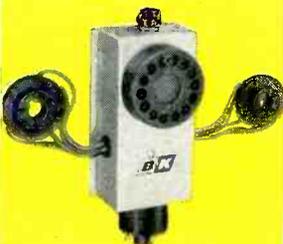
Thousands of servicemen today make money and keep customer good-will by checking and correcting b&w picture tube troubles with the famous B&K CRT 400, right in the home without removing tube from set. Restores emission and brightness. Repairs inter-element shorts and open circuits. Checks leakage. Indicates picture quality customer can expect. Life Test checks gas content and predicts remaining useful life of picture tube. Makes new picture tube replacement sales easier!
Model 400 (without adapter)Net, \$59⁹⁵

NEW MODEL C40 ADAPTER DOUBLES VALUE OF B&K CRT

Designed for use with all B&K Models 400 and 350 CRT's. Makes it easy to test and rejuvenate TV color picture tubes and 110° picture tubes. Isolates and detects difficult color troubles. Tests and rejuvenates each gun of the color picture tube separately the same way as a black & white tube.
Model C40 AdapterNet, \$9⁹⁵

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

New C40 Adapter for 110° Tubes and Color Tubes



Makers of CRT, DYNA-QUIK, DYNA-SCAN and CALIBRATOR

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sumption of vacuum tubes. Fewer call backs may be realized by using the 6AX4 in place of the 6W4. Particularly so if arcing is encountered. However, do not go in the other direction. Most sets designed for use of the 6W4 have very little voltage between heater and cathode, but sets designed for the 6AX4 may have several thousand volts which would cause immediate failure to the 6W4. The 6AU4 can be used in place of the 6AX4 to minimize still further the incidence of arcing. The 6AU4 can handle about twice as much current as the 6AX4, but it does require more cathode power—not enough to be a problem, or to increase the heat of the transformer measurably.

Other Considerations

SURGE RESISTORS—Some manufacturers are reverting to the practice of using surge limiting resistors even when the tubes have controlled warmup heaters. Current surge is one of the most destructive forces at work. There is no doubt that tube life can be extended with this type of protection.

VENTILATION—Poor ventilation is another tube killer. Bright metal sleeves radiate heat very slowly. Glass temperatures can be reduced considerably by removing the shields. If this interferes with circuit functioning, a coat of flat black paint on the inside and outside of the shield will help dissipate the heat much faster. Do not paint the glass.

PIN STRAIGHTENER — Tube socket lugs should not apply undue pressure on tube pins. Glass 7-pin and 9-pin miniature may be subjected to damaging stresses and strains, which in time will crack the tubes. Bent pins, tight leads and bent over socket lugs all contribute to this condition.

SHOCK MOUNT—Microphonics and other difficulties which may be set up by vibration may be minimized by inserting a couple of rubber grommets between the tube socket and chassis.

FILAMENT VOLTAGE—Improper heater temperature can sometimes be predicted just by observation. For example, high voltage rectifiers should appear to be dull red in a darkened room. It may take a worm's eye view to see it, but it's there. Flare ups may be normal for some tubes, when the set is first turned on, but in most cases it is an indication of trouble some place. Many circuit faults are blamed on tubes when filament voltage is low. The sharp technician is alert to these conditions. •



RCA PREMIUM TUBES



Long-life reliability... the result of selected materials, rigid quality controls, and exacting inspection and test procedures... makes RCA Tubes the right choice for replacement in electronically controlled industrial devices.



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

Send for new booklet RIT-104A. "Receiving-Type Tubes For Industry and Communications". Includes descriptions and basic data on RCA Premium and other special tube types. For your copy, write RCA Commercial Engineering, Section L-46-Z, Harrison, N.J.



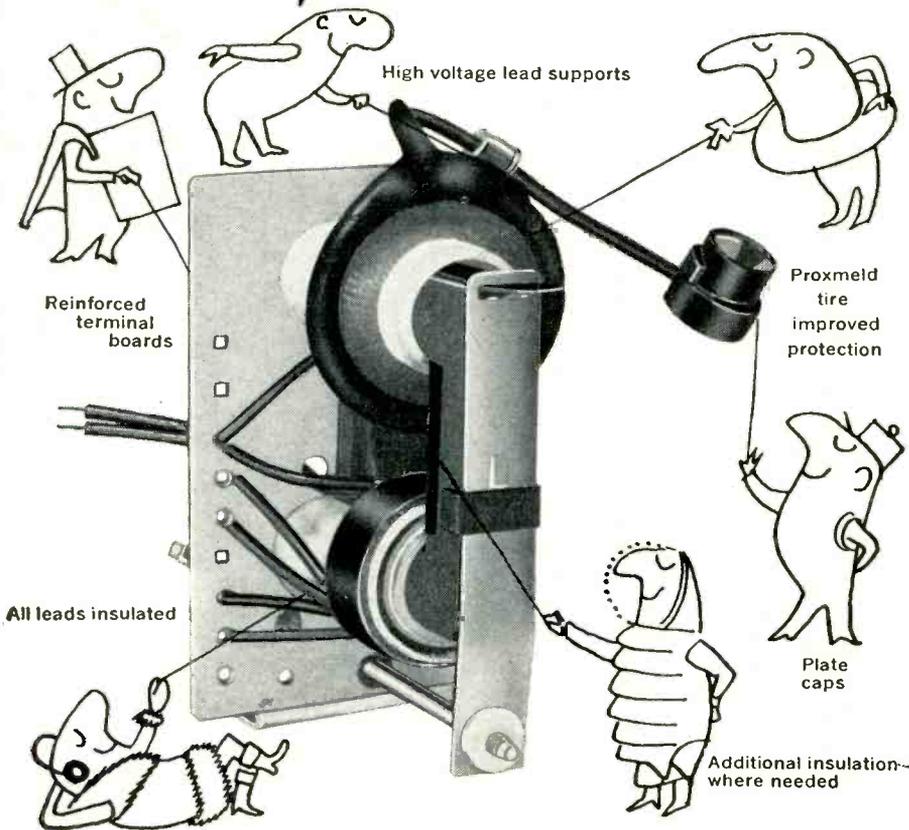


"Sorry, no more night calls. . . .
As of now, that's when!"

Raytheon TUBES

Addition of nine new miniature receiving tubes to the replacement line include the 1AF4, 6DR7, 6EB8, 11CY7, 12AE6A, 12EG6, 12FM6, 6BN4A and 6BR8A. The 1AF4 is a filament type, sharp-cutoff pentode. The 6DR7 is a heater-cathode double triode with dissimilar sections. Section 1 has a high mu and is intended for use as a vertical deflection oscillator. Section 2 has a low mu and is designed for use as a vertical deflection amplifier. It is being used in Zenith TV. The 6EB8 is a heater-cathode type high mu triode, sharp cut-off pentode designed to be used as a voltage amplifier or sync separator. It is being used in Zenith and Motorola TV.

You get these *plus* features with STANCOR



Stancor, the pioneer in the field of exact replacement flybacks, now goes one step further. The Stancor replacement represents an *improvement* over the original manufacturer's units. Additional features—like those above—are added when necessary to insure optimum performance. Stancor flybacks are engineered and improved replacements to help make your work more efficient and more reliable.

FREE—Catalog of sheets listing detailed application information on the newest Stancor exact replacement television transformers. See your Stancor distributor or write us for your free copy.

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Export Sales: Roburn Agencies, Inc. • 431 Greenwich Street • New York 13, N. Y.



The 11CY7 is a heater-cathode type double triode intended for use as a combined vertical deflection oscillator and amplifier in series string TV receivers. It is being used in Zenith TV. The 12AE6A is a heater-cathode type pentode designed for use as an i-f amplifier in automobile radios. Plate and screen voltages are supplied directly from a 12 volt battery. The 12EG6 is a heater-cathode dual control heptode for use as an r-f amplifier in super-heterodyne receivers where the heater, plate and screen grid potentials are obtained directly from an automotive battery. The 12EG6 and 12AE6A are used in Motorola auto radios. The 12FM6 is a heater-cathode double detector diode and medium-mu triode. The triode section is intended for use as an a-f voltage amplifier. It is being used in Bendix auto radios. The 6BN4A is a heater-cathode type medium mu triode special version of the 6BN4 with higher gm. The 6BR8A is a medium mu triode and sharp-cutoff pentode with 450 ma heater. It is being used in the new Philco TV. Raytheon Distributor Products Div., 55 Chapel St., Newton 58, Mass. (ELECTRONIC TECHNICIAN 12-33)

For more information, write in ELECTRONIC TECHNICIAN's new product code number on coupon on page 42.

NEW... SENCORE "Electro-Sub"

ELECTRO-SUB
10 BIG ELECTROLYTICS AT 450 VOLTS FOR COMPLETE SAFE SUBSTITUTION

Model 25-103

Check all **ELECTROLYTIC CAPACITORS** in Seconds!

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

- ★★★ COMPLETELY SAFE—no arc or spark when connecting or disconnecting.
- ★★★ AUTOMATIC CAPACITOR DISCHARGE — within seconds after releasing test switch by unique surge protector circuit.
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Carry it anywhere — measures only **only \$15.95** DEALER NET

4 3/4" H x 4 3/4" W x 2 1/4" D

SENCORE SERVICE
INSTRUMENTS CORP.
171 OFFICIAL ROAD ADDISON, ILL.
Another SENCORE "Time-Saver"!

Hi-Fi Specifications

(Continued from page 33)

harmonic, the weaker it is. However, the distortion figure represents all the harmonics present. IM measurements are similar in that the percentage figure is determined in the same manner, but in this case two different sine wave signals are fed into the input, and removed at the output. What remains, if anything, are sum and difference frequencies. Non-linear conditions are responsible for any beat notes. Here too, many variables are possible, including selection of frequencies, relative strength of each, power output level, etc. In the absence of stated conditions of test, it might be assumed that the two frequencies are 60 and 6,000 cycles, with a four-to-one ratio. That is, four parts of 60 cycles and one part of 6,000 cycles. In most actual conditions of operation in the home, amplifiers are not operated at rated power, but considerably less. It is therefore of value to know what the distortion figures are at lower levels. If these ratings are furnished, it will usually be about 10 db below the rated output.

Frequency Response

Frequency response can be broadened and flattened quite readily, and its accomplishment can almost be taken for granted. But because of its importance, it is well to understand the underlying rules for determining this particular characteristic. Any number of audio frequencies from the lowest to the

(Continued on page 63)



"Oh, all right . . . turn the volume up a little!"



MODEL **311**
VTVM

Simpson



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

HANGS ON WIRE FOR CONTINUOUS READINGS

PROVIDES QUICK, PRESSURE CONTACT

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 5½" 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**

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RIDER BOOKS AND MANUALS

HOW TO TROUBLESHOOT A TV RECEIVER (2nd Edition) by J. Richard Johnson. The second edition of this best selling guide to diagnosing TV receiver faults and correcting them brings the original up-to-date, and adds several valuable new categories on troubleshooting data and procedures. Latest developments such as vertical chassis, portable TV receivers, servicing of printed circuit boards, are thoroughly explained.

The subject of controlled-warmup tubes, their uses and electrical characteristics is discussed in detail. Provides guidance in checking picture tubes and correcting faults. #152, \$2.50.

HOME AIR CONDITIONING—Installation and Repair by J. Derman, F. Makstein, H. Seaman. Modern, practical text by three experts, enables you to understand the organization, operation, installation and repair of all types of home air conditioners. You will understand the function of each part; trouble-shooting and repair techniques; how to select the proper unit to meet the requirements of a specific installation. #211, \$3.50.

REPAIRING PORTABLE AND CLOCK RADIOS, by Ben Crisess and David Gnessin. You can learn all about portable and clock radios—their circuitry, their repair. 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.

FUNDAMENTALS OF TRANSISTORS (second edition) by Leonard M. Krugman, P.E. Published in 1954, the first edition of this book gained an international reputation as an outstanding text devoted to the fundamentals of transistors—their characteristics, performance and application. One of its main features was the lucid presentation of the theory of semi-conductors. This, the second edition (revised and expanded), modernizes the text so as to embrace the latest developments in the transistor art and so bring the book completely up-to-the-minute. The numerical examples contained in this book make every equation both understandable and usable. The tremendous number of transistorized devices—radios, amplifiers, etc.—that require a knowledge of transistors, makes this **MUST READING FOR EVERY TECHNICIAN**. #160, soft cover, \$3.50.

3rd SUPPLEMENT to the RECEIVING TUBE SUBSTITUTION GUIDEBOOK, by H. A. Middleton. A must for every technician! Contains more than 830 latest receiving tube substitutions • more than 200 picture tube substitutions • more than 230 American to European tube substitutions • more than 200 European to American tube substitutions • a cumulative index listing the tube types treated in the basic book and all 3 supplements. It pays for itself almost immediately! #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-12



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New Books

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

***HOW TO TROUBLESHOOT A TV RECEIVER.** By J. Richard Johnson. Published by John F. Rider Publisher. 160 pages. Soft cover. \$2.50.

Aptly subtitled, "The Mental and Physical Approach," this second edition covers both the concept of servicing (Deciding Whether to Pull the Chassis) and its technique (Troubleshooting Snivets, or Barkhausen Oscillations). Subjects include receiver sections, preliminary checks, test patterns, controls, tube checking, dead receiver, raster interpretation and sound troubles. There is a considerable amount of helpful information of particular benefit to the beginning and intermediate technician . . . and even a good refresher for a few of the old timers.

***AUDIO MEASUREMENTS.** By Norman H. Crowhurst. Published by Gernsback Library. 224 pages. Soft cover, \$2.90; hard cover, \$5.00.

Here is a most informative book of substantial value to the many service technicians who install and repair hi-fi equipment. Written by a leading authority on the subject, the book covers measurement techniques, test equipment, amplifiers, transformers, pickups, turntables, changers, tape recorders and microphones. Of notable value is the practical material on the use of such instruments as the audio generator, distortion meter and oscilloscope. This book is to be well recommended.

***METALLIC RECTIFIERS AND CRYSTAL DIODES.** By Theodore Conti. Published by John F. Rider Publisher. 164 pages. Soft cover. \$2.95.

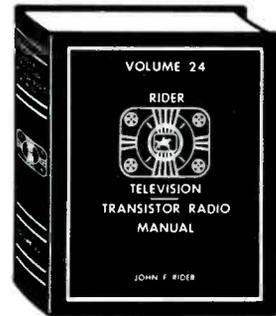
This well-illustrated volume explains the construction, performance and circuit applications of metallic rectifiers and diodes, including silicon, germanium, selenium and copper oxide types. Numerous charts detail the voltage, current, time and temperature characteristics. Considering the many TV-radio-hi-fi-industrial applications of these semiconductors—many of them covered in the text—technicians should find this volume a real aid in understanding the electronic products with which they work.

***SERVICING TRANSISTOR RADIOS.** By Leonard D'Airo. Published by Gernsback Library. 224 pages. Soft cover, \$2.90; hard cover, \$4.60.

After a brief discussion of transistor fundamentals, the text goes into radio circuits, servicing techniques, tests, measurements and a dictionary of transistor terms. An interchangeability chart is included, giving number, type, function and closest replacements. The substantial amount of practical information should make this volume a welcome addition to the technician's library.

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TV Service Information

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**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.

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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.

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New Electronic Products

Wen SOLDERING GUN KIT

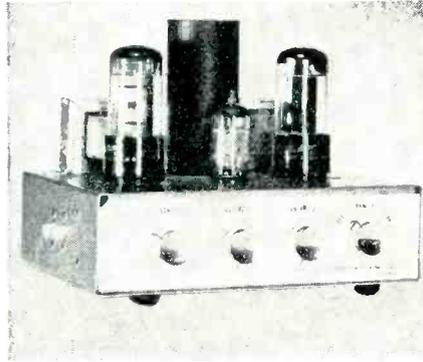
Model 250 heavy duty 250 watt soldering gun now comes in a sturdy metal carrying case. It gets hot in 5 seconds, has a rigid tip, trigger switch, built-in spotlight. The kit contains a 25-x-20 feraloy soldering tip plated for extra service, 25-C-1 cutting tip for plastic



and vinyl tile, 25-F-33 flat iron tip for removing dents in furniture, 5 ft. roll of rosin core solder, 1/16"-3/8" double end nickel plated wrench. An \$18.50 value for \$15.95. 120 v, 60 cycle. Wen Products, 5810 Northwest Highway, Chicago 31, Ill. (ELECTRONIC TECHNICIAN 12-25)

Continental AMPLIFIERS

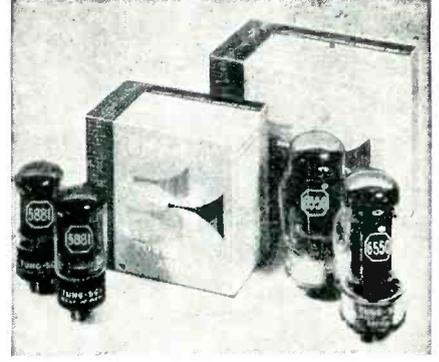
Two stereo amplifiers, designated SA-3 and SA-7, are three and seven watts respectively. Suggested dealer net prices are \$22.45 for the SA-3 and \$29.95 for the SA-7. Technical specifications for the SA-3 are: 1.5 watts per channel;



0.3 to 1.0 volt input for ceramic phono-cartridge, tuner and tape. Tubes: 2-50L6GT, 1-12AX-7, 1-silicon rectifier. For the SA-7: 3.5 watts per channel; 0.3 to 1.0 volt input. Continental Mfg., Inc., 1612 California St., Omaha, Neb. (ELECTRONIC TECHNICIAN 12-32)

Tung-Sol AUDIO TUBES

Types 6550 and 5881 beam power amplifier tubes are now performance-matched at the factory to very tight limits and twin-packed in pairs. Matching eliminates much of the higher order distortion to make possible better sound



reproduction. The 5881's are for service in amplifiers of up to 50 watts; the 6550's are used in amplifiers and commercial sound equipment of up to 100 watts. Tung-Sol Electric, 95 Eighth Ave., Newark 4, N. J. (ELECTRONIC TECHNICIAN 12-30)

for CUSTOM HI-FI installations your best buy is



✓ PRAISED BY THE EXPERTS

✓ PRICED RIGHT FOR YOUR PROFIT

✓ LIFETIME GUARANTEE on SERVICE & ADJUSTMENT



EICO FM TUNER HFT90 with precision "eye-tronic" tuning
KIT \$39.95* Wired \$65.95*
*Less Cover, FET incl.

"(The EICO FM Tuner provides) . . . non-critical tuning, low capture ratio (6db), close-station separation, and insensitivity to drift which are unique among FM tuner kits, to the best of our knowledge . . . one of the best buys you can get in high fidelity kits."
— AUDIOCRAFT Kit Report.



EICO Preamplifiers
HF65A KIT \$29.95, Wired \$44.95.
with power supply:
HF65 KIT \$33.95, Wired \$49.95
HF61A KIT \$24.95, Wired \$37.95
with power supply:
HF61 KIT \$29.95, Wired \$44.95

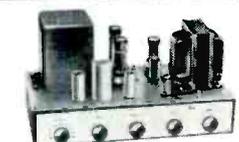
"(The EICO Master Control Preamplifier's) performance rivals that of the most expensive preamps . . . All in all, here is an example of a high level of engineering skill, which has managed to achieve fine performance with simple means and low cost."
— Joseph Marshall, AUDIOCRAFT.

Concerning the EICO 60-watt Power Amplifier: "Listening tests confirmed the fine instrument test results without question. Our HF-60 produced firm, well-defined bass and clear, sweet treble on the finest speaker systems available. It clipped momentary overloads very well and recovered quickly, and this gave listeners the impression of tremendous reserve power. In our opinion, it is one of the best-performing amplifiers extant; it is obviously an excellent buy."
— AUDIOCRAFT Kit Report.

"We believe the EICO HF 52 (50-watt Integrated Amplifier) should prove highly satisfactory for home music systems requiring a 50-watt amplifier. At its price, either in kit form or assembled, it represents an excellent value."—Hirsch-Houck Laboratories.

"For those who have been looking for a well-engineered yet inexpensive power amplifier, the newly-released EICO Model HF-20 unit might offer a simple solution to their problem. Not only does this unit provide 20 watts of power but the circuit incorporates a pre-amplifier and a variety of controls on a single chassis."—William A. Stocklin, Editor, RADIO & TV NEWS.

" . . . the EICO Standard (Speaker System) proved able to create a remarkable illusion of realism from all types of program material . . . String tone was reproduced with a smooth, gutty richness . . . Bass transients were well handled . . . never any sensation of two sound sources; the speakers blended faultlessly . . . an eminently musical reproducer . . . the EICO's compactness and dispersion characteristics would suggest unusual suitability for stereo application."
—J. Gordon Holt, Technical Editor, HIGH FIDELITY.



EICO 50-Watt Ultra-Linear Integrated Amplifier HF52
KIT \$69.95 Wired \$109.95



EICO 20-Watt Ultra-Linear Integrated Amplifier HF20
KIT \$49.95 Wired \$79.95



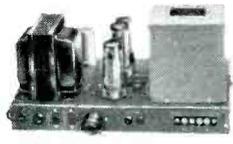
EICO Standard Speaker System HFS2
Completely factory built Mahogany or Walnut, \$139.95 Blonde, \$144.95



EICO Stereo Preamplifier HF85
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EICO Stereo Amplifier-Preamplifier HF81
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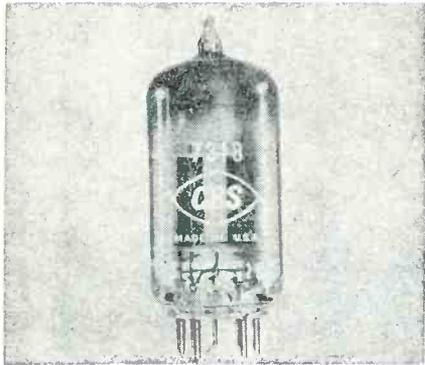
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Show me HOW TO SAVE 50% on top-quality equipment checked: HI-FI
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CBS PULSE TUBE

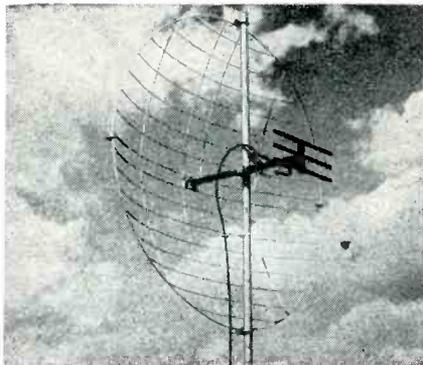
The high pulse-emission 7318, a new reliable miniature twin-triode, provides two amperes of peak current in 10 μ sec pulses. The compact tube features fast operational warm-up. Its major uses include industrial, computer and airborne applications; it is ideally suited for blocking oscillators, square wave



modulators and multivibrators. Warm-up time is given as 10 seconds maximum for 80% of steady-state plate current. Pure tungsten, 175-ma heaters of the 9-pin, medium- μ amplifier, can be connected in series or parallel for operation at 12.6 or 6.3 volts. Bulletin E-318. CBS-Hytron, Parker St., Newburyport, Mass. (ELECTRONIC TECHNICIAN 12-29)

Taco UHF ANTENNA

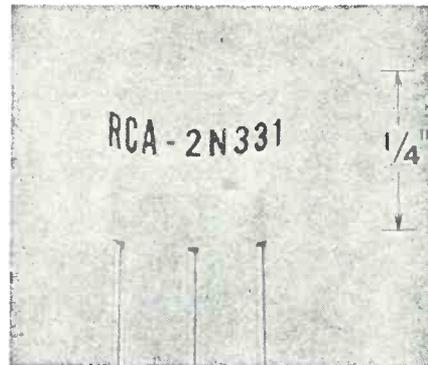
Employing a new principle in UHF TV antennas, the Diversitron offers a gain of 18.5 at Channel 83 and 13.5 db at Channel 20. It is a basic parabolic-reflector-type antenna and employs a four-foot hot-dipped galvanized dish with an anodized driver. The signal



from this reflector is focused to a high-transfer folded dipole. Signal on the folded dipole is further intensified through the use of a screen grid. The antenna also shows an excellent directivity pattern and front-to-back ratio. Technical Appliance Corp., Sherburne, N. Y. (ELECTRONIC TECHNICIAN 12-24)

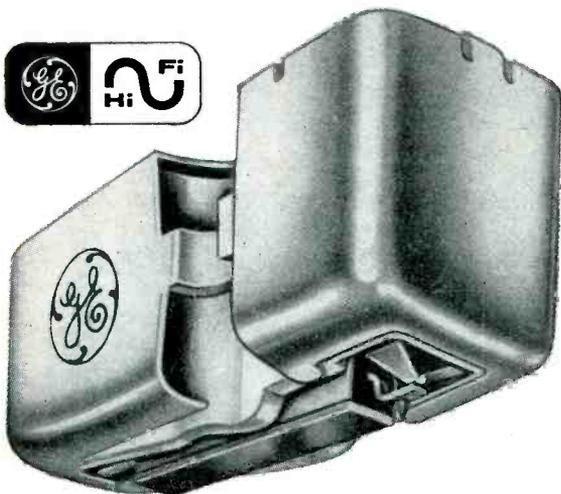
RCA JUNCTION TRANSISTOR

The 2N331 is a new, germanium alloy-junction transistor of the p-n-p type especially designed for use as a low-power audio-frequency amplifier in critical industrial applications where stability and uniformity are required. The 2N331 has a current transfer ratio



characteristic which is essentially constant. In addition, this transistor features low collector and emitter cut-off currents, low base resistance, a typical power gain of 44 db, and a typical noise factor of 9 db. Radio Corp. of America, Semiconductor Div., Somerville, N. J. (ELECTRONIC TECHNICIAN 12-31)

STEREO PROFITS START HERE



- Compatible with both stereo and monaural records
- Full frequency response, 20 through 20,000 cycles • "Floating armature" design for increased compliance and reduced record wear. Effective mass of stylus approximately 2 milligrams • High compliance in all directions—lateral compliance 4×10^{-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.)

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

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

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

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

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

GENERAL ELECTRIC

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

Association News

California

Four Directors were elected to RTASC's Board for a two-year period—George A. Akers, Harley Boltz, Roy Fakler, and John Murphy. Remaining board members who have one more year to go are: Richard J. Kelso, James C. Davis, C. S. Dawson, Russell J. Hamm, and Jack Morrisroe. Recent meeting dealt with the subject of realistic warranties and service allowances which have gotten out of hand. Also attacked were ads showing teenage girls lightly carrying a TV set. Dubious customers are likely to trans- pose their suspicions to the servicing technician. Some of the suggestions included that the manufacturer convert some of these bad sales and advertising practices to appraise the consumer of the tremendous entertainment and educational bargain they get in a TV set, and that a certain amount of cost for maintaining the TV receiver and other modern household appliances is normal and relatively inexpensive when compared to the benefits received. The set maker who can get this point across to the consumer will do much to create a favorable climate for himself, the consumer, and the servicing technician.

The household appliance service industry took the bull by the horns last month and instituted its own apprenticeship training program at the Los Angeles Trade Tech Jr. College. It is a direct outgrowth of official approval, by the California State Division of Apprenticeship Standards, of the Appliance Profession Association's apprenticeship standards.

In welcoming the first class of apprentices, APA's Managing Director, Gerson P. Ribnick, stressed the historic importance and the value of the apprenticeship training program as it concerns the upgrading, in the eyes of the public, of the entire appliance service industry. The course for beginning indentured students lasts four years; during that time, each apprentice is required to spend about three hours per week in class. Periodic examinations will be given to test the progress of the students. For men with some experience in the field, tests have been devised to determine the length of time they will still have to study in order to become journeymen. Representatives of the State Division of Apprenticeship Standards are traveling

through the state, certifying shops for eligibility as training centers. So far, more than one hundred shops in Southern California have been approved. The Appliance Profession Association is composed of shops engaged in servicing and/or selling major household appliances. Its eighteen chapters, spread throughout California, are striving to obtain official recognition for the appliance service shop, through licensing and through upgrading the appliance servicer to the status of a legitimate contractor.

District of Columbia

160 members of the Capitol Radio Engineering Institute Alumni Association of Washington, D.C. attended the annual banquet. Newly elected officers are: Pres., David Steel Sr.; Exec. V.P., Gene Sorensen; V.P.'s, Vincent Lopesti, and A. H. Cross.

Illinois

ARTS is conducting the seventh of a series of technical lectures. This one is on transistors, and eight lectures have been scheduled. The participating companies are CBS-Hytron; Zenith Radio Corp.; Motorola-Chicago, Inc.; Sylvania Electric Products Co.; and RCA Service Company.

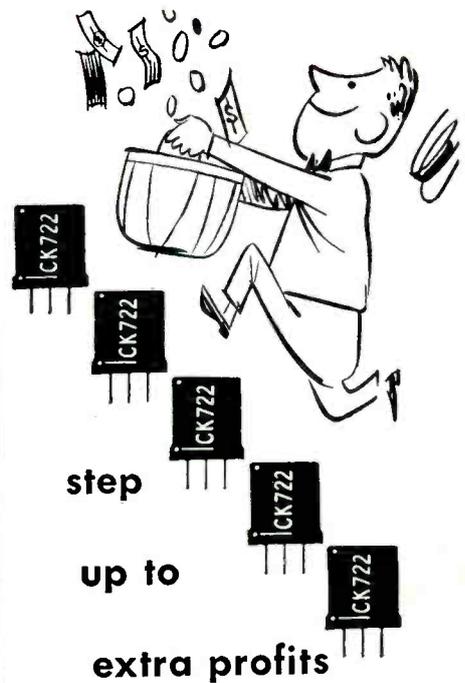
NATESA's Executive Council and Board of Directors will fill out a monthly report to keep them on the ball, reports Vincent J. Lutz, president. These reports will be tabulated and published.

Indiana

Indiana Electronic Service Association, in their reports on the local captive service situation, highlights the mixed attitudes of some companies. Bud Mowrey, RCA Tube Division rep, has offered to work through RCA tube distributors in providing the independent with more effective means of combating the unfair position that the RCA Service Company holds.

Missouri

TESA of Missouri met in Columbia at the Daniel Boone Hotel and elected Vernon Towner to fill a vacancy in the Board of Directors. Mac Metoyer submitted a report on licensing. A new bill is being readied for presentation to the legislature.



STOCK and SELL



TRANSISTORS

You're overlooking a good profit bet, if you are passing up the lucrative transistor receiver servicing business in your area. And the best way to get the lion's share of this good business is to stock and sell Raytheon Transistors. They are first choice of Service Dealers for this type of work because they combine dependable performance with low cost and ready availability.

What's more, hobbyists, engineers and experimenters are buying thousands and thousands of Raytheon Transistors — another source of extra profit for the transistor-wise Service Dealer. For the whole story on Raytheon Transistors call your Raytheon Tube Supplier.



Perma-Power



TRANSISTOR POWER SUPPLY

MODEL A-400

Especially designed to operate, service and test transistor portable radios and low power transistor circuits.

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

\$6450 from Electronic Parts Distributors only

"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 (.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, setting of all transistor battery voltages.
- 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.
- Attractive Slope — Front, Maroon Hammerloid Cabinet — Rubber feet.

Perma-Power

Manufactured by

COMPANY 3100 N. ELSTON AVENUE CHICAGO 18, ILL

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VTVM

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A "foolproof" VTVM with a large, easy-to-read 4 1/2" meter on a sloping panel. Provides 7 AC, 7 DC, 7 ordinary ranges—plus special RETMA (EIA) Ohm scale to check standard resistors and tolerance limits. Operates on 105-125 V. 50-1200 cycles—can be supplied for operation on 220 V. 50-1200 cycle current. Unit has independent line voltage check.

Incorporates specially designed "shift-lever" type function switch with most commonly used functions located at "can't miss" positions. Color coded switch identifies and automatically connects proper probe. Separate jack for HV probe. Meter is shunted by ON-OFF switch when unit is carried. Portable, easy to use—complete with stand, 40" leads with slim probes, and common lead with clip.

Genuine leather, felt-lined carrying case for Model 208. **\$7450** NET **\$9.95** NET

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The Central Electronic Service Conference, scheduled for November 21 to 23 at the Ambassador Hotel in St. Louis, was postponed due to unforeseen circumstances as reported by Lewis Winner to the Chairman of CESCO Conference Committee, TESA's W. O. Hirschberg.

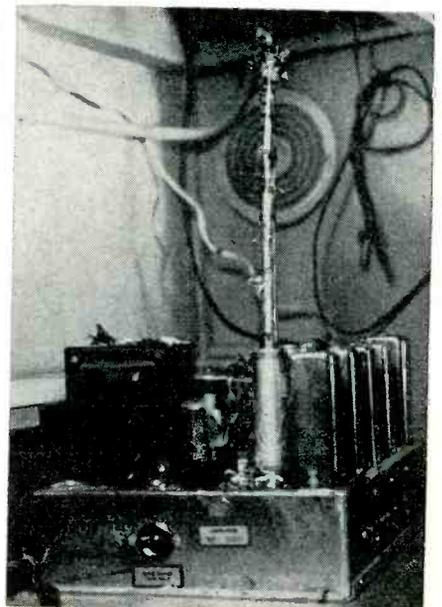
Pennsylvania

ESDA of Mid-state in Harrisburg held their first official election and placed into office as Pres. Wayne Prather; V. P., Charles Ross; Treas., Joe Macko; and Sec'y., Art Molter.

The Television Service Association of Delaware Valley established a Fair Business and Ethical Practices Committee. The committee is now at work methodically checking names, addresses, telephone numbers and employment background of the part time operators in the greater Philadelphia area. Automobile license numbers are being noted of those paying the state's sales tax over the distributor's counter. It is illegal to purchase material for resale without a sales tax registration in this state. The names are being turned over to the authorities. The objection is not to the legitimate part timer, states the association, but to the tax dodger. A competitive advantage is enjoyed by those who avoid paying business and other taxes.

Capacitor Shotgun

Bullet-proof vest needed to service electronic equipment. This capacitor exploded in a hi-fi amplifier while on the bench. The loud shotgun-like bang and flying debris made everyone head for shelter. Christmas decorations—anyone?



Hi-Fi Specifications

(Continued from page 57)

highest are fed in one at a time to the hi fi component. All input signal levels are kept constant, and the output levels for each test frequency is recorded. The standard reference frequency is 1,000 cycles. Any variations in readings for the different test signals are expressed in terms of number of db above or below the output obtained from the reference frequency, and may be displayed in graph form as shown in Fig. 3.

This same technique is used to calibrate equalization networks and other tone controls. Figs. 4 and 5 show typical curves for record equalization and bass treble control circuits respectively. In many instances the frequency response is modified purposely either by fixed non-accessible circuits, such as de-emphasis in FM tuners, tape equalization in tape recorders, etc., or by networks which may be switched or blended in or out. It is essential that

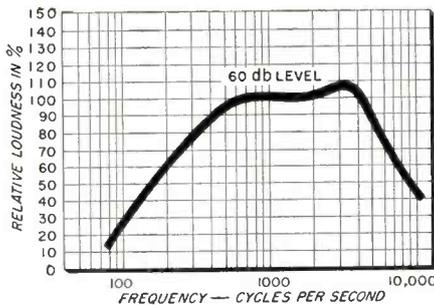


Fig. 6—The average human ear does not respond equally to all frequencies. As the level increases, the response tends to flatten.

these circuits and their effectiveness be taken into consideration when measurements are made, or when trying to interpret the meaning of some of these figures.

The human ear is quite a remarkable mechanism. It is capable of detecting small differences in sound level, a wide range of frequencies and a very wide range of sound intensities, but it has its limitations also. The response curve at a level of 60 db, of an average listener's ear is shown in Fig. 6. It is generally conceded that differences in sound levels of less than 3 db cannot be readily detected; therefore, if the frequency response does not vary more than 3 db over its range it is, for all practical purposes, considered to be flat. An interesting fact to keep in mind when determining power requirements is that it requires twice as much power output to in-



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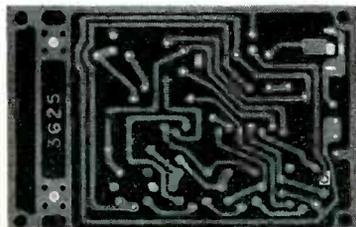


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SPECIFICATIONS FOR ERIE STANDARD AUDIO-AMPLIFIER

- Frequency Response: 30 cycles to 12,000 cycles +0, -3.5 db.
- Sensitivity: 0.56 volt RMS (input at 1 KC) for 2 watt output.
- Power Output: 2 watts • Input Impedance: 2 megohms.
- Output Impedance: 4 ohms • AC Power Consumption: 17 watts.
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crease the output signal 3 db, all other things being equal such as efficiency, distortion, etc. A 40-watt amplifier going full blast would sound just barely louder than a 20-watt amplifier under the same conditions.

Hum and Noise

Hum and noise figures may be obtained for many different modes of operation. When tests are made under no signal conditions, the inputs may be open circuited, short circuited, or terminated with a dummy impedance. The amount of hum and noise may vary for different signal levels. It is, therefore, good to know what the figure is for at least one high and one low signal level. Often the hum and noise figures are weighted to represent more closely what the ear can hear. Weighted ratings when compared to unweighted figures do appear to be much better, but are more realistic. Weighting is usually based on an equal loudness contour curve which shows that the ear is down 1 db at 300 cycles, about 6 db down at 100 cycles, and 9 db down at 60 cycles. Hum is treated separately from noise; only the line voltage frequencies, or harmonics thereof are considered. Noise includes everything else.

Only the hum and noise generated within the units are represented in the specifications. External influences must be kept under control at the time of installation and during the life of the system. The position of the level control is a factor when measuring hum and noise. It is just as unrealistic to accept a reading while the control is wide open as it is when it is completely shut off. Hence one of the reasons for using both a normal high and a normal low setting. One way of expressing this figure is, number of db below a given output. Where the output level is not mentioned, it could be assumed that it is the rated output.

Sensitivity

Sensitivity is the minimum amount of signal needed at the input to provide the rated power output. Here again a family of readings can be obtained by using different input frequencies. In the absence of detailed information, it can be assumed that the ratings apply to the standard 1,000 cycle sine wave input signal, and it represents the number of millivolts of input signal required to obtain the rated output. Amplifier gain may be readily computed by dividing the output voltage by the

input voltage. Gain and sensitivity are different for the various inputs of the amplifier, and it is well to know the ratings for each.

Damping Factor

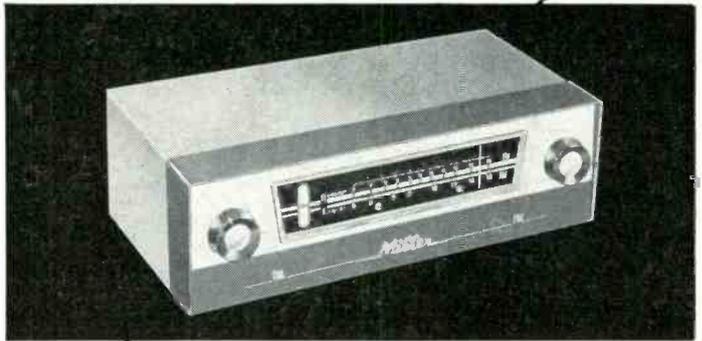
Damping factor is the ability of an amplifier to maintain constant output voltages with varying load impedance. It is the ratio of the rated load impedance to the internal impedance of the amplifier. Here again, unless otherwise specified, the 8-ohm output tap is used when making measurements. The procedure for determining the amplifier's internal impedance is quite simple. Apply just enough of a 1,000 cycle note to the input to produce 1 volt across the unloaded output terminals of the amplifier. Add load resistance until the output voltage is reduced to half of no-load. This resistance is now equal to the internal impedance of the amplifier.

Stability

Modern amplifiers lack only one thing to make them good oscillators, and that is positive feedback. As is commonly known, negative feedback is used to minimize distortion. However, it is virtually impossible to design a circuit with fixed time constants to maintain the same phase conditions for all frequencies. At some point there is going to be a phase change, and what was normally negative feedback will become positive feedback. This is quite common at the ends of the frequency response range. Speakers present a varying inductive and capacitive load to the amplifier at different frequencies, and do alter the phase relationships at some frequencies. An unconditionally stable amplifier is capable of operating into any complex load impedances including an open circuit. A conditionally stable amplifier will oscillate only when operating into a certain complex load impedance. Oscillations, whether they be continuous or intermittent, are undesirable and when they occur in an amplifier, the amplifier is considered to be unstable.

Stability is rated in terms of the amount of pure capacitance that can be placed across the output terminals without causing oscillation. If the amplifier can handle from zero to 15 μf with and without an 8-ohm speaker connected, it can be considered to be unconditionally stable. If an adjustable damping factor control is provided, stability specifications should apply to all settings, otherwise the rating is based on the least stable setting. •

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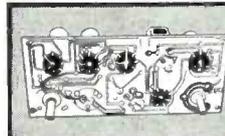
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use 60% Tin-40% Lead
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1958 GE Electronic Technician Awards

Ten TV-electronics technicians who have performed outstanding community services have been selected to receive General Electric's 1958 All-American Awards for public service. Four others have received honorable mention.

The winners were selected by Bennett Cerf, publisher and TV panelist; Senator John Sparkman, Alabama; and Charles E. Shearer, 1957-58 president of the National Junior Chamber of Commerce.

California

Award winner: Stanley Everett, 1325 S. Palm Ave., Alhambra, (Everett's Television and Radio Sales, 2434 W. Valley Blvd.)—Has contributed "truckloads" of used television sets to Parent-Teacher Association drives; invented and "pioneered" a radio space hat to publicize fund drives for veterans' hospitals and other institutions; and is a leader in civic work in Kiwanis Club, Masonic Lodge, Valley Busi-



nessmen's Association; Valley Boulevard Associates Committee, and the Community Church.

Honorable mention: Fred Abrams, Jr., 1718 Artesia Blvd., Long Beach—Serves as civil defense instructor evenings in two different schools, teaching boating, safety practices and elementary navigation; serves on advisory board assisting in apprenticeship guidance and training for Long Beach City College; and is chairman of the board of the State Electronic Association.

Illinois

Honorable mention: Henry Falconio, Jr., Westville, (Falconio Radio & TV)—Leader in community service in Muscular Dystrophy and other fund drives; chief of community rescue squad and also volunteer fire department; active in civil defense emergency communications.

As a reward for their distinguished public service, the ten winners each received trophies and checks for \$500 at a presentation ceremony in Washington, D. C., on Nov. 21. The four technicians named for honorable mention will receive plaques in local ceremonies to be arranged later. Other technicians, still to be named, will receive certificates of commendation for public service.

Massachusetts

Award winner: A. George Cata-volo, 38, 202 Elm Street, Somerville, (Elm Radio & TV Service)—Donates radio equipment and time and service to schools, churches, and youth organizations to promote education



in electronics and reduce juvenile delinquency; has paid for full-page newspaper advertisements addressed "Open Letter to President Eisenhower" encouraging improvements in education.

Award winner: Albert P. Kazukonis, 42, 19 Burton St., Brockton, (Brockton Television, Inc., 743 N. Main St.)—Instructs Boy Scouts and other youths in radio fundamentals



without compensation, contributing materials as well as time; active in promoting better business ethics in the interest of the public.

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- Insulates where applied.
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6 Oz. Spray Can Net To Servicemen **\$3.25**

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- Use for TV, radio and FM.

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

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Minnesota

Award winner: Edwin B. Haines, 31, 415 Layman Lane, Bloomington, (Oxboro Radio & TV, Inc., 636 W. Old Shakopee Rd.)—Provided outstanding support to the Bloomington sports program encompassing more than 2,000 youths participating in football, hockey, basketball and baseball and supported entirely by



individual contributions; Boy Scout leader and counselor; assistance in civic activities such as the Centennial, Lions Club, Civic League.

Honorable mention: Michael J. Myers, 1982 James Ave., St. Paul, (246 Prior Ave.)—Takes foster children into his home to keep them from being placed in institutions.

Missouri

Award winner: Wayne E. Lemons, 34, RFD #2, Buffalo, (A-1 TV & Radio)—Conducted extra-curri-



cular electronics courses in several schools in the state and has been active in youth work in connection with Little League baseball.

Ohio

Honorable mention: Frank Collins, Hillsboro (Collins Appliance Store, 124 S. High St.)—Leader in a project in which members of the Southern Ohio Radio & TV Technicians Assn. installed free of charge complete public address and intercommunications systems in the Hillsboro High School and two new elementary school buildings—three complete control consoles, 70 loudspeakers and provisions for both AM

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and FM radio, three-speed turn tables, and tape recorder attachments for the benefit of 1,500 children in the community.

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Award winner: Vernon E. Brooks, 53, 8 N. White Hall Rd., Norristown, (Brooks Electric Co., 344 W. Marshall St.)—A leading force in the American Business Club consisting of 400 members who have sponsored 102 scholarships to train physical and speech therapists to work with



spastic paralytics; and led in raising a fund of \$100,000 for a school for the handicapped; active in Fire Department, Chamber of Commerce, Red Cross, Community Chest, United Fund and Salvation Army; performs free electronic service for churches; hospitals and other non-profit organizations, with necessary parts supplied at cost.

Award winner: Theodore W. Fickert, 34, 2751 Hatfield Valley Rd., Hat-



field, (Hoover's Radio-TV Sales & Service, Lansdale)—Active in youth work promoting sports and other recreational programs; helped organize Hatfield Junior Chamber of Commerce and served as secretary and state director; has served on Boy Scout Council; a leader in the Heart Fund and other worthy drives; promotes good business relations with his community.

Texas

Award winner: T. E. (Buck) Adams, Channing, (Adams Appliance & Hardware Store)—Donated supplies and installation of all elec-



trical and plumbing in the Baptist Church; voluntarily rigged a special set of earphones to bring television sound to a dying man confined to an oxygen tent during his last months; "he will do anything to help a fellow man—repair a broken down jalopy besides a dusty road, pen a wild cow—where there is trouble, there you will find Buck at work."

Washington

Award winner: Bryce R. McNeely, 35, 110 Williams Ave., Kelso, (McNeely's Ace TV, 1416-14th Ave., Longview)—Assists in a wide range of community projects from child

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—ends most common cause of callbacks!



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- PLACE IN CIRCUIT IN SECONDS — NO DISCONNECTING OF CATHODE
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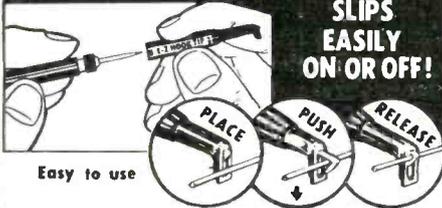
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safety to soil conservation; led a group of men who voluntarily painted the home of an aged widow;



has donated the lot next to his home as a children's playfield; is state vice-president of the Junior Chamber of Commerce.

Wisconsin

Award winner: Vernon Townsend, 48, 1308 North Broadway, Menomonie, (Townsend's Radio & Lock Service, 518 Broadway)—Providing emergency radio communications



service during a devastating tornado on June 4, 1958; devoting a great deal of time to organizing civil defense emergency communications facilities and networks in Dunn County.



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Low-Cost TUBE TESTER and TRANSISTOR CHECKER



Model 800

NEW LEAKAGE AND SHORTS TEST—Checks leakage between tube elements up to 10 megohms.

INCLUDES TRANSISTOR AND DIODE CHECK

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TUBE SOCKETS—4, 5, 6, 7-pin, octal, loctal, noval and 7-pin miniature. Top cap jacks are built into the panel and leads are included.

MICROMHO SCALES—Hickok Mutual Conductance circuits test tubes under simulated operating conditions and accurately evaluate all popular tubes encountered in electronic work. 0-3,000, 6,000, 15,000 micromhos are directly indicated on the meter dial.

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BUILT-IN ROLL CHART—A time saving tube reference chart contains test data for all popular tubes in a new, faster-to-use group system.

The 800 will pay for itself in a short time . . . and give you many years of accurate, **\$159.50 NET** dependable service.

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Meter Switching

(Continued from page 31)

second out. The shortest practical cycle is about 0.25 seconds duration using standard contact meter-relays. As the number of cycles increase, the life of the relay contacts decrease. Many of these controls are supplied with a motor-driven interrupter. This consists of a synchronous motor and cam-actuated switch. One standard arrangement consists of a 1 rpm motor and single notch cam for interruption once a minute. Cams having 1 to 12 notches and motors with speeds from 10 rpm to 1 rph are available. A variety of circuit configurations are possible. Meter relays may have more than one holding coil, one or two meter deflection coils, and one or many sets of contacts. They may be used in various series or parallel combinations. It is possible to replace the interrupter relay with another meter relay for smoother and more rapid action limited only by the response time of the meter, or the time it takes to accomplish the necessary control.

When a meter is equipped with two deflection coils, it is possible to obtain sum and difference interpretations of two signals. The schematic of a differential meter relay having a single holding coil and single set of contacts is shown in Fig. 7. When the two signals are applied in such a manner as to oppose each other, deflection takes place only when one of the signals is greater. Both up-scale and down-scale movements are obtained from this arrangement, and therefore this application lends itself readily to zero-center type meters. When the magnetic forces

created by both signals are aiding each other, the meter will respond to the sum function. With this arrangement it is also possible to obtain a center-scale-normal setting, with control contacts on one or both sides of center, but it would not be a signal-null condition as in the difference application.

Where heavy-duty contacts with more positive make and break action

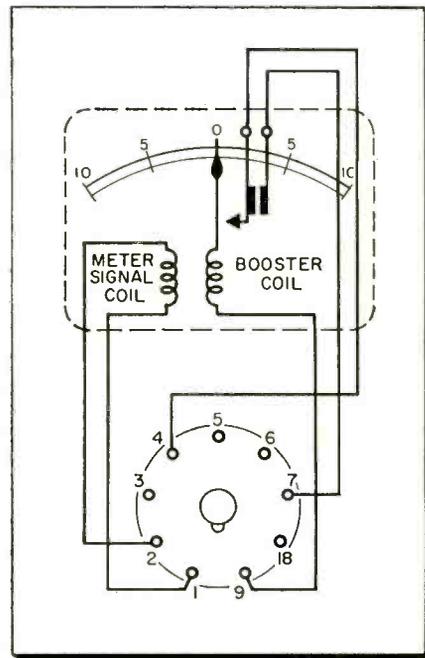


Fig. 8—Heavy duty contacts are held closed by a locking coil. In this application the coil is classified as a booster.

are required on meter relays, they may be mounted adjacent to the regular fixed contact. The regular locking coil then acts like a booster to drive these contacts at the proper time. Fig. 8 shows this application. When the regular contacts close, the booster coil exerts enough force to work on the heavy-duty contacts. These contacts may be normally open or normally closed, depending upon the user's needs. •



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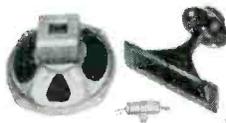
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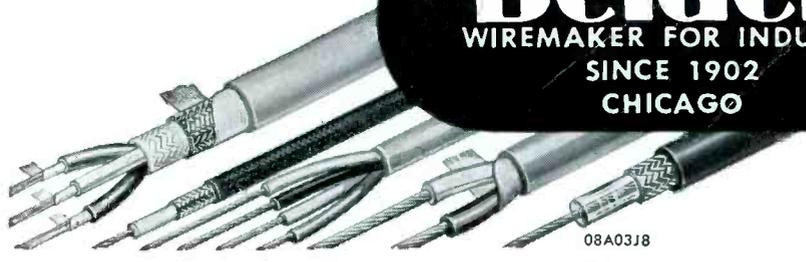
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