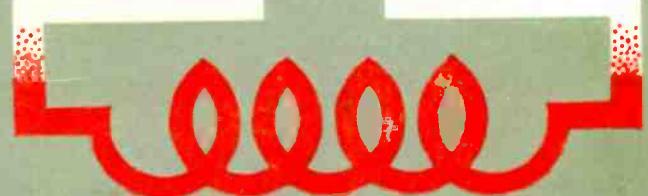
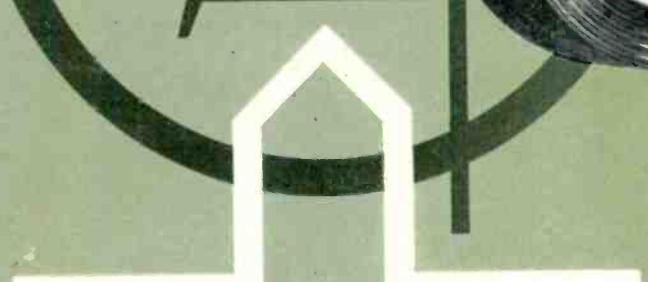
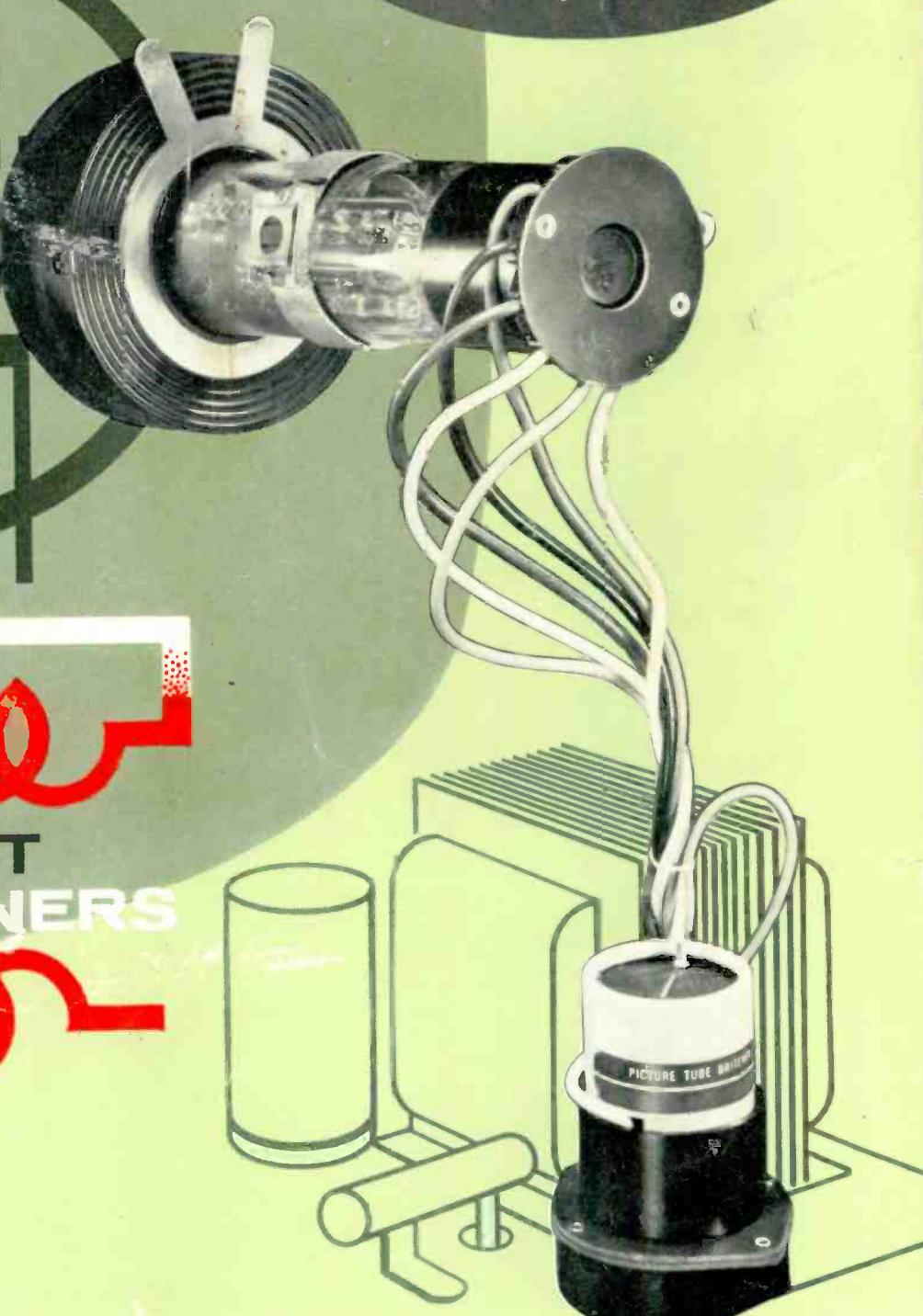
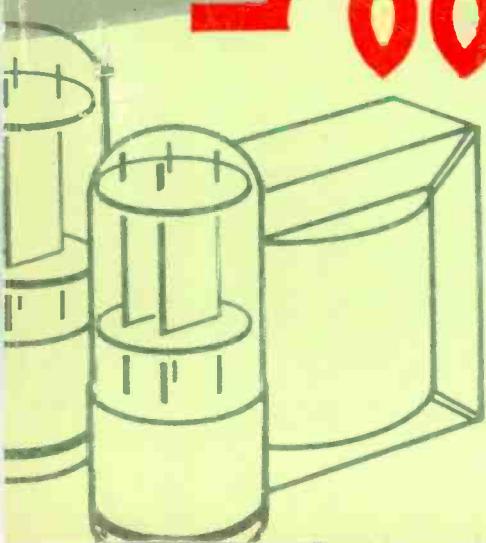


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BRIGHTENERS**



July • 1960

50¢

dealer-serviceman's fuse rack . . .

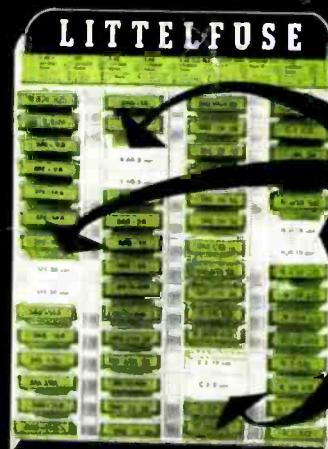
...for wall mounting

most needed



most wanted

...the FUSEMASTER!



dealer-serviceman's fuse requirements at a glance

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July, 1960



FRONT COVER

The unobtrusive "booster" or "CRT rejuvenator" has been in our tube caddies almost as long as picture tubes have been around. Yet, in spite of its utility and age, questions concerning how it works and what type to use—series, parallel or isolation—continue to arise. For a detailed description of this important TV service item, see article starting on page 32.

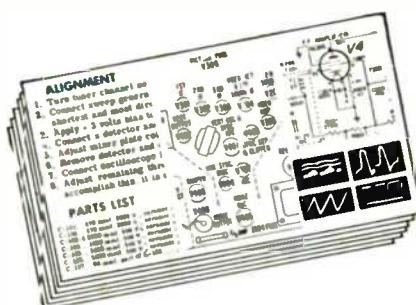
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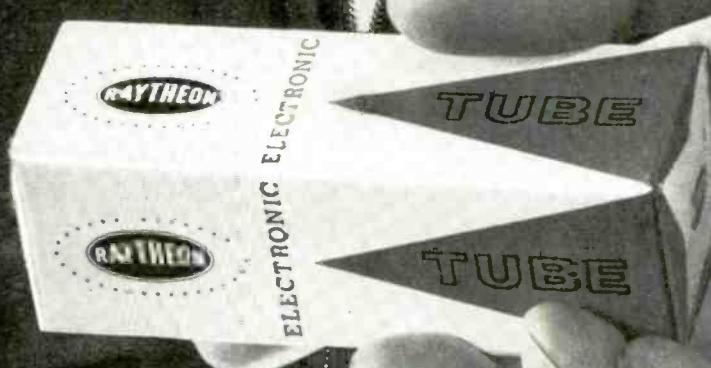
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- MONTGOMERY WARD (Airline): TV Chassis Models GTM 4223A, 4323A
- OLYMPIC: TV Chassis KU, KUU
- WESTINGHOUSE: TV Chassis V-2378-1 & 3
- ZENITH: Transistor Radio Chassis 6ET42Z2

Another bold step in Raytheon's Crusade Against Call-Backs





Raytheon Announces

UNILINE

The new standard of receiving tube quality...
backed by an extraordinary guarantee
against call-back loss.

Now, for the first time, a tube manufacturer offers you a new "tough-type-tested" tube line to protect you against call-backs... UNILINE... built to an entirely new standard of quality and covering the ten types you voted the most troublesome in Raytheon's recent nationwide poll.

We believe the quality of Raytheon's Uniline tubes is so superior that they will become the most trusted and talked about receiving tubes in the industry.

Now... "TAKE TEN AND SEE"!



Your Raytheon Distributor now has in stock specially prepared get-acquainted "Ten-Packs" consisting of one each of the ten Uniline types (1B3GT, 6AU4GTA, 6AX1GT, 6BQ6GTA/B, 6SN7GTB, 1X2A/B, 6CB6A, 6CG7, 6X8, 12AT7). We invite you to "Take Ten and See" if these are not the most trouble-free tubes you have ever used.

To back our complete confidence in Uniline, Raytheon is prepared to make a guarantee never before offered. Your Raytheon Distributor has full details. Prove it to yourself. Start your own Crusade Against Call-Backs today by ordering your Raytheon Uniline "Ten-Pack" in the distinctive new cartons.

RAYTHEON COMPANY

DISTRIBUTOR PRODUCTS DIVISION • WESTWOOD, MASS.

For more data, circle 7-3-1 on coupon, p. 54

PROTECTION where it counts!



TWIN LEAD

Are you in a problem area? AMPHENOL's new Marine Core Twin Lead is winning new friends daily by solving reception problems all over America!

In salt-laden air along the coasts, in ultra fringe areas, in cities with heavy industrial contamination and in locations with heavy precipitation, Marine Core gives protection where it counts, consistently bringing in good pictures.

If you have reception problems try Marine Core—find out for yourself how really good it is!

Marine Core is available in 50, 75, 100 and 500 foot coils and in 1000 foot reels. Order by part number 214-103 from your Authorized AMPHENOL Distributor.

AMPHENOL

DISTRIBUTOR DIVISION

BROADVIEW, ILLINOIS

Amphenol-Borg Electronics Corporation

Editor's Memo



There is a real need in the electronic maintenance industry for specialized, advanced technical training.

In recent months, a number of inquiries have come our way requesting information on places to obtain advanced training in such specialized skills as two-way radio, high fidelity, factory electronics, public address, instrumentation, etc. Frequently, we have been hard put to find a place where ambitious and capable electronic technicians can obtain such schooling.

There are a number of electronic schools which offer excellent courses in many electronic subjects, but these are generally of a basic or scholastic nature. What we need are highly specialized training programs with the overwhelming emphasis on the practical "how-to" for those people who already have a solid background in theory.

There are a few manufacturers that offer such courses, but these are usually limited to a select number of technicians working on certain products in the manufacturer's own line. There are a few books which are helpful, and certainly some trade magazines make a substantial effort to convey such practical and advanced data to their readers.

All of which leaves us with the catch-as-catch can procedure now employed—on the job training. Learning by doing is excellent when the supervision is qualified. However, all too often a technician wishing to specialize must go it alone, learning by botching.

We suspect that electronic schools can tap a good source of revenue and help develop real career skills if they would offer such advanced, practical and specialized courses.

Specialized training opens many doors to advancement. You may not need such training if you are like the young man who started work in the shipping department of a wealthy 20 man service company. Soon he was appointed technician, service manager, and after only two years, vice president.

One day the boss called him in and said, "You have done so well that I have decided to retire and to make you president."

The young man blushed and meekly said, "Thanks dad."

Al Forman



This service man is installing insurance against costly call-backs...capacitors made with MYLAR®

You can save money by using capacitors insulated with "Mylar"** polyester film... eliminate wasted call-backs for failure of newly installed capacitors. "Mylar" means superior performance for four important reasons.

1. High dielectric strength . . . "Mylar" averages 4,000 volts per mil breakdown strength.

2. Long life . . . neither time, temperature nor highest humidities affect the stability of "Mylar".

3. Size reduction . . . the high dielectric strength of "Mylar",

coupled with its great physical strength, permits its use in thinnest gauges. Smaller capacitors are ideal for hard-to-get-at jobs . . . save precious space.

4. Proven value . . . leading manufacturers make capacitors insulated with "Mylar" for critical military applications, missiles and sensitive electronic computers.

Next time you order, ask your distributor for the extra reliability, long life and economy of trouble-free capacitors made with "Mylar". And for test data that details the basic properties of "Mylar", write for Du Pont's free booklet. E. I. du Pont de Nemours & Co. (Inc.), Film Dept., Room #16, Wilmington 98, Delaware.



REG. U. S. PAT. OFF
BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

*"Mylar" is Du Pont's registered trademark for its polyester film.



See DuPont's complete line of industrial films at WESCON, Booth #1034-35

For more data, circle 7-5-1 on coupon, p. 54

NEW WAYS RCA CAN HELP YOU

set up for greater profits

RCA's big continuing program to improve your business is now bigger than ever!

Today you'll find available to you through your Authorized RCA Electron Tube Distributor a variety of new methods, means and materials to help you SET UP FOR GREATER PROFITS. These new aids and services represent the latest phase of RCA's tailor-made program to help you build your business. They include:

- **New equipment for store improvement—to bring added attractiveness to your sales area and greater efficiency to your service area;**
- **New ideas for successfully selling your service;**
- **New informative material to help you open up a whole new area of business: COLOR TV SERVICING.**
- **New conveniences to speed home service calls:**

Check with your Authorized RCA Electron Tube Distributor today. Find out how you can get in on these new aids and services to improve your business, build your position in the community, and increase your profits.

RCA Electron Tube Division, Harrison, N. J.



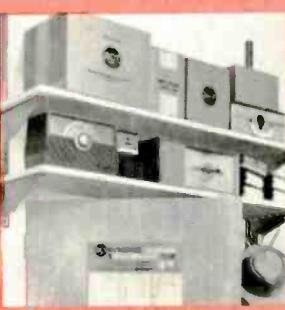
The Most Trusted Name in Electronics
RADIO CORPORATION OF AMERICA

improve YOUR PLACE OF BUSINESS

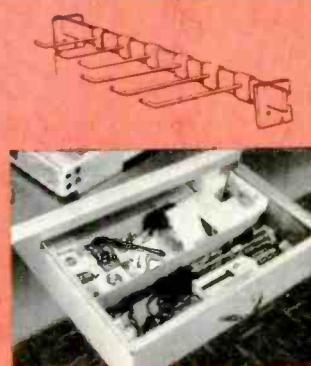


Attractive sales and service areas are invaluable business assets. Plan yours with components from the RCA Store Improvement Program—all available through your RCA Distributor.

NEW Space-Saving Shelving Units help you make use of space over doors & windows, under counters.

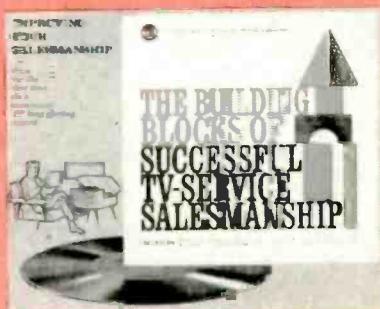


NEW RCA Accessory Bar Kit attaches to wall or shelf-unit standards. Moveable hooks support anything from wire spools and tools to test instruments.



NEW RCA Special Drawer Unit provides a three-way benefit. Attaches under counter as utility drawer in service shop, cash drawer in sales area; or several drawers can be stacked together as a separate stand-up unit.

strengthen YOUR SALESMANSHIP



Here for the first time on a convenient 12" LP record are proven ideas on how to sell your services more effectively. Just sit and listen. Discover how you can apply successful selling techniques to the every-day aspects of your business.

Down-to-earth tips on: • Your Store • Handling Store Customers • Telephone Techniques • Home Service Calls • Advertising—and much more.

develop NEW BUSINESS

Profitable new business awaits you in COLOR TV SERVICING—provided you're ready to take advantage of it. Now RCA—world's foremost color TV authority—offers you a FULL 11-LESSON HOME STUDY COURSE to make you the color TV expert of your community. Prepared by RCA Institutes, it's a complete education in principles and practices of color TV servicing. ACT NOW: the course is a limited-time offer through your RCA Tube Distributor.



And to supplement the course, the famous RCA COLOR TV PICT-O-GUIDE makes an ideal refresher and quick reference on color-TV problems and how to correct them.



speed YOUR SERVICE

Make your home service calls faster, easier. This new lightweight, compact "Quick Call" Tube Caddy has a rugged wooden construction with two-color leatherette covering. This perfect mate to the big RCA "Treasure Chest" is just the thing for service calls that don't require a full tube complement.



New Lightweight "Quick Call" Tube Caddy



Standard "Treasure Chest" Tube Caddy



you can
now
provide
**multiple-master
multiple-remote systems**
with new, complete

BOGEN
CHALLENGER SERIES
INTERCOM LINE



New, complete Bogen Challenger intercom line now includes intermix units—fills all essential intercom requirements—expands your market, greatly increases your sales potential and competitive position.

With the addition of the new intermix units to the Bogen Challenger Intercom line, you can now plan any kind of system—single-master/multiple-remote . . . multiple master . . . and multiple-master/multiple remote, the last permitting any required combination of masters and remotes. And you can also use remotes capable of initiating calls to six master stations.

With the new versatility offered by the Bogen Challenger line you can now fill virtually every intercom requirement with proven equipment that is known to provide reliable, trouble-free day-in-and-day-out performance—equipment whose handsome, modern styling and lower cost give you a decided competitive advantage with any intercom prospect.

THE NEW MODEL CHX12 INTERMIX MASTER STATION can be used with up to twelve other stations consisting of masters and remotes in any combination desired. List price \$63.00

THE NEW MODEL CHXR INTERMIX REMOTE STATION designed to receive and respond to calls from CHX12 Masters, is equipped with a six-position station selector switch, and can initiate calls to any one of six masters. List price \$17.50

The Bogen Challenger Intercom Line also permits you to plan low-cost systems where intermix operation is not required. These units are designed for either single-master/multiple-remote or all-master systems.

MODEL CHM6A MASTER STATION can be used in a six-station system with up to five CHR remotes or five other CHM6A masters. List price \$45.95

MODEL CHM12A MASTER STATION is identical to CHM6A, but designed for use in twelve-station systems with up to eleven CHR remotes or eleven other CHM12A masters. List price \$49.95

MODEL CHR REMOTE STATION is designed to receive and respond to calls from CHM6A, CHM12A or CHX12 Masters and to initiate calls to one master. List price \$12.95

all prices slightly higher in West

The new complete Bogen Challenger Series intercom line puts you in number one position to cash in on a bigger share of the big intercom market—a market that is growing by leaps and bounds.

See your Bogen Sound Distributor.
For complete details and specifications, write to Dept. ET-7.

BOGEN-PRESTO, PARAMUS, N. J. A DIVISION OF THE SIEGLER CORPORATION

Look to Bogen-Presto for the big profit opportunities in sound
For more data, circle 7-8-1 on coupon, p. 54

LETTERS

To the Editor

Association Comments

Editor, ELECTRONIC TECHNICIAN:

Our secretary, Mr. Melvin Cohen, forwarded me a copy of your May 1960 editorial, "Showdown at Distributor Gulch," which deals with the problem of distributor wholesale practices. He suggests we poll our membership as to the advisability of setting up a National Conference with wholesalers, service dealers, and manufacturers. I have directed him to do this and he will advise you of results. Speaking for the moment as an independent serviceman and not as an association leader, let me commend you for this outstanding editorial. It's high time other segments of the industry realize we have a problem and start thinking about taking steps to correct it.

IRVING J. TONER, President
Empire State Federation of
Electronic Technicians Assocs., Inc.
East Aurora, N.Y.

. . . I read with astonishment your May editorial, "Showdown at Distributor Gulch." It is tremendous, it is magnificent, it is items such as this that makes this association proud of granting your magazine its highest award, "ESDA Award of Honor," and I say to you and your fine staff—Keep it up, service needs you.

JOSEPH R. DOYLE, President
Electronic Service Dealers Assoc.
of Western Pa., Inc.
Pittsburgh, Pa.

. . . In your May editorial your proposal for a national conference is most commendable. We have stated such a proposal more than a few times. Naturally, with all NATESA affiliates committed to a "Selective Buying" program, such a proposal invites rejection, particularly if the proposal is made by TEAM. I hope that you are more successful than we have been. It is interesting to note that "Selective Buying" was aimed at manufacturers and after meeting with disdain and ridicule from these manufacturers, the new target has become the distributor, who might be easier to hit. I suggest not one conference with the entire industry represented, but two: the first with NATESA as the service industry representative and the second with all associations not affiliated with NATESA, as representing the service industry. No responsible service dealer approves of component sales to consumers at wholesale prices. But due to mail order catalogs which whet the appetite of the consumer for "wholesale" buying, I think it is preferable to sell them in ones own city, where it adds to local volume of sales, rather

Continued on page 10

For more data, circle 7-9-1 on coupon, p. 54 ➤
ELECTRONIC TECHNICIAN • July, 1960

NEW ILLUMINATED DEALER SIGNS!

pick
the one for your store!



14" x 50" with clock and changeable copy panel
14" x 37" with changeable copy panel



ALL THREE SIGNS IN BRILLIANT BLUE
AND RED ON A WHITE BACKGROUND.



**Channel Master's big, bright spectaculairs
increase your sales. Day and night, they:**

- IDENTIFY YOU IMMEDIATELY AS A CHANNEL MASTER DEALER
- STIMULATE STORE TRAFFIC
- HELP YOU CAPITALIZE ON CONSUMER PREFERENCE FOR CHANNEL MASTER PRODUCTS
- ADD TO THE APPEARANCE OF YOUR STORE

Call your Channel Master distributor today

Sonotone's 1960 census.....over **10,
000,
000,
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(yes, 10 million)
cartridges
now in use!

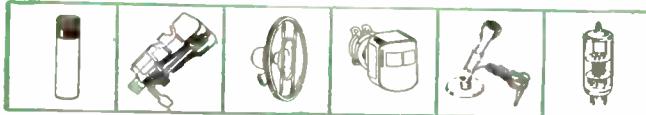


Only a few years ago, Sonotone invented the ceramic cartridge...and has been setting sales records ever since. And no wonder! Over the years, Sonotone has developed its fine cartridge line to the point where today it's the standard of the industry. Models available for virtually every type of phonograph...used as original equipment by over 70 manufacturers. In fact, Sonotone has already sold over 10,000,000 cartridges. Your customers will hear the difference...with Sonotone ceramic or new crystal cartridges.

Sonotone[®]

ELECTRONIC APPLICATIONS DIVISION, ELMFSORD, N.Y., DEPT. C9-70
IN CANADA, CONTACT ATLAS RADIO CORP., LTD., TORONTO

LEADING MAKERS OF



BATTERIES • CARTRIDGES • SPEAKERS • TAPE HEADS • MIKES • ELECTRONIC TUBES

For more data, circle 7-10-1 on coupon, p. 54

(Continued from page 8)

than add to profits of the mail order firms. The absence of any known method to refuse to sell, or rather to prevent the consumer from buying at wholesale prices somewhere, is where the fault lies, not with the distributor. Personally, I feel the tremendous investment represented by a distributor's inventory warrants a little consideration by service dealers. The service dealer, in demanding absolute loyalty from a distributor, is being most unfair if he does not give the same loyalty to the distributor. There is but one way to improve conditions in this industry and that is through sensible discussion of the problems with all parties concerned.

W.C. PECHT, Editor
TEAM News
St. Louis, Mo.

. . . Thank you for the copy of your May editorial. Your position in opposing the action of wholesalers selling retail at wholesale should be found in agreement with all professional electronics repair men. For many years this violation of sound business ethics by some electronics distributors has been a problem in this area. Who is to blame? I for one do not put all the blame on the offending distributors. They are under pressure to move merchandise. The manufacturers come in for their share of the blame, but they too are not the only ones to point at accusingly. They must sell their products. Government contributes to this delinquency of our distribution systems, but they too are under pressure to please the voters and most voters like to buy at the lowest prices possible. The dealer himself must share the blame. Some are careless in their pricing procedure and not always too loyal to those jobbers who are trying to protect them. The public and Government are showing in various ways that they believe two step distribution to be inefficient and obsolete. Sooner or later the one step system will become standard or shall I say a one and a half step. Distributors will retail openly and carry on a half step or wholesale department. Dealers will combine to set up distributor operations.

JOHN H. STOLL, Secretary
Associated Radio & TV Servicemen
Peoria, Ill.

. . . "Showdown at Distributors Gulch" set a new high—even for you!

G.J. HORNADAY, Editor
The Printed Circuit
High Point, N.C.

. . . Your May editorial was so timely, we have sent 600 copies to our key people.

FRANK J. MOCH, Executive Director
National Alliance of TV
& Electronic Service Assocs.
Chicago, Ill.

(Continued on page 12)

**There's a better way
to cut off callbacks**



Your choice of the parts you use has a lot to do with the number of calls you get that become callbacks. When it comes to tubes, Tung-Sol Blue Chip quality is practically built-in callback insurance. Tung-Sol tubes are made to set manufacturers highest standards. They're best for every set — radio, tv or hi-fi. Use them. They'll keep the line clear for money-making service calls. Tung-Sol Electric Inc., Newark 4, N. J.

Tell your jobber you'd rather have

t s **TUNG-SOL®**

Blue Chip Quality

TUBES • TRANSISTORS • DIODES

For more data, circle 7-11-1 on coupon, p. 54

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DEVICES

...for high quality, low prices!

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- *Power Transistors*
- *Diodes • Transistors*

Follow the leaders...the profit leaders in the electronic servicing field! When you have to replace a silicon rectifier or a power transistor, or any diode or transistor, you will find it in the Sylvania line. That's the way to save time, keep costs down and profits up.

For immediate delivery see
your **SYLVANIA**
SEMICONDUCTOR
DISTRIBUTOR

NEW service-dealer's "SEMICONDUCTOR COMPLEMENT MANUAL" — only 50¢. Now at your Sylvania Distributor's. A time-saving guide to semiconductor replacements. Gives set manufacturers' parts numbers with corresponding transistor-type numbers for cross-reference. Gives U. S. equivalents of foreign transistor types. Get your copy from your local Sylvania Distributor, or from Sylvania, P.O. Box 37, Buffalo 9, N.Y.

Check your stock and fill in with quality-assured Sylvania semiconductors. Sylvania Semiconductor Division, Woburn, Mass.



SYLVANIA

Subsidiary of **GENERAL TELEPHONE & ELECTRONICS** 

(Continued from page 10)

... Referring to your May editorial, we as an association, are very glad to have your most welcome assistance in this matter. As you are well aware, this is not only a local problem, but an evil that exists all over the country.

JOHN O. BRUDER, Secretary
TV & Electronic Service Association
Sheboygan, Wisc.

Distributors' Comments

Editor, ELECTRONIC TECHNICIAN:

It is our intent to place in the hands of every service dealer within the Western Pennsylvania area this significant editorial.

HARRY J. HUNTER, Secretary
Mutual Distributors, Inc.
Pittsburgh, Pa.

... You are to be commended for the very fine editorial in the May issue. I refer to "Showdown at Distributor Gulch," which is most timely and up-to-date. We believe more of our dealers should have the opportunity to read this interesting article.

ELLIOTT WILKINSON
Wilkinson Brothers Co.
Electronic Distributors
Dallas, Tex.

Service Dealer Comments

Editor, ELECTRONIC TECHNICIAN:

Your editorial in May, "Showdown at Distributor Gulch," has made me write you. I'm sure you've bitten into a real sour apple, and I'd like to see the outcome. It seems that distributors like the volume that comes from selling to the public, so they call themselves discount houses. Take a close look at distributor history in the past 10 years. The ethical ones have remained small—the unethical have branched out with 5 to 15 outlets. I have given up trying to compete with the distributor—how can I compete? He has the edge with all the aces.

CLYDE D. MERVIS
Red Top Paint & Hardware Co.
McKeesport, Pa.

... The May editorial just hit the spot. My distributor sells picture tubes, transistor radios, etc. at the wholesale price to anyone that walks in. I've lost a tremendous amount of business because of him. There should be a law against it.

LEVINSON'S RADIO & TV REPAIRS
Brooklyn, N.Y.

... I wrote an article on wholesale and discount houses which I had printed. Included is the following: "When a small business man goes to buy his parts and supplies at the wholesale house or at his distributor, he never knows if he will see one of his neighbors or customers buying at the same prices he pays. This person has no right to be there. He has no licenses (business men have to pay for different types). In many cases, this same per-

(Continued on page 14)

SUCCESSFUL SERVICEMEN



**SAVE
CUSTOMERS**



**SELL MORE
TUBES**



**MAKE
MORE MONEY**

WITH



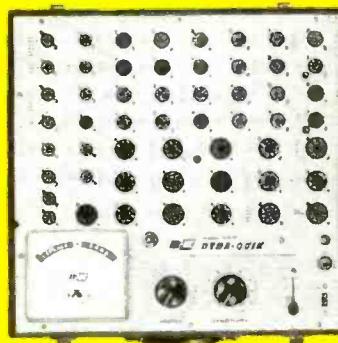
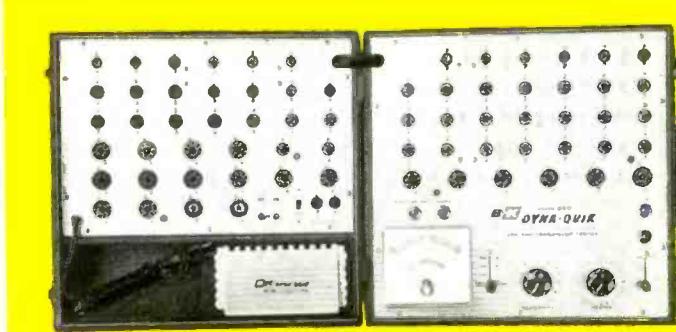
DYNA-QUIK

DYNAMIC MUTUAL CONDUCTANCE

TUBE AND TRANSISTOR TESTERS

Many thousands of servicemen today insure their professional reputation and make each job more profitable—with B&K testers. Each model is based on actual servicing experience, and combines both speed and accuracy. Each is designed to meet individual servicing needs. Each is a top value, with features that mean more for your money.

Measures true dynamic mutual conductance—not just emission. Makes complete tube test under the actual dynamic operating conditions of the TV set. Tests complete set in minutes. Shows your customer the true tube condition. Sells more tubes right-on-the-spot. Saves costly callbacks. Pays for itself over and over again. It's good business to choose B&K.



↑ **MODEL 650.** Fastest and most complete portable Tube and Transistor Tester. Checks over 99% of the tubes most widely used in television receivers. Tests each section of multiple tubes separately for Gm, Shorts, Grid Emission, Gas, and Life. Includes spare sockets and filament voltages for future new tube types. Tests transistors, too. Net, \$179⁹⁵

← **MODEL 675.** Completely reliable, long-service Automatic Tube and Transistor Tester. Only 60 indexed phenolic Dyna-Cards test over 99% of tubes most widely used in television receivers. Tests each section of multiple tubes separately for Gm, Shorts, Grid Emission, Gas, and Life. Easily kept up-to-date with extra cards and punch included. Tests transistors, too. Net, \$169⁹⁵

← **MODEL 550.** Low-cost professional model for limited budgets. Provides 52 tube sockets to test more tubes faster, easier. Accurately quick-checks most of the television tubes usually encountered in everyday service work. Tests each section of dual tubes separately for shorts, grid emission, gas content, and leakage. No multiple switching. Big value. Net, \$119⁹⁵



See Your B&K Distributor or Send for Bulletin AP15-T

B & K MANUFACTURING CO.
1801 W. BELLE PLAINE AVE • CHICAGO 13, ILL.

Canada: Atlos Radio Corp., 50 Wingold, Toronto 10, Ont. • Export: Empire Exporters, 277 Broadway, New York 7, U.S.A.

For more data, circle 7-13-1 on coupon, p. 54

Citizen's Band Radio Operators!



For improved
reception, quality
and range, use

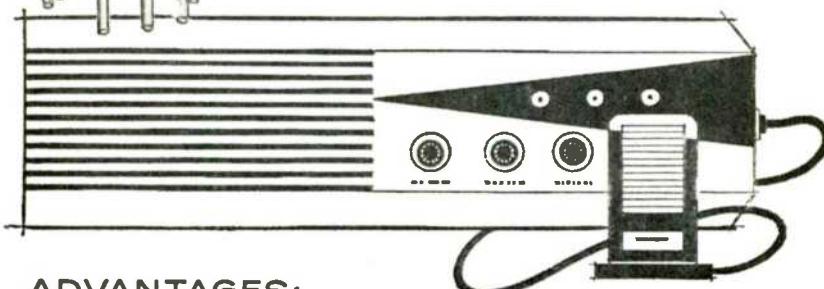
Sarkes Tarzian Full Wave Silicon Rectifiers

S5347—replaces 6BW4 or 12BW4

S5017—replaces OZ4

Tarzian silicon rectifiers are available to replace
over 95% of all popular vacuum tube rectifiers

\$13.00
user's
price



ADVANTAGES:

- Improved performance
- Cooler operation
- More reliability
- Less power drain (batteries last longer)
- Longer life for components
- Better regulation

Sarkes Tarzian's new Full Wave Silicon Rectifiers are ultra-high performance replacement tubes that give you the very maximum in reception, quality and range. Cool operation improves reliability and long life of all components.

Ask your repairman for a Sarkes Tarzian Full Wave Rectifier replacement, or see your nearest Sarkes Tarzian distributor. For additional information about Sarkes Tarzian tube replacement silicon rectifiers, write Section 5102B.



SARKES TARZIAN, INC.

World's Leading Manufacturers of TV and FM Tuners • Closed Circuit TV Systems • Broadcast Equipment • Air Trimmers • FM Radios • Magnetic Recording Tape • Semiconductor Devices

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or more (a circle 7-14-1 on coupon, p. 54)

(Continued from page 12)

son does not pay any taxes on the articles bought, such as sales tax or income tax when the article is sold or used."

PATRICK W. DAVIS, JR.
Lincoln Radio & TV
Pittsburgh, Pa.

. . . My principal competition on tube prices comes from mail order houses, who sell to anyone, dealer-licensed, sales-tax-paying or not, at approximately distributors' prices. If I can meet this by convincing customers that it pays to have tubes checked by an experienced serviceman, avoiding the unnecessary mauling around of tubes which are doing their job and the possibility of damage to a receiver, and without the delay of the mails, and without the collecting of a service charge where no service is performed other than tube checking, then I can sell tubes at list prices to satisfied customers. As to a standard charge on service calls, I feel that this is a matter each serviceman or organization must determine for themselves.

LEO FRUIT

Macks Creek, Mo.

Education

Editor, ELECTRONIC TECHNICIAN

Thank you for the courage of your February Editor's Memo which bucks the popular and powerful educational trend toward disqualifying people past 40 who discontinued high school with a diploma but commenced college without a diploma from any job that pays more than just good money. Henry Ford said, "The man who has stopped learning is old." And, this while admitting that the classroom is the easiest and best way to learn most things—but not the only way. ELECTRONIC TECHNICIAN is one of my many educators.

ADRIAN McMANUS

Adrian—TV
Trenton, N.J.

Comments on Sears Comments

Editor, ELECTRONIC TECHNICIAN

In answer to Jules Elkish's May letter, "Did you ever look at a Silvertone TV?" My answer is yes, quite a few, having been in electronics since 1924. I have to agree with him, most Silvertone TV sets do have a schematic and a tube layout glued inside the cabinet. But, Jules forgot to say they are printed so small that a serviceman must carry a magnifying glass to read them. Not only that, but quite a few of these tube layouts are upside down as viewed from the back of the cabinet. If Sears wants to help the service industry, why can't they start by printing the schematics and tube layouts so a serviceman can read them.

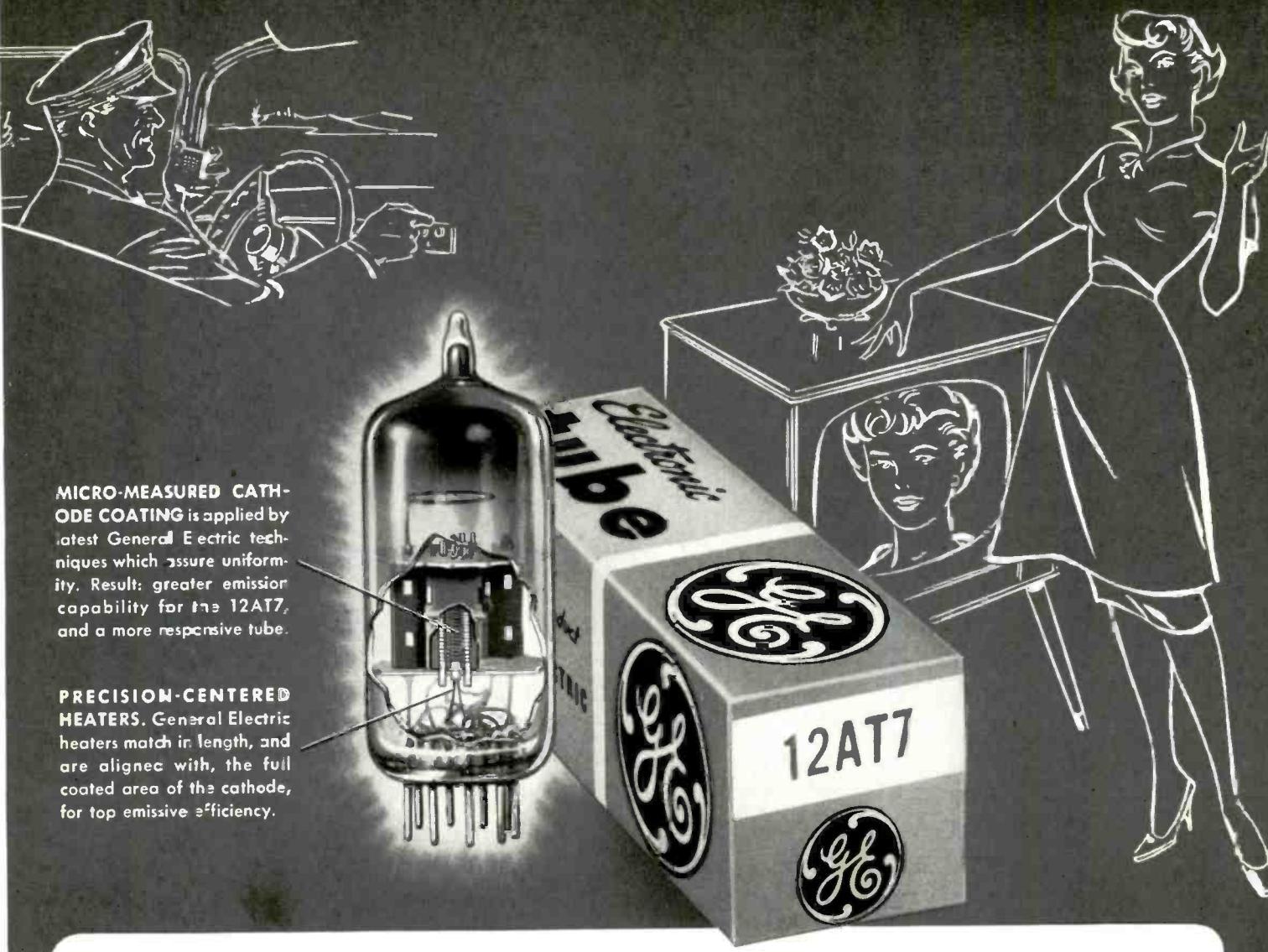
H. L. GRISTY

Gristy Radio & TV
San Saba, Tex.

(Continued on page 18)

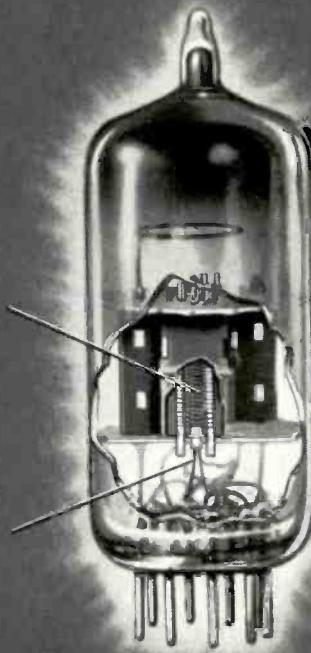
For more data circle 7-15-1 on coupon, p. 54 ➤

ELECTRONIC TECHNICIAN • July, 1960



MICRO-MEASURED CATHODE COATING is applied by latest General Electric techniques which assure uniformity. Result: greater emission capability for the 12AT7, and a more responsive tube.

PRECISION-CENTERED HEATERS. General Electric heaters match in length, and are aligned with, the full coated area of the cathode, for top emissive efficiency.



TWO big markets await super-sensitive G-E 12AT7!

Superior mobile reception, more dependable home TV:
now you can provide both... profitably!

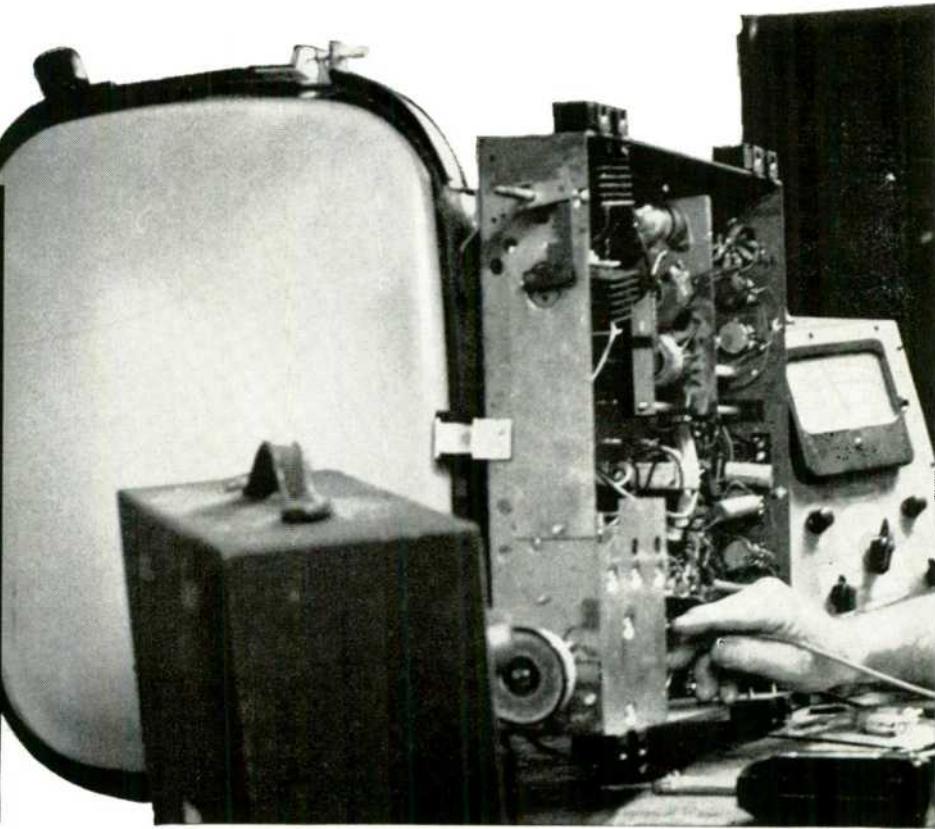
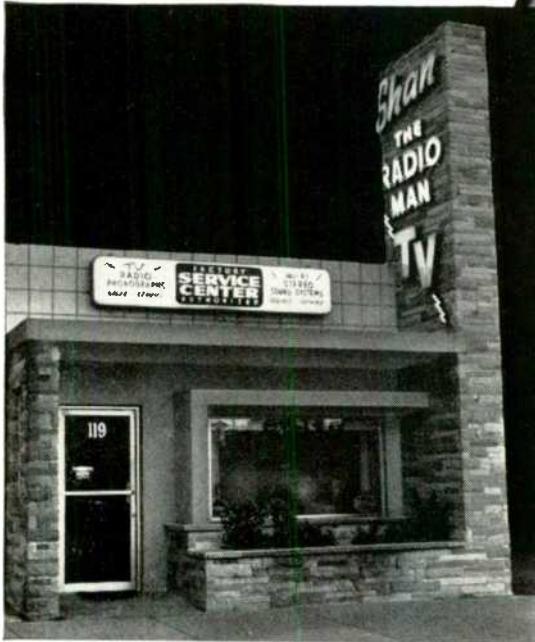
Highest sensitivity of any 12AT7, especially at low voltages! Puts General Electric's twin triode in a class by itself. You can offer improved reception to police, ambulance, other FM mobile-radio users with a battery or generator power source. Also, you can install the tube to help set owners ward off faulty home-television performance when line voltages drop.

Plenty of sockets for the Service-Designed 12AT7! Make new friends with this fine tube... make money, too! With its close inter-element spacings Type 12AT7 must be built right—as General Electric builds it. Get the full quality story from your G-E tube distributor! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Kentucky.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

31-234



Shan the Radio Man says:

"100 years' experience has proved we can depend on Mallory components."



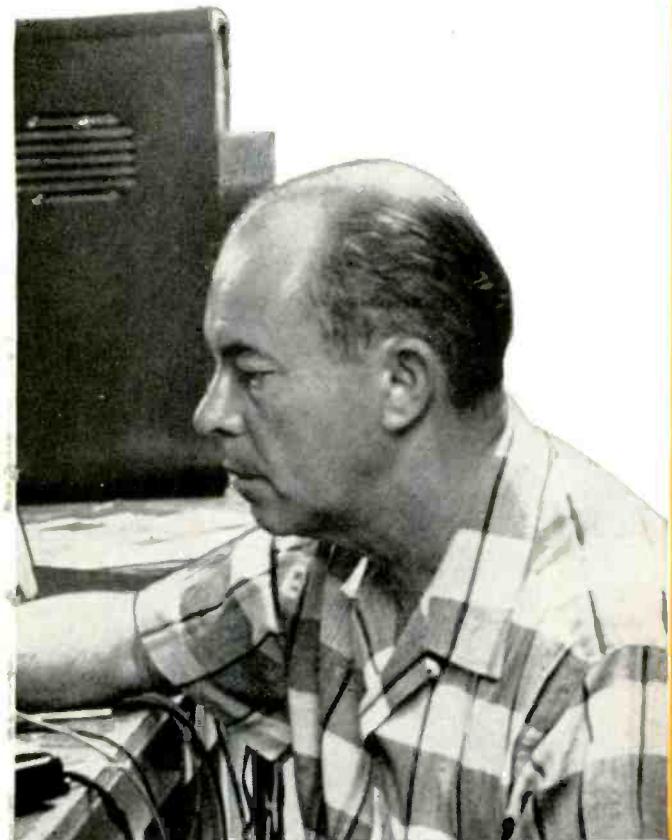
"To be successful, you must make a profit, hire competent technicians, pay a fair salary, give prompt, dependable service and use the best quality components," states Shan Des Jardins, discussing the growth of his business.

"I've used Mallory components since I first started my shop. My shop people and I have a total of a century of experience and we know we can depend on Mallory for top quality components."

Shan runs an exceptional shop . . . the first in Miami to have a complete transistor radio service department, and among the first to service color TV. In all

his operations, he relies on quality Mallory components. When electrolytics need replacement, for instance, he knows—as do thousands of other service technicians—that Mallory FP's give extra service in the smaller, hotter cabinets now common for TV and hi-fi . . . or when mounted next to a hot rectifier or output tube, where ordinary replacement filters wilt. They're the original 85°C capacitor. Leak-proof seal and etched cathode construction—available without premium price only in Mallory FP's—assure long life and hum-free performance.

Whatever your component needs, see your Mallory distributor. He carries the widest line of quality Mallory products . . . at sensible Mallory prices.



Shan Des Jardins is owner and manager of Shan the Radio Man Inc. in Miami. A charter member of TESA and Miami Service Association, he also is zone governor of NATESA. In 1928, Shan opened a one-man service shop for battery-powered radios. He now has five technicians and three trucks, handling 20 to 25 calls a day, servicing radio, TV, stereo and hi-fi.

THESE QUALITY MALLORY PRODUCTS PUT AN END TO CALL-BACKS



GEMS

Handy five-pack dispenser of rugged, moistureproof Mallory "Gem" tubular capacitors . . . keeps stock fresh, clean, easy to find . . . prevents kinks in lead wires. Unequalled for service in buffer, by-pass or coupling applications.



RMC DISCAPS*

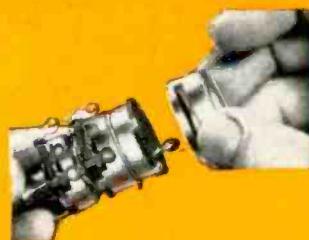
Made by the world's largest producer of ceramic disc capacitors. Long the original equipment standard, they are available for replacement in a handy 3 x 5" file card five-pack package.

*Regr. Trademark of Radio Materials Company, A Division of P. R. Mallory & Co. Inc.



GOLD LABEL® VIBRATORS

For the best in auto radio servicing, use Mallory Gold Label vibrators every time. The quietest vibrator ever made. Exclusive buttonless contact design gives longest life, sure starts.



STA-LOC® CONTROLS

No waiting for out-of-stock controls. In just 30 seconds, your distributor can custom-build any of over 38,000 single or dual controls. You can replace the line switch by itself, without unsoldering control connections.



TC TUBULAR ELECTROLYTICS

Twin-pack of economically priced filter capacitors with a reputation for top performance. Proven in service and backed by years of Mallory experience. Also special Type TCX capacitor available for -55°C.



MERCURY BATTERIES

Unequalled for transistor radios. They give steady power several times longer . . . stay live for years when idle. Chosen as the "power package" in U. S. satellites. Made by the world's largest manufacturer of mercury batteries.

Distributor Division



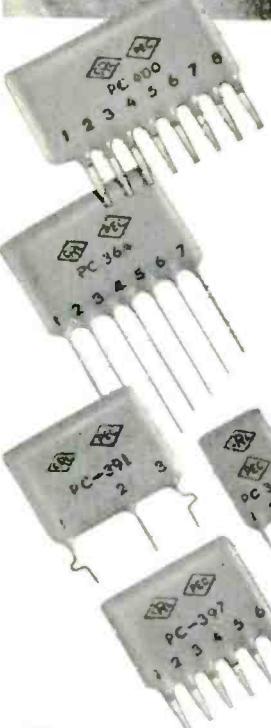
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(Continued from page 18)

Coverage in depth



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Packaged Circuits



You're in the swim with CENTRALAB PEC's—the packaged electronic circuits from the first company to dive in and originate, develop, and manufacture them.

With the electronics industry submerged in packaged circuits (well over one hundred million CENTRALAB units are already in the field), you'll have lots of calls for replacement units—and CENTRALAB has them available... well over 150 different circuits, with new ones being added all the time.

The new CENTRALAB PEC Guide #6 tells you how to select, and replace packaged circuits—and it's available free from your distributor or by writing direct to CENTRALAB. Spear yourself a copy right away!

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CENTRALAB CANADA LIMITED—AJAX, ONTARIO

Centralab

Y-6129

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... Evidently Jules Elkish has no concern for convenience. He stated that Silvertone TV sets have schematics pasted in the cabinet. You need the schematic when the chassis is on the bench for service. Having the schematic right next to the chassis would be better than running back to look in the cabinet every time you check voltage, etc. I am thankful we have no Sears store here. Once I tried unsuccessfully for three months to obtain a yoke, finally gave the customer his set back, said he'd have to take it to Sears.

BILL SCHLICKBERND

Bill's TV-Radio Service
Chadron, Nebr.

... What's with you guys? Get hep. Referring to your Editor's Memo about Sears sets, why you've already printed a lot of them under other brands. Servicemen should know this. Sears policy seems to be whole hog or none, though one of their stores asks me to look at a set occasionally. But rarely. Sears just doesn't know the meaning of SERVICE or care.

DAVID V. CHAMBERS
Harrington, Del.

Radio Interference

Editor, ELECTRONIC TECHNICIAN:

Referring to "Stop TV-Radio Interference" in the March issue, the plug-in filter (Fig. 3) had no effect whatsoever in stopping fluorescent light static and TV interference until I placed a 0.1 or larger capacitor across the two capacitors on the outlet side of the filter. It does a swell job. It's not necessary to put it in a metal case, and forget the ground. I discovered my own 220 v. electric water heater was sending out a signal that made diathermy look like Ned in the first reader. It would cause interference when one of the elements came on or went off. It was going out over the air and would completely knock battery radios out too, sometimes for as long as 30 seconds. A simple filter installed inside next to the heating elements and grounded to the heater case was effective. An enclosed fuse in at least one side of the plug in type filter input is a good idea.

GRADY L. TEAGUE
Porterville, Calif.

Onions . . .

Editor, ELECTRONIC TECHNICIAN:

Your magazine is a joke.

W. H. DAVIDSON

Pendleton, Ore.

. . . and Orchids

Editor, ELECTRONIC TECHNICIAN:

I am a recent subscriber to your magazine and look forward to receiving it each month. It is, in my opinion, a "must" for every technician. Most of the articles are not only informative, but truly invaluable.

PHILIP GROSS

Brooklyn, N.Y.

(Continued on page 20)

NUMBER 4 IN A SERIES OF CDE 50th ANNIVERSARY SPECIALS!



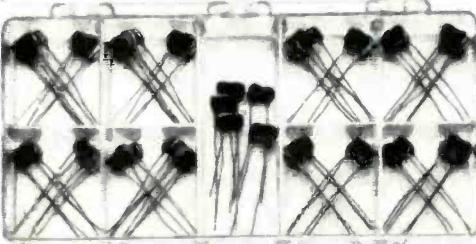
SWEET
DEAL!

CDE'S NEW MINIATURIZED DIPPED MICAS

Here's a SWEET DEAL from CDE to add dollars to your bank account and time to your crowded day. CDE dipped silver micas save you dollars because they cost less. They perform as well as the best molded silver micas at a fraction of the price; and they STAY dependable too, because their rock-hard phenolic coating effectively seals out humidity.

YOU GET...

... ALL 500V. 5%	Five CD15-5T22 220 mmfd.
Five CD15-5Q56 56 mmfd.	Five CD15-5T33 230 mmfd.
Five CD15-5Q82 82 mmfd.	Five CD15-5T39 290 mmfd.
Five CD15-5T1 100 mmfd.	Five CD19-5T47 ~70 mmfd.
Five CD15-5T18 180 mmfd.	Five CD19-5T68 580 mmfd.



CDE dipped micas save you time because they're TINY. They'll slip into a tight chassis or crowded printed board with ease. They replace ANY mica or ceramic capacitor—and you get all 45 of these 500V., 5%, dipped micas, in a convenient clear plastic box, for only \$10.20. Call or write your distributor. CDE Distributor Division, South Plainfield, N. J.



CORNELL-DUBILIER ELECTRONICS DIVISION
Federal Pacific Electric Company

For more data, circle 7-19-1 on coupon, p. 54

Designed with the Serviceman in Mind!



JERROLD magic carpet* antenna

NEW TV-FM Indoor antenna with outdoor performance . . .
NEW profitable business for you . . .

Servicemen everywhere are discovering a whole new market with this revolutionary new *indoor* TV-FM antenna. Now for the first time you can obtain signal gain across all frequencies, within 30 miles of the transmitter, that is comparable to that of a standard conical antenna.

In addition to strong gain characteristics, the Magic Carpet Antenna has an exceptionally low V.S.W.R. (Impedance Match) that assures maximum transfer of signal to the viewer without ghosting or smearing. Your customer avoids the expense and unsightliness of a rooftop antenna and the nuisance of ugly "rabbit ears"—you save time, trouble, and eliminate rooftop hazards with the quality-engineered, and profitable Jerrold "Magic Carpet" antenna. Get the details today!



In the Attic
Garage or Utility
Room Ceiling



For full information and samples of selling promotional material prepared specifically for you see your Jerrold Distributor or write

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ELECTRONICS CORPORATION, Distributor Sales Division

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Jerrold Electronics (Canada) Limited, Toronto

Export Representative: CBS International, New York 22, N.Y.

*Trademark Patent Pending

For more data, circle 7-20-1 on coupon, p. 54

(Continued from page 18)

. . . If I missed one of your issues, I would feel as if I had lost my best piece of equipment. Keep the good work up.

RAY L. SINGLETARY

Jacksonville, Fla.

. . . I think your magazine and the schematics are excellent. I encourage other TV and radio technicians to read them.

MORRIS D. HODGE
Columbus, Miss.

. . . Your magazine is a wonderful publication. I wait each month for my copy. I especially like the Editor's Memo. You are on our side.

L. LOGAN

Logan's Radio & TV Repair
Danville, Ill.

. . . Your magazine is a great help, especially the Tough Dog section. I have begun to accumulate your Circuit Digests. Do you have binders to consolidate them?

OTIS J. HEARN, JR.
East Orange, N.J.

● We have a spring-type binder for Circuit Digests, available from us at \$2.95; also a blade-type binder for holding complete magazines. \$3.75.—Ed.

Antenna Location

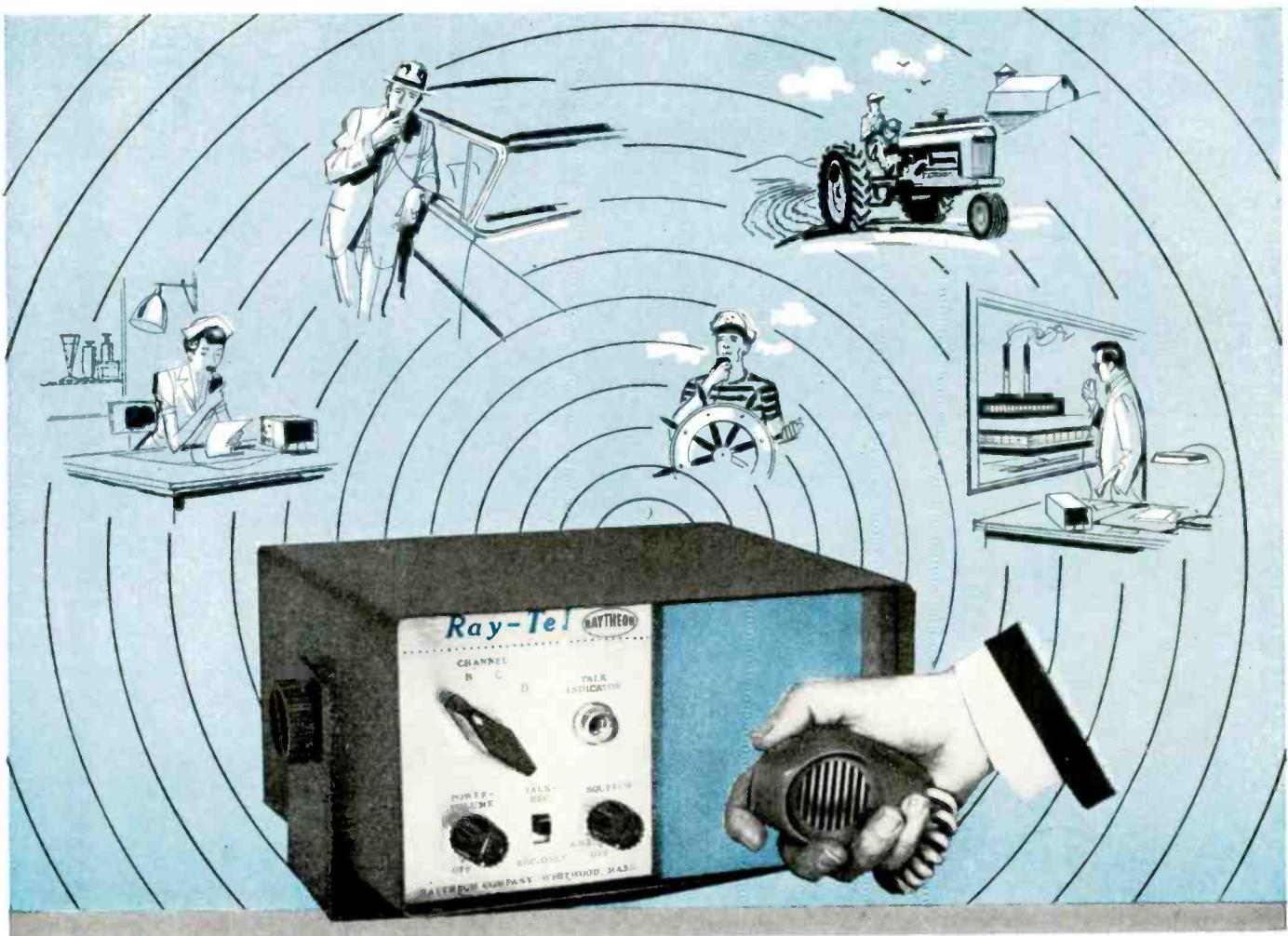
Editor, ELECTRONIC TECHNICIAN:

Reader Bill Frankel's letter, which appeared in these columns in June, is appreciated. His suggested solutions to locating a customer's antenna, through a maze of antenna wires, leaves much to be desired. As described in the Blonder-Tongue Column, "The Practical Approach," in the April 1960 issue, all the 300 ohm transmission lines were cabled in random fashion. Also consider the following. Firstly, what TV technician carries a step-down transformer and a bell or a buzzer with him on a service call? Secondly, if the antenna transmission line is open or shorted, Frankel's technique will get you nowhere fast. Thirdly, if the antenna is a folded dipole, or other type, where the resistance is practically zero across the antenna end of the transmission line, besides a hot transformer there will be no other telltale clues as to which antenna is which. Fourthly, it would still require digging into the cabled lines at some convenient point and penetrating the insulation of other people's transmission lines. (Remember, I had to station a lookout to avoid getting into a hassle with the other occupants of the building.) Fifthly, even if the correct line were found, it would have to be isolated from the cabled mess, or abandoned. As a final count, it turned out that there was no antenna in the first place.

ROBERT CORNELL

New York, N.Y.

● The transformer-buzzer arrangement will frequently locate the antenna, but as writer Cornell points out, it is not always dependable.—Ed.



Now YOU can be a sales outlet for

RAYTHEON RAY-TEL

Raytheon's New Citizens Band Transmitter-Receiver

The Citizens Band Radio market is growing and Raytheon's new RAY-TEL puts you right in the middle of this bustling new sales area with the right prices and the right profits. Raytheon also offers you an attractive promotion package including display, streamers, and a special direct-mail campaign to help you effectively locate and sell prospects! *Doctors, businessmen, farmers, builders, sportsmen* and many others are all potential customers for RAY-TEL. Manufactured to the highest quality standards... RAY-TEL meets all FCC requirements. For full details, see your Raytheon Distributor today.

Suggested List Price: \$169.95 complete with press-to-talk microphone, instruction book, FCC license application and regulations, set of matched crystals.

RAY-TEL QUALITY FEATURES

- Highly Selective, Extremely Sensitive Receiver
- Maximum Talk Power
- Vibrationproof, Ruggedized Design, Versatile Mount
- Effective Noise Limiter and Squelch
- Battery Saver Switch and Automatic Transmitter Performance Indicator
- Plus Many More



RAYTHEON COMPANY

DISTRIBUTOR PRODUCTS DIVISION • WESTWOOD, MASS.

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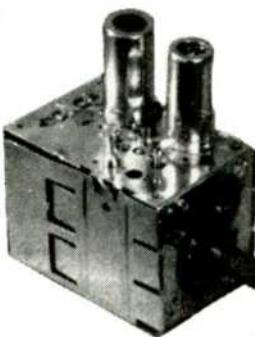
TV TUNERS OVERHAULED

ALL

MAKES
AND
MODELS

\$9.95
NET

90 DAYS
WARRANTY
UHF/VHF \$19.90



SAME DAY SERVICE

ON POPULAR TYPES—48 HOURS ALL OTHERS

Overhaul charge includes labor and minor parts; tubes and major parts are extra at net prices.

Tuner to be overhauled should be shipped complete; include tubes, shield cover and any damaged parts. Quote model and state complaint. Pack well and insure.

WE WILL SHIP C.O.D.—F.O.B. CHICAGO OR TORONTO

Castle TV Tuner Service
U.S.A. • 136 MAIN ST.
CHICAGO 45, ILL. CANADA

For more data, circle 7-22-1 on coupon, p. 54

News of the Industry

STANDARD RECTIFIER has named JAMES R. CONTO Vice Pres. in charge of marketing.

WELLER ELECTRIC sales force has been joined by SAMUEL E. SEAVER in the Neb., Kans., Ia. and Mo. area.

INT'L RECTIFIER announces the appointment of ANGUS SCOTT to the position of Silicon Products Sales Mgr.

VOCALINE announces the appointment of T. H. BLANER as Works Manager, and CHARLES H. MURPHY as Vice Pres. in Charge of Sales.

TUNG-SOL has announced the election of DR. ALFRED K. WRIGHT, Vice Pres. of Operations, to the company's Bd. of Directors.

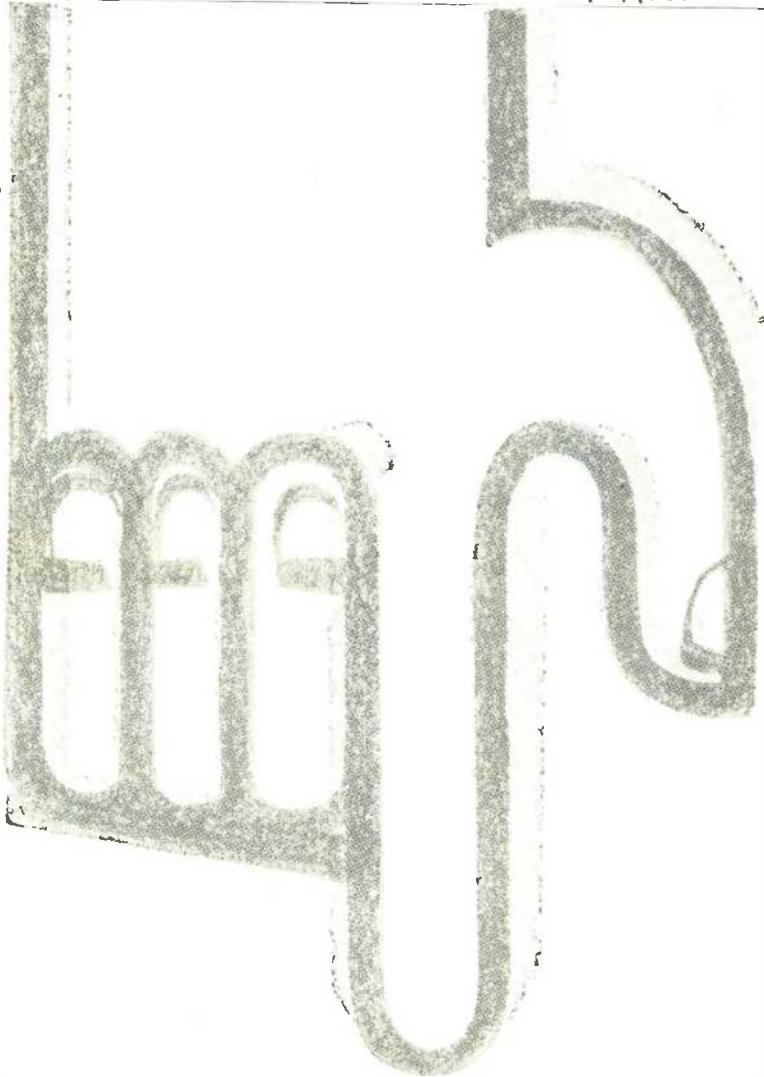
TELEX, INC. has named ROBERT L. SELL Asst. Vice Pres. He will continue as Dir. of Engineering, and will also serve as Dir. of Sales and Marketing for the Components Group.

STANDARD COIL stockholders are being asked to approve a Bd. of Directors proposal to change the company's name to **STANDARD INDUSTRIES, INC.**

CHANNEL MASTER has established an annual scholarship to be awarded graduates of the Ellenville (N.Y.) high school, carrying a 4-year value of \$3,000 or \$750 per year. It will be awarded on the basis of scholastic achievement and financial need and is open to both male and female students desiring to study for a degree at an accredited college or university.

PIILCO Consumer Products Div. reports the following six appointments: JOHN A. WINFIELD, Asst. Dir. of Sales; GIBSON B. KENNEDY, Mgr. of Associate Distributor Sales; ROBERT J. THEIS, Gen. Sales Mgr.; JOHN J. KANE, Mgr. of TV Merchandising; R. B. LAMBERT, Mgr. of Direct Accounts; and MICHAEL L. SEVERINE, Controller. The Lansdale Div. has appointed JOHN F. GILBERT Distributor Sales Mgr. of semiconductor operations.

SENCORE has been holding "Time Saving Clinics" for service dealers at distributor locations. A 45 min. film on test equipment and question and answer discussions are presented. GEM ELECTRONICS of Long Island was host to 100 service technicians and NATIONAL RADIO DISTRIBUTORS of Brooklyn was host to over 200 men at their respective clinics. Vice Pres. ED FLAXMAN and New York rep STEVE FISHER, attended and introduced "The Mighty Mite" tube tester.



exact replacement **STANCOR TRANSFORMERS**
that do the job...and do it better

FLYBACKS • YOKES • POWER TRANSFORMERS

Your distributor has them in stock—along with many other types and the complete line of Stancor Coils. Complete replacement listings in PHOTOFACTS and COUNTERFACTS.

CHICAGO STANDARD TRANSFORMER CORPORATION
3501 WEST ADDISON STREET • CHICAGO 18, ILLINOIS

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*From Winegard - 26 DB gain -
covers TV and FM bands
only \$79.95*



Remarkable New Precision Amplifier A-400 **DRIVES 1 to 30 TV SETS**

Performance and features never before available—Uses four of the new 6FY5 Neutro-electrode tubes (transconductance 13,000 MHOS). These new tubes have the extreme low noise characteristics of the latest triode RF tuner tubes with extra gain and stability normally obtained only with pentodes. Dual 75 ohm outputs, allows you to use two trunk lines right off amplifier if desired. 300 ohm balanced input with no strip disconnect plug and 75 ohm coaxial input. All parts operated well below maximum ratings for long, trouble-free life. Heavy-duty AC power transformer. Unit completely fused. Operates on 117 volt AC. 20 gauge cadmium luster plated chassis, blue-grey baked enamel, perforated steel cover. \$79.95 list.

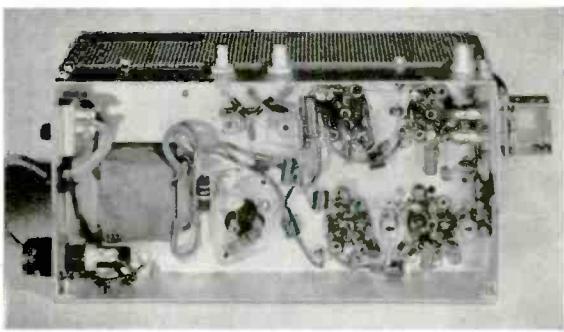
Try one, see the difference for yourself. Other amplifiers available for 1 to 4 sets, and up to 150 sets for Master System.

FROM WINEGARD—Get complete components, quality-built advanced Line Taps, Splitters, Couplers, Disconnects, Antennas, everything for complete MATCHED top-performance systems. MADE BY THE ORIGINATORS OF THE WORLD-FAMOUS COLOR'CEPTOR ANTENNA. Winegard Co., Burlington, Iowa.

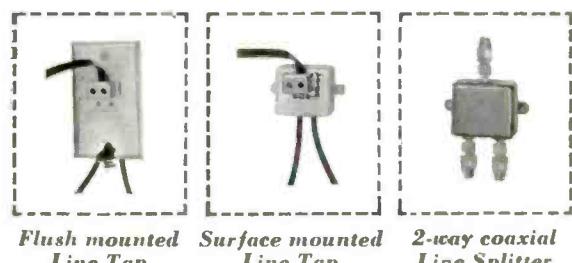
Winegard
ANTENNA SYSTEMS

Everything from the Antenna to the Set

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Wired like a Laboratory Instrument



**Flush mounted
Line Tap**

**Surface mounted
Line Tap**

**2-way coaxial
Line Splitter**

more

...so much more for everyone...for every application...in the complete line of Stanton Stereo Fluxvalves*.

Here is responsible performance...in four superb models...for all who can hear the difference. From a gentle pianissimo to a resounding crescendo—every movement of the stylus reflects a quality touch possessed only by the Stereo Fluxvalve.



STANTON
Calibration
Standard: Model 381 —
An ultra-linear professional pickup for recording and studio calibration, radio stations, and record evaluation by engineers and critics. From \$48.00

Collectors Series: Model 380 — A precision pickup for the discriminating record collector. From \$29.95

Pro-Standard Series: MK II — A professional pickup outstanding for quality control. From \$24.00

StereoPlayer Series: Stereo 90 — A fine quality stereo magnetic pickup for the audiophile... \$16.50

LISTEN!...and you will agree Pickering has more for the best of everything in record reproduction—mono or stereo. More Output—More Channel Separation—More in Response—More in Record Life!

In short...more to enjoy...because, there's more quality for more listening pleasure.

FOR THOSE WHO CAN HEAR THE DIFFERENCE

LISTEN! Ask for a Stereo FLUXVALVE demonstration at your Hi-Fi Dealer today!

Send for Pickering Tech-Specs—a handy guide for planning a stereo high fidelity system...address Dept. M70

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**SUPERIOR'S MODEL 82-A IS THE IDEAL
LOAN-OUT TUBE TESTER
FOR YOUR CUSTOMERS!**

Of the same type as the Self-Service models in Drug Stores and Super-Markets, Model 82-A has the added advantage of easy portability. Simple to use, Model 82-A may be offered as a Self-Service Tester in your store; as a Loan-Out Tester (deposit returnable) or as a Tube Tester for outside commission tube salesmen.

YOUR CUSTOMERS WILL FIND IT EASY TO USE.

1. Refer to instructions.
2. Turn filament selector switch to position specified.
3. Insert tube into specified numbered socket.
4. Press down quality button.

THAT'S ALL!
Read emission quality on meter

Model 82-A comes housed in Texon, Attache Type Portable Case. Complete with instructions. Only **\$36.50**

SHIPPED ON APPROVAL

Try one or more for 10 days. If completely satisfied remit payment (or we will gladly extend 5 month credit with no finance charges added). If not completely satisfied, return, cancelling any further obligation.

MOSS ELECTRONIC, INC.
Dept. D-792, 3849 Tenth Ave., New York 34, N. Y.
Please rush Model 82-A Tube Tester at \$36.50 each.
Bill me on five (5) month payment schedule—no finance charges. If unsatisfactory for any reason whatsoever, I am privileged to return.

NAME _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____
All prices net, F.O.B., N.Y.C.

For more data, circle 7-24-2 on coupon, p. 54

SONY CORP. has named ANTHONY DILLON to the post of Gen. Sales Mgr.

STROMBERG-CARLSON Commercial Products Div. reports the appointment of EDWARD P. SYKES, JR. as Dir. of Marketing.

RAYTHEON Electronic Services Div. has named W. BRADFORD GOVE to the newly created post of manager-facilities planning.

LOWELL MFG. has announced that FRED HARRIS of the ATLAS RADIO CORP., Toronto, Canada, won its "April in Paris" contest.

BELDEN MFG. has elected HERBERT W. CLOUGH, Vice Pres., Marketing, to the company's Bd. of Directors.

TRIPPLETT ELECTRICAL is constructing an addition to the Bluffton, Ohio plant which will more than double meter assembly area when completed by early fall.

WESTINGHOUSE Electronic Tube Div. is offering an indoor-outdoor thermometer with a retail value of \$4.95 as a summer premium on the purchase of receiving tubes. Special offer ends on August 15th.

SOUTH RIVER METAL PRODUCTS sold their 50,000th MAGNESIUM ladder at the Electronic Parts Show to JULIAN LONG of LONG'S DISTRIBUTING CO., Asheville, N.C.

P. R. MALLORY Distributor Div. has opened the 1960 "Cool Deal" contest for service technicians with grand prize of a vacation for two in Jamaica. The service technician states on an official entry blank which line of Mallory parts he likes best and why.

RCA announces appointment of the following seven executives to the position of Division Vice Pres.: CHARLES H. COLLEDGE, Gen. Mgr., Broadcast & TV Equipment Div.; J. J. GRAHAM, Gen. Mgr., Communications & Industrial Electronic Products Operations Div.; BARTON KREUZER, Gen. Mgr., Astro-Electronic Products Div.; S. N. LEV, Gen. Mgr., Moorestown Missile & Surface Radar Div.; C. E. BURNETT, Industrial Tube Products Dept., Electron Tube Div.; J. B. FARESE, Entertainment Tube Products Dept., Electron Tube Div.; and ROBERT L. YORKE, Commercial Records Creation Dept., RCA Victor Record Div. The following three executives were appointed to the new position of Staff Vice Pres., Distributor & Commercial Relations, headed by MARTIN F. BENNETT, Vice Pres.; CARL V. BRADFORD, Eastern Distributor & Commercial Relations; HAROLD A. RENHOLM, Central Distributor & Commercial Relations; and HAROLD R. MAAG, Western Distributor & Commercial Relations.

2 great SPRAGUE DIFILM® tubulars

are tops in their field . . . take your choice!

For maximum reliability
and performance
under toughest conditions

SPRAGUE DIFILM® BLACK BEAUTY®



Sprague Black Beauty tubulars are missile-type capacitors. Actually, they are low cost versions of the famous Sprague capacitors now being used in every modern military missile. Where positive reliability is important, make no mistake, use Black Beauty Difilm Molded Capacitors! You get the most for the least with Black Beauties!

Difilm Black Beauties are engineered to withstand the hottest temperatures to be found in TV or auto radio sets—in the most humid climates. Further, unlike straight polyester film tubulars, these capacitors operate in a 105°C environment—without derating!

Black Beauty tubulars are tough units, too—no fragile shell to break—you can't damage them in soldering. For your convenience, every capacitor is marked twice . . . no need to twist capacitor around to read rating.

For extremely small
size and exact
original replacement

SPRAGUE DIFILM® ORANGE DROP®



The heart of these Sprague Difilm Capacitors can't be beat! It's a dual dielectric combination of Mylar® polyester film and special capacitor tissue—resulting in capacitors which are superior to all other comparable tubulars. Sprague's rock-hard solid HCX® impregnant fills voids and pin holes in the film. Difilm capacitors have high insulation resistance, low power factor, and excellent capacitance stability and retrace under temperature cycling!

Sprague Difilm "Orange Drops" are a "must" for your service kit where only an exact replacement will fit. They are the perfect replacement for dipped capacitors now used by leading manufacturers in many popular television receivers. And when a dipped tubular is called for, you'll find that Orange Drops outperform all others, safeguarding your work and reputation for quality service.

Orange Drops are specially designed for easiest possible installation. Radial leads are crimped to assure neat mounting parallel to printed wiring boards . . . extremely small size makes them fit handily in tight spots. They'll beat heat and humidity because the solid, rock-hard capacitor section, double-dipped in bright orange epoxy resin, is well protected against moisture. A perfect team-mate for Black Beauty.

±10% CAPACITANCE TOLERANCE IS STANDARD AT NO EXTRA COST

Difilm Black Beauty and Difilm Orange Drops are packaged in sturdy, reusable rigid plastic Kleer-Pak® boxes. Your distributor is stocked in all the popular ratings. Order some today. You can count on Difilm.

SPRAGUE®
THE MARK OF RELIABILITY

For more data, circle 7-25-1 on coupon, p. 54

Look for the I. H. Mark of Quality

IT MEANS "DOUBLE ASSURANCE" FOR YOU!

I. H. Mfg., with its resources as the subsidiary of one of the leading manufacturers of OEM hardware — now makes a natural progression into the electronics distribution industry, with the assets and know-how of the former TELEMATIC line. It's your double assurance of superb product precision, tested "long" profits — down the line.

performance and
Brochure on request



C.R.T. BRIGHTENERS

BOOSTER FOR EVERY USE!

CR69 — The Four-In-One Combination Brightener
...one brightener for all applications!

I. H. MFG. CO. — "the mark of quality"

Subsidiary of Industrial Electronic Hardware Corp.
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For more data, circle 7-26-1 on coupon, p. 54

KNOB CORP. OF AMERICA introduces exact replacement knob display, including record player knobs. Minimum investment, as little as \$9.54, puts dealer in the knob business.

BLONDER-TONGUE has announced the following two promotions: JOSEPH GIBBS, Mgr. of Industrial Products Div.; and EDWARD SHAFFER, Mgr., Consumer Products Div.

SPRAGUE ELECTRIC has started major additions to the Ashe County Plant at Lansing, N.C. to add 20,000 sq. ft. of space to the main factory building, raising total square footage to more than 80,000.

EIA reports the election of L. BERKLEY DAVIS, v. p. of GENERAL ELECTRIC, as President for 1960-61. The EIA Medal of Honor was presented to retiring Pres. DAVID R. HULL for his many contributions to the advancement of the electronics industry.

CORNELL-DUBILIER has announced an increase in prices of various types of capacitors and other electronic products, effective June 20th. The company also reported the appointment of BOB HART as Marketing Mgr. of the West Coast Div.

GENERAL ELECTRIC announces the availability of a 34-piece year-round package of colorful window displays and special service merchandisers through franchised G-E parts distributors. The Cathode Ray Tube (CRT) Dept. has appointed DELL A. LOVE as Mgr., Replacement Tube Operations.

RADIO CONDENSER Board of Directors has elected the following new officers: R. E. CRAMER, Chmn. of the Bd.; ALBERT G. SHAFFER, Pres.; R. E. CRAMER, JR., Senior Vice Pres. & Secy.; CHARLES F. MOLZEN, Vice Pres. Western Div.; CLAYTON W. BARTO, Asst. Secy.-Treas. W. W. PAUL continues as Executive Vice Pres., and FRED A. GRABER as Treas.



NEW TRANSISTORIZED



MODEL PS-3 \$6950 net
0-25v. DC variable output voltage

REGULATED DC POWER SUPPLY

NOW service technicians and industrial users can afford the performance of a regulated variable-voltage power supply.

Set It and Forget It—Voltage remains essentially constant at any output voltage setting regardless of load (within ratings) and AC supply voltage fluctuations.

Extremely Low Ripple—Less than 1 MV (.001 V) RMS for all conditions of rated operation . . . less than $\frac{1}{2}$ MV (.0005 V) for AC line voltage between 115 and 120 volts.

Output—0-200 MA, 0-15 volts, 0-100 MA, 0-25 volts.

Input Voltage—110 to 130 volts, 60 cycles.

Regulation—500 MV maximum, for above mentioned ratings.

Sold by Leading Electronic Distributors. Send for Catalog Sheet PS-3

ELECTRO PRODUCTS LABORATORIES

4501-V Ravenswood, Chicago 40 / Canada: Atlas Radio Corp., Ltd., Toronto, Ont.

AT ONE-HALF THE COST!

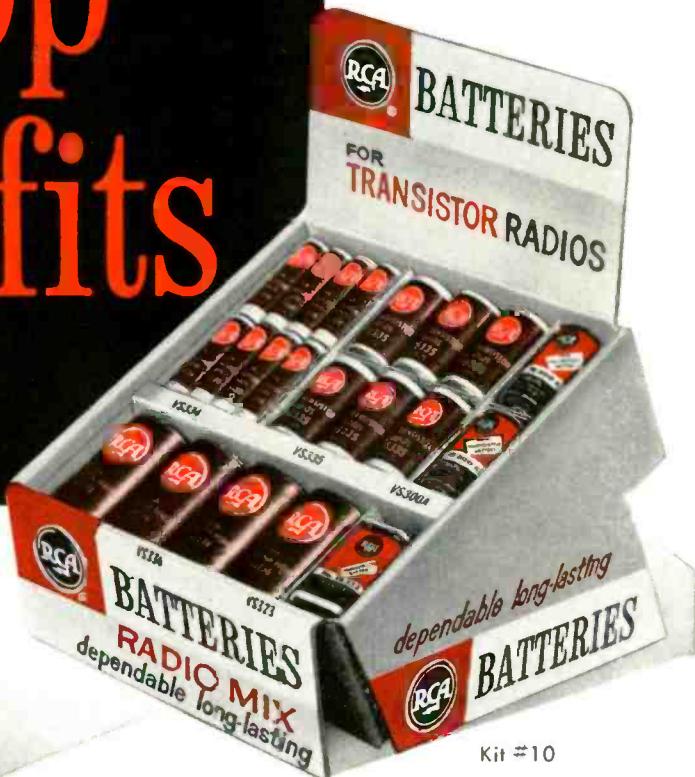
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for quick turnover

...top profits



RCA Batteries in the new and exclusive Self-Display Cartons

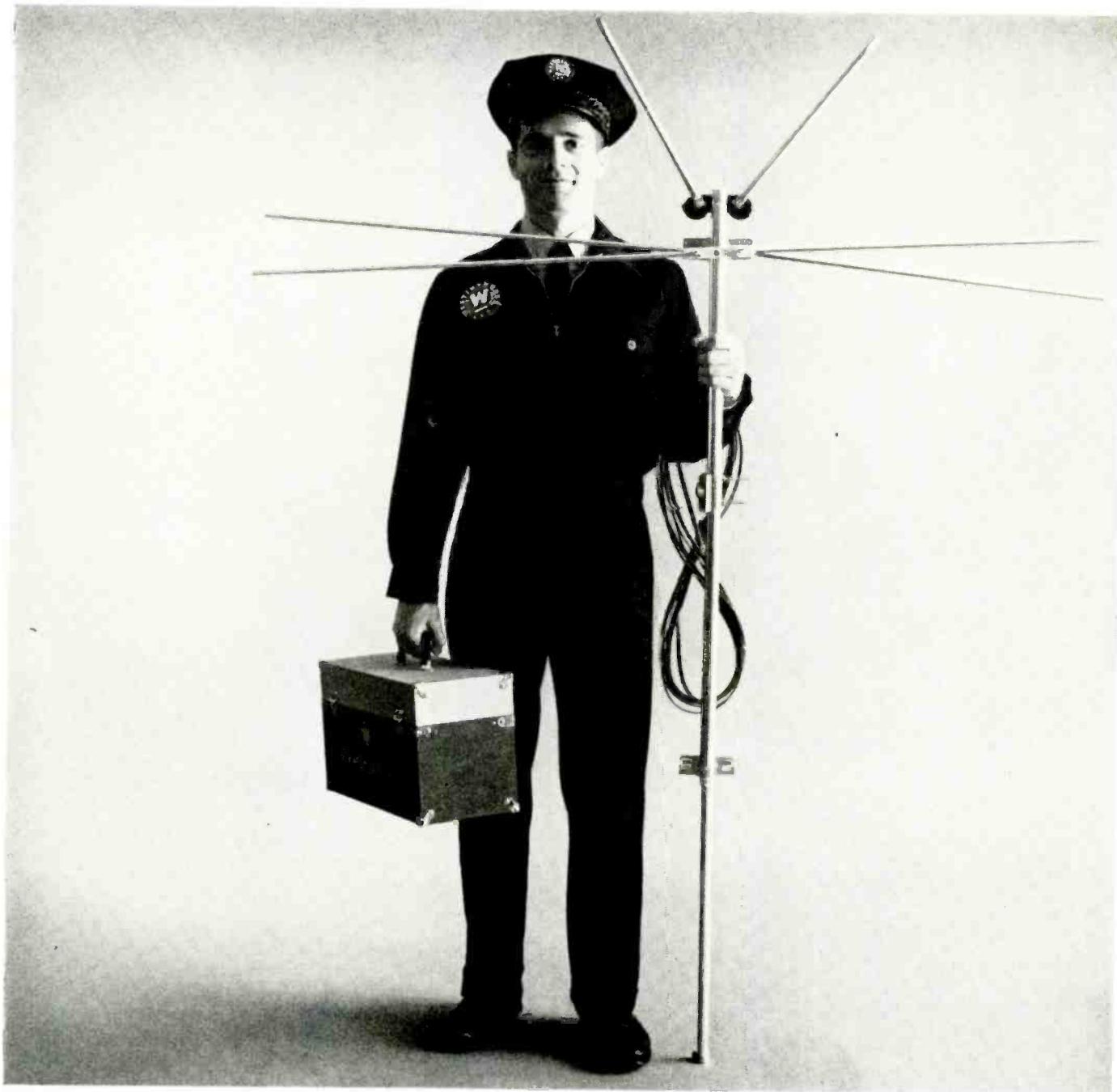
Here are two brand new transistor radio battery assortments that provide you with a complete battery headquarters right on your counter. Each kit contains a complete point-of-purchase inventory of the most popular, fast-moving, transistor radio battery types. When the stock is gone, simply open a new self-display carton. Call your Authorized RCA Battery Distributor today...he'll help put you on the road to bigger and better battery profits in 1960. Ask him for details on the complete RCA 1960 Battery Program including "TOP TAG" Promotions!



The Most Trusted Name in Electronics

RADIO CORPORATION OF AMERICA





The hardest thing to repair is your reputation

Your reputation is the difference between success and failure in your business. Westinghouse helps you maintain your reputation by designing its chassis with you, the service technician, in mind.

When our engineers put a chassis together, a member of the factory service department represents you. He looks at the design from your point of view. He sees to it that the components are arranged to make it easy for you to give maximum service to your customers.

Examine a Westinghouse chassis. One large PC board—the exclusive Westinghouse See-Matic—contains 80% of all circuits, with all component information on the

working side of the board for easy reference. There are B+ jumpers for easy isolation of shorts. All high-voltage transformer connections are clearly marked and are accessible outside of the cage.

The easier Westinghouse chassis are to repair, the better your reputation will be...and ours, too.

For complete information about Westinghouse Tech-Lit Factory Direct Mailing Service, write to Service Dept., Westinghouse Electric Corp., Metuchen, N. J., or your Westinghouse distributor.

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

Westinghouse Furniture TV & Stereo

Westinghouse Electric Corp., TV-Radio Division, Metuchen, N. J. Tune in Westinghouse-CBS TV-Radio Coverage, Presidential Conventions, July 10-29

For more data, circle 7-28-1 on coupon, p. 54

ELECTRONIC TECHNICIAN • July, 1960

ELECTRONIC TECHNICIAN



Postscript to "Showdown at Distributor Gulch"

Our May issue carried the editorial "Showdown at Distributor Gulch." Briefly, we stated our position opposing distributor sales to the public at wholesale prices. We expressed the fear that tension was rising over the retail sales issue, and there was a need for a meeting of men of good will on both sides to head off a destructive showdown. A number of service association leaders have agreed with us and stated their interest in meeting with distributors to work out their problems.

A landmark agreement has been reached between service dealers and distributors in the Philadelphia area. The program provides:

1. The distributors will discourage retail sales. Any such sales will be made at the retail price and the distributor will credit the difference between such sale price and the dealer's price to the service dealer located nearest the purchaser's home address.
2. All cash purchase slips will contain name and address of purchaser.
3. All "part-timers" will be urged to sign and use tax-exemption forms and obtain sales tax number, pursuant to the sales tax law.
4. Hi-fi users shall pay retail price for replacement parts and supplies.
5. All literature mailed to dealers will be in closed envelopes.
6. Ads will be eliminated in classified telephone directory excepting for "bold-type" listings.

In commenting on this program, the president of one distributing company in Philadelphia said, "In the past year we have benefitted to the extent that our volume of sales has increased by the servicemen recognizing our policy as one that benefits them. We feel sincerely that the industry as a whole would benefit if every parts distributor adopted this policy."

We certainly hope that the Philadelphia program works out, and that the dealers and distributors show mutual faith and support for the reliance they have placed on one another. This is certainly a more attrac-

tive solution than alternative answers being sought in other parts of that state. In Pittsburgh, a group of service dealers of necessity were forced into setting up a jointly owned distributorship of their own to provide a real wholesale outlet.

In the state capital, Harrisburg, House Bill 1071 was reported approved last year. This bill included the following section:

"It shall be deemed deceptive advertising within the meaning of this section for any person to . . . misrepresent the true nature of its business by use of the word . . . 'WHOLESALE' unless all merchandise listed or sold under such claims are sales to a purchaser for the purpose of resale or further processing or manufacturing."

We have previously mentioned the Texas law which plugs the sales tax loophole of distributors who sell at retail to consumers. This law prevents a distributor from selling to any person not holding a retail permit unless the distributor acts as a retailer himself and is responsible for the tax due.

At least one publication serving the distributor field has taken the head-in-the-sand position that: "Basically, technicians and distributors have mutual problems. But these problems should not include sales to customers other than full-time technicians, nor price concessions, nor licensing, nor any of the other convenient issues which the professional organizer can fashion into straw men."

Fortunately, the National Electronic Distributors Association has not, to the best of our knowledge, taken such a narrow view of the matter. By not committing itself at this point—NEDA members include both wholesale only and wholesale-retail outlets—NEDA has left the door open for future exploration of this problem and the hope for a peaceful solution.

We plan to contact NEDA and various service associations to see if the retail sales problem can be resolved to the mutual satisfaction of dealers and distributors alike.

Tuning In the

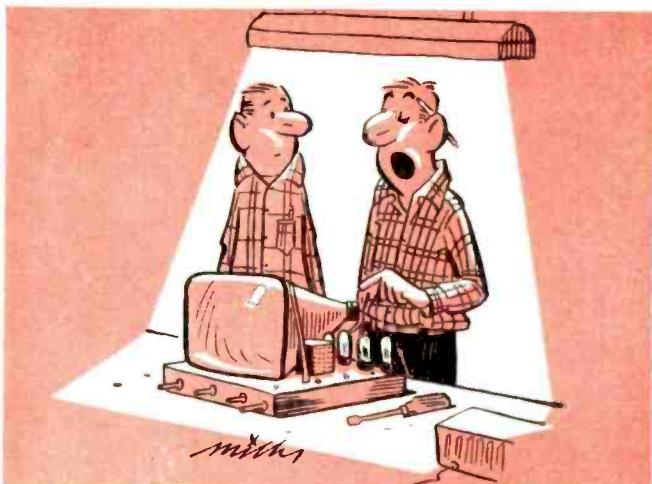
DEAD HORSE on Kenneth Muller's Rosendale, N.Y. farm was the cause of an extraordinary communications tieup. It seems that when the young farmer dug a hole to bury old Dobbin, he disrupted news wires from New York to Toronto, knocked out 38 Western Union lines between New York and Albany, and cut eight AT&T coaxial cables carrying 120 channels, including TV and telephone circuits. Service was restored in two hours by routing around the break, but it took repair crews 12 hours to fix the cable.

"EXTRA COMPENSATION PLAN" for Montgomery Ward service technicians encourages personnel to earn bonuses for top performance. It works as follows: each repair job is allotted performance credit, one credit equalling one hour of work. For a 40-hour week, a service technician earning 45 credits would receive a \$5.00 bonus. The plan is said to take into consideration assignments which do not rate credits by substituting one credit for each hour. Other provisions in the plan account for cancelled calls and two-man jobs.

COMPUTER RECORD PLAYER



Magnetic memory discs of RCA's new 301 Electronic Data Processing System for small companies are similar to 45 rpm records. One of the advantages of this kind of memory storehouse, holding five million characters, is that specific data can be inserted and removed very easily without affecting the rest of the memory.



"This do-hickey—stop me if I get too technical—hooks into this thingamajig . . ."

MAJOR TUBE INNOVATION—the Compactron—will have a profound effect on the design of TV, radio, audio, etc. This GE development consists of a line of tubes, many of which contain several tubes within one $1\frac{1}{8}$ " T-9 glass envelope. 12 pins in a 0.75" dia. circle are used, and the exhaust tip is at the bottom. Heater power consumption is reduced as much as 35-40%, and cost is about 20% less per tube function. In home radio, 2 Compactrons are equivalent to 5 tubes or 7 transistors. In a stereo amplifier, 7 Compactrons equal 10 tubes or 26 transistors. In TV, 10 Compactrons equal 15 tubes plus 3 diodes or 24 transistors plus 11 diodes. For example, one Compactron functions as horizontal oscillator and afc (6CG7 & 6AL5). Units will be in sets next year. Complete story will be in next month's issue of ET.

WHAT'S NEW IN RECENT TV DEVELOPMENTS: a joint effort between Philco's Lansdale Div. and the F. W. Sickles Div. of General Instrument has resulted in the modified Mark 6 TV tuner. It employs Philco MADT (Micro Alloy Diffused-Base) germanium transistors to provide an extremely low noise figure of less than 3.5 db at 200 mc. Sylvania's 1961 TV line, featuring some unusual approaches to furniture styling, accent 23" and 19" bonded shield picture tubes. There are 17" models, but no 21-inchers. G-E is carrying over its two current chassis into the 1961 line with only minor refinements. A new transistor sonic wireless remote will be added to the line, in addition to last year's transistor radio remote. It is claimed that 90% of all servicing jobs on the "M-6" chassis can be done without chassis removal from the cabinet.

Picture.....



CRUSADE AGAINST CALLBACKS, a Raytheon campaign to determine the 10 most troublesome tube types, has been completed. Based on 57,892 ballots cast by independent service dealers at distributors across the country, the following 10 types were voted the most troublesome: 1B3GT, 6AU4GTA, 6AX4GT, 6BQ6GTA/B, 6SN7GTB, 1X2A/B, 6CB6A, 6CG7, 6X8, 12AT7. Raytheon has come out with an unusual policy on its new "Uniline" line of reliable replacement receiving tubes. Should any tube in the new series (built around the 10 most troublesome types) fail within the warranty period, it will be replaced in kind and upon application, the service dealer will receive \$1.00 as a callback labor allowance.

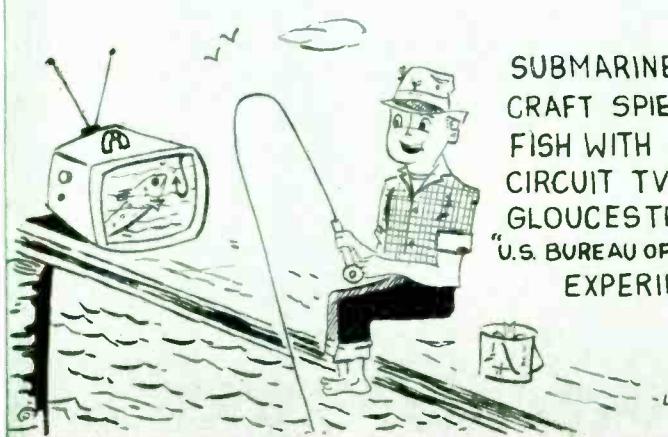
SHORTEST RANGE TRANSMITTER for consumer use has been claimed by Telex. The device is part of a hearing aid system. The tiny transmitter is located in the wearer's eye glasses. It receives sound, converts it to electrical energy, and transmits one milliwatt less than one-half inch to a tiny receiver button in the ear canal. There are five transistors in the transmitter, and a sixth one in the ear piece.

WARNING BUZZER to signal that an auto is near the pavement edge has been developed by General Motors. Called the Electro Lane, it utilizes two 2-ke wires on either side of the road which act as an electrical fence. Ferrite core pickup coils on the front bumper pick up the signals from the wires and activate a buzzer on the instrument panel. A different tone is used for either side of the road.

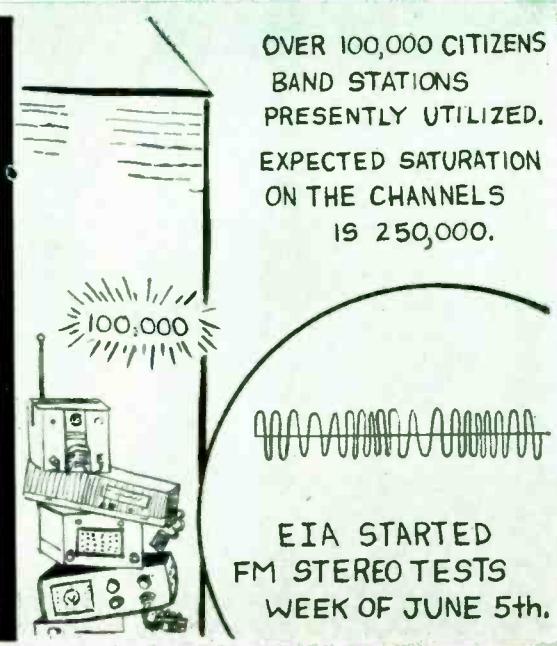
CALENDAR OF COMING EVENTS

- Aug. 1-3: Fourth Global Communications Symposium, Statler Hilton Hotel, Chicago, Ill.
- Aug. 6-9: National Audio-Visual Association Convention & Exhibit, Morrison Hotel, Chicago, Ill.
- Aug. 19-21: NATESA Annual Convention, Sheraton Towers Hotel, Chicago, Ill.
- Aug. 23-26: Western Electronics Show & Convention (WESCON), Ambassador Hotel, Memorial Sports Arena, Los Angeles, Calif.
- Sept. 7-9: Joint Automatic Control Conference, Mass. Institute of Technology, Cambridge, Mass.
- Sept. 14-15: Fourth Annual Joint Military-Industrial Electronic Test Equipment Symposium, Museum of Science & Industry, Chicago, Ill.
- Sept. 15-16: Eighth Annual Eng'g Management Conference, Morrison Hotel, Chicago, Ill.
- Sept. 15-17: Upper Midwest Electronic Conference and Exhibit, Minneapolis Auditorium, Minneapolis, Minn.
- Sept. 21-22: Industrial Electronic Symposium, Sheraton Hotel, Cleveland, Ohio
- Sept. 26-29: American Welding Society Fall Meeting, Penn-Sheraton Hotel, Pittsburgh, Pa.
- Sept. 26-30: Instrument Society of America Conference, Exhibit and Fifteenth Annual Meeting, The Coliseum, New York, N.Y.
- Oct. 3-5: Sixth National Communications Symposium, Hotel Utica, Utica, N.Y.
- Oct. 10-12: IRE National Electronic Conference, Hotel Sherman, Chicago, Ill.

RANDOM NOISE



SUBMARINE-LIKE
CRAFT SPIES ON
FISH WITH CLOSED-
CIRCUIT TV IN
GLOUCESTER, MASS.,
U.S. BUREAU OF FISHERIES
EXPERIMENT.



Boosters For Ailing CRT's

*TV Picture Tubes Can Be Revitalized With Parallel,
Series, Isolation Filament Transformers*

BOB JARMOLOW
Pres. & Chief Engineer
I. H. MFG. CO.

TV specialists silently laud the diminutive CRT rejuvenator. This five or six lead "booster" extends the life of their customers' gassy, shorted, low-emission picture tubes—resulting in additional income, inspired confidence and a future CRT replacement job.

• A customer's defective TV picture tube is viewed in one of two perspectives by TV service technicians: (1) Replace the CRT (2) Attempt to restore CRT operation. The latter decision is usually chosen by knowledgeable service people for both ethical and business reasons.

Chances are the CRT replacement profit will go to the man who prolonged the life of the picture tube because the customer hopes that he will perform another similar miracle.

The probability of receiving the future CRT job is further increased if the technician offers to subtract the price of a "booster" from the cost of a new CRT, should it finally be needed. (This does not represent any parts cost loss to the tech, since the booster taken back for credit can be used over and over again.)

The "picture tube brightener" has become the penicillin of the TV service business to the general public.

Booster Operation

Essentially, a booster is a step-up transformer mounted in a suitable container with all connections terminated in a cathode ray tube base at the input end, and a cathode ray tube socket at the output end, as seen in Fig. 1. The function of the transformer is to increase the normal heater (filament) voltage of the CRT. The lead terminations in a socket make it easy to attach to the CRT by merely plugging the booster's socket into the base of the CRT tube, and the CRT socket from the chassis into the booster base. Five or six lead boosters are readily available. The

six lead booster is used where the defective tube is self-focusing. The sixth lead couples the original focusing voltage to the correct CRT pin connecting (pin 6). Picture tubes with a separate focus coil usually can accommodate use of either the five or six lead booster.

The heater leads from the chassis are connected to the primary winding of the transformer, as shown in Fig. 2, and the transformer secondary winding delivers a "boosted" voltage to the heater. Boosters fall into four categories: Parallel, Series, Isolation and combinations of the first three. The most popular type at the present time is the Parallel. A cross-section view is shown in Fig. 3.

Before we can understand how a booster functions, we must first examine the operation of a CRT. A simplified internal diagram of a cathode ray tube is shown in Fig. 4. A voltage is applied to the filament that causes a current to flow, heating the cathode. The cathode is coated with an oxide of barium and strontium on its face, just behind the aperture in the control grid. As this coating increases in temperature, electrons are emitted

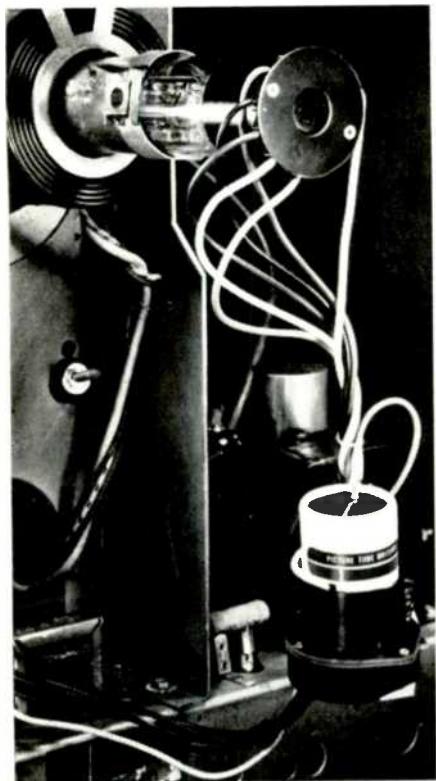


Fig. 1—Illustrated use of the six wire parallel booster. Note the lead which transfers the focusing voltage although a booster is used.

into the space between the cathode and the control grid. A positive voltage applied to the screen grid accelerates the electrons through the aperture in the control grid in the direction of the tube face.

As the tube ages, the emission of electrons from the cathode decreases. Consequently, the little cloud of electrons between the cathode and the control grid becomes smaller. Eventually the electrons available are not sufficient to create a bright picture, therefore, the dull picture. Here is where the booster is usually tried.

When the booster is inserted in the circuit, the voltage to the heater is increased. The increased voltage causes a larger current to flow ($I = E/R$) and the temperature of the cathode is further increased. This additional increase in cathode temperature drives more electrons from its face. The augmented electron flow may restore brightness.

Another situation where a CRT booster may restore brightness to a picture tube that has lost its sparkle is due to unremoved gas at the manufacturer's plant. Accordingly, one of the common defects of CRT's is "gassy" or "silky pictures." When a tube is built, a very important step in its manufacture is the removal, by

vacuum, of all gas in the tube. As far as possible, gas particles should be absent in the tube after it is sealed. However, there are practical limitations and there is always some gas left in the tube. This residual gas is ionized by the electron stream and is deposited on the cathode. The deposit covers the oxide layer required for the emission of electrons. The detrimental process is known as "poisoning of the cathode." When this happens, the electrons are hidden under this cover and can't get out. Adjusting brightness or contrast results in a negative-looking picture with detail information becoming silvery in appearance.

Here, again, the booster goes to work. The extra heat generated by the increased current through the heater, may melt away and break through this film. The electrons are then released and picture detail is restored.

Types

In both of the cases discussed, either a *parallel* or a *series* booster could be used. The correct one to use depends on the kind of circuit used in the television set; whether filaments are in series or parallel.

Combination boosters are made so they will function in either parallel or series circuits. However, it is still necessary to determine which circuit is being used so that the booster can be switched to the proper circuit. In this regard it is comforting to know that if an incorrect booster is installed, such as a series one in a parallel circuit or vice versa, no harm will come to the set, the tube, or the booster. All that will happen will be that the current in the heater will decrease and the brightness will fade. Upon installation of the correct booster the set will function properly again.

The *Isolation* booster is not really a booster at all, but, because it is constructed and installed like one, it has been adopted into the family. It is an isolation transformer, designed to serve a purpose different from the aforementioned ones. This "booster" is used to correct another "sickness" that sometimes befalls the CRT—

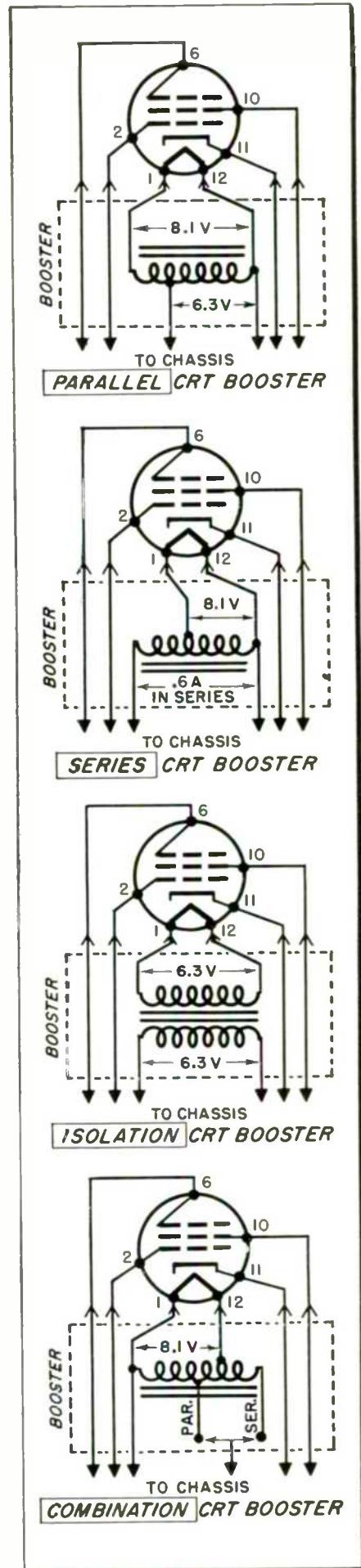


Fig. 2—Practical x-ray view of four types of commercially manufactured boosters.

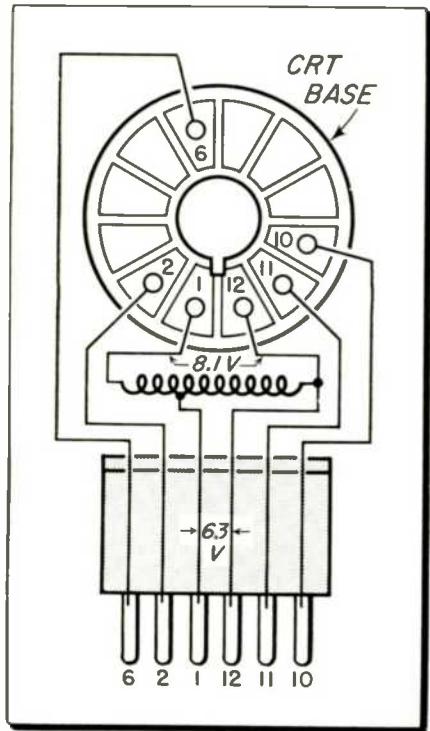


Fig. 3—Physical view showing practical tie-in of booster transformer envelope.

heater-cathode short. Because of the proximity of the heater to the cathode, shorts sometimes develop between them. The isolation booster lifts the filament from the TV set's common ground, thereby separating the cathode from it. In many cases, opening of a filament-to-cathode short can save a tube that would otherwise have to be replaced.

Practical Design

The majority of standard cathode ray tube heaters are rated at 600

millamps at 6.3 volts. The heat produced under these conditions may be expressed in watts. The heating effect is equal to $6.3 \times .600 = 3.78$ watts. Most electrical components are designed with a generous factor of safety; the CRT is no exception. Normally, it is possible to overload the heater circuit, say by 50%. In this case we can allow a total of 150% of 3.78 watts which is equal to 5.67 watts. Since we are dealing with a heater that is a resistive load with unity power factor, the resistance of the heater can be calculated under normal conditions. If 6.3 volts is divided by .600 amperes we get 10.5 ohms. Since another expression for power is I^2R , we can calculate the current that should be drawn by the heater in order to give the effect of 5.67 watts. Thus, $5.67 = I^2 \times 10.5$. Calculating this, $I = .737$ ampere. However, we have neglected the effect of the additional heat on the resistance of the heater.

Experiments indicate that when power to the heater is gradually increased, 150% of rated power is attained when the voltage reaches 8.1 volts and the current is 700 millamps. We can now calculate the new resistance of the heater as 11.6 ohms. In order to take advantage of the self regulating effect of the change in resistance of the heater, proper booster design, in this instance, would call for an output voltage of 8.1 volts at 700 millamps, as shown in Fig. 5.

Sometimes, the picture begins to darken again even though a booster is being used. At this point, adding more power can do no harm (if the CRT is the defective part) since the

tube is already useless. Adding another booster in series to the one in use may, in some cases, extend the life of the tube for an additional period. However, caution should be used to make sure that the loss of brightness is actually the result of lack of emission rather than some other cause.

There are a number of reasons why more power should be used only with caution. If the trouble is not in the CRT, any damage to the tube should naturally be avoided, such as "popping" the filament. In addition, the extra power used is drawn from the power transformer of the set. If we exceed the rating of the power trans-

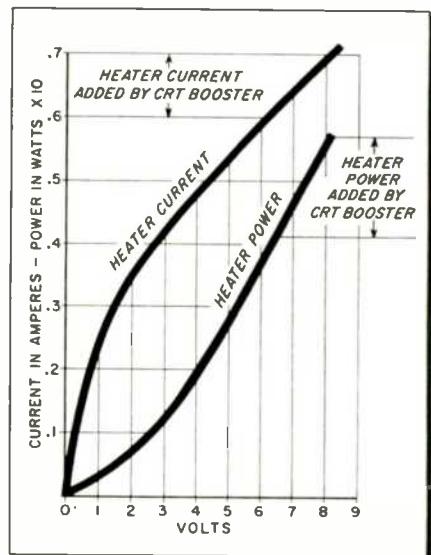


Fig. 5—Graph indicating increase of heater power and current as additional booster voltage is applied to the CRT.

former its output will be affected and the voltage to other parts of the set will be lowered. The result might well be to reduce the overall efficiency of the set and cancel out any improvements obtained. What is more, the overload on the power transformer might cause it to fail with resultant added expense and danger of fire.

These precautions, however, do not weaken the strong service-sales position attained by "picture tube rejuvenators," as a glance into any tube caddy will prove. Though not a cure-all device, boosters surely have a respectable record in extending CRT life. When they accomplish their intended job of restoring proper CRT operation, it's one of the few repairs sincerely appreciated by customers. And, this is what helps build long regular customer lists. ●

Fig. 4—Cross-section drawing of a conventional television picture tube.

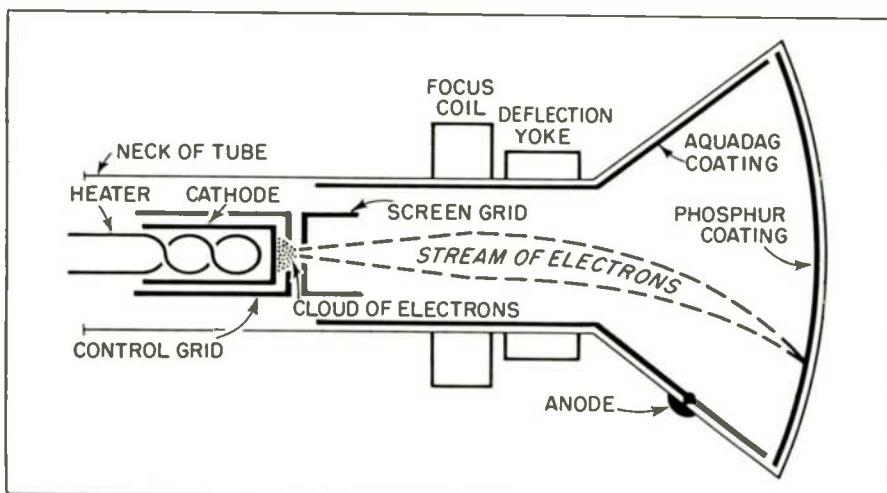




Fig. 1—Tele-Rad, "TEC," is slightly larger than a telephone.



Fig. 2—U.S.L., TR-800, has five channel plate modulated transmitter.



Fig. 3—Seiscor is helmet or belt mounted compact transistor design.

Service

Citizens Band Radios

Practical Maintenance And Adjustment Procedures for Class D Equipment

ALLAN LYTEL

- As we observed last month in part one of this two-part article, class D citizens band radio transmitters and receivers vary widely in circuitry employed and in external appearance. Some additional types are illustrated in Figs. 1 to 5. A top chassis layout of tubes, transformers, etc., of a typical transmitter-receiver, is shown in Fig. 6.

Preventive Maintenance

For years it has been recognized that the most economical method of equipment repair requires periodic check-ups—otherwise known as preventive maintenance.

Preventive maintenance means finding sources of trouble before equipment breakdown occurs. Tubes, vibrators, and other components have limited average lives. Important periodic checks include:

1. Measurement of operating frequency when a change or repair is made which affects the transmitter's frequency.
2. A modulation check should be made at the same time the frequency is measured. The transmitter's modulation should not exceed 100% for modulation peaks.
3. The PA plate power input ($I \times E$), must also be measured and must not exceed the licensed specification of 5 watts input to the PA.
4. Inspection for any loose, damaged

or broken parts caused by vibration.

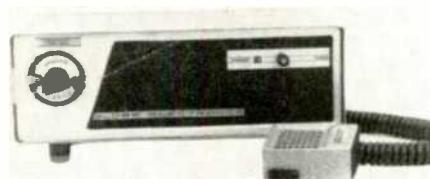
5. Power source inspection—including battery, voltage regulator and vibrator (or dynamotor).
6. Relay inspection and maintenance.
7. Inspection of cable connections.
8. Inspection of antenna.

All connecting cables should be examined for signs of wear, weathering



Fig. 4—Arkay "sky vox" model SQ-9 unit.

Fig. 5—Globe model CB-200 has a dual conversion receiver.



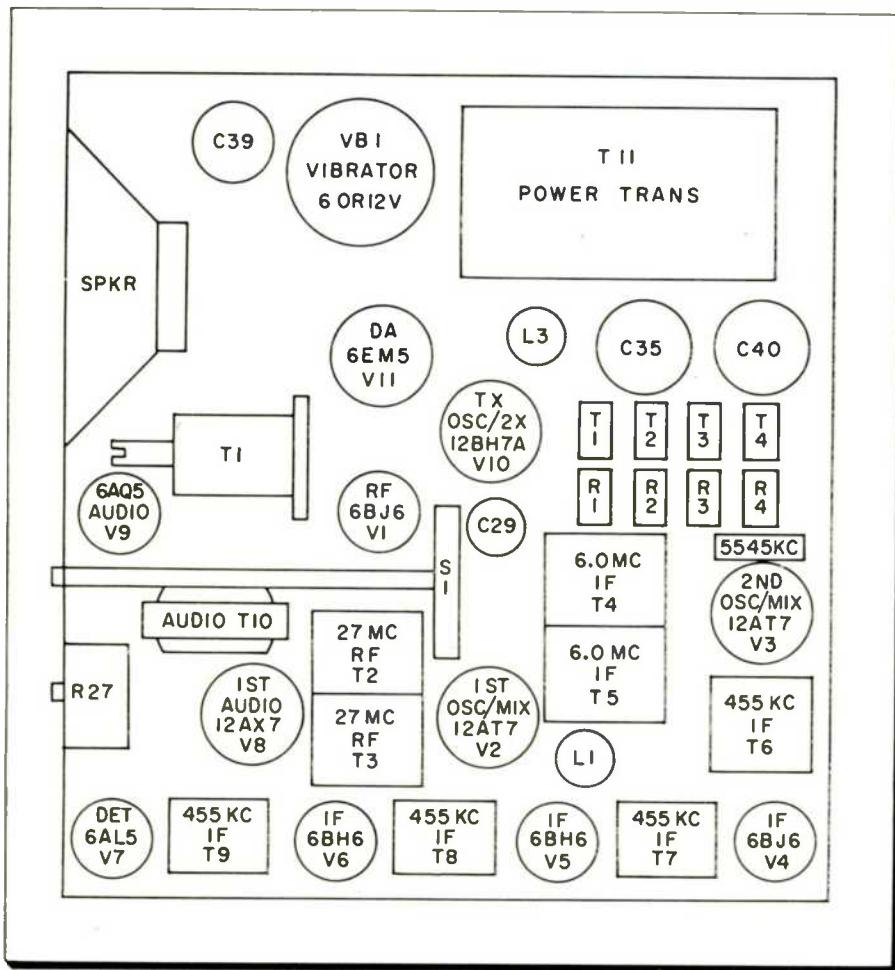


Fig. 6—Top-chassis tube and transformer locations in a typical citizens band radio.

or poor mating of the plugs. This is particularly important where equipment is mounted in the trunk, on top of cabs or where cables can be damaged. Relay contacts should be examined and burnished if necessary. The amount of relay attention re-

quired depends upon amount of use the equipment receives.

Antenna inspection is necessary in routine maintenance. Location of the antenna on a vehicle is always a compromise between best operation and antenna protection. Physical dam-

age to antennas is common, particularly for long antennas extending beyond the car or truck top.

The entire transmitter-receiver unit should be cleaned, inspected carefully for broken parts, and the tubes should be checked. Each tube should be properly seated in its socket.

Measurement of the receiver and transmitter operating voltages are significant checks, together with a check of the receiver sensitivity, local oscillator frequency, transmitter output power and frequency, and audio output.

For efficient operation, a transmitter will require periodic slight re-tuning to compensate for changes in tube characteristics and aging of other parts. Readjustments should follow manufacturer's instructions.

The power supply—whether vibrator, dynamotor, rectifier and filter, requires inspection. Brushes, connections, capacitors, and vibrators are all essential items. Vibrators, for example, should be replaced when their voltage output begins to drop off.

Associated equipment includes all other accessory items such as selective calling, speaker amplifiers, remote control devices, and the like. All of these should be checked for proper operation and inspected for broken or worn parts.

Transmitter Tuning

A frequency meter with an accuracy of 0.0025%, or twice as accurate as the 0.005% tolerance required by the FCC for the transmitter, should be used to check the transmitter's frequency. If the crystal or crystals used in the oscillator are sufficiently accurate, tuning of the transmitter is a simple procedure. For example, referring to the schematic in Fig. 7, proceed as follows:

1. Select crystal used at center-most channel.
2. Plug dummy load or combination r-f watt-meter load into antenna jack, J-1.
3. Press mike button and allow set to warm up.
4. Adjust L-3 for maximum bulb glow or maximum indication on watt-meter.
5. Peak T-1 for maximum glow or reading on watt-meter.
6. Couple frequency meter input loosely to output indicator and measure transmitter's output frequency.

CHART I

Name	Range	Purpose
Modulated r-f Signal Generator	Regular type used for radio-TV	Receiver alignment
Frequency Meter	General coverage	Transmitter Frequency check
Dummy Load	Up to 5 watts	Act as a load to absorb r-f output during transmitter tuning
Oscilloscope	—	General observation
Audio Oscillator	10 cps-20 kc	General use
VTVM	0.1 to 300v d-c	General use

Receiver Alignment

CB receiver alignment is similar to other radio receivers. A signal generator and VTVM is necessary. The signal generator is typically tuned to the i-f frequency and the VTVM is connected across the second detector output load resistor. Crystals are removed from the receiver. Beginning with the detector i-f transformer, each i-f stage is carefully aligned. The signal generator is then used to align the mixer stage (or stages) with crystals inserted. In this manner, the signal generator simulates a transmitter; r-f stages are aligned last. A list of equipment required for normal service and maintenance is shown in Chart I.

Frequency Standards

Both signal generators and frequency meters can be checked for

accuracy against primary frequency standards. The standard frequency stations WWV and WWVH are operated by the Central Radio Propagation Laboratory of the National Bureau of Standards. WWV is located at Beltsville, Md., and WWVH is in

of quartz crystal oscillators operated continuously. All oscillators operate on 100 kc from battery power and are housed in temperature and humidity controlled vaults below the earth's surface.

Broadcasts of WWV and WWVH can be received on a relatively simple communications-type receiver from most points in the United States under normal propagation conditions. An elaborate commercial type receiver for calibration purposes is shown in Fig. 8.

Uses for CB radio expand constantly. In mid-1959 the FCC reported receiving 5,000 applications a month. Citizen-users include doctors, salesmen, store owners, farmers, boat-owners, etc. Its use will no doubt continue to expand.

With a minimum of effort and planning the alert technician can find servicing CB radios a profitable diversification of his operation. •

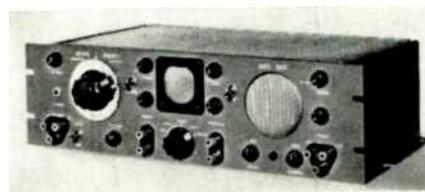
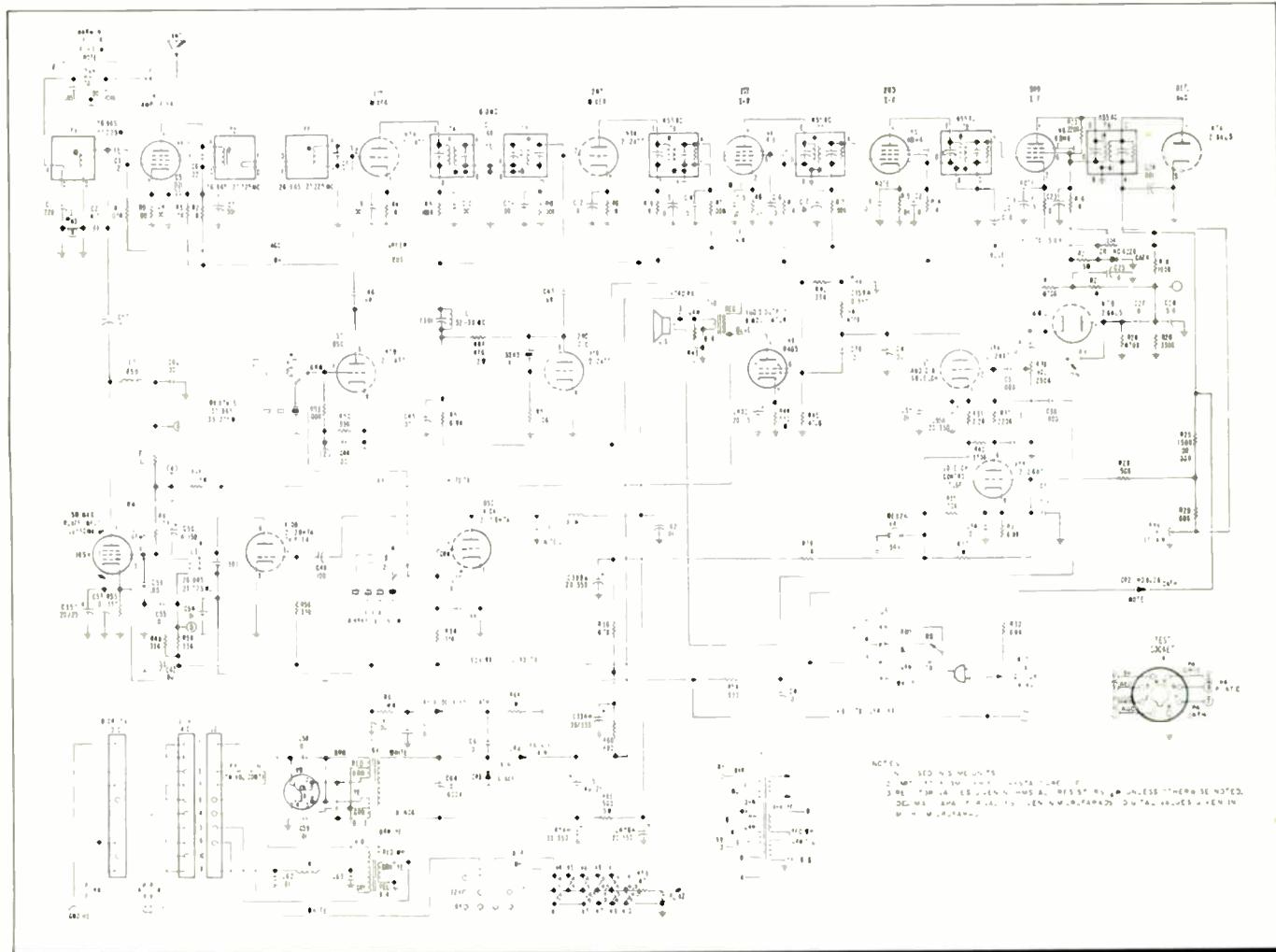


Fig. 8—Specific Products, model WWVC, frequency standard receiver.

the Hawaiian Islands. WWV transmits continuously on 2.5, 5, 10, 15, 20, and 25 mc. WWVH transmits continuously on 5, 10, and 15 mc. The carrier frequencies of both stations are derived from the average of a number

Fig. 7—Schematic diagram of a typical citizens band type receiver and transmitter "package."



TV Vertical Circuit

Stumbling Blocks

Shop Repair Data and Short-Cut Service Aids

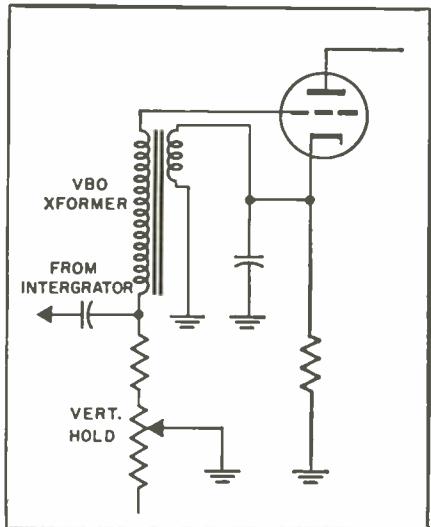
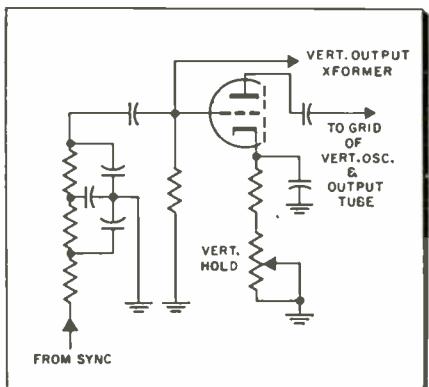


Fig. 1—Vertical blocking oscillator transformer circuit adjusts the frequency by varying the grid bias of the stage.

Fig. 2—Multivibrator oscillator circuits vary cathode bias, thus adjusting frequency.



• Defects in TV vertical circuits show up in a number of ways. We all have encountered the bright horizontal line symptom, crawling picture, foldover, vertical trapezoid (keystone) and breathing picture. Normal service procedure will undoubtedly isolate the faulty component, but ultra-rapid detection is a product of many years of bench and field service.

Manufacturers vary vertical circuit design by using blocking oscillator or multivibrator circuits in the oscillator section, as shown in Fig. 1 & 2. The output is capacity-coupled to an amplifier which contains either an auto or primary-secondary type transformer in the plate circuit. This, in turn, is coupled to the vertical deflection coils in the yoke. With the addition of a few resistor-capacitor networks, and one or two tubes, we have the vertical deflection circuit of most TV receivers.

This section of the TV receiver, under normal circumstances presents no hair pulling problems. The standard test equipment including VTVM, oscilloscope, signal generator, and assorted probes, will cover all vertical circuit problems.

Short-Cut Test Methods

A rapid short-cut service aid for in the home repairs may be constructed from a piece of coaxial cable, a few alligator clips and a .05/600 WDC capacitor. The 60 cycle

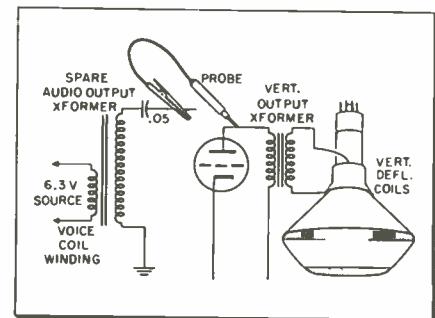
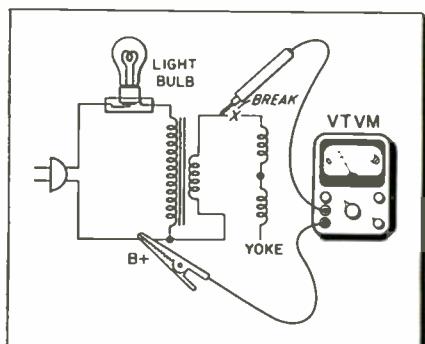


Fig. 3—Vertical deflection by 60 cps substitution signal, checks vertical operation.

input of the filament supply is used to couple the desired frequency into the vertical circuit. Proper component function will be indicated by some vertical sweep on the CRT when the probe is applied.

An improvement on this gimmick test method is illustrated in Fig. 3, employing a conventional audio output transformer, three alligator clips, a probe and a .05/600 WDC capacitor. The normal secondary or voice coil leads are connected to a source of filament voltage. One of the primary leads is grounded and the remaining lead has a capacitor inserted between it and the probe. By touching the probe to the yoke, output transformer, capacitors, and resistors, vertical deflection of almost normal proportions may be seen. A simple resistance check at the point of lost deflection should unmask the open

Fig. 4—Light bulb glows brilliantly if transformer is shorted. Meter reading for conventional 10 to 1 step-down ratio is 12 volts. 44 to 1 ratio readings are about 3 v.



yoke winding, open transformer or defective component.

Another test jig for in the home service may be constructed, as shown in Fig. 4, to check an output transformer for shorts. It consists of a lamp, socket, a-c cord, and alligator clips. After the plug has been pulled out of the TV chassis, proceed in the following manner: Cut the vertical output transformer hot lead from the yoke, isolating the transformer. Connect an a-c voltmeter across B+ and the hot lead of the transformer secondary. The 117 v line is connected across the primary of the transformer. Insert the lamp's socket plug into an a-c outlet.

The average transformer has a step-down ratio of 9 or 10 to 1, and a reading below 12 volts on the VOM indicates a shorted component. Some manufacturers use a 44 to 1 ratio and in this case any reading below 3 volts indicates a shorted part.

A shorted vertical output transformer can cause loss of high voltage in a TV receiver. This, of course, is due to a B+ short, or other fault causing a loss or radical reduction in B+ voltage.

Often, the transformer winding shorts to the housing, (which is grounded to chassis), causing a B+ short. In many cases, isolating this type short from ground, by lifting the transformer from the chassis, will restore normal TV operation.

Commercially manufactured TV analyzers warrant serious consideration as additions to standard shop equipment. These units are, as expected, more reliable than any constructed gimmick testers and, in addition, offer more test facilities than the home-made units.

An important consideration in servicing a vertical circuit is understanding practical operating action

of variable vertical controls. The vertical hold, linearity, size controls perform a specific function and a defective control is indicated by some defect in the picture. The vertical hold control varies the frequency of the blocking oscillator in order to sync it with the transmitted signal. The height control governs the amount of signal the amplifier stage is to receive for proper sweep. The vertical linearity control varies the cathode bias for the output stage to obtain linear sweep.

Many of the current TV receivers have specific weak points in the vertical deflection system. Listed are a few of the popular receivers and their individual recurring failures.

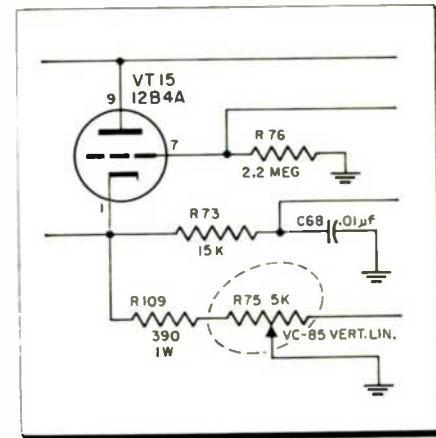


Fig. 7—Vertical collapse caused by open or pitted linearity controls was common to this model Macy TV receiver.

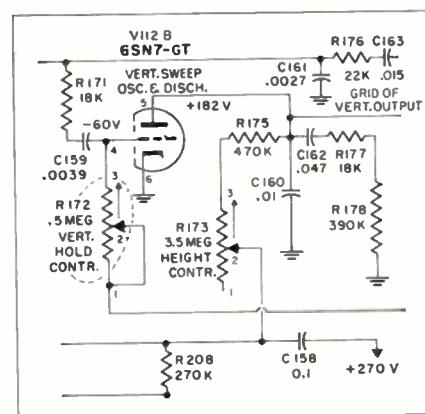


Fig. 6—Pitted vertical hold controls caused sectional or multiple unsyncable pictures in many RCA TV receivers using this circuit.

Case Histories

The Admiral portable sets often employ an auto transformer in the vertical output circuit, as indicated in Fig. 5. It is common to find a B+ short caused by breakdown of this transformer. Using the jig previously described will uncover the shorted output transformer.

The RCA KCS 83 series, shown in Fig. 6 has given a lot of trouble with open vertical hold controls, resulting in collapse of vertical sweep and/or charred spots in the control, causing off-frequency operation of the vertical oscillator.

It is clear to the experienced technician that multiple vertical pictures indicates the vertical oscillator is operating at a lower-than-normal frequency. Accordingly, any resistor or capacitor, including the hold con-

trol, in the time constant or frequency determining section of the oscillator has changed value. Increase of vertical oscillator frequency is indicated by sectional sync less pictures. Under certain circumstances, depending upon the type of oscillator, an open sync coupling capacitor, generally ranging from .0039 to 0.05 μf, will allow the oscillator to drift well beyond its normal operating frequency.

Macy's 921 SP925 series, illustrated in Fig. 7, have shown a siege of pitted vertical linearity pots which allows vertical deflection only when the pot is fully advanced. If the control opens at a point where little resistance remains in the closed circuit end, the 470 ohm/1 watt resistor in series with the pot and oscillator cathode will overheat and probably burn up. A manufacturer's (Traveller) production change in a similar type circuit suggests the substitution of a 680 ohm 1 watt part at replacement time.

Sentinel 606 series chassis have indicated an unusual number of com-

Fig. 8—Sentinel TV receivers using this circuit exhibit a weak spot: the 3.3 meg resistor opens (without discoloration), causing partial loss of vertical deflection.

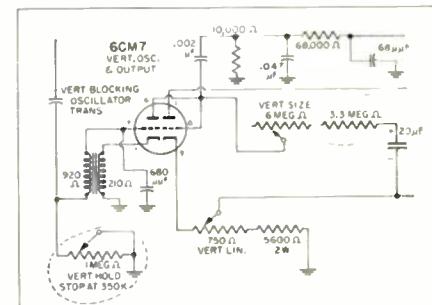
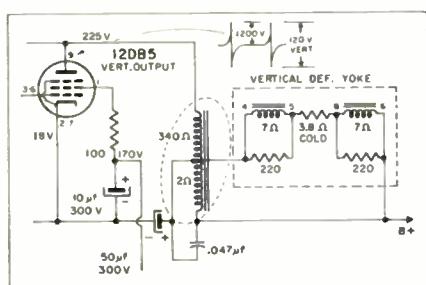


Fig. 5—The B+ short in this Admiral TV set may be caused by an internally shorted auto transformer in the vertical output circuit.



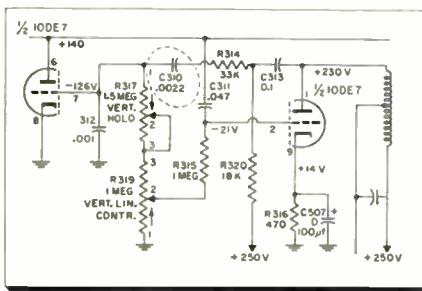


Fig. 9—High amplitude of the vertical spike in this Sylvania double-decked chassis shorts the under-rated .0022, 400 volt capacitor for complete loss of vertical deflection.

plaints of insufficient height. A 3.3 meg, 1/2 watt resistor in the vertical size circuit opens or increases in value to about 12-15 megs. Another source of repeated trouble in this set is the vertical hold control. Finding the exact replacement part at your local distributor may be a problem. The original part is a tapped 1.5 meg control with a tap at 350 K. Replacing this with a normal 1.5 meg pot will result in partial or complete vertical collapse as the control is varied. Inserting a 350 K resistor in series with the lead coming from the integrator, as shown in Fig. 8, converts the un-tapped control to a suitable component.

Sylvania's double-decked chassis with the 10DE7 vertical oscillator-output tube, shown in Fig. 9, has a habit of frequent vertical deflection failure. Incidentally, RCA used the same type chassis in their 17 inch red and white portable. After repairing many of these chassis, it was observed that the same component was being replaced in all sets (and in some sets more than once). It was found that a .0022/400 volt capacitor in the grid of the oscillator circuit was repeatedly failing. This capacitor is connected between B+, and the grid of the tube. The problem was solved by replacing the 400 volt capacitors with 1600 v types. Later, a production change came through recommending a 1000 v capacitor.

The TV service technician will sometimes find the exact auto type vertical output transformer missing from a distributor's shelves and the counterman will come up with a four lead easily converted replacement. Many of us in the field have changed four lead types to auto operation by merely joining the red and the yellow leads (sometimes the yellow

lead may be black), thereby creating a tapped transformer (illustrated in Fig. 10).

Some older Du Mont sets used a six lead vertical blocking oscillator transformer. Vertical sync failure was often caused by an open primary red and blue leads) on this transformer. Many of these sets are still in use, have been converted to 20 inch rectangular picture tubes and still pop up with sync trouble caused by this failure.

Replacement vertical blocking oscillator transformers are a little difficult to obtain in many localities and replacing this part requires chiseling or drilling away the mounting rivets holding the original part. The pri-

at 30 cycles. If this pulse is normal, and the picture is rolling "fast," the oscillator is probably way off frequency and the trouble lies in the frequency determining network of the oscillator.

The aforementioned types of defective sync should not be confused with that caused by poor low frequency response in a defective video i-f, detector or video output circuit. This generally results in a "soft" vertical hold, with frequent picture "flips" on random noise pulses.

Complete vertical collapse is sometimes difficult to pinpoint quickly. This failure, however, is generally confined to an open blocking oscillator transformer section, output transformer, decoupling or B+ supply resistor; shorted or open coupling capacitors, and of course, open vertical coils in the deflection yoke.

In approaching any vertical sweep problem, the careful technician will examine the manufacturer's schematic and service data, paying particular attention to the B+ source supplying the vertical sweep section. He knows by experience, for example, if part or all of the section is supplied by B+ boost, his vertical trouble may easily originate in the horizontal output, flyback, yoke, damper circuitry.

Conversely, he also knows that the cause of trouble in these horizontal areas can be caused by a B+ boost short in the vertical sweep section. Furthermore, when other circuits are operating normally, he recognizes that most vertical component breakdowns display a typical symptom on the CRT screen. He has made it his business to become adept at diagnosing the exact area of failure by remembering or neatly recording past experiences. •

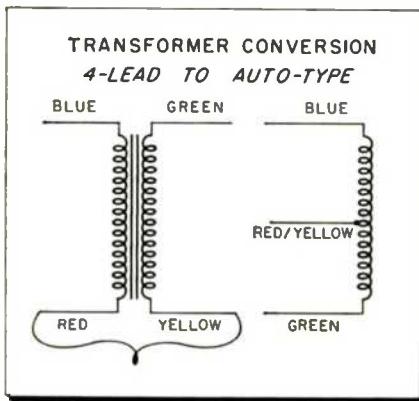


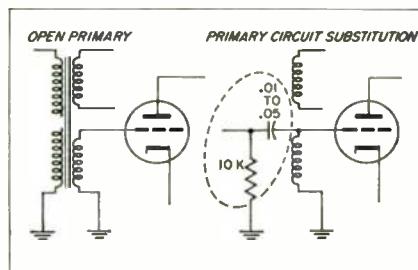
Fig. 10—If an auto transformer is not obtainable at a parts distributor, a four-lead transformer (with the proper turns ratio) can be converted, as shown.

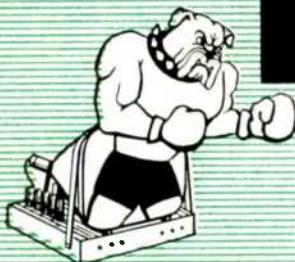
mary winding can be simulated by connecting a 10 K/.01 or .05 capacitor-resistor network in its place, as shown in Fig. 11. Vertical sync may prove better than the original and rarely will the oscillator circuit conversion break down.

In addition to vertical failure characteristics of sets previously described, the technician is frequently confronted with general faults occurring in all TV types, models and production runs. It is obvious that while blocking oscillators and multivibrators perform identical basic functions, they do so by entirely different means and by employing various circuit configurations.

A slowly rolling picture that cannot be locked generally results from the absence of vertical sync pulses at the oscillator grid. This fault can be quickly isolated with a scope set

Fig. 11—Some Dumont sets, converted to large-screen CRT's, use a six-lead V.B.O. An open primary winding can be replaced by the illustrated R-C network.





"Tough Dog"

Corner



Difficult Service Jobs Described by Readers

Intermittent Vertical Stretch

My customer complained of periodic picture elongation in a GE model 12T24, "G" line. At the first call the symptom did not occur. I asked the owner of the set to please call again if the trouble came back. A few days later the customer notified me that the set was acting up again. I requested that the set remain on until I arrived. At the home, the set would elongate and suddenly snap back to normal size. I replaced the vertical output tube but the trouble remained. The customer consented to my removing the set for shop repair.

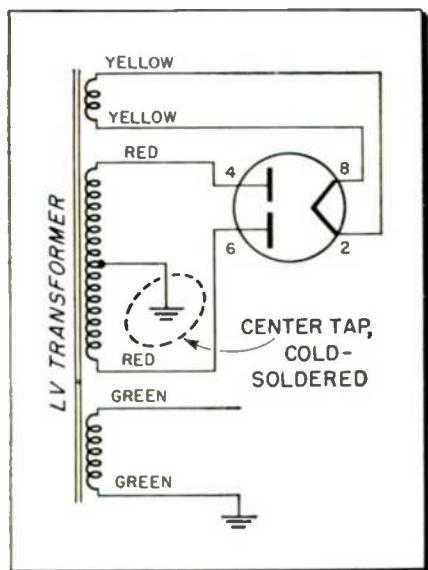


Fig. 1—Low voltage transformer center tap's cold solder connection caused intermittent vertical stretch. Detected by seeing an arc.

Once in the shop, I examined the entire undercarriage of the chassis for evidence of overheated resistors and wax-dripping capacitors. No clues

were apparent. I switched the set on and after a half hour the picture suddenly elongated. At the precise moment of the elongation, I heard a snap and spotted a faint bluish arc visible near the low voltage transformer. I then turned the set flat on the bench to closely inspect the area around the low voltage transformer. The arcing was coming from the ground connection of the center-tapped winding of the transformer.

Shutting the set off and using my ohmmeter I found, by wiggling the ground connection (illustrated in Fig. 1), I could make and break the contact. This unmasked a cold solder joint and I applied heat and solder to the existing connection. Normal operation returned and after "cooking" the set for about two hours, confirmed satisfactory completion of the repair.—George F. Georges, Staten Island, N.Y.

AFC Resistors Kill High Voltage

A Motorola 17T5E with sound, but no raster was brought to my shop by a customer. A check with my high voltage probe showed absence of second anode high voltage. All tubes were checked and, since my tube checker indicated they were good, as a double check, I replaced all tubes allied to the high voltage supply with known good tubes.

Using my VTVM, the grid of the horizontal output tube (25BQ6) measured zero. Surmising the set was not oscillating, I backtracked to the horizontal oscillator circuit and compared pin voltages with the manufacturer's schematic. Plate and grid voltage of the afc portion of the 6SN7 tube should have read $-1\frac{1}{2}$ volt, it measured 40 volts positive. The os-

cillator grid was about 20 volts positive, as well, instead of a negative voltage.

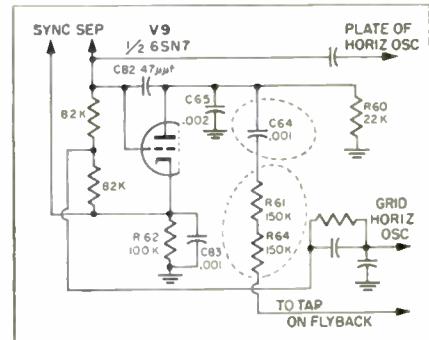


Fig. 2—Combination failures in the feedback circuit caused loss of high voltage.

Lifting the $47\mu F$ capacitor, unsoldering the lines from the sync clipper and horizontal oscillator section made no difference. I still had the unwanted voltage. I then isolated the .001 capacitor, which couples the horizontal frequency from the flyback, as shown in Fig. 2—the raster returned. A simple resistance test revealed the .001 capacitor was leaky and I promptly replaced it. Turning the set on, my high voltage was lost.

Considering this strange twist, I speculated that something was overloading the afc and/or horizontal oscillator circuits. I proceeded to examine the feedback resistors, since a leaky capacitor could change a resistor's value. After locating them (two resistors) in a six inch sleeve, an ohmage check showed they had decreased from the required 150K to an unwanted 5K resistance. Replacing the additional defective parts and resoldering the previously unsoldered connections restored normal set operation.—Edward Troman-hauser, Jackson, Mich.

Solving Audio Matching

Distortion & Power Loss Can Frequently

NORMAN H. CROWHURST

- A majority of the questions asked by technicians, and others interested in audio or high fidelity, have some connection with impedance matching. Consequently, it is important to clarify the meaning of impedance matching in its various applications.

Input Matching

The first requirement at the input end of an audio amplifier is sufficient voltage or current to the first stage. At this point power is not the criterion, since a tube amplifier depends on the voltage (and a transistor amplifier on the current) delivered to its first stage. Other things being equal, a higher impedance delivers a higher voltage and a lower impedance a higher current.

On this basis, a tube amplifier works better with a high impedance pickup or microphone connected to its input. A transistor amplifier gives more gain from a low impedance version. But this is not all there is to the subject.

A high impedance connection, ideal for tube amplifier inputs, needs shielding; and shielding on a high impedance connection results in high frequency loss. Thus, a compromise is needed to suit the individual situation. In a hi-fi system, the connection can be reasonably short, say a few feet. Consequently a moderately high impedance with accompanying shielding is acceptable.

Most magnetic pickups have an impedance of a thousand ohms or so. This is not to be confused with the recommended load required to optimize frequency response, which is

usually in the range of 20,000 to 50,000 ohms.

This brings us to the frequently asked question about the proper input resistor for a particular pickup (Fig. 1). With magnetic pickups, where a considerable inductive component exists in the pickup's impedance, it is fairly important to use the correct value. A typical result of using input resistance values other than the correct ones is shown in Fig. 2.

With moving coil pickups, especially when no transformer is used,

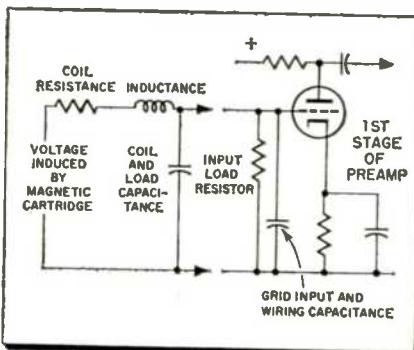


Fig. 1—Basic resistive, inductive and capacitive components contributing to proper impedance match when a magnetic pickup is connected to a preamplifier input.

the precise resistor value makes little difference. Using one that is radically too low—say 100 ohms—may result in loss of extreme highs, but reasonably normal values all perform about the same.

The newer moving magnet types are more critical than the moving coil, but not usually as critical as the more conventional magnetic type. The moving coil has much lower impedance, not by choice, but because it is impossible to wind any higher impedance on such a small

coil. For this reason its load is not critical.

Microphones

Public address and industrial installations using microphones frequently require long mike lead lengths. Lower impedances are therefore needed. The choice here is usually 500 to 600 ohms. Connecting a microphone of this impedance directly to a tube grid will result in some 20 db less gain than using a high impedance microphone. To eliminate this loss, a line matching transformer is used on the amplifier input.

It is important for the matching transformer to be at the amplifier end of the connection (Fig. 3). If it is at the microphone end, all benefit of the 500 or 600 ohm line impedance is lost.

Here we should clarify the difference between microphones. If the microphone is crystal or ceramic, its impedance characteristic is high. Moving coil, ribbon and similar microphones are basically low impedance types. They can only be made line or high impedance by building a transformer into them.

A low impedance microphone can be used satisfactorily with leads up to 30 or 50 feet, but the amplifier will need a microphone-to-grid transformer at its input. Some amplifiers (usually professional) have self-contained input matching for low Z mikes.

A line impedance (125, 250, 500 or 600 ohms) microphone can be used up to any distance from the amplifier. For best results the amplifier line-to-grid input transformer should match the microphone impedance. If a lower impedance microphone is connected to a higher

Problems

Be Traced to Mis-Matched Impedances

impedance input, sensitivity is reduced and there may not be enough gain, depending on the reserve power of the amplifier. If a higher impedance microphone is connected to a lower impedance input, quality is lost, particularly the higher frequencies.

When a crystal or ceramic pickup or microphone is used, it is also important to maintain a very high amplifier input impedance. In this case the use of too low an input impedance results in loss of low frequencies. The exception to this is when the input circuit is precisely designed to adapt a particular ceramic or crystal pickup to give an output corresponding to a magnetic type.

With transistors, the input matching problem is almost reversed. To obtain optimum gain, the lowest impedance is ideal. But the use of too low an impedance results in distortion. A transistor's input impedance is non-linear, and relies on a certain minimum input source impedance to linearize input current. The ideal input impedance can very easily be modified, however, by the transistor circuitry, which has possibilities for variation that tube circuits do not have.

Output Matching

Generally, the first requirement at an amplifier's output is the production of maximum power with minimum distortion. Proper drive to the amplifier is assumed.

Maximum power with minimum distortion depends on the load value reflected to the plate circuit of the output tube(s). The proper value is one which produces the most linear operation over the greatest voltage

and current swing. Every tube, or pair of tubes, has an optimum load for this purpose, according to operating conditions (B+ supply and grid bias) chosen.

How critical is this load value in relation to maximum output and minimum distortion? The question usually assumes the specified load value, whether correct or not, is constant. Usually the question relates to a loudspeaker, and its nominal value is only correct at a few frequencies. (Speaker impedance ratings are usually measured with a 1,000 cps input signal). Over most of the range, the impedance is either below or above its nominal value.

Therefore, if the nominal value is correct, the actual impedance may deviate widely from the intended matched load. If the nominal value is incorrect, the probability is that deviation from optimum loading will be increased. But the exact effect of this kind of deviation depends on several factors: (A) the kind of output tubes used, (B) how they are operated and (C) the manner in which feedback is used.

The safest rule is to stay within a 2:1 ratio either way from nominal. If the rated amplifier output impedance is 8 ohms, a loading between 4 and 16 ohms is not likely to make a radical difference in performance.

With pentode tubes, use of a load higher than the rated nominal will give greater output under this condition. With triodes, a lower value increases the output. These statements apply infallibly only without feedback. When feedback is used in the amplifier, different results are apt to occur.

If you are looking for maximum power when there is a gain limita-

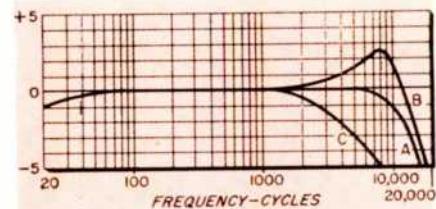


Fig. 2 (A)—Frequency response with the correct value preamplifier input load resistor. (B)—Response when resistor value is doubled. (C)—Response when correct value is cut in half.

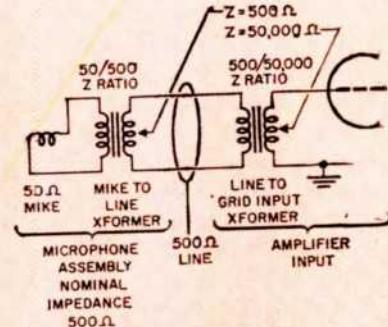
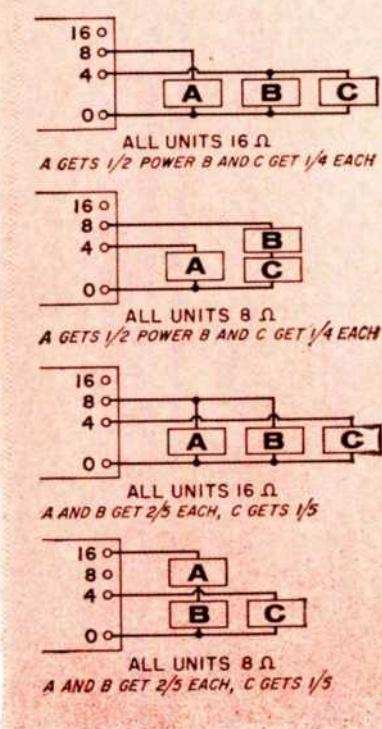


Fig. 3—A line-to-amplifier matching transformer is required at the amplifier input when long microphone cables are used.

Fig. 4—Speaker connection combinations using different amplifier taps for obtaining varying power distribution in each speaker.



tion, you can try connecting the load to different speaker output taps, leaving the gain wide open. But if you are looking for the best tapping to use for maximum power with minimum distortion, you need to adjust the gain control each time you change tapping, carefully listening (or looking, with the aid of a scope) to get maximum power with minimum distortion on that tap. Only by carefully comparing results obtained on each tap can you discover which tap gives the most power before distortion begins.

Multiple Speakers

Often people want hi-fi in various rooms, so they just connect more speakers to the same amplifier. If 16 ohm speakers are used, for example, they go on connecting 16 ohm units, all onto the same 16 ohm output tap. Presently they find the amplifier is incapable of driving them all.

This is not only due to the power divided between too many units, but also because the amplifier is seriously mis-matched, so it no longer gives its normal power. If you have four 16 ohm speakers, they should be connected in parallel on the 4 ohm tap because the resulting impedance is 4 ohms.

Connecting several loudspeakers, with different voice coil impedances, you may want to operate each at a different loudness. When the amplifier drives one speaker to a desired volume, another may be too loud. This requires some connecting ingenuity to enable the various units to receive different portions of the total power.

This can be worked out by determining how much of the total power each gets. Fig. 4 shows some possibilities by connecting speakers to different amplifier taps. This may not always give the combination you are looking for. If not, it may be possible to find a series connection or combined connections that uses the output power in the best manner. Some possibilities of this kind are shown in Fig. 5.

Space limitations forbid a pro and con discussion of series connecting loudspeakers. If results are acceptable and satisfactory, don't worry about series connections. If some of the speakers don't sound right, however, the series connecting may be

the culprit.

Another matching question concerns multi-way systems involving tweeters and woofers of different impedances. How can you connect this speaker array properly? Some say you can't; some do it incorrectly, but it sounds acceptable; and there is a correct way: It is correct to use different amplifier taps to feed the units, using separate crossover sections to suit the individual impedances (Fig. 6).

Many people who want multiple speaker operation also want to control the volume from each speaker locally. This can be achieved by inserting proper L-pads in each loudspeaker. But the user should be warned to use them properly. These L-pads are in a power circuit. Because 10 or 15 db loudness difference does not have a great effect, it's easy to forget that an L-pad can absorb a major portion of the total power. Here's an example of what can happen: If you want to turn the remote speaker down while keeping the main speaker loud, you may also

Fig. 5—Series-parallel speaker hook-up combinations for obtaining various power distributions. Note percentage of power distribution to individual speakers.

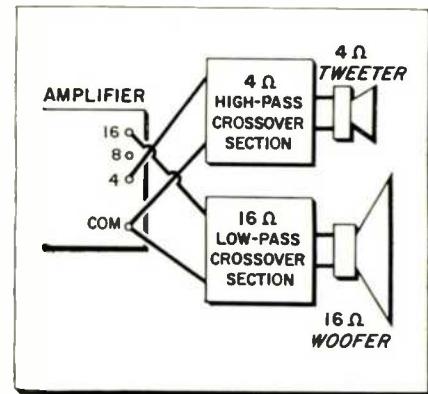
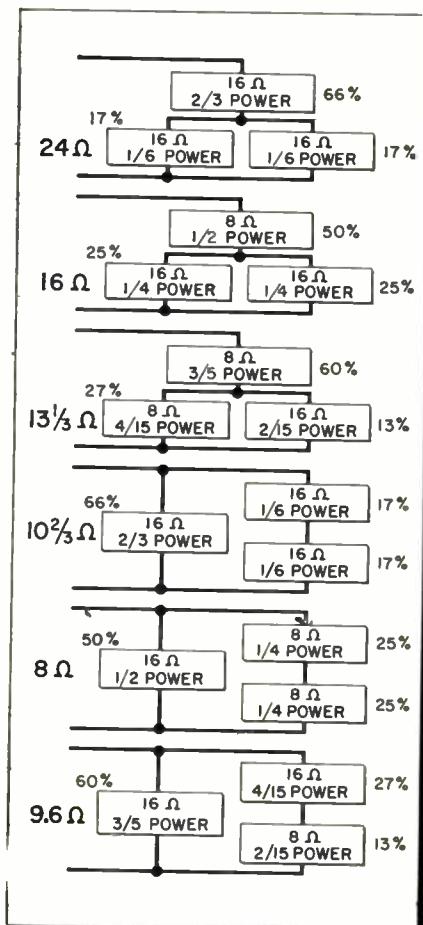


Fig. 6—Tweeters and woofers with different impedances can be connected properly by using different amplifier output taps.

want to do the opposite. So it's necessary to provide both speakers with L-pads. Now suppose the speaker near the set has already been turned down by its L-pad, and the user wants it at normal volume. Instinctively he turns up the main amplifier volume control—and gets plenty of distortion.

For this reason, it would appear more sensible to use a preamp with cathode follower output for the connection between rooms. Then each room would be provided with its own power amplifier feeding its own speaker. The power amplifier gain control can then set local volume without fear of getting into a distortion situation. A few systems are being designed to operate in this manner. It appears to be a favorable trend.

If a customer doesn't feel it's worth the cost of additional amplifiers as well as speakers, then suggest that the speakers be installed so they all sound equally loud in their own rooms, when all are on. If they are provided with individual switches the unwanted ones can be switched off. When you go to the set to select a program, you can adjust the local speaker level from there and, if not wanted, switch it off. This will then give the correct level where you want to listen.

Transformers

Some hi-fi enthusiasts frown on the use of input transformers. Others frown on output transformers, suspecting they are the major source of distortion in their rig. Often, ironically enough, they suffer far more
(Continued on page 72)

New Thermoelectric Semiconductors Heat & Cool Efficiently

● Development of a thermoelectric semiconductor alloy which produces heat or cold, without moving parts, has been announced by General Thermoelectric Corporation, Princeton, N.J. The material, called Neelium, is composed of bismuth, tellurium, selenium and antimony.

Eight of the thermocouples are fabricated into a module, called a Frigistor, and sealed in a plastic case (see Fig. 1). Neelium thermoelements were said to be less than half the size of any known thermoelements, more efficient and capable of manufacture in quantity at costs that make commercial applications immediately practical.

As we already know, the phe-



Fig. 1—Frigistor module consisting of eight Neelium thermocouples compared in size with a typical germanium transistor.

nomenon of thermoelectricity occurs when an electrical current is passed through a suitable semiconductor material. The current moving in one direction produces cooling. Reversing the current produces heat.

When compared to present cooling and heating methods, gas expansion, ice, liquids or liquid gasses, thermoelectric methods appear far less complex (no moving parts) and the materials employed are not corrosive.

Applications

Thermoelectricity for cooling or heating may be used in place of all present day methods. Obvious applications include refrigeration, cooling and heating of homes, commercial buildings, automobiles, aircraft, ships, etc. Applications in industry, scientific and military, appear virtually endless and include: spot cooling devices for electronic equipment, microscope tables, cold traps for vacuum systems, dew point measuring instruments, temperature references and calibration devices; cooling photoelectric and infrared detectors, distillation devices, sonic transducers, and cooling devices for plasma, sera, etc.

According to the company, replacement of the entire compressor system of a refrigerator is possible, while occupying only a fraction of the space presently required (its size compares favorably to a germanium transistor's size). A number of elements could replace the present type air-conditioning and heating systems for houses and large office buildings by being built into the walls. A relatively small unit mounted in an automobile can serve the dual function of air-conditioning and heating. A switch that reverses the direction of the current is all that is required to change cooling to heating, the company said.

Simplified cooling of other electronic devices, including quartz fre-

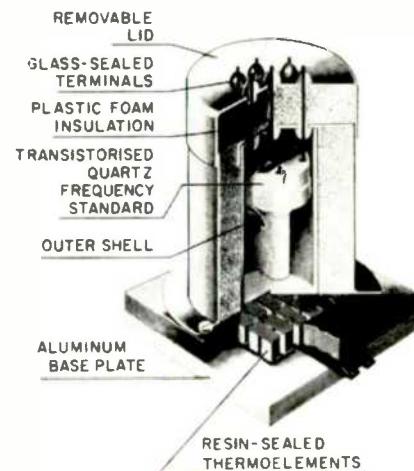


Fig. 2—Neelium thermocouples cool quartz crystal in frequency standard constant temperature chamber.

quency standards, (see Fig. 2) was said to be one of the principal applications of Neelium units. When used in devices which pump heat away from high power transistors to a heat sink, for a considerably higher dissipation rating, an eight couple Frigistor was reported to be capable of dissipating from 10 to 15 watts.

The company announced that experimental kits, containing all of the necessary components for thermoelectric cooling experimentation, including a guide booklet, were being made available to research centers, laboratories, schools, colleges and scientific groups engaged in applied research or broad experimentation. ●

Sencore SUBSTITUTION LAB

A new complete substitution service lab for fast, accurate, troubleshooting contains: model H36, for instant direct substitution of capacitors and resistors; ES102 electro sub, for electrolytic capacitor substitution; and the RS106 rectifier troubleshooter for selenium and silicon rectifiers substitution. These three units are designed to save technicians time in troubleshooting and to eliminate the soldering mess that occurs when actual parts are substituted for testing purposes only. Complete, \$41.45. Sencore, Addison, Ill.

For more data, circle 7-45-1 on coupon, p. 54



New Products For Technicians

B&K TRANSISTOR TESTER

Model 160 transistor tester uses a true small a-c signal measurement for transistor current gain (beta); and gives quick accurate direct reading of transistor's current gain. Accurate within $\pm 3\%$. Transistors are automatically biased to standard 1 ma. collector current. Tests gain and leakage current of



power transistors; permits accurate matching for audio circuits. Tests tetrodes and automatically provides proper bias for base 2. Socket and clip leads and reference chart furnished with each instrument. Operates on 105-125v, 50-60 cycle, a-c. \$69.95. B&K Mfg. Co., 1801 W. Belle Plaine, Chicago 13, Ill.

For more data, circle 7-46-1 on coupon, p. 54

Clarostat ABC HANDI-BIN

The ABC Handi-Bin is designed to provide the most versatile and useful selection of carbon controls possible with the smallest investment. The complete package consists of a heavily constructed steel cabinet containing a complete selection of carbon controls,



Pick-A-Shafts, switches and push/pull control switches. The cabinet is designed for either bench-top use or wall mounting. Gravity fed shelves provide automatic up-front positioning of the components. The ABC Handi-Bin cabinet is free, being supplied with the control and component selection. Clarostat Mfg. Co., Dover, N. H.

For more data, circle 7-46-2 on coupon, p. 54

EICO CODE PRACTICE OSCILLATOR

A rugged, battery-operated, transistorized unit, model 706 code practice oscillator features: built-in 3" speaker; pitch, tone and/or light controls; flashing light on panel which can also be used for after-dark signaling; and external key terminals, plus a "tempo-

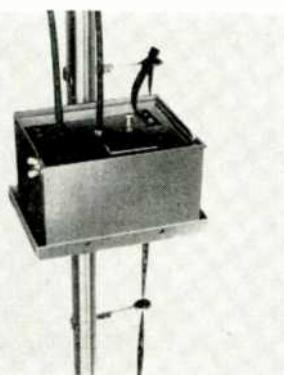


rary" key on the front panel. Tone frequency range, approximately 500 to 2,000 cps continuously variable. Current drain, at 3v d-c; tone, 40 ma; light, 300 ma; tone and light, 340 ma. Case, high-impact bakelite. Kit, \$8.95. Wired, \$12.95. Electronic Instrument Co., 33-00 Northern Blvd., Long Island City 1, N. Y.

For more data, circle 7-46-3 on coupon, p. 54

Blonder-Tongue TV BOOSTER

Model CB single-channel antenna-mounted booster amplifies signal strength of a single channel or, when connected in series with other CB amplifiers for other channels, provides a multi-channel system. Designed primarily for mast mounting, but may be used indoors. Specifications include:



Gain, channels 2-6, 17 db; channels 7-13, 15 db. Response, $\pm 1/2$ db for each 6mc TV channel. Maximum output, 0.5 v for 1% cross modulation. Impedance, input, 300 ohms; output, two 75 ohm solderless connectors. Power, 117v, 60 cps, 0.09 amps. \$52.50. Blonder-Tongue Labs., 9 Alling St., Newark 2, N. J.

For more data, circle 7-46-4 on coupon, p. 54

Hickok TUBE TESTER

Introduced is the new model 1234 cardmatic tube tester, reported to be more advanced than previous models. Because all set-ups are card-programmed, the tester can be operated by less skilled personnel and precise results will be obtained on every test.

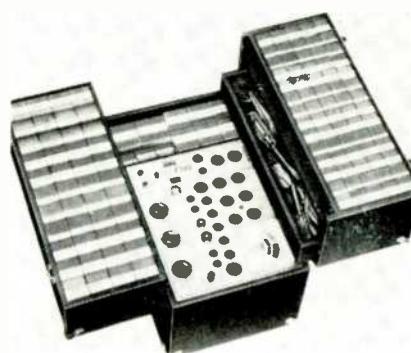


A greater Gm range in this model permits the testing of more tubes at their proper Gm value. Additional features are: easily accessible calibration compartment; calibration cards for self calibration of the instrument and controls for specialized tests. Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland 8, Ohio.

For more data, circle 7-46-5 on coupon, p. 54

Mercury TUBE TESTER

Model 102-C caddy tube tester is a tube caddy with a built-in multiple socket tube tester, which can be used in or out of the caddy. Emission, shorts, leakage and gas content of over 700 tube types can be checked. Types include the newest series-string TV tubes,



OZ4's, gas regulators, hi-fi and foreign tubes. Each section of multi-purpose tubes checked separately. The caddy has metal corners, a tool drawer and compartments that hold 125 tubes. Appliance power outlet on the panel of the tester. 7-pin and 9-pin straightener included. \$74.50. Mercury Electronics Corp., 77 Searing Ave., Mineola, N.Y. For more data, circle 7-46-6 on coupon, p. 54

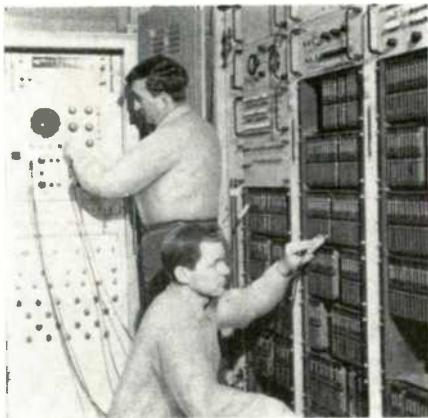


Fig. 1—Edward Arslanian (standing), Sylvania field engineer, and Stanley J. Porter, RCA technician, test data processing equipment with an echo word generator set.



Fig. 2—R. Braun, (kneeling), and H. Brewster, GE technicians, check out synchronizer unit at Thule, Greenland.

• Preliminary tests for performance are under way on the initial units of the gigantic detection radars of the U. S. Air Force Ballistic Missile Early Warning System (BMEWS), at Thule, Greenland. (See Figs. 1 to 3.)

Designed to send their beams over 2,000 miles across Eurasian skies to detect ballistic missiles aimed at the United States, Great Britain, and southern Canada, BMEWS will give the North American Air Defense Command, (NORAD) the Strategic Air Command, (SAC) and Civil Defense agencies the brief, but vital, warning time necessary to take defensive and retaliatory measures. When completed the system will have radar bases located at Thule, Greenland; Clear, Alaska; and Fylingdales Moor in Yorkshire, England. These bases will be connected by a rapid communications system to

Technicians Check Missile Early Warning System

NORAD headquarters, Colorado Springs, and to the SAC headquarters at Omaha, Nebraska.

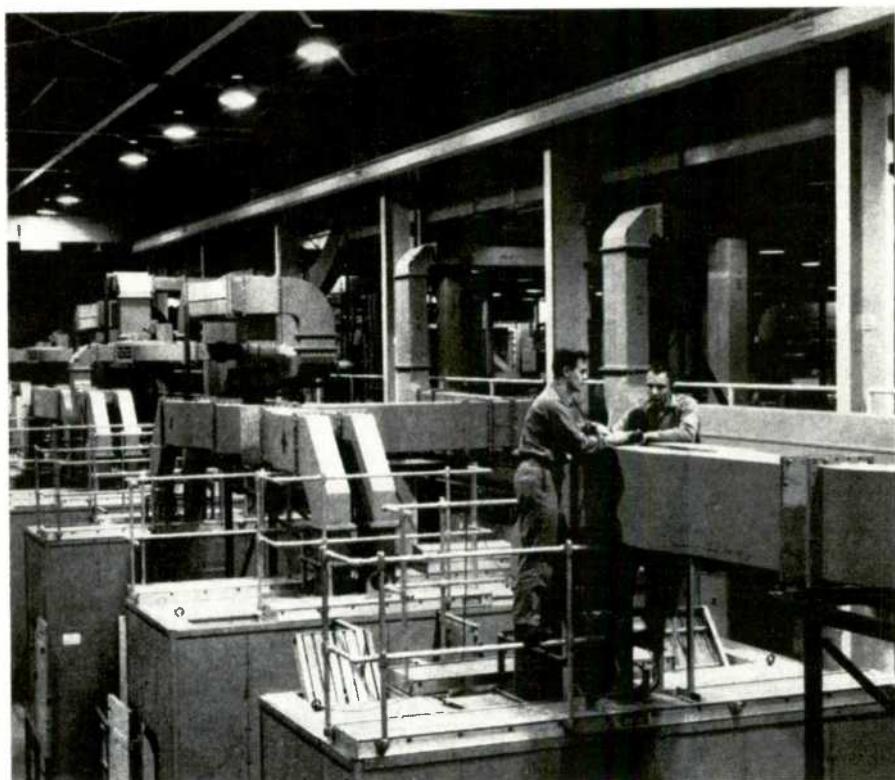
Construction of the long-range ultra-high-speed electronic complex is under the direction of the U. S. Air Force with the Radio Corporation of America as prime system manager. The joint industry and military project is supported by General Electric, Goodyear Aircraft Corporation, Sylvania Electric Products, Inc., Western Electric, as major subcontractors, plus a team of almost 3,000 large and small business suppliers located in 29 states from coast to coast. RCA Service Company will furnish installation, maintenance, and operational services at the sites for a period of at least two years. Special headquarters have been set

up at Riverton, N. J., for technician training courses. The company currently employs 1,400 on the project, with an eventual build-up of the total force to 4,000.

Warning of an attack and identification of enemy ICBM's and detailed trajectory data will be made by transistorized digital computers and allied data processing systems at the forward sites and at NORAD headquarters. All information will be projected on graphic visual displays at NORAD and SAC within seconds of the time the enemy missiles are detected.

Extreme reliability of critical equipment is achieved through duplicate circuits which automatically take over the function of a component which fails. •

Fig. 3—GE technicians, Robert Morse, left, and Elnor Schilling, right, inspect waveguide sections which will carry r-f energy from transmitter power amplifier cabinets to scanner building. Nine-foot high klystron tubes are used in power amplifier.

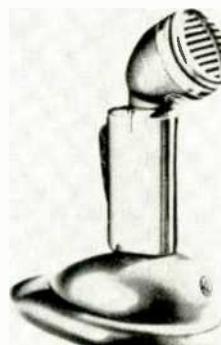


New Audio Products

Shure MICROPHONES

Two microphones, designed for single-side-band transmission, models 440 and 440SL, have high speech intelligibility for the narrow audio frequency range required in single-side-band transmission. Model 440SL, shown, is an integral assembly of a microphone, a grip-to-talk slide-to-lock switch and a desk stand. Microphone response cuts off sharply below 300 cps and above 3,000 cps, with an average rising characteristic for speech intelligibility. Model 440, \$15.00. Model 440SL, \$28.50. Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.

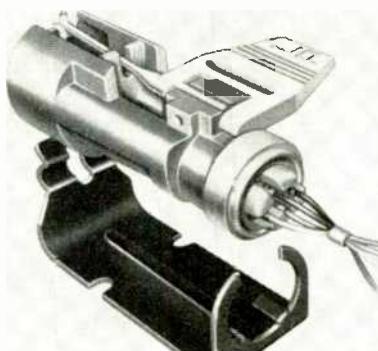
For more data, circle 7-48-1 on coupon, p. 54



Sonotone STEREO CARTRIDGES

New Series "12" high output, crystal, stereo cartridges feature an all-plastic cartridge, except for the styli, crystal elements and mounting bracket; a snap-in and snap-out needle assembly; and a jack-in terminal plug for easy replacement of the cartridge. There are no eyeletted or cemented joints. All parts snap and lock together. Output: model 12TH, 2.5v; model 12TL, 1.0v. Either model, including mounting bracket, terminal plug, and standard 0.7-mil, 3-mil turnover sapphire jewel tips, \$6.45. Sonotone Corp., Elmsford, N. Y.

For more data, circle 7-48-2 on coupon, p. 54



Rek-O-Kut HI-FI SOUND SYSTEM

Rythmaster, a portable multi-speed hi-fi sound system, has particular application in teaching skills demanding synchronized movement such as dancing, skating, swimming, etc. Record playing speed is continuously varied from 25 to 100 rpm without stopping the turntable, which operates on either 50 or 60 cycles. Can be used with 33 1/3, 45 and 78 rpm records and permits slowdown to 1/3 normal tempo and speed-up to 300%. The system comprises: full range hi-fi phonograph; hi-fi PA system; and hi-fi radio (when used with AM-FM tuner). \$349.95. Rek-O-Kut Co., 38-19 108th St., Corona 68, N. Y.

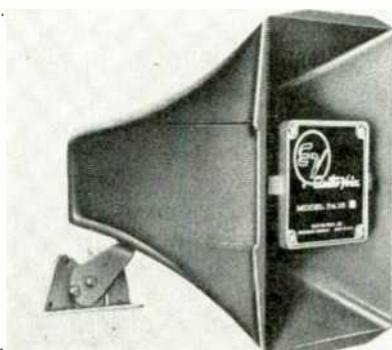
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E-V PA PAGING SPEAKER

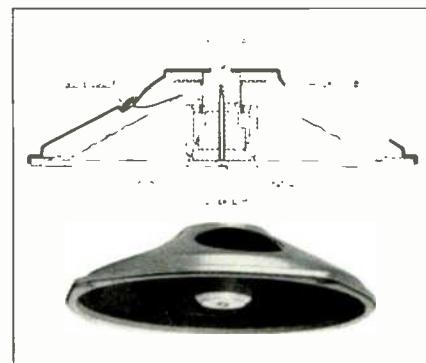
Model PA15, designed for a variety of paging applications, has a power handling capacity of 15 watts, provision for an internal matching transformer, and uses a field replaceable driver. Its well-balanced sound gives maximum noise penetration, and its unifold die-cast design gives optimum voice reproduction with minimum size and cost. Also, not shown: model 844, compact low-cost paging speaker for general use; and AR150 ring reflector re-entrant horn. Electro-Voice, Inc., Buchanan, Mich.

For more data, circle 7-48-4 on coupon, p. 54



Utah SPEAKER

Claimed to be the first practical inverted speaker, the new "Magni-Magic" is offered in both 8" and 6"x9" sizes. Developed for this unit, a magnetic circuit utilizes the popular and efficient dual diameter Alnico V magnet in conjunction with a highly specialized



pure iron magnetic return circuit, plus a self-centering pole assembly. It features a slim profile which is provided by removing the pot and magnet assembly from the back of the speaker and placing it inside the cone. Utah Radio & Electronic Corp., Huntington, Ind.

For more data, circle 7-48-5 on coupon, p. 54

For More Information On NEW PRODUCTS Circle Code Numbers, p. 54

Bogen INTERCOM

The new TIS series of transistorized intercoms may be used in any of three basic arrangements: Single master-multiple remote with up to 23 remote stations; all master system with up to 24 masters; and multiple master-multiple remote with up to 24 stations. Power requirements, 117v a-c, 7 watts. Output impedance, balanced 45 ohm line. Available in steel or wood cabinets. Wide variety of accessories include telephone-type handsets. Bogen-Presto, P.O. Box 500, Paramus, N. J.

For more data, circle 7-48-6 on coupon, p. 54

Knight STEREO TUNER

Deluxe stereo FM-AM tuner kit, 83 YX 731, features completely independent FM and AM sections. The FM section sensitivity, 2 1/2 μ v for 20 db of quieting. Complete FM-AM kit, \$87.50. FM tuner kit, \$68.50. "Add-in" AM section, \$21.50. Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill. For more data, circle 7-48-7 on coupon, p. 54

SHOP HINTS



Tips for Home and Bench Service

Antenna Helper

Did you ever stand on a ten foot ladder leaning against a guyed TV mast, on a peaked roof forty feet from the ground, removing a defective rotor and holding a stacked yagi in one hand—wondering whether to drop the yagi and then fall, or vice versa? If so, you may be interested in this time-and-life-saver. This gimmick will hold the antenna while you remove the rotor.

A piece of $1\frac{1}{2}$ " tubing 18" long is bolted over a piece of $1\frac{1}{4}$ " tubing about 3' long. Two pieces of $1\frac{1}{2}$ " angle iron about 12" long are attached with antenna "U" clamps to the main body. At the opposite ends of the angle irons, drill $\frac{3}{8}$ " holes for a pair of $1\frac{1}{2}$ " muffler clamps. See Fig. 1C.

Here is how it works. When the mast is telescoped down to a point where the rotor can be reached, the "little helper" is clamped to the mast, as shown in Fig. 1B. The antenna with stub mast is lifted out of the rotor and dropped into the big end of the helper, as illustrated. This procedure now frees both hands for re-

moving the rotor and supports the antenna until the repaired rotor is returned. It has the added advantage of allowing the customer to use his antenna in one fixed direction while repairs are made.—Dennis Crisp, Howard, Kansas.

Flag That Tool!

Small often used tools have a habit of "disappearing" when you need them most. A favorite, much used adjusting tool can roll off your test bench or desk. Perhaps it became hidden in a clutter of tools and small parts on the work bench. To quickly end this problem, "flag" the alignment tool, probe or pen with a bit of pressure tape, as shown in Fig. 2. A band of tape is placed near one end of the tool, with the tape ends squeezed together, to make a flag. This flag prevents the tool from rolling when it is placed on a flat surface. A daub of red paint or other color code on the flag will make a popular tool easy to spot at a glance if it's buried among other tools.—Glen F. Stillwell, Manhattan Beach, Calif.

Fig. 1 (A)—The antenna helper is clamped to the mast after the mast has been telescoped down to position. (B)—The short mast holding the antennas is disconnected from the motor and then lowered into the helper's large end. (C)—Component dimensions of the "little helper."

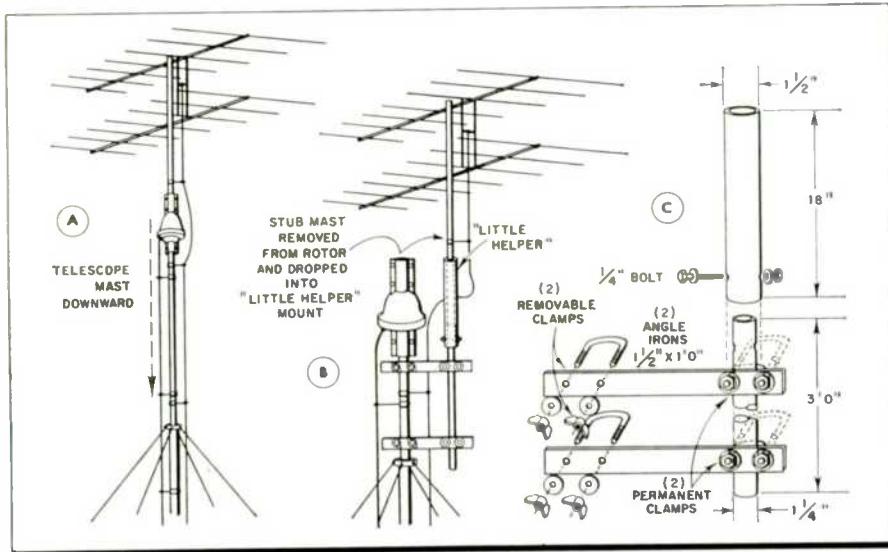


Fig. 2—A color coded pressure-tape "flag" attached to alignment tools, prevents their rolling from bench top. Locating tools is simplified in cluttered surroundings.

Damper Kills Sound

When some technicians confront a TV with no raster and no sound, they suspect, and rightly so, B+ trouble. After checking the fuses, low voltage rectifiers, etc., and the trouble is not corrected, they frequently determine it's a shop job.

A set with these symptoms was brought into my shop recently and, once on the bench, the trouble was quickly traced to a defective damper tube. A glance at the schematic showed that the 6DT6, a gated-beam sound discriminator, received its B+ from the boost line (Fig. 3). Sound was promptly killed when the boost voltage line became defective.

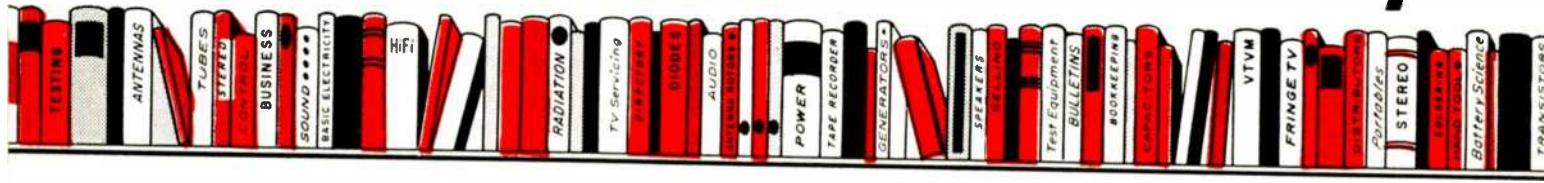
(Continued on page 56)

SHOP HINTS WANTED!

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

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TWO-WAY RADIO

By Allan Lytel. For the communications technician, and those interested in entering the field, this book covers mobile and fixed base stations. Theory is presented with a minimum of math. Antennas, selective calling, power supplies and test instrument chapters are included. Photos, drawings and charts are generously used. Hard covers, 304 pages. Price \$9.50.

INDUSTRIAL CONTROL CIRCUITS

By Sidney Platt. Excellent starting point for TV technician interested in learning about industrial electronics. Non-mathematical text explains circuitry and operation of power controls, relays, timers, photoelectric devices and instrumentation found in factories. Practical applications shown. Soft cover, 200 pages. Price \$3.90.

101 WAYS TO USE YOUR SIGNAL GENERATOR

By Robert G. Middleton. A fine collection of brief explanations on how to use the generator for various tests. Twenty-five equipment checks are presented, seven antenna tests, 27 AM-FM receiver tests, 28 TV tests, 10 component tests and four miscellaneous. Each description briefly lists the required equipment connections etc. Soft cover, 123 pages. Price \$2.00.

HOW TO USE METERS

By John F. Rider & Sol D. Prensky. Revised and brought up-to-date, this second edition includes such instruments as transistorized voltmeters and digital displays. Among the many meters covered are ohmmeters, voltmeters, milliammeters, wattmeters, panel meters, grid dip, VTM, thermocouple meters and many others. Testers are pictured with circuit schematics. 216 pages. \$3.50.

A-C MOTOR CONTROL FUNDAMENTALS

By R. L. McIntyre. A-c motor fundamentals are dissected by the author. Circuits are developed step-by-step, accompanied by a detailed discussion of their functions. Chapters include: Control of Motor Starting, Control Components, Pilot Devices, Development of Control Circuits, Maintaining Control Equipment etc. 248 pages. Hard cover. \$5.95.

BASICS OF DIGITAL COMPUTERS (3 vols.)

By John S. Murphy. Using the easy-to-learn picture book technique, these three volumes explain the theory and functions of digital computers. Very little mathematics. Covers counting systems, computer language, programming, memories, logic diagrams, flip-flops, clamping, input-output and data processing. Soft cover. 416 pages. Price \$8.10/set.

IMPEDANCE MATCHING

By Alexander Schure. Divided into five major sections, this informative book covers power transfer, impedance matching devices, matching at audio and r-f, and matching in transistor circuits. Complete with tables, schematics and computation examples. Soft cover, 128 pages. Price \$2.90.

RADIO OPERATOR'S LICENSE Q & A MANUAL

By Milton Kaufman. This sixth edition gives you the information you need to pass FCC license examinations. In question and answer form similar to actual FCC tests, all eight elements are covered, including law, radiotelephone, radiotelegraph, aircraft and ship radar, Abbreviations, code, etc. included. Hard cover, 736 pages. Price \$7.10.

HOW TO INSTALL & SERVICE AUTO RADIOS

By Jack Darr. This second edition contains much practical information of real use to technicians. In addition to service data on antennas, intermittents, noise suppression, speakers and troubleshooting, transistorized and hybrid radios are covered. 6-12 volt conversions are explained. Soft cover 160 pages. Price \$3.25.

INTERNATIONAL ELECTRONIC TUBE HANDBOOK

Published by De Muikerkring N.V. An unusual format is used by this American-Foreign tube manual: diodes, triodes, etc., are numerically grouped by different color bands. A schematic drawing of the specific tube socket with a commonly used circuit stage is illustrated, with volt-amp values listed next to the pin number. 402 pages. Vinyl cover. \$4.00.

★ 2-WAY MOBILE RADIO HANDBOOK

By Jack Helmi. The fast growing mobile radio field is expertly covered in 10 illustrated chapters exploring mobile radio, including: basic systems, receivers, transmitters, antennas, and control systems. One chapter covers servicing and setting up the shop. 208 pages. Soft cover. \$3.95.

PIN POINT TRANSISTOR TROUBLES IN 12 MINUTES

By Louis E. Garner, Jr. This comprehensive source of troubleshooting and repair information for all types of transistorized equipment, directly referenced to recently manufactured transistorized radios, TVs, hearing aids, mobile receivers, preamplifiers; audio amplifiers, auto radios, both hybrid and fully transistorized. 478 pages, soft cover. \$5.95.

SERVICING HI-FI AM-FM TUNERS

Volume 5 in the Sams series, this schematic collection of AM-FM tuners and receivers, published in 1958-1959, covers 15 brands. Parts lists and chassis layouts are shown. A short section is devoted to speakers. This book is primarily a circuit book, so there is no text devoted to the techniques of servicing tuners. 160 large pages. Soft cover. \$2.95.

OBTAINING & INTERPRETING TEST SCOPE TRACES

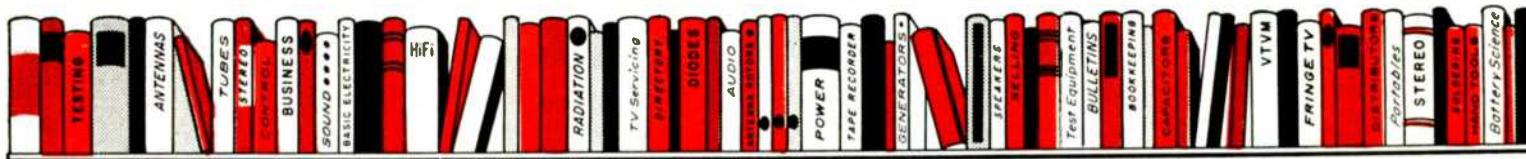
By John F. Rider. This handbook shows how to get the most out of your oscilloscope. Over 800 traces are shown, including sine, square, rectangular, trapezoid, sawtooth differentiated and integrated types. Explains scope connections, manipulating controls and test setups. Soft cover, 190 pages. Price \$3.00.

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By J. K. Lasser. Here is a basic business guidebook for service dealers and other operators of retail and small manufacturing firms. Covers record keeping, avoiding frauds, tax management, credit sales, insurance programs, how to buy an established business, financing and other important topics. Hard cover, 400 pages. Price \$4.95.

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By Milton Aronson & Charles Kezer. Here is a useful basic circuit reference book covering a wide variety under eight major sections, including power supplies, amplifiers, oscillators, pulse circuits, test instruments, alarms, phototubes and miscellaneous. In addition to the schematic, a page or two of text accompanies each circuit, explaining the operation and characteristics. Soft cover, 180 pages. Price \$2.00.

Also See New Books on Page 66

HOW TO TROUBLESHOOT TV SYNC CIRCUITS

By Ira Remer. Here is a practical and informative book on repairing that often troublesome part of the TV set, the sync section. After discussing fundamentals, the author digs into sync troubles, commercial sync circuits and color TV sync. Includes signal traces and raster photos. 128 pages, soft cover. \$2.90.

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One way to increase store traffic—and sell more batteries—is to take advantage of tester-merchandisers designed to encourage customers to test their own batteries.

past vacuum tube portable radios. At present, some of the most popular transistor radio batteries include the "D," "C," and "AA" size 1½ volt flashlight batteries, plus NEDA battery numbers 1600, 1601, 1602, 1604, and 1900. Contrast this with the economic impracticality of stocking more than 100 popular size batteries used in vacuum tube portables.

There are now 15 million portable radios, vacuum tube and transistor, in use in the U.S. About four million more are expected to go into operation this year. At the same time, one and one-half million will be retired because they are obsolete or inoperative. This indicates an excellent battery market. Are you getting your share of it?

In a survey of stores last spring, it was found that many dealers had inadequate stocks of dry batteries. Some didn't even have batteries for the portable radios they were selling. This is an extreme example of inadequate stocking, of course. However, it emphasizes the carelessness that exists when purchasing stock. Battery sales present an easy, non-aggravating profit maker. Every sales aid, and there are many available at only a reasonable or no cost to the service dealer, should be used. Here are some merchandising recommendations for electronic service dealers

Transistors Boom Battery Sales

Adequate Inventory, Proper Displays & Merchandising Promote Sales

NEAL FOSSHAGE
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• "The King is dead! Long live the King!" may be an appropriate declaration for electronic dealers doing a thriving portable transistor radio service business. Vacuum tube portables have a worthy successor in transistorized types, which account for 85% of the estimated five million portables manufactured in 1960.

Volume transistor battery sales, due to increased sales of transistor radios, are helping service dealers recoup their normal summer TV profit loss. The future of transistor radio battery sales is viewed opti-

mistically, as indicated by this recent statement by a prominent battery manufacturer sales executive: "Radio battery sales will increase 10 to 15% this year, and several hundred percent in the next ten years."

Alert service dealers are taking advantage of the trend toward transistors by increasing their inventory of radio batteries. They are, unlike drug and hardware stores, in a unique position to sell batteries because they can also give professional advice and service.

Inventory

Battery inventory for transistor radios is much simpler than with

that can increase battery sales 50 to 75 percent, as indicated by statistics. In addition, store traffic is increased.

1. Take advantage of radio and battery manufacturers free selling helps and displays.
2. Remind customers to buy batteries when they buy other items.
3. Attach a small sticker to the radio reminding the owner to return to your store for batteries.
4. Place batteries near the cash register for impulse sales.
5. Include radios and batteries in store advertising. These are impulse items that build store traffic. Free ad mats and layouts can be obtained

(Continued on page 58)



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For more data, circle 7-54-5 on coupon

6 Stereo Speaker Systems: A new complete stereo speaker system, the "Galaxy III," consists of a bass center and two satellites. Two new 3-way speaker systems are: TR-30 "TRi-ette"; and "Thrifty TF-3." These and other systems in the firm's line are covered in bulletin KU. Jensen Mfg. Co.

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7 Coils: Vol. 1, No. 1, of "The Coil Forum" tells how to build a transistorized FM receiver. Eight pages of data on circuits, construction, testing and alignment, sketches, and layouts. J. W. Miller Co.

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8 CB Radio: A folder describes the "Ray-Tel" low-cost personal two-way radio. Features include: highly

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10 Crystals: A 16-page citizens band directory provides transmitting and receiving crystal charts that show channel number and transmitting and receiving frequency. The charts are cross-referenced to descriptions of CB radios. Texas Crystals.

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7-13-1	7-45-1	7-54-3	7-62-1	7-68-9	7-73-1	7-78-1
7-14-1	7-46-1	7-54-4	7-62-2	7-68-11	7-73-2	7-78-2
7-15-1	7-46-2	7-54-5	7-62-3	7-69-1	7-74-1	7-78-3
7-17-1	7-46-3	7-54-6	7-62-4	7-69-2	7-74-2	7-78-4
7-18-1	7-46-4	7-54-7	7-62-5	7-69-3	7-74-3	7-78-5
7-19-1	7-46-5	7-54-8	7-63-1	7-69-4	7-74-4	7-79-1
7-20-1	7-46-6	7-54-9	7-66-1	7-69-5	7-74-5	7-79-2
7-21-1	7-48-1	7-54-10	7-66-2	7-69-6	7-75-1	7-80-1
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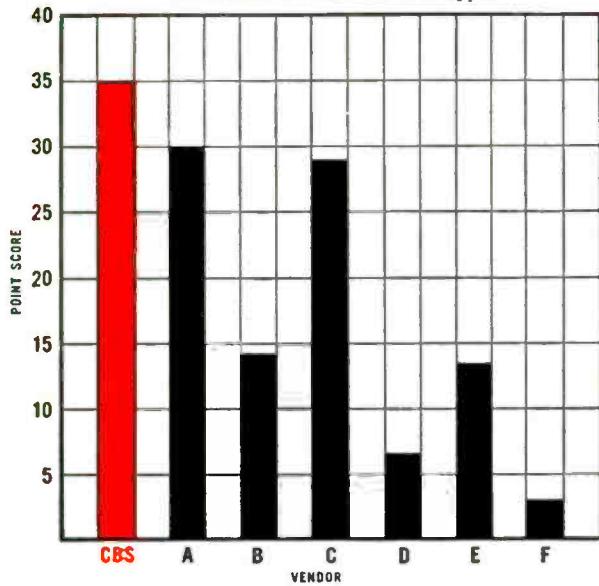
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Leading set manufacturers RATE CBS RECEIVING TUBES TOPS

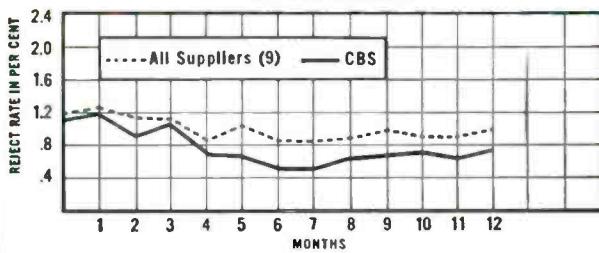
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B	2	2	0	Preferred
C	1	1	0	Preferred
D	10	10	0	Preferred
E	3	3	0	Preferred
F	4	4	0	Preferred
G	1	1	0	Preferred
H	6	5	1	Fair
I	5	5	0	Preferred
J	2	1	0	Preferred
K	1	1	0	Preferred
L	7	7	0	Preferred
M	1	1	0	Preferred
N	4	4	0	Preferred
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Total	65	64	1	

*Ratings: Preferred, Excellent, Good, Fair, Poor, Unsatisfactory

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	All Vendors	CBS
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2	.8	0
3	.9	1.0
4	.5	.5
5	.8	.3
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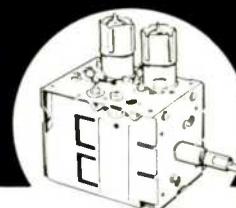
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Shop Hints

(Continued from page 49)

To avoid an embarrassing situation, the damper should therefore be checked when both sound and raster are missing. Some sets in this classification include Admiral 15A2, 15D1, Hoffman 344, and RCA KCS 120. When making voltage checks at the plate of this tube, a multiplier probe should be used on the VOM or a 1 meg resistor connected in series with the regular meter probe because of the high pulse from the boost line.—Albert J. Krukowski, West Springfield, Mass.

• It also follows: since the boost voltage is the sum of regular B+ and d-c voltage developed from the flyback pulse, if a stage that contributes to the flyback's operation fails, the added d-c voltage in the boost circuit will be missing. Therefore, if the horizontal oscillator or output stages are defective, not only will the raster disappear, sound may also be reduced due to the lowered B+ to the sound section.—Ed.

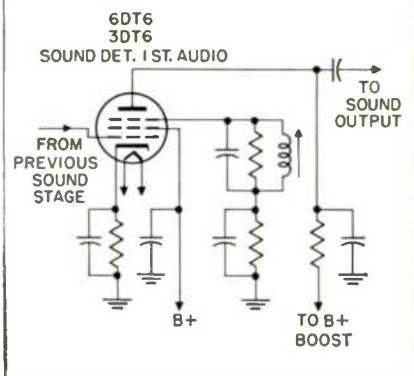


Fig. 3—When a TV set's first audio stage is powered from B+ boost, loss of raster and sound occurs when damper tube ceases to conduct. Failure of preceding horizontal stages results in lowered sound volume.

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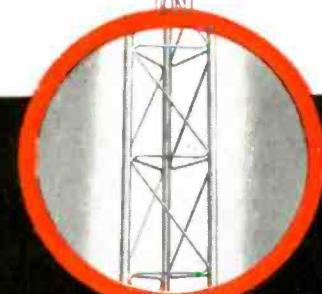
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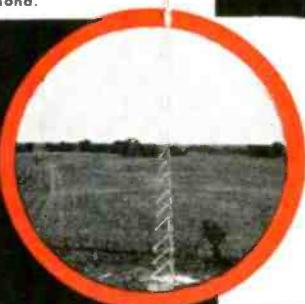
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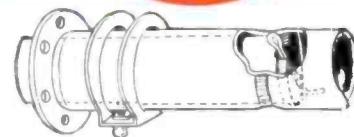
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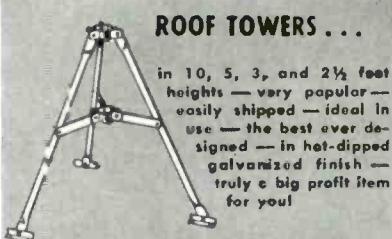
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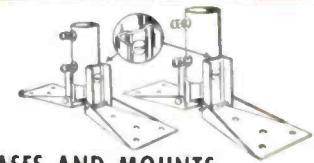
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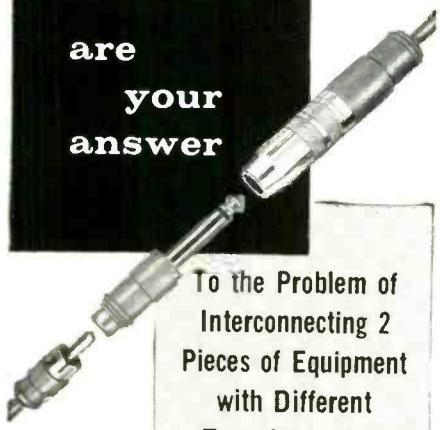
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Transistor Battery Sales

(continued from page 52)
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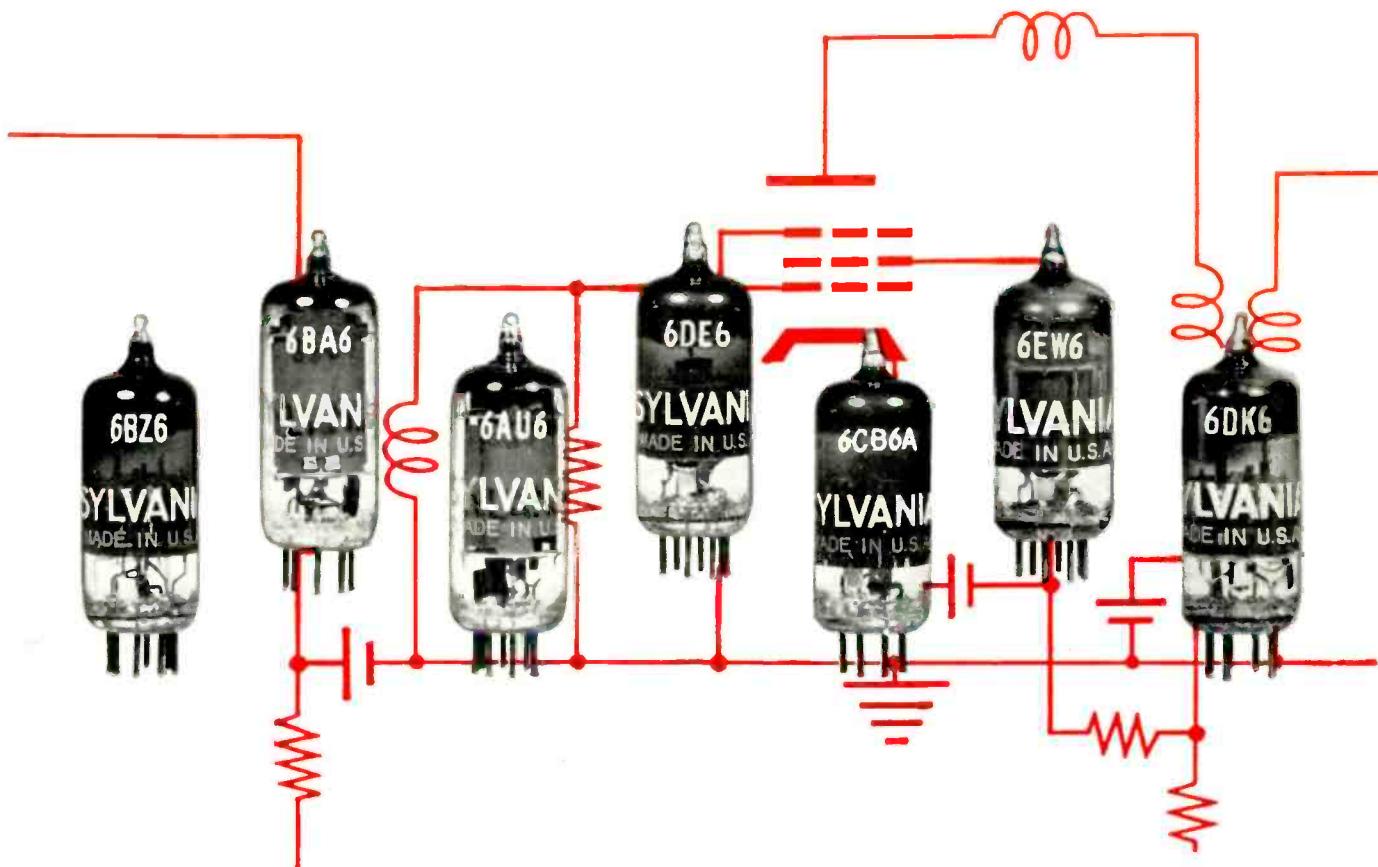


Optional Canopy Top, at left, has 53" floor-to-roof height. Body is also available with compartment-high telescopic roof.

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Why are SYLVANIA PENTODES so popular in TV sets?

Why, for example, are they so popular in video-if stages?

Video-if stages are critical with respect to over-all set performance. Must develop sufficient gain to "drive" the picture tube and to give effective age. Have to deliver "clean" signals, free of hum modulation. When a TV set goes into quantity production, tubes used must be uniform in performance in their specific circuits. Tubes that are sent to the service dealer for that eventual replacement job must be just as good as those supplied to the set manufacturer.

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6DE6, 6CB6A, 6EW6, 6DK6 in TV set after TV set. They're reliable. And, because of the unique, automated techniques used by SYLVANIA in manufacturing those types, they feature exceptional uniformity from tube to tube, minimum interelectrode leakage and gas, thus a longer life expectancy.

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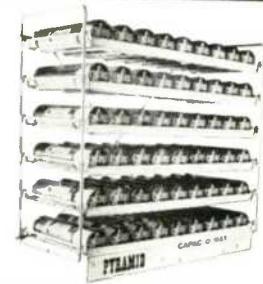
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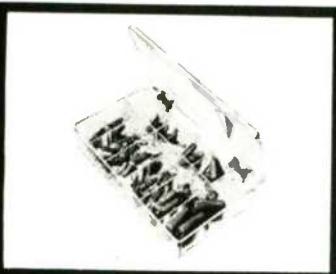


JEWEL BOX



Handsome tan plastic, high impact cabinet with 9 drawers, contains 45 assorted Mylar-paper Gold Dip capacitors, type 151. Practical... convenient... for storage in your shop, or home. Actual value of the Jewel Box with 45 Gold Dip capacitors—\$19.50, dealer net only \$9.25.

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JAMES B. LANSING will take over sales of the CONRAC Fleetwood TV line.

SHERWOOD appoints Trimble Electronic Sales rep in Ill. & Wisc.

CHEMTRONICS introduces a 2-oz. bottle of tape recorder cleaner @ 89¢.

DUOTONE announces the Selecto tandem record band selector and brush @ 98¢.

UNIVERSITY names Henry Mandler to newly created post of Assistant General Sales Manager.

CROSBY ELECTRONICS announces the Madison Fielding Troubadour bookshelf speaker system @ \$29.95. It measures 9" H x 9" D x 14" W.

CLEVITE announces the Walco Microgram Stylus Pressure Gauge listing @ \$1.50. Lever and balance weight arrangement cover 1/2 to 10 gram range.

FISHER announces its FM-50 tuner @ \$129.50 has 1.3 µv sensitivity for 20 db quieting. The XP-2 3-speaker system is \$79.50 unfinished, \$84.50 finished.

FAIRCHILD introduces the Model 440 turntable @ \$69.95 for August 1 delivery. The 2-speed unit uses single belt drive and Speed Sentinel control. Speed is controlled by applying d-c to the motor windings.

FIDELITONE announces a 4-track recording and playback head claimed to be the smallest of its kind. The 2-channel unit features a tapered solid core. 15 kc response @ 3-3/4 ips is said to be obtainable.

GENERAL ELECTRIC's new phono line includes a device to vacuum clean records while they are playing. Called "Vacu-Magic," it carries dust picked up by a brush mounted in front of the stylus to a container inside the cabinet.

SHURE announces new mikes: 425 Commando is an omnidirectional gooseneck; 510SLB magnetic comes with disk stand; 440 is for ssb communications; 545 Unidyne III is a uni-directional dynamic. Also, a professional universal tone arm and \$75 lab standard M3D cartridge.

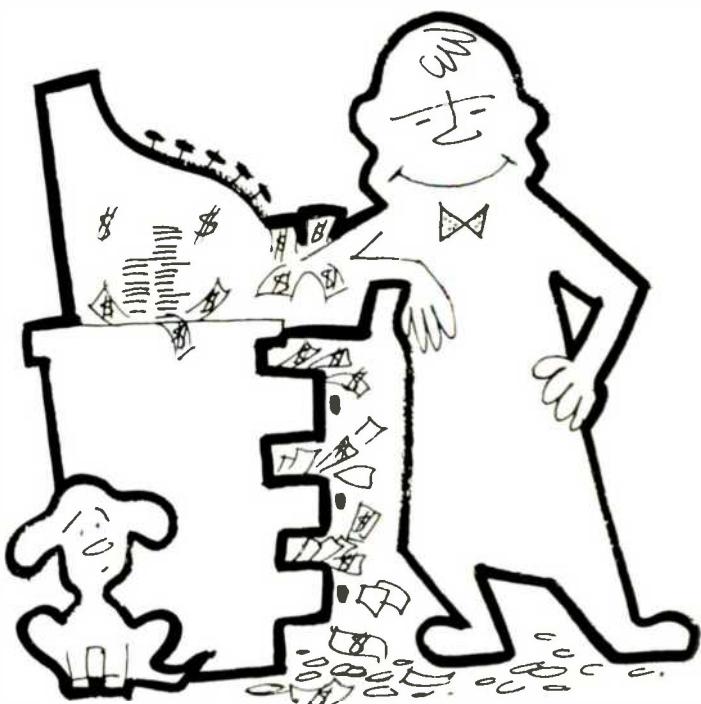
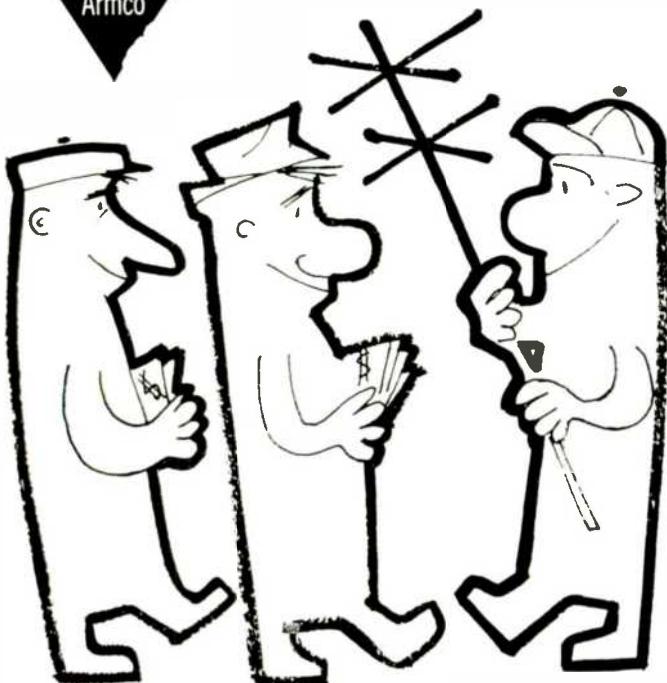
ROBINS INDUSTRIES introduces: Tape reel holders @ 85¢/pair. They are particularly suitable for vertical tape decks as well as warped reels; Strobe and light kit, lists @ \$1.50; Metal 45 rpm record adapter @ 30¢; Round turntable level @ \$2.50; and Model VU-100 meter @ \$22 list. The 4 1/2" meter is rated from -20 to +3, and has 200 µa movement sensitivity.

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NEW 4-WAY POCKET TOOL

a real "working partner" for removing backs of TV sets and installing antennas



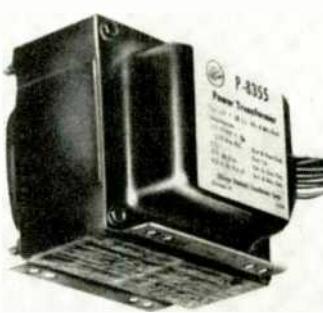
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Canada: Charles W. Pointon, Ltd., Toronto, Ont.

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Stancor TRANSFORMERS

Two new exact replacement TV power transformers are: P-8355, shown,



with plate supply of 285-0-285v a-c at 250 d-c ma with 5 v at 3a and 6.3v at 9.5a filament windings; and P-8356 with plate supply of 270-0-270v a-c at 260 d-c ma with 5v at 3a and 6.3v at 8.8a filament windings. These two units are used in more than 700 models of eight manufacturers. Chicago Standard Transformer Corp., 3501 W. Addison St., Chicago 18, Ill.

For more data, circle 7-62-3 on coupon, p. 54

Paco CONTINUITY TESTER KIT

Model T-5 filament tester kit, a portable battery operated unit, is used for continuity test of tube filaments, fuses and pilot lights. It uses two readily available penlite (1.5v) batteries. The

panel has sockets for straightening pins of 7-pin and 9-pin miniature tubes. Comes with all parts and components



including batteries, and instruction manual. Kit \$4.50. Factory wired, \$6.50. Paco Electronics Co., 70-31 84 St., Glendale, L.I., N.Y.

For more data, circle 7-62-4 on coupon, p. 54

Raytheon TUBES

The 32ET5, used in radios, is a 7-pin miniature, beam pentode, audio amplifier. Now in use in many TV receivers is the 6FM8, a double diode triode utilizing separate cathodes for each section. It is designed for use in FM detector and audio amplifier applications. Raytheon Co., Distr. Products Div., Westwood, Mass.

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• July, 1960



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Westinghouse Electronic Tube Division, Elmira, N. Y. • Tune in
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During the past couple of years, every electronic magazine serving the maintenance industry has raised its subscription price—with one exception—Electronic Technician. Since its inception in 1953, ET has benefited its subscribers by holding the subscription rate down to its original introductory price.

Quite candidly, the economic realities of increasing postage, labor and material costs during the past seven years, coupled with the need for expanded reader services (more editors, more editorial pages, larger inquiry processing staff, etc.), make a price increase necessary.

Effective later this year, at a date to be announced, prices will go up about 8¢ per copy (or less for 2 & 3 year subscribers), which is a modest increase.

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Time-Delay System Creates Reverberant Acoustics

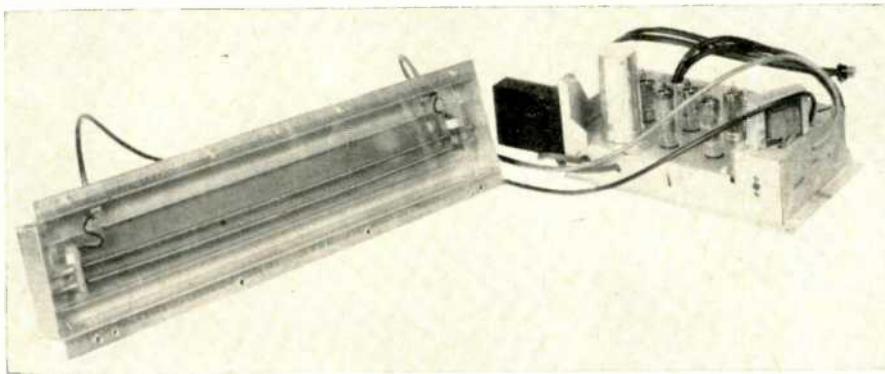


Fig. 1—Philco's "Reverbaphonic Sound" system, with delay unit (left) and associated amplifier.

• A reverberation system, developed by the Hammond Organ Co., is the latest major audio innovation to receive the attention of equipment manufacturers. Philco's "Reverbaphonic Sound" and Zenith's "Reverba-Tone" systems have already been announced. Both use essentially the same principle: Part of the audio signal is tapped, delayed—and subsequently combined with the main signal. The two signals, main and delayed, are reproduced through the speaker with a slight echo effect, simulating "actual concert hall" acoustics.

How It Works

The reverberation unit consists of an amplifier and time-delay device. A typical unit is shown in Fig. 1. The main audio signal is divided; one signal being amplified in a normal manner, while the second signal is fed to the reverberation unit's amplifier. This delay signal in turn, is coupled to the input of a transducer and converted into mechanical vibrations. The vibrations take a finite amount of time, in effect, a delay, are attenuated, and then converted back to an electrical signal and amplified.

A reverberation control switch at this amplification point enables the user to select the desired level or amount of reverberation effect. Following selection of the reverberation, the signal is impressed onto the tube grids in a matrix stage, and combined with the original signal. The combined main amplifier signal and delayed signal are then fed to the speaker, resulting in reverberant sound.

Frequency of the reverberant signal is said to be relatively flat from 200 cps to 4,000 cps, diminishing above this point. Similarly, natural reverberant sound, as experienced in concert halls, auditoriums, etc., are attenuated at the high end.

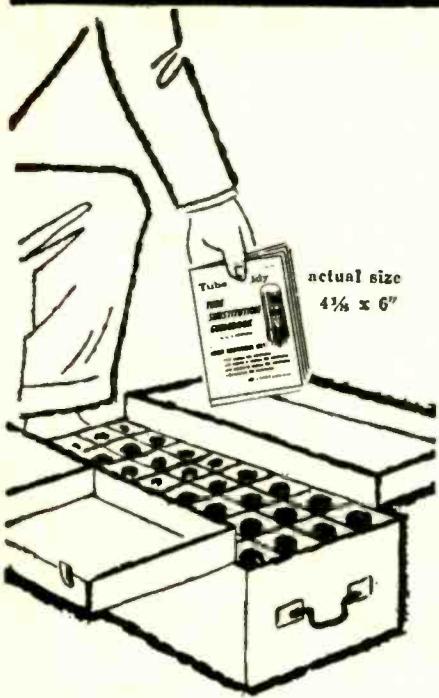
In effect, this system of reverberation provides the listener with an opportunity to control and, thereby create, the degree of echo that simulates the acoustic environment when listening to "live" music. Reverberation may be used with either stereo or monophonic systems.

The actual delay line is interesting. As seen in Fig. 1, it looks like two stretched springs in an enclosure. The mechanical parameters of the two coiled lines, in conjunction with

their transmitting and receiving transducers, provide different vibration travel time. One line, coiled tighter than the other, has a travel time of approximately 29 milliseconds. The other line's travel time is 37 milliseconds. Each vibration travels back and forth along its delay line, gradually decaying until it is below audible level. Each time a vibration reaches its respective output transducer, a portion is converted into an electronic signal. (It's at this point that the amount of reverberation effect is adjustable by the listener.)

Since the delay line termination is operated as an open-ended or unmatched system, a portion of the energy is reflected back over the line. These repeated reflections decay logarithmically in value, having the same delay characteristics as in a reverberant hall. Using two delay lines gives a relatively smooth delay characteristic.

The reverberation circuitry is located at a relatively low signal level point. Since this makes it susceptible to extraneous noise, particularly hum, the reverberation amplifier tube filaments are heated by d-c. •



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66

New Books

Books marked with an asterisk (*) may be obtained prepaid from Electronic Marketers, Book Sales Division of Electronic Technician

***BASICS OF INDUCTION HEATING.** Volumes 1 & 2. By Chester A. Tudbury. Published by John F. Rider Publisher, Inc. 140 & 144 pages, respectively. Soft cover, \$3.90 each.

Huzzas for Rider! This down-to-earth presentation of the principles and applications of the induction heating art fills a long-standing void. Volume 1 presents the principles of induction heating equipment, including how it works, efficiency factors, types of work-pieces, heating coils, and basics of heat flow. Higher mathematics has been avoided. Many basic numerical problems, however, are presented, in an effort to clarify the subject matter. commendably illustrated in "picture text" form.

Volume 2 continues the format established by the initial text. Induction heating equipment is analyzed from a practical viewpoint. This includes motor-generator set-ups, their rating and protection, vacuum tube generators, loading an oscillator, three-phase rectifiers, proximity effect and controls. Once again, the "picture text" demonstrates how an otherwise complicated subject can be simplified. Persons who can profit from these volumes run the gamut—student to operating and maintaining personnel to graduate engineer. If you're the least interested in induction heating equipment, don't miss this two-set volume.

RADIO-TELEVISION & BASIC ELECTRONICS. By R. L. Oldfield. Published by American Technical Society, 848 E. 58th St., Chicago 37, Ill. 400 pages, hard cover. \$4.95.

This book is the second revised edition of a predecessor, "Fundamentals of Radio." The edition is a concise discussion of electrical principles, including Ohms law, magnetism, and other basic radio principles. Audio fidelity (monophonic and stereophonic systems), TV transmission, and reception principles, black and white TV problems are explained. A chapter outlines semiconductor theory and applications. The experienced TV and electronic technician may find this book too basic an addition to his electronic library, but the volume is adequate for the beginning electronic student.

MOST OFTEN NEEDED 1960 TELEVISION SERVICING INFORMATION. Compiled by M. N. Beitzman. Published by Supreme Publications, 1760 Balsam Rd., Highland Park, Ill. 192 large pages, soft cover. \$3.00.

As with previously published volumes, covering earlier models, this collection of TV data includes schematics and parts layouts. Fifteen different brands are covered.



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ELECTRONIC TECHNICIAN • July, 1960



***FROM TIN FOIL TO STEREO.** By Oliver Read & Walter L. Welch. Published by Howard W. Sams & Co. 524 pages, hard cover. \$9.95.

This is an historical account of the evolution of the phonograph. Personalities unfold in the text, some even before the advent of Edison's tin foil phono. Equipment development (from a news viewpoint), disc versus cylinder, and 78 rpm versus LP, are just a few of the topics discussed in this book. Many rare photographs and drawings are reproduced, showing old equipment. Aside from the smaller-than-usual type, which may play havoc with the myopic crowd, if you'd like to know more about the history of the phonograph, there is much to be offered by this book.

***FUNDAMENTALS OF SEMICONDUCTORS.** By M. G. Scroggie. Published by Gernsback Library, Inc. 160 pages, soft cover. \$2.95.

This basic book on semiconductor theory is written in a lucid style. Commencing with atomic and molecular structures, the author moves freely to transistors, rectifiers, photo cells, strain gauges, scintillation counters, thermistors, masers, etc. The nicely illustrated book presents semiconductor fundamentals in an easy-to-take manner.

***101 WAYS TO USE YOUR AUDIO TEST EQUIPMENT.** By Robert G. Middleton. Published by Howard W. Sams & Co. 136 pages, soft cover. \$2.00.

The author, one of the prolific writer-technicians in the electronic field, gives us the benefit of his practical experience in checking out audio gear. A typical one of the 101 items mentions the test required, and then goes on to discuss very briefly the equipment, connections, procedures and evaluation of results. A test hookup is illustrated. Amplifier tests are discussed as are tests of components and audio systems. This is no text book, but rather a test instrument techniques manual. It's practical and most worthwhile.

***PRINCIPLES OF FREQUENCY MODULATION.** By B. S. Camies. Published by John F. Rider Publisher, Inc. 147 pages, soft cover. \$3.50.

This clearly detailed and comprehensive volume covers the basic principles, theories and practical problems involved in the transmission and reception of frequency modulation. A brief history is given of the development of FM and space is devoted to comparisons between AM, FM and phase modulation. Various detection methods are discussed, including the Foster-Seeley, radio and slope. Transmitters, receivers and tuners receive adequate attention. Mathematical calculations are tactfully injected to develop complete explanations. The final chapter covers non-broadcast uses of FM including microwave and facsimile applications. This book may prove helpful to the student and technician in arriving at a clearer understanding of the subject, and the engineer interested in FM design problems.

***101 MORE WAYS TO USE YOUR SCOPE IN TV.** By Robert G. Middleton. Published by Howard W. Sams & Co. 160 pages, soft cover. \$2.50.

Continuing the format established by the author's first volume, this second volume presents an additional 101 ways to employ an oscilloscope to test TV receivers. TV circuits, test connections for scopes and other instruments and resulting waveforms are evaluated. TV circuits include: r-f & i-f amplifier, video amplifier, agc, sound, sync, vertical and horizontal sweep and horizontal afc and oscillator circuits.

HANDBOOK OF TV TROUBLES. By Sol Heller. Published by Holt, Rinehart and Winston, Inc., 232 Madison Ave., New York, N.Y. 302 pages, hard cover, \$5.95.

A black and white TV receiver is dissected circuit-by-circuit. Chapters include discussions on brightness, contrast, sync and sound troubles. Numerous illustrations show examples of individual component failure. The experienced technician may not always agree with the author's explanations but the overall text information should help the field technician understand and repair many complex circuit defects.

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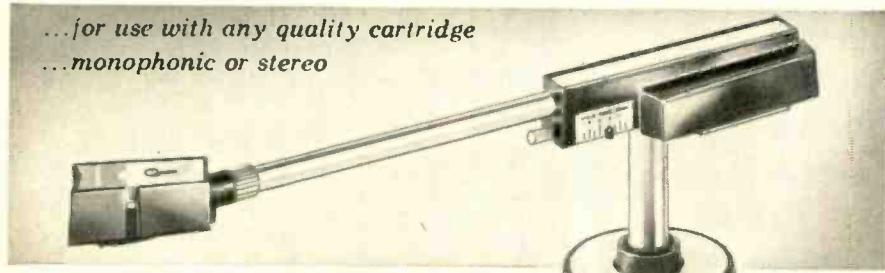
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that measures up to

SHURE STANDARDS

...for use with any quality cartridge
...monophonic or stereo



new safety for records

Surface wear is held to absolute minimum through flawless tracking made possible by an ingenious and unprecedented combination of adjustments. Optimum static and dynamic balance, precise height, correct cartridge "overhang," and incredibly accurate stylus force are quickly achieved and easily maintained without guesswork.

new sound from records

Modern high-compliance, light tracking cartridges (Shure M3D compliance is 4.0×10^{-6} cm/dyne; 3 gm. tracking) require arm balance of a high order in all planes to deliver ALL the sound, undistorted. The Shure arm pivots on drag-free precision bearings. Precision adjustments assure optimum suspension and permanent balance, regardless of cartridge characteristics.

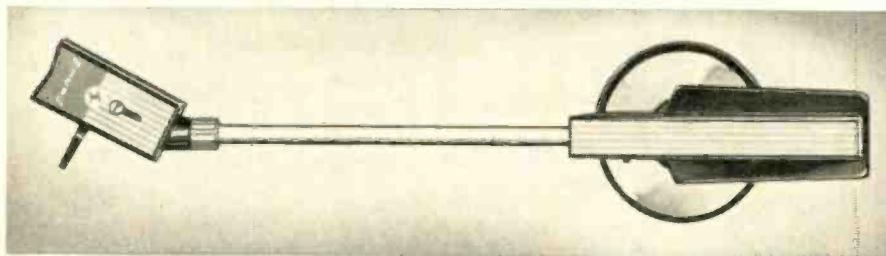
new simplicity in installation and operation

Installs completely from top side of motorboard. Special cable and plug assembly eliminates hum problem, speeds up and simplifies installation. Eliminates soldering. All you do is plug in one end of cable to tone arm, the other end to amplifier. Lock-on heads are instantly interchangeable. Direct-reading stylus force gauge with instant disconnect, and "micrometer" counterweight assembly permit visual static balance checks.

TONE ARM M232, for 12" records.....\$2995 net.

TONE ARM M236, for 16" records.....\$31.95 net.

SHURE BROTHERS, INC., 222 HARTREY AVENUE, EVANSTON, ILLINOIS



For more data, circle 7-68-1 on coupon, p. 54

24 HR REPAIR and ALIGNMENT SERVICE

VHF or UHF — All Makes

90 DAY WARRANTY ISSUED ON ALL TUNERS	DEALER VHF Tuners	\$950
NET	UHF Tuners	
PRICE	UHF Converters	
	UHF-VHF Combinations	\$17.95

THE ABOVE SERVICE & PRICES ARE FOR UNMUTILATED UNITS. Missing, broken & damaged parts, defective tubes charged extra at LOW net prices.

IMPORTANT: SHIP COMPLETE. —INCLUDE ALL BROKEN PARTS. STATE MODEL & COMPLAINT. PACKAGE WELL TO AVOID TRANSIT DAMAGE.

JW ELECTRONICS 1538 W. Jarvis Ave., Chicago 26, Illinois
Telephone Broadway 4-9757

For more data, circle 7-68-2 on coupon, p. 54

Catalogs & Bulletins

TEST PRODS: An illustrated catalog sheet describes the Kleps series of universal third-hand test prods and the Pruf series of insulated test prod. Rye Sound Corp., 145 Elm St., Mamaroneck, N.Y.

For more data, circle 7-68-3 on coupon, p. 54

SUBSTITUTION LAB: Literature covers a new complete substitution service lab for fast, accurate, troubleshooting. The lab consists of three units: H36; ES102; and RS106. Sencore, Addison, Ill.

For more data, circle 7-68-4 on coupon, p. 54

LEAD EXTRACTORS: New tools which provide a safe, quick way to eject insulated leads through the shields of braided wire, "Little Joe" lead extractors, are covered in a catalog sheet. Macdonald & Co., 1325 Ethel St., Glendale 7, Calif.

For more data, circle 7-68-5 on coupon, p. 54

TUBE TESTER: The new counter model V2001 self-service tube tester is covered in a colorful catalog sheet. Description, test specifications and price are included. Vis-U-All Products, Hampshire, Ill.

For more data, circle 7-68-6 on coupon, p. 54

BATTERY: A new long-life battery for radios, flashlights, and photoflash, the firm's new alkaline manganese battery, is described in current literature. Mallory Battery Co., 13000 Athens Ave., Cleveland 7, Ohio.

For more data, circle 7-68-7 on coupon, p. 54

SPEAKERS: Just published is a complete and fully illustrated catalog of the "Crescent" line of speakers, speaker systems and enclosures. Included is the "Falcon" series of Hi-Fi reproducers. Federated Industries, Inc., 4477 Elston Ave., Chicago 30, Ill.

For more data, circle 7-68-8 on coupon, p. 54

3-SET COUPLER: A new bulletin describes the TV/FM amplified 3-set coupler model HSA-43, which employs a single 6DJ8 tube to provide 5 db gain from two outlets and unity gain from the other outlet. Jerrold Electronics Corp., 15th & Lehigh Ave., Philadelphia 32, Pa.

For more data, circle 7-68-9 on coupon, p. 54

PHONO RECORDER DRIVES: A pocket-size reference guide provides: manufacturers part number; description of the part; replacement part number; and the models on which the part is used. Price, 50¢. Order direct from Robins Industries Corp., 36-27 Prince St., Flushing 54, N.Y.

CADDY TUBE TESTER: Covered in current literature is the new model 102-C caddy tube tester—a tube caddy with a built-in multiple socket tube tester. 700 tube types can be checked. The tester can be used in or out of the caddy. Mercury Electronics Corp., 77 Searing Ave., Mineola, N.Y.

For more data, circle 7-68-11 on coupon, p. 54

ANTENNAS: The new 1960 Exact Replacement Antenna Guide for portable TV sets provides 16 pages of descriptions, illustrations and prices. Includes an index of set manufacturers with antenna part number and exact replacement. JFD Electronics Corp., 6101 16th Ave., Brooklyn, N.Y.

For more data, circle 7-69-2 on coupon, p. 54

KNOBS: Literature is available covering a carefully selected line of exact replacement phono knobs. The 36 knobs in the line satisfy more than 90% of the demand and fit 11 different changers from 4 original equipment manufacturers. Knob Corp. of America, 469 Jericho Turnpike, Mineola, N.Y.

For more data, circle 7-69-3 on coupon, p. 54

AUTOMOBILE FM RADIO: Literature covers the new transistor powered FM radio, AR-12, designed for under the dashboard mounting in any car with a 12v ignition system. Completely self-contained. Has its own audio system. Granco Products, Inc., 83-30 Kew Gardens Rd., Kew Gardens, N.Y.

For more data, circle 7-69-4 on coupon, p. 54

ANTENNAS: Colorful catalog sheets are available as follows: Form No. 666, covers VHF and UHF antennas; Form No. 515, the new "Miracle" line of TV Antennas; and form No. 620 on Auto Antennas. Descriptions, illustrations, prices and information on accessories included. Tenna Mfg. Co., 7580 Garfield Blvd., Cleveland 25, Ohio.

For more data, circle 7-69-5 on coupon, p. 54

MICROPHONE CONNECTOR: Described in new literature is a molded female microphone connector to replace the former connector used on certain cable assemblies. The conversion feature of female to male, by screwing back the ring, is the same as the former connector. Switchcraft, Inc., 5555 N. Elston Ave., Chicago 30, Ill.

For more data, circle 7-69-6 on coupon, p. 54

RECEIVING TUBES: A handy-up-to-date wall chart, ETR-1916B, lists interchangeability information for American and foreign receiving tubes. Easy-to-read. 11" wide and 28" long. Lists approximately 300 American tube types which are interchangeable with approximately 100 foreign tube types. From distributors of General Electric Co., Receiving Tube Dept., Owensboro, Ky.

TRANSISTOR TESTER: Bulletin No. 160 covers the new model 160 professional quality low-cost transistor tester for servicing, lab, and industrial use. The unit is designed to save time and guess-work in servicing transistor sets and equipment; simplify incoming factory inspection; speed on-the-line testing; and facilitate lab testing and transistor quality control. B&K Mfg. Co., 1801 W. Belle Plaine, Chicago 13, Ill.

For more data, circle 7-69-8 on coupon, p. 54

CARBON CONTROLS: Literature covers the new "ABC Handi-Bin" which consists of a heavily constructed steel cabinet containing a complete selection of carbon controls. Clarostat Mfg. Co., Dover, N.H.

For more data, circle 7-69-9 on coupon, p. 54

CAPACITORS: CDE bulletin TVR-7C, the new 1960 edition of the firm's Television Twist-Prong Capacitor Replacement Guide, provides 56 pages of information including over 3,500 original part numbers used by 100 TV set manufacturers. Cornell-Dubilier Electric Corp., South Plainfield, N.J.

For more data, circle 7-69-10 on coupon, p. 54

TUBE TESTER: Literature is available covering the new Model 1234 cardmatic automatic tube tester. All set-ups are card-programmed. Has greater Gm range. Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland 8, Ohio. For more data, circle 7-69-11 on coupon, p. 54

PACKAGED CIRCUITS: The 6th edition of PEC Packaged Circuit Guide consists of 16 pages giving complete replacement data covering over 250 equipment brands and over 1,400 replacement applications. Centralab, the Electronics Div. of Globe-Union, Inc., 900 E. Keefe Ave., Milwaukee 1, Wis.

For more data, circle 7-69-12 on coupon, p. 54

Pinpoint in Seconds...

HORIZONTAL & VERTICAL SWEEP TROUBLES

NEW

SENCORE

Time Saver

The missing link in TV service ...

SENCORE SS105 SWEEP CIRCUIT TROUBLE SHOOTER

IT'S A ...

UNIVERSAL HORIZONTAL OSCILLATOR. For direct substitution. No wires to disconnect in most cases. Traces trouble right down to the defective component. Variable output from 0-200 volts, peak-to-peak. Oscillator will sync to TV sync signal giving check on sync circuits.

HORIZONTAL OUTPUT CATHODE CURRENT CHECKER. A proven method that quickly checks the condition of the horizontal output tube and associated components. Adaptor socket prevents breaking wires. Easily replaceable Roll Chart gives all necessary pin, current and voltage data. New Roll Charts are Free.

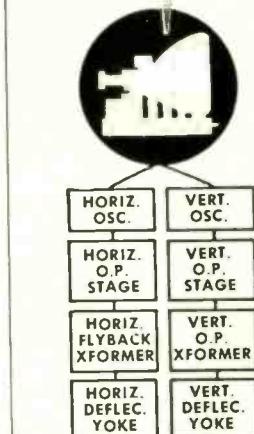
UNIVERSAL DEFLECTION YOKE. A new, simple way to determine yoke failure accurately—without removing yoke from picture tube. Merely disconnect one yoke lead and substitute. If high voltage (also bright vertical line) is restored, TV yoke is defective.

DYNAMIC FLYBACK TRANSFORMER CHECKER. Merely flip switch to "Flyback Check" and meter will indicate condition of flyback transformer, in degrees of horizontal deflection. Extremely sensitive and accurate; even shows up one shorted turn on flyback.

VOLTMETER. For testing bootstrap, screen and other voltages. Direct-reading voltmeter, 0-1000 volts.

UNIVERSAL VERTICAL OSCILLATOR. Checks oscillator, output transformer and yoke. Merely touch lead to component and check picture on screen.

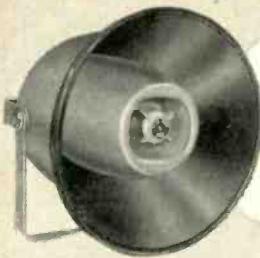
SS105 is completely self-contained, nothing else is needed. New Improved Circuit... DEALER NET **42⁹⁵**



SENCORE
ADDISON 2, ILLINOIS

For more data, circle 7-69-1 on coupon, p. 54

NOW...enjoy your HI-FI OUTDOORS
PATIO, GARDEN, TERRACE, PORCH



with the new **WT-6**

ATLAS HI-FI COAX-PROJECTOR

all-weather construction...install it, forget it!...
or take it with you wherever you listen.

True HIGH FIDELITY TWO-WAY system—not just a "compromise" of two horns coupled to a single diaphragm. The WT-6 comprises a weather-proof cone type driver (with 6-inch throat) coupled to its individual woofer horn; a separate pressure-type driver loaded to its separate tweeter horn. The built-in crossover electronic filter supplements the electro-mechanical frequency-limiting characteristics of the 2 individual reproducers—providing for smooth frequency division as each speaker functions within its engineered range of frequencies.

All-weather...high efficiency...compact...for all indoor and outdoor uses...universally adjustable "U"-type rugged steel mounting...finished in high temperature baked modern beige enamel.

POWER RATING 15 watts continuous **net** \$34.50
FREQ. RESP. 140-15,000 cps

IMPEDANCE 8 ohms. **DISPERSION** 120°

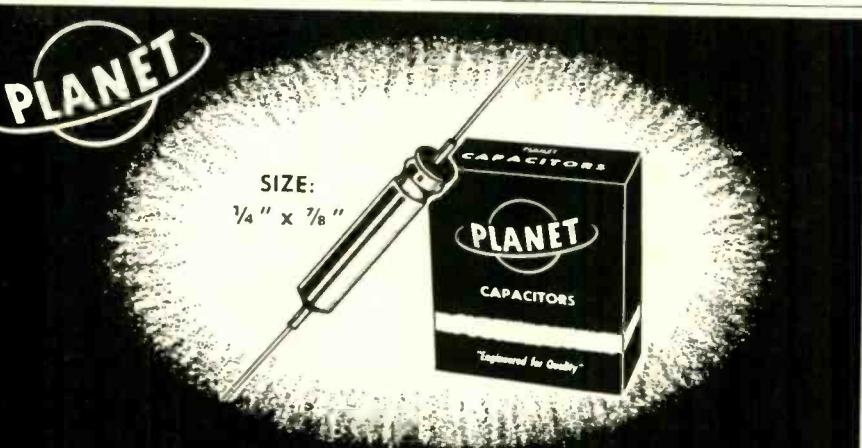
DIMENSIONS bell opening 15", overall depth 12"

See the WT-6 at your local distributor. Send for catalog ET-7.

ATLAS SOUND CORP.
1449 39th St., Brooklyn 18, N.Y.



For more data, circle 7-70-1 on coupon, p. 54



TRANSISTOR LYTICAPS TYPE "TL"

TYPE "TL"...Sub-miniature aluminum foil capacitors...hermetically sealed in aluminum tubes...clear plastic outer insulating sleeves...all mechanical internal connections...no "cold weld" nor "pressure" connections...engineered for quality for replacement in all transistorized circuits.

Write today for complete information.

PLANET SALES CORPORATION
225 Belleville Avenue Bloomfield, New Jersey

For more data, circle 7-70-2 on coupon, p. 54

ASSOCIATION NEWS

California

TSDA, San Mateo County, elected the following officers: Pres., Ernest Meissner; 1st V.P., Don Marshall; 2nd V.P., Ernest Henderson; Sec'y, Winston Haines; Treas., Gordon Cole.

CSEA, Fresno, announced a special invitation has been extended to electronic service shops to join the organization if they are in an area where no local branch exists. A concentrated recruiting drive for new members was reported underway in these areas. The state organization also reported that results of a survey were being compiled to determine technicians who are interested in industrial electronic installation and maintenance "plus" business now being offered by some manufacturers. CSEA would act as liaison between manufacturers and technicians.

IPET, Van Nuys, said that a recent Los Angeles fire code ordinance states that: "No person shall install or maintain a radio or television aerial, or the guy wires thereto, on any fire road or fire break. Antenna wires shall be not less than 16 feet above a fire road or fire break."

Florida

TESA, Miami, reports a lively interest in Citizens band radio being shown by local dealers who are installing these units for speedy communications between their shops and field vehicles.

Illinois

Natesa Convention

NATESA, Chicago, announced its annual convention will take place at the Sheraton Towers Hotel, Chicago, August 19-21.

TESA, Springfield, took a booth at the recent Better Living Exposition and brought the TESA story to the public. A special educational pamphlet was distributed to visitors as they observed themselves on a closed circuit TV camera which was set up in the booth.

Indiana

IESA, Indianapolis, elected new officers as follows: Chm'n., Dean R. Mock; V-Chm'n., Ted G. Fink; Sec'y, Lamar Zimmerman; Treas., Edward T. Carroll.

ITTA, Indianapolis, elected the following new officers: Pres., Leon Howland; V.P., Bob Shuck; Rec.-Sec'y, Delbert Williams; Cor.-Sec'y, Frank J. Teskey; Treas., Cleo Taylor.

Distrib: 1 Yr. Free TV Service

IESA, Indianapolis, reports that a local RCA set distributor, Associated Distributors, has advertised one-year service free on RCA Victor portable TV's as a trial offer for May over the opposition of franchised RCA dealers and other independent service technicians. Strong opposition against the plan was voiced by association, whose members will oppose any extension of the plan. The manufacturer does not sponsor this program.

Kentucky

KRTA, Louisville, has elected the following officers: Pres., Lucius Wilks; V.P., Clem Rauffauf; Sec'y, Charles Simmons; Treas., George Leitner.

Michigan

TSA, Detroit, has elected the following officers: Pres., Louis Hudson; V.P., E. Russell Goode; Sec'y, Michael Graham; Treas., Lawrence Nelson. TSA, Inkster, reports that the village adopted a TV licensing ordinance patterned after Detroit's 110F, regulating TV service. Allen Park, Lincoln Park, and the City of Dearborn had previously instituted similar ordinances.

Missouri

TEAM, St. Louis, has elected the following officers: Pres., A. A. Mayer; V.P., Robert Lucas; Sec'y, Herman Wolfe; Rec.-Sec'y, Tom Dooly.

North Carolina

NCFEA, High Point, Pres., Charles McBroom reports that approval of the associations licensing proposal has been obtained from the State Attorney General. License certificates will be available to all holders of journeyman or technician cards.

Ohio

TESA, Summit County, has elected the following officers: Pres., Gregory Barkoukis; V.P., Charles Papp; Sec'y, John Kranshan; Treas., Joe Lutz.

Pennsylvania

Distributor Cooperation

TSDA, Philadelphia, reports that independent service technicians have reached an agreement with a number of wholesalers covering the following points: (1) Discourage sales to the retail trade. (2) Have all part-time technicians sign and use the tax exemption form and obtain tax numbers. (3) Purchase slips to contain name and address of parts purchasers. (4) Hi-Fi users to pay retail

prices for parts and supplies. (5) All wholesale literature mailed to service technicians and dealers to be mailed in sealed envelopes only. (6) Distributors discontinue display ads in the Yellow Pages and use only bold type listings.

ESDA, Western Pa., has elected the following officers: Pres., B. A. Bregenzer; V.P., Norman Falck; Sec'y, Joseph S. Doyle; Treas., Charles Colerich.

TSA, Delaware Valley, has received a memorandum from H. C. Brown, local service manager of Sears in Philadelphia, authorizing a 20% discount on Silvertone Radio

and TV parts. The discount is available to bona fide service dealers who present a tax registration number. TSA also said that service data on Silvertone equipment was not available, but any registered-with-Sears service dealer was welcome to examine service notes at the Sears service shop or at the TSA of Delaware Valley office.

Wisconsin

TESA, Milwaukee, has elected the following officers: Pres., Larry Dorst; V.P., Art Nelson; Sec'y, Dan Smith; Treas., Lee Cowen.

Spot in a flash...

FAULTY CAPACITORS AND RESISTORS



A complete range of capacitors and resistors at your command.

SENCORE HANDY 36 SUBSTITUTION UNIT

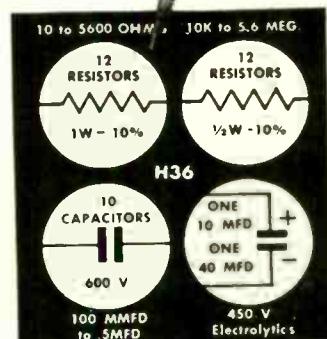
Serviceman... Engineer... Experimenter... here's a unit that really saves you time. The Handy 36 provides the 36 most often needed capacitors and resistors for fast, on the spot substitution. The 12 position, 3 wafer switch individually selects one of the 36 components. You simply dial the value you want to the exact or closest reading. Substitution is still the only time tested method for determining whether or not a component is faulty while operating in circuit.

Eliminate time wasted in hunting for parts to use in testing. Say goodby to the soldering mess created by substituting individual components. Put an end to the twisted wires and messy parts you've tossed in parts drawers.

The Handy 36 is simple to use. If a component is suspected of being shorted, open one end and substitute the Handy 36. Or, merely parallel any capacitor or resistor you think is open.

Model H36..... DEALER NET 1275

Ask any parts distributor for the "Handy 36", accept no substitute.



The Handy 36, with new improved circuitry, pays for itself in the first month by saving you those valuable minutes. The parts alone in the H36 would cost you more than the completed unit.



SENCORE
ADDISON 2, ILLINOIS

For more data, circle 7-71-1 on coupon, p. 54

Audio Matching

(Continued from page 44)

distortion due to mis-matching the tubes than a transformer could ever give.

Transformers do have to be used properly for best results in matching—so must other components. A transformer should not only have the proper ratio, it should be designed to work with the specific impedances used. But this does not mean it cannot sometimes be used quite successfully a little off these values.

If a transformer is designed for use between 3,000 and 16 ohms, for example, it will work reasonably well between any impedances in the same ratio, from 1,500 and 8 ohms to 6,000 and 32 ohms. With some loss of quality (not too serious) or some loss of efficiency, an even wider deviation from design values are acceptable.

Don't use a microphone or pickup matching transformer for loudspeaker work, or vice versa. The microphone or pickup transformer will not handle power enough for loudspeaker work—even if the impedances should suit, which is unlikely. The loudspeaker transformer will pick up too much hum for microphone work.

Preamp to Power Amp

Is a cathode follower preamp output necessary? Very often it is not necessary, but it's a good way to be sure of reasonably satisfactory matching. It is possible to work a low impedance output, such as a cathode follower, into a high impedance input, such as a tube grid, but not vice versa.

The cathode follower output is low impedance. But this does not change the inherent nature of the tube used. It still has an optimum load range, which is relatively high; probably from 20,000 ohms up. So the cathode follower works better into a high impedance than into one lower than

20,000 ohms. It is incorrect to work a cathode follower into a 500 or 600 ohms line transformer input, although its own impedance may be of this order.

When transistors become more widely used, the matching picture will change somewhat. Input current will be the important feature and in some circuits a low impedance will have advantages over a high one, although distortion factors will limit possibilities.

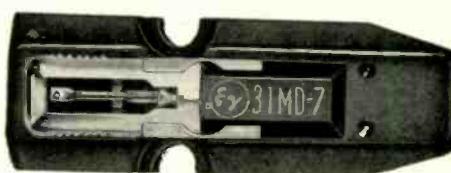
More important than impedance matching, under certain conditions, is level matching. If the total system, preamp plus power amp, does not have enough gain, you'll soon know it—not enough output, even with the gain wide open. But if the combined gain is too much, the question of transfer level arises.

It's easy enough to turn the gain back to a point where it isn't too loud. But you may be getting more than necessary distortion if the level from preamp to power amp is too high, or if the level at this point is too low, you may get more noise and hum than necessary.

THE MAGNIFICENT MAGNERAMIC 31MD7



For more data, circle 7-72-1 on coupon, p. 54



E-V's Magneramic 31MD7 meets the most demanding specifications of the professionals. It feeds into the preamp input jack specified for magnetic cartridges and does not require adaptors or circuit modifications. Try the Electro-Voice Magneramic... today. You owe it to your record collection... and to yourself!

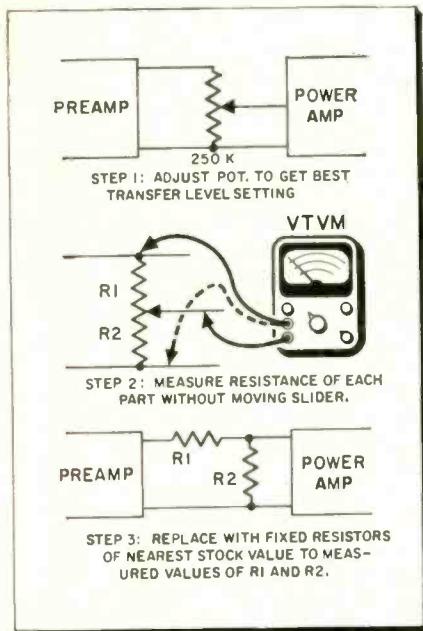
Only \$24.00 net with diamond stylus at your Electro-Voice Distributor. Want more information? Write Dept. 70-T for the booklet, "Facts About the Magneramic".

Electro-Voice®

ELECTRO-VOICE, INC. — BUCHANAN, MICHIGAN

Where the power amplifier has a pre-set input gain control, this should be set so the preamplifier drives the power amplifier to full output with minimum distortion from the preamp, and also minimum noise and hum. Then the preamp gain or volume control should be used for regular volume adjustment.

Where there is no such pre-set control, a permanent resistance pad attenuator could be devised to serve the same purpose. Use a $\frac{1}{4}$ -meg pot to find the best setting, then install permanent resistors by measuring the two legs of the pot at the best setting (Fig. 7).



These are some of the main facts about matching. Some forethought concerning optimum matching will remove the more common "mysteries" surrounding it. Deriving the best transfer of energy is often a product of applying theory to the job at hand. •



"I couldn't get the knobs off!"

Ungar LUBRICANT

Introduced is a new special lubricant, Anti-Seize, for use on metals operating at high temperature. It is reported that its repeated use on soldering tip threads helps reduce seizure and resultant breakage of tips and heating units. Because Anti-Seize guards against tip freezing and protects against corrosion, heat transfer is greatly improved. With the repeated use of this lubricant tip and heating unit life may be considerably lengthened. #8001, 2 oz. tins, \$0.69. Ungar Electric Tools, 4101 Redwood Ave., Los Angeles 66, Calif.

For more data, circle 7-73-2 on coupon, p. 54



FIND TUBE TROUBLES OTHERS MISS!



A New Dynamic Approach
Check over 1300 tubes for
• Cathode Emission
• Grid Emission
• Leakage
• Shorts
• Gas

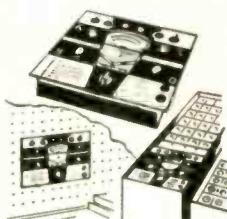
SENCORE "MIGHTY MITE" TUBE CHECKER

Answers the needs of the fast moving, profit minded serviceman who hates time consuming call backs. A "mite" to carry but a whale of a performer that spots bad tubes missed by large mutual conductance testers.

New unique "stethoscope" approach tests for grid emission and leakage as high as 100 megohms, yet checks cathode current at operating levels. Special short test checks for shorts between all elements. The MIGHTY MITE will test every radio and TV tube that you encounter (over 1300!) plus picture tubes, foreign, five star and auto radio tubes (without damage). As easy to set up as a "speedy tester" from easy to follow tube booklet. New tube charts free of charge.

AND check these added Sencore servicing features: • Meter glows in dark for easy reading behind TV set • Stainless steel mirror in cover for TV adjustments • Rugged, all steel carrying case and easy grip handle • Smallest complete tester made.

Model TC109 DEALER NET 59⁵⁰



Use it everyday in every way. Especially designed so you can transfer inner chassis to your tool caddy, bench or counter. Only 9" x 8" x 2 $\frac{1}{2}$ ".

Ask your distributor for the "MIGHTY MITE" with the mirror in the cover



SENCORE
ADDISON 2, ILLINOIS

For more data, circle 7-73-1 on coupon, p. 54

RELIABLE REPLACEMENT



TWIST-PRONG ELECTROLYTICS

A satisfactory repair job means a satisfied customer. To keep your customer happy and to prevent costly call-backs you must depend on a reliable replacement. Aerovox AFH Twist-Prong Electrolytics can always be depended on to give long-life and excellent service because they're made better... high-purity aluminum foil construction throughout, 85°C operation, improved hermetic sealing and rugged prongs and mounting terminals.

Available in the widest selection of exact-duplicate replacements including printed-wiring and selenium rectifier types. Your local Aerovox Distributor stocks the replacement you need when you need it. Call on him today for all your capacitor requirements.

BUY THEM BY THE KIT...

Your Aerovox Distributor offers you special "Stack-A-Lytic" kits (AK-400 and AK-401) with a selection of 8 or 16 popular TV replacements with a FREE handy metal storage rack with stacking features.



AEROVOX CORPORATION
DISTRIBUTOR DIVISION
NEW BEDFORD, MASS.

For more data, circle 7-74-1 on coupon, p. 54
74

Jerrold ANTENNA

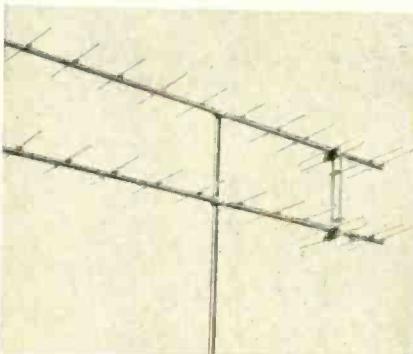
"Magic Carpet," a new TV-FM master antenna system, is a flat, flexible all printed circuit antenna based on a broad-banded dipole design. It simply mounts inside any type of roof or attic and can be quickly stapled to the joists. Made of tough cellulose fiber sheets



imprinted with pure silver, the "Magic Carpet" in conjunction with the TV-FM amplifier provides rooftop reception without bulky outside antennas. Performance is comparable to a conical type outdoor antenna (mounted in the same location) at a fraction of the cost. \$9.95. Jerrold Electronics Corp., 15th & Lehigh Ave., Philadelphia 32, Pa.
For more data, circle 7-74-4 on coupon, p. 54

Winegard ANTENNAS

As a result of new design of cut-to-channel and broad band FM yagi antennas, a three-element model now serves where a five was necessary, a six for a ten and a twelve for toughest reception. The new transcoupled FM yagis (FMTC 3, 6 and 12, with 3, 6, and



12 elements respectively) have unique transcoupler bars that swing instantly into position for a perfect 300-ohm match. With simplified stacking, 100% of the power is delivered from both bays. Available are 42 different models, all bright gold anodized. Winegard Co., Burlington, Iowa.

For more data, circle 7-74-5 on coupon, p. 54

For More Information
Circle Code Numbers, p. 54

• "Arcturus" is Back—
And anxious to Get in Touch With
You—Again!

SAMPLES OF WHAT TO EXPECT FROM "ARCTURUS":

*5" Bench Test Picture Tube—\$4.99

*7" Bench Test Picture Tube—\$6.99

*750 ma—400 p.i.v. MA Silicon Rectifiers — .69 ea.

*Seleniums, Tube Cartons, Transistor Radios, Picture Tube Brighteners, Imported Batteries, Cheeter and Zipp Cords.

*Quotations on XMTG, Special Purpose and Ruggedized Tubes and Crystals at Startling Prices—LOW—that is.

*Picture Tubes at 70¢ per inch.

Enormous stock of sub-miniature tubes at close-out prices. Write for quotation.

!! AND—OF COURSE !!
!!That Grand Old Brand of Receiving Tubes
—“Arcturus Since 1925”

(Average Discount—75% Off List)

... FREE Catalog—Write for One Now ...

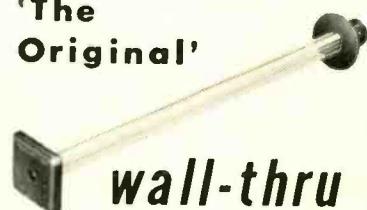
... FREE—Useful Gift for Home with
Each Catalog—FREE ...

Arcturus Electronics Corp.

420 Kearny Ave., Kearny, N. J.
Phone: WYmon 8-9192

For more data, circle 7-74-2 on coupon, p. 54

'The Original'



Profit-Wise TV Servicemen
Choose MOSLEY!

ECONOMY *

* You'll find using MOSLEY TV accessories to be truly economical because your work and time will command a better price. The more efficient installations result in satisfied customers... fewer callbacks!

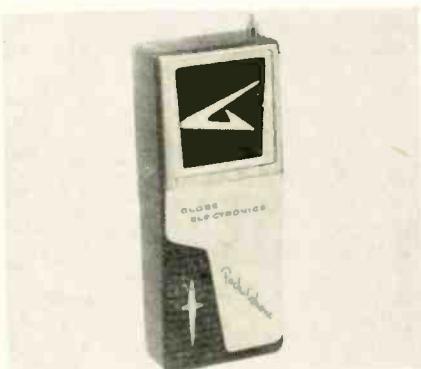
Install MOSLEY accessories—it pays!

Mosley
Electronics, Inc.
ST. LOUIS 14, MISSOURI

For more data, circle 7-74-3 on coupon, p. 54
ELECTRONIC TECHNICIAN • July, 1960

Globe CB TWO-WAY RADIO

A new two-way, transistorized, miniature radio, "Pocketphone" hand radio broadcasts and receives at distances up to one mile in the citizens broadcast band. Features include: an exclusive "Power-Pak" built-in rechargeable battery which will last up to one year without replacement; built-in micro-

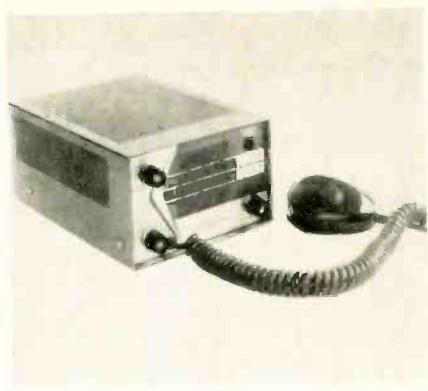


phone and speaker and retractable antenna. The unit receives without antenna extended. Can be used with a similar unit or, for additional range, can be operated in connection with CB-100 or CB-200. "Pocketphone" weighs 13½ oz. \$125.00. Globe Electronics, 22-30 S. 34th St., Council Bluffs, Iowa.

For more data, circle 7-75-2 on coupon, p. 54

Raytheon CB RADIOTELEPHONE

Ray-Tel is a 23-channel, 5-watt, crystal controlled, 27 mc transmitter-receiver for use between either fixed or mobile installations. Operates from 115v house current or 12v car or boat batteries and features an exclusive battery-saver switch. It is highly selective and includes a full-range automatic volume control. Complete with press-to-talk microphone, instruction manual, FCC license application and regulations, and set of transmitting and receiving crystals. \$169.95. Raytheon Co., Distr. Products Div., Westwood, Mass. For more data, circle 7-75-4 on coupon, p. 54



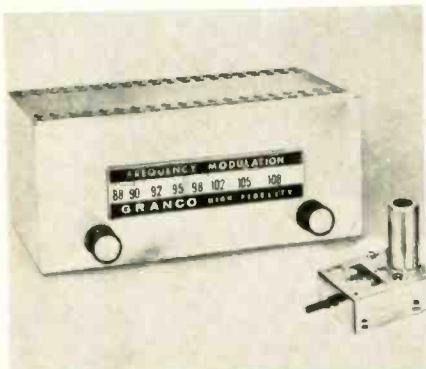
Substitutes FOR ALL ELECTROLYTICS without Arc or Spark!

ELECTRO-SUB

Complete range of electrolytics - 4 to 350 MFD. Connect in any circuit from 2 to 450 V.

Granco AUTO FM RADIO

Model AR-12 transistor powered FM radio is completely self-contained with its own audio system; and is designed for under the dashboard mounting in any car with a 12v ignition system. Sensitivity, 1.5μV for 20 db of quieting. Power output, 15 watts peak power



from push pull transistor power circuit. Bandwidth, 220 kc at 3 db points. Image rejection, 40 db minimum. I-F rejection, 80 db minimum. Controls, volume on/off; tone; tuning; afc, on/off. 3" h, 3¾" d, 7¾" w. Weight, 5 lbs. Designed to cost less than \$75 installed. Granco Products, Inc., 83-30 Kew Gardens Rd., Kew Gardens, N. Y.

For more data, circle 7-75-3 on coupon, p. 54

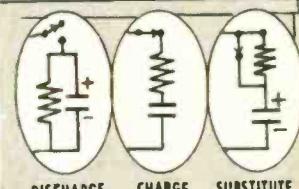
SENCORE ES102

ELECTRO-SUB

- What more can you ask for? The Electro-Sub not only saves time for any serviceman, engineer or experimenter but insures maximum protection too. Simply select the electrolytic, connect test leads and push surge protector switch.
- How many times have you reached for an electrolytic for substitution to find that value or voltage rating missing?
- How many times have you wanted a value just a little higher to see if you could knock out annoying hum?
- How many times have you had sets that blow fuses, fuse resistors or rectifiers and you did not check all electrolytics because it was too time consuming?
- Have you ever healed a suspected electrolytic by "bridging" it and made a call back that same week on the same trouble?
- Have you ever grabbed an electrolytic that you thought was discharged or watched a customer's dismay as you discharge one?
- Well, here is your answer . . . from the smallest electrolytics used in transistor radios to the largest used in costly Hi-Fi amplifiers . . . complete, safe substitution.

ES102.....DEALER NET 15⁹⁵

**AUTOMATIC SURGE PROTECTOR
for you and
the circuit**



It does all this by merely pushing surge protector switch. Move it as fast as you want; it is smooth and returns automatically.

You'd pay more for just the parts than you would for the complete ES102 . . . amazed? See your parts distributor.



SENCORE
ADDISON 2, ILLINOIS

For more data, circle 7-75-1 on coupon, p. 54

THE PRACTICAL APPROACH



Robert Cornell

Signal-To-Noise Ratio

Q. What is the significance of signal-to-noise ratio?

A. Many of us have a tendency to overlook, underestimate, or completely ignore the signal-to-noise ratio (S/N) with the resultant loss of a tool which could help solve some of the most difficult TV reception problems. Fortunately, in the majority of cases, we can get away with it. Even if we wanted to determine what the ratio is, some of us aren't equipped to do so. But, from a practical point of view, and without regard to S/N, in a weak signal area, we try to achieve the best reception by using high-gain antennas, amplifiers, pre-amps and "clean" installations having minimum signal losses.

What happens when there is excessive snow on the screen, even after inserting another amplifier to provide more gain? Gain is only one consideration. An amplifier increases everything it "sees," including noise. An amplifier introduces a certain amount of noise of its own. As a matter of fact, the other components, from the antenna down, contribute their own noise.

Let's consider this—in order to achieve a clean picture when the noise characteristics form a noticeable pattern, industry standards prescribe a minimum of 50 db S/N at the control element of the CRT.

If the noise is random and cannot assume any particular shape, the acceptable S/N figure could drop down to as low as 30 db. Assuming no other introduction of noise by the TV set, the minimum S/N at the input must be 30 db or higher. This means that for every μ v of noise there must be at least 31.6 to 316 μ v of signal present. If a low-noise amplifier introduces only 10 μ v less noise than an ordinary amplifier, it is possible to use a signal which is weaker by as much as 316 to 3162 μ v, for 30 to 50 db S/N respectively. Remarkable, isn't it?

The solution now is evident . . . use low-noise amplifiers. With the recent introduction of low-noise frame-grid tubes, and more recently, with transistors capable of handling VHF, it is now possible to take advantage of signals that previously were considered too weak.

After the first stage of RF amplification, the amount of noise introduced or present is relatively very small, and for the most part can be disregarded. Since it is the noise characteristics of the first RF stage of the receiver that are most important, it should be obvious that in order to achieve any degree of improvement in signal reception it is necessary for an external amplifier to have a lower S/N characteristic than the receiver.

This is the philosophy incorporated in the design of the new Blonder-Tongue amplifiers. Premium frame-grid tube circuitry for minimum noise and maximum gain is employed in the Model HAB, All-Channel TV/FM Amplifier; Model MLAB, All-Channel TV Amplifier; Model CB, Single-Channel Mast Mounted TV Amplifier; Model AB-2, VHF Antenna Booster; Model AB-FM, FM Antenna Booster; Model B-24, Two-Set Pow-R Booster.

If you want more information, contact me at Blonder-Tongue Laboratories, 9 Alling Street, Newark 2, New Jersey.

ET7

Reps & Distributors

GENERAL INSTRUMENTS reports the appointment of ART CERT & CO. as manufacturers rep for the Middle Atlantic states to handle the radio and TV replacement component parts of the Distributor Div.

LAFAYETTE RADIO has announced the July opening of its newest 8,000 sq. ft. store in Paramus, N.J.; expansion to 13,000 sq. ft. is planned for next year. The store will be managed by DAN LIPNER.

ELECTRONIC PUBLISHING announces publication of VAN SICKLE RADIO SUPPLY CO.'s "Electronic Buyers Guide" a 164-page book. The company also reported publication of a 156-page Buyers Guide for ARROW ELECTRONICS, INC.

AMPEREX has announced the appointment of BROTHERS & CONNEEN ASSOCIATES as distributor sales reps for Va., Md., except Washington Co., Del., Dist. of Columbia, N.J. south of and including Mercer and Ocean Cos., and Delaware and Philadelphia Cos. in Pa.

RAY R. HUTMACHER ASSOC. announces the purchase of their own building located at 6668-6670 Northwest Hwy., Chicago 31, Ill., containing 3340 sq. ft. on one floor.

GONSET DIV. has named MARTY BETTAN SALES CO. as rep in the New York City and Northeastern N.J. metropolitan area to represent their Citizens Band and FM radio equipment lines.

INT'L RESISTANCE has announced appointment of the following three rep firms: LOGAN & STONE CO., Northern Calif. and Northern Nev.; RON MERRITT CO., Wash., Ore., Western Idaho and Western Mont.; and JACK COVERT ASSOC., West Va. and Western Pa.

KIERULFF & CO. reports realignment of management team as follows: C. R. "CHARLIE" KIERULFF, Chmn. of Bd. of Directors; C. T. "CAP" KIERULFF, Pres., Chief Executive Officer, and Gen. Mgr.; C. R. "BOB" MC CARTY, Vice Pres., Secy., & Asst. to the Pres.; S. C. "SAM" GRASINGER, Vice Pres. for Sales, Consumer Products; S. G. "SID" KLIER, Vice Pres. for Finance & Treas., A. C. "ART" BUSTAMANTE, Asst. Secy.

OXFORD
*-the
Leader*

Largest exclusive
SPEAKER manufacturer
in the world
6 factories located
throughout the U.S.A.

ONCE MORE UNTO THE BREACH,
DEAR FRIENDS! When you are
looking for replacement speakers
on a par with original equipment,
the prime source is Oxford. Oxford
is the foremost name in original
equipment speakers specified by
manufacturers. We can supply you
with exact replacement speakers
which will be of the same high
quality as that originally supplied.
Oxford has a complete line for any
and every application.

OXFORD SPEAKERS . . .
Preferred for original
equipment.
Proven for replacement.
Our catalog is available upon request.

OXFORD Components,
A Division of Oxford Electric Corp.
556 West Monroe St., Chicago 6, Illinois

Oxford Speakers are available from
recognized electronic parts distributors.

BEST BUYS IN TEST INSTRUMENTS



- Praised by the experts
- Lifetime service guarantee
- Ruggedized mechanical design for utmost accuracy & stability
- Only the latest, finest quality parts used



Color & Monochrome • DC to 5 MC Lab & TV 5" Oscilloscope #460

Wired \$129.50. Kit \$79.95

Features DC amplifiers; flat from DC to 4.5 mc, usable to 10 mc.



TV-FM Sweep Generator & Marker #368

Wired \$119.95 Kit \$69.95

Entirely electronic sweep circuit with accurately biased inductor for excellent linearity. Extremely flat RF output.

Dynamic Conductance Tube & Transistor Tester #666
Wired \$109.95
Kit \$69.95
Tests all receiving tubes (picture tubes with adapter), n-p-n and p-n-p transistors.



Peak-to-Peak VTVM #232 & Uni-Probe (pat. pend.)
Wired \$49.95
Kit \$29.95

Uni-Probe — exclusive with EICO — only 1 probe performs all functions: half-turn of probe tip selects DC or AC-Ohms.



In stock at over 1500 distributors in the U.S. and Canada

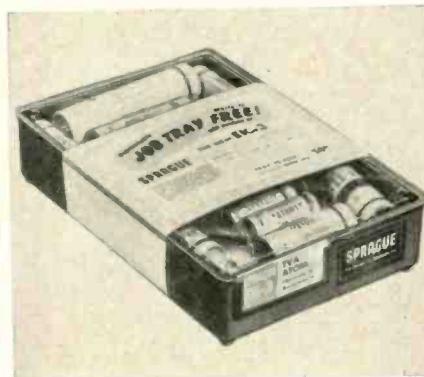
IMPORTANT NOTE: All EICO kits built according to our instructions, and all EICO factory-assembled equipment, conform to the high standards and specifications published in EICO literature and advertisements. All EICO factory-assembled equipment is completely and meticulously hand-wired throughout — no printed circuitry; each factory-assembled unit is 100% final-tested throughout for each feature and function — no "spot" or "partial" checking. In EICO's final test techniques, nothing is left to chance.

EICO, 33-00 Northern Blvd., L.I.C. 1, N.Y.

For more data, circle 7-77-1 on coupon, p. 54
ELECTRONIC TECHNICIAN • July, 1960

Sprague CAPACITORS

Announced is the EK-3 Atom assortment, consisting of 15 tubular electrolytic capacitors in the 12 most frequently used ratings packaged in an unbreakable plastic job tray. The capacitors are small dependable electro-



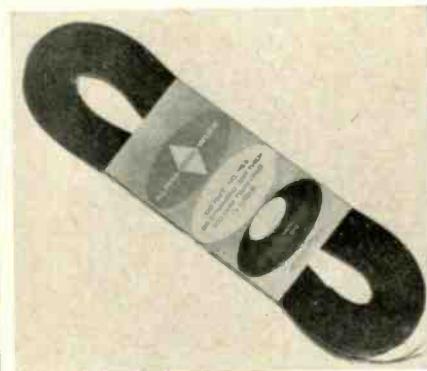
lytic capacitors designed for 85°C operation. Exhibiting low leakage and long shelf life, they withstand high ripple currents and high surge voltages. The tray measures 9"x6"x1½", has built-in cardholders and is free. Price for the assortment, \$14.91. Sprague Products Co., North Adams, Mass.

For more data, circle 7-77-3 on coupon, p. 54

For More Information Circle Code Numbers, p. 54

Alpha TV CABLE

300-ohm flat lead-in TV cable has been added to the firm's 5000-item line. The conductor is pure copper, #20 AWG, and the jacket is abrasion-resistant, waterproof, polyethylene. Two constructions are available: a 0.060" web for general purpose application



and a 0.100" web for use where more rugged lead-in is required. Packaged in four coils of 25', 50', 75', and 100' each, the cable comes with one end completely preassembled with lugs and the other slit back for fast connection. Alpha Wire Corp., 200 Varick St., New York, N.Y.

For more data, circle 7-77-4 on coupon, p. 54

BEST BUYS IN CUSTOM STEREO HI-FI...



- Praised by the experts
- Lifetime service guarantee
- Modern "low silhouette" horizontal chassis
- Easy console installation



AM Tuner HFT90 Wired \$65.95 Kit \$39.95* Cover \$3.95. *Less cover, FET included.

"One of the best buys." — AUDIOPRACTIC

AM Tuner HFT94 Wired \$65.95 Kit \$39.95 Includes cover & FET.

"One of the best... ideal for those wishing to add AM to their systems." — HI-FI SYSTEMS

FM/AM Tuner HFT 92 Wired \$94.95 Kit \$59.95 Includes cover & FET



Stereo Dual Amplifier — Preamplifier HF81 Wired \$109.95 Kit \$69.95

"Outstanding quality... extremely versatile." — ELECTRONICS WORLD LAB TESTED



Stereo Dual Preamplifier HF85 Wired \$64.95 Kit \$39.95 "Outstanding buy." — THE AMERICAN RECORD GUIDE

Stereo Dual Power Amps
28-Watt Model HF86. 70-Watt Model HF87
Wired \$74.95 Kit \$43.95 Wired \$114.95 Kit \$74.95



In stock at over 1500 distributors in the U.S. and Canada

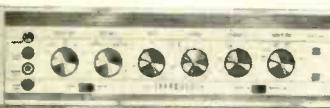
EICO, 33-00 Northern Blvd., L.I.C. 1, N.Y. ET-7
Show me how to save 50% on top quality: Hi-Fi
 Test Instruments Ham Gear. Send free catalog and name of neighborhood EICO supplier.
 Send free STEREO Hi-Fi Guide.

Name _____
Address _____
City _____ Zone _____ State _____
Add 5% in the West

For more data, circle 7-77-2 on coupon, p. 54

only for those who want the ultimate

SHERWOOD "TOP RATED" again and again -and NOW AGAIN!



Model S-5000, 20+20 watt "stereo"
Dual Amplifier-Preamplifier, Fair Trade Price-\$189.50



Model S-2200, FM-AM-MX Stereo tuner,
Fair Trade Price-\$179.50



AMERICAN
AUDIO INSTITUTE

394 EAST 10th ST., PATERSON 4, N.J.

October 27, 1959

Sherwood Electronic Labs., Inc.
4300 North California Avenue
Chicago 18, Illinois

Gentlemen:

We find that the incorporation of a center-channel output and a damping factor selector in July, 1959, increases the Summary Rating of the Sherwood S-5000 to the highest of all 18 Stereo Amplifiers tested in the AAI Evaluation Test Reports.

Sincerely,

AMERICAN AUDIO INSTITUTE

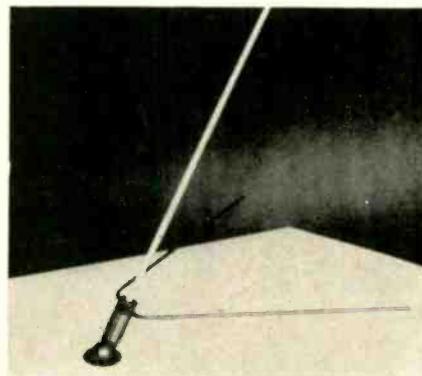
Felix R. Bremy
Executive Director

The "Most honored of them all" S-5000 stereo amplifier-preamplifier is joined by the S-2200 stereo tuner. As with its "Top Rated" predecessors, the S-2200 features FM "Interchannel Hush" plus push button selector, internal plug-in adaptor for Stereo FM Multiplex, 2 "Acro-beam" tuning indicators, simulcast FM/AM stereo. All Sherwood tuners feature FM sensitivity below 0.95 microvolts and 1/3% distortion @ 100% FM. For further details write: Sherwood Electronic Laboratories, Inc., 4300 N. California Avenue, Chicago 18, Illinois.

For complete specifications write Dept. ET-7
For more data, circle 7-78-1 on coupon, p. 54

Kaar BOAT ANTENNA

"Sea Sprite" antenna, for marine installation of Class D citizens equipment, is especially adaptable for outboard runabouts and cruisers. It consists of a five-foot center loaded fiberglass whip with a sturdy chromed counterpoise. The counterpoise makes possible proper antenna loading, without the need for

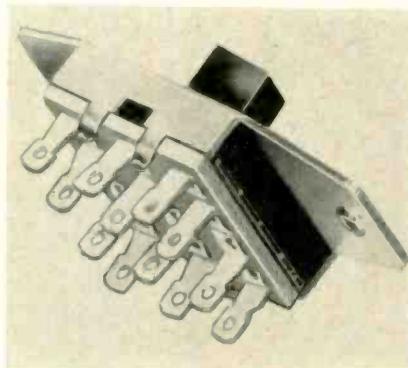


special under deck ground installation. Installation is through the boat deck with an automobile-type swivel mount. Temporary, on-deck or windshield installations can be made with a chrome mounting bracket with suction cups. \$33.90. \$5.95 additional for temporary-installation mounting bracket. Kaar Engineering Corp., 2995 Middlefield Road, Palo Alto, Calif.

For more data, circle 7-78-4 on coupon, p. 54

Continental-Wirt SWITCH

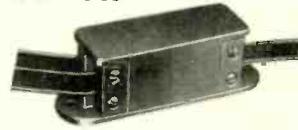
Type SW-742 slide switch has a four-pole, double-throw circuit and, for easy assembly in end products, has all terminals in a common plane. Terminals and contacts are silver plated. Standard units feature the "short" terminal with overall distance of 0.575" nominal from



mounting surface to extreme tip of terminal. The new switch is useful in many multiple switching applications related to audio system, electronic measuring devices, home appliances and industrial controls. Continental-Wirt Electronics Corp., 5221 Greene St., Philadelphia 44, Pa.

For more data, circle 7-78-5 on coupon, p. 54

'Dual Match'



set coupler

Profit-Wise TV Servicemen
Choose MOSLEY!

PERFORMANCE*

* Nothing satisfies customers as much as performance . . . That's what Mosley 2-set TV couplers provide. Rated *BEST* in quality for weak signal reception by a nationally known independent product rating group. Write today for free literature.

Mosley
Electronics, Inc.
ST. LOUIS 14, MISSOURI

For more data, circle 7-78-2 on coupon, p. 54

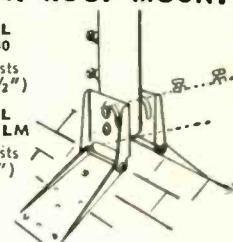
ask the
"Man-on-the-Roof"
why he prefers

South River

COMBINATION PEAK & FLAT ROOF MOUNT

MODEL
PFM-30
(Fits Masts up to 1½")

MODEL
PFM-30 LM
(Fits Masts up to 2")



Features the patented South River "Walk-Up" — "Drop-Lock" mast socket for easy installation on either Peak, Flat or Pitched roofs. Heavy gauge pipe mast socket has two heavy duty screws and locknuts to secure mast. Factory assembled and supplied in a heavily plated rust resistant finish. U.S. PAT. #2734708

SOUTH RIVER

METAL PRODUCTS CO., INC.

South River, New Jersey

pioneer &
outstanding
producer of
finest line
of antenna
mounts

For more data, circle 7-78-3 on coupon, p. 54
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*Anywhere
Automatically*

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EMERGENCY
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POWER UNIT

Illustrates ATR Emergency Lighting and Power Unit, Model ETS complete with lamps.

Completely Automatic Standby-Power Units Specially Designed to Permit the Instantaneous Continued Operation of Critical Lighting Equipment, PA Systems, Amplifiers, Intercom Systems, Burglar Alarms, Fire Alarms, Synchronous Electric Clocks, Electric Time and Recording Clocks, Incubators, Gas Valves, Telephone and Test Equipment, and Similar Critical Devices in the Event of 115 Volt AC Commercial Power Line Failure. For Use: In Hospitals, Banks, Hotels, Theatres, Factories, Office Buildings, Schools, Homes, and Many Other Areas of Operation.

SEE YOUR JOBBER OR WRITE FACTORY

* "A" Battery Eliminators • DC-AC Inverters • Auto Radio Vibrators



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Quality Products Since 1931

SAINT PAUL 1, MINNESOTA, U. S. A.

PHONE
ED 9-9653

\$7.50
plus ports,
C.O.D. and postage charges

90 DAY
WARRANTY



Precision Tuner Service

ALL TYPES T.V. TUNERS REPAIRED AND ALIGNED TO FACTORY SPECIFICATIONS ON CRYSTAL-CONTROLLED SWEEP GENERATORS
24-HOUR SERVICE ON MOST TUNERS
UHF - VHF COMBINATIONS — \$13.50

See your local distributor or send to:

P.O. Box 272, 601 N. College
BLOOMINGTON, INDIANA

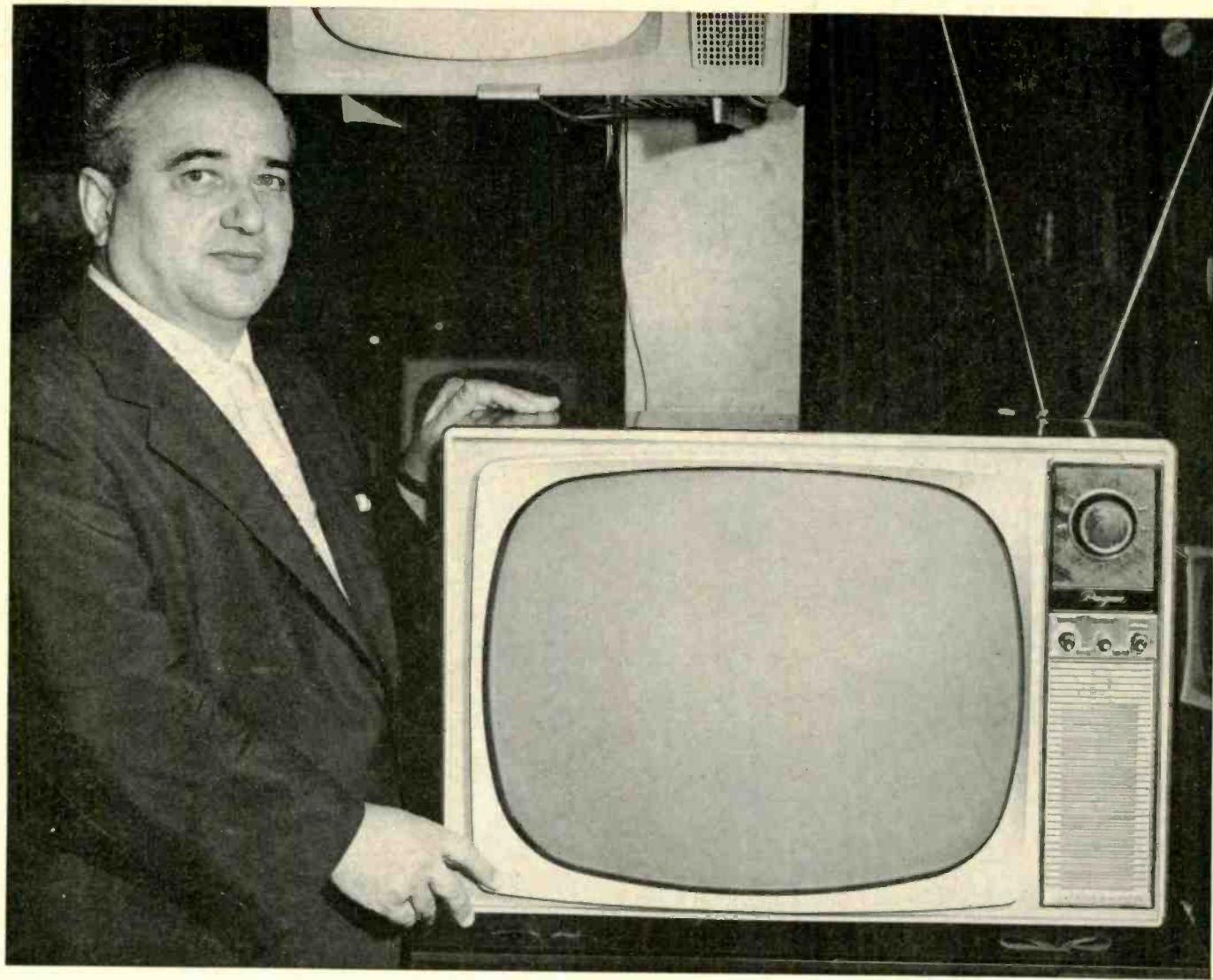
State make and model. Send
all parts, tubes and shields

For more data, circle 7-79-1 on coupon, p. 54

ELECTRONIC TECHNICIAN • July, 1960

For more data, circle 7-79-2 on coupon, p. 54

79



"YOU'LL SELDOM FIND

a General Electric 'Designer' in for service,"

says Henry Feldman, Manager of Burk's,
a leading television and servicing dealer
in Long Beach, California.

"Our men seldom have to pull the chassis of a General Electric 'Designer'. They do practically all of the repairs in the home on the few calls necessary. You seldom find one of these sets in the shop. This is because most key check points are easy to get at when you take the back off."

Mr. Feldman is also kind enough to say: "The entire General Electric Line moves fast and is one of our top profit lines. The fact that it requires very little service has a lot to do with this."

Here's why the "Designer" is such a particular hit with service men all over the country:

You can leave the "Designer" chassis in the set

and still get at both sides of the printed boards. All tubes are easily replaceable. Fuses are accessible and you can get at key check points.

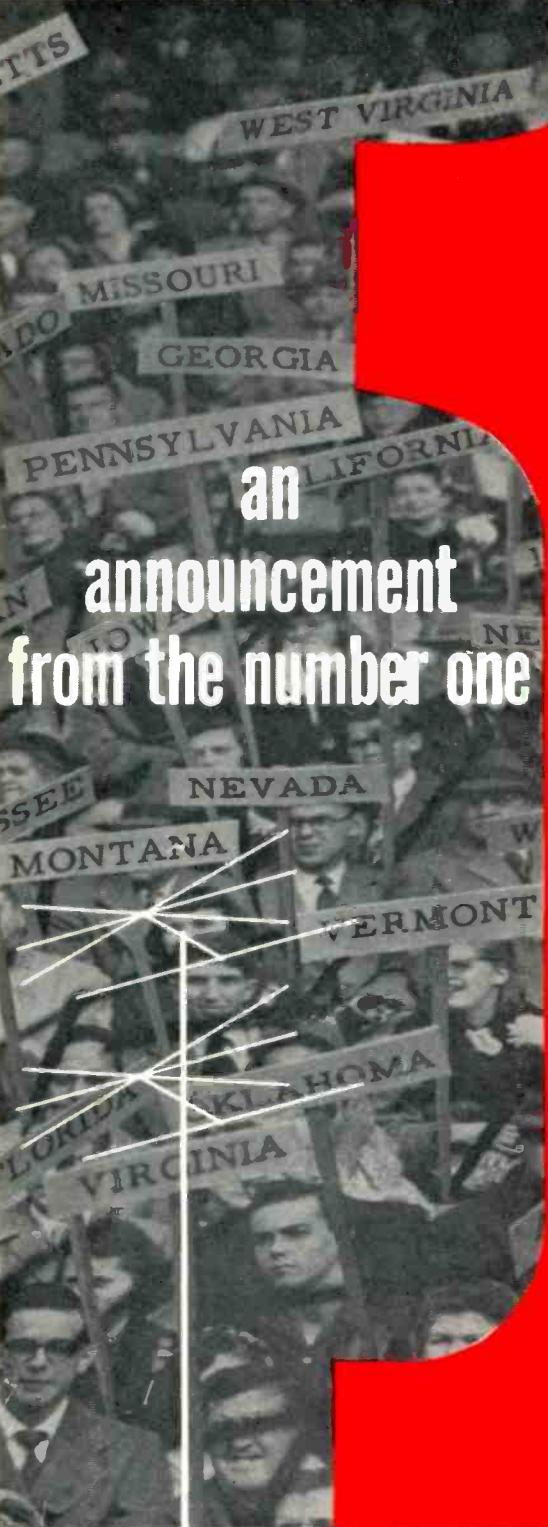
Precision Crafted Circuitry is the name General Electric gives to its reliable, uniform circuitry. Each board has a *painted* schematic so that you can find your way through it easily. Service one and you'll be thoroughly familiar with it.

"Designer" TV—the easiest-to-service set in television! General Electric Company, Television Receiver Department, Syracuse, N. Y.

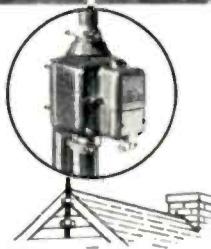
Progress Is Our Most Important Product



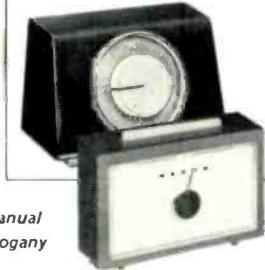
GENERAL  **ELECTRIC**



an
announcement
from the number one

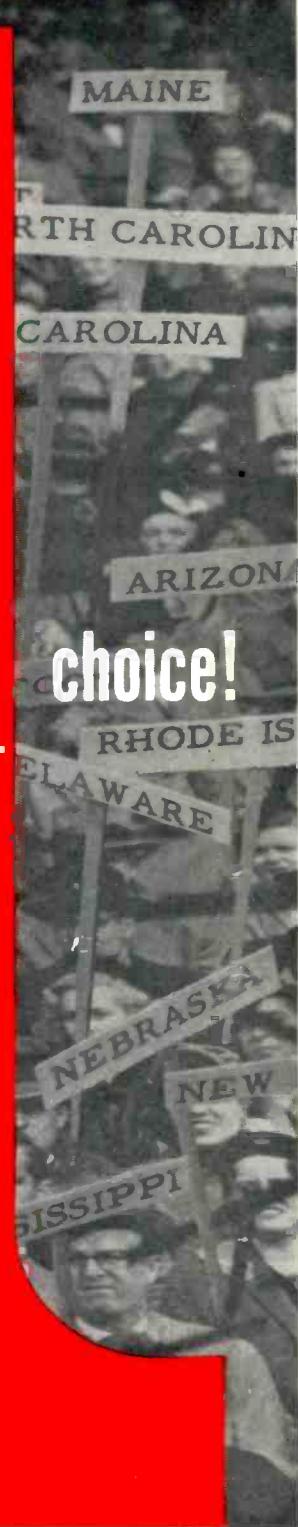


Newest automatic and manual
Alliance models—In mahogany
ivory and forest green.



Dealers!

Nation's #1 choice
in antenna
rotators
announces new
discount structure...
new low cost to
you: means more
profits, more
sales than ever
before...
see your jobber
for details, today!



choice!

alliance
TENNA • ROTOR

Nation's Number 1 choice in Antenna Rotators! And why not? The Alliance
name, Alliance advertising, Alliance features—they're all Number 1, also!
Ask 4 million users from coast to coast.

The Alliance Manufacturing Company (Division of Consolidated Electronics Industries Corp.) ALLIANCE, OHIO
WORLD'S LARGEST PRODUCERS OF SUB-FRACTIONAL H. P. MOTORS • MFRS. OF ALLIANCE GENIE AUTOMATIC GARAGE DOOR OPENERS

For more data, circle 7-C3-1 on coupon, p. 54

NOW'S THE TIME TO GET IN ON

RCA's giant new sales promotion program for SILVERAMA PICTURE TUBES

THE BIGGEST, MOST COMPREHENSIVE PICTURE TUBE PROMOTION IN THE INDUSTRY!

Here at last is the all-in-one picture tube promotion program you have been waiting for! Five strong sales-building elements in a single package put you ahead of competition, help you reap greater profits by selling RCA Silverama Picture Tubes.

Silverama, as you know, is RCA's all-new premium tube that can command premium price and profit on every sale!

PROMOTE YOUR SERVICES BY ANY MEDIUM YOU CHOOSE—



TO C. CHASTAIN
4133 ELLIOTT AVE
DAYTON 10 OHIO
74-6111 RAI GE 6671

1 2 3 4 5

BILLBOARD
POSTERS

FILMED TV
COMMERCIALS

RECORDED RADIO
COMMERCIALS

NEWSPAPER
AD MATS

PROMOTION AND
DIRECT MAIL

Full-color billboard posters in 6- or 24-sheet size with space for your imprint to link your name with the most trusted name in television: RCA.

30- and 50-second spots with open end for your name. The first filmed TV commercials by a major manufacturer designed for dealer use.

Pre-recorded 30-second and 60-second open-ended spots let you reach your customers at home, out-of-doors, in cars, everywhere!

Seven different mats with space for your name allow you to take advantage of a consistent, well integrated news-paper advertising campaign.

Window streamers, sales pro-motional postcards, miniature billboards, consumer litera-ture, all to augment your other promotion activities.

ALL BACKED BY RCA'S HEAVY NATIONAL ADVERTISING CAMPAIGN IN TV GUIDE AND ON NETWORK TV

Check with your Authorized RCA Tube Distributor NOW for full facts on this exciting new program.
RCA Electron Tube Division, Harrison, N. J.



The Most Trusted Name in Television
RADIO CORPORATION OF AMERICA

