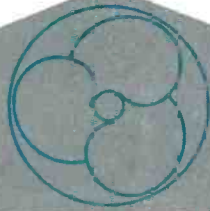


TECHNICIAN

& Circuit Digests



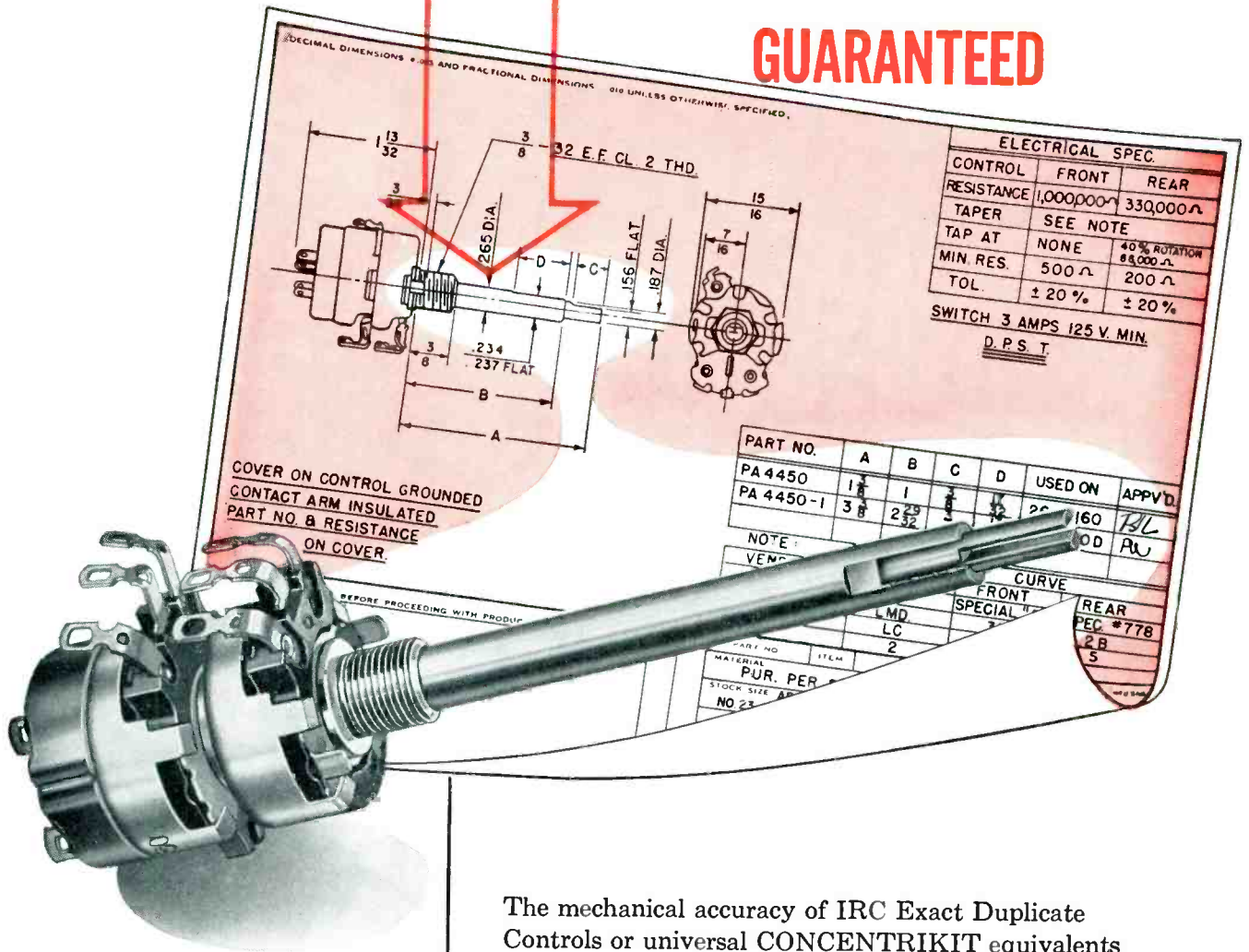
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The typical manufacturer's specifications shown here are exactly duplicated by IRC QJ-180 control. CONCENTRIKIT assembly includes P1-229 and R1-312 shafts with B11-137 and B18-132X Base Elements, and 76-2 Switch.



Wherever the Circuit Says ~~~

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JULY, 1956

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FRONT COVER

A growing number of techs are finding interesting challenges and increased income in providing complete TV-electronic-appliance service for the home. A kick-off feature beginning on page 26 tells you how to use your present test equipment to get started in air conditioning and refrigeration work—an ideal income booster for the sick summer months. Cover shows TV, radio, intercoms, hi-fi systems and many home appliances . . . all prospective sources of servicing income.

FEATURES and ARTICLES

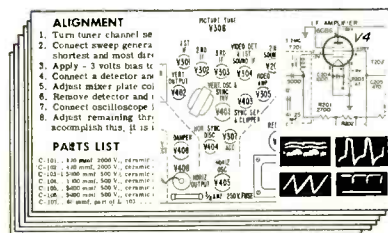
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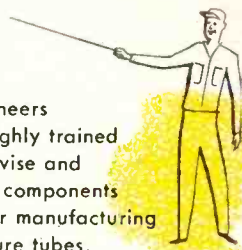


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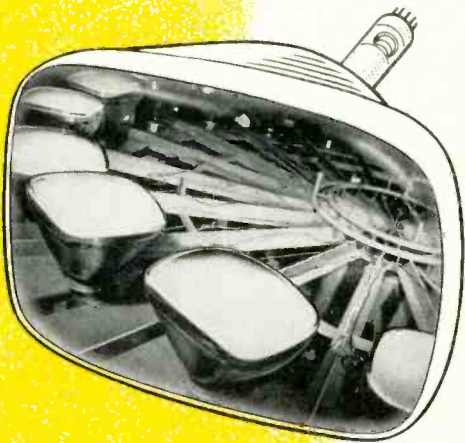
CBS-COLUMBIA: Clock Radio Chassis 636, 656, 616
HALLICRAFTERS: TV Chassis A2005, B2005, C2005, D2005
OLYMPIC: TV Chassis CA, CB, CE
PACKARD-BELL: Table Model Radio Model 5R1
RAYTHEON: TV Chassis Aristocrat Series 21T42
WESTINGHOUSE: TV Chassis V-2344, V2354, V-2345, V-2355



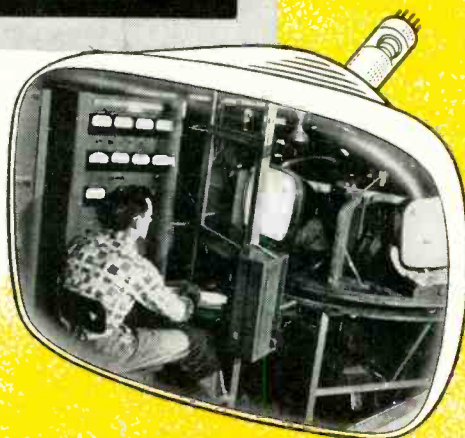
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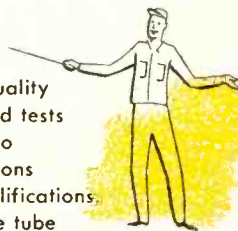


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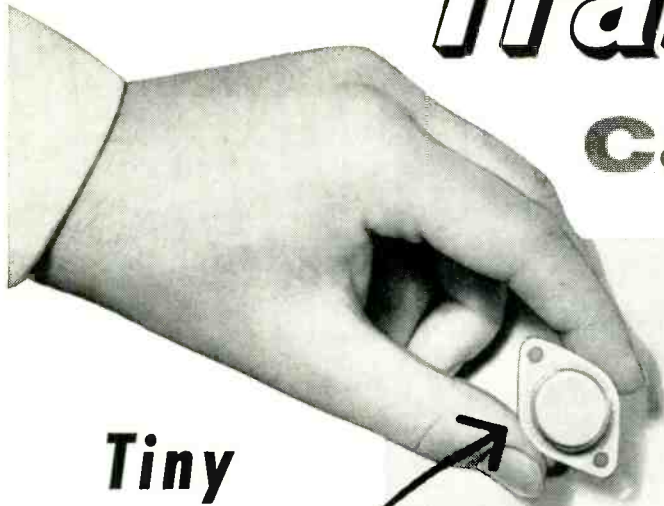


IT'S DEALERS CHOICE

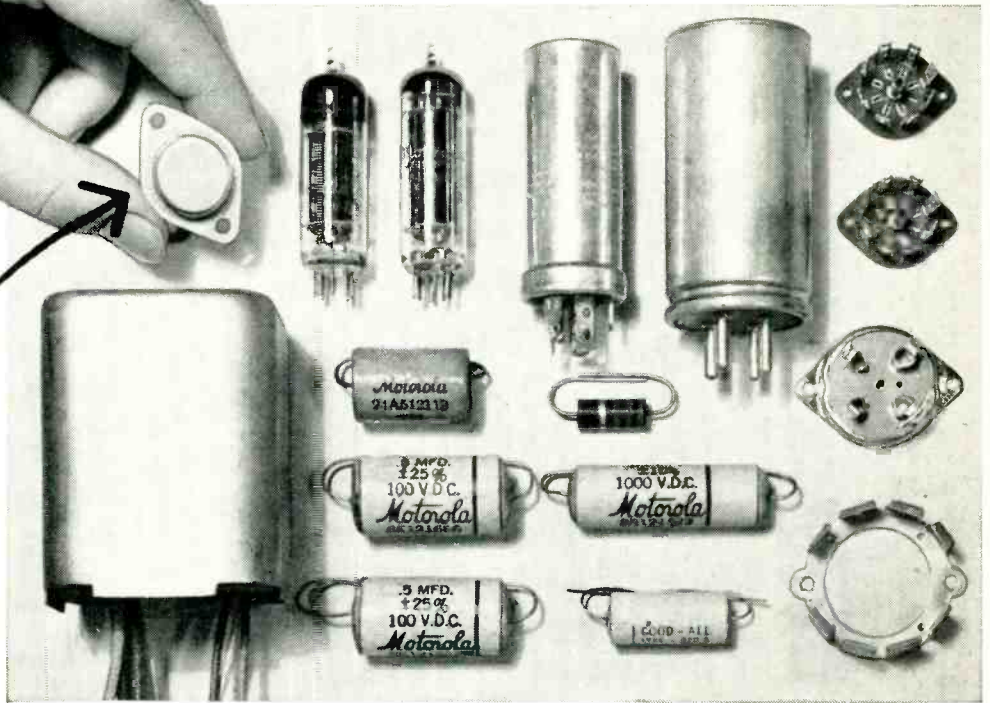
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Cathode-ray Tube Division, ALLEN B. DU MONT LABORATORIES, Inc., 750 Bloomfield Avenue, Clifton, N. J.

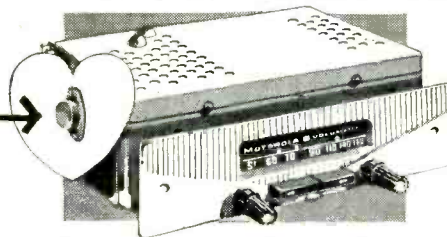
New Motorola® **Transistor** POWERED Car Radio



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PLUS—NEW TWIN BAR STATION FINDER Most automatic tuning of all! Electronically picks and pinpoints any station. Twin Search Bars move station selector either right or left from any point on the dial.

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Editor's Memo

Brother, this takes the cake. Last month in this column, I noted that it's a darn good idea not to take things for granted too readily. Sure, that seems pretty obvious, but you'd be surprised. A cousin of mine read the item, and then related this story. Only the names have been changed to protect the innocent.

My cousin's next door neighbor, whom we'll call Charlie, has a friend we'll refer to as Stan. Stan is a TV tech, and he went over to Charlie's house to repair the set. After the set had been put in operating condition again, thanks to one horizontal oscillator tube, Charlie asked Stan to do him the personal favor of packing and moving some heavy stuff up to the attic.

Stan agreed, and after an hour of grimy work, the job was done and both men were dirty and sweating. Charlie suggested that Stan take a shower while he ran out to buy a few cans of cold beer. While Stan was in the shower and Charlie was out of the house, Charlie's wife came home.

Charlie's wife walked into the bathroom, assuming it was her husband in the shower. Being in a playful mood, she pinched him through the shower curtain.

Stan, on the receiving end of the pinch, assumed it was Charlie in the bathroom, back from his beer-shopping expedition. So he threw back the shower curtain—and they stared at each other in stunned disbelieving silence for a moment. Then she fainted.

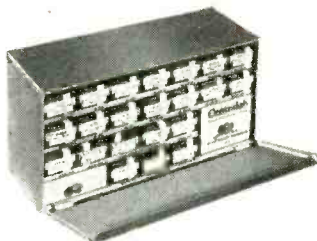
Well, everything turned out all right in the end in this case. Not so in many other relations between techs and customers across the country. Many a small claims court has heard the complaint: "I naturally assumed this serviceman would call for my approval on the estimate before going ahead with such an expensive repair job." Or from the tech's viewpoint: "I assumed she meant it when she said to do any work necessary, even if it turned out to be a big bill."

Moral? Don't assume! Make sure everything is fully explained and mutually understood.

When I say understood, I refer to clear-cut terms that are neither ambiguous nor open to several interpretations. Be specific, and you will probably not stir up unexpected emotions.

There's an old gag about double-meaning expressions, and the humor of it may help you keep the point in mind. A lady getting off the rear exit of a bus called to the driver: "Don't close the door until I get my clothes off!" And as other passengers turned to stare, the lady alighted from the bus . . . with her bag of laundry.

Al Forman



BA Kit
\$19.40 complete
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Suggested net prices

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200	130	207G1
250	130	208G1
300	130	202G1
350	130	209G1
400	130	203G1
500	130	204G1
400*	130	210G1
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*Special thin types for use where available space will not permit the use of type 203G1 or 204G1.



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Yours with every purchase of the exclusive new Westinghouse "TEN TOP TUBE" PACK!

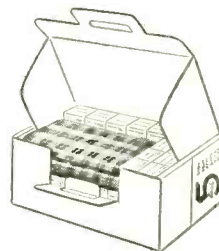
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- Keeps foods and drinks warm or cool for hours!
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- Waterproof!
- Seamless bottom!

Open a "TEN TOP TUBE" PACK . . . and there it is! Your *free* gift from Westinghouse—a big, beautiful Fiberglas-Insulated Thermal Bag for picnics, travel, hunting and fishing trips, dozens of household uses.

And that's just the beginning! You'll *also* find in the "TEN TOP TUBE" PACK an entirely *new* idea in TV-radio tube packaging. *Five each of the ten tubes you use most**—all in one handy carton. And each and every tube with famous Westinghouse Reliatron® quality—the quality that virtually eliminates call-backs.

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ORDER YOURS TODAY!



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6AL5, 6AU6, 6CB6, 6BZ7,
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Tests each tube for shorts, grid emission, gas content, leakage, dynamic mutual conductance and life expectancy. One switch tests everything. No roll charts. No multiple switching. Makes complete tube test in as little as 12 seconds. Large 4½-inch plastic meter shows tube condition on "Good-Bad" scale or in micromhos on scales calibrated 0-6,000 and 0-18,000. Used in home or shop, DYNA-QUIK is a proved money-maker!

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With 20 popular types you cut call-backs,

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- Tubes are life-tested under actual operating conditions, including peak voltages that will be encountered. Assures dependable performance!

NEW 6BK7-A, 6BQ7-A, 6BZ7. *Improved heater design* provides better heater-cathode insulation. Cuts shorts to a minimum, acts to prevent tube burn-outs.

- Heater-cathode leakage is greatly reduced. Gives improved tube operation, and stabilizes tube performance.

- High zero-bias G_m . This increases tube gain and improves TV reception in fringe areas, giving a clearer, sharper picture.

PROTECTS AGAINST FILAMENT PULL-OUTS.



NEW 6AL5. *New, advanced heater design* limits initial voltage surges when tube is used in early-model series-string receivers. Same advantage applies in parallel-connected circuits. Tube flash burn-outs are greatly reduced. Vertical bars at right show approximate drop in initial voltage surges between heater of old tube and new Service-Designed 6AL5.

- New heater design also minimizes heater-cathode leakage. This is an important "plus" in AGC and video-detector applications.

HEATER VOLTAGE SURGES REDUCED.



YOU CAN CROSS OFF HEATER-CATHODE SHORTS!

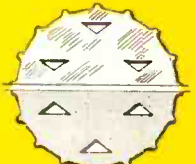


NEW 6CB6. *New sprayed micas* combat interelement leakage, improving AGC performance by reducing any tube leakage in the controlled 6CB6 stages.

- Special-alloy screen grid gives superior heat dissipation. Result: freedom from G_1 and G_2 grid distortion and shorts.

- High zero-bias G_m , for improved fringe-area reception. Helps make the new 6CB6 a better-performing, more dependable tube!

REGULAR MICA DEPOSITS WILL CAUSE LEAKAGE.



NEW, SPRAYED G-E MICA IS LEAK-AGE-RESISTANT!

NEW SERVICE-DESIGNED



6BK7-A

6BQ7-A

6BZ7



NEW SERVICE-DESIGNED 6CB6

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please customers on more than half your TV tube sales!

EVERY new General Electric Service-Designed Tube increases your profit opportunity. The 6 new types now available give you 20 Service-Designed Tubes in all . . . and by actual sales count for the year 1955, these 20 tubes meet 54 percent of your total TV replacement requirements!

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Stock and install G-E Service-Designed Tubes! They cost no more than other tubes, are fully interchangeable with prototypes. They're widely advertised, nationally popular. Your G-E tube distributor has them. Phone him today! *Tube Department, General Electric Co., Schenectady 5, N. Y.*

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1X2-F/B	5AX4-GT	6BX7-GT	6J6
5U4-GA/G3	6BG6-GA	6BZ7	6SW7-GTB
5Y3-GT	6BK7-A	6CB6	12SN7-GTA
6A-5			25C66-GB
	6BQ6-GA/6CU6		258Q6-GA/25CU6

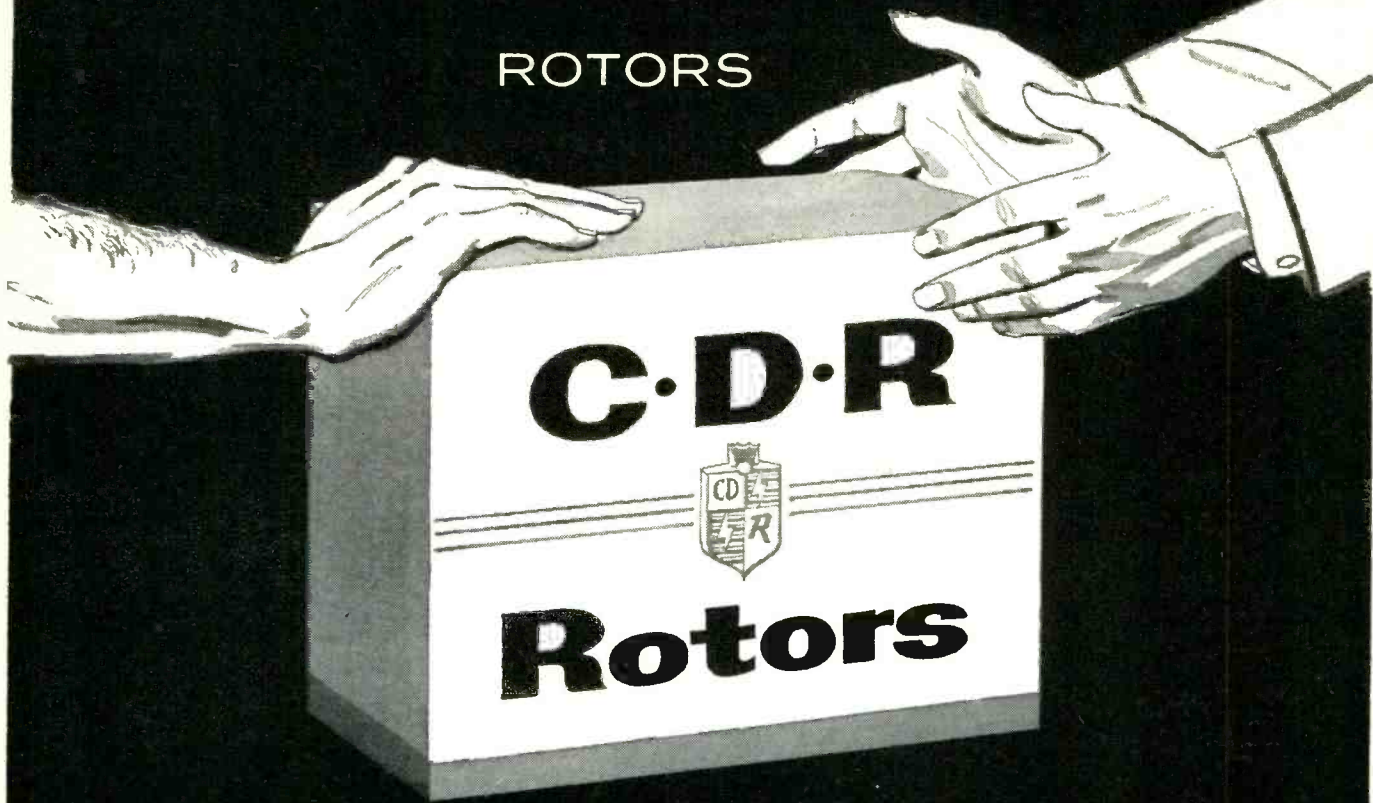
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<p>Completely AUTO-MATIC version of the TR-2 with all the powerful features that made it famous.</p>	<p>Completely AUTO-MATIC rotor, powerful and dependable. Modern design cabinet. 4 wire cable.</p>	<p>Completely AUTO-MATIC rotor with thrust bearing.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



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New Books

ANALYSIS OF ELECTRICAL CIRCUITS. By William H. Middendorf. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 306 pages. Hard cover. \$6.00

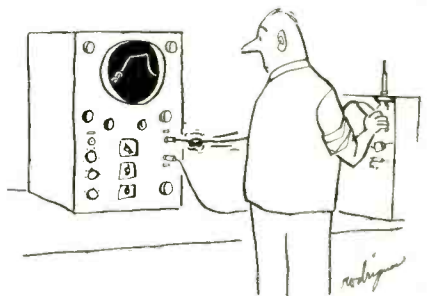
Intended for use on the undergraduate college level, and relying heavily on advanced algebra, this book will turn away many a practical technician. Yet, for the eager beavers who have already enriched their minds to some extent and seek to continue the quest for broader knowledge, the text will be rewarding. In a straightforward treatment, the author starts out with six basic laws of physics—including the ubiquitous laws of Ohm and Kirchhoff—and builds upon them problem-solving methods that will enable the reader to do his own broadly applicable analysis, rather than accepting the pat solutions generally offered him.

R-F TRANSMISSION LINES. By Alexander Schure. Published by John F. Rider Publisher, Inc., 480 Canal Street, New York, N. Y. 72 pages. Paper cover. \$1.25.

This is the 8th short volume in the Electronic Technology Series, earlier called the Review Series. Principally intended for student use, it covers the role of the r-f transmission line as a linking device in the chain of propagation or reception, operation of such lines, their characteristics, their uses, and problems encountered in use. To maintain a broad approach suitable alike to student, technician and engineer, mathematical treatment has been kept to a minimum.

RADIO RECEIVER LABORATORY MANUAL. By Alex W. Levey. Published by John F. Rider Publisher, Inc., 480 Canal Street, New York, N. Y. 106 pages. Paper cover. \$2.00.

The practical experiments that fill the perforated, tear-out pages of this workbook, are planned to give the student an introduction into the construction, analysis, testing and repair of radio receivers, and to acquaint him with the use of test equipment. Intended for one who is already versed in ac, dc, and vacuum-tube fundamentals, the experiments are built around a particular receiver, but are adaptable to most existing superheterodyne circuits.



COLOR TELEVISION—Simplified Theory and Service Techniques. Consulting editor Donald Fink. Published by Philco Corp., P. O. 9817, Philadelphia 40, Pa. 154 pages. Paper cover. \$5.00.

Over 50,000 well written words supported by 288 illustrations provide a comprehensive explanation of the color TV science. After reviewing black and white TV, colorimetry and transmission standards, the text goes on to describe the various circuits and color crt assembly. Of special value to service techs are the sections on crt and receiver adjustments, alignment, servicing and installation procedures. Illustrated in color.

PICTURE BOOK OF TV TROUBLES, Vol. 5 (Horizontal Output and H-V Circuits). By John F. Rider Laboratories Staff. Published by John F. Rider Publisher, Inc., 480 Canal Street, New York, N. Y. 108 pages. Paper cover. \$1.80.

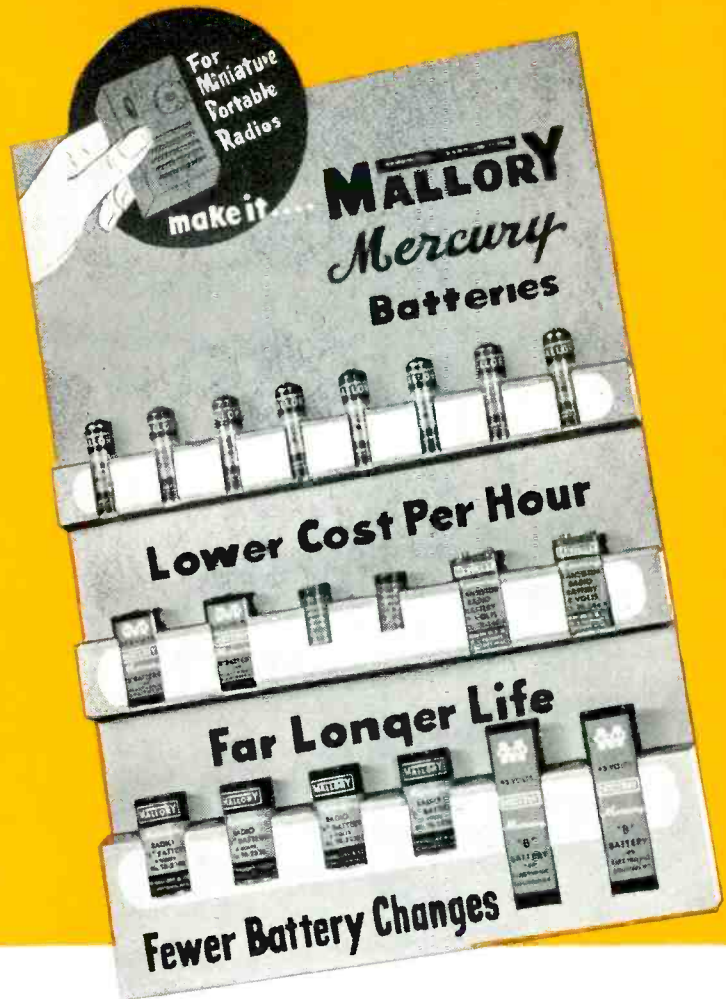
As with its predecessors, this catalog of TV faults attacks its chosen receiver section systematically and comprehensively, exploring a wide range of possible defects with all associated components, and reporting on all symptoms whether oscillographic, observed with the meter, or visual. Direct-drive, auto-transformer and separate-secondary types of output circuits are included, as well as yoke and width coil circuits and h-v rectifiers, including a voltage tripler. There are details on the construction and use of a h-v scope probe, as well as the usual convenient fold-out section in the back depicting all circuits discussed.

AUTOMATIC GARAGE DOOR CONTROL. By L. R. Chase. Published by Richards-Lawrence Book Co., 13339 Debby St., Van Nuys, Calif. 40 pages. Paper cover. \$1.50.

This how-to-do-it book tells you how to build a pushbutton door operator, and includes provisions for intrusion alarm, electric lock and fail-safe programming. Functions of various units, mechanical details and circuits are all given. Although intended for the hobbyist, this volume gives the technician interested in expanding his operation the practical insight needed for making profitable garage door operator installations. (See April 1956 *TECHNICIAN*, p. 40, for "Earn Extra Profits by Installing Automatic Garage Door Operators.")

COLOR TELEVISION SERVICE SCHOOL. Prepared and published by Westinghouse Electric Corp., TV-Radio Div. Service Dept., Metuchen, N.J. 32 pages. Paper cover. \$1.00.

This handy and informative text used in the manufacturer's training program concentrates for the most part on detailed circuit description, with brief coverage of color fundamentals and test equipment. Among the 22 different circuit functions examined are the tuner, i-f, luminance detector, subcarrier oscillator, chroma amplifier, and synchronous demodulators. It's concisely written, and contains 28 illustrations.



Pick The Profit-Making Battery Line

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Put this display of Mallory Mercury Batteries on your counter . . . and you're set to service *all* popular miniature portable radios with the longest-lasting, lowest-cost-per-hour batteries on the market!

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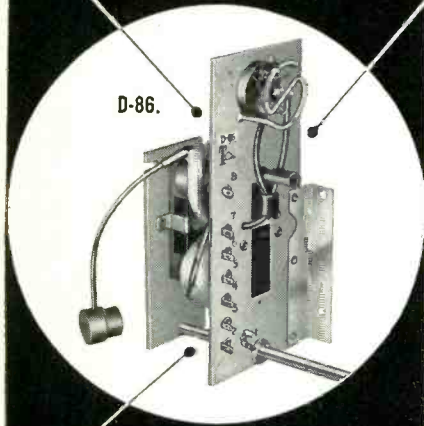


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P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA

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to fill your TV replacement needs



With the addition of the 8 new flybacks (Horizontal Output transformers) listed below, you can depend on TRIAD to supply all your Television replacement transformer requirements.

- D-78. List Price \$11.60. Correct Replacement for Sylvania 241-0011.
- D-79. List Price \$12.35. Correct Replacement for CBS and Firestone PC-10137.
- D-80. List Price \$12.35. Correct Replacement for CBS and Firestone PC-10147, G.
- D-83. List Price \$11.80. Correct Replacement for Raytheon 12E-24612, 12E-24612-1 and 12E-25040.
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- D-85. List Price \$12.70. Correct Replacement for Airline MW22E67 and Sentinel 22E67.
- D-86. List Price \$15.50. Correct Replacement for Airline MW22E75 and Sentinel 22E75.
- D-87. List Price \$12.70. Correct Replacement for Airline and Sertinel 20E947, B

Write for Catalog TV-56



4055 Redwood Ave., Venice, California



LETTERS

To the Editor

Association Listing

Editor, TECHNICIAN:

The "Roster of Service Associations" in your May directory is out of date so far as certain listings in this area are concerned. Our own association, Associated Radio-Television Servicemen of New York (ARTSNY), which is the only organization here recognized by the City Council and the various district attorneys, is not listed, except for a news item on page 55.

MARTY BOXER, Secy.

ARTSNY

Brooklyn, N. Y.

• Our sincere apologies for the unintentional omission of ARTSNY. We're well aware of ARTSNY's good work and the recognition it has achieved.—Ed.

Invention Protection

Editor, TECHNICIAN:

In connection with my TV business, I have come across several helpful ideas. Not having the investing capital or manufacturing contacts, I thought you might be in a position to advise me. One idea is a roof-top platform to fit almost any slope. Another is a device to use on antenna lead-in wire replacement jobs to eliminate removing the antenna in order to replace the wire.

My biggest problem is to locate a manufacturer who might be interested and who would respect my ideas as mine. Some people lose their ideas and due profit from certain manufacturers.

ROBERT B. SAVAGE

Doc's Television Service
West Bath, Maine

• For the many techs who develop aids in the course of service work that may have some market potential, we hope to run helpful information in a future issue.—Ed.

Florida Tech Job

Editors, TECHNICIAN:

If you know of an outstanding TV technician who would like to live in an up and coming Florida East Coast community, will you please put me in touch with him? I believe this is an exceptionally good opportunity, but it calls for an exceptionally good man, personality being about as important as know-how. Color knowledge and/or experience is a must.

JAMES B. ROCK

Telorex
604 Orange Ave.
Fort Pierce, Fla.

Mfrs. Literature

Editor, TECHNICIAN:

This is to thank you for your effort to help service men build the literature they need (March 1956 issue). I am more than pleased with the results. Keep up the good work.

FRED J. WILL

Will's Radio & TV Service
East St. Louis, Ill.

Editor, TECHNICIAN:

A month ago we sent you a card requesting literature from manufacturers which was taken out of the March issue. Included was a P. O. money order for \$3.75 to cover five prepaid pieces, and a request for 24 free pieces. To date we have not received a single piece of mail. We understood from you that it would take a few weeks, but it seems you must have meant a few months.

CHESTER E. SIMPSON

Simpson Radio & TV Service
Saco, Maine

• We honestly regret the delay, but the unprecedented flood of close to 600,000 literature requests from more than 12,000 readers has made it unavoidable. We're doing everything possible to process your requests promptly . . . as a matter of fact we're spending over \$15,000.00 to do so. Also, it takes the manufacturer a while to handle the record number of requests we pass on to him. Every penny sent in is being carefully accounted for. Please be patient a bit longer; you'll find this literature well worth waiting for.—Ed.

Color TV Converter

Editor, TECHNICIAN:

Would you tell me more about the price and availability of the color TV converter described in your April issue. This issue is the first of my subscription, and I am looking forward to my next one.

G. B. GINSHERMAN

Videorama Electronics
Montreal, Canada

• Advertised dealer cost in the U. S. is \$106. More data may be obtained by writing Color Converter, Inc., Columbia City, Indiana.—Ed.

Needed: Tube Data

Editor, TECHNICIAN:

Since the service technician must often repair old equipment, it would be most helpful if someone would publish a list of all tubes and prices, including those types no longer made. Complete data should be given. At present the tube companies are doing only part of the job. They provide a list price sheet for posting on the wall. You can't buy this list. You may get it if the wholesaler has any on hand. I would be willing to pay up to \$25 for a tube listing that has no deletions.

J. D. SPEICHER

Speicher's Radio Service
Bellerose, N. Y.

Something she'll be proud to own—



FREE

with your
**SYLVANIA TUBE
PURCHASES**

*Earn the complete 54-piece set
in the smart anti-tarnish chest

exclusive *Capri*

triple silverplate by Wm. A. Rogers

Watch the family's interest in your service skyrocket when you start working on the fabulous *Capri* triple silverplate. It's something anyone would be proud to own and Sylvania makes it possible for you to own it fast and free of extra cost with your purchases of "Silver Screen 85" picture tubes and Sylvania receiving tubes. You get one token for every two picture tubes or 25 receiving tubes.

When you need only 5 Sylvania tokens for a complete 4-piece setting, in no time at all you can earn a complete set of *Capri* triple silverplate.

Capri is an exclusive Wm. A. Rogers design of Oneida Limited, Silversmiths.

***Get started on your *Capri* triple silverplate right away. It's an exclusive, offered only by your Sylvania Distributor. Call him today.**



***Only 5 tokens for this 4-piece place setting.**

You get one token for every two picture tubes or 25 receiving tubes.

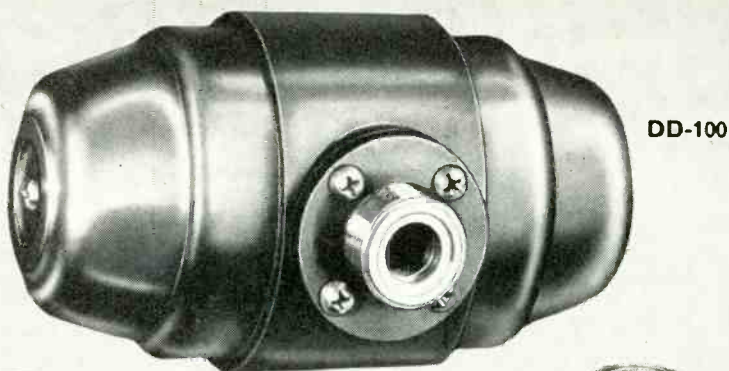


SYLVANIA ELECTRIC PRODUCTS INC.
1740 Broadway, New York 19, N. Y.
In Canada: Sylvania Electric (Canada) Ltd.,
University Tower Bldg., Montreal

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DD-100



D-30



D-40

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DRIVER UNITS
LIFETIME
GUARANTEED
 BY
Jensen

HIGHER POWER RATING...HIGHER EFFICIENCY, TOO!

Designed to pack a terrific sound "punch"...to penetrate high noise levels...to project sound over great distances, the new Jensen LIFETIME Driver Units will do the job better, more dependably, and more economically than ever before.

The D-30 (30 watts) and D-40 (40 watts) have higher power ratings than comparable previous units. This means that the projector can deliver more sound output and better coverage when called upon to do so. Moreover they are more efficient although their cost is approximately the same. This means more sound output per dollar...more sound output per watt input... saves amplifier power and cost too.

DD-100 Superpower Driver (100 watts) is a new advance in packaged sound power, for an integrated unit with such a high power rating has never been available before. It makes possible concentrated projector arrays

with a power capacity of 1600 watts or even more.

We are so confident of the excellence of design, skilled craftsmanship, precision materials and careful inspection that go into every Jensen Hypex Lifetime Driver unit that we are taking the unprecedented step of guaranteeing each and every one against electrical failure indefinitely. Should any Driver Unit fail at any time when used under normal operating conditions, we will either repair or replace it at our option without service charge.

Jensen LIFETIME Driver Units are standout members of the new Jensen Professional Series...a group of speakers covering every requirement for effective sound communication and entertainment in commercial, industrial and institutional sound systems. We'd like to send you Catalog 1070 which contains complete information.

SPECIFICATIONS						
MODEL	POWER RATING*	IMPEDANCE OHMS	FREQUENCY RANGE	LENGTH	DIA.	LIST PRICE
D-30	30 w.	16	75- 7,000	4 1/16"	4 1/2"	\$27.50
D-40	40 w.	16	75-10,000	4 1/16"	4 1/2"	\$36.00
DD-100	100 w.	8 1/2	75-10,000	5 1/16"	8 1/2"	\$96.50

*Integrated speech and music program material. For sine wave or siren signal input, reduce ratings one-half. Ratings apply only for frequencies above horn cutoff.

LIFETIME GUARANTEE

D-30, D-40 and DD-100 Lifetime Driver Units.

Every Lifetime Driver Unit is unconditionally guaranteed for life against failure when operated according to the instructions accompanying the unit.

Should any Lifetime Driver Unit become inoperative at anytime under these conditions, it will be repaired or replaced at our option entirely free from any service charge.

The instruction sheet supplements and is a part of the warranty under which the Lifetime Guarantee is extended.

JENSEN MANUFACTURING COMPANY

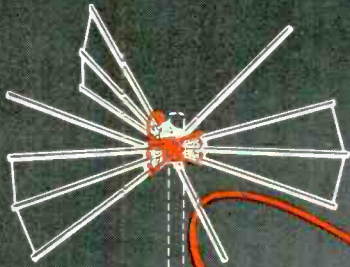
Jensen MANUFACTURING COMPANY

6601 S. Laramie, Chicago 38, Illinois • Division of The Muter Co. • In Canada, Copper Wire Products, Ltd. Licensee

Directronic[®] TV ANTENNA SYSTEMS

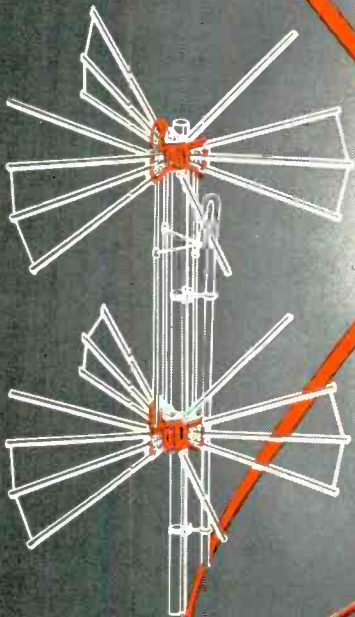
the Ultimate in Antenn-gineering

by **Snyder**
PHILADELPHIA



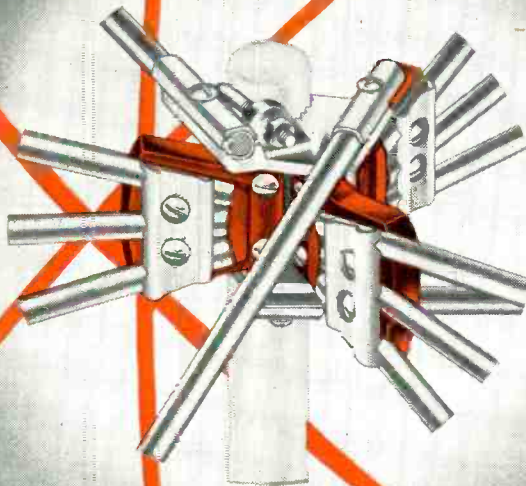
AX-520 METROPOLITAN
SINGLE BAY
SUPER DIRECTRONIC

22.⁵⁰
LIST



AX-524 FRINGE AREA
TWO BAY
SUPER DIRECTRONIC

47.⁵⁰
LIST



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TV TENNA KIT

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24.⁷⁵
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SNYDER MFG. CO., PHILADELPHIA 40 U.S.A.
BELLEVUE TUBE MILL, INC., PHILADELPHIA
SNYDER ANTENN-GINEERS, LTD., TORONTO 14, CANADA
WORLD EXPORT: ROBURN AGENCIES, INC. N.Y.
VAN DER HOUT ASSOC., LTD., NEW TORONTO, CANADA
SNYDER ANTENN-GINEERS, INC., LOS ANGELES 58

Sarkes Tarzian

"Time Proved" HIGH DENSITY Rectifiers



Not New ---
But **FOUR YEARS OLD**

Better for you and better for your customers because hundreds of thousands have been field tested and proven during the past four years. **Don't be fooled** by offers of extremely small plate sizes and narrow spacings. We have found during four years of laboratory and field testing that there is a practical minimum cell size and spacing that are needed for maximum performance and minimum service call backs.

The Tarzian High Density Rectifiers are **Time Proved**—don't be fooled by unrealistic ratings and sizes.

SPECIFICATIONS

Model No.	Max. A.C. Input Volts	Max. D.C. Load Current	Plate Size	Overall Length	Replaces Model
250A	130	250	1.25" sq.	1 7/8"	200-250
300A	130	300	1.4 " sq.	1 7/8"	300
350A	130	350	1.6 " sq.	2 5/32"	350
400AD	130	400	1.8 " sq.	1 1/4"	400
500AD	130	500	1.8 " sq.	1 5/16"	500

All Sarkes Tarzian Replacement Rectifiers are truly universal and will plug-in on original set replacements on Motorola, Westinghouse, Arvin and Sylvania sets.

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News of the Industry

ADMIRAL has purchased the assets of **RAYTHEON** TV-radio operation. Latter company reports election of **HAROLD S. GENEEN** as executive vice-president.

WESTINGHOUSE "Ten Top Tubes" packaging plan contains 5 each of the 10 most used types. Thermal picnic bag is given as premium, reports **J. C. LANE, JR.**, ad and sales promotion manager. The TV-radio div. has appointed **THOMAS B. KALBFUS** sales manager.

SNYDER executives **BEN & GUS SNYDER** have been admitted to the 25 Year Club of the Automobile Accessories Manufacturers Association. The firm's export div., **ROBURN AGENCIES**, will ship antennas to Pacific area through new warehouse at 2724 Leonis Blvd., Vernon, Calif.

REGENCY has appointed **EARL H. KIRK** distributor sales manager.

AEROVOX vice president **CHARLES GOLENPAUL** has received the First Annual Award of the Radio Old Timers Club.

TEXAS INSTRUMENTS has combined the semiconductor and components division under vice president **MARK SHEPHERD, JR.**, with **J. P. RODGERS, JR.** as asst. vp and marketing manager, **W. E. LOVE** as sales planning manager, **Z. W. PIQUE** as sales manager, and **LESLIE KING** products manager.

TODD PRODUCTS reports the resignation and retirement of one of its founders, **GEORGE HOROWITZ**.

TELREX has signed patent license agreements with **JFD** and **RMS** for conical antennas.

MOTOROLA has named **C. J. GENTRY** national car radio specialist.

ASTRON display at Parts Show included voodoo drums and witch doctor prescribing "magic cure" for inventory-itis (capacitor over-stocking, that is).

WARD PRODUCTS has presented its 8-millionth auto radio antenna to Pres. **JOHN BRIGGS** of Gabriel Co.

UNITRONICS CORP. is the new name of **OLYMPIC RADIO & TELEVISION INC.**, with **OLYMPIC** and **DAVID BOGEN** functioning as separate divisions.

SHURE BROTHERS, after celebrating 31 years in Chicago, have moved to 222 Hartrey Ave., Evanston, Ill.

(Continued on page 20)



Get in the swim for bigger profits...

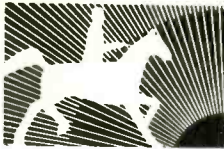
STOCK AND SELL RCA RADIO BATTERIES

Your customers are going "on vacation" every day now—and wherever they go, along go their portables! Catch this rising tide of portable battery business—stock, promote, and sell RCA Radio Batteries. RCA offers you the brand-name customers go out of their way to buy—a famous emblem that pre-sells for you. RCA backs you up with the most extensive sales promotion program in the radio-battery industry, featuring the powerful theme: "PORTABLES COME TO LIFE WITH RCA BATTERIES... *radio engineered for extra listening hours.*" Your RCA Distributor is ready now to help you make this your biggest battery season ever. See him soon. He'll get you right in the swim for bigger profits—with RCA Batteries.



RADIO BATTERIES

RADIO CORPORATION OF AMERICA • HARRISON, N. J.

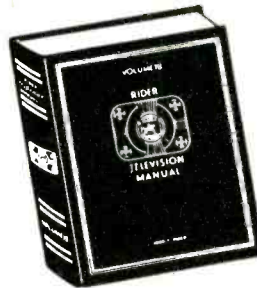


Complete SERVICE KNOWLEDGE

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RIDER MANUALS—THE ONLY FULLY FIELD-TESTED, FACTORY-APPROVED SERVICE DATA—IS AVAILABLE TO YOU AT AN INCREDIBLE PER CHASSIS COST OF 8¢! AT A PER-MODEL COST OF ONLY 2¢ . . .

Now available...
TV 18
 Limited Printing...
 order your copy NOW!
 Only \$19.80



HANDBOOK OF 630-TYPE TV RECEIVERS

by Miller & Bierman

Deals with all versions of the famous 630-type receivers made up to 1955. Explains modifications and circuit improvements made by various manufacturers, and includes 26 pages of troubleshooting charts. A book every technician can use to major advantage! Soft Cover, 200 pp., 5½ x 8½", illus.

#174 Only \$3.50

RECEIVING TUBE SUBSTITUTION GUIDE

by H. A. Middleton

Lists 2,500 radio-TV tube substitutions. Also lists ratings and wiring instructions, original and substitute tube socket illustrations. Soft Cover, 224 pp., 8½ x 11", illus.

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FIRST SUPPLEMENT: Lists 750 new and different tube substitutions, not listed in the original edition. Soft Cover, 48 pp., 8½ x 11", illus.

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PICTURE BOOK OF TV TROUBLES

by Rider Lab. staff

A series of books, each covering a different part of the TV receiver, and showing typical troubles, their symptoms and causes. All material is from actual case histories. These books do your troubleshooting for you! Soft Covers, 5½ x 8½", illus.

VOL. 1: HORIZONTAL AFC-OSCILLATOR CIRCUITS

#168, 80 pp. Only \$1.35

VOL. 2: VERTICAL SWEEP-DEFLECTION CIRCUITS

#168-2, 96 pp. Only \$1.80

VOL. 3: VIDEO IF & VIDEO AMPLIFIER CIRCUITS

#168-3, 96 pp. Only \$1.80

VOL. 4: AUTOMATIC GAIN CONTROL CIRCUITS

#168-4, 96 pp. Only \$1.80

VOL. 5: HORIZONTAL OUTPUT AND HIGH POWER CIRCUITS

#168-5, 108 pp. Only \$1.80

HOW TO USE TEST PROBES

by A. Chirardi & R. Middleton

The only book of its kind, it covers all types of test probes used with VOM's, VTVM's, and scopes. Complete step-by-step explanations, with practical examples of results and effects. Soft Cover, 176 pp., 5½ x 8½", illus.

#165 Only \$2.90

TELEVISION—HOW IT WORKS

(2nd Edition)

by J. Richard Johnson

A completely rewritten, up-to-the-minute edition of an authoritative and informative book. It is the newest and most comprehensive text on the subject, and follows the progress of the received signal from the antenna to the picture tube and loudspeaker. Leather Finish MARCO Cover, 352 pp., 5½ x 8½", illus.

#101 Only \$4.60

#101-II, Cloth Bound Only \$5.50

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 Charles W. Pointon, Ltd.
 6 Alcino Ave., Toronto, Ontario
 Prices approx. 5% higher.

News of the Industry

(Continued from page 18)

PHILCO promotions include HENRY E. BOWES to vp and general manager of TV div.; JOHN L. UTZ to general manager of portable TV receivers; GIBSON B. KENNEDY becomes sales manager of the TV div.

RCA Tube Div. is making a color TV home study course available to techs. The 11-lesson course was prepared by RCA INSTITUTES.

BELL LABS has named HAROLD S. RENNE technical information supervisor.

BURGESS BATTERY has promoted CHARLES E. BALZ to vice president for sales.

PYRAMID ELECTRIC has elected STEPHEN D. FULLER as chairman of the board, and RALPH M. SCARANO as president succeeding STANLEY STAKLINSKI. JOHN R. WARD has been appointed controller.

CBS-HYTRON has expanded West Coast operations at 4722 W. Jefferson Blvd., Los Angeles, with the appointment of LEONARD M. MURCHISON as equipment sales manager, and WILLIAM J. ANDERSON as supervisor of field engineering.

THOMPSON PRODUCTS program to boost summer sales of TV accessories is called "Superrotor Summer Barrel of Profit," reports sales manager LARRY KLINE.

GENERAL CEMENT has named ARCH T. HOYNE sales manager.

DUMONT is entering the 14-in. and 17-in. portable TV field. Ad and promotion manager J. CALVIN AFFLECK announces 1739 new dealers have been added as a result of its "New Dealer Derby."

TRIAD TRANSFORMER Service Awards, 54 of them, went to 5-year and 10-year employees, including Pres. L. W. HOWARD. Over 27% of employees have been with company over 5 years.

ASTATIC has appointed HERBERT O. WILSON works manager.

PENTRON, recently merged with ACE INDUSTRIES, has named GAIL CARTER sales manager.

CHANNEL MASTER Pres. HARRY RESNICK has been given the "Page One Achievement Award" by the Kingston Newspaper Guild for creating the area's first summer music festival.

CLEAR BEAM has promoted ART STUMPUS to Asst. sales manager.

Reps & Distributors

PERMA POWER CO., Chicago, has appointed **ALBERT E. MUIR** as rep in the Northwest, and the **WES ALDERSON CO.** as rep in Northern Cal., Arizona and Nevada.

TODD-TRAN CORP has appointed the following sales reps: **HANK LIEBERMAN CO.** of Texas and **PAYSER CO.** of Colorado for the Southwest, and **DON SMITH SALES CO.** of Washington for the Northwest.

The **DAVE KUBRICK CO.** and **SAM YURMAN**, independent rep, have merged to form the **KUBRICK-YURMAN CO.**, with offices on West 34th St., New York City.

SYLVANIA ELECTRIC PRODUCTS INC. has appointed **B & B ELECTRONICS CO.**, Poughkeepsie, distributor for Sylvania's full line of electronic tube products.

HARRIS TARUMOTO, Hawaiian parts distributor, has opened a new store in the **PRECISION RADIO, LTD.**, chain in Honolulu.

BRENNA & BROWNE, Hawaiian rep firm, has announced the appointment of **JAMES HASTIN** as sales manager.

JACK BERMAN, Los Angeles rep, spoke at the annual dinner meeting of the **CALIFORNIA STATE ELECTRONICS ASSN.** on how "agreeable selling" aids in public relations and profit earning.

ALPHA WIRE CORP., New York, has announced the appointment of **BILL KOLANS & CO.**, San Francisco, as sales rep for Northern California.

OXFORD ELECTRIC CORP. has announced the appointment of **JOHN L. STONE** as sales rep in non-metropolitan New York State.

PILOT RADIO CORP. has announced the appointments of three new reps: **APPLESTONE AND BRERETON** for northern California and Nevada, **The LES A. MORROW CO.** for Ohio, West Virginia and Pennsylvania, and **DOUGHERTY ENTERPRISES** for the Hawaiian Islands.

ELGIN NATIONAL WATCH CO., Electronics Div., announces the following new appointments: **GENE ROSEN & ASSOC., INC.** for the mid-Atlantic coast, **W. H. CONNORS** for the Southwest, **FRANCISCO FERNANDEZ FERNANDEZ** for Cuba, and **TIM COAKLEY** for New England.

ELECTRONIC TUBE CORP., Philadelphia, is handled in the West by **KIT-TLESON CO.**, Los Angeles.

(Continued on page 52)

**WHEN STORMS BREAK LOOSE
PERMA-TUBE STAYS UP**
... and so does your reputation!

**J & L
M**

Look for this brand mark
—only genuine Perma-Tube
gives you this protection

Here's why . . . sturdy steel PERMA-TUBE is stronger than any other television mast

1. Its resistance to bending is *five times stronger* than structural aluminum.
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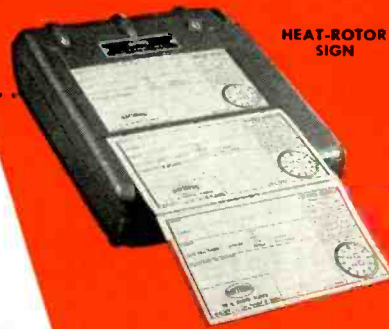
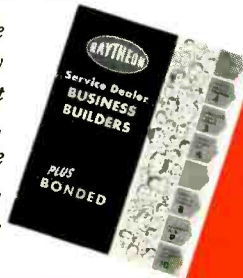
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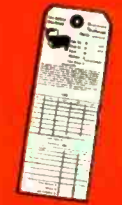
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TECHNICIAN & Circuit Digests

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

You Have the Power . . . Use It!

TV-electronic service technicians are in a first rate position to exert considerable influence to improve their positions. This vantage point is derived from both extensive public contact and huge purchasing power.

Before discussing the how and why of exercising your influence, we must recognize that each individual technician has limited power alone. However, when acting collectively for the same goals, your power becomes formidable. It's something like voting; your single vote does not swing the election, but collectively you determine the rise and fall of government administrations.

PUBLIC CONTACT: During the course of a year's service calls, technicians in a medium-size shop may make 2000 calls; some make many more. Multiply this by 60,000 shops and you have a staggering total of some 120,000,000 visits to consumers' homes and places of business. No other segment of the electronic industry—or perhaps any industry for that matter—has such consistent intimate contact with the public.

Furthermore, the set owner has confidence in the technician in his living room. Sure there are chronic complainers and sensational newspaper stories attacking TV-electronic repair men. But the basic confidence has been proved by a recent Roper poll showing that 91% of TV set owners are satisfied with service quality and courtesy, 89% had their requests for service answered promptly, 83% were satisfied with price, and 83% were sufficiently pleased to plan to call the same firm again.

You can employ this extensive public contact for your benefit in two ways. First, in low pressure fashion you can sell more of your service by suggesting improvements. Often the customer will be grateful for the idea. Depending on the work you do, don't hesitate to discuss the merits of various electronic devices: The pleasure of an extension speaker in the game room; the safety and convenience of a radio-controlled garage door operator; the step saving capabilities of an intercom; the ease

of connecting a second TV set. Don't overlook mentioning the loss from worn lead-in and corroded antenna; the portable radio batteries ready for outdoor entertainment, etc. And if you install air conditioners and repair small electrical appliances, say so . . . and leave your calling card. Let it be known that your abilities and service extend beyond the unit under repair at the moment.

The second use of your consumer contact is public relations. Let the customer know how important you think he is. If you have completed a specialized training program, or are an association member, casually mention it. If a manufacturer has a particularly good product, pass on the praise. If the manufacturer is a "public (and technician) be damned" character, let this be known.

PURCHASING POWER: If you have a typical service shop, chances are you pay your distributor over \$10,000 a year for tubes, parts and test equipment. Industry-wide the annual service business purchasing power mushrooms out to a fabulous \$1,140,000,000 at the retail level. Collectively, this huge purchasing power places a potent economic weapon in your hand. Buy from the jobber who cooperates with you, and buy the brand of the manufacturer who caters to you. There's no law which requires you to buy from a company whose policies work against you.

And don't hesitate to write to any manufacturer or jobber. Rest assured that a serious drop of business resulting from your buying elsewhere, coupled with hundreds of outspoken letters, will force a policy shift to your favor.

OPPORTUNITY IS YOURS: A door-to-door dinnerware salesman once said: "If I could get into 25 homes a week where the people trust me, I'd be a millionaire before I'm fifty." Well, maybe you'll never be a millionaire, but you get into more than 25 homes a week, and the people do trust you. Use this opportunity fairly and positively to sell more service and make your collective influence felt.

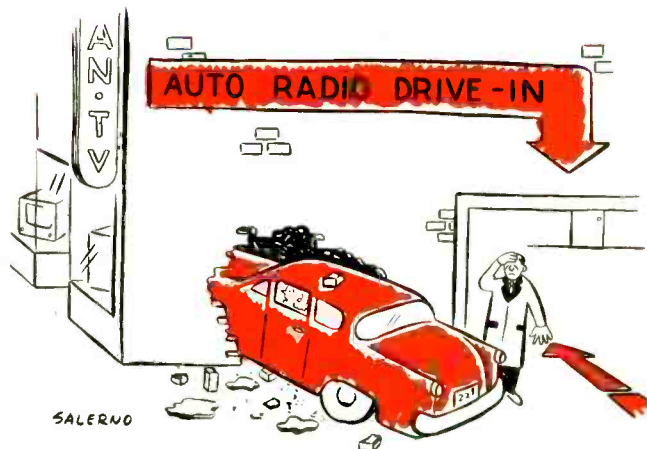
Tuning In the

AN ELECTRONIC CLOCK without a power cord keeps accurate time, being locked to 60-cycle line voltage by remote control. The GE-designed clock has a synchronous motor operated by self-contained batteries, and may be placed anywhere without fear of having unsightly line cords mar its appearance. A small "transmitting pylon," which may be concealed from view in or behind furniture, is plugged into the ac line and may be positioned several feet from the clock, even in another room. Transmitted pulses keep the clock accurate. Another feature: unlike ordinary electric clocks, this one will keep going on batteries when power failures occur, although long-term failures will permit accuracy to deteriorate. The clock is not yet on the market.

"AIR-MAIL" TV is solving the problem of circulating 4,000 TV films every week to and from stations throughout the country. Most major networks are using the facilities of the Railway Express, Air Express Div., to rush canned shows all over the country to meet rigid air-time schedules. The traffic manager of one of the film-producing outfits, Screen Gems, Inc., says he has never missed a single show this way—and he has more than 200 unbreakable dates each week.

MEDICAL ELECTRONICS. The Edin "anesthograph," an electronic device for clinical use, tells how deep a patient has gone into anesthesia. It simultaneously records brain waves and heart action. Here again, an exact scientific instrument supplements or replaces human guess work.

The NATESA Friends of Service Management Award is presented to **TECHNICIAN & Circuit Digests** magazine. The plaque given by William Nichols (center), Pres. TESA-Kansas, Inc., to Al Forman, editor of **TECHNICIAN**, is inscribed with the reason for the award: "For outstanding service to TV-radio service management in creating better customer relations." Observing at left are Larry Corlew, 2nd VP TESA-Chicagoland, Joseph Blink, 1st VP TESA-Chicagoland; Frank J. Moch, Pres. NATESA is at extreme right.



ANTENNA PRICES are on the rise. Tescon reports that increases in the cost of aluminum, steel and copper of 7½ to 20% will mean a 10% rise in antenna prices.

METROPOLITAN TV reception varies in quality from excellent in one area to ghosts and snow in another. A detailed neighborhood-by-neighborhood study of this problem in New York City has been undertaken by Channel Master Corp. To pinpoint trouble spots, this antenna manufacturer is enlisting the aid of some 5000 dealers and techs in the area, and with the aid of maps and reception questionnaires expects to gather considerable data to be published in a booklet, "How to Cure TV Reception Problems in the New York Area."

AUTOMATIC WAREHOUSING SYSTEM, operated by electronic controls, is being demonstrated by the Link Belt Co. at its plant in Colmar, Penna. Signals originate from punched cards, trip the carriers of an overhead trolley conveyor. The conveyors then discharge packages to various chutes, in which are accumulated orders for different customers.

CLOSED-CIRCUIT TV is headed for a boom in '56, according to J. L. Lahey, gen. mgr. of Dage TV. He foresees about 5,000 new installations this year, which is more than 3 times as much as all installations now in existence. One important area of growth will be educational TV, with about 180 schools and colleges using such systems by year's end.

THE IDIOT (Instrument Lab Digital Online Transcriber) is a computer that doesn't deserve its name. As a matter of fact, in designing aircraft, this remarkable machine can transcribe over 3,000,000 items of information in eight minutes.

Picture



ELECTRONICALLY CONTROLLED TRAFFIC LIGHTS in Evansville, Ind., are reported to save \$20,000 over a wired system and ease traffic congestion. The system, built by General Electric, uses a master controller at City Hall. It stores a week's data on the most desirable traffic patterns, and every hour tones are transmitted by FM radio to receivers connected to each of 54 lights. The receivers control the length of red-yellow-green time.

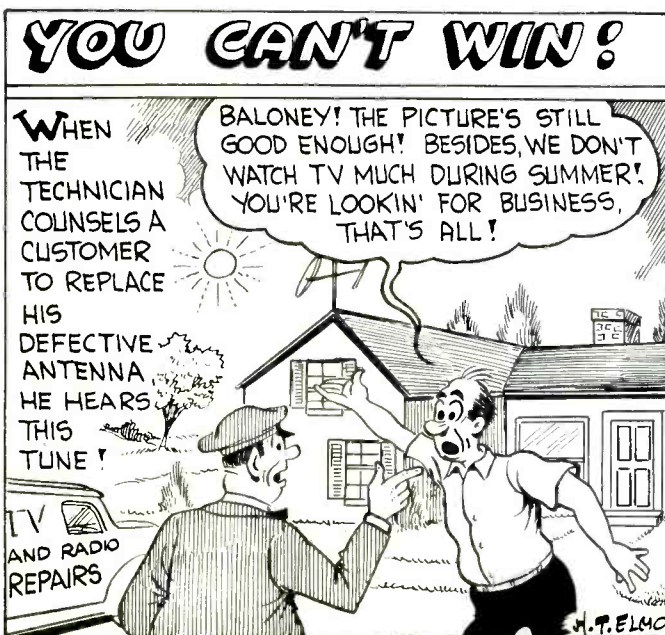
SHORTAGE OF TECHNICAL MANPOWER is making it well-nigh impossible for American industry to maintain high-level personnel requirements. The bottleneck is education, according to J. J. Hopkins, prexy of General Dynamics Corp., who says that, in 19 years' time, we shall be "compelled to lock the doors of our empty university, government and industrial laboratories." Education and industry, he claims, must cooperate if we are to survive this "education crisis of the atomic age." Another view of the matter comes from the National Science Foundation. For the period between 1928 and 1954, NSF presents figures on graduate professionals in this country and in the Soviet Union: 682,000 professional engineers in the USSR, as compared to 480,000 in the US; also 320,000 graduates in medicine behind the Curtain, as compared to 148,000 here.

INSTALLATION OPPORTUNITIES. Motorola reports that speedboat owners are becoming increasingly interested in having auto radios installed in their craft. Job leads can be picked up from local yacht clubs and boat outlets.

CALENDAR OF COMING EVENTS

- July 16-20: 1956 Summer Market, Western Merchandise Mart, San Francisco, Calif.
- July 22-25: 1956 National Audio-Visual Convention and Trade Show, Hotel Sherman, Chicago, Ill.
- Aug. 30- Sept. 2: 3rd Conference, Rocky Mountain Chapter of "The Representatives," Colorado Hotel, Glenwood Springs, Colorado.
- Aug. 22- Sept. 1: 23rd Annual British National Radio Show, Earls Court, London, England.
- Sept. 9-12: 1956 Distributor Conference, Heart of America Chapter of "The Representatives," Lake Taneycomo, Mo.
- Sept. 11-12: Second RETMA sponsored Conference on "Reliable Electrical Connections," Philadelphia, Pa.
- Sept. 14-16: NATESA TV-Radio-Electronic Service Industry Convention, Sheraton Hotel, Chicago, Ill.
- Sept. 26-30: High Fidelity Show, New York Trade Show Building, New York City, N. Y.
- Oct. 1-3: National Electronics Conference and Exhibition, Hotel Sherman, Chicago, Ill.
- Oct. 1-3: Canadian I.R.E. Convention and Exposition, Automotive Building, Exhibition Park, Toronto, Canada.
- Oct. 4-7: The Audio Fair & Hi Fi Show, Hotel New Yorker, New York, N. Y.
- Nov. 2-5: High Fidelity Show, Palmer House, Chicago, Ill.
- Dec. 10-12: Eastern Joint Computer Conference, Hotel New Yorker, New York, N. Y.

COLOR TV receiver prices have dropped considerably, and we can expect sales volume to rise, particularly in view of the growing number of color programs scheduled for the fall. The new line of RCA Victor sets includes a \$495 color receiver (21-in. Model 21CS781)—\$200 below previous price levels. Another major set maker is expected to have a color set available soon at an even lower price. The RCA set has 23 tubes including crt, plus two crystals and four rectifiers.



Service Air-Conditioning

This Profitable Side-Line Balances out the Traditionally

ROBERT G. MIDDLETON
SIMPSON ELECTRIC CO.

• The growing trend toward *independent* servicing of refrigeration and air-conditioning units provides a profitable side-line which, fortunately, is at its peak during the slack summer season of radio-TV servicing. This attractive source of supplementary income, in many ways a "natural" for the electronic technician, has often been overlooked because most service work of this type, in the past, has been handled by the manufacturers. Today the situation has changed and continues to change. The manufacturer, whose primary interest in providing service is to maintain the reputation of his product, has far more service to contend with than he can handle.

In our case, we will approach the techniques of refrigeration and air-conditioning service from the standpoint of the radio-TV technician, who may have little or no prior direct experience in the field. Nevertheless, despite the apparent lack, this technician will discover that his special knowledge and background in electronics and test equipment

give him a big head-start over mechanics and electricians with whom he may be competing. The scope of the entire field is too big for a single article. In this one, we will deal with a single problem of importance.

Current Leakage

A complaint which must be investigated upon occasion concerns electrical leakage to the refrigerator or air-conditioner cabinet, which causes the user to receive a shock when the cabinet is touched. When such leakage exists, a heavier shock is received during humid weather conditions. If the floor has been recently scrubbed and dampened, the intensity of the shock will be correspondingly greater.

Electrical leakage takes place due to insulation defects between the wiring and the cabinet, to insufficient insulation between the motor stator and winding, or poor terminal insulation. The cabinet is designed to "float" electrically, which requires that insulation resistance throughout the electrical system must be very high.

When leakage exists in the wiring external to the compressor-motor

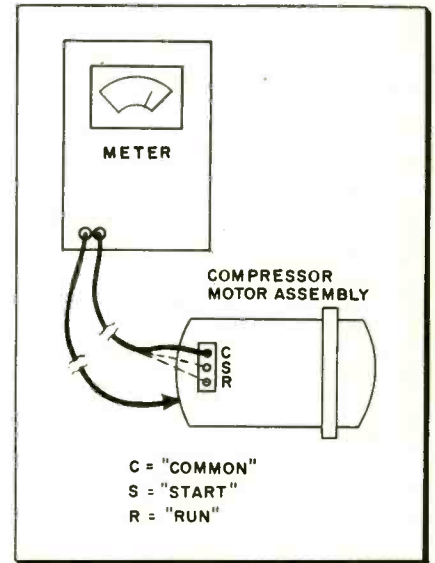


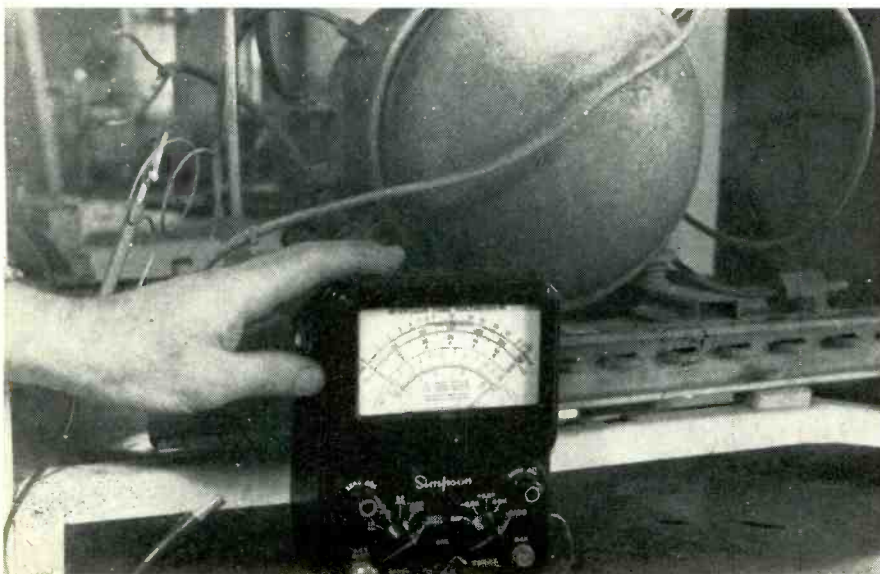
Fig. 2—Insulation resistance is checked separately from each terminal to dome of the unit.

assembly, suitable repairs must be made. On the other hand, in case leakage occurs within the compressor-motor assembly, the assembly must be replaced. Whether such a faulty unit can be economically repaired, or discarded and perhaps salvaged for various parts, is a matter for subsequent investigation and decision.

Before tests for electrical leakage are made, it is essential, of course, to unplug the power cord from the wall outlet. Everyone is familiar with the damage suffered by ohm-meters when applied across live electric circuits, to say nothing of the possibility of severe shock to the operator. As shown in Fig. 1, the usual compressor-motor assembly is provided with three terminals, identified in the trade as "common," "start," and "run" terminals. The leads to these terminals are often color-coded red, black, and white, respectively, but after long service the colors may fade and become unidentifiable. Hence, each wire should be tagged before it is disconnected.

Disconnect all three wires before making leakage tests, because it is necessary to determine whether the leakage path is within the compressor-motor assembly, or in the wir-

Fig. 1—A vtvm makes leakage checks on the 3 terminals of a compressor-motor assembly.



and Refrigeration Units

Slack Summer Season for the Radio-TV Service Industry

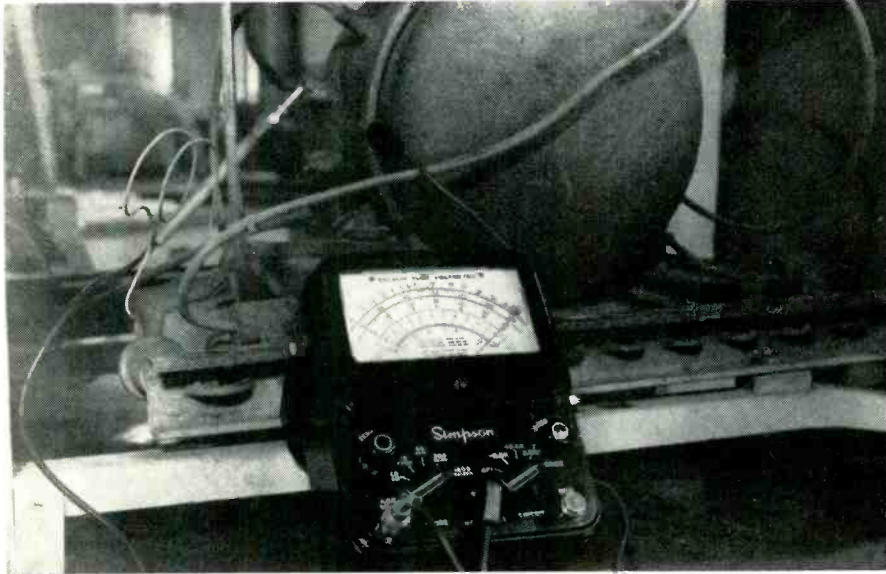


Fig. 3—Connections made, in practice, from the dome of the unit to one of the terminals.

ing system external to the assembly. We are concerned with leakage resistance values at least as high as 10 megohms, and preferably as high as 100 megohms. In the parlance of the trade, a leakage resistance of 1 megohm, for example, is termed a "ground." This terminology is somewhat at variance with radio and TV practice, in which we usually regard a ground as equivalent to a short-circuit. However, we sometimes refer to a 1-megohm leak in a coupling capacitor as a "short," and this usage is analogous to that of "ground" as encountered in the refrigeration and air-conditioning trade.

Leakage Tests

Tests for leakage usually start with the terminals of the compressor-motor assembly. This test is made as shown in Fig. 2; one terminal of the VTVM is connected to the dome of the unit for a ground return, and the other terminal of the VTVM is applied at the "common" terminal of the unit. The instrument is set to the $R \times 1$ meg range, and the insulation resistance is observed. A reading of 100 megs or more is very satisfactory, and a

reading of less than 10 megs is usually regarded as unsatisfactory. A reading of 1 meg or less indicates that the unit is quite unusable.

As indicated in Fig. 2, the test is repeated at the "start" and "run" terminals, for a thorough check-out. A photograph of an insulation test being made at the "common" terminal is shown in Fig. 3. Details of operation of the VTVM are not given, inasmuch as the radio and TV technician is already quite familiar with such matters.

Cabinet Wiring

Following the check of the compressor-motor assembly, the cabinet wiring is tested for insulation resistance. This test is made as depicted in Fig. 4. The VTVM is connected to the metalwork of the cabinet, for a ground return, and the insulation resistance of the red, black, and white leads are measured in turn. The insulation resistance of each of the power-plug prongs to ground is also measured, as indicated.

As in the foregoing test, an insulation resistance of 100 megohms or more is considered satisfactory, while a resistance as low as 10 meg-

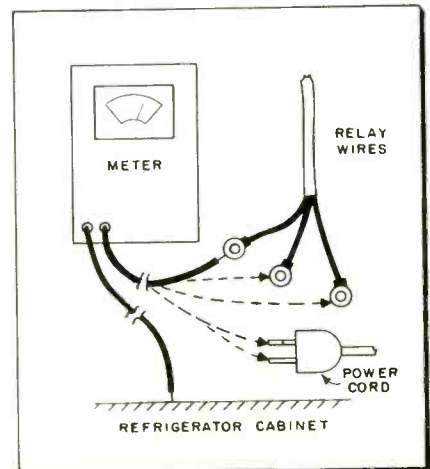
ohms is usually regarded as questionable. Insulation resistance values below 10 megohms are basis for definite rejection of the wiring or associated component. A photograph of this type of test is seen in Fig. 1.

Avoid Expedient Grounding

Although it might be supposed that shock to the customer could be avoided by the simple expedient of grounding the cabinet to a water pipe, *this is poor practice*. It is in the class of expedients such as turning over the power plug in the outlet to make the cabinet "cool." When the refrigerator cabinet is grounded to drain off leakage current, it may confidently be anticipated that the leakage path will steadily decrease in resistance as time goes by, and eventually an enormous electric bill will be run up prior to blowing the fuses.

Turning over the power plug is an unacceptable expedient, inasmuch as the plug could be reinserted the other way at any time by the owner, exposing him to even heavier shock, due to the progressive deterioration of the insulation resistance. There is only one appropriate answer to low insulation resistance—fix it. •

Fig. 4—Insulation resistance also checked from cabinet to each of three relay wires and to the two prongs of the ac power plug.



Horizontal Instability?

In the Absence of Circuit Defects, Improper Adjustment Can

BOB ELDRIDGE

• This is not an attempt to give omnibus coverage of the many faults that may arise in the horizontal oscillator section of a TV receiver. Rather, it is an attempt to discuss in considerable detail just certain types of abnormal conditions that may be encountered, with particular emphasis on the correct adjustment of the oscillator stage. The "simple" matter of proper adjustment is not as problem-free as might at first appear.

Cases often occur where a set gives unstable horizontal deflection and synchronization, not because a fault has developed, but merely because the adjustments have not been checked by the technician after servicing. Whatever the reason for the set having been brought to the bench, it is always good insurance to check the horizontal hold adjustment and the lock-in range before bringing the set back, particularly where the pulse-width (or synchro-guide) type of circuit is used. No-charge call-backs to stop squegging are embarrassing as well as unprofitable.

Though multivibrator horizontal oscillators (usually of the cathode-coupled type these days) are relatively straightforward, both in servicing and adjustment, they are also not quite so simple as first appears. They shall be considered first.

Figure 1 shows a typical cathode-coupled m-v oscillator. Consider

R-82, the horizontal hold control. It is part of the r-c network whose time constant determines the resonant frequency of the oscillator. It is also part of the grid leak of the second triode section in the multivibrator. Resonant frequency is also affected by the setting of the ringing coil L-9. There are many different combinations of the inductance of L-9 and the resistance of R-81/R-82 that will result in the desired frequency of 15,750 cps—but not all of these combinations will give stable oscillation and good sync.

Ringling Coil Setting

For stable oscillation it is essential that the natural frequency of the oscillator *with the ringing coil out of circuit (shorted)* should be *higher* than 15,750 cps. When the short is taken off the ringing coil, its inductance should then be set to bring the frequency *down* to normal. But on the other hand, if the natural frequency of the oscillator time constant is too far removed from 15,750 cps, then multiple bending of the vertical lines in the picture will occur near the top of the raster when the ringing coil is adjusted to drag the frequency down to normal.

This effect, illustrated in Fig. 3, is sometimes called "pie-crust" or "cogwheel" effect. It is caused by "hunting" (over-correction). This effect occurs more noticeably at the top of the picture for this reason: during the vertical blanking period it is not possible for the horizontal

sync pulses to control the horizontal oscillator so effectively, and it may be many horizontal lines after the picture has become visible before the frequency is once again completely stable and controlled. During this interim period the oscillator is "hunting" above and below the correct frequency.

Control Voltage Bias

Yet a third factor which influences the frequency of the oscillator is the dc bias on the grid of the control section (first triode) of the tube. The bias here is dependent on the action of the phase detector tube. When servicing the oscillator, a preliminary check is advisable at the grid of the control section, because a high bias voltage, positive or negative, due to a defect in the phase detector stage, can make it impossible for the oscillator to work at the correct frequency, or may disable it altogether. With the phase detector tube removed from its socket, the dc bias on the control section grid should be zero or slightly negative (contact potential). If it is positive, the most likely cause is a leaky condenser at C-33 or C-34. If this fault has been present, the plate circuit resistor R-78 should be checked in case it has suffered from the flow of excess current in the tube.

With the phase detector tube in place, a very high negative bias is sometimes encountered, usually due to C-53 going open. This causes

Fig. 1—Combined phase detector and multivibrator for horiz. sync.

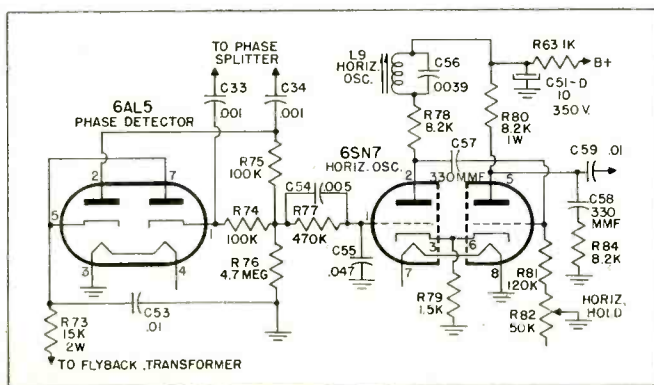
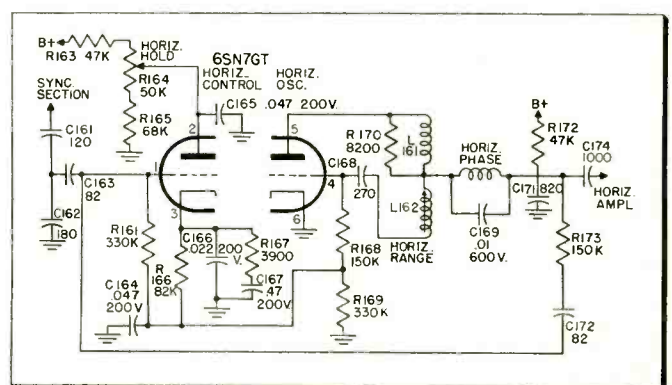


Fig. 2—A pulse-width or synchroguide circuit used for horiz. sync.



Adjust That Oscillator!

Cause Embarrassing, Profitless Call-Backs. Try These Tips

heavy conduction in the phase detector due to the high "spike" on pin 5 instead of the sawtooth normally formed at lower amplitude by the waveform action of R-73 and C-53.

Squegging, which we will soon explain, seldom occurs in this type of oscillator, but it is worth noting that an open circuit or greatly changed value of C-58 and R-84 in the discharge network, can cause this condition, usually accompanied by decreased width and brightness. Occasionally the oscillator will squegg because of too high a value at R-81, which would produce an undesirable relationship between the time constant of the network R-81/R-82/C-57 and the final frequency of the oscillator. (Other possible causes could be the lack of a parasitic suppressor resistor in the grid of the horizontal output tube, or inadequate drive to the grid of the output tube.)

"Squegging" Defined

Before we discuss the pulse-width or synchroguide type of circuit in detail, we had better be absolutely sure that the term squegging is completely understood. This condition is sometimes called "mode-hopping" or "motor-boat-ing." It is an unstable oscillating condition which produces a raster broken up into horizontal lines of irregular length, often with a bright section somewhat like a Christmas tree in the center of the raster. It is usually accompanied by a rough hissing or shrieking sound, which replaces the clean 15-kc whistle characteristic of the correctly operating horizontal section.

A tendency to develop squegging is the most serious disadvantage of the synchroguide circuit. A common version of this oscillator is shown in Fig. 2. Probably this circuit suffers more from misadjustment than any other part of a TV set, so it is very important that the technician be careful and methodical in setting up the frequency and phase adjustments. If the job is done on the bench, there are several points to be observed when pro-

ducing the desired "hump and spike" waveform illustrated at Fig. 4:

1. Connection of the scope probe must not load the circuit in any way. It is therefore important that a high-impedance probe be used, but its low capacity must not discriminate in favor of the higher frequencies. A tall order.

2. Due to the fact that the spike part of the waveform owes its sharpness to the presence of high-order harmonics, the scope and probe combined should have good high frequency response in the ver-

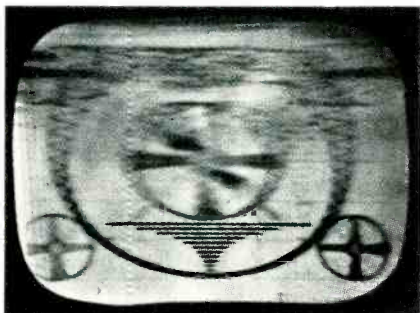


Fig. 3—Pattern showing "piecrust" effect.

tical amplifier, up to at least 200 kc.

3. There should be no peaky resonance at relatively high frequencies in the scope or probe, as this would tend to accentuate the spike.

4. The frequency and phase slugs interact, especially if they are housed in the same can, so every time one is moved, check the other.

5. The spike should always be higher than the hump. Not too high, or poor noise immunity will result. Until recently it was generally assumed that correct operation resulted when the spike and the hump were of equal amplitude, but there is now a growing agreement that the spike should be up to 10 percent higher. See for example the comments on the Hallicrafters chassis covered in Circuit Digest No. 189 in "Technician" of April 1955.

6. When adjustment has been completed, the signal should be on the verge of slipping out of phase when the horizontal hold is turned fully clockwise. It may or may not

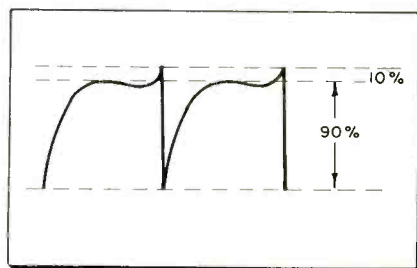


Fig. 4—Correctly adjusted relative height of hump and spike in pulse-width waveform.

hold when turned fully counter-clockwise, depending on the make or model of set involved.

7. The final test: With the hold control fully clockwise the frequency coil should be slowly adjusted so that the picture goes out of lock, with one bar sloping diagonally across the screen (maybe flicking the channel selector to make the picture lose lock). Turning the slug of the frequency coil further in the same direction should result in squegging before a second bar appears across the picture.

Some technicians are usually reluctant to risk setting up the synchroguide without a scope. In fact it is more reliable when set up by visual indication on the picture than by observation of the waveform on the scope—provided a methodical and careful procedure is followed in adjusting the phase control. There are at least three reliable methods, two of which are described in detail below. A careful examination of the principles involved will enable the technician to carry out the operation without trying to remember the various steps parrot-fashion.

Raster Observation

Method 1 uses observation of the correct proportions of the front and back porches of the blanking pedestal, by looking at the horizontal blanking bar as displayed on the picture tube when a signal is being received:

1. Reduce picture width until both edges of the raster are visible. If this is not possible, the picture will have to be decentered to ob-

serve each side of the raster in turn. Do *not* reduce width by reducing drive.

2. Turn contrast down and brightness up until there is no black in the picture or blanking bars.

3. Turn horizontal hold control fully clockwise.

4. Turn horizontal frequency slug until the picture begins to shift in phase to the right, then back again until it is just barely stable.

5. Turn horizontal hold control about 1/3 rotation in a counter-clockwise direction.

6. Observe the respective widths of the dark grey portions (front and back porches of the blanking pedestals) on each side of the picture.

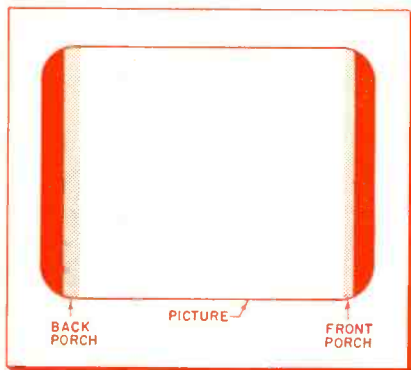


Fig. 5—CRT picture (width reduced to show raster edges), with correct pulse-width adjustment reflected in the relative widths of the front and back porches at raster sides.

Adjust the horizontal phase control so that the grey portion on the right of the picture is half the width of the grey portion on the left. See Fig. 5.

7. Check for straight vertical lines at the top of the picture (indicating correct horizontal hold). If the frequency coil has to be adjusted to straighten them, recheck the phasing slug again as in step 6.

Method 2 is that recommended by RCA:

1. Turn horizontal hold fully clockwise.

2. Place alignment tools on both frequency and phase slugs and be prepared to adjust both controls simultaneously.

3. Turn the frequency slug until one black bar appears sloping from top left to bottom right.

4. Turn the phase slug into the coil, simultaneously readjusting the frequency slug to maintain just one black bar on the screen. Continue until the oscillator begins to squeg, then turn the phase slug out of the coil until the squegging just stops.

5. Check by turning the frequency slug until the picture drops into sync, then reverse direction until it

falls out with one bar sloping to bottom right. Further rotation should not produce more bars, but the oscillator should begin to squeg. Reset the frequency slug until the oscillator is just in sync.

This procedure emphasizes the main difficulty in using the synchroguide—correct adjustment is very close to a squegging condition.

Critical Placement

C-169 in Fig. 2 should be located away from heat and should be reasonably stable in capacity with changes in temperature, as a squegging tendency is introduced if this condenser should rise in capacity.

“Flag-wagging,” or tearing at the top of the picture, is not usually due to a fault in the oscillator, but rather to the lack of sync pulses of sufficient amplitude arriving from the sync section. It is more often due to clipping of the sync pulses in the i-f or video-amplifier stages than to incorrect conditions in the sync stages themselves.

It is often helpful to check the lock-in range of the oscillator and control circuits to determine whether or not the sync pips arriving are of sufficient amplitude to control the oscillator adequately. The simplest way to make a quick check is to rotate the horizontal hold control fully counter-clockwise and throw the signal out of sync. Then, whilst turning the control slowly clockwise, carefully observe the reduction in the number of bars. The oscillator should snap into sync from 2 or 3 bars when correct operating conditions are present.

Other Effects

Remember that the plate impedance of the oscillator stage will have some effect on the frequency of oscillation and, in the case of Fig. 1, the value of R-78 is also rather critical. As an example of the way an unexpected fault can throw off the operation of a horizontal multi-vibrator, the writer would like to quote one practical case. A Stewart-Warner chassis had no high voltage, the oscillator was running at about 7000 cps, and the loudspeaker emitted a loud howl at that frequency unless the audio output tube was withdrawn. The technician decided that before he did anything else he would at least stop the howl. A quick check showed that the screen of the audio output tube was being modulated, so a 20-mfd electrolytic was shunted from this point to ground to filter out the

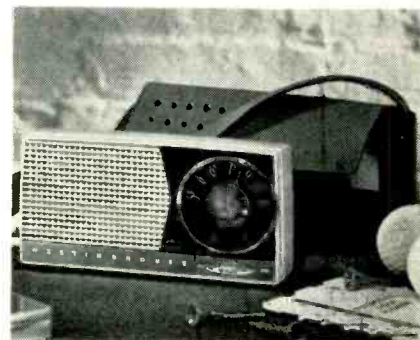
howl. To his surprise and delight the horizontal section then fired up completely normally! The actual fault in the set was an open 80-mfd B-plus filter, resulting, among other things, in the absence of a low-impedance return path to ground from the top end of the oscillator plate load.

Note in Fig. 2 the network R-167 and C-167. This constitutes an anti-hunting network: should it go open it may cause the piecrust effect mentioned earlier.

Two final tips: Remember that the phase detector is part of the horizontal sweep setup, in that a short in this tube can disable the oscillator completely by providing an excessive dc control bias. And second, before you dash off down to the manufacturer's parts depot to change a ringing coil “in case,” just remember that the set should work pretty well with this control shorted. If it doesn't there is something else wrong in the circuit, so save your time and gas! •

Breakproof Transistoradio

The Westinghouse entry into the transistor-radio derby offers several interesting features. Though it is of the purse-pocket size, it uses a 7-transistor circuit, including push-



Breakproof, 7-transistor Westinghouse radio.

pull audio output, similar to those found in the larger transistorized receivers, and operates from a compact 9-volt cell.

In addition, to fully realize the possibilities for ruggedization inherent in the use of transistors, the tiny receiver features a housing of unbreakable moulded plastic. The plastic is said to withstand unusual punishment, resisting cracking, chipping, and breaking, even under strenuous indoor-outdoor use. Printed-board construction is used to render the circuit immune to heat, vibration, and moisture. A genuine leather carrying case, with handle, is also provided.

Hi-Fi Tests with a 'Scope

Response Defects Can Be Noted with Music Instead of Test Tones

NORMAN H. CROWHURST

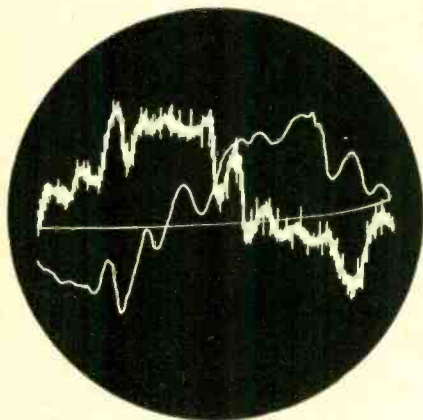


Fig. 1—The way audio should look on a scope for typical balanced music. Faint part of trace is preceding cycle fading away.

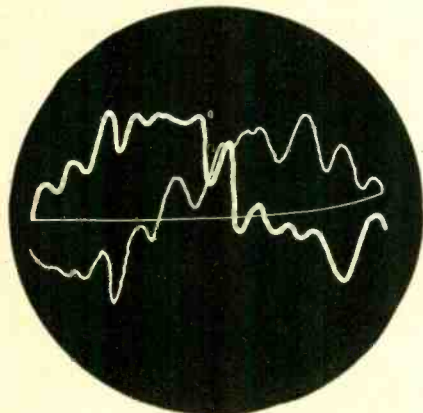


Fig. 2—How the trace in the preceding figure looks with a deficiency of the highs.

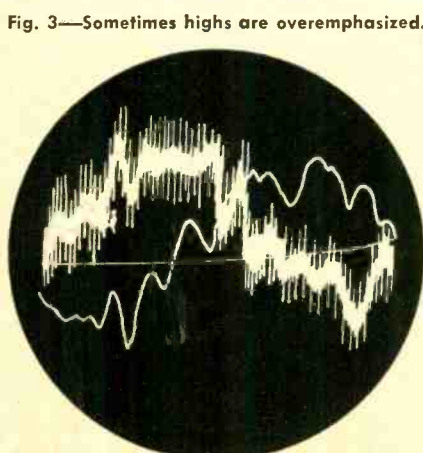


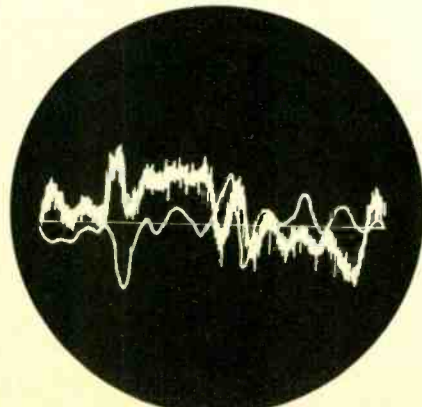
Fig. 3—Sometimes highs are overemphasized.

• Many more radio-TV service shops should be tackling high-fidelity system service than actually do. Although the field is somewhat specialized, it is booming now with considerable promise for the future. In addition, special equipment is less vital than a better understanding of this rather special kind of customer and his problems.

Since the marketing aspects of high-fidelity seem, at present, to have taken a somewhat different course from those characteristic of radio and TV, there is a false impression that Hi-Fi service, too, is a different field. However, many of the sources currently selling the equipment do not provide service or have the facilities to do it. It is surprising how few outlets there are that will undertake such service. The owner of quality audio equipment often has to try several places if he should have the bad luck to run into trouble with his system.

Part of the audiophile's difficulty arises from the fact that he is a much misunderstood person. He is not always looking for a simple repair of a dead set that can be corrected with the replacement of a defective tube or similar measure. To learn how to handle his equipment we must first appreciate what he is looking for.

Fig. 4—Suppression of low frequencies. In spite of what some people say and some ears hear, this is not the same as overemphasis of the highs. Compare with Fig. 3.



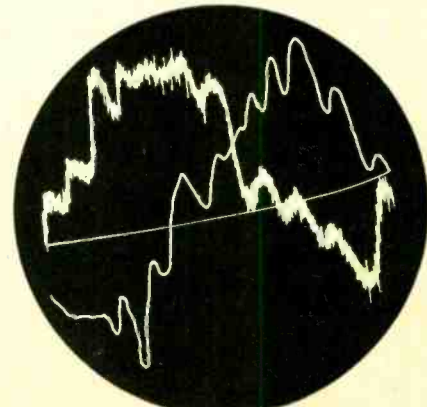
Part of the difficulty arises from the different part that a Hi-Fi system plays in the life of its owner compared with that occupied by a radio or TV set. The radio or TV set is a domestic piece of equipment which the user will usually go out and buy at a local store like any other piece of domestic furniture or equipment. The Hi-Fi business has grown up with quite a different approach. Invariably the Hi-Fi system is a *hobby*. While the average radio or TV owner does not profess to know anything about radio or TV, the audiophile professes to be somewhat of an expert on high fidelity—although (and this he freely admits) he may not know the first thing about electronics.

Many technicians will be tempted at this point to turn aside and say "Why bother with them? They are more nuisance than they are worth." But this is not true: the hobby aspect has its advantages as well as its disadvantages; a man's hobby is much dearer to his heart than just a piece of furniture, as he may regard radio or TV set to be. For this reason, he will be prepared to pay more to the man who respects this fact and gives his hobby the attention it deserves.

We have all seen the TV viewer who is content with a distorted picture (or sound) and does not realize anything is seriously wrong un-

(Continued on page 46)

Fig. 5—Overemphasis of the low frequencies.



SHOP HINTS



Tips for Home and Bench Service by Readers

Stop Tape Fraying

Before starting a roll of friction tape, use a knife to draw criss-crossing lines across both faces of the roll. These shallow scorings will pre-



Prevent tape fraying by scoring the roll.

vent fraying of the tape along the edges, which can be very annoying when pieces are torn off the roll.—*Harry J. Miller, Sarasota, Florida.*

Weak, Noisy Radios

In our shop we have had an influx of radio sets with the following trouble: Reception is either weak or below normal with continuous static. Turning the volume control down eliminates the static, indicating that the trouble is not in the audio.

The fault is in the type of i-f transformer used in these sets. They are slug-tuned, with fixed silver mica capacitors built-in, one across each winding. Minute particles of the silvered mica cause high resistance shorts between these two capacitors, with the leakage being so small that it often does not show up on the ohmmeter. However, there is enough of it to cause the symptoms described.

Where this trouble is suspected, it can be confirmed by disconnecting the leads to the secondary of the transformer and turning the set on. A meter is then used to check for positive voltage on the secondary. If there is none, the leads are recon-

nected and the remaining i-f transformer is checked similarly.

Once the condition is established, a simple and permanent repair can be made as follows: Use the high voltage (approximately 700 volts) available from the secondary of a conventional power transformer. Place a 5000-ohm 10-watt resistor in series with one lead. With the secondary of the faulty i-f transformer still disconnected, apply the high voltage between the two windings. This step will vaporize the particles of silvered mica and thus eliminate the short. After this operation, the i-f transformer should be retuned. This method has always worked for us.—*Julius Futterman, New York, New York.*

Saving a CRT

Some time ago a customer's set developed a heater-cathode short on the picture tube. Such a crt can be continued in use if a way is found to prevent the cathode from being grounded by the short, through the grounded side of the filament supply. This is done by using an isolation transformer between the crt filament and the filament supply. In this case, the set was restored to normal operation with the old picture tube still in use by means of a universal pix tube booster or brightener that had a separate primary and secondary.

Recently, the set lost its raster completely. High voltage was normal. However, while measuring the picture tube's bias, I accidentally had my test prod short the cathode to the heater. Strangely enough, this caused the picture to return.

Some thought on the subject led me to the following conclusion: now the cathode was open, but cathode current could flow through the pre-existing cathode-heater short. With the external short in place, cathode current could flow to its normal return, as indicated in the accompanying diagram. Since either open cathodes or cathode-heater shorts

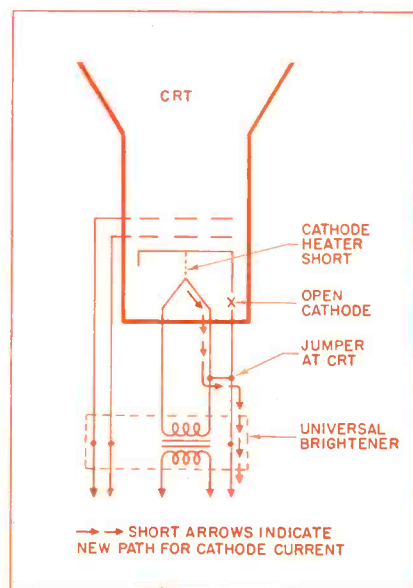
SHOP HINTS WANTED

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

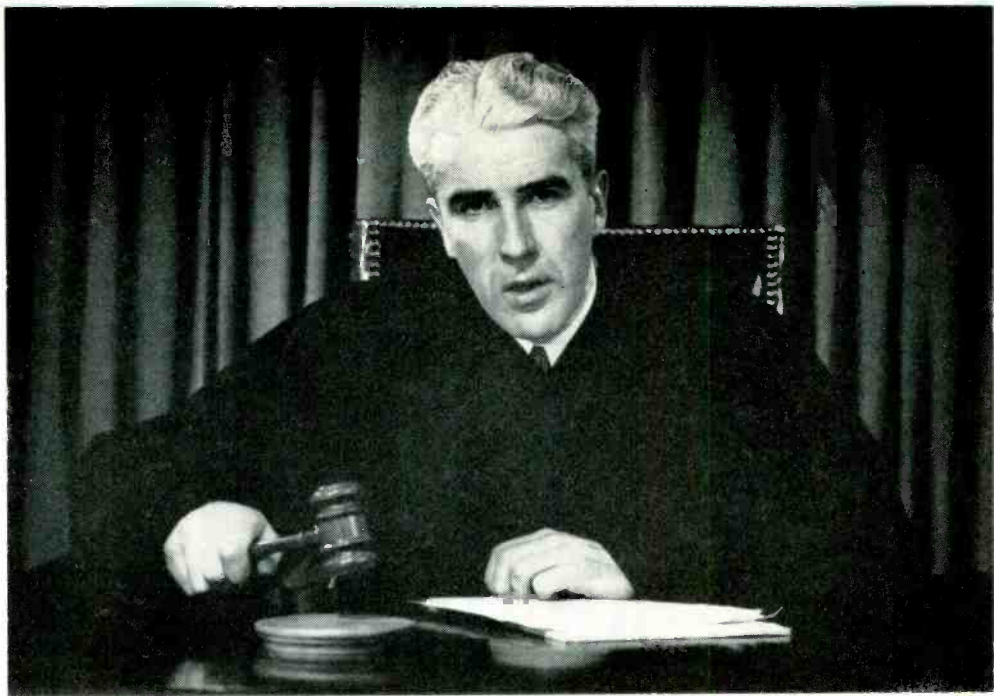
separately are rather common pix tube troubles, it is logical to assume that they sometimes occur simultaneously.

In cases where the symptoms indicate an open cathode and the customer is unwilling to pay for a new tube, it is suggested that an isolation transformer be installed and that the cathode be shorted to the heater with a test prod or screw driver. If this experiment restores the picture, the full condition and the cure are both obvious. A permanent jumper from heater to cathode, as shown, will put the tube back in operation.—*Charles Fisher, Penns Grove, New Jersey.*

CRT with cathode-heater short and open cathode is restored with xformer and jumper.



YOU and the LAW



The Technician's Rights on the Property of Others

FLOYD WILKINS, JR.
MEMBER, NEW YORK BAR

• In relation to the person in control of the property on which a technician goes to work, what are the rights of the technician if he is injured by some condition, artificial or natural, or by an activity being conducted on the property?

The common situation will be that the technician will call at the home or apartment of a customer who wants equipment installed, repaired or replaced. While there, he is hurt. Has the person in control violated some duty toward the technician? (Incidentally, the person in control need not be the owner of the property; he may be a tenant, a general contractor or any other person whose activities effectively occupy the land or building in question.)

Although an answer to this broad question is difficult in that it depends upon the circumstances of each case, it is possible to state the general rules that will apply and to recommend steps which, if taken, will help the technician to achieve the maximum possible protection under the law.

At the outset let us make sure that the technician is classified properly. As is frequent in the law, the courts designate categories into which they place the parties, and give to each category certain rights and duties. In our situation, the courts deal with two parties: (1) the person or persons in control of

the land and building visited by the technician and (2) the person visiting the premises. The second group, which in this case includes the technician, consists of three classifications: business visitor, licensee and trespasser.

Distinctions in Category

If, at the request of the person in control, the technician goes on the property to do anything "connected with business dealings between them" he is a business visitor. As such, he has the right to expect that the person in control will take reasonable care to learn the actual condition of the property and either eliminate dangerous conditions or warn the technician of unsafe situations and activities. As we shall see, the business visitor receives the greatest protection of those who go on another's property.

It is possible, however, for the technician to slip into the next category, that of licensee. He is a person who is privileged to enter or remain on the property but is not there on business and toward whom the person in control has the duty to use reasonable care only to disclose dangerous conditions known to him. To put it another way, unlike the business visitor the technician, when a licensee, will not be protected against the rotting porch railing or the loose step that could have been discovered by a reasonable inspection of the area. A business visitor becomes a licensee if he

lingers beyond a reasonable time after completing his job or stays after working hours without there being any necessity for his presence. Another example of a licensee is the case of a technician who stops by for a personal chat. However, if his stop is to see how the set is operating, he probably would be a business visitor.

The third category is a familiar one, namely, the trespasser. Normally the rules regarding trespassers should not involve a technician except where he trespasses by mistake or is led onto property by misleading appearances, as where a private road is not marked as such but is apparently a continuation of the public way. In the latter case, the technician generally will have the rights of a licensee. But one who trespasses because of his own mistakes has no right to protection against unsafe conditions or dangerous activities on the property.

There are exceptions to this rule, if the trespasser is discovered or if the specific area is one where trespassers frequently intrude. However, the safest rule of thumb is to remember that trespassing on private property is discouraged and accordingly trespassers generally have no right to be protected against personal injury due to conditions or activities on that property.

It must be clear that just because a technician is a business visitor, who is thereby entitled to the great-

(Continued on page 49)

Voltage-Regulated TV Sets

A Special Power Transformer Stabilizes B-Supply Voltages

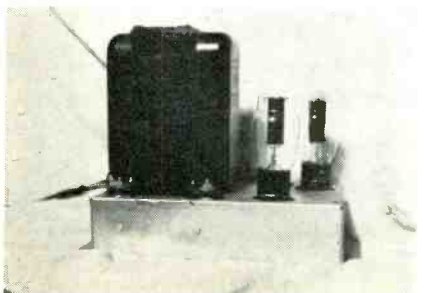
J. RICHARD JOHNSON

• A considerable number of TV receivers now in use contain a special type of power transformer, designed to maintain dc output voltage of the power supply as a whole within very close tolerances, even with rather large variations in input power-line ac voltage. These transformers, and the power supplies with which they are associated, have special features which bear upon their servicing, primarily involving a capacitor which may appear at first to be a filter, but is not. Very little has appeared in service literature concerning this type of supply.

The physical appearance of a subchassis containing such a power supply is shown in Fig. 1. It does not look much different from conventional transformer-type supplies, except that the transformer is somewhat taller than other types. Fig. 2 illustrates the construction of the core, which is important in operation. The basic factor is the *magnetic shunt*, across the middle between the primary and secondary windings. This causes the transformer to have high leakage reactance; in other words, without the resonance condition, explained below, the core saturates relatively easily, and inductance varies with the load.

Now consider the schematic diagram of Fig. 3. Capacitor C is connected across the secondary winding. Its value is chosen so that, before full primary voltage is applied, the secondary inductance is just too great to resonate with it at 60 cps. However, when full primary voltage is once applied, the flux density in

Fig. 1—Separate subchassis features power supply with special regulating transformer.



the core increases, and the secondary inductance decreases until resonance with C is attained. Once resonance is established, it has a "flywheel" effect, and reduces the effective reluctance of the magnetic shunt system. Changes in primary voltage are thus absorbed by the shunt system, and little voltage change takes place in the resonant secondary. What small changes do take place are cor-

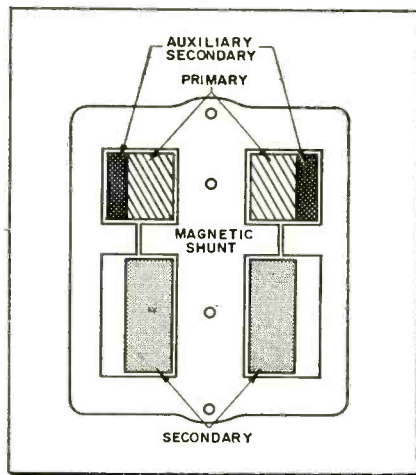
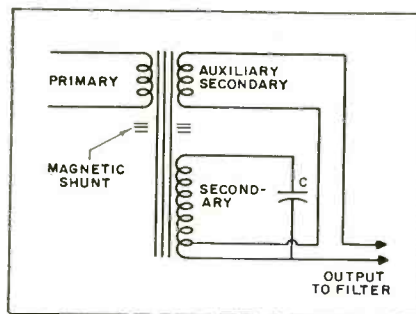


Fig. 2—Simplified cross-section view shows construction of regulated-type transformer.

Fig. 3—One popular arrangement in which regulated transformer is used. Auxiliary winding stabilizes, prevents overcompensation.



rected by an *auxiliary winding* on the primary portion of the core, connected as shown. Excellent voltage regulation, in the order of $\pm 1\%$ or better for $\pm 15\%$ primary voltage variation, is thus obtained.

With regulation in this order, there should be exceptional immunity from such effects as changes in raster size or brightness, sync stability, sensitivity, focus and others

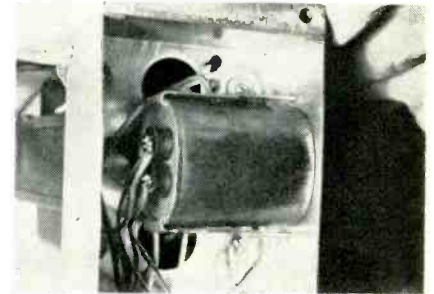


Fig. 4—Special oil-filled capacitor used to resonate with xformer in stabilizing circuit.

in the presence of ac line voltage fluctuations. In fact, the occurrence of such effects with input voltage variations warrants a check of the transformer and its resonating capacitor. Needless to say, when the transformer is defective, it should be replaced with a similar one rather than one that simply meets the voltage/current output requirements of the secondary.

Also of special interest to the service technician is the capacitor C, shown in Fig. 4. Since this capacitor is connected across an ac voltage source, it cannot be electrolytic. The capacitor shown in this supply is of the oil-filled type, having a rating of 1.5 mfd at 950 v, 60 cps. This is an rms rating, so the peak rating (corresponding to dc voltage rating) is in the order of 1340 v. Besides its voltage rating, the capacitor must meet rigid *current* requirements. When resonance is established, a rather heavy alternating current flows through C, and, even if the voltage rating were sufficient, lack of current capacity could render the capacitor useless for its purpose.

Thus, it should be remembered that capacitors in these supplies must be replaced only by types recommended by the manufacturer, and conventional types cannot be employed. •

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Add a Square-Wave Generator

Easily Added One-Tube Circuit Broadens Present Equipment

K. BRAMHAM

• The small size and low current consumption of the square-wave generator described here make it ideal as an addition to an existing signal generator or other piece of equipment rather than as a separate unit with power supply. A further advantage of using an existing generator is that the square-wave output can be fed into the output attenuator of the original instrument, or used to modulate its r-f output.

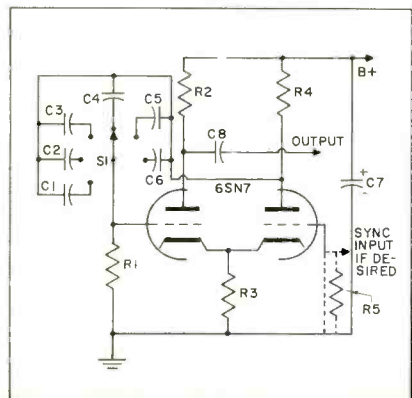
Construction is simplified by the elimination of fine-frequency and waveshape adjustment controls, but the resulting output is useful and stable. Six pre-set frequencies are provided, 20 cps, 40 cps, 140 cps, 300 cps, 1.8 kc and 5 kc. They have been selected as most useful for audio and TV linearity testing, but these values could be changed to suit individual needs simply by changing the values of coupling capacitors in the switching circuit. See Fig. 1.

Multivibrator Is Used

Circuitwise there is nothing unusual in this multivibrator, which consists of two triodes, cathode coupled, and has a choice of coupling capacitors determining the pre-selected frequencies.

Construction is quite unusual, and is responsible for the small space requirement and high stability. The tube socket is mounted directly on

Fig. 1—Circuit of the auxiliary one-tube multivibrator, to provide adequate square waves.



the switch assembly simply by removing one section of a two-section switch and substituting an octal tube socket. A phenolic wafer socket will fit the mounting bolts of a Centralab or similar rotary switch. This forms a solid "chassis," on which all other components are mounted before installation in whatever piece of test equipment has a couple of surplus inches of panel space. See Fig. 2. As the available B supply may be different from the 220 volts used originally by the author, some slight change in the values of R3 and R4 may be required in individual cases.

Frequency calibration can best be achieved with a scope. Apply a 60-cycle wave to the vertical input of

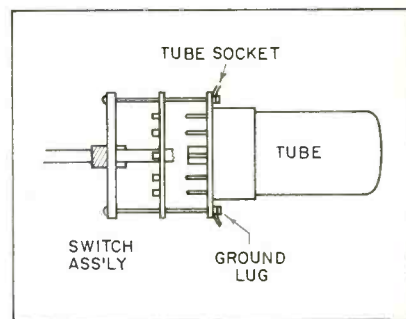


Fig. 2—Mounting detail of miniature subchassis, showing tube and wafer socket on switch.

Parts List

- C1 .1 mfd, tubular
- C2 .05 mfd, tubular
- C3 .01 mfd, tubular
- C4 .005 mfd, tubular
- C5 1000 mmfd, ceramic
- C6 250 mmfd, ceramic
- C7 10 mfd, electrolytic
- C8 .25 mfd, tubular
- R1 100k, 1/2 w
- R2 3.3k, 1/2 w
- R3 470 ohm, 1/2 w
- R4 100k, 1/2 w
- R5 100k, 1/2 w
- S1 Centralab switch #1411

the scope and adjust the sweep frequency. Remove the 60-cycle wave, and apply a square-wave signal from the generator. Without re-adjusting the sweep frequency but increasing the sync amplitude control on the scope slightly, to steady the scope trace, count the number of square waves shown on the tube. Thus if the sweep frequency is adjusted to show five 60-cycle sine waves, and shows only one square wave, then the frequency of that square-wave signal is 300 cps. If the square-wave signal can not be made steady enough to count with only the slightest increase in sync amplitude, then a different sweep frequency (different number of 60-cps waves) should be tried. Extreme accuracy is not normally required, but is worth trying for to an extent determined by the time available.

The square wave is to the audio circuit as the sweep generator is to the r-f circuit. Perfect square-wave response in a circuit can only be achieved if that circuit has a response from approximately 1/10 to 10 times the square-wave frequency applied. Thus, if a 5 kc square wave is applied to the input of an amplifier and a perfectly square scope trace is obtained at the output, then the frequency response of that amplifier is linear and without phase distortion from 500 cps to 50,000 cps.

It is important to remember in square-wave testing that the scope trace at the output of a circuit under test does not *have* to be perfectly square, but it should be the same shape as the input wave. This is to say that the output waveform of a square-wave generator does not have to be perfectly square. As long as it bears the general shape of a square wave, and its appearance is known before application to circuits under test, comparisons between input and output waveforms will give the information required for square-wave testing.

Scope Response

Another important factor in such testing, of course, is the linearity and square-wave response of the scope vertical amplifier and its effect on the waveshape. This can be checked by applying a square-wave signal first to the scope's vertical amplifier and then directly to the vertical deflection plates, and comparing them. Any difference should be noted and taken into consideration.

(Continued on page 53)

The Versatile Soldering Gun

Its Applications Are Not Limited Just to Making Connections

(The capabilities of the modern quick-heat soldering gun extend far beyond the simple task of making good electrical connections, according to the Weller Electric Corp. A report by this manufacturer of a popular line of soldering guns discusses and illustrates their versatility. Highlights and illustrations from the report are presented here.)

• The contents of the technician's tube-and-tool kit used for outside calls should include a modern low-heat soldering gun. This impressive looking item is useful in creating a favorable impression on the customer, as well as being adaptable to many applications without a long wait for warm-up.

Aside from its role as a soldering device, the gun can be used in circuit and component defect analysis. The 60-cps field set up around the tip when the gun is energized can be used as a signal source in many cases. For example, when troubleshooting in audio circuits, the energized tip can be placed near the grid circuit of the audio amplifier or other

critical points in the audio strip to see whether the hum is being picked up and getting through to the loudspeaker (Fig. 1).

It is also an invaluable aid in running down thermal intermittents. The heated gun is placed about $\frac{1}{8}$ in. beneath a suspected component in an attempt to induce the troublesome condition. This technique is especially valuable in tracking down component drift in tuners and elsewhere.

Recessed Chassis Spots

The long thin tip of the gun is especially useful for reaching into recessed tube sockets (Fig. 2) and other out-of-the-way places where the standard soldering iron cannot enter. In these cases, the built-in spotlights eliminate the need for setting up other light sources for the darkened portions of a chassis.

The narrow quarters for manipulation characteristic of most tuners, sometimes totally inaccessible to other instruments, can be reached with extra-long electrodes available

for guns (Fig. 3), especially where supplementary tips have been bent into convenient shapes for reaching into tight spots.

Hidden Connections

The gun provides the solution to soldering partially hidden connections, like the printed i-f strip in Fig. 4, which is partly covered by a shielded enclosure. The absence of excessive constant heat and the ability to regulate the heat with the finger-trigger action permits the safe removal of the delicate pix i-f coil in this circuit, and provides a greater safety factor in dealing with printed circuits in general.

When a voice coil connection breaks loose from the paper cone of a loudspeaker, a repair can be made readily with a gun (Fig. 5), whereas an ordinary iron would burn the cone.

Removal and replacement of crystal devices, like the oscillator control crystals in color demodulator circuits, phono pickups and ger-

(Continued on page 54)

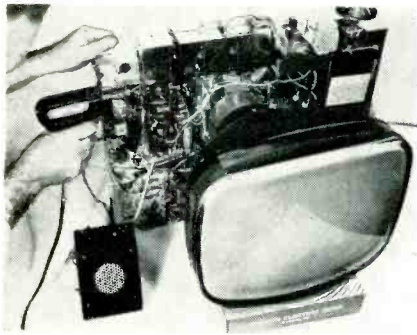


Fig. 1—Gun used as 60-cps test signal source.

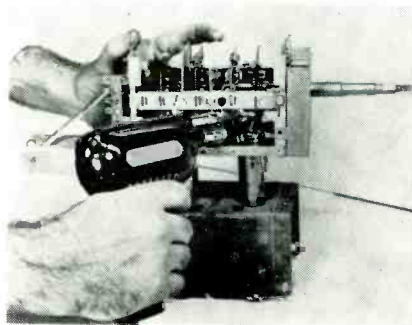


Fig. 3—Special tip used in cramped tuner.



Fig. 5—Resoldering the severed connection of a voice-coil lead to paper speaker cone.

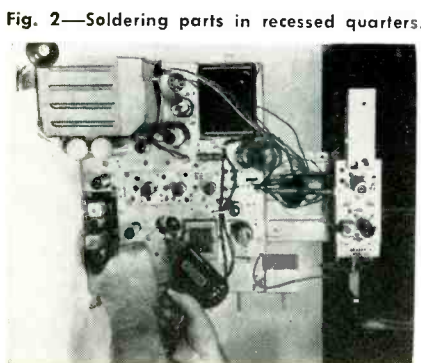


Fig. 2—Soldering parts in recessed quarters.

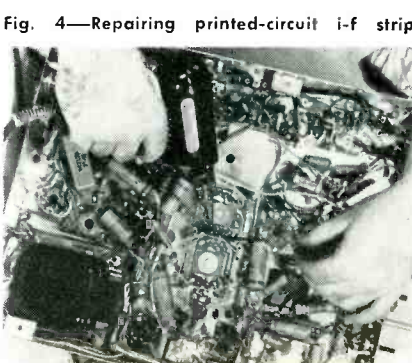
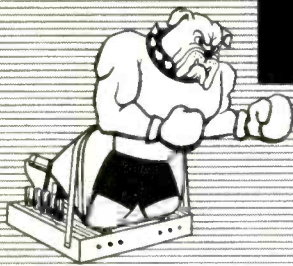


Fig. 4—Repairing printed-circuit i-f strip.



Fig. 6—Skinning 300-ohm antenna lead wire.



"Tough Dog"

Corner



Difficult Service Jobs Described by Readers

No Width—Vertical Fault

The receiver was an RCA using the KCS68E chassis with a 21-in. picture tube. The complaint was that the picture was only 12 in. wide, compressed in the center of the raster, and that there was serious bending of the raster about a third of the way over from the right edge. In addition, another symptom would appear intermittently: White streaks would suddenly flash across the picture followed by a total raster blackout.

Both the linearity coil and the 100-ohm cathode resistor for the 6CD6 horizontal output tube were charred and overheating. There was a strong odor indicative of arcing in the vicinity of the flyback transformer, although no corona was visible in a darkened room. Also, a check of the 6CD6 indicated serious grid emission. Replacement of the 6CD6, its cathode resistor, the linearity coil, and the flyback transformer cleared up all of the troubles, except for one: the raster was just as narrow as ever.

A test with a flyback-interval and yoke checker showed that there was nothing wrong with the flyback in-

terval and that both halves of the horizontal winding were identical and in order. Despite this, after a check of all related chassis voltages and components in the deflection circuit, it was decided that the trouble was most likely in the yoke. While going over the schematic again very carefully, it was noted that the only remaining part connected with the horizontal circuit that had not been checked was the 270-mmfd balancing capacitor (see the accompanying diagram) connected between the lower end of the horizontal windings and the center of the vertical windings. It proved to be shorted. Its replacement cured the trouble.

After repair, a second check was made with the flyback tester. Exactly the same indication was obtained as with the shorted capacitor in the circuit.—C. G. Adair, San Antonio, Texas.

Trapezoidal CRT

This rather unusual trouble cropped up on a Westinghouse using chassis 2175. To begin with, there was no raster and no high voltage

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

because the horizontal multivibrator wasn't working. Replacement of a couple of defective components in this circuit took care of that part of the problem. However, once the high voltage was back on, a trapezoidal raster was very much in evidence.

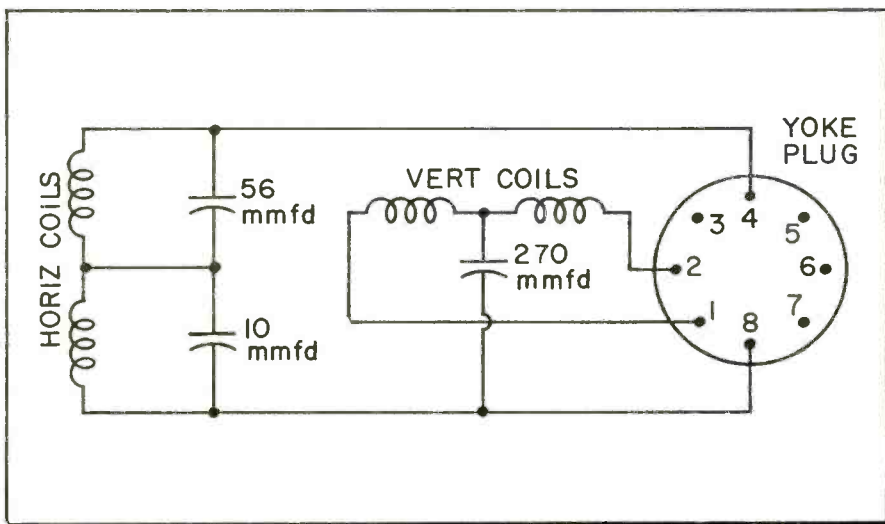
Naturally, immediate suspicion fell on the vertical section of the yoke, with the possibility taken into account that one of the two windings was all or partially shorted. However, a careful check showed that this was not the case. In fact, a new yoke was tried, with the same result in the raster.

There had to be some component somewhere causing the trouble. Finally, replacement of the picture tube straightened out the raster. A close examination of the old crt showed why. Most picture tubes have an accelerating anode, which is a cylinder or ring that is the part of the electron gun nearest to the front (screen) of the tube. This anode carries the same high voltage that is used for the second anode aquadag coating, and is connected to the latter by some wires or "spiders" projecting from the edge of the cylinder. In this picture tube, there were four such wires to begin with, but close inspection showed that two of these had been burned off. This condition resulted in an unequal electrostatic charge around the ring of the accelerating anode, which had an effect on deflection.—Thad Weidman, Red Oak, Iowa.

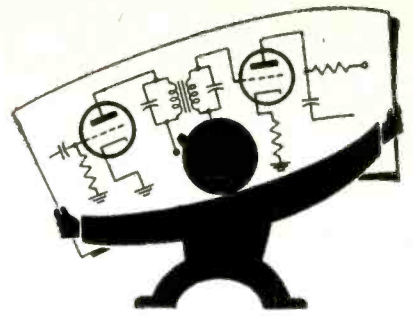
Dim View of Things

The symptom of which the customer complained on this Crosley H21COMH was a very dim raster. To find the cause, I checked all the volt-
(Continued on page 48)

Shorted balancing capacitor from the vertical winding resulted in reduced horizontal width.



Let's Look at CIRCUITS



No. 9: Changes in the Cathode of the Triode Amplifier

SIDNEY C. SILVER
MANAGING EDITOR

• With variations, the triode amplifier presented in our last discussion lays the foundation for any amplifier likely to be encountered in electronic equipment. Even where a tetrode or pentode is used, fundamental operation is unchanged: we simply add such advantages as increased amplification and reduced capacitance between control grid and plate, refinements that will merit future discussion. Of immediate interest is the fact that our basic amplifier, first shown with a grounded cathode, very often has a resistor appearing between cathode and ground.

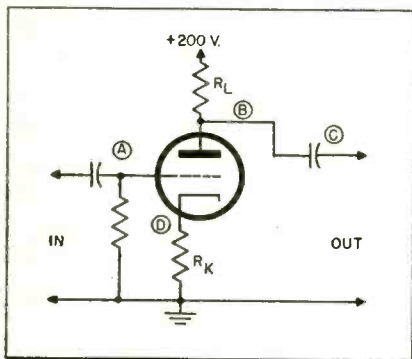


Fig. 1—The basic grid-input triode amplifier with a resistor added to the cathode circuit.

Fig. 1 shows the basic stage altered to include such a resistor. Why is it there? Well, we start with the knowledge that any tube's operation depends on such factors as the various voltages applied to its active elements (or the relationship of these voltages to each other), the values of components used in the stage (which often determine the voltages), and the characteristics of the type of tube used. The relationship between the voltages at the control grid and cathode are very important in this overall picture. This relationship—the difference in voltage between grid and cathode—is called the tube's bias. As we shall see, in-

sertion of a cathode resistor is a commonly used method of providing all or some of the desired bias.

For most tubes and most types of amplifiers, it is generally desirable to keep the grid more negative than the cathode. In this condition, electron flow through the tube, as we learned, is limited. Thus, when no signal is being applied to the tube, we guard against the possibility of the tube running wild, as it were. That is to say, with a positive grid encouraging electron flow from cathode to plate, the tube would conduct heavily or even saturate when no signal is present at the input to exercise control. Damage or early death for the tube or other components in the path of this heavy flow may be predicted.

Cathode Bias

The desired grid-cathode relationship may be obtained in either of two ways: we can do something to the control grid to make it more negative than the cathode, or we can do something to the cathode to make it more positive than the grid. In either case, we achieve the desired relationship. With the insertion of a cathode resistor, we achieve it by the second of the two methods mentioned.

How this comes about may be seen if we retrace the movement of electrons from the most negative point of the circuit (ground in this stage) to the most positive (B-plus). Briefly (since the path was travelled in our last installment), the electron current flow proceeds through the tube and all components in series with it. Since cathode resistor R_K is now in this path, a voltage drop will occur across it with the top of the resistor (the point nearest the cathode) more positive than the bottom point, which is ground.

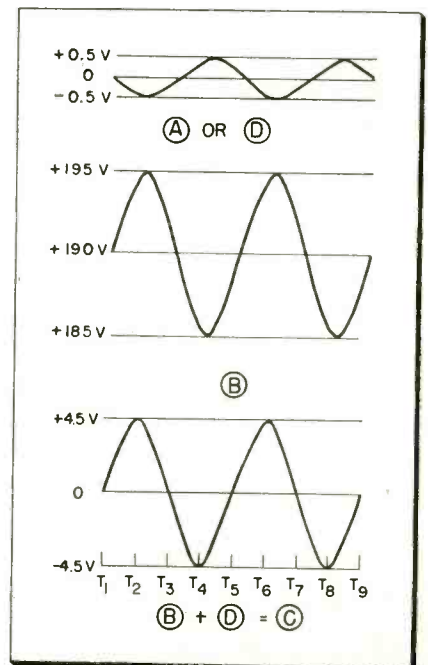
This drop occurs in the same way that we have already described for the drop across R_L , the plate load resistor. However, compared to the size of the plate load resistor (we

had chosen an arbitrary value of 10k), R_K is generally quite small. It will usually be in the range between 50 and 1000 ohms. If we assume the latter convenient value, we have a cathode load that is $\frac{1}{10}$ the plate load. The voltage drop across the cathode resistor will then be about $\frac{1}{10}$ that across the plate resistor, or 1 volt instead of 10 volts. It will be recalled that the input sine wave also had an amplitude of 1 volt. This is more than coincidence: the signal appearing across the cathode resistor of most amplifiers is of the same order of magnitude as that of the input signal.

We have tried to make this point graphic in Fig. 2, which is an extension of the second figure used in the last discussion. Input waveform A, appearing between grid and ground, has the same amplitude as waveform D, appearing between cathode and ground. Also, both of these are in the same phase, and both

(Continued on page 48)

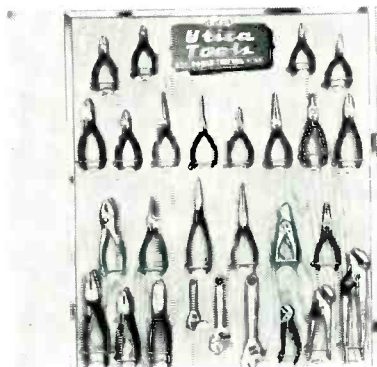
Fig. 2—Signal voltage waveforms at the grid (input), the plate, the cathode and output.



New Products for Technicians

Utica TOOLS →

Full assortment of tools for electronics is offered on a chrome-trimmed wooden display panel, 25 by 31 in., with 1, 2, or 3 pieces of each tool. Assortment includes midget diagonals, long chain nose pliers with cutters, needle nose and chain nose pliers (no cutters), all with red plastisol handles. Also included: 3 sizes of rib-joint pliers, slip joints, duck bills, side cutters, heavy-duty diags, adjustable wrenches and printed-circuit pliers. Unit E27. Utica Drop Forge & Tool Corp., Utica 4, N. Y. (TECHNICIAN No. 7-11)

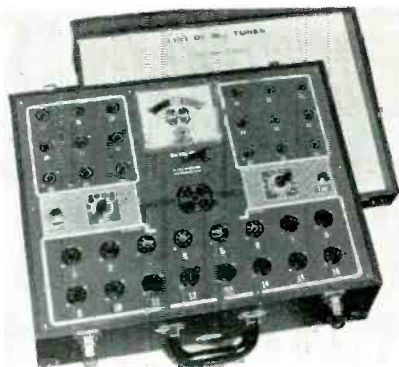


B-T 4-SET CABLE TAP-OFF

Model MIT-4 simplifies TV distribution installations where several isolated outlets are needed at one location. It features 75-ohm coaxial fittings at line input, output, and 4 outlets. Compact weatherproof case can mount on TV mast or screw to flat surface. It maintains match over both VHF bands, provides 17 db isolation of each outlet from the line, has insertion loss of only 0.3 db per outlet, and maintains uniform response. List price, \$29.00. Blonder-Tongue Laboratories, Inc., 526-536 North Ave., Westfield, N. J. (TECHNICIAN No. 7-14)

ASD TUBE CHECKER →

Simple and rapid set-up procedures are made possible by the TV-340 tube tester, which dispenses with most selector switches and knobs. It gives a cathode-conductance test to some 400 popular tube types; also detects shorts and gaseous conditions. Primarily intended to be a TV service instrument, it comes mounted in a portable case with a carrying handle, in red leatherette finish. Dealer net price is \$79.50. American Scientific Development Co., 334-336 South Main, Fort Atkinson, Wisc. (TECHNICIAN No. 7-9)

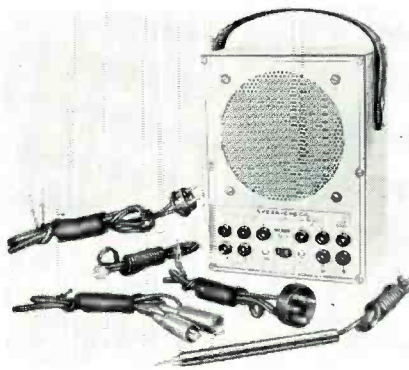


Telco TV ROLL-AROUND

Installing casters underneath a TV console cabinet is greatly simplified with the redesigned TV Roll-Around. This adjustable metal frame, to which 4 casters are mounted, can be fitted beneath the cabinet by setting one wing nut. The device is made of heavy steel frame, uses ball-bearing casters, comes completely assembled. When installed, the unit is out of sight under the set. Cat. No. 8957-N. List price, \$7.95. Television Hardware Mfg. Co. (Div. of General Cement-Textron American), 919 Taylor Ave., Rockford, Ill. (TECHNICIAN No. 7-12)

Century SPEAKER TESTER →

Compact multi-purpose tester, Speak-Check, Model SC-1, can be used to test speakers, trace signals and check voltages. It substitutes for all kinds of speakers, output transformers, field coils; traces injected audio and video signals; checks for vertical and horizontal sweep voltages; measures B-plus; and substitutes power-supply bleeder resistors. Complete with tracing probe, cables and connectors. 10-day trial; \$22.50 net. Century Electronics Co., Inc., 111 Roosevelt Ave., Mineola, N. Y. (TECHNICIAN No. 7-10)

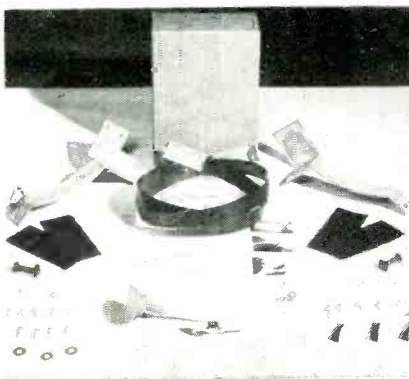


FTR SILICON RECTIFIERS

New line of silicon diode power rectifiers includes pigtail and threaded types. Suitable for airborne power supplies and other airborne electronic equipment, they may also be applied wherever minimum size, high operating temperature and resistance to vibration and shock are required. Electrically, the new rectifiers exhibit exceptionally low forward voltage drop when passing full rated forward current. Leakage current is negligible. Components Div., Federal Tel. and Radio Co., 100 Kingsland Rd., Clifton, N. J. (TECHNICIAN No. 7-13)

Colman CRT CONV. KIT →

Most chassis using older metal-cone picture tubes can be adapted to accommodate all-glass tubes with some changes. Newest addition to the manufacturer's line of conversion kits to effect such changes is the C-5, for all Silverstone sets using the 110-821 chassis. All components and other materials needed to make the permanent conversion are included. This kit, 5th in the line, also fits many Firestone and CBS-Columbia models. List price, \$6.25. Colman Tool & Machine Co., P.O. Box 7026, Amarillo, Tex. (TECHNICIAN No. 7-8)



G-C SELF-HOLDING PRODS

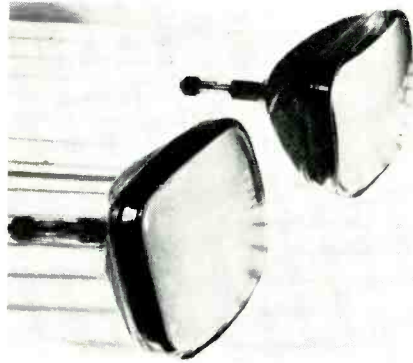
The "Klipzon" line of self-holding radio-TV service aids, added by the manufacturer, gives him a complete line of test prods and leads for streamlined service work. The new line, which includes crystal probes, jumpers, handles, adapters and plugs, frees both hands of the service tech for other work while he is probing or making other temporary connections at the bench with these aids. Available at distributors. General Cement Mfg. Co. (Div. of Textron American, Inc.), 919 Taylor Ave., Rockford, Ill. (TECHNICIAN No. 7-15)

For more technical information on new products, use inquiry coupon on page 40

New Tubes & Semiconductors

Sylvania TV TUBES

Five pix tubes include the 14SP4, 90° rectangular type (illustrated, bottom) for portable sets, with electrostatic focus, 104 sq. in. area; 14QP4 and 14QP4A aluminized (shown at top), 70° with 96 sq. in.; 8XP4 8½" rectangular crt with automatic self-focusing for testing crt's and sets; and 21AXP22 70° color pix tube. Line of 13 receiving tubes for color include 3A2, 3A3, 3B2, 3C2, 6AZ8, 6BC7, 6BJ7, 6BJ8, 6BK4, 6BN8, 6CL5, 6CL6 and 6CB5A. Sylvania Electric Products, 1740 Broadway, New York 19, N.Y. (TECHNICIAN No. 7-4)



Du Mont SHORT PIX TUBES

Aluminized TV picture tubes which reduce the tube's length by as much as 2" feature reduced neck length because of the compact, straight electron gun, but the need for an ion trap has been completely eliminated. Sizes to be produced are the 24", 21", 17", and 14" diagonal sizes, 90° deflection. An important characteristic is the elimination of fluctuating picture due to line voltage variation. Improved performance enables gun to operate at anode voltages in excess of 20 kv. Allen B. Du Mont Labs., 750 Bloomfield Ave., Clifton, N.J. (TECHNICIAN No. 7-7)

CBS SEMICONDUCTORS

The 2N155 power transistor for the audio output stage of auto radios is designed to operate from 12-v. batteries. This plug-in unit (illustrated) will be used in 1957 car radios. Also, three high-frequency alloy-junction germanium NPN transistors, 2N182, 2N183 and 2N184 have been announced, the first two suitable for broadcast receiver r-f and i-f stages. In addition, series of glass-sealed bonded-junction germanium diodes, types 1N947 through 1N502. CBS-Hytron, Danvers, Mass. (TECHNICIAN No. 7-1)



Raytheon RECEIVING TUBES

Additions to the tube replacement line are the 2BN4 triode for tuners (\$2.15 list); 4BS8 triode for cascade amps (\$3.25); 5CG8 triode-pentode osc-mixer (\$2.80); 6BY8 diode-pentode amp and limiter/detector (\$2.40); and 6CS7 dual triode for vert. These are all 600-ma series string types. Also included are 6BN4 (\$2.10); 6BS8 (\$3.25); 6CG8 (\$2.75); and 6CR8 (\$2.05). Latter four are all of miniature construction. Raytheon Mfg. Co., Receiving & CRT Operations, 55 Chapel St., Newton 58, Mass. (TECHNICIAN No. 7-2)

RCA TV TUBES

The 21AXP22-A color pix tube (illustrated) is a metal shell type with 255 sq. in. screen area. Internal neck coating eliminates external resistor to ultor supply. Other tubes added to line include the aluminized 14RP4 pix tube with 106 sq. in. area, 90°, weight 8½ lbs.; 6CG5-A beam power tube for color TV horizontal deflection amplifiers; and 6CH8 medium-mu triode-sharp-cutoff pentode for wide variety of b&w and color receiver applications. RCA Tube Div., Radio Corp. of America, Harrison, N.J. (TECHNICIAN No. 7-3)



GE SERIES TUBES

New line of eight 300-ma heaters series-string TV receiving tubes (117v., 35w) for small portable sets includes 6AU6-A, 6CE5, 6CB6-A, 7AU7, 9U8-A, 10C8, 17H3 and 18A5. Latter three have no prototype. Also, 22 450-ma tubes (117v., 53w) for medium-sized series-string sets now have been registered: 3AF4-A, 4BC5, 4BN6, 4CB6, 4BU8, 5BQ7-A, 5BZ7, 6AQ5-A, 6BK7-B, 6J6-A, 6T8-A, 6U8-A, 8AU8, 8BH8, 8CG7, 8CM7, 8CN7, 9AU7, 17AV5-GA, 17AX4-GT, 17C5, and 17DQ6. Tube Dept., General Electric Co., Schenectady 5, N.Y. (TECHNICIAN No. 7-5)

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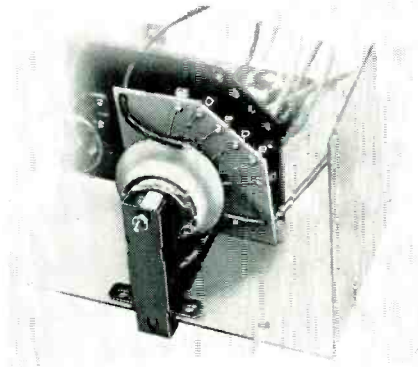
Amperex TRANSISTOR

Switching-type transistor, type OC76, has been developed particularly for dc converter applications. Some uses include high voltage supplies of portable and mobile radio sets, transistorized photo-flash units and Geiger counters. The OC76 offers 250 ma peak-current capability in a small package. Its collector-to-base voltage rating is 32. Semiconductor and Special-Purpose Tube Dept., Amperex Electronic Corp., 230 Duffy Ave., Hicksville, L.I., N.Y. (TECHNICIAN No. 7-6)

New Circuit Components

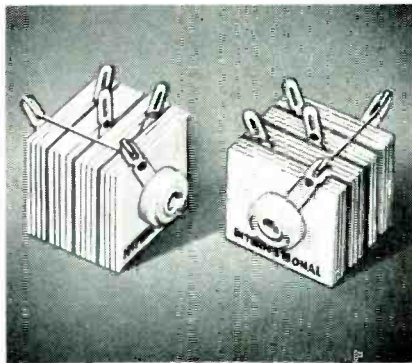
Ram FLYBACK

Exact replacement composite flyback model X079 has been revised to include additional Trav-ler replacements. It continues to replace Trav-ler flybacks TVX 107 to TVX 114. It now also replaces Trav-ler flybacks TVX 104, 105 and 106, which were formerly replaced by Ram flyback X078. The composite now replaces 73 models using 10 chassis in the Trav-ler line. The change was made in order to reduce duplication of stock. Ram Electronic Sales Co., Irvington, New York. (TECHNICIAN No. 7-19)



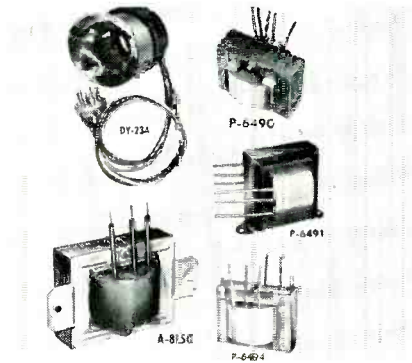
Int'l SEL. RECTIFIERS

Selenium rectifier type 61-2020, a single-phase full-wave bridge rectifier, was designed to fill the need for an additional small and inexpensive unit for operating magnetic devices. It delivers 90 volts dc at 175 ma for an rms input of 130 volts maximum. Widest dimension is 1 1/2 in.; mounting is with a No. 8 machine screw. Ideal for use in dental equipment, or other places where ac hum is objectionable, and for solenoids, counters, relays, and small dc motors. International Rectifier Corp., El Segundo, Calif. (TECHNICIAN No. 7-16)



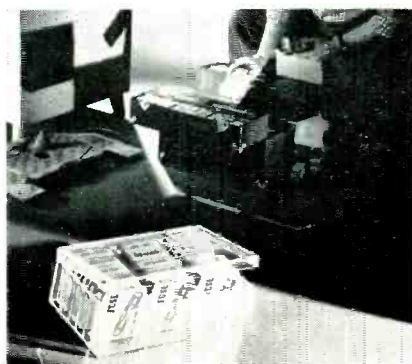
Stancor TRANSFORMERS

Three new auto-radio vibrator transformers bring replacement line to 34. P-6490 replaces Bendix C291787 in Ford models. P-6494 replaces Philco 32-8592-1 in 12-volt radios. P-6491 is a general replacement type for 6-volt primary use. Also, deflection yoke DY-23A replaces RCA 972459-2, -3 in KCS 96 and 97 chassis. Vert. output transformer A-8150 replaces RCA C971798-1 in 6 chassis, 89 models. Physical and electrical duplicates. Chicago Standard Transformer Corp., 3501 W. Addison, Chicago 18, Ill. (TECHNICIAN No. 7-17)



Littelfuse FUSE CADDY

This transparent plastic fuse caddy, designed to fit into the larger tube and tool caddy, has individual compartments for 18 different types. Caddy comes already stocked with 15 types, including LC (limited current) fuses. The assortment is intended to cover all fuse replacements normally encountered by the service technician. Three vacant compartments allow for special fuse needs. Caddy model no. is 094037. Net price for combination is \$6.25 from jobbers. Littelfuse, Inc., Des Plaines, Ill. (TECHNICIAN No. 7-18)



CPC CAPACITORS

Two new Teflon dielectric capacitors are designed for high-temperature usage in airborne applications. Both have high insulation resistance and low power factor at all frequencies and temperatures. Standard voltage ranges are 200, 400, 600 and 1000 vdc. Capacitance range is from .001 mfd to 1.0 mfd. The TACM type is hermetically sealed in tubular brass shells. Type TAG is glass encapsulated. Type TACM operates at temperatures up to 200° C.; TAG to 170° C. Condenser Products Co., New Haven, Conn. (TECHNICIAN No. 7-23)

IRC FILM RESISTORS

Molded deposited carbon and boron carbon precision resistors, types MD and MB, are available in ratings of 1/8, 1/4, 1/2, 1 and 2 watts. Double protection is provided by addition of molded plastic housing to protect unit against damage and effects of environmental conditions. Recommended for computer and amplifier circuits requiring superior resistance-temperature characteristics and stability, voltmeter multipliers, decades, divider and bridge circuits. International Resistance Co., 401 N. Broad St., Philadelphia 8, Penn. (TECHNICIAN No. 7-22)

C-D HI-TEMP. CAPACITORS

Two new series of high-temperature molded midget mica-dielectric capacitors are for operation to 130°C and 160°C, respectively, without derating. Dimensions are same as midget 85°C types. These were developed to meet applications in high-heat equipment, requiring high stability and reliability in the smallest case. Maximum capacitance is 15,000 mmfd (130°C) and 7,500 mmfd (160°C). Voltage ratings are 300 and 500 vdc working, with temperature coefficient characteristics B,C,D,E, or F available. Cornell-Dubilier Electric Corp., South Plainfield, N.J. (TECHNICIAN No. 7-20)

Aerovox MODULE KIT

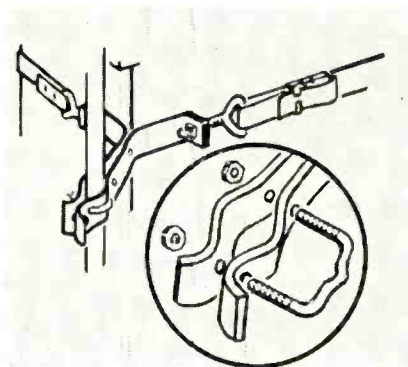
Standard-Circuit Modules are available with handy breadboard for simplifying and speeding up experimental and prototype assemblies. Engineers, technicians, and special-equipment builders can work up breadboard layouts by simply plugging in basic-circuit modules in breadboard sockets, and completing necessary connections with banana-plug jumpers. Introductory kit includes 7 standard-circuit modules; one 12-position module breadboard; 50 banana plugs. Distributor Service Div., Aerovox Corp., New Bedford, Mass. (TECHNICIAN No. 7-21)

For more technical information on new products, use inquiry coupon on page 40

New Antennas & Accessories

South River MOUNTS

"Snap-In" line of chimney mounts and wall brackets features a specially designed "U" bolt which permits one-hand spintite fastening. After mast is "snapped" into spring-tension mast retainers, the installer inserts the U bolts, instead of nuts and screws. He needs to use only one hand to tighten the nuts, instead of the customary two hands formerly needed for the screwdriver and wrench. This design permits greater safety. South River Metal Products Co., 377-379 Turnpike, South River, N. J. (TECHNICIAN No. 7-35)



Alliance "TENNA-ROTORS"

New decorator models are featured for Tenna-Rotors by placing emphasis on the new colors, Forest Green and Ivory, as well as the standard mahogany-grain finish. Both new TV antenna rotator models, the T-12 with the Tenna-Teller dial, as well as the deluxe automatic U-98, will now be available in three shades. Alliance Mfg. Co., Lake Park Blvd., Alliance, Ohio (TECHNICIAN No. 7-39)

Jerrold MATCHING XFORMER

Outdoor matching transformer which passes ac is used in remote operation of r-f amplifiers over twin-lead and open-wire transmission lines. Model TO-374 for 72-300 ohms permits the use of twin lead or open wire in long runs between pre-amplifiers and power supplies. This facilitates location of the antenna and pre-amp for best signal reception independent of the ac power source. This unit connects the r-f output of a 72-ohm pre-amp lead while supplying 24-volt power over the same line. (TECHNICIAN No. 7-37)

Clear Beam YAGI

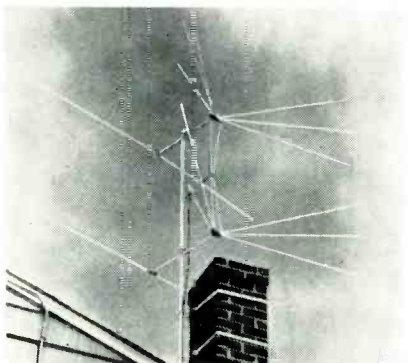
"San Franciscan" model MY600 features two separately functioning receiving arrays. One is broad-banded for channels 7 through 13 and the other broad-banded to cover 2 through 6. Both receiving arrays are phased into an inline Yagi through use of a dual delta match. Response of single bay is said to equal two-stack conicals on channels 4-10, slightly higher in gain than a single conical on channels 2, 3 and 11-13. Clear Beam Antenna Corp., 21341 Roscoe Blvd., Canoga Park, Calif. (TECHNICIAN No. 7-38)

Dynamic "FILTER-TENNA"

The "Filter-Tenna" model DB500 contains built-in, hi-pass filter, which rejects electrical disturbances picked up in antenna circuit of TV receiver but permits filtered signal to go through. Unit uses 2 precision high-gain phasing elements as well as a variable 12-position channel attenuator, which will reportedly tune out ghosts and fuzz in most instances and minimize antenna orientation problems. List price is \$18.95 in three finishes. Dynamic Electronics-New York, Inc., 73-39 Woodhaven Blvd., Forest Hills, L.I., N. Y. (TECHNICIAN No. 7-36)

Taco CONICALS

Complete line of conical television antennas comprising eight single and eight stacked models is available in a variety of standard packages. The new line has been designated as the "Turret" series, based on the assembly, by means of which the elements are completely pre-assembled at the factory and ready to flip into position for rapid mounting. The Turret head is designed to maintain the accuracy of the element spacing and forward angle. Technical Appliance Corp., Sherburne, N. Y. (TECHNICIAN No. 7-32)



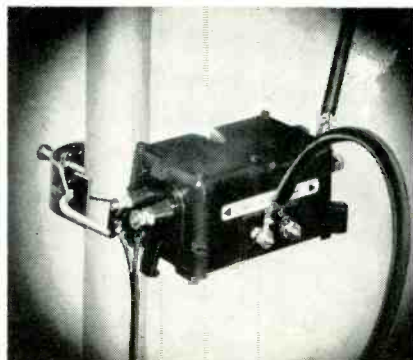
Ward AUTO AERIAL

Auto radio aerial called the "Silver-amic," a flexible fiberglass rod that features a metallic chrome-like finish, is completely resistant to rust, corrosion and changing weather conditions. It is readily installed with familiar "8-Ball" cap and sturdy rubber seal, and measures 38" in height, with a 54" lead cable. Aerial is available in front or rear mounts. A continuous-length conductor runs through center of rod. Ward Products Corp., Div. of The Gabriel Co., Dept. 56, 1148 Euclid Ave., Cleveland 15, Ohio. (TECHNICIAN No. 7-34)



C-M UHF-VHF FILTER

Completely re-designed model of UHF-VHF inter-action filter, the "Ultra-Tie," joins together all antenna types and bands for use with a single transmission line of any length, and is housed in a plastic case of the same design as "SelecTenna" couplers. In conjunction with "SelecTenna" it is possible to join as many as seven separate antennas to a single transmission line. Model No. 9034-A, superseding Model No. 9034, lists at the same price, \$3.75. Channel Master Corp., Ellenville, N. Y. (TECHNICIAN No. 7-33)



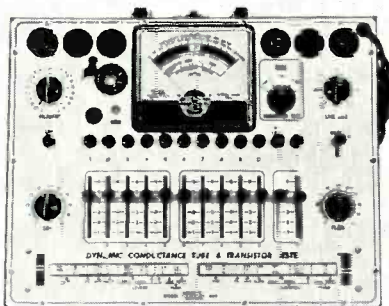
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New Test Equipment

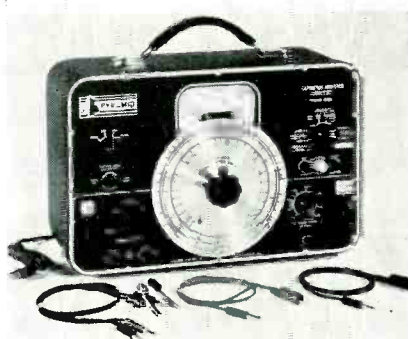
EICO TUBE-TRANS. TESTER →

Dynamic Conductance Tube & Transistor Tester 666 features close simulation of operating conditions. 2-step transistor test provides leakage measurement of collector current and direct reading of Beta (current ampl. factor). Provides composite indication for all tubes of mutual conductance, plate conductance, and peak emission. Inter-element leakage read in ohms. Checks b&w or color pix tubes with adapter. Kit, \$69.95; wired, \$119.95. Electronic Instr. Co., 84 Withers St., Brooklyn 11, N. Y. (TECHNICIAN No. 7-27)



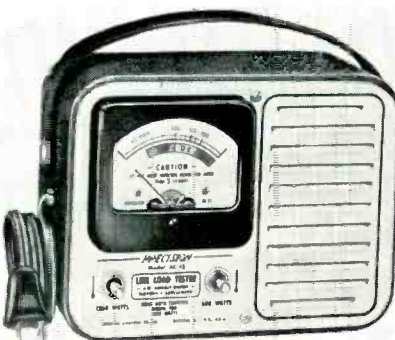
Pyramid ANALYZER →

Multi-purpose capacitor-resistor analyzer, model CRA-2, uses a vacuum-tube ohmmeter for accurate insulation-resistance readings on many types of capacitors; reads leakage current directly. Checks power factor of capacitors rated from 6 to 600 vdc (electrolytic), and performs many in-circuit tests for intermittent high r-f impedance, open conditions, and others. Uses combination Wein and Wheatstone bridge, precision meter. Pyramid Electric Co., 1445 Hudson Blvd., North Bergen, N. J. (TECHNICIAN No. 7-26)



Precision LOAD METER →

Line-load survey meter model AC-12, checks ac power line capacity to handle appliance loads. It can pre-check ability of 110-volt ac lines to handle loads imposed by air conditioners, broilers, etc. Line-load conditions are indicated directly as "Low," "OK," or "High." The instrument also reads actual line voltage. Three test loads (600, 1200 and 1800 watts) handle a wide range of appliance needs. The price is \$29.50 net. Precision Apparatus Co., Inc., 70-31 84th St., Glendale 27, L.I., N.Y. (TECHNICIAN No. 7-25)



Simpson CAPACITOR TESTER →

In-circuit Capacohmometer, model 383-A, is said to cut capacitor service time up to 75%, locating 7 out of 10 faulty capacitors without removal from circuit. Applicable to both shunt and coupling capacitors, detecting over 90% of faults in the latter, it uses a metered pulse test. Reads leakage resistance in circuit and directly reads capacitance from 10 mmfd to 10 mfd. Also checks leakage in transformers, chokes, yokes. Sells for \$89.95. Simpson Electric Company, 5200 W. Kinzie St., Chicago 44, Ill. (TECHNICIAN No. 7-24)



Telonic COLOR INSTRUMENTS

Model CB-2 Color Bar Generator has correct NTSC luminance, chrominance and phase angle, and displays 6 colors (plus black and white) simultaneously. The DG-1 White Dot Generator produces small, square dots as well as crosshatch, horizontal bars and vertical bars. This unit produces stable patterns because the frequencies are derived from count-down circuits from the master 315-kc oscillator. Telonic Industries, Beech Grove, Ind. (TECHNICIAN No. 7-29)

Senco BIAS SUPPLY

Improved TV bias supply, model BE3, provides any voltage from 0 to 18, positive or negative. The earlier model BE2 provided only 10 volts. It was designed to include higher voltages recommended on some current monochrome and color TV sets. Because the supplies are isolated, 2 (either BE2 or BE3, or one each) may be used in series to provide higher voltages, if needed. Some color sets require 2 supplies for alignment. Priced at \$7.85. Service Instruments Co., 171 Official Road, Addison, Ill. (TECHNICIAN No. 7-30)

Leitch AUTOMATIC METER

New Meter-Matic automatic vtvm, model 21-56 "Compact," retains all features of prototype model 20-55, including automatic range-switching and scale indicator lights, direct reading without zero multipliers, and burn-out protection up to 2000 volts. Measures ac and dc from 1 to 1500 volts. Permits automatic reading from .5 to 1 billion ohms in 6 ranges. On ohms, unit is protected against application of voltages up to 300, ac or dc. Sells for \$149.50. Leitch Engineering Corp., 326 Lincoln St., Manchester, N. H. (TECHNICIAN No. 7-31)

Seco GRID TESTER

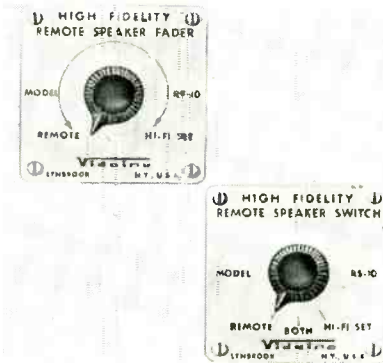
Model GCT-5, now in kit form, will test over 125 tube types for control-grid emission, grid-cathode shorts, gas and cathode-heater shorts. Features include 7 wired sockets and 1 spare (for expansion and special adaptation) and a replaceable panel etched with tube lists. Sensitivity is as follows: Grid emission .35 microwatts; grid-cathode leakage: 125 megs; gaseous condition: 125 megs; grid to plate or screen: 125-250 megs; Cathode-heater leakage: 1 meg: plate or screen to suppress: .1 meg. List, \$19.95. Seco Mfg. Co., 5015 Penn. Ave. South, Minneapolis, Minn. (TECHNICIAN No. 7-28)

For more technical information on new products, use inquiry coupon on page 40

New Audio Products

Vidaire SWITCH & FADER →

Remote speaker switch, Model RS-10 and a remote speaker fader, Model RF-10. The RS-10 (right) and RF-10 (left) are used where an additional speaker is added to the Hi-Fi system. The switch is a 3-position type which will turn either the remote or Hi-Fi speaker on or off or will turn both on. The 10-watt fader will control the volume level from either the remote or Hi-Fi speaker. Both are mounted on heavy gauge gold embossed plates for panel mounting. Vidaire Electronics Mfg. Corp., Lynbrook, N.J. (TECHNICIAN No. 7-42)



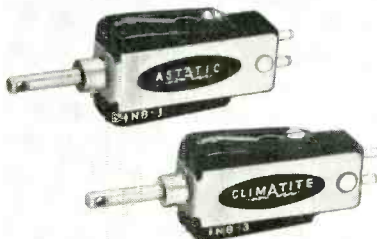
Electrovox MICROSCOPE →

Any service shop can be turned into a complete needle clinic with the new microscope needle merchandiser display. It enables the customer to see the worn condition of his needle, demonstrating the damage it causes his records. The display is available to all Walco needle dealers. It consists of an illuminated 100 power precision microscope on a storage base, and two lighted lucite needle replicas depicting a new and a worn needle. Electrovox Co., Inc., 60 Franklin St., East Orange, N.J. (TECHNICIAN No. 7-41)



Astatic CARTRIDGES →

"Climatite" phono cartridges are weatherproofed for use in areas of extreme cold, heat or humidity. Model 420ts is a high output, high compliance, wide range turnover unit with removable 1- and 3-mil sapphire needles. Other replacement models are: 310T, 3-v. output, 0.7 compliance, frequency response 50 to 12,000 cps; 312T, 0.8-v. output, extremely high compliance of 2, response 30 to 15,000 cps; 414-1, for 45 rpm changers, same specs as 310T. Astatic Corp., Conneaut, Ohio. (TECHNICIAN No. 7-40)



Fedtro "PRIVATE-LEE" →

Private listening device is installed in minutes on TV, radio or phonograph simply by breaking into one speaker lead and connecting to second lead. In operation it can either cut off main speaker, or leave it on when device is used as an aid for hard of hearing. Comes complete with volume control and jack box, earphone and cable for listening up to 20 ft. from set. Two people can use Private-Lee by plugging second earphone into extra jack on control unit. Federal Electronics, Rockville Centre, N.Y. (TECHNICIAN No. 7-43)



University "DIFFAXIAL"

"Diffaxial Family" of speakers are unitary assemblies containing two or three radiators integrated to give two- or three-way performance. The split-range performance of the 2-way Diffaxial is obtained through the mechanical parameters designed into the woofer and patented Diffusicone sections to achieve mechano-acoustical crossover characteristics. In the 3-way Diffaxial, the added element is a top-range compression driver tweeter coupled to a "reciprocating flare" horn. University Loudspeakers, Inc., 80 South Kensico Ave., White Plains, N.Y. (TECHNICIAN No. 7-47)

Electro-Voice MIKE

Model 649 miniature lavalier dynamic microphone is extremely small, only 2 1/16 in. long x 3/4 in. diam., yet provides efficient pick-up. It is omnidirectional, can be hung on a neck cord close to chest, and is ideal for concealment, individual mobility, or free movement of the hands. Response is uniform from 70 to 13,000 cps. Weighs only 1.3 ounces. Supplied with 30-ft. three-conductor shielded cable, neck cord assembly and belt strain relief clip. List price, \$115.00. Electro-Voice, Inc., Buchanan, Mich. (TECHNICIAN No. 7-44)

Robins TAPE SPLICER

"Gibson Girl Semi-Pro" SP-4 tape splicer, which is designed for semi-professional and amateur use, miter cuts and trims the tape splice without scissors or razor blades. It consists of a tape guide which may be fastened on recorder and a hand held splicer which has two different cutting actions. "Gibson Girl" describes the appearance of the tape splice, which forms a slight "waist" in the tape. This prevents adhesive from contacting critical parts of the recorder and prevents layer to layer tape adhesion. (TECHNICIAN No. 7-45)

Jensen LOUDSPEAKERS

Comprehensive line of loudspeakers designed for commercial sound systems includes more than 60 items. The new line, known as Professional Services, includes a group of interchangeable Hypex driver units for horn type projectors with 30, 40 and 100 watt ratings. Another product is a rectangular horn designed for stacking. There is also a group of 2-way and 3-way unitary hi-fi loudspeakers for better sound in buildings as well as out-of-doors. Jensen Mfg. Co., 6601 S. Laramie, Chicago 38, Ill. (TECHNICIAN No. 7-46)

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Hi-Fi Tests with Scope

(Continued from page 31)

til something fails completely. The Hi-Fi fan is just the opposite of this: he is all the while extremely critical of the quality of reproduction and uses quite a number of terms, which may at first be strange to the technician, to describe the deficiencies in this quality. Sometimes the terms are used correctly and sometimes incorrectly.

To give satisfaction to the audiophile, the first thing necessary is to know what the various specialized terms mean, so that we can understand what he means and know what to listen for. We have to cultivate a critical listening ear. While it is certainly advantageous to have some special test equipment, specifically designed for high fidelity equipment, much can be done with equipment which the average technician already has.

Use of Oscilloscope

The oscilloscope, for example, can be a useful trouble tracer in the Hi-Fi system, and it seldom fails to impress the owner with the technician's efficiency. So, if you get a call from a Hi-Fi owner saying that the system does not sound right, take your scope along with you and examine waveforms at different points in the system.

I say "take along" advisedly. Many technicians prefer to bring all TV and radio service jobs in to the shop. However, when servicing Hi-Fi systems, unless there is a definite or complete failure, it is advisable to go and listen to the system *where it*

is installed. Then, when the trouble has been localized to a particular unit, this can be removed to the shop for further work if necessary.

The problem of portability of the instrument need not be great. Since the highest audible frequency does not exceed 20,000 cps (although test frequencies of interest may be somewhat higher) the portable and other small narrow-band oscilloscopes, many of which are in use today, are entirely adequate.

Music Waveforms

While a standardized test signal, obtained from some kind of audio signal generator is ideal for making tests, some very useful checks can be performed on normal program material—some kind of music recording—which can be used as standard. Choose a recording with which you are familiar, so you know what it should sound like. With a little experience you will also get to know what it should look like on the oscilloscope screen.

Fig. 1 represents a single audio trace on the screen at a time-base frequency of 100 to 150 cps. The lowest frequency present shows one cycle, while two higher groups of frequencies are discernable: one that causes the ripply effect on the large waveform consisting of "middle frequencies" in the 500 to 1000 cps region and then a still higher group—the "highs"—that cause the "fuzz" on top of this.

Fig. 2 shows the same waveform practically denuded of the fuzz. This is due to loss of the extreme high frequencies. The average listener would probably not notice the difference, but the high fidelity enthusiast will quickly tell you it has lost the "highs".

Fig. 3 shows an opposite effect which can also happen. Here the fuzz frequencies have become exaggerated and the resulting sound (excessive treble) is extremely "edgy" or harsh.

Fig. 4 shows another variation. This time the low frequencies are deficient. Notice that the relation between the upper fuzz frequency and the intermediate ripple is about the same as in Fig. 1, but the major up and down deviation, of which there is only one cycle, is considerably less, indicating a loss of the lowest frequency present.

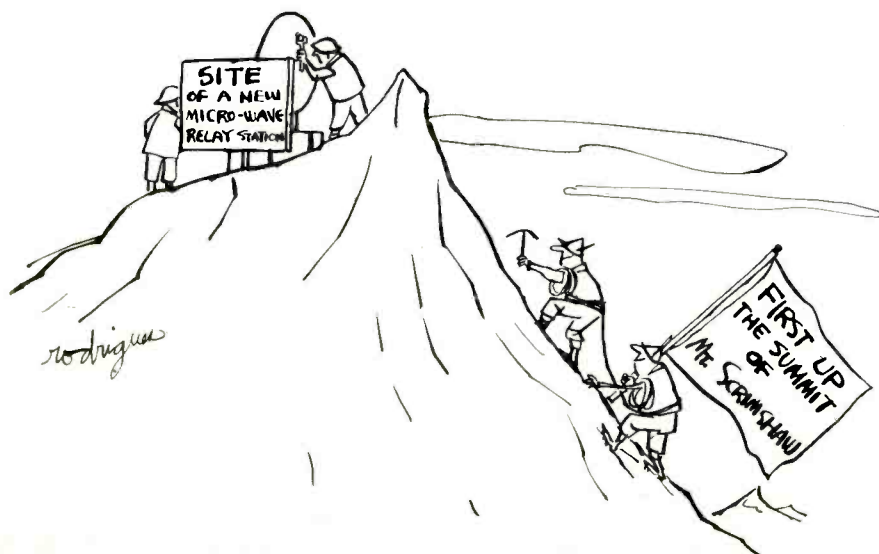
The reverse of this is shown at Fig. 5 where the lowest frequency is overemphasized and the remaining frequencies seem small in comparison. This condition of excessive bass may also be described by the audiophile as boomy or dull.

Separate-Channel Check

If a system sounds good on one kind of program material but not on another, for example, maybe the phono is good but the radio is poor (or vice versa), then the scope can be used to trace the audio through whichever channel or unit seems to be poor to determine at what point the deficient or excessive response shows up. If the waveform at the input to an amplifier is the same as that at the output (when the scope amplitude control is adjusted) this exonerates the amplifier and search for the defective response must be taken back a stage further to the unit that precedes it—either the radio tuner or the pickup preamp.

In this way the cause of faulty reproduction is traced down in the same way as signal tracing in an ordinary radio receiver, the big difference being that, instead of finding where the signal ceases entirely, you look for the point where the *quality changes*.

Sometimes, of course, the quality *should* change, as for example in going through an equalizer or tone control circuit. In this case it is necessary to check that the change produced conforms with the requirements set. There are also other deficiencies in quality which cannot be simply explained in terms of excess or loss of the lower or upper frequencies. These require a little more careful checking, but this too can be done by quite simple methods when you know exactly what you are looking for. This, as well as detailed procedure for tracking down excess or loss of low and high frequencies, we shall discuss in detail in further articles. •



Catalogs & Bulletins

INTER ACTION FILTER: Technical data and applications of filter which ties together VHF and UHF antennas for use with a single transmission line. May also separate UHF and VHF signals at the TV set or converter where separate terminals are provided. Channel Master Corp., Ellenville, N.Y. (TECHNICIAN No. B7-3)

TUBE LAYOUTS: Tube replacement information with notes on how to locate an open filament tube and how to use receiver controls. Tube layout charts suitable for wall mounting. Westinghouse Electric Corp., TV-Radio Div., Metuchen, N.J. (TECHNICIAN No. B7-5)

ELECTRONICS TESTING: Illustrative bulletin describes new test instruments including a temperature meter with 3 test probes and an in-circuit capacitor leakage tester. Simpson Electric Co., 5200 W. Kinzie, Chicago 44, Ill. (TECHNICIAN No. B7-6)

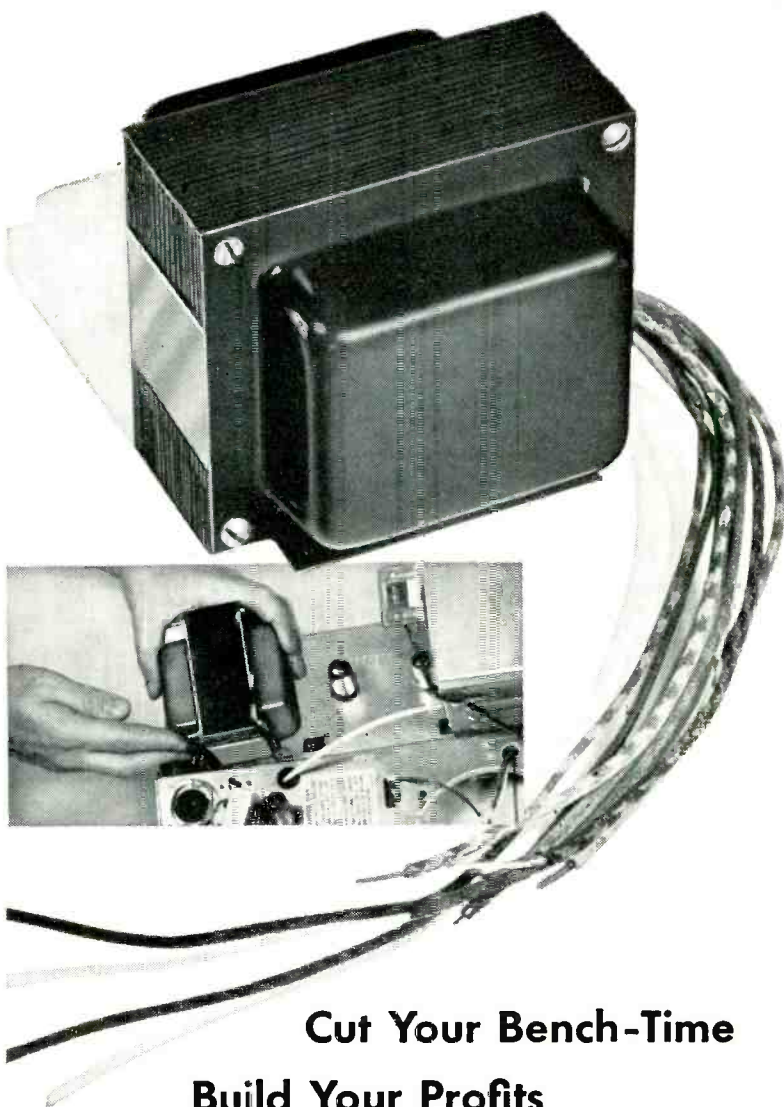
TEST EQUIPMENT: Uses and applications of test equipment calibrator and video-generator given in new bulletins. B & K Manufacturing Co., 3726 N. Southport Ave., Chicago 13, Ill. (TECHNICIAN No. B7-11)

GENERATOR: Universal Color Bar and Dot Bar Generator Model 7100 described with specifications, general operating instructions, color charts to aid in applications, and circuit descriptions. Philco Corp., Accessory Div., Philadelphia 34, Pa. (TECHNICIAN No. B7-13)

TRANSFORMER GENERAL CATALOG: Illustrates and describes nearly 700 items, 76 of which are new to the line. Catalog TR-56 available from Triad jobbers, or Triad Transformer Corp., 4055 Redwood Ave., Venice Calif. (TECHNICIAN No. B7-18)

RESISTORS: Comprehensive data on types, construction, tolerance, dimensions, temperature coefficient, derating, etc., with detailed charts and graphs. Data Bulletin B-5. 4 pages. International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa. (TECHNICIAN No. B7-20)

AUTO SPEAKERS: Bulletin "How To Make Big Profits Selling Rear Seat Speakers" outlines for dealers a step-by-step method to boost speaker sales and add to profits. Also available is a new Delco speaker catalog. United Motors Service, General Motors Building, Detroit 2, Mich. (TECHNICIAN No. B7-2)



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Let's Look at Circuits

(Continued from page 38)

are out of phase with the amplified output at the plate (waveform B).

Since we made such a point of explaining how the tube turns the signal upside down, there may be some confusion as to how it has been turned right side up again at the cathode. It hasn't. Another reference to the last installment should clear up any doubts. We discovered that tube current and thus the drop across the plate load resistor were in phase with the input voltage. It is only in the tube itself that we discovered the out-of-step condition. Like R_L , R_K is outside the tube and in series with it. As with R_L , the in-phase tube current passing through R_K produces an in-phase voltage drop across the latter.

The existence of this additional drop has its effect on the output signal. Output reflects conditions between point B and ground. Before we complicated the stage with another resistor, this output included nothing more than what was occurring in the tube. Now waveform B is no longer the entire output, but just a picture of conditions across the tube, from point B to point D. Since output is from point B to ground, including action across the cathode load, we must add waveform B to waveform D to get the complete output, waveform C. Since D is exactly out of phase or negative with respect to B, it cancels out part of B in the combined output, or reduces it in amplitude, as shown in Fig. 2. In effect, we have introduced some degeneration or negative feedback. Thus, to obtain the advantages of a cathode resistor, we have had to sacrifice some gain.

In this connection, note that the figures given for the amplitudes of

the various waveforms are only approximate. Actually, introduction of the cathode load will have its effect on the balance of the entire stage, so that even the amplitude of waveform B and the voltage values around the stage will be slightly altered. However, such factors are best ignored at present, since they do not alter anything in principle. Essentially, R_K has reduced the output from a peak-to-peak amplitude of about 10 volts to one of about 9 volts.

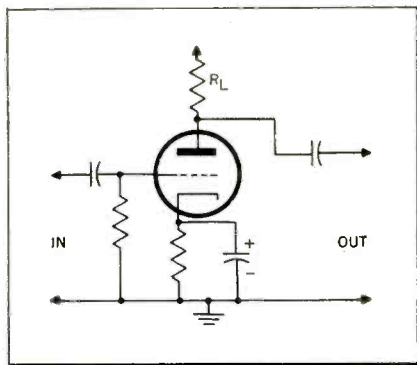


Fig. 3—The cathode bypass capacitor added.

If we wish, we can take advantage of the cathode resistor without having to put up with degeneration. To accomplish this, we only have to shunt a suitable capacitor across the cathode resistor, as in Fig. 3. The r-c network thus formed in the cathode acts as a filter, smoothing out the signal drop (ac) to produce a steady dc bias voltage, rather than one varying out of phase with the voltage across the tube. No degeneration can now take place.

However, if we want the amplifier to work well at low frequencies, the capacitance will have to be made very large or eliminated altogether. Otherwise, degeneration will continue to take place at these extreme low frequencies, which are not readily bypassed by the capacitor, and we will not have flat response at the low end. If this flat response is

important, we may have to forget about the bypass capacitor. This practice is actually followed, for example, in high-fidelity amplifier design. A check of the circuit for the Williamson and other well-known quality audio amplifiers will show that these bypass capacitors are either not used at all or confined to the push-pull output stage.

Fortunately, the signal present at the cathode can be more than just a nuisance that must be eliminated or tolerated. There are cases in which we actually welcome its presence and take advantage of it. We will consider some of these next. •

Next installment: Split-load phase inverters and cathode followers.

Tough Dogs

(Continued from page 37)

ages in the horizontal oscillator, output and damper circuits. All were very close to normal.

In other voltage measuring, I found very low readings in the vertical oscillator and output stages. Since the voltage used for these stages is the boosted B-plus, I went back to the damper circuit, but voltage and resistance readings in these stages were still okay. In the course of troubleshooting, I noted a very peculiar thing: just a light tapping on the picture tube caused the vertical oscillator to quit functioning. The voltage on the vertical oscillator plate would then drop near zero, and all other voltages in the vertical stages were thrown off.

All bypass capacitors in these stages were checked for intermittent shorting. The yoke was checked by substitution. No difference. In fact, everything else I tried gave the same result. I was about ready to start wholesale replacement of parts when one of the other men in the shop jokingly suggested that I needed a new picture tube (the old one had been checked out by the tester-rejuvenator). By this time I was ready to try anything. Lo and behold, with a new picture tube in place the set worked perfectly.

A check on the old tube with a megohmmeter showed a very high resistance between the high-voltage anode and the second grid. Boosted B-plus supplies this point and the retrace blanking network also ties in here. Presumably, the element was leaking enough to darken the raster and short out the voltages in the vertical stages.—Curtis Brovald, Jamestown, North Dakota.



You and the Law

(Continued from page 33)

est degree of protection, does not mean that the person in control will fulfill his duty toward the technician. But it does mean that, if the technician is injured, he will have a better chance of recovering. Therefore, it is important that the technician do everything possible to establish himself as a business visitor and to maintain himself in that category.

Of first importance is that the technician should be a business visitor from the start. He is, if he goes on the property for a purpose connected both with his job as a technician and with any purpose for which the person in control uses the property. Examples of common purposes are to pick up or deliver parts or sets, to inspect faulty equipment, to make repairs and to install new equipment or replacements. Make sure that the person in control has requested, by his words or actions, that the technician is to go on the property for the stated business purpose. This warning applies even when arrangements are made with technician's employer.

Once on the property as a business visitor, the technician must be sure that he stays in that category. In addition to the ways of slipping into other categories already mentioned in defining a licensee, one will also lose his classification of business visitor by leaving the parts of the property which related to the business purpose at hand. Of course, the technician is entitled to a safe entrance and exit. Normally the technician is protected in his rights as a business visitor whenever he is on area entered with the consent of the person in control as, for example, when the technician is tracing wires or putting up an aerial. But he loses his business visitor's rights when he goes to a part of the property for a personal reason; this limitation probably applies to use of toilet facilities, for example.

Although the law grants the technician a safe place to work, it does not hold the person in control responsible for injuries resulting from defects in the very machine on which the technician is working. The technician himself is supposed to know the dangers of his work and guard against them. The distinction is that the person in control

is responsible for making the premises safe, but not for making the television set safe.

Other limitations on the technician's rights as a business visitor are that the person in control is not responsible for injuries resulting from unknown defects which he could not have discovered by making a reasonable inspection. Neither is he responsible for dangers known or reasonably apparent to the business visitor. For example, an electrician could not recover for injuries sustained when in broad daylight he fell in a trench while trying to

leap across it. Neither can one recover damages when his injuries result from his going into a strange place in the dark.

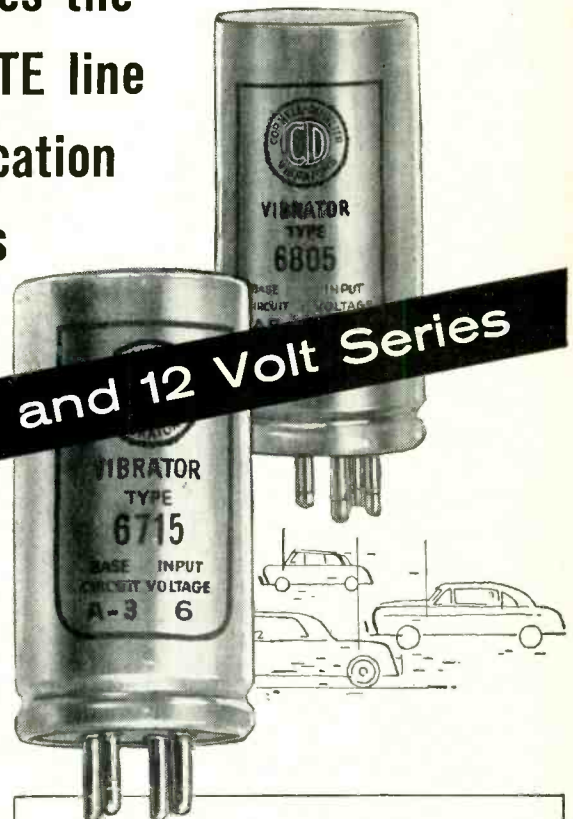
Finally, the person in control is not responsible for harm caused by someone not under his control. Related is the situation where control of the property passes to some one else before the injury occurs. In this connection, be sure that you know you are making your arrangements with the same person each time and that he is the person in control or is an authorized agent of the person in control. •

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1L84	1.00	6AV5GT	1.25	7N7	.95
1L05	1.00	6AV6	.60	7O7	1.00
1L06	1.00	6AU3GT	.90	7P7	1.30
1L03	1.00	6AX4GT	.90	7Y7	1.30
1L03	1.00	6AX5GT	.90	7Z7	1.30
1L05	1.00	6BA6	.70	7Y1	.70
1LH4	1.00	6B07A	1.60	7A1	.70
1LW5	1.00	6BC4	.75	7A1	.85
1N5GT	.95	6BC5	.75	7A1	.85
1O5GT	1.15	6BC7	1.25	7A15	.70
1R4	1.00	6BD5	1.40	7A05	.75
1R5	.85	6B06	1.15	7A16	.65
1R4	.90	6B6	.75	7A17	1.00
1S5	.75	6BF5	.90	7A06	.70
1T4	.85	6BF6	.70	7A07	.85
1T5GT	1.05	6B06G	1.85	7A06	.65
1U4	.80	6B07	.90	7A07	1.05
1U5	.75	6B16	.85	7A06	1.00
1V	.95	6BK5	1.15	7A0XGT	1.00
1V2	.70	6BK7A	1.15	7A0X7	.90
1X2B	1.00	6BL7GT	1.25	7A07	1.15
2AF1A	1.40	6BN6	1.15	7A27	.95
2D21	1.00	6B06GTA	1.45	7B1A	.90
2X2	.50	6B07A	1.30	7B0A6	.70
3A3	1.10	6BX7GT	1.25	7A07	.95
3A4	.55	6BY5G	1.30	7B06	.75
3A5	.75	6B26	.80	7B06	.75
3AL5	.70	6B27	1.35	7B06	.70
3AU6	.75	6C1	.60	7B07A	1.00
3AV6	.65	6C5	.80	7B0K	1.10
3BA6	.75	6CB5	4.50	7B06GTB	1.45
3BC5	.80	6C6	.75	7B0X7	.90
3BE6	.75	6C06G	1.90	7B07A	1.05
3BN6	1.05	6CF6	.90	7B27	1.10
3BY6	.90	6CG7	.90	7C0A5	.80
3B26	.80	6CL6	1.20	7C0C6	1.45
3CB6	.85	6CM6	.85	7C16	1.30
3CF6	.85	6CS6	.75	7S0A7GT	1.00
3CS6	.80	6C06	1.45	7C5C7	.95
3LF4	1.20	6D06	.95	7C17	.75
3O1	.80	6D06	.85	7S0K7GT	.80
3O5GT	1.00	6F5	.85	7S0L7GT	1.00
3S4	.80	6F6G	.80	7S0N7GTA	.85
3V4	.85	6H6	.75	7S07GT	.75
4B07A	1.30	6H4	.95	7S0VGT	.80
4B27	1.35	6I5	.75	7S0WGT	.95
5AN8	1.05	6I6	.70	7A1	1.00
5AN8	1.10	6I7	.95	7A45	1.50
5A05	.75	6K6GT	.75	7A47	.85
5A58	1.10	6K7	.80	7A47	1.00
5A78	1.10	6K8	1.25	7B86	.85
5AY8	1.15	6L6G	1.35	7A47	1.00
5AW4	1.15	6L6GA	1.30	7A46	1.20
5AZ4	.60	6L6M	1.35	7A47	1.30
5B07	1.10	6N7	1.20	7A47	1.00
5I6	.95	6O7	1.00	7A48	1.30
5T4	1.75	6S4	.70	7A47	1.00
5T8	1.10	6S8GT	1.10	7A47	1.00
5U4G	.70	6S4GT	.90	7A47	.95
5U4GB	.75	6S57	1.00	7A47	1.30
5U8	1.10	6S75	.75	7A57	1.25
5V4G	1.00	6S7	1.00	7A47	1.35
5V6GT	.70	6S7	1.00	7A47	1.20
5W1GT	.70	6S7M	.95	25A44GT	1.30
5X1G	.80	6S7M	.85	25BK5	1.10
5X8	1.05	6S7GT	.85	25B06GT	1.15
5Y3GT	.60	6S7GT	1.00	25C06GA	1.85
5Y4G	.65	6S07GT	.75	25C06	1.45
5Z3	.90	6S7	.75	25L66GT	.75
5Z4	1.25	6S7	1.00	25W1GT	.85
6A7	1.15	6V3A	1.50	25Z5	.80
6ARM	1.10	6T8	1.10	25Z6GT	.85
6A8GT	.70	6T8	1.10	35A5	.75
6AB1	.70	6V6	.75	35B5	.70
6AC5GT	1.15	6V6GT	.75	35Z5	.70
6AC7	1.15	6V6M	1.35	35L6GT	.65
6AD7G	1.55	6W1GT	.80	35W4	.55
6AF4	1.35	6W6GT	.95	35Y4	.75
6AF6G	1.20	6X1	.55	35Z5	.60
6AG5	.80	6X8	1.20	41	.85
6AG7	1.35	6X5GT	.55	42	.75
6AH4GT	1.00	6X8	1.20	43	.85
6AH6V	1.05	6Y6G	.95	50A5	.75
6A15	1.75	7A5	.95	50B5	.75
6AK5	.80	7A6	.85	50C5	.75
6AK6	.80	7A7	.85	50L6GT	.75
6AL5	.65	7A8	.80	50M6GT	.90
6AL7GT	1.65	7A7	1.00	50Y6GT	1.00
6AM4	1.55	7A7	1.00	50V7GT	.90
6AN8	1.15	7B1	.80	70L7GT	1.25
6AN4	1.50	7B5	.80	80	.65
6AN5	3.50	7B6	1.00	117L7GT	2.50
6AN8	1.20	7B7	.80	117N7GT	2.00
6AN5	.75	7B8	.90	117P7GT	2.00
6A06	.60	7C5	.80	117Z3	.80
6A07GT	1.25	7C6	1.00	117Z4GT	1.15
6AR5	.75	7C7	.85	117Z6GT	1.15
6AS5	.80			5642	1.00

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Association News

ESFETA Annual Meeting

Delegates and observers from 5 N. Y. State groups attended the 8th annual meeting of the Empire State Federation of Electronic Technicians Associations, in Binghamton.

Progress of self-licensing plans, like that of Jamestown's ETA and Long Island's RTG, were discussed, with consideration given to the possibility of making the self-licensing program state-wide.

Annual elections returned the following officers: Gordon Vrooman (Syracuse TTA), president; Harold Hazzard (Binghamton, Southern Tier Chapter, RSA), vice-president; John A. Wheaton (RTGLI), secretary; Pat Pratt (RTSA of Western N. Y.), treasurer; Herman Seehausen (ETA of Jamestown), sergeant at arms.

Indiana Group Formed

The Indiana Television Technicians Ass'n, 2912 Clifton, Indianapolis, Ind., is a recently formed state-wide group that includes several local organizations as members. Officers include Robert R. Sickels, president, and Edward T. Carroll, Secretary.

ARTS Incorporates

The Associated Radio & Television Servicemen, 433 S. Wabash Ave., Chicago 5, Ill., has been incorporated under the laws of its home state. A minor name change was also involved, with the new name being Associated Radio & Television Servicemen, Illinois. ARTS begins its fourth year of existence with all charter members but one still in the fold.

NATESA Tax Stand

A letter concerning H.R. 10833, introduced in the House of Representatives, was sent to the bill's sponsor, Rep. Simpson, by NATESA president Frank Moch. The bill is designed to give tax relief for businesses with prepaid income (e.g.; prepaid service contracts). Moch asks that the measure be broadened to include the radio-TV-electronic service industry.

With no changes, present law will require that service dealers pay full tax on the sum collected. Revised legislation would permit the dealer to pay as he goes on the basis of profits derived from such prepayments, after expenses are deducted.



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ARTSNY Color Clinics

Following the success it has enjoyed with its monochrome TV clinics, Associated Radio-Television Servicemen of N. Y. has established a color clinic. The latter will be held at 220 Knickerbocker Ave., Brooklyn, former location for the black-and-white clinic. The monochrome clinic will be continued at another address, 663 Washington Ave., Brooklyn. Meetings for both clinics will be Wednesday nights. Manhattan clinic meetings were suspended until larger quarters could be found.

TSDA Invites Distribs

In an open letter to all distributors in its area, the Television Service Dealers Ass'n, 5016 York Rd., Philadelphia 41, Penna., is inviting the wholesalers to its meetings to iron out conflicts on wholesale-retail matters and cement better relations in general. TSDA asks distribs to make advance arrangements for such attendance, to avoid having two or more of them attend the same meeting, where each would not feel free to discuss his policies in the presence of competitors.

(Continued on page 51)

25 Years of Growth

The remarkable expansion of the TV-radio-electronic industry over the past quarter century is unparalleled in any field. From a \$150-million dollar industry it has mushroomed into an \$8-billion industry.

It is appropriate, therefore, to examine the rise of one 25-year-old company, Snyder Mfg. Co., and see how its growth reflects the industry's expansion.

In 1931, during the frustrating and disheartening early period of the Great Depression, brothers Ben and Gus Snyder founded their company. They had little money, just one employee, and an 18-ft. store front. Snyder was making radio aerials in quantity for jobbers and chain stores, and as the industry grew by 1935, they moved to larger quarters.

1937 was a significant year. The company developed the triangle grille guard for autos, launching them into mass production.



Gus Snyder



Ben Snyder

The 1941-45 period saw the entire electronic industry devote its efforts to war work, and Snyder was no exception. They kept radio gear flowing to the armed services and our allies. The 40,000 sq. ft. of plant space was proving inadequate, and in 1946, with civilian products being turned out, was expanded to 75,000 sq. ft.

1948 saw Snyder's entry in the TV antenna field, and by 1950 the company was among the top producers in the field. New antenna designs were developed, and plant size increased. In 1952 Janoco was added as an affiliate to handle export packing and subassemblies for military products. During 1953-55 still more affiliates were added: Bellevue Tube Mill, Inc., for fabricating tubing, and Snyder Antenn-Gineers, Ltd., in Canada to produce for that market.

Now, in 1956, Snyder is celebrating its Sterling Jubilee with continued expansion . . . a new plant in Los Angeles.

In like fashion, the TV-radio-electronic industry has grown. The brilliant engineers, the enterprising manufacturers, the astute jobbers and the skilled technicians . . . all have done their part.

Association News

(Continued from page 50)

TV Service and Unions

A recent issue of *TV Flashes*, organ of the Television Radio Ass'n of Alameda County, 4223 E. 14th St., Oakland, Calif., carries an article on organized labor and the TV service industry. Author is Edward Bird, Secretary of Local 202, International Brotherhood of Electrical Workers.

Bird believes that the problems of the employing dealer and his employed technicians are basically similar, to the extent that industry problems cannot be worked out without both elements working together.

He says in part: "Show me a prosperous industry and I will show you three attributes pertinent to that prosperity: One, a strong employer organization; and two, a strong union organization; and three, a co-operative effort on the part of both to raise the standards of their common trade."

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Ask for **QUAM**
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speakers.

The performance of a set can be no better than the performance of its loudspeaker—and QUAM speakers will make any set sound better—because of their patented design, heavier magnetic structures, and because a QUAM replacement speaker is an exact replacement—designed to do a specific job.

That's why servicemen all over the country have named QUAM their preferred brand of replacement speaker, by a wide margin (Brand Name Surveys, April, 1954).

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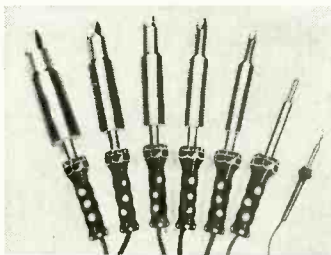
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THERMOSTATIC ACTION...

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Prevents excessive tip burning!

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soldering irons of equal tip size

Proved 4 times faster on the production lines of America's leading electronics firms. Complete range of sizes... scientifically designed... individually tested... for easier, surer precision work or heavy duty soldering. Operate on 110-120 volts, AC or DC! Model 18T illustrated, \$6.25 list.



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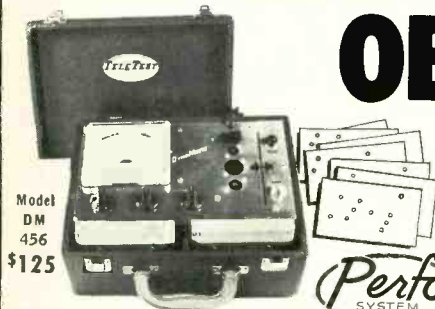


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New PERFO System TV tube tester

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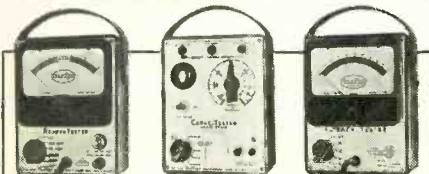
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\$125

DynaMatic tube tester uses perforated plastic cards to automatically set up socket pin connections & test voltages.

For the first time AUTOMATION comes to TV service! No more waiting for new roll charts for 6 months to a year, every time new tubes come out. And no more multiple socket panels that become obsolete as soon as a new tube is made. The DynaMatic's 'PERFO-System' allows you to test the newest tubes and all future tubes as soon as they're out!

- Speed! Tests complete set of tubes in 15 minutes!
- Compact! Smallest and lightest mutual conductance tester made! Easy to carry.
- Permits full-complement tube testing which must result in increased tube sales

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AT YOUR
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IN SEPT.



REJUVANESTER
RT-203
A CRT tester and rejuvenator in one compact featherweight unit!

CAPACITESTER
CT-355
Checks coupling condensers, under load, without removal from the circuit.

FLYBACK TESTER
FT-100
Doesn't require a reference transformer for comparison.

TELETEST

Teletest Instrument Corporation

121-08 14th Road
College Point 56, New York

Reps & Distributors

(Continued from page 21)

DYNAMIC ELECTRONICS, New York, has announced the firms handling its nation-wide distribution. They include A. T. R. ARMSTRONG, LTD., LEON S. BUSH CO., HERBERT L. DIENES CO., GENE FORRESTER, JACK FIELDS SALES CO., SAM W. HART CO., W. R. HEMMINGER, ROY M. HOWARD SALES CO., NORMAN MAC INNIS, PAT QUINN, and VICTORIA SALES CO.

The JACK FIELDS SALES CO. has been appointed rep for **H. H. SCOTT** in the New York Metropolitan Area and New Jersey.

SHIELDING, INC., N. J., has appointed **WILLIAMS & ASSOC.** as sales rep for Colorado and New Mexico.

The DAVE M. LEE CO., northwest sales rep for **INTERNATIONAL RESISTANCE CO.** was awarded National Championship for IRC Distributor Sales in 1955.

The **CHICAGOLAND CHAPTER** of "THE REPRESENTATIVES" elected the following officers for the 1956-7 term: JOE ROSE, WALTER SPARF, WILLIAM J. DOYLE, RINGLAND KRUEGER, CLAUDE BOOTH, and RUSS DIERTHERT.

The **EMPIRE STATE CHAPTER** of "THE REPRESENTATIVES" elected JOSEPH MARSEY of Rochester to the national board of governors.

The **ASTATIC CORP.**, Ohio, has held a series of 2-day seminars for Astatic rep organizations.

REGENCY DIVISION, I.D.E.A., INC., has appointed MITCHELL & MORRIS, Indianapolis, as rep for the Indiana-Western Kentucky territory.

The **AUDIO COMPONENTS REPRESENTATIVES ASSN.** held its first annual elections at the April meeting.



"I tell you, I don't think he's to be trusted! —I just heard him mumble something about a CHEATER cord!"

Square-Wave Generator

(Continued from page 35)

tion when using this type of test.

When a scope connection is at the output transformer of an audio amplifier being checked with square waves, a speaker or dummy load must be used across the secondary of the transformer to prevent oscillation.

Square waves are usually associated in TV work with the video amplifier. Frequencies recommended for a complete video amplifier response check would be from 50 cps to over 400 kc. However, a service technician is not a designer and, for most practical servicing (restoring a TV set to its original condition) 50 cps to 10 kc would be adequate. This fact is further emphasized by the limitations of scope bandwidth. The low-frequency square wave is a fast and effective tool when troubleshooting a video amplifier. The generator output is applied to the video detector output electrode and the scope probe connected to the control electrode (can be cathode or grid) of the picture tube. The probe is then moved back towards the input, taking response checks at each end of the various components. A defective component will normally give a pronounced change in wave-shape when bypassed by the probe.

An emergency video alignment has been made with no other equipment than a square-wave modulated r-f source! More civilized uses include sync circuit checks, linearity adjustment, and sensitivity tests. The important thing is to use a square-wave generator. Within a very short time you will be finding more and more time-saving shortcuts to better and faster service work. ●

Film on Washer Service

A 20-min. color-and-sound slide film for use by organizations doing appliance servicing treats everyday problems encountered in the service of automatic washing machines. The film has been produced by and is available from the Monsanto Chemical Co. Interested service organizations should communicate by phone or letter with Monsanto's Consumer Products Div., with offices in New York, Philadelphia, Boston, Atlanta, Columbus, Chicago, Kansas City, Dallas, San Francisco and Los Angeles.

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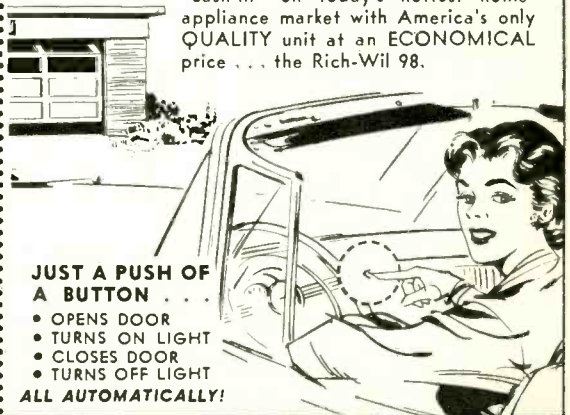
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FOR RESIDENTIAL GARAGE DOORS PROVIDE TODAY'S GREATEST OPPORTUNITY FOR:

- YEAR 'ROUND SALES
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Now you can offer the modern, practical way to eliminate the minor irritations and "back-breaking" lifting involved in opening and closing garage doors . . . sell the Rich-Wil 98 Electric Operator with remote controls. Fits all 8' to 18' one piece or sectional doors with track-type hardware. Now's the time to "cash-in" on today's hottest home-appliance market with America's only QUALITY unit at an ECONOMICAL price . . . the Rich-Wil 98.



JUST A PUSH OF A BUTTON . . .

- OPENS DOOR
- TURNS ON LIGHT
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- TURNS OFF LIGHT

ALL AUTOMATICALLY!

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for service and lab. work

Heathkit PRINTED CIRCUIT OSCILLOSCOPE KIT FOR COLOR TVI

① Check the outstanding engineering design of this modern printed circuit Scope. Designed for color TV work, ideal for critical Laboratory applications. Frequency response essentially flat from 5 cycles to 5 Mc down only 1½ db at 3.58 Mc (TV color burst sync frequency). Down only 5 db at 5 Mc. New sweep generator 20-500,000 cycles, 5 times the range usually offered. Will sync wave form display up to 5 Mc and better. Printed circuit boards stabilize performance specifications and cut assembly time in half. Formerly available only in costly Lab type Scope. Features horizontal trace expansion for observation of pulse detail — retrace blanking amplifier — voltage regulated power supply — 3 step frequency compensated vertical input — low capacity nylon bushings on panel terminals — plus a host of other fine features. Combines peak performance and fine engineering features with low kit cost!

Heathkit TV

SWEEP GENERATOR KIT ELECTRONIC SWEEP SYSTEM

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

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Versatile Soldering Gun

(Continued from page 36)

manium diodes, is a ticklish business, as crystals may be damaged by excessive heat. The controlled heat available from a gun eases this problem.

For outdoor use, the soldering gun is advantageous in skinning two-conductor 300-ohm lead-in wire (Fig. 6). The gun maintains its heat where the ordinary iron cools because the latter has a larger area exposed to the wind.

When handling hearing aids, mid-get radios, and mobile radios, the gun provides the advantages of accessibility to tight spots in compact equipment, speed in rush jobs, and performance under adverse weather conditions in emergency repairs.

The handy tool is also useful for repairing damage to plastic radio cases, especially where damage in the hinge area is involved. Also, many a chipped or broken control knob has been prevented from reaching the trash bin by a technician with gun in hand. There are countless jobs where nothing else can take the place of the gun. •

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Absolutely non-corrosive and non-conductive, KESTER "RESIN-FIVE" CORE SOLDER contains an activated type of resin that gives you that fast, positive action on all your jobs . . . including the most difficult.

"Op. 25" for Raytheon Bonded



All service tech members of Raytheon's Bonded Electronic Technician Program are being listed nationally with Western Union "Operator 25," who will tell customer name of nearest Bonded tech. Ad campaign in "TV Guide" and other promotion urge viewers to call OP. 25. Discussing business boosting program are (l to r) F. E. Anderson, Raytheon distributor sales manager; F. E. Moran of Western Union; Op. 25; E. I. Montague of Raytheon's tube operations.

MINIATURE TUBES: Illustrated pamphlet on production and uses of miniature and subminiature tubes. Illustrated. Electronic Applications Div., Sonotone Corp., Elmsford, N.Y. (TECHNICIAN No. B7-8)

ANTENNA TRELLIS KIT: Engineer's report on ground-installed antenna which gives the appearance of a trellis and can be planted with roses or a climbing plant. Trio Manufacturing Co., Griggsville, Ill. (TECHNICIAN No. B7-9)

for service and lab. work

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Versatile Soldering Gun

(Continued from page 36)

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Reg. U.S. Pat. Off.

**Chemically engineered
for tuners and switching
mechanism**



6 oz.
Spray
can

\$2.25
net

**CHEMICAL ELECTRONIC
ENGINEERING, INC.**

Matawan, N. J.

Hush comes in a 6 oz. pressure can with sufficient pressure to reach all contacts to wash-away that dirt, leaving clean and positive contacts, protected with a lasting lubricant film. Hush does not affect inductance, capacitance or resistance.

Hush also available in 2 oz., 8 oz. and 32 oz. containers.

Free literature available. Use special inquiry card.

See your distributor
or write to



*"... the hand of the princess
in marriage, and half of all
the JENSEN NEEDLES
in my kingdom."*

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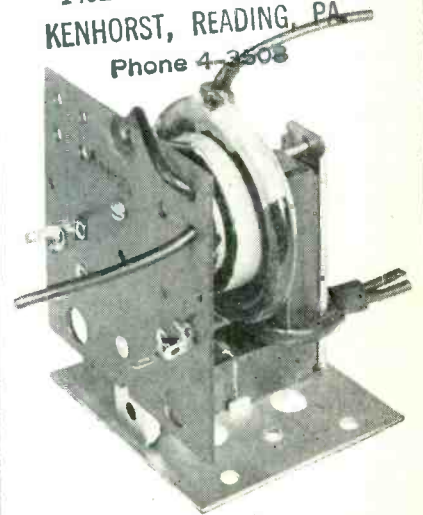
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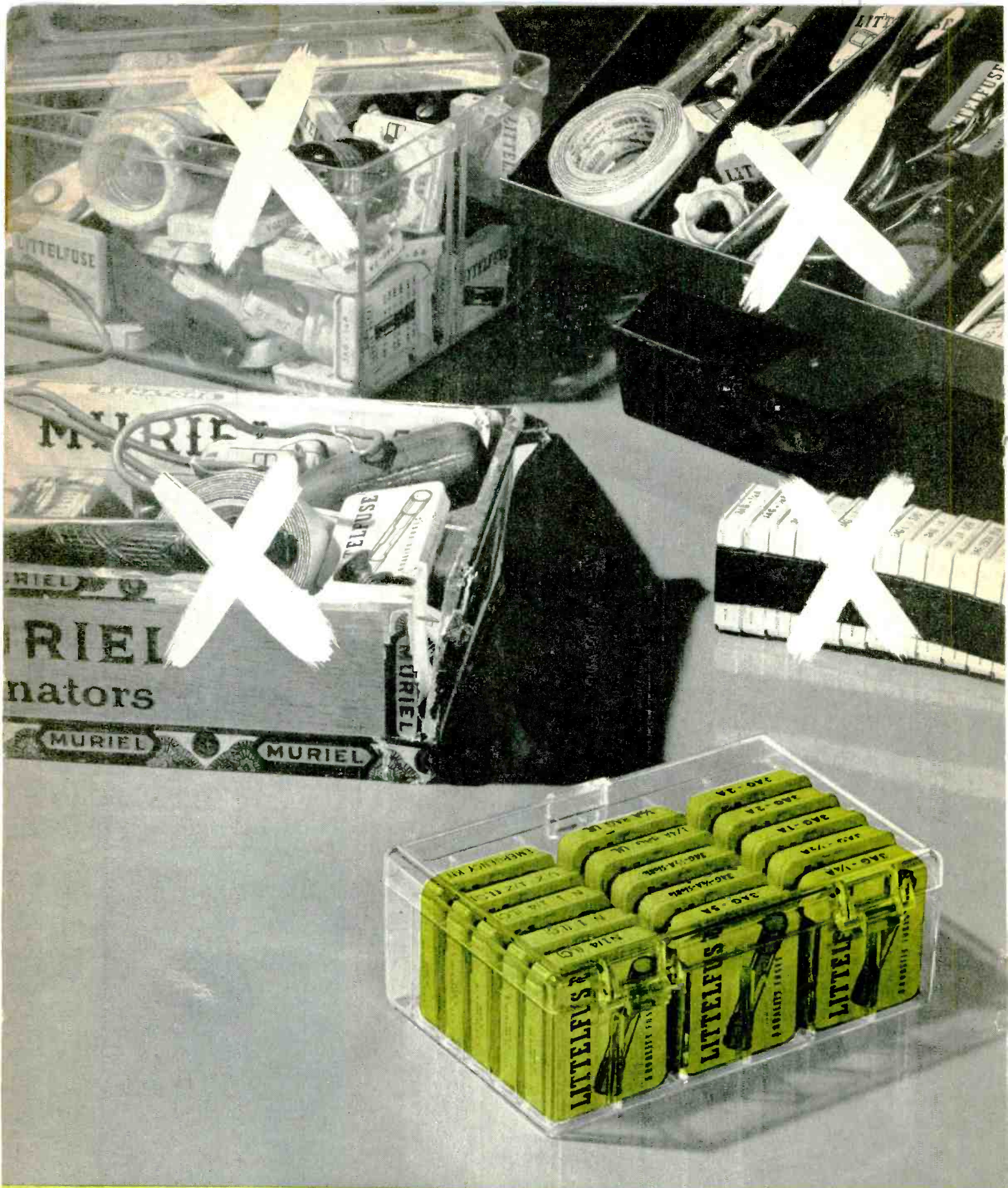
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HVO-45 FOR EXACT REPLACEMENT IN WESTINGHOUSE covers 13 chassis. Another in the complete Merit line of exact and universal transformers, yokes and coils. Merit is the only manufacturer of transformers, yokes and coils who has complete production facilities for all parts sold under their brand name.

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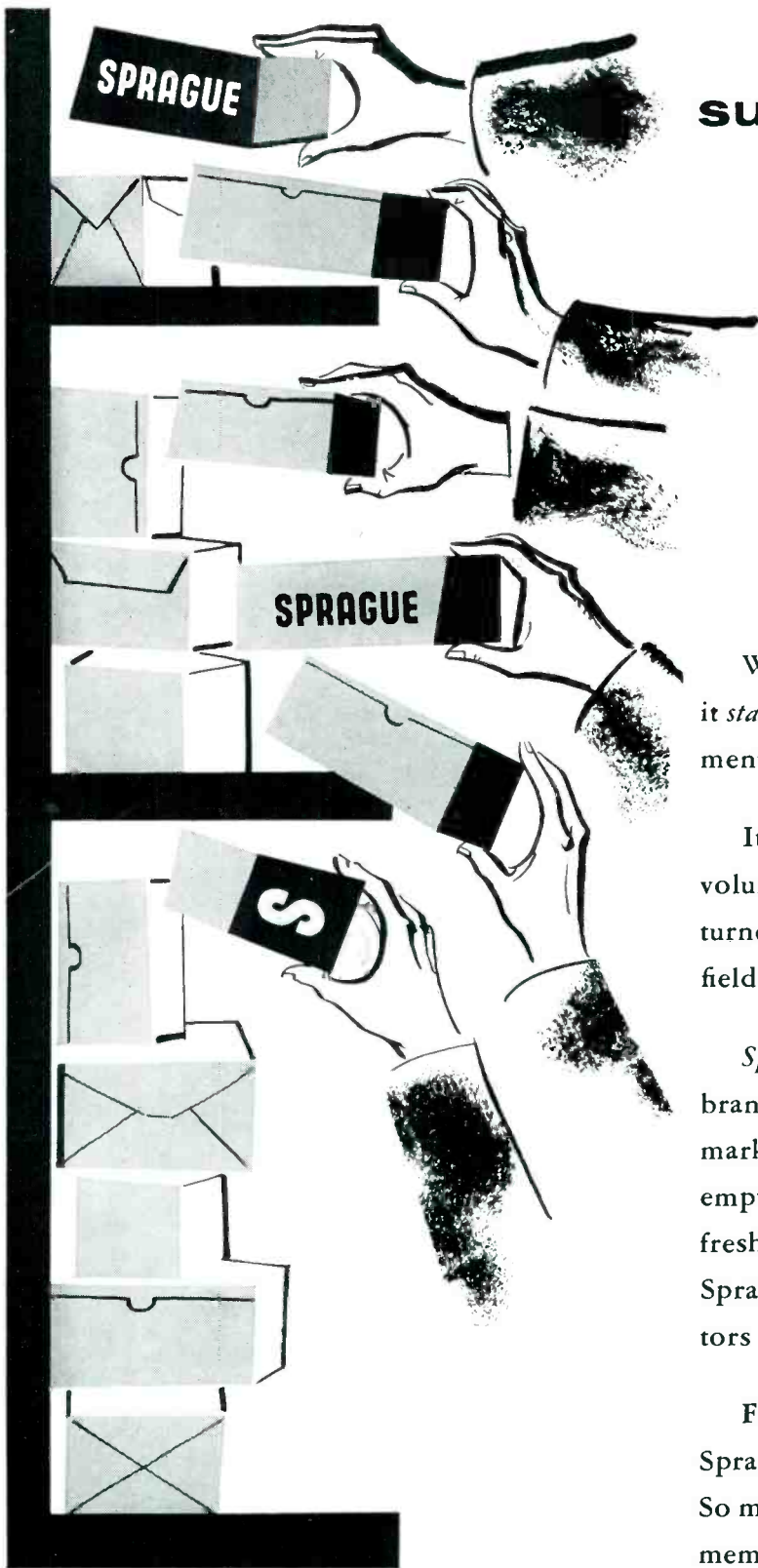


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THERE'S ONLY ONE RIGHT WAY

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SPRAGUE
supermarket strategy
helps build
YOUR reputation
... gives you
the last word
in design

When you fix a set with Sprague capacitors, it *stays* fixed. One reason is that Sprague replacements are fresh when you buy them.

It's just like the modern supermarket! Big volume sales means fast turnover of goods. Fast turnover means the bins are always filled with field-fresh produce.

Sprague capacitors sell faster than any other brand. Like the produce shelves at the supermarket, the Sprague shelves at your distributor empty fast—need frequent refilling with factory-fresh units. As a result, when you insist on Sprague, you're sure to get the freshest capacitors in stock, in the latest designs.

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don't be vague ... insist on

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world's largest capacitor manufacturer

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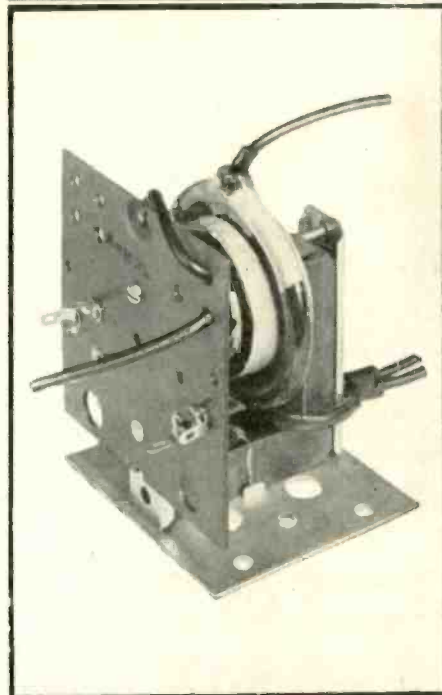
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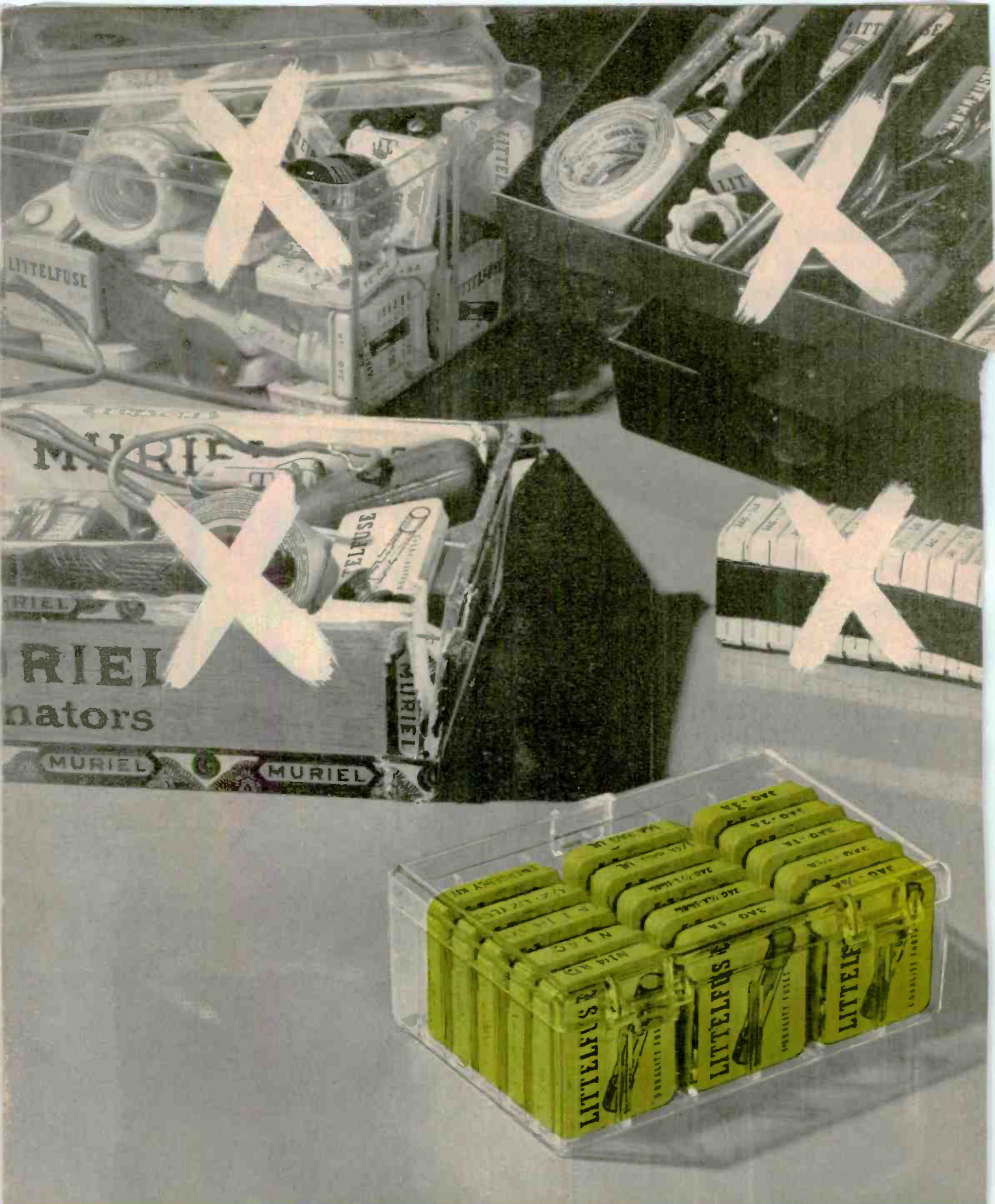
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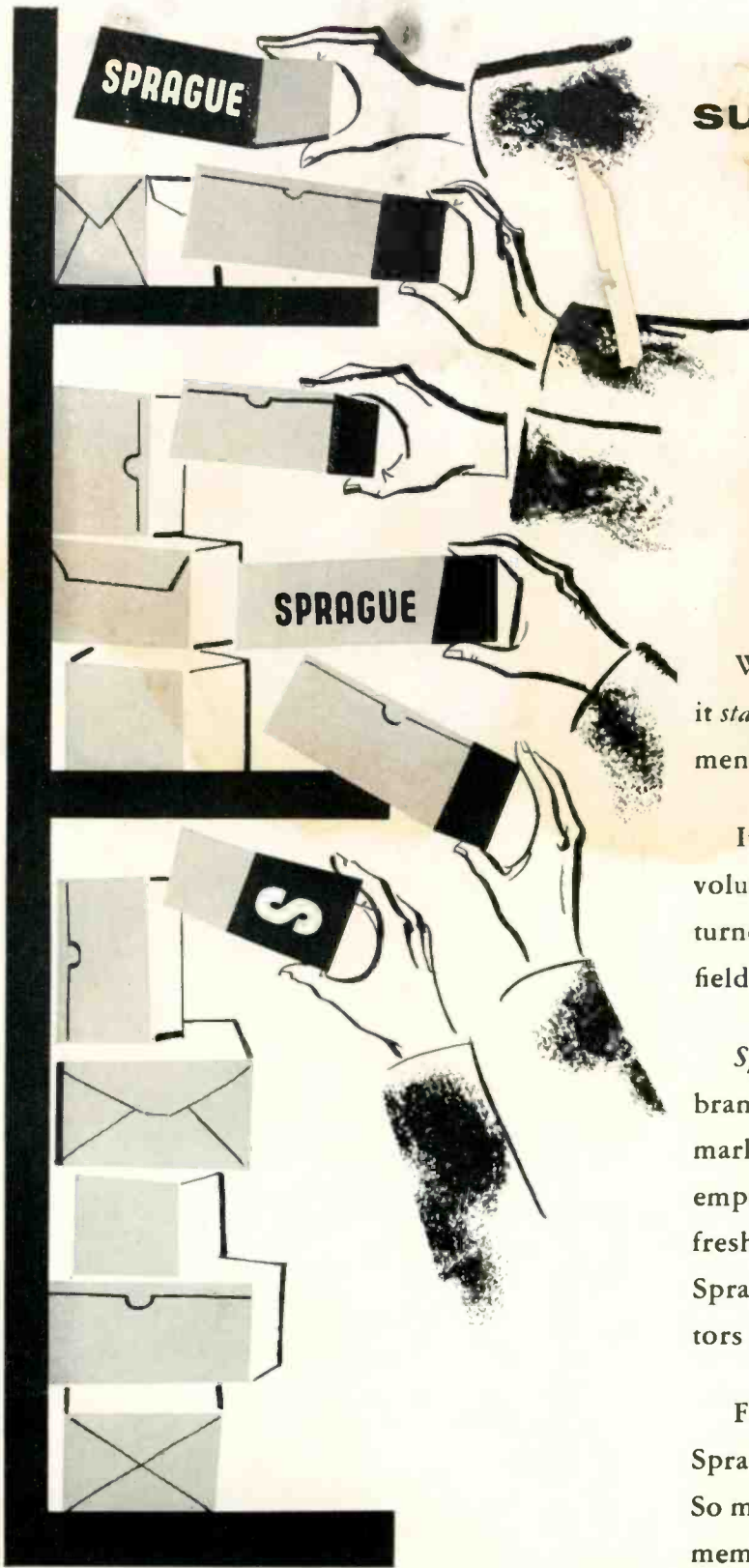


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