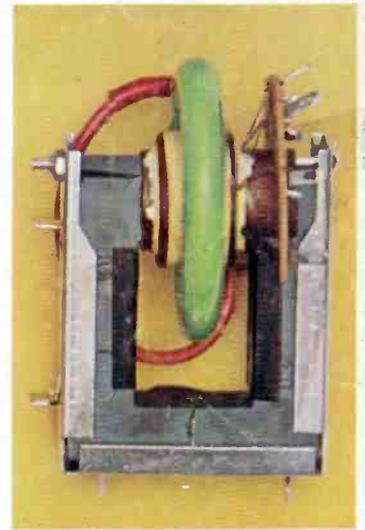
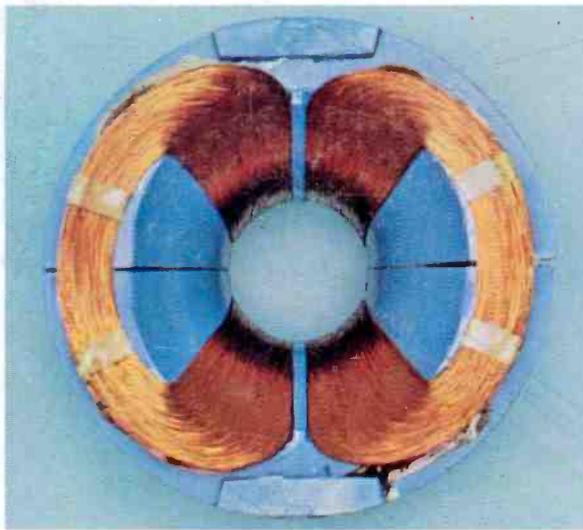
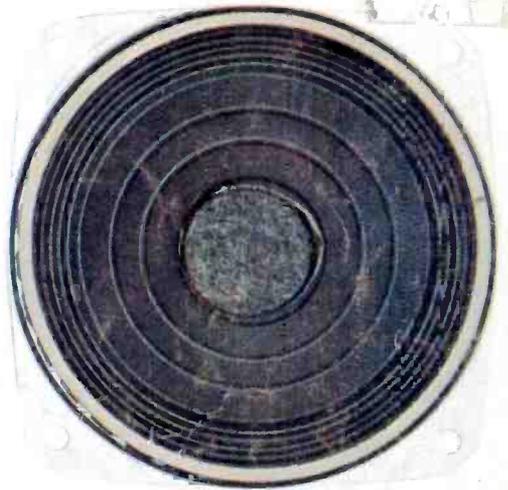
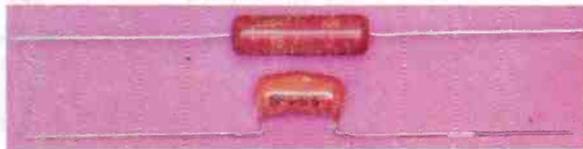


RETURNS - NO - ADD.
TV DULUTH MINN

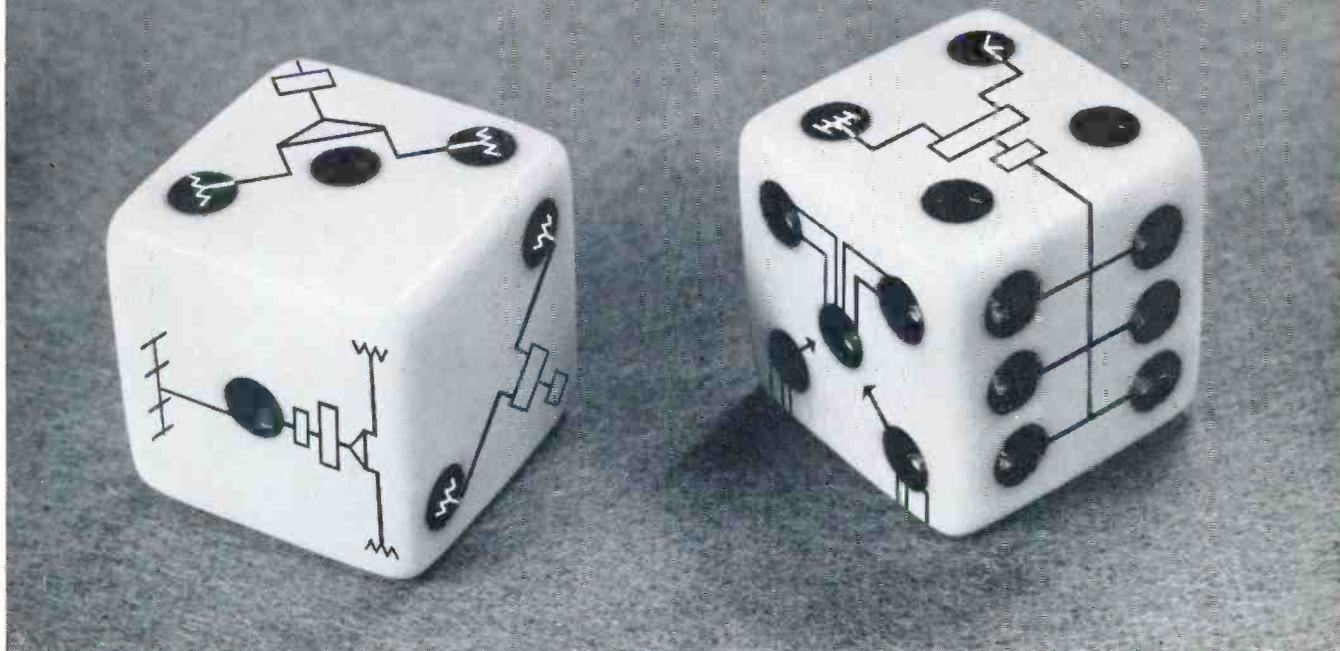
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WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION



MAY 1964

WITH JERROLD, YOU DON'T GAMBLE ON SYSTEMS OR PROFITS



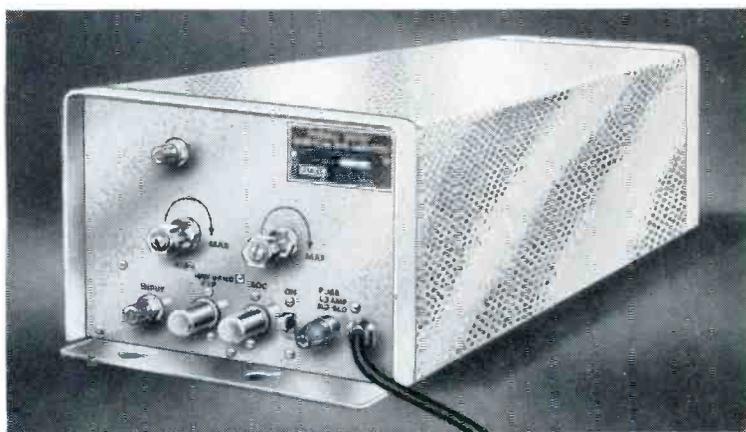
Assure yourself a profitable motel, small-hotel, and apartment-house antenna-system business—rely on Jerrold's 15-year, 50,000-mile cable experience

There are many good reasons why servicemen and architects throughout the nation insist on Jerrold master-antenna systems equipment. One of the most important is *reliability* . . . for Jerrold is the *one* truly reliable name in TV/FM cable systems—proven over fifteen years and in over 50,000 miles of installed systems.

When you go after the growing systems business in motels, small hotels, and small apartment houses, the profits lie in staying with the equipment you don't have to nurse after it's in. That's Jerrold. Everything *works* right off the bat—from the special 75-ohm antenna to the industry's finest room outlet. See your Jerrold distributor today, or write *Distributor Sales Division, Jerrold Electronics, Philadelphia, Pa. 19132.*

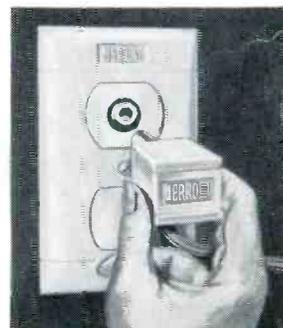


THE NATION'S FOREMOST
MANUFACTURER AND
SUPPLIER OF TELEVISION
CABLE SYSTEMS



↑
New Model 2300-A, hi-output broadband amplifier—workhorse of the small-systems field. Rugged, heavy-duty construction; excellent overload capability; dual manual gain control (14db range).

→
New Ultra-Tap—the beautiful universal plug-in wall outlet that accommodates 75- or 300-ohm connectors for TV or FM or both. Flush or surface-mounting, in a wide choice of decorator colors.



--- for more details circle 37 on post card

Plan your weatherproof hi-fi speaker installations around University ...the most complete line.

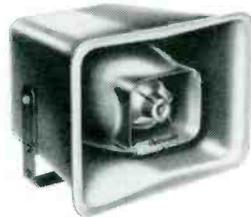
APPLICATION

Low level system, moderate crowds or areas, patios, pool areas, motels, parking areas, etc.

REQUIREMENTS

Voice and music sound reinforcement. Compact size. Fiberglass reinforced polyester housing.

RECOMMENDED SPEAKER



UNIVERSITY
MODEL MLC

SPECIFICATIONS

15 watts
150-15,000 cps
120° dispersion
12 $\frac{3}{4}$ " x 9 $\frac{1}{8}$ " dia.
10 $\frac{5}{8}$ " deep

Moderate power systems, high quality public address and high fidelity. Concert halls, large patios, shopping centers, recreation areas, etc.

Lightweight, shallow depth, replaces trumpet/driver installations where high noise/distance penetration is necessary. Wide audio range, superior bass response.



UNIVERSITY
MODEL CLC

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12 $\frac{1}{16}$ " deep

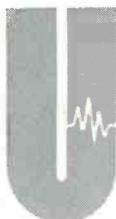
Moderate to high power systems for high fidelity reproduction. Stadiums, arenas, ball parks, outdoor concerts.

Greatest efficiency. Full low-end frequency response. High intelligibility. Maximum distance penetration.



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MODEL WLC

30 watts
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90° dispersion
33 $\frac{1}{2}$ " dia.
20" deep



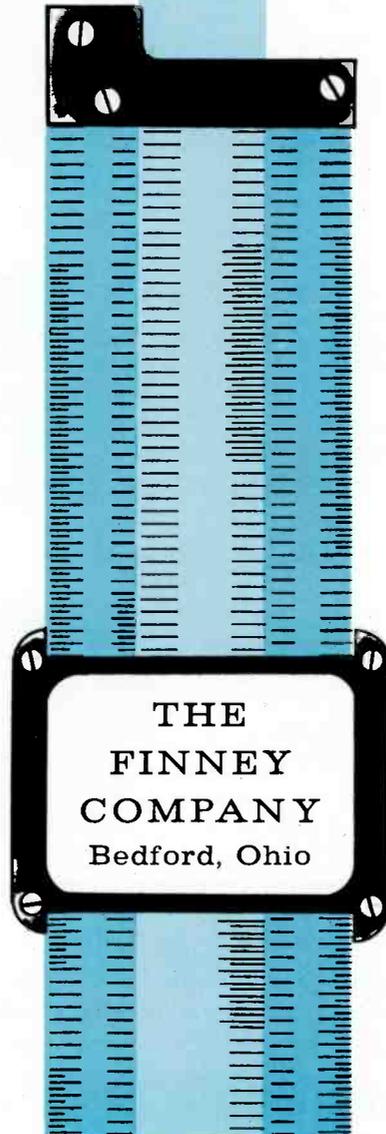
Shown here are the world's finest weatherproof speakers—each a complete system providing smooth, balanced bass, mid-range and high frequency response for indoor and outdoor high fidelity installations. University weatherproof design and construction—proved in rugged military applications throughout the world—insure their reliable operation under all environmental conditions—rain, snow, wind, humidity, etc. For complete details and Free University Public Address Catalog, write : Desk ET-5, LTV UNIVERSITY DIVISION, Oklahoma City, Oklahoma.

LTV UNIVERSITY

A DIVISION OF LING-TEMCO-VOUGHT, INC.
9500 West Reno, Oklahoma City, Oklahoma

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A Finco Engineer is designing
A "special area" TV Antenna
Finco has produced 3,152 already
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See your Finco distributor
Or write us.



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CIRCULATION**

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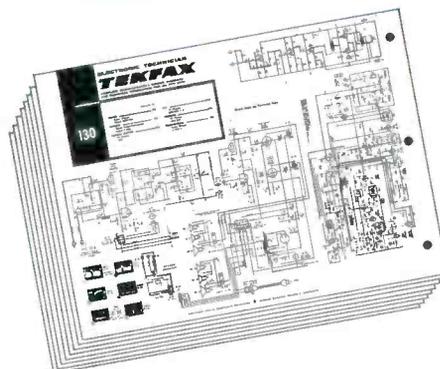
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A COMPLETE INDEX of all Circuit Digests
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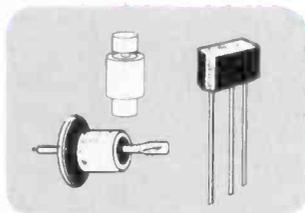
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MT 3643/3633

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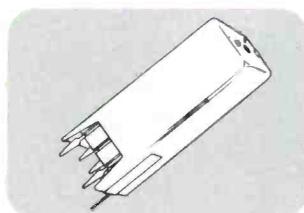
THE QUALITY OF YOUR SERVICE DEPENDS ON THE PARTS YOU USE...DEPEND



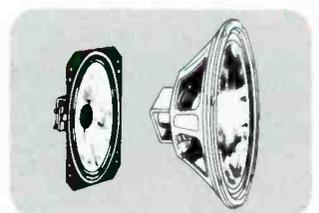
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Complete variety for all makes and models.



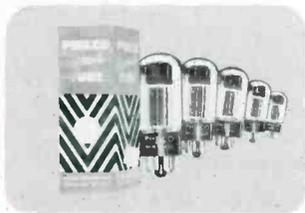
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Philco TV and Radio Contact and Control Cleaner, Lubricant in self spray can, complete with protective cap and spray nozzle.



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Genuine Philco TV yokes, made to original factory specifications. Accurately wound and inspected. Packed in individual boxes, ready to install.

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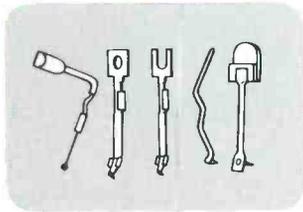
Customer Confidence Begins When You Use Genuine Philco Star Bright 20/20 Picture Tubes

Every CR Tube you replace represents a high-dollar service sale for you . . . and your customer. Play it safe with a brand that's known for Quality . . . PHILCO. All material and parts used in the manufacture of Philco Star Bright 20/20 Picture Tubes are new except for the envelope, which prior to reuse, has been inspected and tested to the same standards as new envelopes.

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Intermixes all size records. Light-weight tone arm with retractable scratch protection assembly and famous Euphonics U8 cartridge. Changer ideal for built-in installations or "modernizing" record playing equipment. Template and instructions included.



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PHILCO
A SUBSIDIARY OF *Ford Motor Company*

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City _____ Zone _____ State _____

LETTERS TO THE EDITOR

2000 Color Sets Sold

Your recent controversy concerning color television surely points up one of the reasons why color has been so long getting off the ground. (See Editor's Viewpoint, August 1963.) Incompetent technicians', or rather, repairmen's "bad-mouthing", something they don't in the first place even understand nor wish

to take the time and effort to become proficient in.

We've been selling color since 1958 and have in excess of 2000 sets in operation in Odessa, Tex. and surrounding area. One third of our service department's operation is devoted to color, and amounts to about \$20,000 a year.

In all this time (and even though color requires slightly more service than black and white) I have never heard a customer say he would willingly return to a B/W-only television set.

Our records indicate that during the first year of operation, the average customer service cost of color is approximately \$2.70. We warrant all parts for a year, and as an enhancement to sales, charge the same for servicing color as we do for B/W. Our reputation for color sales and service is unchallenged in the West Texas area.

Despite interruptions in color broadcasting in this area when our local color outlet, (1) moved their antenna to a new location necessitating intermittent operation of about two months and (2) moved into new studios with new equipment for another two months of intermittent operation, our customers, although somewhat perturbed at missing some of their favorite programs, have not deserted us. Sales of color sets during 1963 averaged one-per-day.

If these people who can't or won't take time to equip themselves with technical knowledge and experience necessary to service new and different equipment would just keep their "bad-mouthing" to themselves, we technicians whose careers are constantly at stake will be glad to take care of the customers they refuse by their indifference.

WALTER R. McCARTY
Odessa, Tex.

Flyback Substitute

Your February 1964 issue of ELECTRONIC TECHNICIAN carries a story entitled, "Substituting Flybacks," on page 60, written by Mr. Jay Shane. . . . Although transformer 360580-1 originally incorporated in the 300 Series Magnavox

A NEW CONCEPT IN COLOR TV ANALYZING PUTS YOU IN THE PROFITABLE COLOR TV SERVICE PICTURE AT A VERY LOW COST

Model 900 COLOR TV ANALYZER

- Checks color, video and picture tube circuits
- Checks the overall performance of color TV sets
- Provides for fast purity, convergence and gray scale tracking adjustments

Color TV set sales are booming all over the country! To help progressive servicemen get their share of the color service business Mercury has developed a highly efficient instrument based on an ingenious new engineering concept in color TV analyzing. The Model 900 Color TV Analyzer enables you to tackle color TV servicing in the home and in the shop with ease and confidence at a minimum cost.



FEATURES

- ✓ Makes all tests dynamically while color set is in operation
- ✓ Exclusive circuit eliminates need of range switches. Just set element selector and meter is automatically on right range
- ✓ Connects as easily as a picture tube brightener... no need to get under TV chassis
- ✓ Safety feature... circuit allows safe measurement up to 7000 volts on focus grid

See your electronics parts distributor or write for complete Mercury catalog

\$44.95 Slightly higher in the West

NEW

MAKE ANY ONE OF THESE TESTS IN MINUTES

- TEST each control grid voltage... indicates shorts or gas in each color gun
- TEST each color gun screen voltage and screen current... indicates trouble in power supply or boost circuits
- TEST focus voltage... indicates high voltage or horizontal deflection circuit trouble
- TEST each cathode voltage... indicates circuit trouble
- TEST each control grid emission current... indicates shorts or gas in each color gun
- TEST each color gun cathode emission... indicates dynamic quality of each color gun.

The Model 900 enables you to cut-out color guns in any combination and adjust for proper PURITY—CONVERGENCE—and GRAY SCALE TRACKING.

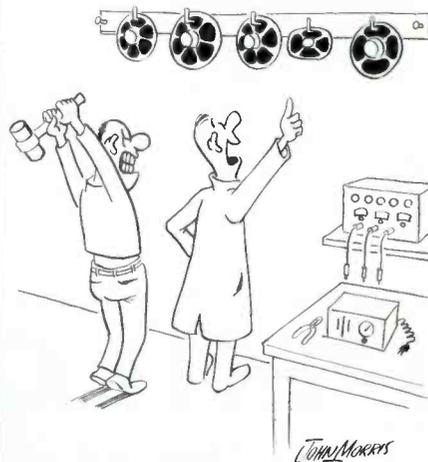
Mercury ELECTRONICS CORPORATION

manufacturers of quality electronic products

111 Roosevelt Avenue, Mineola, New York

IN CANADA: R. C. Kahnert Sales Ltd., 359 Enford Rd., Richmond Hill, Ontario

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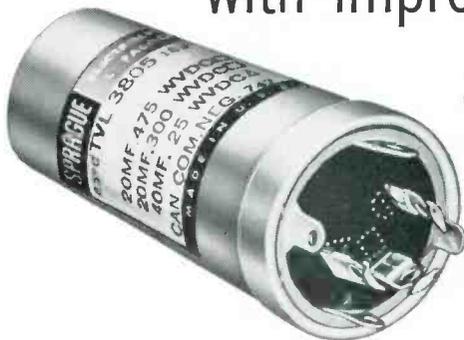
"I hung up all your speakers for you chief!"

WHY

bother with makeshift twist-prong capacitor replacements ?

When you substitute capacitor sizes and ratings, you leave yourself wide open for criticism of your work . . . you risk your reputation . . . you stand to lose customers. It just doesn't pay to use makeshifts when it's so easy to get the exact replacement from your Sprague distributor!

Get the right SIZE,
right RATING every time
with improved



SPRAGUE TWIST-LOK® CAPACITORS!

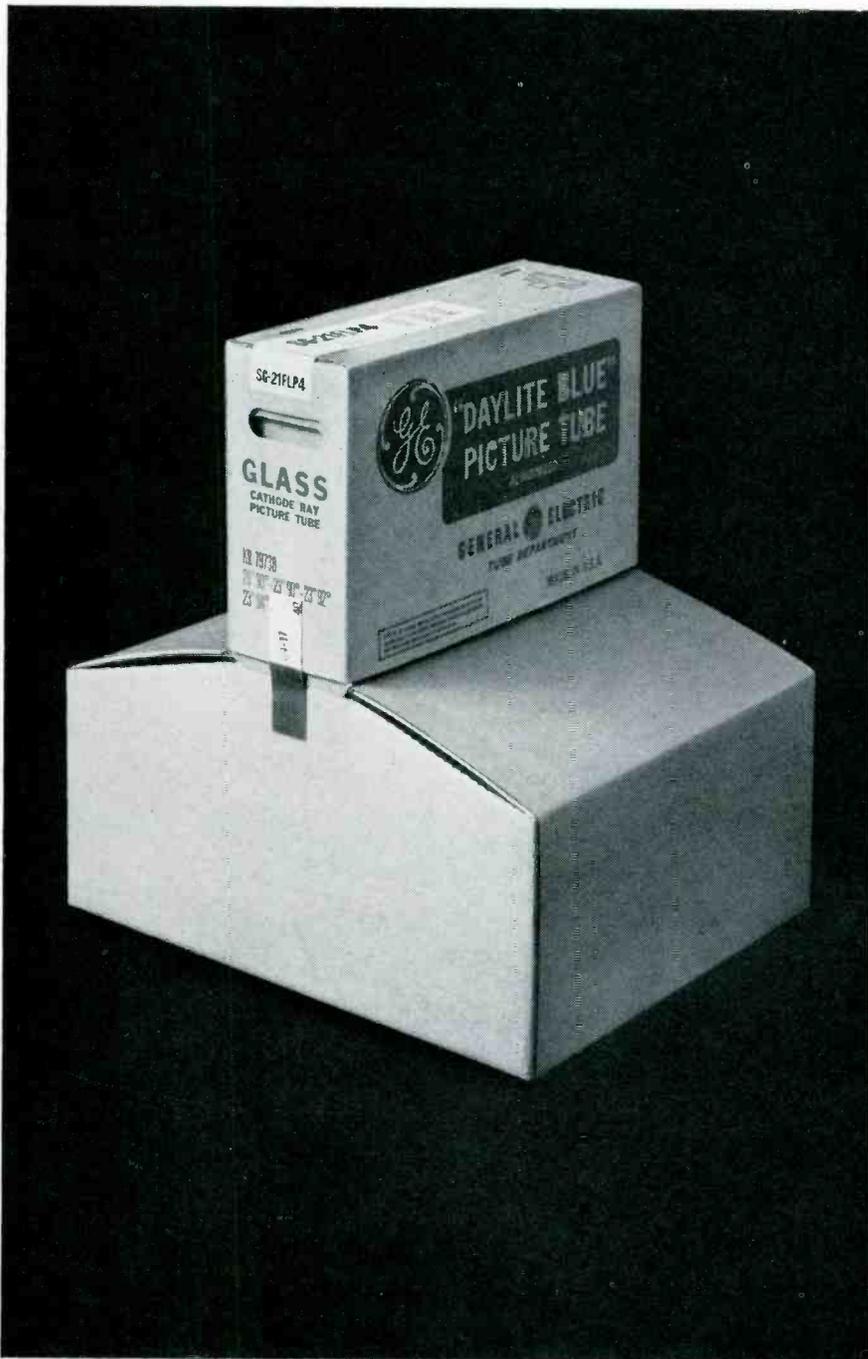
Over 1,690 different capacitors to choose from!

The industry's most complete selection of twist-prong capacitors, bar none. Greater reliability, too. Exclusive Sprague cover design provides a leak-proof seal which permits capacitors to withstand higher ripple currents.

GET YOUR COPY of Sprague's comprehensive Electrolytic Capacitor Replacement Manual K-106 from your Sprague Distributor, or write Sprague Products Co., 65 Marshall St., North Adams, Massachusetts.



WORLD'S LARGEST MANUFACTURER OF CAPACITORS



New T-Box

(It's what's inside that counts)

This is the new General Electric T-Box picture tube carton. It reduces the amount of space needed for stocking and transporting. It's easy to carry, easy to open... dust free and stronger. But it's the picture tube* inside that really counts.

**All new parts and material in a reused envelope.*

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GENERAL  ELECTRIC

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LETTERS TO THE EDITOR

Chassis is no longer stocked, we supply a replacement that is electrically and mechanically identical to the original under the identification, Part 360604-1."

R. J. YERANKO
National Service Mgr. Magnavox
Fort Wayne, Indiana

Needs Schematic

I have a Duco tube tester, Model 303, Serial 9342. It was manufactured by the Dayton Acme Co., Cincinnati, Ohio.

J. S. CLANIN
Beulah, Michigan

Tekfax

... Ignore those guys that complain about the size of your schematics. Invite them to have a change of glasses. The size you are using allows easy filing.

VERN W. MAXWELL
Cantrall, Illinois

COMING EVENTS

May 18-20: 1964 Electronic Parts Distributors Show, Conrad Hilton, Chicago, Ill.

May 19-21: 1964 Int'l Symposium on Microwave Theory & Techniques, Int'l Hotel, Kennedy Airport, N. Y.

May 19-21: 18th Annual Armed Forces Communications & Electronics Assn. Convention, Sheraton-Park, Washington, D. C.

May 25-28: 13th Nat'l Telemetering Conference & Exhibit, Biltmore, Los Angeles, Calif.

June 2-4: Nat'l Symposium on Global Communications, Sheraton Hotel and U. of Pa., Philadelphia, Pa.

June 8-11: Systems Engineering Conference & Exposition, Coliseum, N. Y.

June 16-18: 40th Annual Convention, EIA, Edgewater Beach Hotel, Chicago, Ill.

June 17-21: 1964 ERA conference, Concord Hotel, Kiamesha, N. Y.

July 19-23: Music Industry Trade Show & Convention, Palmer House, Chicago, Ill.

ELECTRONIC TECHNICIAN

For window-size blow-ups of this message, send 10¢ to Sprague Products Co., 65 Marshall St., North Adams, Mass., to cover handling and mailing costs.



You'll never see your doctor advertise a special sale on appendectomies . . .

You'll never see your lawyer announce cut-rates for divorce cases . . .

You'll never see your dentist hold a "2-for-1" sale on extractions . . .

AND You'll never see the day when you can take your TV set in for a service "bargain" and be sure you're getting a square deal!

"Bargains" in home electronic service are as scarce as the proverbial hen's teeth! Here's why—

The expert service technician, just like other professional people, must undergo years of study and apprenticeship to learn the fundamentals of his skill. And a minimum investment of from \$3000 to \$6000 per shop technician is required for the necessary equipment to test today's highly complex sets. Finally, through manufacturer's training courses and his own technical journals, he must keep up with

changes that are developing as fast as they ever did in medicine, law, or dentistry. Those best equipped to apply modern scientific methods are almost certain to be most economical for you and definitely more satisfactory in the long run.

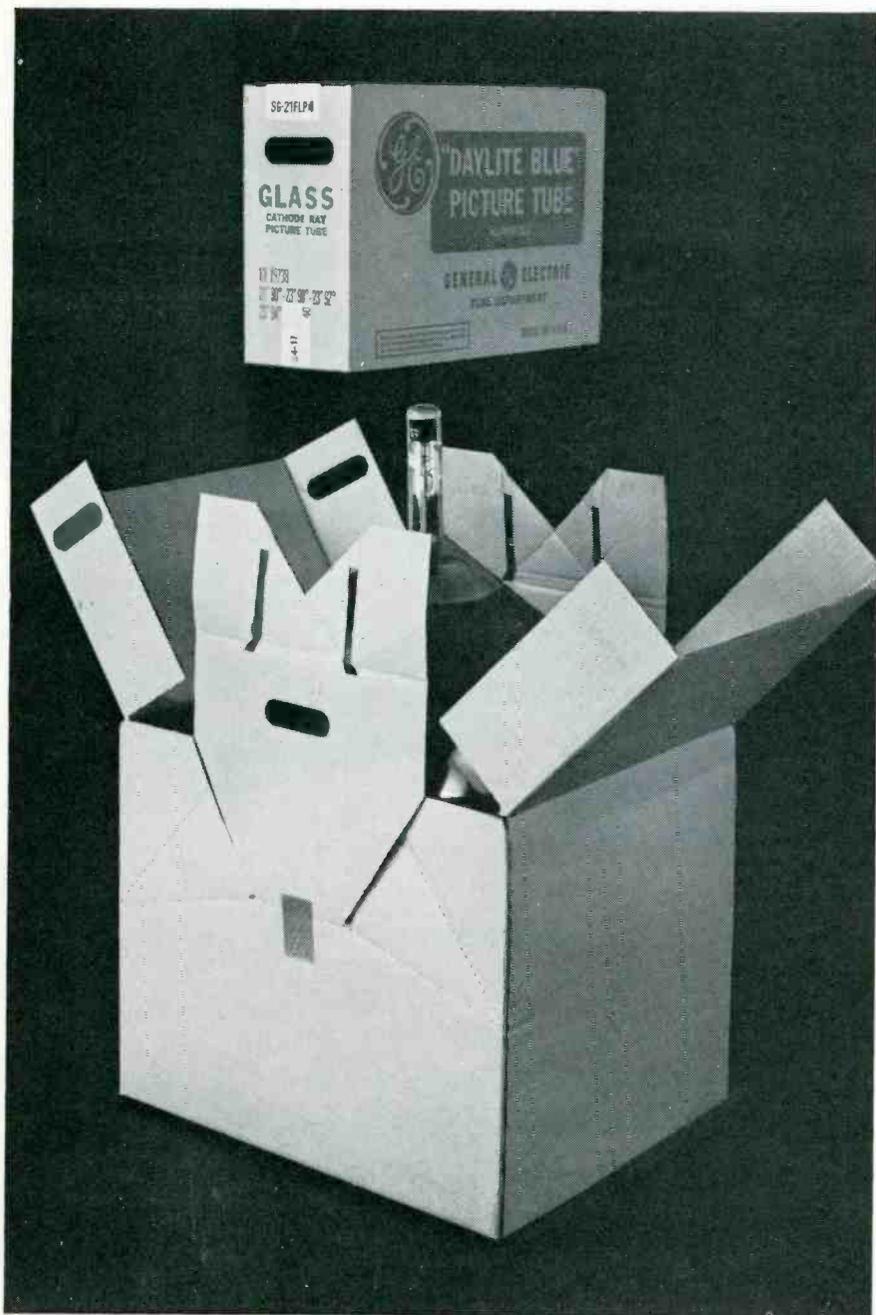
Unfortunately, as in any business, there will always be a few fly-by-night operators. But patients, clients, and TV set owners who recognize that you get only what you pay for, will never get gypped. "There just ARE no service bargains" . . . but there is GOOD SERVICE awaiting you at FAIR PRICES!

THIS MESSAGE WAS PREPARED BY SPRAGUE PRODUCTS COMPANY,
DISTRIBUTORS' SUPPLY SUBSIDIARY OF SPRAGUE ELECTRIC COMPANY, NORTH ADAMS, MASSACHUSETTS, FOR . . .

YOUR INDEPENDENT TV-RADIO SERVICE DEALER

65-124-63

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It's the G-E straight-gun picture tube

The General Electric straight-gun picture tube* needs no ion trap. It fires electrons with precision accuracy to give sharply resolved pictures . . . up to 80% brighter. This cuts the time necessary for installation and adjustment . . . reduces call-backs . . . saves time and money for you.

**All new parts and material in a reused envelope.*

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FREE LITERATURE

STORAGE EQUIPMENT 300

A 48-page, 2-color catalog describes a complete line of industrial and commercial steel storage equipment; listing steel shelving and related equipment, storage bins, storage cabinets, shop equipment including work benches and tables, clothing lockers and book shelving. Penco Products.

COMPONENT CATALOG 301

Complete catalog of exact and universal replacement parts for TV-radio receivers with handy replacement guides for thermal switch breakers and transistors. Workman.

SELF-SERVICE 302

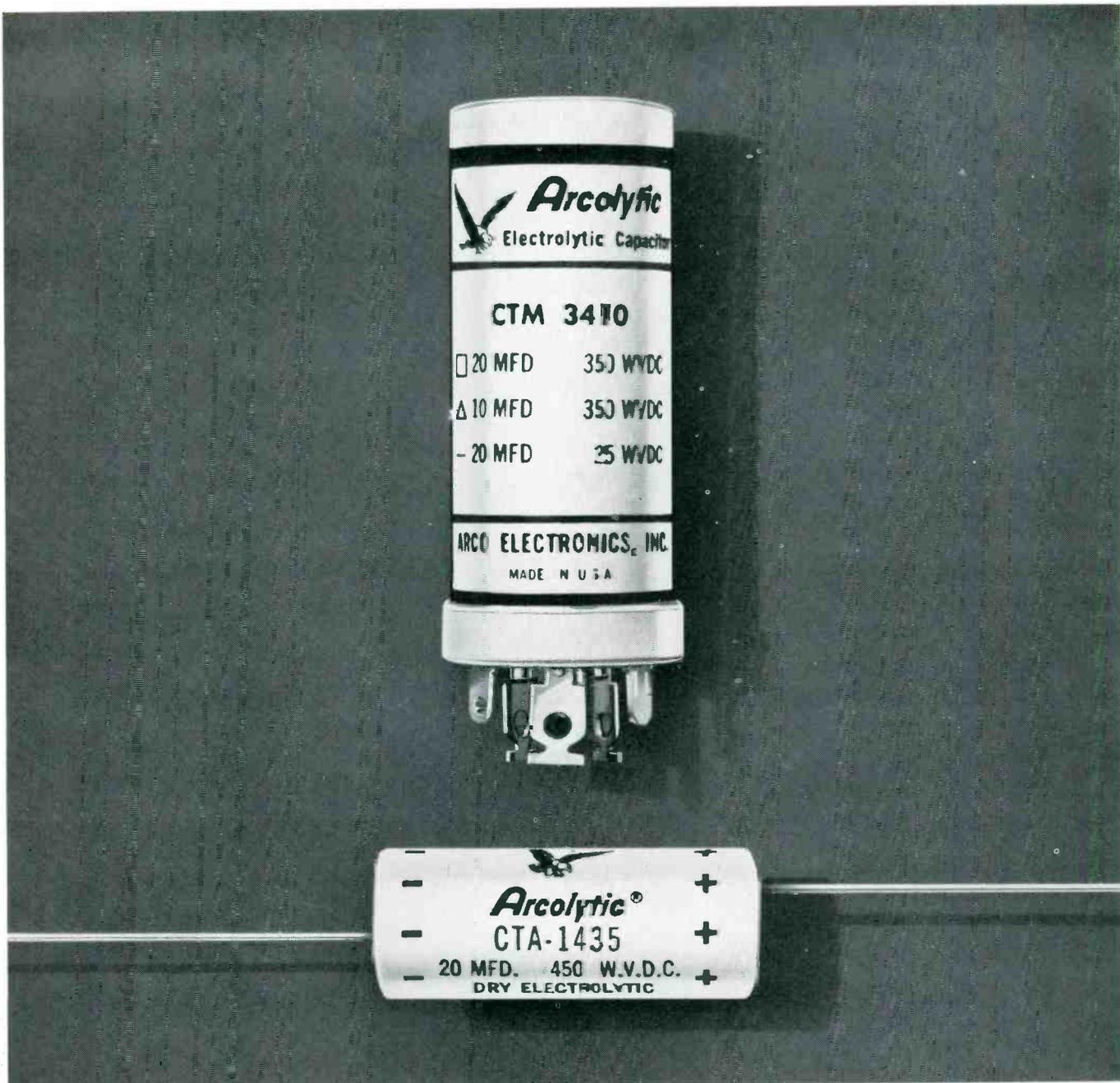
Information covers a self-service automatic tube tester that is said to provide the maximum in automated tube testing while maintaining the utmost in simplicity for the user. GC Electronics.

WIRE & CABLE 303

An 18-page wire and cable specification guide covers insulating and jacketing for many kinds of wire and cable. Included are communication, power, signal and control cable, military and miscellaneous constructions. Du Pont.

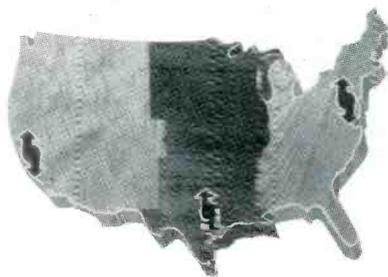


"Would you like to hear it again at full volume Sir?"



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These superior quality electrolytic capacitors are made of 99.99% pure aluminum foil... designed to operate at 85°C, and withstand high ripple and surge voltages. All are made and tested to EIA RS-154. Premium grade materials and construction make Arcolytics last longer—on the shelf... and in the set! Over 1400 values to meet all requirements for tubular and twist-mount electrolytics—single, dual, triple or quad-



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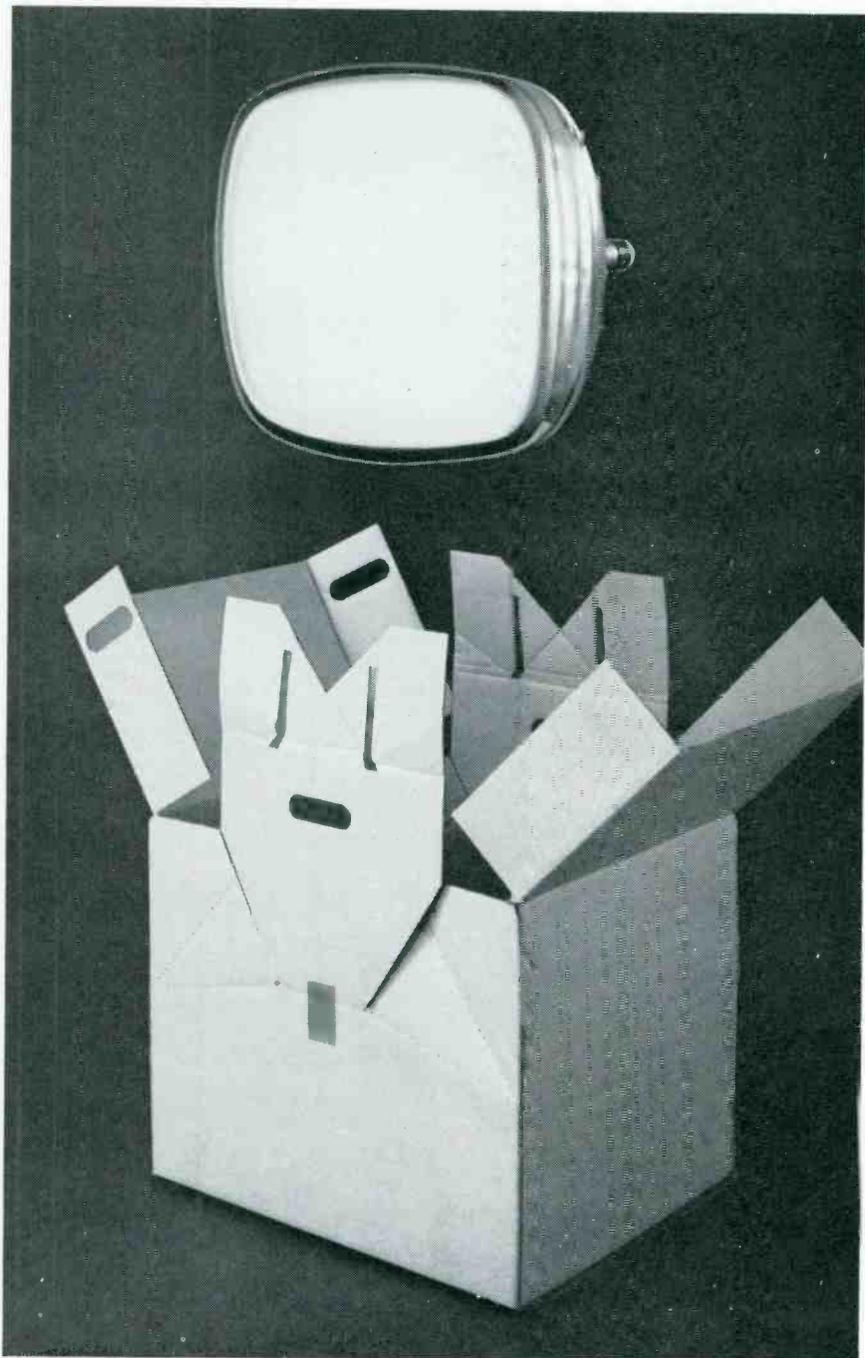
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Community Drive, Great Neck, New York

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**It has a brighter,
"DAYLITE-BLUE" screen**

General Electric's "DAYLITE-BLUE" screen gives a sharp, clear picture. The carefully deposited phosphor has a graphite-coated, high-purity aluminum film to increase the brightness. General Electric straight-gun picture tubes* will brighten your profit picture, too.

**All new parts and material in a reused envelope.*

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FREE LITERATURE

ROTOR APPLICATIONS 304

This 20-page booklet describes reasons for poor TV and FM reception—the basic forms and purpose of antennas available—and the advantages of coupling the proper directional antenna with a rotor system for optimum reception. Cornell-Dubilier.

GUIDE TO OUTDOOR HI FI 305

Brochure describes a portable speaker system and how it is used for outdoor music applications. Electro-Voice.

AUTOMATIC TELEPHONE 306

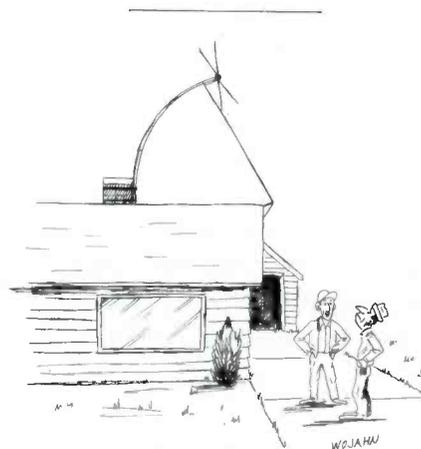
A brochure describes a desktop set that provides automatic telephone answering service for one-man TV-radio shops. Can be used around the clock to take outside calls at any time the phone is unattended. Code-a-phone Electronics.

AUTO IGNISTORS 307

A 4-page data sheet gives details on an Ignistor—a transistor and a matched zener diode—integrated into one power package for auto ignition systems. Bendix.

BOOST/BUCK XFORMERS 308

An 8-page catalog, Bulletin 5A3, discusses application of boost and buck transformers to correct off-standard voltage conditions. ACME Electric.



"I nearly didn't have enough lead in wire."

ELECTRONIC TECHNICIAN



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119 INDEPENDENT SERVICEMEN ASSURED THEIR LIFE'S FUTURE with the LAFAYETTE ASSOCIATE STORE PROGRAM

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You're in business for yourself, probably an independent serviceman like those other 119 businessmen. You have a basic knowledge of radio, television or electronics, and most of all you have ambitions to become a true success story—with your own profitable business, a respected place in your community, and security for your family.

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1. Business Stability—Lafayette Radio Electronics has been in business for 43 years. You'll cash in on this established reputation.
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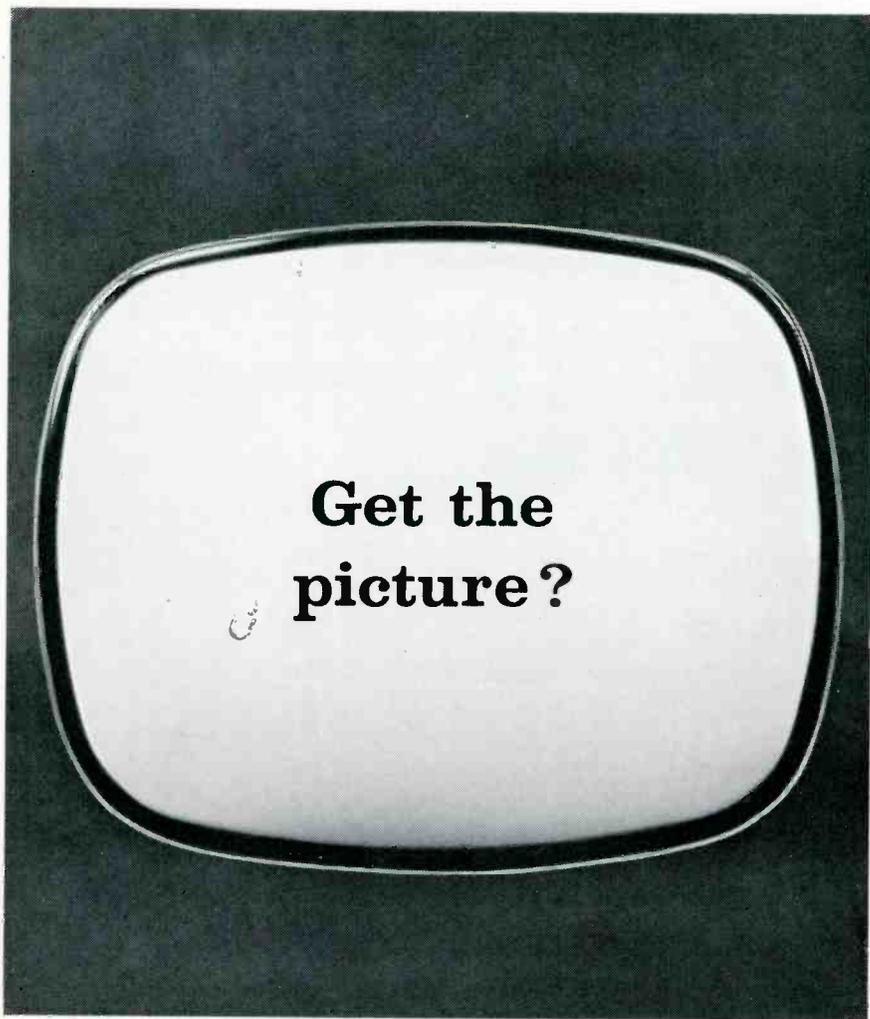
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Get the
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The new General Electric "DAYLITE-BLUE" picture tube* is designed, built, packaged to help you do a top-notch service job at the lowest operating cost. The new T-Box carton saves space in your shop and truck. Duds are easily repackaged for return . . . no tape or staples needed.

The tube is easy to install . . . no ion trap to adjust . . . fewer call-backs. And your customers are happy because of the high-quality picture.

But one of the most important features of G-E picture tubes is stocking and replacement. A single tube will replace as many as twenty other types . . . bent-gun or straight-gun. A selection of 25 G-E tubes will replace 250 other picture tube types. This means that you can now carry a minimum inventory for commonly replaced tubes. You can give customers faster service, simplify your ordering and avoid emergency pickups. G-E "DAYLITE-BLUE" picture tubes will save your time and help you make more money. Order from your G-E distributor today.

**All new parts and material in a reused envelope.*

Progress Is Our Most Important Product

GENERAL  ELECTRIC

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NEW BOOKS

PRACTICAL TRANSISTOR THEORY. By E. Patrick Wiesner. Published by Howard W. Sams & Co., Inc. 128 pages, soft cover. \$2.50.

Complete electronic circuits no larger than the head of a pin have already become practical. And in the not too distant future they will no doubt be used in consumer products. The technical aspects of semiconductor theory are a must for modern technicians. This book classifies semiconductor devices into active, passive, linear and nonlinear categories. Its seven chapters discuss basic semiconductor action and material, passive semiconductor devices, transistors, other active linear semiconductors, transistors in nonlinear circuits, special semiconductor devices and integrated circuits. Schematics, photos and drawings illustrate the text.

FUNDAMENTALS OF UHF. By Allan Lytel. Published by John F. Rider Publisher, Inc. 153 pages, soft cover. \$3.90.

Although in publication for a few years, rapid expansion of activity in UHF dictates a new look at this book. The text provides a comprehensive coverage of the theory, equipment and applications. It concentrates on the area from 300 to 3000 Mc, stopping short of microwaves. The field of UHF is examined from the standpoint of antennas, transmission lines, wave propagation, generators, communications equipment, and test equipment and techniques. FCC rules and regulations covering its use are also provided. Eleven chapters deal with UHF principles, propagation, transmission lines, resonant lines, UHF oscillators, transmitters, amplifiers and receivers, antennas, communication and television and test equipment. The text is adequately illustrated with photos, drawings and schematics. The book can doubtless prove helpful to many technicians at a time when commercial and educational TV station expansion in the UHF area is taking place at a rapid rate. The need to know UHF characteristics is urgent.

Half of all TV lead-in cable needs replacement...now!

TV lead-in cable should be replaced at least once every two years. Hot summers, cold winters, and salty air do the dirty work... and the picture suffers.

This means that you have a made-to-order replacement market. Automotive garages make extra profits by selling replacement spark plugs and fan belts. You can make extra profits simply by telling your customer how his old deteriorated cable keeps him from getting the best possible picture.

Tell him about the best... Belden. It is an insurance policy against weak signals and reception failure. And there is a Belden lead-in cable for every requirement, including Permohm* for areas of salt or industrial contamination, Weldohm† with 2½ times the flexing strength of ordinary lead-in, Celluline* for resistance to sun and wind, RG59/U for multi-set operation and areas of extreme interference, neutral color Decorator lead-in, plus regular 300-ohm line, 150-ohm line, and 75-ohm line. Call your Belden jobber.

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*Belden Trademarks and Patents—U.S. Patent No. 2782251 and 2814666

†Belden Trademark—Reg. U.S. Pat. Off.

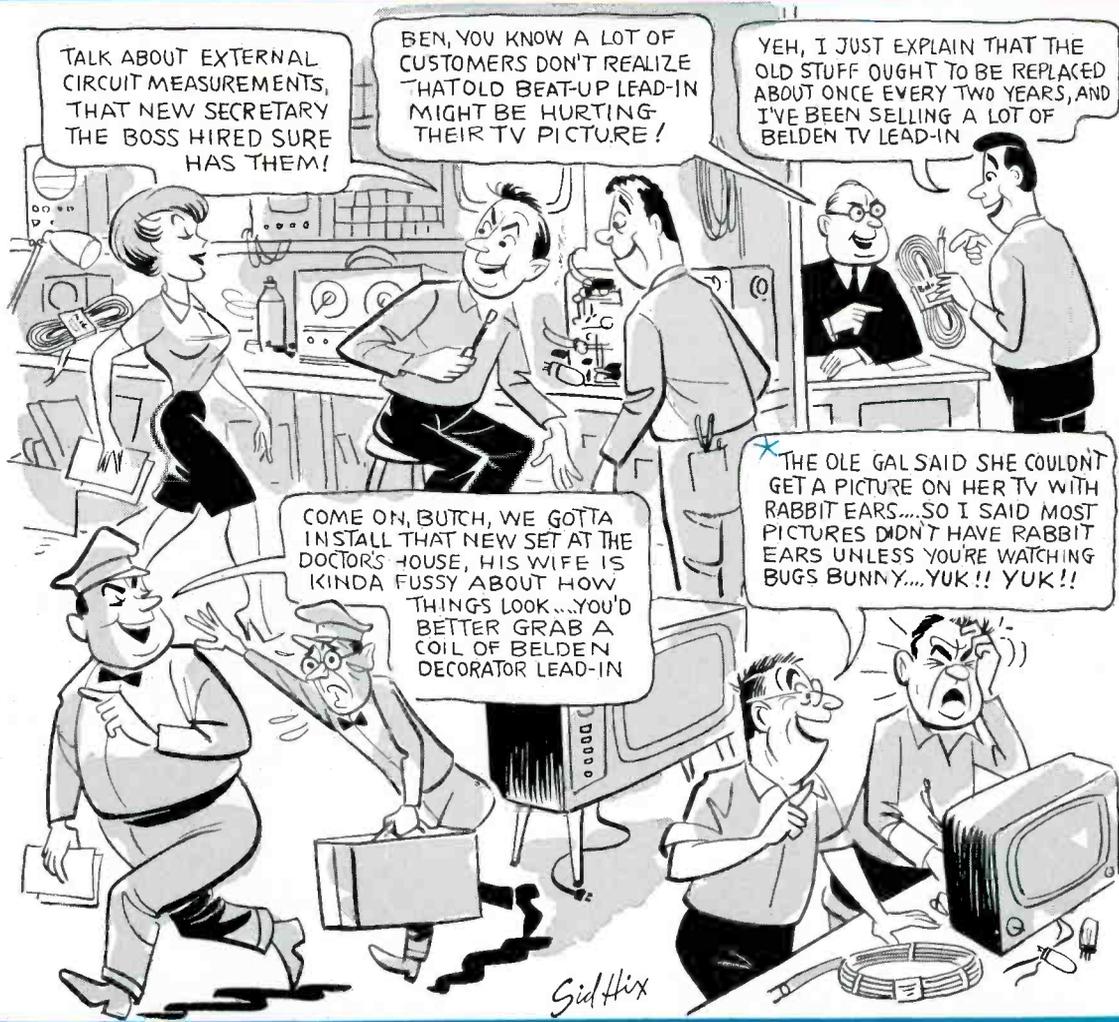
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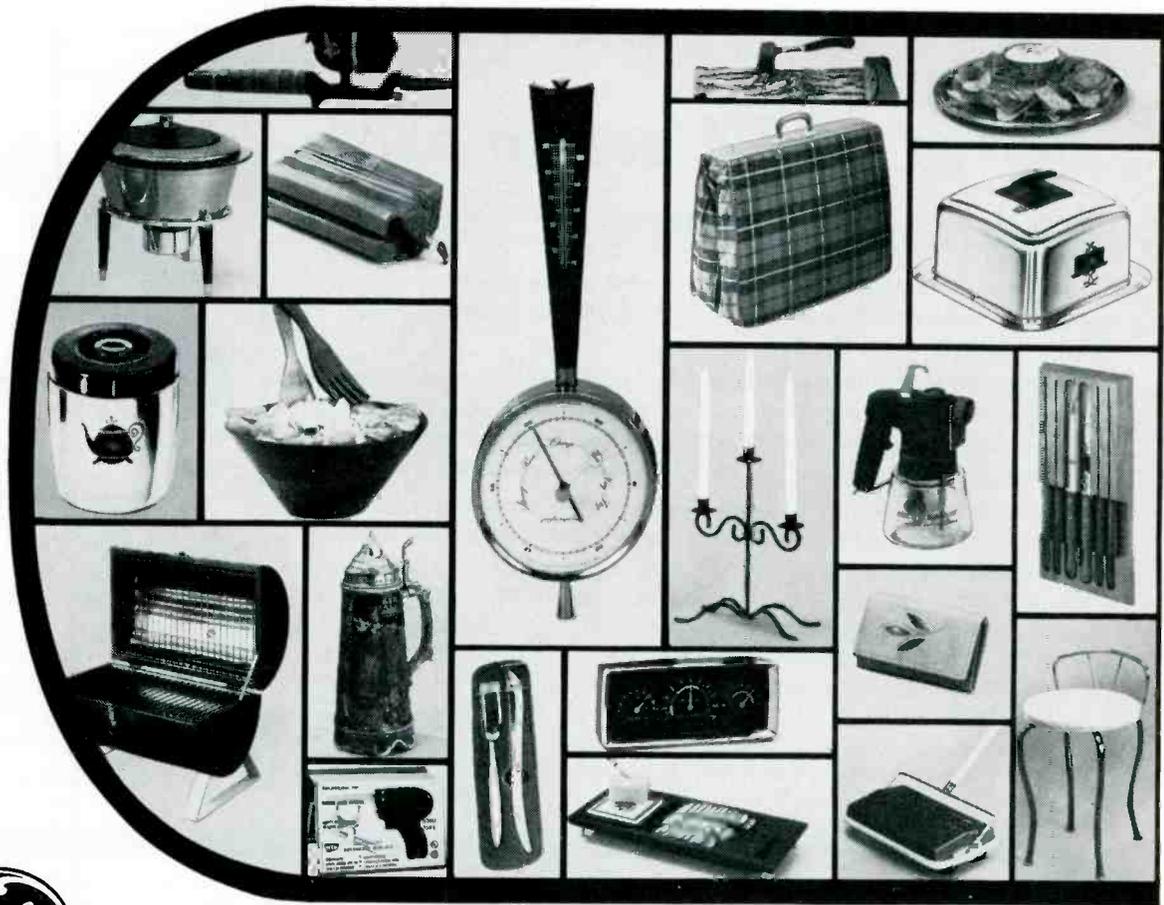
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Send us your gag ideas for future cartoons. For each of your gag ideas used, we'll send you a \$25 Savings Bond. Write Belden Manufacturing Company, Attention: Mrs. Madelsa Allison, P.O. Box 5070-A, Chicago 80, Illinois.

*This month's winner: Charles W. Forster,
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pleasure pak

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Pleasure-Pak COUPON
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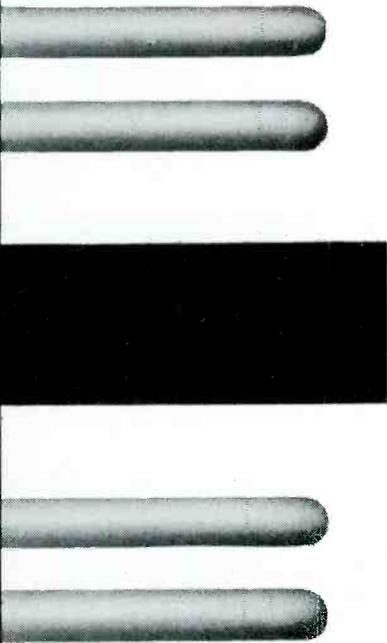
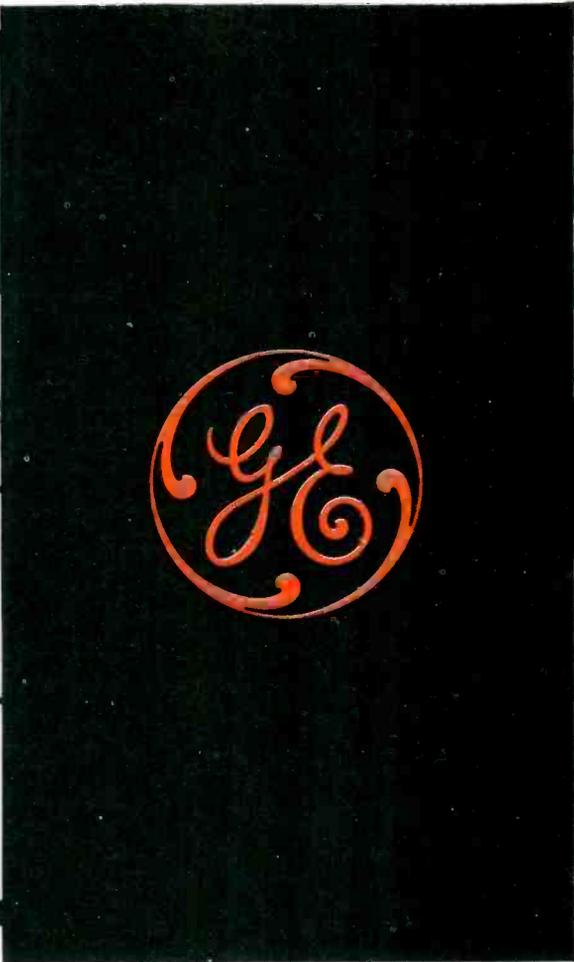
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1 "J" Award	1 "K" Award	1 "L" Award
1 "M" Award	1 "N" Award	1 "O" Award
1 "P" Award	1 "Q" Award	1 "R" Award
1 "S" Award	1 "T" Award	1 "U" Award
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The purchase of General Electric tubes makes you eligible to receive valuable merchandise during G-E's Pleasure Pak program. Imported musical steins, luggage, barbeque grills, tools, sporting equipment, carving sets and tableware and many other things can be yours at a tremendous discount or *even free*. All of these are well-known brand name products or special items that are not normally for sale.

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Your General Electric receiving tube distributor has a supply of Pleasure Pak books. The back cover of each book is a certificate redeemable for the merchandise shown in the book. Ask your distributor how to get them. The Pleasure Pak program is limited to April and May, 1964. Better stock up on G-E tubes NOW!

Revised May 7, 1964
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Progress Is Our Most Important Product



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Bigger and Better

While most technicians were enjoying the radio-TV-Hi Fi boom money that has come their way in recent years, the industrial electronic segment of this industry has made some dramatic changes.

Some technicians have taken it upon themselves to become a part of these changes while others have stuck by their TV guns. Many of the latter group have "made it" and many more have dropped by the wayside. Ironically, many who left the TV business were hired by industrial plants who could have been their salvation.

To help shop owners who are engaged in some sort of industrial electronics work or plan to go into it soon, ELECTRONIC TECHNICIAN plans to incorporate a big, new industrial electronic section into every issue starting with June. This section will carry information for every technician about new components, how they work and their uses in the industry. It will also tell what technicians need to know about PA, two-way, CCTV, and remote control systems. These are but a few of the many articles we are planning.

As a bonus to the entertainment-equipment-only technicians who have "made it," ET will be able to devote more space to radio, TV and Hi Fi articles.

The new section will increase ET's use to all technicians. If I were a side show huckster, I believe I'd describe the change by simply saying "everybody wins."

ET is still its readers' magazine, however. Our editors' only job is to provide interesting and informative articles which will be helpful in your business. One of our guide lines for this task is your mail. We read and consider every signed card and letter. We regret that we cannot personally answer every letter but getting out your magazine comes first. We hope those of you who have taken time to write understand this and will continue to give us your opinions.

Vic Bee

ELECTRONIC TECHNICIAN



EVERYTHING IN A NUTSHELL

... Viking your source from beginning to end. Manufacturers of the Rainbow series of 59U and all featured mainline cables. Plus a complete line of taps, amplifiers, wall plates, connectors and every component to successfully and profitably install a small or large system. Specializing in all phases of the closed circuit industry. We plan, design, layout and supply everything you need. Viking is your one shop for every phase of Master Antenna, Educational and Instructional Television System Equipment and cable. For a look at what's in our nutshell drop a line on a company letterhead and we will do the rest.

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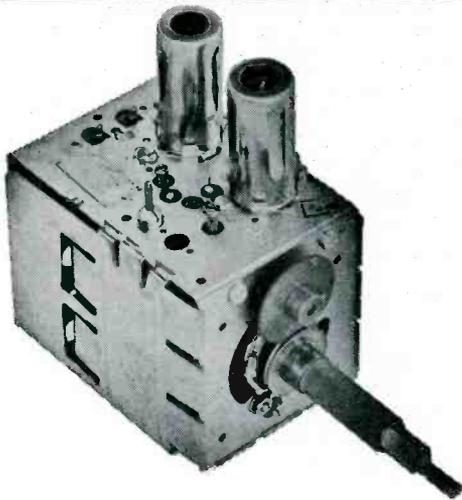
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Prices effective January 1, 1963

Tarzian offers
**FAST, DEPENDABLE
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MAKES)**



It just makes sense that a manufacturer of tuners should be better-qualified, better-equipped to offer the most dependable tuner repair and overhaul service.

Sarkes Tarzian, Inc. pioneer in the tuner business, maintains two complete, well-equipped Factory Service Centers—assisted by Engineering personnel—and staffed by specialized technicians who handle **ONLY** tuner repairs on **ALL** makes and models.

Tarzian-made tuners received one day will be repaired and shipped out the next. Allow a little more time for service on other than Tarzian-made tuners.

Tarzian offers a 12-month guarantee against defective workmanship and parts failure due to normal usage. And, compare our cost of \$9.50 and \$15 for UV combinations. There is absolutely no additional, hidden charge, for **ANY** parts except tubes. You pay shipping costs. Replacements on tuners beyond practical repair are available at low cost.

Ⓢ Tarzian-made tuners are identified by this stamping. When inquiring about service on other tuners, always give TV make, chassis and Model number. All tuners repaired on approved, open accounts. Check with your local distributor for Sarkes Tarzian replacement tuners, replacement parts, or repair service.



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Bloomington, Indiana

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STOP!

LOOK!

SAVE!



All crystal controlled

A STANDARD COLOR BAR GENERATOR

at **1/2**
THE COST OF OTHERS

only **\$124⁵⁰**

the all new SENCORE CG126 STANDARD COLOR BAR GENERATOR

A standard color bar, white dot, crosshatch generator especially made for field service on color TV . . . and at a great savings to you.

Check these outstanding features and you will see why this generator belongs on the top of your list for color TV servicing.

All patterns crystal controlled offering "rock like" stability. You'll think the patterns are painted on the TV screen.

Simplified operation speeds up every servicing job. Just dial the standard keyed bars, white dots, crosshatch, vertical bars or horizontal bars and watch them "pop" on the screen. That's all there is to it.

Exclusive adjustable dot size. The white dots can be adjusted to the size that satisfies your needs by a screwdriver adjustment on the rear. No need to argue about dot size anymore. Just select the size that you like to work with best.

Pretuned RF output to Channel 4. Other low channels can be selected if Channel 4 is being used in your area by simple slug adjustment. Patterns are injected directly into antenna terminals, simplifying operation and saving servicing time.

Reserved output on color bars for forcing signal through defective color circuits. The color output control is calibrated at 100 percent at the center of rotation, representing normal output. A reserve up to 200 percent is available on the remainder of rotation.

Smaller and more portable. With color receivers weighing much more than black and white TV, portable equipment becomes essential for home servicing. The CG126 weighs less than 10 pounds and measures only 11" x 8" x 6".



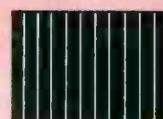
Ten standard keyed color bars (RCA type) that automatically provide all colors at specified NTSC phases . . . but without need of interpretation when servicing.



Stable white dots with new exclusive dot size adjustment in rear.



Stabilized crosshatch pattern for simplifying convergence adjustments.



10 thin white vertical lines for horizontal dynamic convergence adjustments . . . often missing on other generators.



14 thin horizontal lines for vertical dynamic convergence. Also missing on many high priced generators.

March into your local parts distributor and demand the CG126 Sencore color generator that sells at 1/2 the price of others. Don't let him switch you.

SENCORE

426 SO. WESTGATE DRIVE • ADDISON, ILL.

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ELECTRONIC TECHNICIAN

TECHNICAL DIGEST

DELCO RADIO

All Chassis—Intermittent Noises

Whenever you have the complaint that a hybrid radio makes weird noises occasionally—motorboating, whistles, squeals—better check the electrolytic filter capacitor. Not only can these noises be heard when a filter opens intermittently, but motor noise, turn signal and brake light noise will also usually be present during the time the filter is not doing its job. When the complaint follows the above pattern, try tapping the electrolytic can with the handle of a screwdriver. If this doesn't make the noise occur, turn the lights on and off, depress the brakes and turn the ignition key and radio on and off several times. Before changing the capacitor, make sure the solder connections at that point are good and not causing the trouble. And remember that AVC by-pass capacitors cause a similar type of motorboating noise sometimes, but this is very rare in recent models.

EMERSON-DUMONT

TV Chassis 120677-A, 120678-B, 120679-A, 120684-A, 120689-A,
—UHF Channel Strips

Individual channel UHF strips may be installed within VHF tuner 471332 (used in 23-in. receivers) if desired. As many as four different UHF strips may be utilized after the VHF tuner has first been modified by the addition of a UHF antenna input adapter plate, Standard Kollsman part number 31T3898-01. Part numbers for the various UHF channel strips may be derived by stating the part number of the desired UHF channel, followed by the designation "P4". For example, the part numbers for the correct UHF strips for use with tuner 471332 would be 31P4 (channel 31), 54P4 (channel 54), etc. The UHF antenna input adapter plate required, as well as the individual channel strips for receivable channels in any particular area, may be obtained from your local DuMont distributor.

GAMBLE-SKOGMO

TV Chassis TV2-9542A—Centering 23 in. Receivers

Receivers using the 92 deg tubes are more subject to pin cushion and linearity problems when not properly centered than are the 90 deg type sets. Should you experience any difficulty with either of these prob-

lems, a careful check of centering should be made. Exact centering and adjustment of the height and linearity controls will result in an improved picture in nearly all cases.

GENERAL ELECTRIC

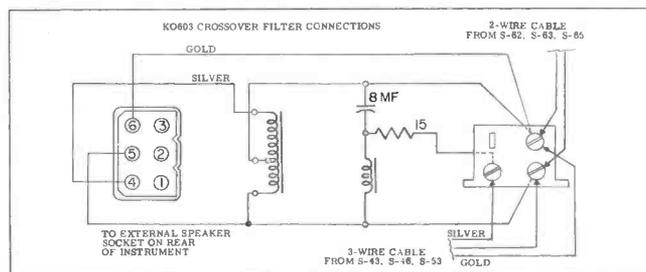
TV Chassis "MW"—Production Changes

To improve circuitry, capacitor C170 and C171, in the video amplifier circuit, were deleted in all chassis bearing code 133MW and above. . . . To improve circuitry in chassis bearing code 134MW and above, the value of capacitors C305 and C308 in the 6DT6, audio detector circuits, are changed from 10,000 pf to 5,000 pf. . . . To decrease UHF radiation, the UHF B+ dropping resistor (R2) was changed from 10,000 to 15,000 Ω . Although this change was made effective on chassis coded 125 MW and above, if replacement becomes necessary of the previous 10,000 Ω units, replace with ET 14X-145, 15,000 Ω To increase the audio output for models M780 and M781 coded 137MW and above, the divider resistor (R316) in the plate circuit of V8 (6DT6) was changed from 10,000 Ω to 15,000 Ω .

MAGNAVOX

Companion Speaker Systems Models S-62, S-63 & S-65—Connections

All of these speaker units incorporate 1,000 cps horns in conjunction with either a 12 or 15 in. bass speaker. The frequency crossover network is included



Magnavox connections for two types of speaker units when used with KO603 kit in conjunction with Astro-Sonic 100-w models.

in the speaker unit. This means that these speaker units can be connected directly to the external speaker terminals of any Magnavox instrument except Astro-Sonic models using the A590 (100 watt) Amplifier. With earlier speaker units, similar to the S-43, S-46

TECHNICAL DIGEST

and S-53, using high frequency horns it is necessary to install the KO602 crossover filter kit when used with models other than the 100-w Astro-Sonic. The KO603 kit must still be used with the Astro-Sonic models incorporating the 100-w amplifier regardless of which companion speaker system is used. In the case of the S-62, S-63 and S-65, however, only the impedance matching section of the network is used. The diagram shows the different connections required for the two types of speaker units when used with the KO603 kit in conjunction with the 100-w Astro-Sonic Models.

MOTOROLA

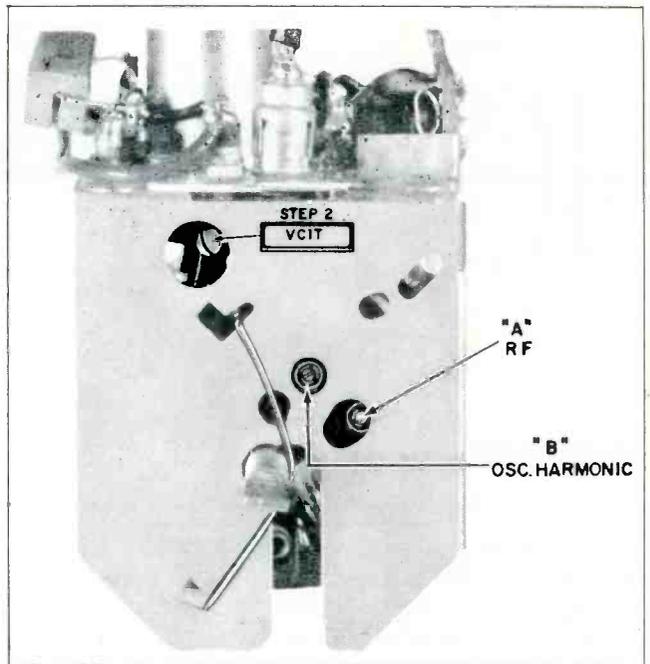
Color TV Chassis T5-908—Circuit Guard

The circuit guard is a thermal cutout type of overload relay. It is in series with the B+ power into the receiver for protection against shorts. The circuit guard will remain in the "closed circuit" state when the current requirements are normal. In the event of a continuous high current overload, the bi-metallic elements of the unit will become overheated to the extent of "opening" the contacts and disconnecting the B+ power. After the bi-metallic elements have cooled, the circuit guard may be re-set by depressing the plastic re-set button. The circuit guard is designed to remain "closed" on the higher-than-normal instantaneous surge currents encountered during the initial charge of the filter capacitors. When a short exists in the associated circuitry, power will not be reapplied when the re-set button is held depressed.

PHILCO

TV Tuners TT82, TT83, and TT84 Series—Installation and Adjustment of UHF Channel Strip

1. Before installing UHF strip the tuner must be modified for UHF operation by installing a UHF adapter kit, part no. 425-0052. Where tuner is already adapted for UHF disregard above.



Trimmer screw locations on Philco tuner.

2. Remove tuner cover.
3. Remove unused VHF channel strip and two adjacent VHF strips.
4. Install UHF strip in center portion and replace adjacent VHF strips.
5. Replace tuner cover.
6. Rotate tuner to bring in UHF station.
7. Adjustment of the UHF strip is usually not necessary. However, in the event the UHF strip, when installed in a fringe area, does not provide adequate reception, the RF and oscillator trimmer on the UHF strip may be touched up.
8. Make certain fine tuning control is correctly adjusted.
9. Using a non-metallic screwdriver, carefully adjust trimmer screws "A" (RF) and "B" (osc) in this order, for best picture with minimum snow.

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THE AUGUST
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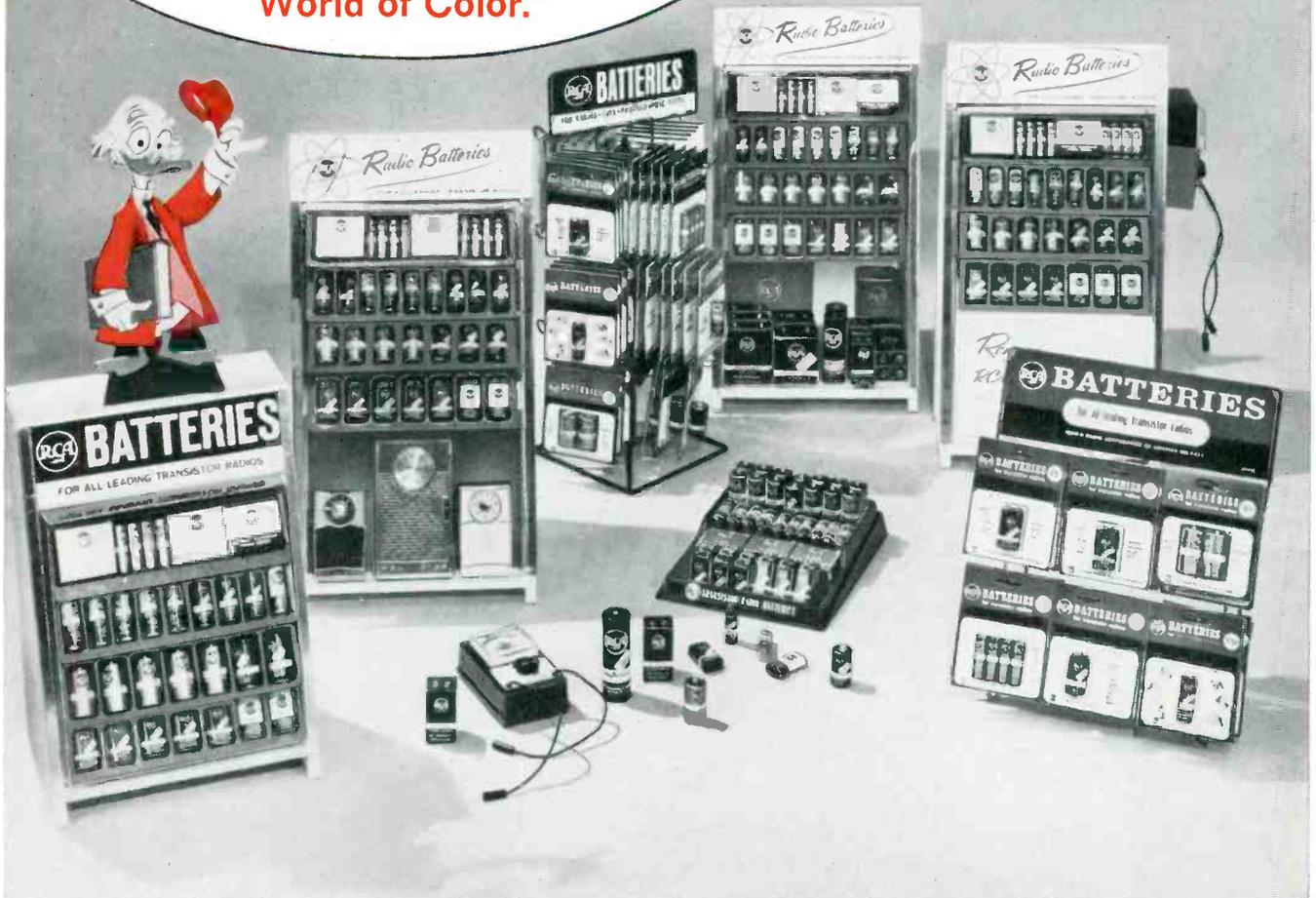
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city _____ zone _____ state _____

In their homes, your customers are being pre-sold on **RCA Radio Batteries** over network TV ...on Walt Disney's "Wonderful World of Color."

In your store, these compact counter merchandisers **continue that pre-selling** right at the point-of-purchase.



NETWORK-TV ADVERTISING

During the key summer months, network-TV commercials will be carrying RCA Battery Advertising into over NINE MILLION homes...to over 21

MILLION viewers*. Get the most out of the radio battery business with the name your customers associate with radio...RCA.

COMPACT COUNTER MERCHANDISERS

Here's the way to take a single foot of counter space and really put it to work. Any one of these attractive merchandisers effectively displays RCA Batteries while creating strong RCA brand recognition. Such a merchandiser, with pilfer-proof plastic front face, creates a real battery showcase.

For self-service operation, there's RCA's award-

winning blister-packaging. New to the battery business? Then pick an RCA pre-packed battery assortment as a start.

See your Authorized RCA Battery Distributor or write: Battery Department, RCA Electronic Components and Devices, Harrison, N. J.

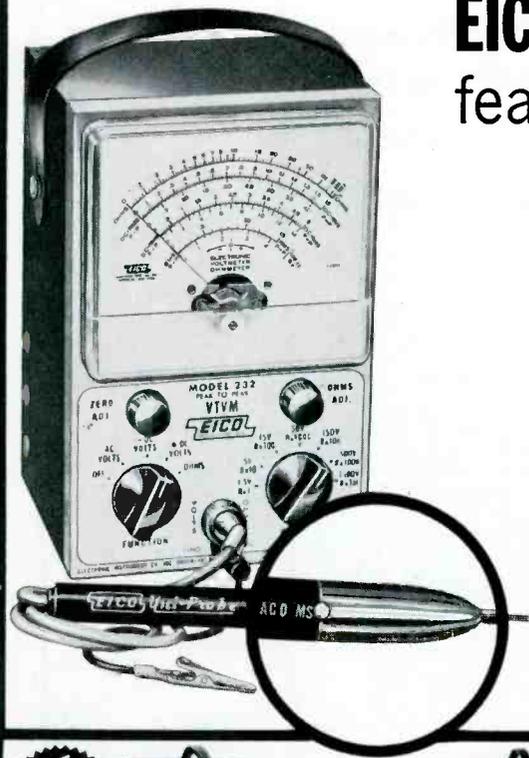
*Estimate of average viewing audience per show during June, July and August based on Nielsen National Television Index.



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EICO 232 peak-to-peak VTVM featuring exclusive Uni-probe® (U.S. Pat.)



Deluxe VTVM for color & B & W

- Calibration without removing from cabinet
- Measure directly p-p voltage of complex & sine waves: 0-4, 14, 42, 140, 420, 1400, 4200
- DC/RMS sine volts; 0-1.5, 5, 15, 50, 150, 500, 1500 (up to 30,000 volts with HVP probe, & 250 mc with PRF probe)
- Resistance ranges: 0.2 ohms to 1000 megs in 7 ranges
- 7 non-skip ranges on every function
- 4 functions: + DC Volts, - DC Volts, AC Volts, Ohms.
- Uniform 3 to 1 scale ratio for extreme wide-range accuracy
- Large 4 1/2" meter in can't-burn-out circuit
- Zero center for TV-FM discriminator alignment
- Smart professional styling—new satin finish etched panel with contrasting knobs and meter and grey wrinkle steel case.

Kit \$29.95; wired \$49.95.

◀ Exclusive UNI-PROBE: (pat. pending) Terrific timesaver, performs all functions: A half turn of probe-tip selects DC or AC-Ohms

EICO KITS FOR 1964

BEST BUY SCOPES



EICO 460 WIDEBAND 5" SCOPE For color & black-and-white TV servicing. Easily reproduces 3.58 mc color TV synchronizing burst. Vert. amp. flat from DC to 4.5 mc, usable to 10 mc; 25 mv rms/inch sensitivity. Horiz. amp. flat from 1 cps to 400 kc; 0.6 v rms/inch sensitivity. Automatic sync. Sweeps from below 10 cps to 100 kc. Kit \$89.95; Wired \$129.50.



EICO 427 ADVANCED GENERAL PURPOSE 5" SCOPE High sensitivity scope has all the facilities and quality demanded for servicing audio, communications and industrial equipment. Vert. amp. flat from DC to 500 kc, -6 db at 1 mc; 3.5 mv rms/cm sensitivity. Horiz. amp. flat from 2 cps to 450 kc; 0.18 v rms/cm sensitivity. Automatic sync. Sweeps from 10 cps to 100 kc. Kit \$69.95; Wired \$109.95.



EICO 430 PORTABLE GENERAL PURPOSE 3" SCOPE Remarkably fine compact scope. Excellent for servicing audio, communications, and industrial equipment. Ideal as a ham shack monitor. Flat-face 3" CRT with mu metal shield eliminates affects of external fields. Vert. amp. flat from 2 cps to 500 kc, -6 db at 1 mc; 25 mv rms/cm sensitivity. Horiz. amp. from 2 cps to 350 kc, 0.25 v rms/cm sensitivity. Sweeps from 10 cps to 100 kc. Kit \$69.95; Wired \$99.95.



EICO 955 IN-CIRCUIT BRIDGE-TYPE CAPACITOR TESTER Unique shunt-resistance balancing* provision, permits in-circuit short checks even in the presence of as little as 1 ohm shunt resistance. Sensitive open check down to 15 µmf normally, adjustable to as little as 5 µmf. Wien Bridge capacity measurements from 0.1 to 50 µf. Kit \$19.95; wired \$39.95 *Pat. applied for.



EICO 667 DYNAMIC CONDUCTANCE TUBE & TRANSISTOR TESTER Combines mutual conductance test with a peak emission test—gives a single reading of tube quality. Also spots bad NPN and PNP transistors for gain and leakage tests. New 1964 design has sockets and settings for the latest receiving types, including 5 and 7-pin novators. Also tests novars, 10-pin miniatures, and compactrons, many low-power transmitting and special-purpose tubes, voltage regulators, electron-ray indicators, etc. Multi-circuit lever switch; 13 tube-element pushbutton switches. 4 1/2" meter; roll-chart in snap-in window. Kit \$79.95; wired \$129.95. **EICO CRU CRT ADAPTER**—Adapts 667 to test all color and B & W CRT's. Wired \$9.95.



FOR COLOR AND B & W

EICO 369 TV/FM SWEEP GENERATOR WITH BUILT-IN POST INJECTION MARKER Feeds only the sweep signal to the circuit under test or alignment. A demodulator picks off the response signal and feeds it to a mixer stage where the markers are added before scope display. Thus, troublesome interaction effects are eliminated. Sweep generator has controllable inductor sweep circuit (all electronic) with no mechanical parts to wear and give trouble, and 5 fundamental ranges from 3.5 to 316 mc. Variable frequency marker provides output on 3 fundamental ranges from 2 to 60 mc., and 60 to 225 mc range on harmonics. 4.5 mc crystal supplied for rapid check of marker generator alignment. Kit \$89.95; wired \$139.95.



TOP-NOTCH TRANSISTOR TESTING TEAM

EICO 1020 POWER & BIAS SUPPLY with 0.005% ripple. Continuously variable metered output voltage, 0-30 VDC at 150 to 300mA. Kit \$23.95; wired \$29.95.

EICO 680 TRANSISTOR & CIRCUIT TESTER Measures basic characteristics of signal and power transistors. Provides DC current, DC voltage (20K ohm/volt), and resistance ranges normally needed for transistor work. Kit \$25.95; wired \$39.95.

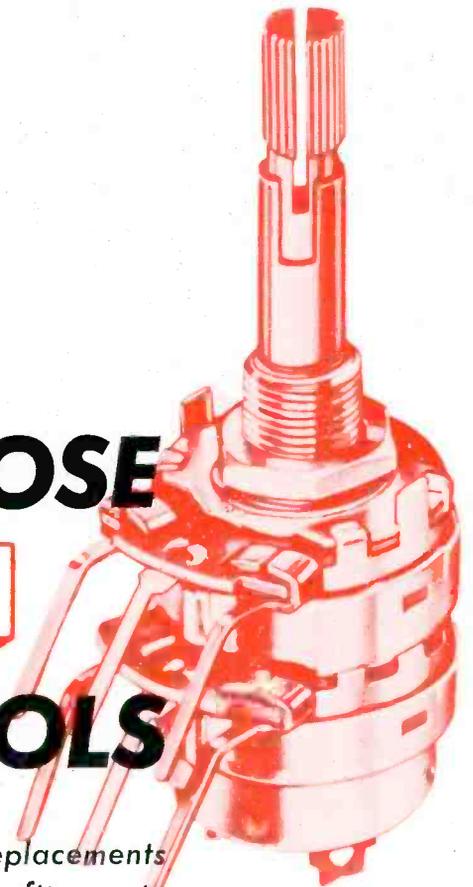
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HOW TO CHOOSE AND USE CONTROLS



*Make rapid replacements
and improve your profit margin*

by Norman Nelson

Sales Engineer, Centralab

■ Modern black and white TV receivers use the equivalent of 8 to 9 single controls (one or two may be dual concentric types). Color TV approximately triples this number of controls. (Earlier RCA color designs used 32 to 35 controls whereas late sets use about 26 single controls.) Obviously, the selection and application of proper TV controls is important to technicians.

A typical control complement in a modern B/W TV set includes: (1) volume control, 2) contrast, 3) brightness, 4) height, 5) AGC, 6) horizontal hold, 7) vertical hold, 8) vertical linearity and 9) sync stability. (This does not include the controls on additional devices such as remote control tuner, AM/FM tuner and stereo-monophonic amp-

lifier chassis which may be incorporated into the larger packaged assemblies.)

Rapid replacement of a defective control is important to a profitable service operation. It is equally important, therefore, for technicians to find a duplicate of the original control with minimum effort.

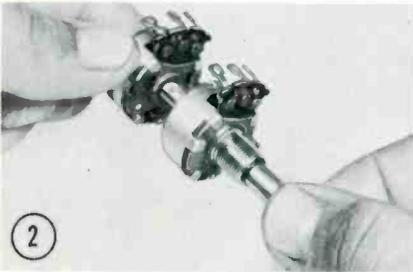
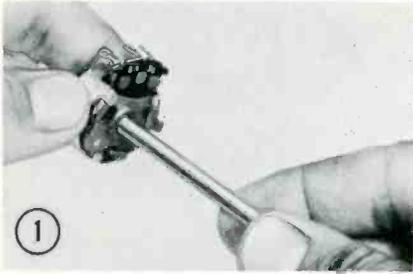
Ordering an exact duplicate control from the original set manufacturer may result in an extended delivery delay and customer dissatisfaction and loss of net profit. Fortunately, there are several control manufacturers whose lines of "off-the-shelf" controls and shafts can be assembled rapidly into exact duplicate replacements. These are generally available through electronic parts distributors.

Where complete information is available on a control's electrical and physical specifications, these units are ideal replacements. However, where detailed reference data is not readily available, considerable time may be expended in determining the proper replacement.

Power Ratings

Power ratings for TV controls vary with circuit applications and engineering design. Volume controls require negligible current dissipation whereas the typical wattage rating specified by the set manufacturer for brightness, contrast, height, horizontal and vertical hold controls is $\frac{1}{2}$ w or less.

Depending on the original manufacturer's design, the AGC, buzz



It's easy to assemble a dual concentric control (1). Components merely snap together (2). Courtesy Clarostat.

and vertical linearity controls are either $\frac{1}{2}$ w carbon composition types or flange or PC mounting $1\frac{1}{2}$ to 2 w screwdriver slot wirewound types. Early TV sets used wirewound focus controls with a 4 w rating and, in many cases these would burn out. About 11 or 12 years ago, newer circuit designs reduced this wirewound requirement to 2 w maximum. Subsequently, this was reduced so that the standard $\frac{1}{2}$ w carbon composition control provided an ample safety factor.

Voltage Breakdown

Almost all $\frac{1}{2}$ w and 2 w controls are tested to EIA specifications. Controls are required to withstand 900 vac RMS between any terminal and the case (ground) for one minute. Actually, most controls of this type will readily withstand 1200 vdc. This is adequate for most applications.

Recently, circuit designs have been developed that use higher voltages, some as high as 1500 vdc, usually as vertical size/height controls. Fortunately, a newly developed control with a nylon rotor will handle a minimum of 1500 vdc with no difficulty.

Taper Considerations

Selection of the correct taper is a prime requisite if technicians expect to achieve: 1) original optimum circuit performance, 2) easier cir-

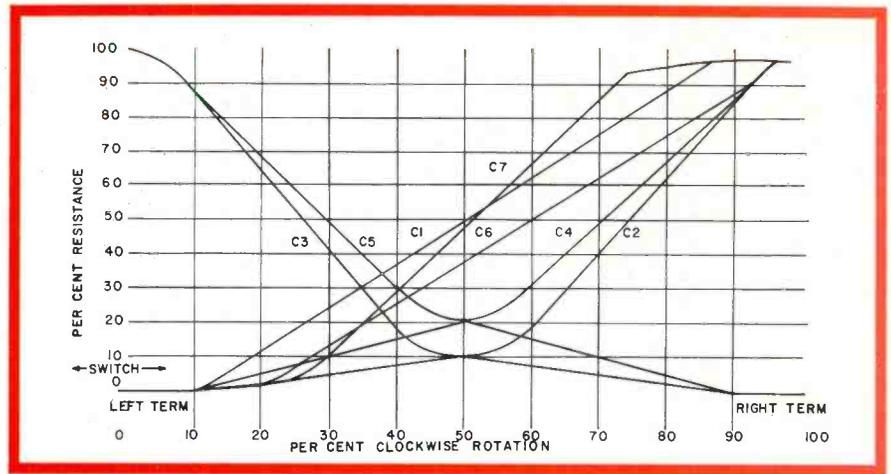


Fig. 1—Standard resistance curves. C1: linear, has uniform resistance change from either end, TV hor. drive; vert. lin; hor. & vert. centering; Hor. & vert. hold; focus; brightness; height; contrast. C2: semi-log audio vol. or tone. C3: right-hand semi-log, decrease with clockwise rotation. C4: modified log, vol. and tone control. C5: right-hand modified log, decreases with clockwise rotation. C6: modified log, vol. control or antenna shunt and 'C' bias. C7: symmetrical-straight line with slow resistance change at either end, used as tone control.

cuit adjustments, 3) normal operating life, and 4) smooth control of volume and contrast.

Perhaps a dozen basic tapers are used widely in TV controls. There are many more less frequently used tapers, however. Occasionally, to obtain optimum circuit performance, a set design will use a special taper not readily available. Identification of these special tapers presents no difficulty if technicians are familiar with control design.

Taper Application Data

The following information should assist technicians in understanding and identifying control tapers.

The most common standard (non-tapped) resistance tapers and taper functions are listed at the right side of Fig 1. Tapers C1, C2, C3 and C5 are employed in most TV controls. Tapers C4 and C6 are modified cw log and no longer too popular for new design. Taper C7 was originally designed for a combination bass-treble tone control in one unit. It is still currently very popular in TV, auto radio and also stereo-monophonic preamplifiers. It is also a good substitute for linear taper replacement.

Tapers C3 and C5 are very popular in tone controls. However, these tapers have also been used for contrast controls since the early days of TV. They are used in contrast controls for two basic reasons:

1) to provide a much smoother and finer adjustment of contrast, and 2) more current can be dissipated at the *clockwise end* by connecting the control as a rheostat. This greater current dissipation is obtained by depositing a thicker layer of resistance material from the 50 to 100 percent clockwise rotation-area of the resistance element. This is equally true for tapers C2, C4 and C6 in Fig. 1 except that this heavier resistance layer is deposited at the opposite or counter-clockwise end. Taper C7 is designed to dissipate a greater amount of current at either end of rotation.

This extra current-carrying capacity applies *only* between the center terminal and the appropriate clockwise or counter-clockwise terminal. (except in taper C7). This taper design makes it possible for technicians to use these modified ccw or cw log tapers in a standard $\frac{1}{2}$ w rated carbon control instead of a costly wire-wound control.

A graph of standard tapped resistance tapers is shown in Fig 2. Tapers C12, C13, C14, C15, C16 and C17 are all modified clockwise log for volume (loudness) controls. The "tap" terminal at 37, 50 or 62 percent of clockwise rotation is connected to the RC network which in turn gives automatic bass compensation which *increases progressively with counter-clockwise rotation* from the tap position.

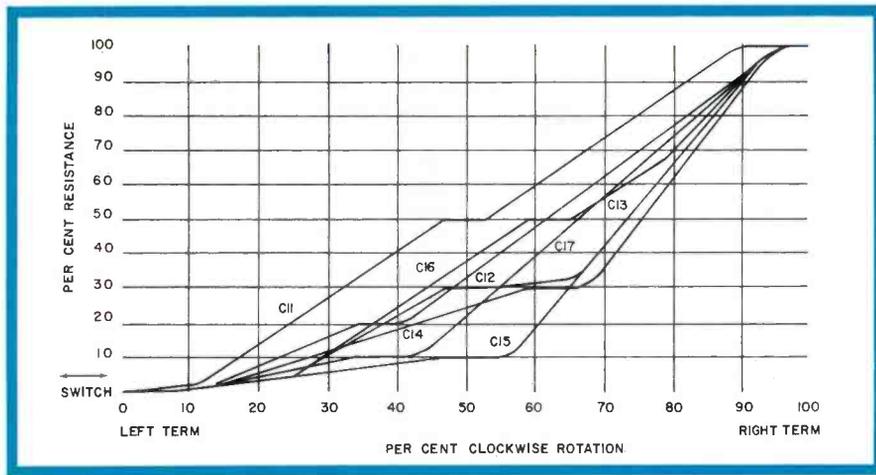


Fig. 2—Standard tapped resistance curves. C11: taper tapped, tone control or in TV or vert. and hor. centering. C12, C13, C14, C15, C16 and C17: used as vol. control with tone compensating tap.

Tapers C12 and C16 are by far the most popular “tapped” tapers used since the advent of TV. Taper C13 is no longer frequently used, although it is relatively common in older TV sets. Tapers C14 and C17 are also found in TV sets and C14 is extremely popular in auto radio controls.

Special tapped tapers C51, C53, C59 and C60 are shown in Fig. 3. C51, C53 and C60 are used principally as “tapped” type contrast controls in resistance values 30K and lower.

Special tapped tapers C52, C54, C55, C56, C57 and C58 are shown in Fig. 4. Tapers C52 and C55 are quite popular for TV contrast controls in resistance values 25K and less.

Taper Determinations

An end view shaft layout of a typical control is shown in Fig. 5. The three-standard terminals are pointing down and designated as LT, CT, and RT. The three-optional tap terminals are dotted in and designated 37, 50 and 63 percent. These aforementioned tapped tapers will show these positions from the counter-clockwise end. Single taps are available in any one of these three positions, but double-taps will exist only in the 37 and 63 percent positions.

Determining the replacement
Continued on page 90

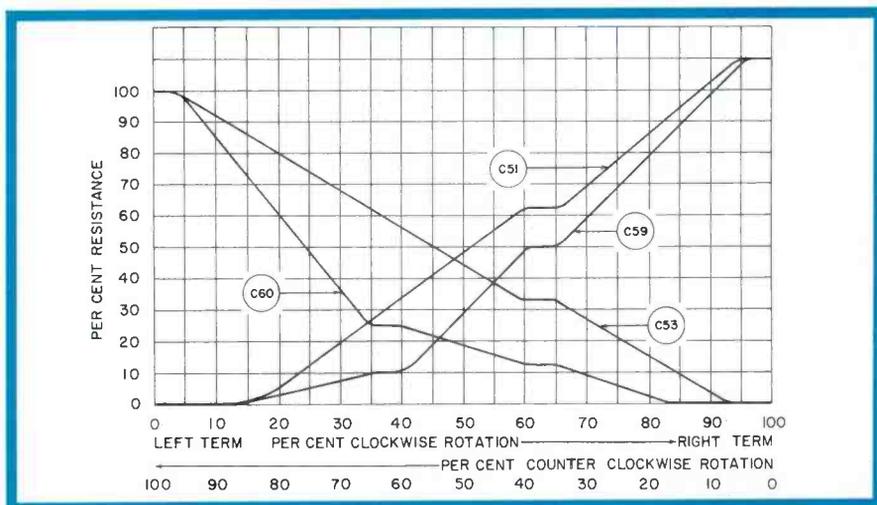


Fig. 3—Special tapped resistance tapers. C51: LH linear; C53: RH linear; C59 LH semi-log; C60: RH semi-log.

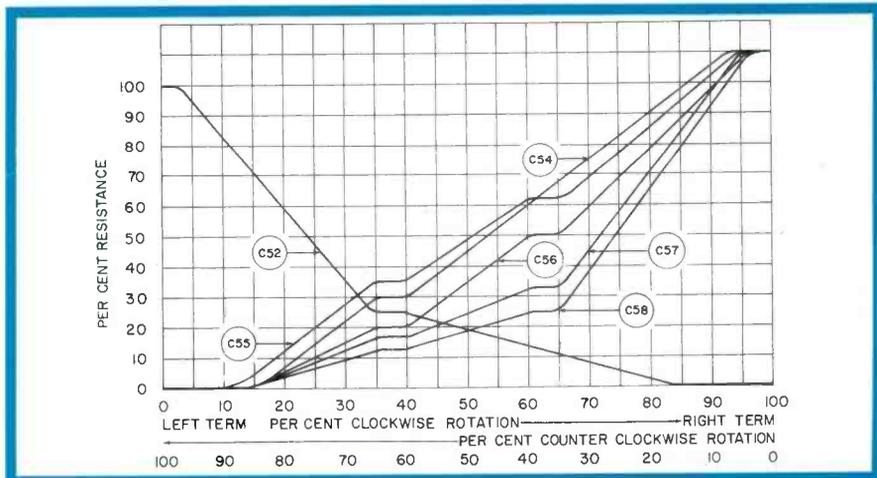


Fig. 4—Special tapped resistance tapers. C52: RH taper; C54: LH linear taper; C55: LH linear taper; C56: LH taper; C57: LH taper; C58: LH taper.

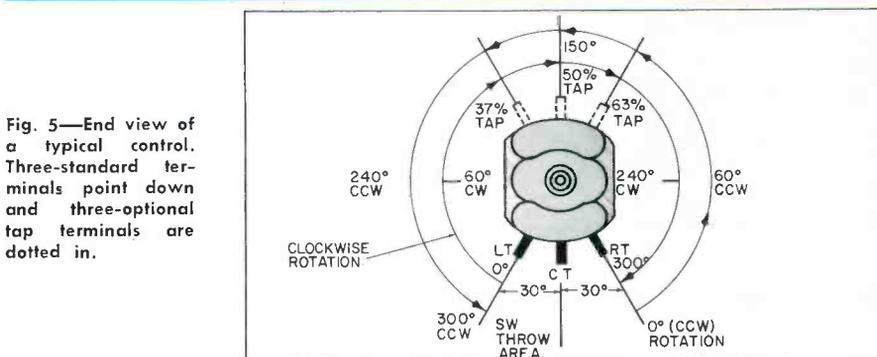
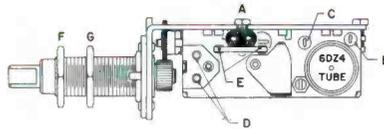


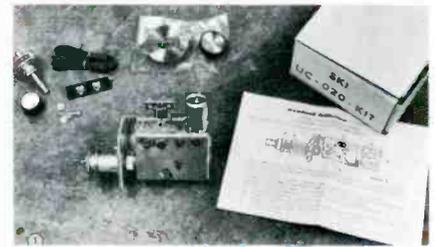
Fig. 5—End view of a typical control. Three-standard terminals point down and three-optional tap terminals are dotted in.

TABLE I

Takeoff Point Voltage	Resistor Value	Wattage to Deliver 80 v at Point "B"
300	14K	10
275	12K	10
250	10K	5
225	9.2K	5
200	7.5K	5
175	6.0K	5
150	4.7K	5
125	3.0K	2
100	1.3K	2



Top view of converter shows terminals used in hookup.



IN-CABINET UHF CONVERTER

1—The basic items in the Standard Kollsman SKI UC-020 kit include the UHF converter tuner, tuning knob and dial, terminal board, antenna B+ switch, switch knob, a length 300 ohm lead and all necessary mounting hardware.

2—Installation instructions; parts checked; proper tools; and you are ready to install the UHF converter tuner into the TV set. Before starting out, look the TV cabinet over and determine the best location for mounting the converter. Take exterior appearance, ease of customer tuning, finished dress of leads, and ease of securing desired voltages into consideration.

3—Drill 7/16 in. diameter hole in the cabinet for B+ switch. If switch is to be mounted on removable back plate of TV set, it should be mounted last. Remember to leave sufficient lead lengths.

4—Drill or punch 3/4 in. mounting hole in cabinet for converter.

5—Provide enough lead length between connection points and converter mounting location; five connections must be made. Connect ground terminal on UHF converter to chassis ground on set with standard hook-up wire. Connect terminal "B" straight through proper dropping resistor (value determined from Table I) to B+ source in set. Connect terminal "C" to source of 6.3 vac. In many cases the required voltages can be taken off terminals on the VHF tuner without going below the chassis. Shown here is the standard twin-

lead from antenna terminal strip on back of set being soldered to terminals "D" on the converter.

6—Proper dropping resistor to B+ source in set is soldered to terminal "B" on UHF converter tuner. A terminal mount will be desirable to support the "free" end of the resistor in some installations.

7—Check the wafer switch to assure proper connections.

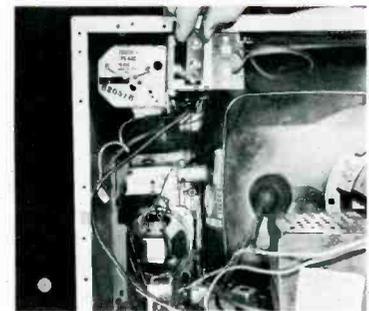
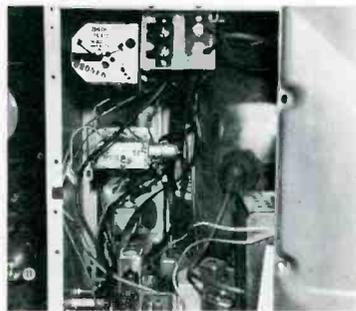
8—Wired UHF converter tuner ready to be placed inside TV cabinet. Mounting bushing is inserted through 3/4 in. hole and entire unit held in place by two hex mounting nuts.

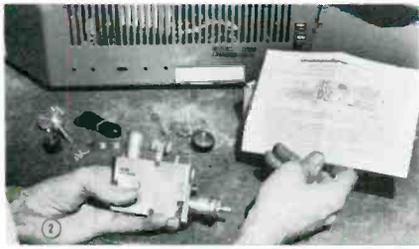
9—Most sets have a place to mount the UHF antenna terminal board adjacent to VHF antenna board on back of TV set.

10—Interconnect B+ dropping resistor with switch assembly prior to final stage of installation.

11—Putting on the rear cover with the UHF converter tuner kit completely installed.

12—Final adjustment and tuning UHF channel. Total time: 45 minutes!





■ A UHF television converter kit that can be installed in about 45 minutes in consoles, table models, and most portables, has been developed. The converter tuner permits the TV dealer or service technician to customize television sets for his customers, make VHF television trade-ins more saleable, or replace defective UHF tuners. It tunes all channels, 14 through 83. The kit contains all necessary parts including tuner.

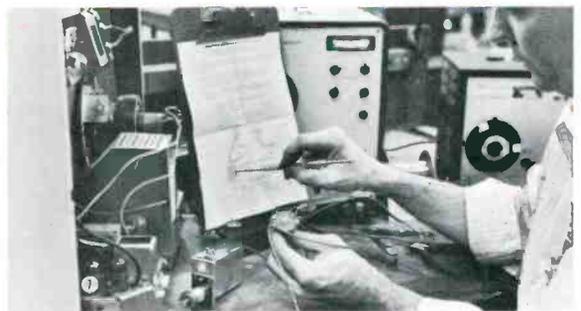
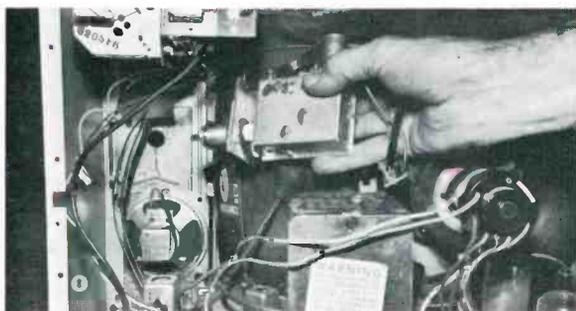
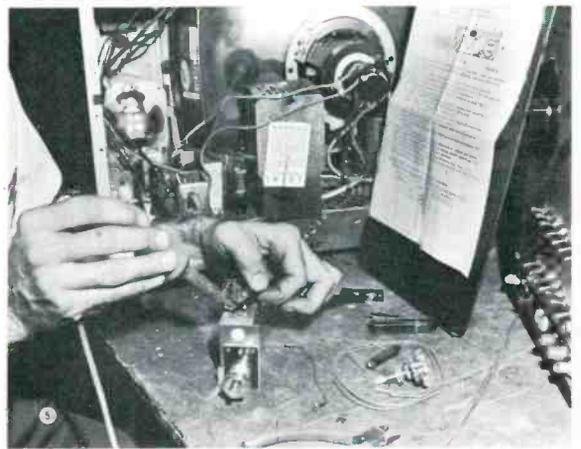
The unit can be installed inside the TV set giving it that factory "built-in" appearance. This is particularly desirable for customers who do not want a top-of-the set converter or where the TV is portable.

The tuner has a channel 5 or 6 output to the VHF tuner. The unit fits in any open space 5½ in. long, 1½ in. wide and 3¾ in. high.

A separate switch is incorporated in the converter kit for switching between UHF and VHF channels.

A portable drill with ¾ in. bit, or chassis punch, a soldering gun, screwdriver, wrench and wire insulation strippers are the basic tools needed.

The accompanying photos show the installation procedure. ■



TYPE	DESCRIPTION	CHARACTERISTICS SIMILAR TO	BASING	HEATER	BULB	MAXIMUM DIMENSIONS IN INCHES		
						DIAMETER "A"	HEIGHT "B"	
1AD2	HV Diode	1J3 High-Voltage Rectifier	12DQ	1.25 v	0.2 a	T-9	1.188	3.000
2AH2	HV Diode	3A3 High-Voltage Rectifier	12DG	2.5 v	0.3 a	T-9	1.188	3.000
2AS2	HV Diode	2AH2 High-Voltage Rectifier	12EW	2.5 v	0.33 a	T-9	1.188	3.250
3AT2	HV Diode	3A3 High-Voltage Rectifier	12EX	3.15 v	0.22 a	T-9	1.188	3.250
4HA7	Dissimilar Double-Triode	One 12AU7 Section (Pins 4, 9, and 10) plus One 12AX7 Section	12FQ	4.2 v	0.6 a	T-9	1.188	1.500
6AF11	Dissimilar-Double-Triode Pentode	High-Mu Triode Section (Pins 5, 6, and 8) plus 6CX8	12DP	6.3 v	1.05 a	T-9	1.188	2.000
6AG11	Duplex-Diode Twin Triode	12AT7 Twin Triode plus 6BW8 Diodes with Separate Cathodes	12DA	6.3 v	0.75 a	T-9	1.188	1.500
6AL11	Dissimilar Double Pentode	6DT6 (Pins 2, 3, 4, 6, and 7) plus 6AQ5	12BU	6.3 v	0.9 a	T-9	1.188	2.000
6AR11	Twin Pentode	Two 6GM6 Pentodes	12DM	6.3 v	0.8 a	T-9	1.188	1.500
6AS11	Dissimilar Double-Triode Pentode	High-Mu Triode Section (Pins 5, 6, and 8) plus 6CX8	12DP	6.3 v	1.05 a	T-9	1.188	2.000
6AV11	Triode Triode	Three 12AU7 Triode Sections	12BY	6.3 v	0.6 a	T-9	1.188	1.500
6AX3	Diode	6AX4-GTB Damping Diode	12BL	6.3 v	1.2 a	T-9	1.188	2.250
6AX11	Duplex-Diode Twin Triode	12AX7 Twin Triode plus 6BW8 Diodes with Separate Cathodes	12DA	6.3 v	0.69 a	T-9	1.188	1.500
6B10	Duplex-Diode Twin Triode	12AU7 Twin Triode plus 6BW8 Diodes	12BF	6.3 v	0.6 a	T-9	1.188	1.500
6BA11	Triode-Twin Pentode	6HS8 plus Medium-Mu Triode	12ER	6.3 v	0.45 a	T-9	1.188	2.000
6BD11	Dissimilar-Double-Triode Pentode	Medium-Mu Triode Section (Pins 3, 4, and 7), High-Mu Triode Section (Pins 5, 6, and 8), plus Video Pentode	12DP	6.3 v	1.05 a	T-9	1.188	2.000
6BE3	Diode	Damper-Maximum Rating: Peak Inverse Voltage—5000 Volts, DC Output Current—200 Milliamperes	12BL	6.3 v	1.2 a	T-9	1.188	2.500
6BF11	Dissimilar Double Pentode	6DT6 (Pins 2, 3, 5, 6, and 7) plus Power Output Pentode	12EZ	6.3 v	1.2 a	T-9	1.188	2.000
6BH11	Twin-Triode Pentode	Two 6GH8 Triode Sections plus 6GH8 Pentode Section	12FP	6.3 v	0.8 a	T-9	1.188	2.000
6BJ3	Diode	6W4-GT Damper	12BL	6.3 v	1.2 a	T-9	1.188	2.250
6C10	Triple Triode	Three 12AX7 Triode Sections	12BQ	6.3 v	0.6 a	T-9	1.188	1.500
6D10	Triple Triode	Three 12AT7 Triode Sections	12BY	6.3 v	0.45 a	T-9	1.188	1.500
6FJ7	Dissimilar Double Triode	6DH7 Vertical Oscillator (Pins 9, 10, and 11) and Amplifier	12BM	6.3 v	0.9 a	T-9	1.188	2.000
6FM7	Dissimilar Double Triode	6EA7 Vertical Oscillator (Pins 9, 10, and 11) and Amplifier	12EJ	6.3 v	1.05 a	T-9	1.188	2.000
6FY7	Dissimilar Double Triode	6DR7 Vertical Oscillator (Pins 9, 10, and 11) and Amplifier	12EO	6.3 v	1.05 a	T-9	1.188	2.500
6G11	Dissimilar Double Pentode	6DT6 (Pins 2, 3, 4, 6, and 7) plus 6CU5	12BU	6.3 v	1.2 a	T-9	1.188	2.000
6GE5	Beam Pentode	6DQ6-B Hor. Defl. Amp.	12BJ	6.3 v	1.2 a	T-12	1.563	2.500
6GF5	Beam Pentode	6DQ6-B Hor. Defl. Amp.	12BJ	6.3 v	1.2 a	T-9	1.188	2.500
6GV5	Beam Pentode	6DQ6-B Hor. Defl. Amp.	12DR	6.3 v	1.2 a	T-12	1.563	3.250
6GY5	Beam Pentode	Hor. Defl. Amp.—Maximum Ratings: Plate Dissipation—18 Watts, DC Cathode Current—230 Milliamperes	12DR	6.3 v	1.5 a	T-12	1.563	3.250
6HB5	Beam Pentode	6GY5 Hor. Defl. Amp.	12BJ	6.3 v	1.5 a	T-12	1.563	3.000
6HD5	Beam Pentode	Hor. Defl. Amp.—Maximum Ratings: Plate Dissipation—24 Watts, DC Cathode Current—280 Milliamperes	12E5	6.3 v	2.25 a	T-12	1.563	3.000
6HE5	Beam Pentode	6EZ5 Vert. Defl. Amp.	12EY	6.3 v	0.8 a	T-9	1.188	2.500
6HF5	Beam Pentode	6DQ5 Hor. Defl. Amp.	12FB	6.3 v	2.25 a	T-12	1.563	3.750
6J10	Pentode-Gated Beam Disc	6BN6 plus 6AL11 Power Output Pentode	12BT	6.3 v	0.95 a	T-9	1.188	2.000
6J11	Twin Pentode	Two 6EW6 Pentodes	12BW	6.3 v	0.4 a	T-9	1.188	1.500
6J28	Triode-Pentode	6SB7 Triode plus 12R5 Pentode	12DZ	6.3 v	1.2 a	T-9	1.188	2.000
6K11	Three Section Triode	One 12AU7 Section (Pins 4, 9, and 10) plus Two 12AX7 Sections	12BY	6.3 v	0.6 a	T-9	1.188	1.500
6M11	Twin-Triode Pentode	Two 12AT7 Sections plus 6EW6 Pentode	12CA	6.3 v	0.75 a	T-9	1.188	1.500
6Q11	Three Section Triode	6K11	12BY	6.3 v	0.6 a	T-9	1.188	1.500
6T9	Triode-Pentode	6AL11 Power Pentode plus One 12AX7 Section	12FM	6.3 v	0.93 a	T-9	1.188	2.000
6T10	Dissimilar Double Pentode	6AL11	12EZ	6.3 v	0.95 a	T-9	1.188	2.000
6U10	Three Section Triode	One 12AX7 Section (Pins 5, 6, and 7) plus Two 12AU7 Sections	12FE	6.3 v	0.6 a	T-9	1.188	1.500
8B10	Duplex-Diode Twin Triode	6B10	12BF	8.5 v	0.45 a	T-9	1.188	1.500
10AL11	Dissimilar Double Pentode	6AL11	12BU	9.8 v	0.6 a	T-9	1.188	2.000
11AR11	Twin Pentode	6AR11	12DM	11.2 v	0.45 a	T-9	1.188	1.500
12AL11	Dissimilar Double Pentode	6AL11	12BU	12.6 v	0.45 a	T-9	1.188	2.000
12AX3	Diode	6AX3	12BL	12.6 v	0.6 a	T-9	1.188	2.250
12BE3	Diode	6BE3	12BL	12.6 v	0.6 a	T-9	1.188	2.500
12BT3	Diode	6W4-GTA	12BL	12.6 v	0.45 a	T-9	1.188	2.250
12GE5	Beam Pentode	6GE5	12BJ	12.6 v	0.6 a	T-12	1.563	2.500
13J10	Pentode-Gated-Beam Disc	6J10	12BT	13.2 v	0.45 a	T-9	1.188	2.000
15AF11	Dissimilar Double Triode	6AF11	12DP	14.7 v	0.45 a	T-9	1.188	2.000
15BD11	Dissimilar-Double-Triode Pentode	6BD11	12DP	14.7 v	0.45 a	T-9	1.188	2.000
15FM7	Dissimilar Double Triode	6FM7	12EJ	14.8 v	0.45 a	T-9	1.188	2.000
15FY7	Dissimilar Double Triode	6FY7	12EO	14.7 v	0.45 a	T-9	1.188	2.500
16GY5	Beam Pentode	6GY5	12DR	15.8 v	0.6 a	T-12	1.563	3.250
17AX3	Diode	6AX3	12BL	16.8 v	0.45 a	T-9	1.188	2.250
17BE3	Diode	6BE3	12BL	16.8 v	0.45 a	T-9	1.188	2.500
17BF11	Dissimilar Double Pentode	6BF11	12EZ	16.8 v	0.45 a	T-9	1.188	2.000
17GE5	Beam Pentode	6GE5	12BJ	16.8 v	0.45 a	T-12	1.563	2.500
17GV5	Beam Pentode	6GV5	12DR	16.8 v	0.45 a	T-12	1.563	3.250
17JZ8	Triode-Pentode	6JZ8	12DZ	16.8 v	0.45 a	T-9	1.188	2.000
21GY5	Beam Pentode	6GY5	12DR	21.0 v	0.45 a	T-12	1.563	3.250
21HB5	Beam Pentode	6HB5	12BJ	21.0 v	0.45 a	T-12	1.563	3.000
21HB5-A	Beam Pentode	6HB5	12BJ	21.5 v	0.45 a	T-12	1.563	3.000
21HJ5	Beam Pentode	6DQ5 with External Connection to Suppressor	12FL	21.5 v	0.6 a	T-12	1.563	3.250
22BW3	Diode	22DE4	12BL	22.4 v	0.45 a	T-9	1.188	2.500
23Z9	Dissimilar Double-Triode Pentode	6JZ8 plus Medium-Mu Triode (Pins 7, 10, and 11)	12FT	23.0 v	0.45 a	T-9	1.188	2.000
30AG11	Duplex-Diode Twin Triode	6AG11	12DA	30.0 v	0.15 a	T-9	1.188	1.500
33G17	Diode-Pentode	6GE5 plus 6AX3	12FC	33.6 v	0.45 a	T-12	1.563	2.500
33GY7	Diode-Pentode	6GE5 plus 6AX3	12FN	33.6 v	0.45 a	T-12	1.563	2.500
38HE7	Diode-Pentode	6HB5 plus 6BJ3	12FS	37.8 v	0.45 a	T-12	1.563	2.750
79B4	Beam Pentode	6146	12EU	13.5 v	0.58 a	T-12	1.563	2.500
8156	Beam Pentode	R-F Power Amplifier—21 Watts Output (IMS) at 17.5 Mc	12EU	13.5 v	0.3 a	T-9	1.188	1.938

Take the guess out
of CRT troubleshooting

The 'Other' End of the Picture

by Ben Allen

■ At one time or another, all technicians have probably spent considerable time troubleshooting a TV set only to find that the picture tube was bad. This can be an aggravating experience to say the least. One good way to avoid such problems is to always check the CRT with a high quality tester. But in addition, we should know as much about CRT malfunctions as possible. Also included in this category are the components normally associated with the CRT which may cause it to appear "dead" or, as in the case of ion traps, may even damage it if the trap is misadjusted for an extended period.

Picture tubes may be classified in several ways: Angle of deflection, size of screen, type of focus or whether the tube uses an ion trap are the most common factors in classification. Since the deflection angle and the size of the screen do not actually affect the electrical characteristics of a CRT, the method of focus is most commonly used when describing the tube's type.

Focus types are broken down into two categories: 1) Electrostatic, the most commonly used type in today's sets, and 2) Magnetic. The later category can be further divided depending on whether a permanent magnet or an electromagnet is employed in a given set. Either may be used with a CRT designed for magnetic focus.

All sets being produced today use electromagnetic deflection. Early sets, however, employed electrostat-

ic deflection (as most oscilloscopes still do). How the elements of a modern picture tube are connected to its base plug and the relative positions of the centering magnet, ion trap and focus coil or PM focus assembly when they are used is shown in Fig. 1.

While many testers will show that a tube is not performing properly, it is sometimes desirable to find out why. For example, if one of the tube's elements is open, a bad solder joint in the connector may be at fault. A repair is possible if it can be determined which element is open.

Tests to determine which element is open are shown in Fig. 2. When the open element is determined, heat and a small amount of solder can be applied to the pin on the CRT base. If an open pin connection is at fault, this will generally solve the problem.

Ion Traps

Ion traps rarely fail, but they can be most puzzling when they do fail. While an ion trap may fail completely and cause low or complete failure of CRT brightness, it is usually found that a trap is too strong or more frequently too weak. Either of the latter conditions can easily be recognized by noting the optimum position of the ion trap. If the ion trap is positioned forward on the neck of the tube, the magnet is probably too weak. On the other hand, if the magnet is positioned very near the tube

base, it is probably too strong. In either case, the magnet should be replaced.

A myth has circulated for years that a tube can be damaged if the ion trap is reversed on the CRT. This is not true. If the trap is not too far back or forward, and if it is adjusted for maximum brightness, the trap may be installed in either direction. This is true, however, only for single magnet ion traps.

The double magnet ion trap should never be used to replace the single unit ion trap or vice versa. When a double magnet ion trap is reversed on the CRT neck severe shadowing will sometimes result when the trap is positioned for maximum brightness.

In order to be prepared for almost any case, it is a good idea to stock one of the adjustable ion traps which are variable in strength from about 30 to 50 gauss. If you are in doubt as to whether a certain CRT should have an ion trap, consult the tube manual.

Focus Assemblies

The focus assembly on magnetic focus CRTs can also be the cause of considerable trouble in the older sets.

Most focusing coils or magnets are designed so they can only be installed in one direction on the CRT. If poor focus is a problem, the magnet's position should be checked. When the set has a round tube, it may be advisable to rotate the picture tube for best focus.

Tube

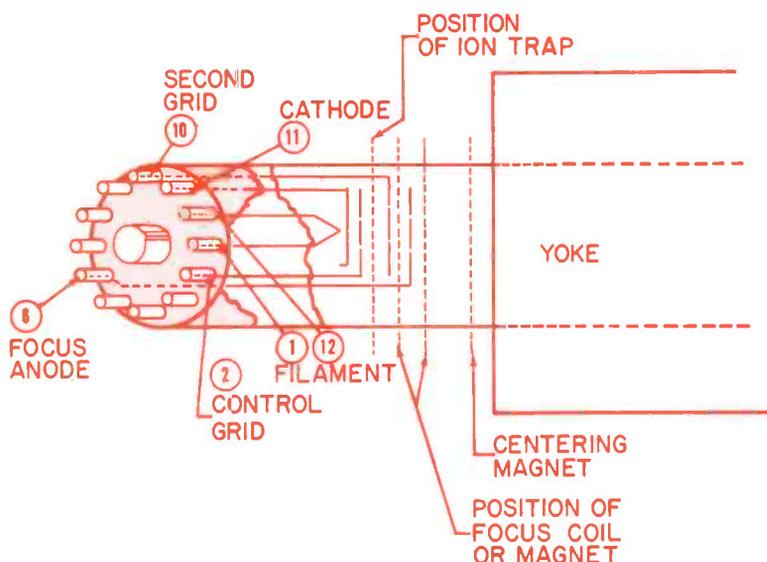


Fig. 1.—The physical relationship of the CRT's elements, the base and its accessories.

Ordinarily, reversing the front and back of the focus coil assembly will not have an effect on the picture quality, but the focus will have to be adjusted. Also, more current will usually be required to obtain the proper focus when it is installed in one direction than in the other direction. Where a great deal of current is required to focus a given tube, and this current is out of the adjustment range, reversing the coil may improve the control's range.

When a focusing coil is employed, it is generally in series with other B+ circuits in the set. Gradual deterioration and changes in component values may make a good focus adjustment impossible.

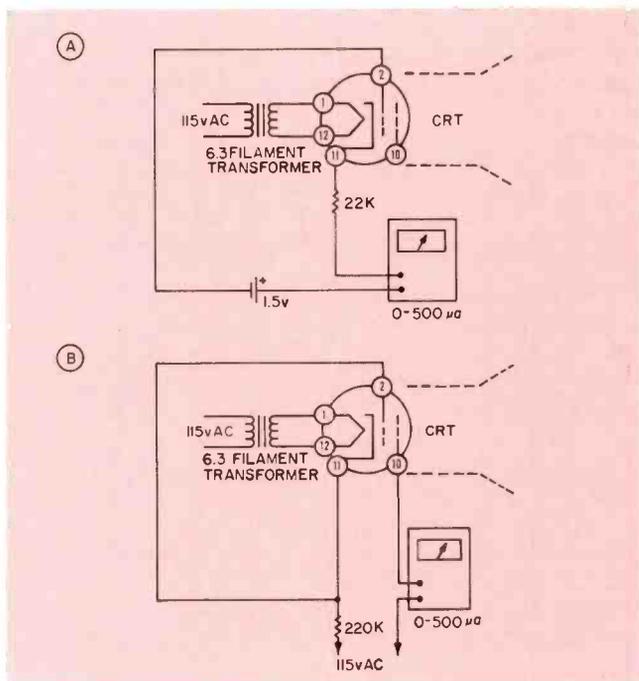
Both PM and coil-type focusing assemblies may allow good focusing at the center or sides of the CRT only. This is usually brought about by misplacement of the assembly on the CRT neck.

There are no set rules regarding the amount of voltage on the focusing anode of electrostatic focused CRTs. The voltage may be less than the cathode or up to 500 v more than the cathode. The focus pin may even be grounded.

Most sets now being built do not have a focus adjustment, but pin six is tied directly to some point in the B+ line. If focus is poor, it may be advantageous to locate the tap at some other point which has a higher or lower voltage.

Some sets have a 2 MΩ pot in series with the focus grid and the highest point in the B+ circuit. ■

Fig. 2. (A)—Set up to check for an open control grid. Any reading indicates continuity. (B)—Set up to check for open second grid. If a zero reading is obtained in both of these checks, an open cathode is indicated.



Coming Next Month

- The first part of a series on auto radio repair.
- An enlightening article on using the ac VTVM.
- Part I of a series on credit risks and collections.
- How to eliminate 'spooks', 'snivets', and Barkhausen lines.
- New Industrial Section: Pocket pagers, tunnel diodes, ultrasonics and zener diodes.
- Plus more features and all the regular departments.

1964 ELECTRONIC TECHNICIAN'S DIRECTORY

An alphabetical listing of the names and addresses of manufacturers of replacement products, component parts, equipment, instruments, materials and services

A

AC Electronics Div GMC 1925 E Kenilworth Milwaukee Wis
 ATR Electronics 300 E 4th St St Paul Minn
 Acme Electric Corp 31 Water St Cuba NY
 Acoustic Research 24 Thorndike St Cambridge Mass
 Acro Products 369 Shurs Lane Philadelphia Pa
 ADC Inc 2833 13 Ave S Minneapolis Minn
 Adler Electronics 1 Lefevre Lane New Rochelle NY
 Admiral Corp 3800 W Cortland St Chicago Ill
 Advance Relay 2435 N Naomi St Burbank Calif
 Aerovox Corp 740 Belleville Ave New Bedford Mass
 Akro-Mils 820 Market St Akron O
 Allen-Bradley 136 W Greenfield Ave Milwaukee Wis
 Alliance Mfg Co Alliance O
 Allied Radio 100 N Western Ave Chicago Ill
 Alpha Wire Corp 200 Varick St New York NY
 Altec-Lansing 1515 S Manchester Anaheim Calif
 American Concertone 9449 W Jefferson Blvd Culver City Calif
 American Electronic Labs Inc PO Box 552 Lansdale Pennsylvania
 American Geloso Electronics 251 4 Ave New York NY
 American Microphone Div see Electro Voice
 American Telephone & Telegraph 195 Bdw New York NY
 Amp Inc 3822 Eisenhower Blvd Harrisburg Pa
 Ampex Electric 230 Duffy Ave Hicksville NY
 Ampex Corp Box 5000 Redwood City Calif
 Amphenol-Borg Electronics 2801 S 25 Ave Broadview Ill
 Amprobe Instrument 630 Merrick Rd Lynbrook NY
 Analab Instrument 30 Canfield Rd Cedar Grove NJ
 Anasphone Corp 10912 La Cienega Blvd Inglewood Calif
 Andrea Radio 27-01 Bridge Plaza N Long Island City NY
 Antennacraft 1215 Agency St Burlington Iowa
 Antenna Designs Box 110 Burlington Iowa
 Antenna Products Co Box 110 Mineral Wells Tex
 Antenna Specialists 12435 Euclid Ave Cleveland O
 Antronic Corp 2712 W Montrose Ave Chicago Ill
 Arco Electronics Community Drive Great Neck NY
 Arcturus Electronics 420 Kearny Ave Kearny NJ
 Argos Products 600 South Sycamore Genoa Ill
 Arkay Int'l 88-06 Van Wyck Expressway Richmond Hill LI NY
 Armo Steel Corp 703 Curtis St Middletown O
 Arrow Fastener Co 1 Junius St Brooklyn NY
 Arrow-Hart & Hegeman 103 Hawthorne St Hartford Conn
 Artisan Organs 2476 N Lake Avenue Altadena California
 Arvin Industries Columbus Ind
 Astratic Corp Jackson & Harbor Sts Conneaut O
 Astron Corp 255 Grant Ave East Newark NJ
 Atlas Sound 1449 39 St Brooklyn NY
 ATR Electronics 300 E 4 St St Paul Minn
 Audax Inc 109-01 37 Ave Corona NY
 Audio Devices 444 Madison Ave New York NY
 Audio Dynamics 1677 Cody Ave Ridgewood NJ
 Audio Empire Div Dyna Empire 1075 Stewart Ave Garden City NY
 Audio Corp 514 Bdw New York NY
 Audio-Master Corp 17 E 45 St New York NY
 Audiotech Mfg 400 S Wyman St Rockford Ill
 Audiotech Mfg 3225 Exposition Pl Los Angeles Calif
 Automatic Electric Co Northlake Ill

B

B&K Instruments (Bruel & Kjaer) 3006 W 106 St Cleveland O
 B&K Mfg Co 1801 W Belle Plaine Chicago Ill
 BSR (Birmingham Sound Reproducers) Ltd College Point LI NY
 Ballantine Labs Boonton NJ
 Barber-Colman Co Rockford Ill
 Barker & Williamson Bristol Pa
 Barry Electronics 512 Bdw New York NY
 Beauchaine Sales Corp 584 Union Avenue Laconia NH
 Beckman Instruments Berkeley Div 220 Wright Ave Richmond Calif
 Belden Mfg 415 S Kilpatrick Chicago Ill
 Bell & Howell 7100 McCormick Rd Chicago Ill
 Bell Sound Systems 6325 Huntley Rd Columbus O
 Bell Telephone Labs 463 West St New York NY
 Benco TV Assoc 277 Taber Rd Rexdale Ont Canada

Bendix Radio Div Industrial Electronic Prods Baltimore 4 Md
 Benjamin Electronic Sound 97-03 43 Ave Corona NY
 Berns Mfg 9853 Chalmers Detroit Mich
 Bird Electronics Corp 30303 Aurora Rd Solon O
 Bimbach Radio 145 Hudson New York NY
 Bliley Electric Union Station Bldg Erie Pa
 Blonder-Tongue Labs 9 Alling St Newark NJ
 Bogen-Presto PO Box 500 Paramus NY
 Boonton Radio Boonton NJ
 Bourns Labs Box 2112 Riverside Calif
 Bozak Co RT Box 1166 Darien Conn
 Browning Labs 100 Union Ave Laconia NH
 Brush Instruments 37 St & Perkins Cleveland O
 Bud Radio 4605 E 355 St Willoughby O
 Burgess Battery Exchange St Freeport Ill
 Burroughs Corp 6072 2 Ave Detroit Mich
 Bussmann Mfg 2538 W University St St Louis Mo

C

Cabinart Inc 35 Geyer St Haledon NJ
 Cadre Industries Box 150 Endicott NY
 Calbest Electronics 4801 Exposition Bldg Los Angeles Calif
 Cannon Electric 3208 Humbolt St Los Angeles Calif
 Capehart Corp 87-46 123 St Richmond Hill NY
 Castle TV Tuner Service 5710 N Western Ave Chicago Ill
 Centralab 900 E Keefe Ave Milwaukee Wis
 Champion De Arment Tool 5 Main St Meadville Pa
 Channel Master Corp Ellenville NY
 Charles Engineering Inc 3421 N Knoll Drive Los Angeles Calif
 Chem Spray Corp 67-27 Cadillac St Houston Tex
 Chemical Electronic Engineering Jackson & Ravine Drive Matawan NJ
 Chemtronics Inc 870 E 52 St Brooklyn NY
 Cinch Jones Div Cinch Mfg 1026 S Homan Ave Chicago Ill
 Cisin Co Harry G Amagansett NY
 Clairex Corp 19 W 26 St New York NY
 Clearstat Mfg Dover NH
 Clearbeam Antenna 21341 Roscoe Blvd Canoga Park Calif
 Cletron Inc 1974 E 61 St Cleveland O
 Cleveland Institute of Electronics 1776 E 17 St Cleveland O
 Cohu Electronics Massa Div 5725 Kearny Villa Rd San Diego Calif
 Colman Tool & Electric Products PO Box 2965 Amarillo Tex
 Colorgrams Inc 58 Old Stewart Ave New Hyde Park LI NY
 Communications Co 300 Greco Avenue Coral Gables Florida
 Conar Instrument 3939 Wisconsin Ave Washington DC
 Conrac Inc 19217 E Foothill Blvd Glendora Calif
 Continental Electronics 1050 N Central Expressway Dallas Texas
 Cornell-Dubilier Electronics 50 Paris St Newark NJ
 Crown Int'l Box 261 Elkhart Ind
 Cushman Craft 621 Hayward St Manchester NH
 Cutler-Hammer 436 N 12 St Milwaukee Wis

D

Dale Electronics 1378 28 Ave Columbus Neb
 Daystrom Inc Archbald Pa
 DeJur-Amsco 45-01 Northern Blvd Long Island City NY
 Delco Radio Div GMC Kokomo Ind
 Delmonico Int'l 120-20 Roosevelt Corona Ill
 DeWald Radio 35-15 37 Ave Long Island City NY
 Dialight Corp 60 Stewart Ave Brooklyn NY
 Diamond Tool 4602 Grand Ave W Duluth Minn
 Don Bosco Electronics Little Rd Hanover NJ
 Drake Mfg 4626 N Olcott Chicago Ill
 DuKane Corp St Charles Ill
 Du Mont Labs Allen B 750 Bloomfield Ave Clifton NJ
 Du Pont de Nemours Wilmington Del
 Duotone Co Locust St Keyport NJ
 Dutch Brand Div Johns-Manville 78 S Woodlawn Ave Chicago Ill
 Dymo Industries 2725 10 St Berkeley Calif
 Dynaco Inc 3912 Powelton Ave Philadelphia Pa
 Dyna-Empire 1075 Stewart Ave Garden City LI NY

E

ECL Electronic Communications 325 N Macquesten Pkwy Mt Vernon NY
 ELPA Industries Ortofon Div New Hyde Park Ill
 E-Z Hook Products 1536 Woodburn Ave Covington Ky
 E-Z Way Towers PO Box 5767 Tampa Fla

Eby Sales 148-05 Archer Ave Jamaica LI NY
 Eitel-McCullough 301 Industrial Way San Carlos Calif
 Elco Corp M St below Erie Philadelphia Pa
 Electric Auto Lite 3529 24 St Port Huron Mich
 Electric Storage Battery 1717 E 9 St Cleveland O
 Electro Acoustic Prods 2135 Bueter Rd Ft Wayne Ind
 Electronic Chemical Corporation 813 Commimpaw Avenue Jersey City NJ
 Electronic Instrument Co (EICO) 33-00 Northern Blvd Long Island City NY
 Electronic Measurements Lewis St. & Maple Ave Eatontown NJ
 Electronic Organ Arts 4949 York Blvd Los Angeles
 Electronic Prods Div Victoreen Instrument 111 E 3 St Mt Vernon NY
 Electronic Technician Ojibway Bldg Duluth Minn
 Electro Products Labs 4501 Ravenswood Chicago Ill
 Electro-Sonic Labs 627 Bdw New York NY
 Electro-Voice Inc Buchanan Mich
 Elgin Advance Relays 2435 W Naomi St Burbank Calif
 Eltec Labs 14 Alsop Avenue Middletown Connecticut
 Emerson Radio & Phono 14 & Coles Jersey City NJ
 Empire Scientific 1075 Steward Ave Garden City LI NY
 Enterprise Development Corp 917 Circle Tower Blvd Indianapolis Ind
 Entron 2141 Industrial Pkwy Silver Springs Md
 Ercona Corp 16 W 46 St New York NY
 Essex Wire 1601 Wall St Indianapolis Ind
 Euphonics Corp PO Box 2746 Rio Piedras Puerto Rico USA
 Eveready Batteries (see Union Carbide Co.)
 Exide Industrial Div Electric Storage Battery 52 S 15 St Philadelphia Pa

F

Fanon-Masco 439 Frelinghuysen Ave Newark NJ
 Fidelitone Inc 6415 Ravenswood Ave Chicago Ill
 Finney Co 34 W Interstate St Bedford O
 Fischer Special Mfg Co 446 Morgan St Cincinnati O
 Fisher Radio 21-24 44 Dr Long Island City NY
 Foxboro Co Newponset Ave Foxboro Mass
 Freed Transformer 1718 Weirfield St Brooklyn NY

G

GAM Electronics 138 Lincoln Street Manchester NH
 Gator Probe Corp 2751 San Juan Road Hollister California
 GC Electronics 400 S Wyman St Rockford Ill
 Garrard Sales 80 Shore Rd Port Washington NY
 Gavin Instruments Depot Square & Division Street Somerville NJ
 General Dynamics/Electronics 1407 N Goodman St Rochester NY
 General Electric Audio Products Div Deatur Ill
 General Electric Communications Products Div Lynchburg Va
 General Electric Receiving Tube Dept Owensboro Ky
 General Electric Receiver Div Utica NY
 General Instrument 65 Gouverneur St Newark NJ
 General Precision GPL Div Mt Kisco NY
 General Radio West Concord Mass
 General Radiotelephone Co 3501 W Burbank Blvd Burbank Calif
 Gertsch Products 3211 S La Cienega Blvd Los Angeles Calif
 Glaser-Steers Corp 155 Oraton St Newark NJ
 Globe Electronics 400 S Wyman St Rockford Ill
 Gosnet Div Altec Lansing Inc 1515 S Manchester Ave Anaheim Calif
 Good-All Electric 112 W 1 St Ogallala Neb
 Gotham Audio 2 W 46 St New York NY
 Grado Labs 4614 7 Ave Brooklyn NY
 Granco Products 80-30 Kew Gardens Rd Kew Gardens NY
 Greenlee Tool Rockford Ill
 Greentree Electronics 1122 S La Cienega Blvd Los Angeles Calif
 Gremer Mfg Co 7 North Ave Wakefield Mass
 Greyhound Package Express 140 W Dearborn St Chicago Ill
 Greylock Electronics 438 Central Ave Albany NY
 Griffith Electronics 1301 E Lyndon Avenue Lyndon NJ
 Grommes Div Precision Electronics 9101 King Ave Franklin Park Ill
 Guide Lamp Div GMC 2919 Pendleton Ave Anderson Ind
 Gulston Industries 212 Durham Ave Metuchen NJ

H

Hallamore Electronics 714 N Brookhurst St
Anahem Calif
Hallcrafters Co 4401 W 5 Ave Chicago Ill
Hallmark Electronics 436 N 31 St Philadelphia
Pa
Hallmark Instruments 6612 Denton Dr Dallas
Tex
Hammarlund Mfg 53 W 23 St New York NY
Harman-Kardon 55 Ames Plainview NY
Hartley Products 521 E 162 St Bronx NY
Hathaway Instrument 5800 E Jewell Ave
Denver Colo
Heath Co Benton Harbor Mich
Hewlett-Packard 1501 Page Mill Rd Palo Alto
Calif
Hickok Electrical Instrument 10514 Dupont Ave
Cleveland O
Hi-Lo Mfg 1122 Newport St Chicago Ill
Hitachi (see Sampson Co)
Hoffman Electronics Consumer Prods Div 3761
S Hill St Los Angeles Calif
Hollywood Television Wuerth Surgitron Div
1949 Moffett St Hollywood Fla
Hunter Sales RN 9851 Alburton Ave Santa Fee
Springs Calif
Hycon Electronics 1030 S Arroyo Pkwy Pasa-
dena Calif
Hy-Gain Antenna 1135 North 22 Lincoln Neb

I

I-T-E Circuit Breaker 601 E Erie Ave Philadel-
phia Pa
ITT Components 100 Kingsland Rd Clifton NJ
ITT Distributor Products PO Box 99 Lodi NJ
Injectorall Co 6 Bay 50th St Brooklyn NY
Int'l Business Machines 590 Madison Ave New
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Int'l Correspondence Schools Scranton Pa
Int'l Crystal Mfg 18 N Lee Oklahoma City Okla
Int'l Rectifier 233 Kansas St El Segundo Calif
Int'l Resistance 401 N Broad Philadelphia Pa
Int'l Tel & Tel 320 Park Ave New York NY

J

Jackson Electrical Instrument 124 McDonough
St Dayton O
J-B-T Instruments 61 Hamilton New Haven Conn
JFD Electronics 15 Avenue at 62 Street Brook-
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JW Electronics 1538 W Jarvis Chicago Ill
JW Electronics PO Box 51 Bloomington, Indiana
Jensen Industries 301 Interstate Rd Addison Ill
Jensen Mfg 6601 S Laramie Chicago Ill
Jerrold Electronics 15th & Lehigh Ave Philadel-
phia Pa
Jersey Specialty PO Box 235 Wayne NJ
Johnson Co EF Waseca Minn
Jones & Laughlin 401 Liberty Pittsburgh Pa
Jones Div Cinch Mfg 1026 S Homan Chicago Ill

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KLH Research & Devel 30 Cross St Cambridge
Mass
KTV Tower & Comm Equip Co PO Box 294
Sullivan Ill
Karlson Assoc 1610 Neck Rd Brooklyn NY
Kay Electric 14 Maple Pine Brook NJ
Kay-Townes Antenna 1511 Dean Rome Ga
Kepco Inc 131-38 Sanford Ave Flushing NY
Kester Solder 4201 Wrightwood Chicago Ill
Klipsch & Assoc PO Box 96 Hope Ark
Knob Corp of America 469 Jericho Tpk Mineola
NY
Koss Inc 2227 N 31 St Milwaukee Wis
Kraeuter & Co 585 18 Ave Newark NJ
Krylon Inc 18 W Airy Norristown Pa
Kwikheat Mfg 3731 San Fernando Rd Glendale
Calif

L

LA Tuner Exchange 4611 West Jefferson Los
Angeles California
Lafayette Radio Electronics 111 Jerico TPK
Syosset LI NY
Lambda Electronics 515 Broad Hallow Hunt-
ington NY
Lampkin Labs Bradenton Fla
Lance Antenna 1730 1st St San Fernando
Calif
Lansing Sound James B 3249 Casitas Ave
Los Angeles Calif
Lavoie Labs Morganville NJ
Leach Corp 18435 Susana Rd Compton Calif
Ledex Inc 123 Webster Dayton O
Leeds & Northrup 4907 Stenton Philadelphia
Pa
Les of America 11 W 42 St New York NY
Littelfuse Inc Des Plains Ill
Los Angeles Turner Exchange 4611 W Jefferson
Los Angeles Calif

M

3M Electrical Products Div 900 Bush Ave St
Paul Minn
McIntosh Labs 2 Chambers St Binghamton NY
Magnavox Co 2131 Buerer Rd Ft Wayne Ind
Magnecord Div Midwestern Instrument PO
Box 7186 Tulsa Okla
Majestic Int'l 743 N LaSalle St Chicago Ill

Mallory & Co PR 3029 E Washington Indian-
apolis Ind
Marantz 25-14 Bdwy Long Island City NY
Marconi Instruments 111 Cedar Lane Engle-
wood NJ
Mercury Electronics 111 Roosevelt Ave Min-
eola NY
Mercury TV Tuner Service 890 River Ave
Bronx NY
Methode Mfg 7447 W Wilson Ave Chicago Ill
Merit Coil & Transformer Merit Plaza Holly-
wood Fla
Michigan Magnetics Vermontville Mich
Milgray/NY 136 Liberty St New York NY
Millen Mfg James 150 Exchange Malden Mass
Miller Co JW 5917 S Main Los Angeles Calif
Milo Electronics 530 Canal New York NY
Honeywell Commercial & Residential Div
2753 4 Ave Minneapolis Minn
Monitoradio Div Idea 7900 Pendleton Pike
Indianapolis Ind
Mosley Electronics 4610 N Lindberg Brideton
Mo
Moss Electronic 2435 White Plains Rd Bronx
NY
Motorola Communications Div 4501 W Augusta
Chicago Ill
Motorola Consumer Prods 9401 W Grand Ave
Franklin Park Ill
Mueller Electric 1583 E 31 St Cleveland O
Mullard (see Int'l Electronics New York NY)
Multicore Div British Industries 80 Shore Rd
Port Washington NY
Muzak Co 220 4 Ave New York NY

N

Nat'l Radio 37 Washington St Melrose Mass
Neshaminy Electronics Neshaminy Pa
Newark Electronic 223 W Madison Chicago Ill
Newcomb Audio Products Co 6824 Lexington
Ave Hollywood Calif
North American Philips (NORELCO) 100 East
42 Street NYC NY
Nortronics Co 8133 10th Ave N Minneapolis
Minn

O

Oak Mfg Co Crystal Lake Ill
Oelrich Publications 4308 Milwaukee Ave
Chicago Ill
Ohmite Mfg 3673 Howard St Skokie Ill
Olson Radio 500 S Forge Akron O
Olympic Radio & TV 34-01 38 Ave Long
Island City NY
Ortron Electronics 29 Lincoln Ave Orange NJ
Oxford Electric 3911 Michigan Blvd Chicago Ill

P

Packard Bell Electronics 12333 W Olympic
Blvd Los Angeles Calif
Pacotronics Inc 70-31 84 St Glendale LI NY
Pearce-Simpson 2295 NW 14 St Miami Fla
Perma-Power 3100 N Elston Ave Chicago Ill
Phaotron Instrument & Electronics 151 Pas-
adena Ave South Pasadena Calif
Philco Consumer Products Div 2 & Westmore-
land Philadelphia Pa
Philco Parts & Distributor Operation "C" &
Westmoreland Philadelphia Pa
Philharmonic Radio & TV 235 Jersey Ave
New Brunswick NJ
Pickering & Co Sunnyside Boulevard Plainview
NY
Pilot Radio 100 Electra Lane Yonkers 4 NY
Pioneer Electric & Research Forest Park Ill
Planet Mfg Corp 225 Belleville Avenue Bloom-
field NJ
Pomona Electronics Co Inc 1500 East Ninth
St Pomona California
Potter & Brumfield 107 N 10th St Princeton
Ind
Precision Electronics & Devel 76 E 2 St Min-
eola LI NY
Precision Apparatus 819 King St Woodmere
LI NY
Precision Electronics 800-00 Cooper Avenue
Glendale NY
Precision Tuner Service PO Box 272 Bloom-
ington Ind

Q

Qualitone Industries 102 Columbus Ave
Tuckahoe NY
Quam-Nichols 234 E Marquette Rd Chicago Ill
Quan-Tech Labs 60 Parsippany Blvd Boonton
NJ
Quietrol Co 395 St John St Spartanburg SC

R

RCA Institutes 350 W 4 St New York NY
RCA Parts & Accessories 19th & Federal
Streets Camden NJ
RCA Set Division 600 N Sherman Drive Indian-
apolis Indiana
RMS Electronics Inc 2016 Bronxdale Avenue
Bronx 62 NY
Racom Electric 1261 Bdwy New York NY
Radiart Co 2900 Columbia Indianapolis Ind
Radio Corp of America Electron Tube Div 415
S 5 St Harrison NJ
Radio Corp of America 30 Rockefeller Plaza
New York NY
Radio Receptor 240 Wythe Brooklyn NY
Radio Shack 730 Commonwealth Boston Mass

Rauland Corp 4245 N Knox Chicago Ill
Ray-O-Vac Co 212 E Washington St Madison
Wis
Raytheon Distributor Products Div 55 Chapel
Newton Mass
R-Columbia Products 305 Waukegan Ave
Highwood Ill
Recaton Corp 52-35 Barnett Long Island NY
Reeves Soundcraft Great Pasture Rd Danbury
Conn
Regency Electronics 7900 Pendleton Pike
Indianapolis Ind
Rego Insulated Wire 830 Monroe Hoboken NJ
Rek-O-Kut Co 38-19 108 St Corona NY
Rawn Co Spooner Wis
Roberts Electronics 829 N Highland Ave
Hollywood Calif
Robert Bosh Corp Blaupunkt Car Radio Div
40-25 Crescent Long Island City NY
Robins Industries 1558 127 St College Pt NY
Rockbar Corp 650 Halstead Mamaroneck NY
Rohn Mfg 116 Limestone St Peoria Ill
Rustrak Instrument 130 Silver Manchester NH

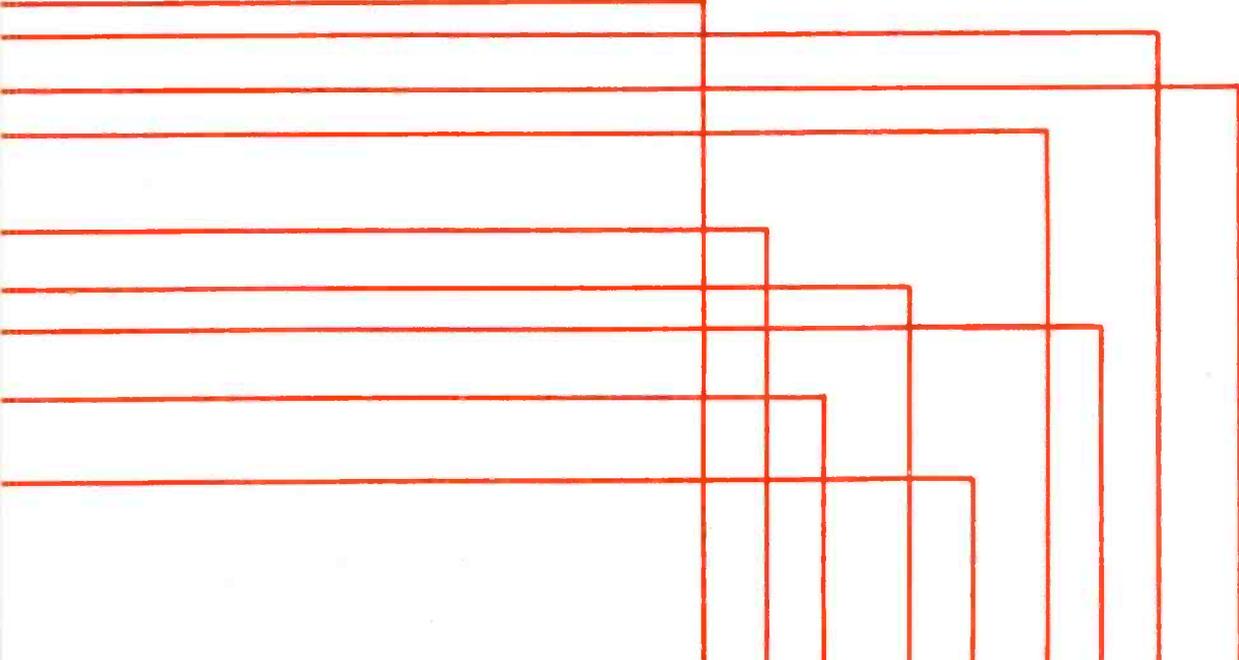
S

S&A Electronics 202 W Florence Street Toledo
O
Sampson Co 2244 S Western Ave Chicago Ill
Sangamo Electric 1301 N 11 St Springfield Ill
Sarkes Tarzian Tuner Div E Hillside Dr Bloom-
ington Ind
Sarkes Tarzian Semiconductor Div 415 N
College Ave Bloomington Indiana
Schober Organ 43 W 61 St New York NY
Scott Inc HH 111 Powdermill Rd Maynard Mass
Seco Electronics 1201 W Clover Dr Minne-
apolis Minn
Semitronics Corp 265 Canal Street NYC NY
Sencore Inc 426 S Westgate Dr Addison Ill
Setchell-Carlson New Brighton St Paul Minn
Sherwood Electronic Labs 4300 N California
Ave Chicago Ill
Shure Brothers 222 Hartrey Ave Evanston Ill
Simpson Electric 5200 W Kinzie St Chicago Ill
Slep Electronic Co Automotive Division PO
Box 178 Ellenton Florida
Smith Inc Herman H 2326 Nostrand Brooklyn
NY
Synder Mfg 22 & Ontario Philadelphia Pa
Sola Electric 1717 Busse Rd Elk Grove Village
Ill
Sonar Radio 73 Wertman Avenue Brooklyn NY
Sonotone Corp Elmsford NY
Sony Corp of America 580 S Ave New York
NY
Sorensen Prods Div Raytheon South Norwalk
Conn
Soundolier Inc PO Box 3848 St Louis Mo
South River Metal Prods 377 Tpk Rd South
River NJ
Sprague Products Marshall Street North Adams
Mass
Stackpole Carbon Electronics Div St Marys Pa
Stancor Electronics 3501 W Addison Chicago Ill
Standard Kollsman Industries 2085 N Haw-
thorne Melrose Park Ill
Stromberg-Carlson Div General/Dynamics 1400
N Goodman St Rochester NY
Switchcraft Inc 5555 N Elston Chicago Ill
Sylvania Electric Products 730 3 Ave New
York NY
Symphonic Radio & Electronic 10 Columbus
Circle N New York NY 10019

T

TACO Sherburne NY
TV Tuner Service 2103 W 3 St Bloomington
Ind
TV Tuner Service 118 Third St West Twin
Falls Idaho
Talk-A-Phone Co 5013 N Kedzie Ave Chicago
Ill
Tandberg of America 83 Ave Pelham NY
Tap-A-Line Mfg PO Box 563 Pompano Beach
Fla
Tech-Master 75 Front St Brooklyn NY
Tektronix Inc PO Box 500 Beaverton Ore
Telrad Div Lionel Corp Route 69-202 Flem-
ington NJ
Telex Inc 3054 Excelsior Mpls Minn
Telex/Aemco Div Teles Inc Mankato Minn
Teleonic Industries 60 N 1 Ave Beech Grove
Ind
Tenatronics Ltd 1011 Power Ave Cleveland O
Tenna Mfg 19201 Cranbrook Pkway Clevel-
and O
Tennalab 10 & State Sts Quincy Ill
Terado Co 1068 Raymond Ave St Paul Minn
Texas Crystals 1000 Crystal Dr Ft Myers Fla
Thomas Electronic Organs 8345 Hayvenhurst
Ave Sepulveda Calif
Thordarson-Meissner 7 & Belmont Mt Carmel
Ill
Thorens Div Atlantic & Stewart Avenues ELPA
Mktg Industries New Hyde Park NY
Toshiba Mitsui & Co 530 S Ave New York NY
Trav-Ler Radio 571 W 8345 Chicago Ill
Triad Transformer 4055 Redwood Ave Venice
Calif
Trio Mfg Griggsville Ill
Triplett Electrical Instrument 286 Harman
Road Bluffton O

Continued on page 93



Soldering— Profit or Loss?

Select an alloy to fit the job and
eliminate callbacks caused by inadequate joints

Part 1

by Melvin Zalkin

British Industries Corp.

■ Service technicians' incomes are directly proportional to the number of service calls made. Callbacks, to redo or recheck service jobs, reduce the number of calls that can be made—and the result can be less profit, perhaps a loss.

Poor solder connections are responsible for a good many callbacks. Unfortunately, many service technicians do not take the work of soldering too seriously. They may exercise a great deal of care in

selecting replacement components or refitting the shaft of a new control, but they are apt to take the solder connection for granted and do it a little bit too matter-of-factly. Yet, when you think of it, the solder joint is just about the most critical part of a circuit. All the precision and close tolerances of component parts are worth little more than the quality of the solder joint that connects them to the circuit. Let's see why this is true.

Poor Solder Joints

A poor solder joint can be the source of many circuit faults—intermittents, high resistance, an open circuit or shorted circuit. Generally, poor solder connections are cold joints that result from carelessness or from using improper tools, materials or techniques.

To understand the problems inherent in soldering, let's analyze what we have to work with. First, all metals—wire leads, component and chassis lugs — are normally covered with a thin, invisible oxide film. This oxide is non-metallic and acts as an insulation between the metal surfaces being soldered—preventing the metals from contacting each other. Moreover, the oxide film produces a surface tension which prevents the penetration of molten solder into the metal pores. In short, oxidized surfaces impede the fusing of solder to the metal surfaces being joined. And the type of solder used is important too.

Solder

Solder is a fusible alloy of tin and lead that has a melting point much lower than the metal it joins. The alloy of solder (ratio of tin to lead) determines its melting point. The best alloy for TV and radio work is 60/40 (the first number is the percentage of tin content). This has the lowest melt-

ing point, 370°F. Other alloys suitable for certain communications and electrical work are: 50/50, 414°F; 45/55, 419°F; 40/60, 453°F. A special alloy solder containing copper can prevent the molten solder from absorbing copper from the soldering iron tip. This prevents rapid pitting and wear of soldering tips and avoids the need for frequent resurfacing of the solder tip. This alloy has a melting point of 419°F.

Solder also comes in a variety of gages (thicknesses) ranging from 22 to 10 SWG (Standard Wire Gage). The gage of solder required depends on the particular job characteristics. Thin gages—18 or 20 SWG—should be used for miniature and printed circuit boards which require rapid touch-soldering. This solder melts almost instantly after contact with the heated joint. Larger gages are used for soldering joints which have larger areas with heavier leads.

As a general rule, keep in mind that solder with the greatest percentage of tin (60/40) becomes molten more rapidly, flows more easily and faster, and provides brighter, stronger and more perfect joints. But make certain that the solder meets stated specifications.

Solders that contain less tin are difficult to work with and require more heat, which may damage circuit components. A top-grade solder

will flow more rapidly, tin better, and in the long run, cost less to use than low-grade types.

Flux

Have you ever wondered about fluxes? You just can't make a solder joint—good or bad—without rosin flux. When applied to a heated surface, flux becomes activated (before the solder becomes molten) and removes the oxide film, keeping it away from the surface. At the same time, the activated flux lowers the molten solder's surface tension—allowing it to flow freely over and around the joint area. Only rosin flux should be used for TV and radio work. It is non-corrosive and any small flux particle that remains on the work will not be harmful.

Modern solders are cored. That is, the flux is in the solder wire for more convenient and rapid application. Most makes of solder have a single flux core running through the center of the solder wire, as shown in Fig. 1. Another type has 5 cores of flux, see Fig. 2. The cores are located close together and at the perimeter—to provide a thin solder wall of the alloy between the flux core and the work.

Part II of this article will discuss soldering tools, basic rules and modern soldering techniques necessary for making soldered connections that will stay put. ■

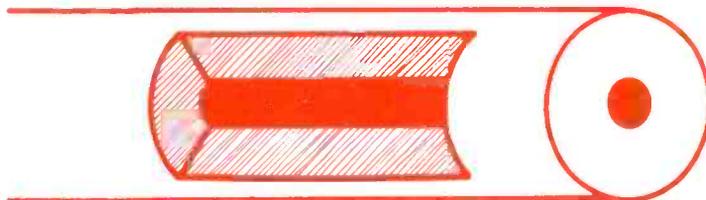


Fig. 1 — A cut-a-way sketch of single-cored solder.

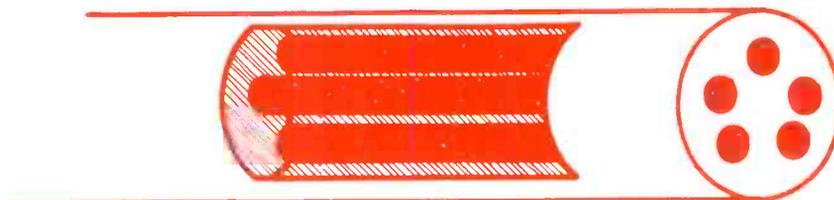


Fig. 2 — Cut-a-way sketch of a 5-core solder.

KNOW YOUR ELECTROLYTICS

Check leakage and ripple current to quickly locate marginal units that should be replaced before failure occurs

■ Every TV-radio technician knows that a regular electrolytic capacitor has two aluminum foil plates — anode and cathode—usually separated by a thin paper spacer saturated with electrolyte.

It is known too that polarized electrolytic capacitors present a high resistance to dc when a positive voltage is applied to the anode and a negative voltage to the cathode. If the polarity is reversed, however, the capacitor presents a low resistance and excessive current flow will cause the capacitor to heat quickly and ultimately burn out or possibly “blow out” with a bang.

But many other equally important details of electrolytic capacitors are generally ignored by technicians.

General Considerations

With the exception of tubes, electrolytic capacitors probably have the shortest average life expectancy of any major component used in TV, radio or Hi Fi equipment. This average life expectancy is determined by a number of factors. Only those factors bearing directly on the day-to-day work of technicians will be discussed here. It should be noted that none of the factors involved are related to design faults in electrolytic capacitors—and it is assumed that capacitors are top quality.

Under normal conditions and with proper care, electrolytic capacitors frequently operate efficiently for years. And most of the service

problems which technicians encounter with electrolytic capacitors can be avoided by observing specialized preventive maintenance practices.

Temperature and Ripple

Perhaps the greatest deteriorating effect on an electrolytic capacitor is higher-than-normal temperature. This may be environmental or internal or both. Of course, original equipment design engineers presumably locate electrolytic capacitors away from equipment transformers, tubes and high wattage resistors to prevent ambient temperatures rising above capacitor temperature ratings. All other factors being equal, electrolytics which operate at normal room temperatures (25°C), will last longer than those operating at 10 or more degrees above room temperature. As a rule, electrolytics with a temperature rating of 85°C will last many times longer when operated at room temperature than when operated at 85°C. This is true primarily because electrolytic capacitors are *electrochemical* devices. And continued operation of electrolytics above normal ratings will result in a permanent decrease in capacitance and increase in resistance.

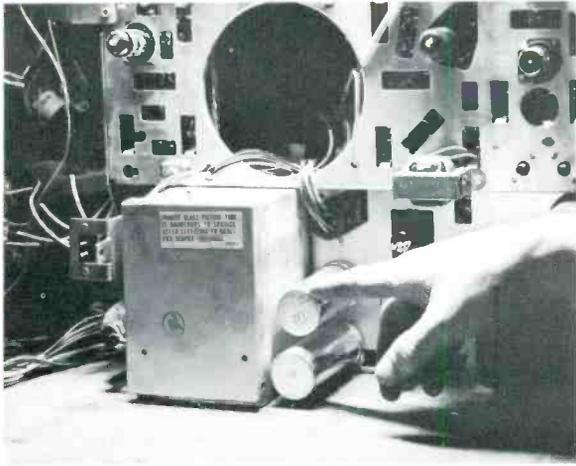
Depending on circuit application, high ripple and leakage currents or both will cause the internal temperature of a capacitor to increase, reducing the capacitor's life span. This process can occur in an ap-

proximately exponential manner: leakage current causes the internal temperature to increase and the temperature increase causes leakage current to increase—eventually resulting in “bootstrap” thermal runaway — destroying the capacitor. This can also occur if the capacitance of a power supply electrolytic filter drops. In this case, ripple voltage across the capacitor will increase, in turn increasing the ripple current. As the ripple current increases, it will cause increasing heat dissipation inside the capacitor, resulting in an increase in dc leakage current — also causing “bootstrap” thermal runaway—destroying the capacitor.

Another consideration is the “shelf-life” of electrolytic capacitors. Once again, because electrolytic capacitors are electrochemical devices having particular characteristics, a capacitor deteriorates faster on the shelf than it will when operating in a circuit at normal voltage and temperature ratings. And the length of a capacitor's shelf-life will vary with ambient temperature. It is generally understood that the average shelf-life of electrolytic capacitors, at room temperature, is about 2½ years. The average in-circuit life at room temperature is about 6 years.

Specific Approach

Public demand for faster and higher-quality service is constantly increasing and will continue to



create competitive pressures throughout the industry. But your knowledge of electrolytic capacitor characteristics, for example, can save you time and help you provide the kind of service that inspires equipment owners to keep calling you month after month, year after year. How can we put this knowledge to work?

In addition to regular electrolytic capacitor replacements — those in the obviously defective category — you should perform preventive maintenance checks on electrolytic capacitors in all TVs, radios and Hi Fi equipment whenever it comes into the shop for repairs. The few minutes required to check all electrolytics will pay in the long run.

The two indicators of the condition of an electrolytic capacitor are: *leakage current* and *ripple current*. A good capacitor tester, designed to test electrolytics, is a necessity here. If you find marginal capacitors in equipment, no matter what the customer complaint is, you should make a note of the capacitor's condition on the repair record and inform the customer. If a test shows that the capacitors are in an advanced stage of deterioration, it is advisable to recommend replacements to the customer *before* breakdown occurs. Replacements *now* will usually save the customer money in the long run.

Checking Capacitors

If you do not have a regular



EICO capacitor tester.



Precision Apparatus electrolytic capacitor tester.



Cornell-Dubilier capacitance-resistance analyzer.



Sprague capacitor analyzer.

ELECTROLYTICS

Continued



Lafayette Radio capacitor checker.

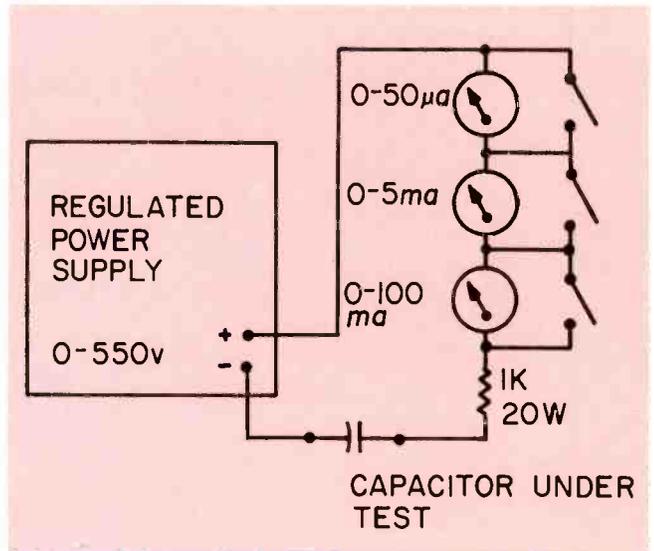


Fig. 1—Basic circuit used to measure electrolytic capacitor leakage current.

capacitor tester available at the moment, ripple current can be determined in several ways. One approximate method is to insert a low-value resistor in series with the capacitor, read the voltage drop across the resistor with an ac VTVM, and use Ohm's law: $I = E/R$. Of course, the resistor introduces an error.

An approximation may be obtained by dividing the RMS ripple voltage by the impedance of the capacitor at the ripple frequency, if the exact capacitance of the unit is known. The result may be considerably in error, however, and it is recommended that the ripple current be measured directly.

Ripple current can be measured directly with a low-impedance thermal ammeter (an RF ammeter is one type of thermal ammeter) in series with the negative lead of the capacitor. If the capacitor is a multisection unit, disconnect all sections except the one being tested—checking each section in turn.

If you have a regulated variable-voltage dc power supply, leakage current can be measured with the setup shown in Fig. 1. Before turning on the power supply, close all three switches which parallel the meters and turn the voltage control to zero output voltage. Connect the capacitor under test to the test terminals, and then turn on the power

supply. Increase the output voltage to about one-tenth the voltage rating of the capacitor.

Now open the switch which parallels the 0-100 ma meter and observe the meter reading. The current indicated is the leakage current, and it should gradually decrease. When the leakage current appears to have stopped dropping or when the drop has slowed considerably (this should take place within a minute or two) increase the power supply output voltage gradually until the rated operating voltage of the capacitor is reached.

After a few minutes of continuous application of rated voltage, the leakage current of a good capacitor should be very low. When the current drops below 5 ma—the full-scale limit of the 0-5 ma meter—open the switch shunting the 0-5 ma meter and close the switch shunting the 0-100 ma meter. When the current has dropped below $50 \mu\text{a}$, the switch shunting the 0-50 μa meter can be opened.

This, of course, is merely a generalized procedure, because the normal leakage current of a good capacitor depends on its capacitance and rated voltage. Again, it is recommended that a regular commercial capacitor tester be used.

Replacements

Both new and in-stock capacitors

should be checked before they are installed. And if the capacity of an in-circuit electrolytic checks more than 10 percent below its specified capacity rating, it should be replaced to eliminate the possibility of future breakdown—a repeat-job the owner may complain about.

Although *circuit capacity value ranges* are reasonably broad (about 20 percent average tolerance), you should attempt to make replacements with *exact* values specified by manufacturers. This does not mean, of course, that you cannot make satisfactory replacements with suitable units which fit physical specifications but are otherwise inexact in some minor detail. In these cases—where time is frequently the determining factor—technicians must use their individual judgment. A careful review of one or more capacitor manufacturers' cross-referenced replacement guides will reveal the best unit for a given job.

You should keep in mind, too, that most general replacement electrolytics have tolerances of $-10 + 250$ percent depending on the capacity and voltage rating.

And it is obvious that you must employ the most advanced desoldering and soldering tools and replacement techniques to round out an efficient electrolytic capacitor maintenance and replacement program. ■

■ In November of 1956 and again in June of 1959, ELECTRONIC TECHNICIAN printed an American-to-foreign and a foreign-to-American tube substitution guide. Times change, however, and the need for the first type of list has diminished. Foreign tubes which were found frequently in foreign equipment at that time are less frequently encountered now. For example, tubes found in foreign portables a few years ago are rarely seen now that the transistor has gained renown and have consequently been removed from the list.

Because of this, ELECTRONIC TECHNICIAN has compiled a new listing which shows only popular tubes and tubes which are directly interchangeable in either series or parallel sets. The foreign tube is listed in the right hand column and its American equivalent is listed in the left hand column. There are minor differences in some of these tubes and in rare instances the set's performance may not be as good as with the original tube. This should be remembered any time a substitution is necessary. ■

Guide to Foreign Tubes

Nomenclature Guide

1st Letter Heater or Filament Voltage or Current	2nd, 3rd & 4th Letters Tube Type*	1st Figure Tube Base	2nd & 3rd Figures
A—4.0 v	A—Single Diode	2—Loctal	Design or Development Serial Number
C—200 ma	B—Double Diode	3—Octal	
D—.5 v to 1.5 v	C—Triode	4—8 Pin Miniature	
E—6.3 v	F—Voltage Amplifying Pentode	5—9 Pin and Special Bases	
G—5.0 v	H—Hexode	6—Sub-Miniature	
H—150 ma	K—Heptode or Octode	7—Sub-Miniature	
K—2.0 v	L—Output Pentode	8—Noval	
P—300 ma	M—Tuning Indicator	9—7 Pin Miniature	
U—100 ma	N—Thyratron		
	Q—Nonode		
	Y—Half-wave Rectifier		
	Z—Full-wave Rectifier		

*Note—2 or 3 letters may be combined, e.g. BC—Double diode triode.

American and Foreign Tube Substitution Guide

Foreign	American	Foreign	American	Foreign	American	Foreign	American
B36	125N7	ECC85	6AQ8	EY88	6AL3	U52	5U4, 5U4G
B63	6A6	ECC88	6DJ8	EZ35	6X5	U70	6X5G
B152	12AT7	ECC91	6J6	EZ40	6BT4	U76	35Z4GT
B309	12AT7	ECC180	6BQ7A	EZ81	6BW4, 6CA4	U147	6X5, 6X5G
B319	7AN7	ECC189	6E58	EZ90	6X4	U707	6X4
B329	12AU7	ECC230	6O80	EZ91	6AV4	UAA91	12AL5
B339	12AX7	ECF80	6A8, 5BL8, 6DL8	GZ30	5AZ4, 5Z4	UAF42	12S7
B739	12AT7	ECF82	6U8	GZ34	5AR4, 5U4	UF41	508M8
B749	12AU7	ECF86	6HG8	H63	6F5	UU12	12AC5
B759	12AX7	ECH42	6C9, 6CU7	HAA91	12AL5	UY41	6CA4
BPM04	6AQ5	ECL80	6AB8	HBC90	12AT6	V2M70	31A3
D2M9	6AL6	ECL84	6DX8	HBC91	12AV6	V884	6X4
D63	6H6	ECL86	6CW8	HCH81	12AJ7	W61	6CQ6
D77	6AL5, 6058	EF41	6CJ5, 6F15	HF61	6CJ5	W63	6K7
D152	6AL5, 6058	EF80	6BX6	HF93	12BA6	W179	6B7
D717	6AL5, 6058	EF85	6BY7	HF94	12AU6	X77	6BE6
DD6	6AL5, 6058	EF86	6Z67	HF121	12AC5	Z63	6J7
DH63	6Q7	EF89	6DA6	HK90	12BE6	5M-HH3	5J6
DH74	12Q7G1	EF89F	6DG7	HL90	19AQ5	6AT7N	6DT8
DH76	12Q7G1	EF91	6AM6	HL92	50C5	6B32	6AL5
DH77	6AT6	EF92	6CQ6	HL94	30A5	6BC32	6AV6
DH149	7C6	EF93	6BA6	HMO4	6BE6	6CC31	6J6
DH150	6CV7	EF94	6AU6	HY90	35W4	6D2	6AL5
DH718	6CV7	EF95	6AK5	KT32	25L6, 25W6GT	6F10	6AC7
DH719	6AK8	EF96	6AG5	KT63	6F6, 6F6G	6F25	6EH7
DP61	6AK5	EF97	6E56	KT66	6L6, 6L6GC	6F31	6BA6
DY30	1B3GT	EF98	6ET6	KT71	50L6GT	6F33	6A56
DY70	5642	EF183	6EH7	KT77	6CA7	6F36	6AH6
DY80	1X2A	EF184	6EJ7	KT88	6550	6G-B3A	6GW6
EAA91	6AL5, 6058	EF190	6CB6	L63	6J5	6G-B6	6BQ6GT
EABC80	6AK8, 6T8	EH90	6C56	L77	6C4	6G-B9	6DQ6A
EAF42	6CT7	EK90	6BE6	LN152	6AB8	6G-K17	6AU4GT
EB91	6058	EL34	6CA7	N78	6BJ5	6H31	6BE6
EBC41	6CV7	EL36	6CM5	N709	6BQ5	6L10	6AG7
EBC80	6BD7	EL37	6L6	OBC3	12SQ7	6L12	6AQ8
EBC90	6AT6	EL38	6CN6	PCC88	7DJ8	6L13	12AX7
EBC91	6AV6	EL41	6CK5	PCL84	15DQ8	6L31	6AQ5
EBF32	6B8*	EL81	6CJ6	PF9	6K7	6L43	6CL6
EBF80	6N8	EL82	6DY5	PL21	5727	6LD12	6AK8
EBF81	6AD8	EL83	6CK6	PL81	21A6	6M-HH3	6J6
EBF83	6DR8	EL84	6BQ5	PM04	6BA6	6P15	6BQ5
EBF89	6DC8	EL90	6AQ5	PM07	6AM6	6Z31	6X4
EC84	6AJ4	EL91	6AM5	PY80	19X3	10PL12	508M8
EC86	6CM4	EL180	12BY7	PY81	17Z3	12BC32	12AV6
EC90	6C4	EL500	6GB5	PY82	19X3, 19Y3	12F31	12BA6
ED91	6AQ4	EL821	6CH6	QB65	65N7GT	12G-B6	12BQ6GT
EC92	6AB4	EL822	6CH6	QB309	12AT7	12G-K17	12D4A
EC94	6AF4	EM80	6BR5	QL77	6C4	12H31	12BE6
EC95	6ER5	EM84	6FG6	R19	1X2A	13D2	65N7
ECC81	12AT7	EM840	6FG6	T2M05	6J6	20D3	12AH8
ECC82	12AU7	EQ80	6BE7	U41	183, 183GT	20D4	6AJ8
ECC83	12AX7	EY80	6U3	U50	5Y3, 5Y3GT	25G-B6	25BQ6GT



ESTIMATE OR GUESSTIMATE

by Reg Bartlett

*Solve the estimate problem
with a stream-lined
system that
fully satisfies
your particular needs*

■ Giving a TV, radio or Hi Fi equipment owner an estimate for a repair job before you begin working on the equipment can be an unpleasant task if you don't establish an intelligent approach to the problem. And no fail-safe, cut-and-dried blanket formula has yet been designed to fit all service operations. Each operation must provide a formula that works best under particular circumstances. Because this is true, we won't try to diagram a coverall formula here. We will look at the problem, mention a few methods that work for some operations, and focus on one particular method which appears to have considerable merit.

The Problem

Very few home-equipment owners are willing to give you permission to make repairs unless they know

in advance how much it will cost. This is true for many reasons. Of course, we can argue that this is like asking a hospital for an *exact* quote on an operation before a full diagnosis has been completed (or after, for that matter) but it is assumed that most TV, radio, Hi Fi owners don't see it that way. Nor do they interpret an "estimate" as a flexible approximation. Instead, it is viewed as a "statement of final cost" and you are generally stuck with it. Only one thing seems obvious in this apparent dilemma: a "free estimate" is a misleading "gimmick" and is factually impossible—but some operators feel they should allow the customer to retain this illusion. It would be a mistake to argue this point with customers, they say. It is a problem that can be solved only over a long period of time and after a lot of public-relations sweat has run under the bridge.

One other preliminary observation should be made at this point: we will not discuss the "in-house estimate" here. It is better left to the few "gamblers" among us who swear by their "rubber slip-sticks."

One large group of successful operators quote charges of \$7.50 and up for in-shop repair estimates in the event the customer does not want the set repaired for any reason. It is explained, of course, that the "estimate charge" is part of the labor charge for repairing the set in the event the customer approves the estimate. Some of these operators claim that only an insignificant number of their customers have failed to approve an estimate.

Another group of equally successful operators say that they cannot use this system with *their* customers. The estimate-charge people counter that the reason this system won't work is because the operators have never tried it.

Those who have been in the business for years may be able to come up with a price for most repair jobs based on repair records of similar sets with similar faults. At best, like the in-house estimate, this can only be considered a "guesstimate." It does have the advantage that very little time is used in giving it and no doubt there are occasions when we could all use this method advantageously. The disadvantage is, of course, that it is of little value to experienced men faced with newer sets and is of no use to younger and less experienced technicians.

It is clear then that a certain amount of bench time

is required to give an *accurate* estimate. And those who expound the merits of this system say that the proficient benchman must, therefore, establish a flexible procedure to cover the largest number of sets and arrive at an optimum estimate in the shortest possible time. This approach, in effect, allows the customer to retain the illusion of a "free estimate." But, in relation to time—money—the approach here is logical. To paraphrase the old Mississippi River pilot, Mark Twain, it means finding out quickly what parts are *not* bad instead of wasting time discovering which part or parts *are* bad. There is time enough for troubleshooting *after* the customer has given the go ahead on the repair, they say.

Optimum Estimate Procedure

A total bill consists of two main items: time and material. Let's consider the material first. Most technicians have found out, probably the hard way, that the average customer thinks of "shop work" and "overhaul" as being analogous. In any case, the technician will certainly be held responsible for malfunctions in the set for quite a few weeks after the set has been delivered. It is pointless, then, to treat a job as anything other than a complete overhaul unless it is a fairly new set or a repeat job.

Regardless of what malfunction caused the owner to allow the set to be brought into the shop, all tubes should be tested and bad ones listed. This can be done very quickly with a multiple-socket type tube tester. This type tester may not make sophisticated checks, but experience shows that shorted and gassy tubes give the most grief. These faults show up well on a good multiple socket tester. A further speed-up of the tube testing process in parallel heater sets is possible by removing the rectifier tube or disabling the B+ supply and leaving the set turned on so the tubes are pre-warmed. And it is generally a good idea to allow for a damper tube in the estimate. They seldom show bad on checks but many arc when vibrated a little if they have been in use for some time.

After bad tubes are listed, check the CRT, flyback transformer, deflection yoke and any major component that can materially affect the estimate. These are unknown factors only if the set comes in with no high voltage. A most valuable tool in cases like these is a TV analyst. With this instrument a pulse may be

TABLE I

- | | |
|------------------------------------|--|
| 1. Owner's hourly wage | 12. Business license |
| 2. Phone | 13. Warrantee repairs |
| 3. Electricity | 14. Non-productive time |
| 4. Insurance | 15. Bad debts written off |
| 5. Advertising | 16. Service manuals |
| 6. Stationery | 17. Bank interest |
| 7. Rent | 18. Contributions |
| 8. Heat | 19. Shop and store maintenance |
| 9. Taxes | 20. Equipment maintenance |
| 10. Truck maintenance, gas and oil | 21. Accounting |
| 11. Depreciation | 22. Hourly wage or wages (if more than one man shop) |

applied to the flyback transformer which will produce high voltage if the receiver's system is capable of doing so. If a raster is thus produced, most of the major components in the set can be checked by observing the CRT screen. In the event high voltage is produced but no raster, the CRT's condition remains unknown. A CRT tester can be used to resolve this problem although a more accurate check can be obtained by using an old spare TV set. The yoke, HV and CRT base leads are extended and it does not matter what the deflection angle of the CRT is, the display will be sufficiently adequate to determine the condition of the tube under test. Most tubes can be checked without removing them from the cabinet.

Now we know whether or not to include a CRT in our estimate. Suppose, however, the injected pulse does not produce high voltage. We could still check the CRT, but the flyback and yoke would be in doubt. Admittedly, a smaller defective component could cause the same symptoms, but the flyback and yoke are statistically favored as being the troublemakers since they are more vulnerable than resistors or capacitors. In any case, as previously pointed out, the purpose of this procedure is to eliminate expensive unknowns rather than pinpoint faulty components.

Yoke trouble which prevents high voltage can be checked very quickly by snipping the horizontal leads and twist-connecting the horizontal coil of a good yoke in the circuit. It is not necessary to fit the new yoke to the CRT at this stage. Presence or absence of high voltage will prove the yoke's condition. If the yoke proves good, a check of the flyback is called for. A

good analyst has a built-in flyback tester. If the flyback checks good, the fault can be assumed to be caused by a minor component and a small allowance is made for it on the estimate.

At this point it is possible to check operation of the rest of the set by supplying the CRT with high voltage from another chassis in the shop as previously mentioned.

How about a set that comes in with no vertical deflection? Among the major possibilities is the vertical output transformer, blocking oscillator transformer and deflection yoke. Even if we know, by whatever means, which of these (if any) are at fault, the rest of the set, including the CRT, would be in doubt. Once again the TV analyst, this time in conjunction with a test socket adapter, becomes indispensable. Simply by using the adapter in the vertical output stage to provide a suitable test point we can inject a pulse into the plate circuit of that stage. If this produces deflection, we have immediately eliminated the vertical output transformer and deflection yoke from blame and have also provided the means to check the CRT and the general performance of the rest of the set.

These examples will suffice to give you an idea of how the optimum estimate procedure works. But before we leave the subject of parts and discuss the labor area of estimates, one special case must be detailed here. This is the case where a set comes in with a burned power transformer. In the great majority of cases like those discussed up to now, it will be found that checks can be made without removing the set from the cabinet. But a burned power transformer

TABLE II

AVERAGE TIME GUIDE

Service Call				0.75 hrs.
Minor bench service.				
(Clean chassis, tuner and controls. Minor set up, etc.)				1.0 hrs.
Major Service:				
Component	Shorted	Open	Intermittent	
Coils, deflection yokes	1.2 hrs.	1.2 hrs.	1.2 hrs.	
Capacitors	.5	.8	.8	
Controls	.5	.5	.8	
Diodes, single or duo	.8	.8	.8	
Filters — B +	.8	.8	.8	
Filters AGC and others	.5	1.0	1.0	
High voltage lead	.5	.5	.5	
Rectifiers, selenium and silicon	.6	.6	.6	
Resistors	.5	.5	.8	
Speakers	.5	.5	.5	
Transformers —				
Audio and vertical	.5	.5	.8	
Horizontal oscillator or output	1.5	.8	1.5	
Power	1.5	1.5	—	
I.F. audio and video	.8	.5	.8	
Picture tubes, remove and install				0.8 hrs.
Alignment, complete				1.5 hrs.
Change tuner				1.0 hrs.

will almost certainly require pulling the chassis. As it stands, there would seem little we can do to find out what else is wrong with the set over and above the obvious requirement of a new power transformer. Tubes can be checked, of course, but that is about all without getting power back on the set.

Fortunately, most TV power transformers are very similar. In fact, universal types are available which are suitable for most sets. The smart benchman has one of these handy with the leads extended and terminated in alligator clips. Only a few moments are required to snip the defective transformer leads and clip on the test transformer. *But check for a B+ short before switching the set on.* In fact, a B+ short is one of the few faults that has to be traced and rectified before any estimating can be done at all. Usually, however, this does not require very much of the efficient benchman's time.

Labor Charges

Charges for bench time can be arrived at in any one of three ways. First, a charge based on past experience—our old friend the “guesstimate” again. Second, a fixed rate for all bench jobs which works on the carnival-type system that what you lose on the merry-go-round you make up on the roller-coaster. Both methods are widely used but neither seem very business-like nor as scientific as one might expect in a service-field like ours. A third and very interesting method will be discussed here.

If you happen to be a beginner in the business, or find it difficult to stay in business, it would be a good idea to review some of the things that have to be paid for before you can see a profit. A breakdown of overhead expenses which would apply to a typical service business is shown in Table I. You or your accountant will have to take all these items into consideration and come up with an hourly operating cost. To this must be added an amount which will be your profit on your investment. All of this will give you an *average hourly rate*. This figure will be used in the following discussion.

About a year ago the Radio Electronic Technicians Association of Ontario did considerable research into the shop time required on different repair jobs in different shops. From their findings they published an *average time guide* for the benefit of members. These

TABLE III

Service call	(0.75 x \$6.00)	\$4.50
Minor bench service	(1.0 x \$6.00)	6.50
Major bench service			
Picture tube	(0.8 x \$6.00)	4.80
Yoke	(1.2 x \$6.00)	7.20
Delivery (half service call)			2.25
Total Labor			\$24.75

statistics were published and made available to members in order to help them arrive at a just and reasonable price for their services. It represents the average time spent on each specified job by an average technician and was compiled with the aid of service technicians from every major city and town in southern Ontario.

No attempt has been made to suggest a price for any job since this will vary from city to city and even from shop to shop. To find a price, the time listed for the job in the Average Time Guide shown in Table II is multiplied by the firm's *average hourly rate*.

For example, suppose your shop's hourly rate comes to \$6.00. The set requiring an estimate has a defective yoke, CRT and a few small tubes. The labor charge would be as shown in Table III. To that figure is added the charge for parts and the estimate is ready. In actual practice, most estimates can be made in little more time than it takes to read this article. ■

Why Can't You Give Me a TV Repair Estimate Right Now?

Every day many TV set owners ask this of their service technicians. It's a fair question. Here's the answer.

By their very nature, electronic parts—even the best made parts—are subject to unexpected failure at any time. A typical TV receiver contains over 585 separate tubes and components plus thousands of feet of wire. When a certain few of these components break down, they produce symptoms that sometimes are immediately traceable to the respective parts. When this happens, your TV technician can give you an estimate—and frequently even repair the set—immediately, right in your own home.

However, most of the 585 parts can cause symptoms identical with other parts. No guess work here, because a 25¢ resistor can cause the same apparent symptoms as a \$25 transformer! To locate the troublesome part or parts requires costly and bulky test instruments frequently found only in the repair shop. So your service technician often cannot give you an estimate until your set is examined at the test bench to determine the cause of the failure and the cost of replacing the part that failed.

Your service technician wants you as a customer. All TV sets require periodic repair. To hold your good will for future business, he wants to give you an accurate estimate based on instrument tests, not guesswork. Unfortunately, it is often not technically possible for him to do so “right now”—in your home—much as he desires to please you.

Prepared as a public service by

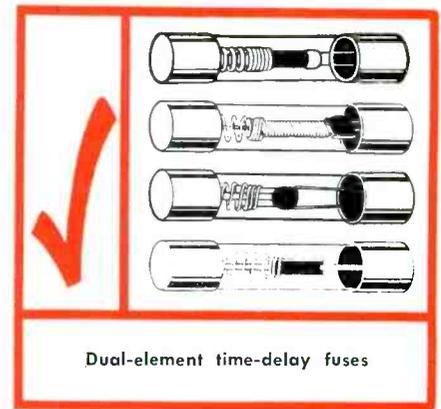
**ELECTRONIC
TECHNICIAN**

World's Largest Electronic Trade Circulation

“Why Can't You Give Me a TV Repair Estimate Right Now?” was first published in ELECTRONIC TECHNICIAN magazine in May, 1959. To help you in your customer-relations we repeat it here. Ideas have changed somewhat since that time, however. The accompanying article gives still more viewpoints on how to make TV repair estimates.

Replace protective devices
with exact types specified
by the equipment manufacturer

by *Walter A. Mathews*
Chief Engineer Bussmann Mfg. Co.



So You Think A Fuse Is A Fuse...?

■ All expert technicians are thoroughly aware of the role played by fuses in electronic equipment circuitry. This knowledge has been obtained both from theory and practice.

What technician, for example, has not at some time in his life and while under the stresses and strains of "hurry-up" work, placed the probes of an expensive VOM across a high dc voltage—with the volt/ohm switch set on OHMS? Only a fuse inside the case prevented serious damage to the VOM. And who has not observed, at least once, that typical do-it-yourselfer "fuse-abuse"—a piece of solder or copper wire wound around the two terminals of a fuse block—resulting in a burned up power transformer or fly-back?

Fuse Types

Two primary fuse types are used in TV, radio and Hi Fi equipment: normal-opening and time-delay or "slow-blow." Both are used to effectively protect equipment components from damage. And the exact fuse specified for a particular circuit by the equipment manufacturer should always be used when making replacements.

A normal-opening fuse element has a high melting temperature between 1000 and 1600°F. Thus, its current-carrying capacity is relatively unaffected by increased environmental temperatures. At most, the opening time may be decreased some 5 to 10 percent.

Time-delay or "slow-blow" fuses have dual elements. One operates on overload currents up to about five multiples of the rating; the other element operates in the short-circuit

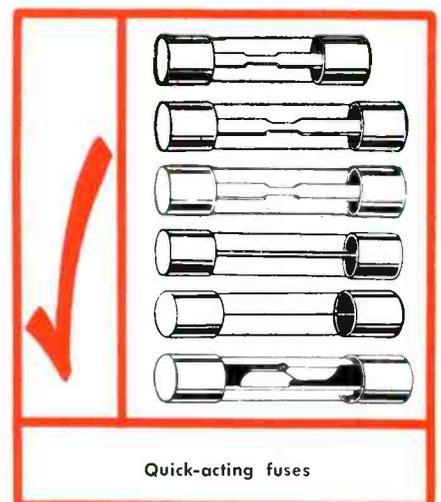
range, above five multiples of the rating. These are designed to open at 280°F, regardless of the heat source. Thus, they are much more sensitive to ambient temperatures than normal-opening fuses.

The voltage rating of a fuse indicates the maximum voltage of the circuit in which the fuse can be used and meet the interrupting capacity requirements of Underwriters Laboratories' standards. The rating of any fuse is the maximum current that will produce the maximum temperature rise of the fuse link without melting it. Any slight increase in current will eventually melt the link because the adjacent wiring cannot conduct sufficient heat out of the fuse, and the ambient cannot remove the heat by convection and radiation.

The speed of opening depends upon the type of fuse and the magnitude and duration of the overcurrent. Normal-opening fuses, of course, will open much faster at low-overload currents than time-delay fuses. The latter have extra mass built into them so they can absorb the extra heat for a finite time before opening.

Time-delay fuses, consequently, are often loaded from 80 to 90 percent of their rating without fear of needless opening. Normal-opening fuses do not have the thermal capacity to cope with low-overload. So, it is considered good practice not to load them to more than 75 to 80 percent of their ratings because practically every circuit has transients, surges and overload currents, no matter how harmless. Many applications load these fuses to only 50 percent of rating.

Time-delay fuses are almost in-



variably used to protect loads characterized by inrush currents of long duration.

To save yourself a lot of headaches and callbacks: replace a "slow-blow" with a similar type and ditto for the normal-opening type. ■



MALLORY

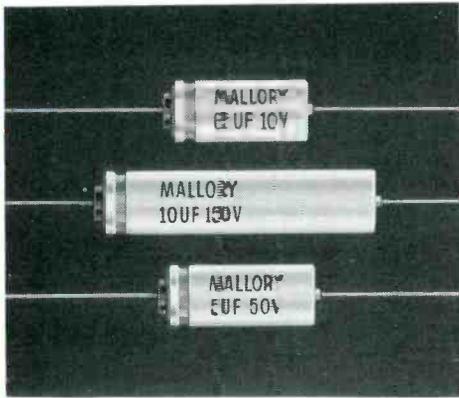
Tips for Technicians

Mallory Distributor Products Company
A division of P. R. Mallory & Co. Inc.
Indianapolis, Indiana 46206

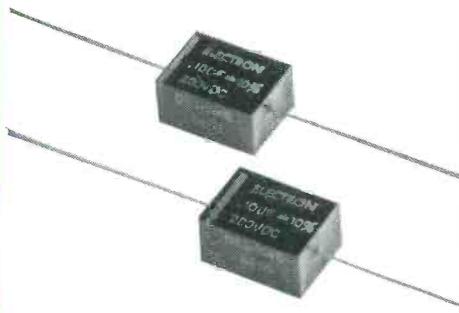
How to select high-reliability capacitors



Computer Grade Capacitor



▲ Type TPG Capacitors



Metallized Mylar* Capacitors

Much of today's electronic gear is used in places where a shutdown because of failure can be astronomically expensive—or it could be downright dangerous to life and limb. In these places it is essential that high reliability components be used. But how does one select truly highly reliable components? The surest method is to bank on the reputation of the manufacturer and to have an intimate knowledge of types of products available.

Take the case of tubular electrolytic capacitors. The standard Mallory TC type has been used for years in literally millions of radios and TV sets with unparalleled success. But the new TPG (Tubular Premium Grade) type is engineered and manufactured to vastly more critical standards. These standards apply to the aluminum foil, to the electrolyte, the all-welded construction, safety vent, and to the extra testing required.

Then there are computer grade filter capacitors. Mallory computer grade types have proven their ability to be better than new after twenty years of continuous service. Standard ratings are available "off-the-shelf" up to 115,000 mfd.

When it comes to Mylar* capacitors one may select from dipped, molded, wrapped, and umpteen other styles. There are dual-dielectrics, plain Mylar, Metallized Mylar, etc. Mallory PVC and the all-new GEM series utilize 100% Mylar dielectric, but these are commercial types. For high reliability applications, one needs the new ELECTRON metallized Mylar type available in up to 10 mfd @ 100 WVDC. And in the smallest package by volume available anywhere. ELECTRON capacitors are metallized with *aluminum* . . . not zinc as are virtually all other types. Capacitor cartridges are sealed in pre-molded cases with high-density epoxy and the cases are rectangular to better withstand vibration and occupy minimum space.

Tantalum capacitors to meet the most extreme standards of reliability are stock items with Mallory: solid electrolyte, plain and etched foil, wet slug types and 200°C high capacity types (even radiation resistant types).

Whenever you need a truly high reliability capacitor, call your Mallory Distributor. Just ask him for a copy of the 1964 Mallory General Catalog and you'll be able to make a selection from the hundreds of types listed.

*Registered Trademark E. I. du Pont de Nemours

- - - for more details circle 40 on post card



Difficult Service Jobs Described by Readers

Wrong Polarity

Recently a customer brought in a hybrid car radio complaining of no sound. A quick check and we found a shorted power amplifier transistor along with the usual burned out emitter fuse resistor and bias pot. The new parts were installed and the radio was left to cook. It was picked up again and returned—the owner complaining of the same trouble. Re-check proved the output transistor and fuse resistor had again failed. Customer again picked up radio and brought radio back complaining that set smoked. This time he was instructed to bring his car to the shop. Lifting the hood proved the battery was installed properly but a check with the VOM showed polarity was reversed. Close questioning of customer disclosed that all his trouble started when his battery went dead and the filling station recharged it for him, obviously in a reversed polarity. *Donald H. Van Engen, Sheboygan, Wisconsin.*

Leaky Capacitor

After correcting an easy fault on a Motorola TV model TS-702A I noticed a condition that the customer had not complained about but was certainly not normal. The Horizontal hold had a fair range

but when the control was manipulated beyond the hold limits on either side, the horizontal oscillator would run wild showing a crazy raster which at times would collapse to a vertical line for a moment or two. Shorting the AFC control voltage to ground gave a "floating" but otherwise stable picture indicating that the trouble was ahead of that point.

Sync injection at the grid of the phase inverter indicated that the trouble was between here and the AFC control grid.

Waveforms at grid and cathode of the phase detector were checked and looked normal, so the search was moved to the plate circuit of the same tube. Eventually the capacitor indicated in the accompanying diagram was found to be leaky and replacement cured the trouble. *Reg. Bartlett, Windsor, Ontario.*

Grounded Control

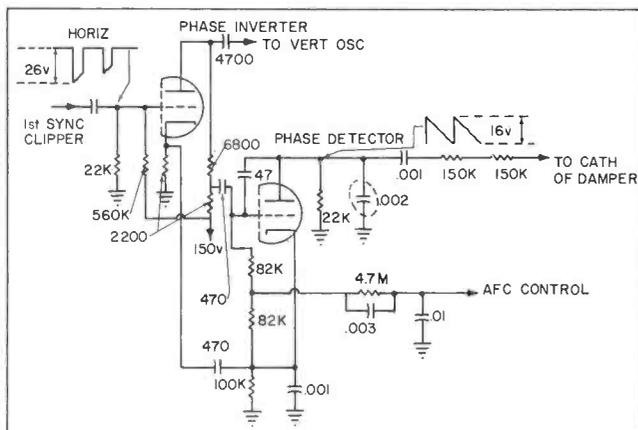
We ran into an odd situation on a Curtis Mathes TV recently. The set came into the shop from a dealer brand new with no vertical sweep. Upon pulling the chassis and measuring a little voltage in the vertical section we found that the vertical oscillator plate, which is pin five of

a 6EM7, had no voltage at all on it.

Checking further back to the vertical size control we found no voltage on the control either, but noticed that the boost was tied to this control through a one meg resistor. On the end of this resistor away from the control there was plenty of voltage, and the resistor heated when set was left on for awhile.

Taking the one meg resistor loose from heating so the next logical step was to check the 0.1 μf bypass capacitor tied to one side of the size control to ground. This unit proved to be good. There remained only the control itself. It was taken out of the set and there was no short from the terminals to ground, but upon close examination it was found that the center lug (where it goes into the control case) was so thick that when control was mounted onto the back apron of the chassis that it actually touched the chassis and was killing the plate voltage to the oscillator and causing the resistor to heat.

We have seen several sets like this since and have found that TV chassis number 10 used in some combination units have this problem. It is not necessary to change this control but only to slip a thin plastic or fiber washer between control case and chassis. *J. H. Wyatt, Searcy, Arkansas.*



Post bench check found unusual problem caused by faulty capacitor.

TOUGH DOGS WANTED

\$10.00 paid for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Photographs are desirable. Unacceptable items will be returned if accompanied by a stamped envelope. Send your entries to "Tough Dog" Editor, ELECTRONIC TECHNICIAN, 1 East First St., Duluth 2, Minnesota.

Find it and Fix it in 1/2 the time!

EASILY SOLVES "TOUGH DOGS"... INTERMITTENTS... ANY TV TROUBLE



B&K MODEL 1076

TELEVISION ANALYST

BLACK & WHITE AND COLOR

NOW WITH KEYED RAINBOW COLOR DISPLAY

By Easy Point-to-Point Signal Injection, You see the Trouble on the TV Screen and Correct it—Twice as Fast and Easy!

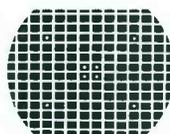
Simplified technique stops lost hours never recovered on "tough dogs", intermittents, and general TV troubleshooting. This one instrument, with its complete, accurate diagnosis, enables any serviceman to cut servicing time in half... service more TV sets in less time... satisfy more customers... and make more money.

With the Analyst, you inject your own TV signals at any time, at any point, while you watch the generated test pattern on the picture tube of the television set itself. This makes it quick and easy to isolate, pinpoint, and correct TV trouble in any stage throughout the video, audio, r.f., i.f., sync and sweep sections of black & white and color television sets—including intermittents. No external scope or waveform interpretation is needed. Checks any and all circuits—solves any performance problem. Gives you today's most valuable instrument in TV servicing—proved by thousands of professional servicemen everywhere.

Available on Budget Terms. As low as \$30.00 down.

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SIMPLIFIES COLOR TV SERVICING, TOO



Enables you to troubleshoot and signal trace color circuits in color TV sets, or facilitate installation.



Generates white dot, crosshatch and color bar patterns on the TV screen for color TV convergence adjustments.



Generates full color rainbow display and color bar pattern to test color sync circuits, check range of hue control, align color demodulators. Demonstrates to customers correct color values.

Time-Saving, Money-Making Instruments Used by Professional Servicemen Everywhere



Model 960 Transistor Radio Analyst



Model 360 V O Matic Automatic VOM



Model 375 Dynamatic Automatic VTVM



Model 700 Dyna-Quik Tube Tester



Model 445 CRT Rejuvenator Tester

See Your B&K Distributor or Write for Catalog AP 21-T



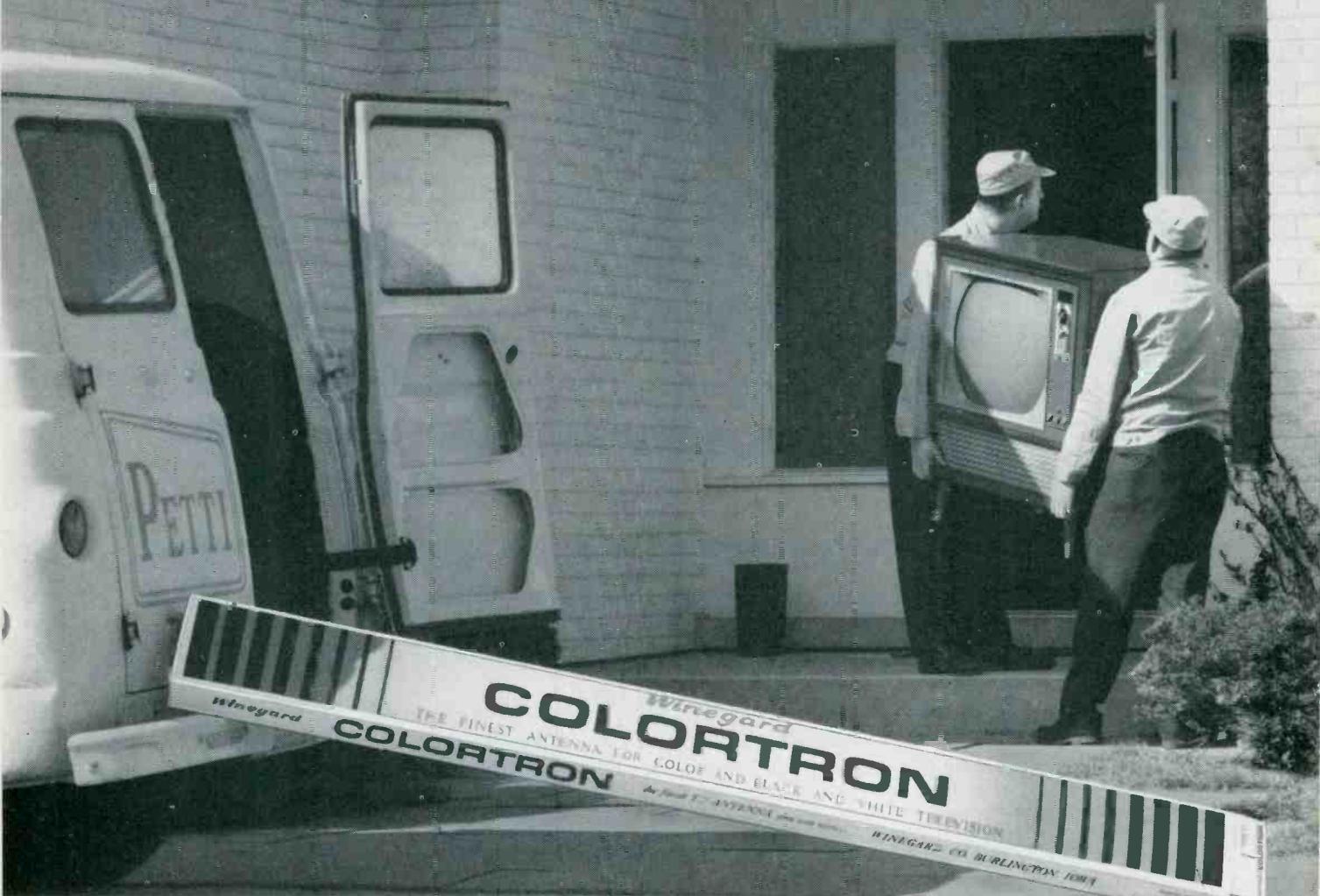
B & K MANUFACTURING CO.

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1801 W. BELLE PLAINE AVE. • CHICAGO 13, ILL.

Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.

Winegard COLORTRON Antenna



The Colortron Antenna's "BALANCED DESIGN" is the Winegard secret of superior color reception!

It takes a combination of high gain, accurate impedance match, complete band width and pinpoint directivity to make the perfect color antenna. Only the Winegard Colortron gives you all 4 with **BALANCED DESIGN**.

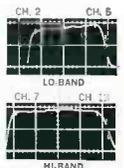
What is Balanced Design? It's not enough to design an antenna for high gain alone and expect good color reception. A high gain antenna without *accurate impedance match* is ineffective. Or an antenna with *good band width* but *poor directivity characteristics* is unsuitable for color. The Winegard Colortron is the one antenna with *balanced design*, excellence in *all* the important characteristics that a good color antenna requires.

For example:

Gain and Bandwidth—A superior color antenna must have high gain and complete bandwidth as well. But the response must be *flat* if it is to be effective. Peaks and valleys in the curve of a high gain antenna can result in acceptable color on one channel and poor color on another.

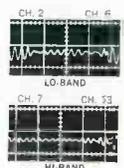
No all-channel VHF-TV antenna has more gain with complete bandwidth across each and every channel than the Colortron. Look at the Colortron frequency response in this oscilloscope photo.

Note the consistent high gain in *all* channels. Note the absence of suck-outs and roll-off on end channels. The flat portion of the curve extends on the low band from the channel 2 picture carrier past the channel 6 sound carrier. On the high band, it is flat from the channel 7 picture carrier to the channel 13 sound carrier. There is less than $\frac{1}{2}$ DB variance over any channel.



Impedance Match—the two 300 ohm "T" matched Colortron driven elements have far better impedance match than *any* antenna using multiple 75 ohm driven elements. The Colortron transfers *maximum* signal to the line without loss or phase distortion through mismatch. Winegard's "T" matched driven elements cost more to make, but we know the precision results are well worth the added manufacturing expense . . . because a mismatched antenna causes loss of picture quality which *might* get by in black & white, but becomes highly disturbing in color.

The oscilloscope photo here shows the Colortron VSWR curve (impedance match). No current VHF-TV antenna compares with it across all 12 channels.



...made for color!



Directivity—Equally important for superior color pictures is freedom from interference and ghosts. Therefore, an antenna with sharp directivity and good signal-to-noise characteristics is necessary. Extraneous signals picked up at the back and sides produce objectionable noise and ghosts in black and white reception . . . frequently ruin color reception.

Winegard's Colortron has the most ideal directivity pattern of any all channel VHF antenna made. It has no spurious side or large back lobes . . . is absolutely dead on both sides. Colortron does not pick up extraneous signals, and even has a higher front-to-back ratio than a single channel yagi.

Look at this Colortron polar pattern. No other VHF-TV antenna has sharper directivity on a channel-for-channel comparison.



BALANCED DESIGN COLORTRONS HAVE SUPERIOR MECHANICAL FEATURES, TOO!

Every square inch of the Colortron has been engineered for maximum strength, minimum weight and minimum wind loading. Even the insulators are designed for low wind resistance. The result

is a streamlined, lightweight antenna that stays stronger longer. Colortrons have been wind tested to 100 mph.

Colortrons are simpler to put up, too. Easier to carry up a ladder and mount on a high mast. No extra weight and bulk to frustrate the antenna installer.

And, you can see the difference in quality when you examine a Winegard COLORTRON. The GOLD ANODIZED finish is bright weather-proof gold that *won't fade*, rust or corrode. It's the same finish specified by the Navy for military antennas. Full attention is paid to every detail.

Winegard Helps You Sell—does more national advertising than all other brands combined. When you sell Winegard, you sell a brand your customer knows . . . backed by a *written factory guarantee of satisfaction*.

It's not surprising that Winegard leads the field in the number of antennas installed with color sets. And Colortrons have been installed by the hundreds of thousands for black and white sets too—for the antenna that's best for color is best for black and white as well. Why don't you try a *balanced design* Colortron and see for yourself?



COLORTRON ANTENNA
Model C-44 • Gold Anodized • \$64.95

COLORTRON ANTENNA
Model C-43 • Gold Anodized • \$51.90

COLORTRON ANTENNA
Model C-42 • Gold Anodized • \$34.95

COLORTRON ANTENNA
Model C-41 • Gold Anodized • \$24.95



Winegard Co.

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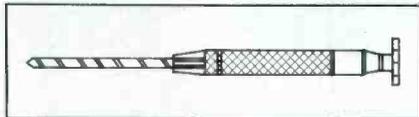
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SHOP HINTS

TIPS FOR HOME AND BENCH SERVICE

Miniature Hand Drill

A convenient light-duty drill for wood or masonite can be easily made from an old jeweler's screw-



driver by chucking a small drill point in place of the blade. It will take approximately a 3/32" bit as is, or can be reamed out to take a slightly larger bit. I can cut a new screw hole in an old TV back in almost "no time" with mine and it takes very little room in my caddy. *F. M. Burton, Grand View, Idaho.*

Intermittent Locator

Many service technicians waste valuable time struggling to find a tube with an intermittent filament in series string filament receivers. Some tubes are so evasive, they can work for days before an opportunity to recheck occurs, but by the time they are checked again the filament closes. One way of dealing with intermittents is to raise the filament voltage about one third higher when checking in a tube checker. The resulting higher filament heat will expand and open up most intermittents. *M. Vincek, Clifton, N. J.*

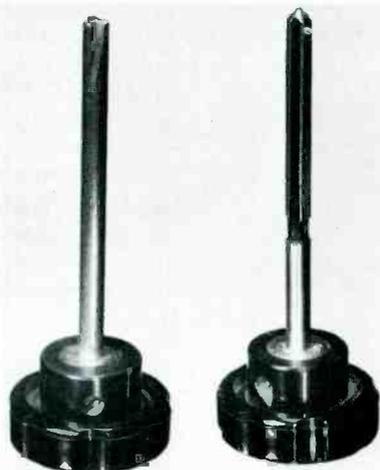
Simple Monitor

Monitoring the carrier and modulation of CB and ham equipment can be done economically using only some hook up wire, a crystal diode and a set of 2000 Ω headphones. Connect a length of wire, to serve as the antenna, about six ft long, to one end of a crystal diode. To the other end of the diode connect a grounded wire. Now attach the headphones across the diode. Broadcast stations may be heard in the headphones. Since there is no tuned circuit there is no selectivity. The strongest stations are the loudest heard; with the CB or Ham

station on the air, that signal will be the loudest, drowning out all the other stations. *James J. Porten, Chicago, Illinois.*

Knob Reamers

Small instrument knobs, particularly those made recently from the new semi-rigid plastics often warp and shrink with age and no longer slide onto the shaft. As most electronic controls are fragile, driving the knob onto the shaft will ruin the interior mechanism. The obvious tool is a 1/4" drill, which certainly sizes the hole effectively, but may "feed" into the knob and break out the top. Some drills, also, tear out the side of the knob hole, making it unusable. In most instances, an effective knob reamer can be made from a piece of steel shafting or drill rod of the desired size. Taper the end very slightly, then file three or more deep grooves into the tip, as in the accompanying photo. With the addition of an old knob as a handle, this tool usually enlarges the hole to the desired size without trouble. If only occasional knob reaming is needed, use the tool as is. If several knobs need reaming each week, heat the sharpened tool red hot, then quench it in water. This tempers the tool so it will ream

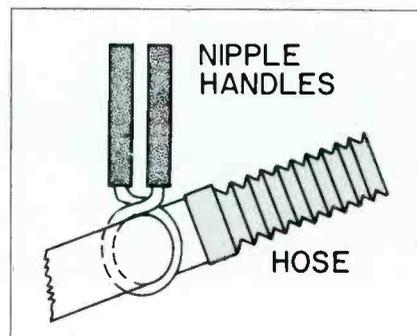


Knob reamers with handles made from old instrument knobs. At left is "home made" reamer; at right is commercially made fluted reamer.

many holes before dulling. If half a dozen knobs a day need reaming, then it is economically desirable to purchase a fluted reamer which works faster and lasts longer than the "goldberged" reamer just described, but also costs about \$5.00 *Ronald L. Ives, Palo Alto, California.*

Hose Clamp Handles

When servicing auto radios it is sometimes necessary to remove some defroster or heater air hoses in the car. A simple and safe solution to removing the spring clamps that retain the hoses is the use of pipe nipple fittings. Using two, they act as handles to open the spring and pull the hose off. These are



Pipe nipples serve as handles for clamp removal.

available at most hardware and plumbing supply houses. *Anthony J. Fusco, Buffalo, N. Y.*

SHOP HINTS WANTED

\$3 to \$10 for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Unacceptable items will be returned if accompanied by a stamped envelope. Send your entries to Shop Hints Editor, ELECTRONIC TECHNICIAN, Ojibway Building, Duluth 2, Minn. The hints published in this column have not necessarily been tried by ELECTRONIC TECHNICIAN editors and are the ideas of the individual writers.



**Keep Inventories Low!
Save Time and Money!
Speed Up Repairs!**

NOW, WITH ONLY 10 RCA "TOP-OF-THE-LINE" TRANSISTORS YOU CAN REPLACE OVER 1900 ENTERTAINMENT TYPES

RCA's ten new "Top-of-the-Line" transistors can solve nearly every transistor replacement problem you will encounter in your servicing of phonographs, tape recorders, battery-operated portable radios, auto radios, and other entertainment-type equipment.

With an inventory of only 10 types, the RCA SK-Series transistors can quickly, easily, and economically provide you with hundreds of replacements—over 1900 in all, including many types of foreign manufacture.

For example, if you are active in the servicing of auto radios, you will find that just three types, the SK-3008, SK-3009 and SK-3012, will speed up repairs by providing you with replacements for virtually every transistor type used in auto radios.

RCA Type

SK-3003
SK-3004
SK-3005
SK-3006
SK-3007
SK-3008
SK-3009
SK-3010
SK-3011
SK-3012

Application

pnp type, AF Driver and Output Stages (9 V Supply)
pnp type, AF Driver and Output Stages (15 V Supply)
pnp type, RF, IF, and Converter Stages of Broadcast Receivers
pnp type, RF, IF, and Converter Stages of FM and AM/FM Receivers
pnp type, RF, IF, and Converter Stages of All-Wave Receivers
pnp types, RF, IF, and Converter Stages of Auto Radios
pnp type, Audio Output Stages of Auto Radios
npn type, AF Driver and Output Stages of Broadcast Receivers
npn type, RF, IF, and Converter Stages of Broadcast Receivers
pnp type, Audio Output Stages of Auto Radios

Ask your RCA Distributor for your copy of the new RCA replacement wall chart. It lists in alphabetical-numerical order the more than 1900 types which the 10 RCA SK-Type Transistors can replace.

RCA Electronic Components and Devices, Harrison, N. J.



The Most Trusted Name in Electronics

NEW PRODUCTS

FOR MORE INFORMATION CIRCLE PRODUCT NUMBERS ON POSTCARD FOLLOWING PAGE 98.

VARNISH

200

An aerosol spray is said to produce a smooth, clear insulating and protective coating with dielectric



strength of 200 v/mil. It dries at room temperature and is recommended for hot and humid climates on all surfaces of electronic assemblies. It is available in a 16 oz spray can or in gallon size cans. \$2.40 (1603) Injectorall Company.

CB TRANSCEIVER

201

The following specifications are claimed by the manufacturer of a



newly announced CB transceiver. Power input: 5w to plate of final RF amplifier (FCC Maximum); transmitter frequency range: 26.965-27.255 Mc; transmitter frequency control: 3rd overtone type quartz crystal operating within .005% of marked channel frequency between -32°F and $+140^{\circ}\text{F}$. Sockets provided for 6 different crystals selected by front panel switch; modulation: AM Plate modulation automatically limited to less than 100% (FCC Requirements); output impedance: variable "pi" network permits adjustment to most popular antenna types; antenna connector: one on rear apron; dummy antenna load: supplied for off-the-air tuning of the transmitter; indicators on panel: pilot light indicates transmission mode; microphone: ceramic element, push-to-talk switch, plastic case coiled and connector; power supply: 3-way type, 6vdc, 12vdc, 117vac. Current drain 8 amp at 6vdc, 4amp at 12vdc. The set transmits with a 6GK5 and a 12BY7 tube. According to the manufacturer, receiver specifications include super heterodyne with RF stage, double convergence; first IF—1750kc, Second IF—262kc selectivity 5kc,-6db, 8kc-20db; automatic noise limiter; adjustable squelch, spotting switch; "S" meter; continuous tuning with vernier drive, or crystal controlled reception; six crystals selected by

front panel switch and tunes from 26.965 to 27.255 Mc. Sensitivity is said to be better than $1\mu\text{v}$ for 10db signal-to-noise ratio. Tube complement in the receiver section is 6DK6, 6KE8, 6BE6, 6AJ8 (ECH-81), 6AY11, 6GW8 (ECL-86). Size (HWD): 6 x $8\frac{1}{2}$ x 10 in., Weight: 16 lb; Kit \$119.95, Wired \$189.95. EICO.

CUSHIONS

202

A custom cushion design for its ED-300 headphone together with an 18-month warranty against ma-



terial or workmanship defects in the headset is announced by the manufacturer. The square cushion is said to provide the wearer with better comfort over long periods of time while maintaining a tighter seal. The listening quality of the headphones are further enhanced by the resistance to background noise provided by the new cushion, according to the maker. Clevite.

INTERCOM SPEAKER BOX

203

An intercom speaker box, Model ISB-45, designed to house 4 in. or 5 in. speakers is now available. It's made of 16 ga CRS and 20 ga perforated steel and painted in Dark Hammer-X, with the perforated metal in white enamel, giving this unit decorative appearance according to the manufacturer. The per-

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All Types T.V. Tuners Cleaned, Repaired and Aligned to Factory Specifications. Same day in shop service on most Tuners. Price Includes Minor Parts, Major Parts at Cost Price. We use Original Parts if possible. State Make Model and Enclose all Parts and Tubes. Pack Well and Insure.

ALSO HAVE LARGE STOCK OF EXCHANGE TUNERS, WRITE FOR TYPES AND PRICES.

- - - for more details circle 48 on post card

CHECKS AND REJUVENATES ALL PICTURE TUBES WITHOUT ADAPTORS OR ACCIDENTAL TUBE DAMAGE

Featuring Automatic Controlled Rejuvenation

The All New SENCORE CR125 CATHODE RAY TUBE TESTER

An all new method of testing and rejuvenating picture tubes. Although the method is new, the tests performed are standard, correlating directly with set-up information from the RCA and GE picture tube manuals.

Check these outstanding features and you will see why this money making instrument belongs on top of your purchasing list for both monochrome and color TV testing.

Checks all picture tubes thoroughly and carefully; checks for inter-element shorts, cathode emission, control grid cut-off capabilities, gas, and life test. Checks all picture tubes with well filtered DC just like they are operated in the TV set.

Automatic controlled rejuvenation. A Sencore first, preventing the operator from over-rejuvenating or damaging a tube. An RC timing circuit controls the rejuvenation time thus applying just the right amount of voltage for a regulated interval. With the flick of a switch, the RC timer converts to a capacity type welder for welding open cathodes. New rejuvenation or welding voltage can be re-applied only when the rejuvenate button is released and depressed again.

Uses DC on all tests. Unlike other CRT testers that use straight AC, the CR125 uses well filtered DC on all tests. This enables Sencore to use standard recommended checks and to provide a more accurate check on control grid capabilities. This is very important in color.

No adaptor sockets. One neat test cable with all six



All six sockets, including latest color socket, on one neat cable.



Checks Each Gun Individually In Color Tubes.

sockets for testing any CRT. No messy adaptors, reference charts or up-dating is required. The Sencore CR125 is the only tester with both color sockets. (Some have no color sockets, others have only the older type color socket.)

No draggy leads. A neat, oversized compartment, in the lower portion of the CR125 allows you to neatly "tuck away" the cable and line cord after each check in the home.



MODEL CR128 For the man on the go. Same as above but in all steel carrying case . . . \$69.95

Model CR125 \$69.95

PS127 DELUXE WIDE BAND OSCILLOSCOPE AT A SURPRISINGLY LOW PRICE

This all new 5 inch oscilloscope offers the finest in performance, portability and appearance. Vertical amplifier frequency response, flat within 1 DB from 10 CPS to 4.5 mc and only 3 DB down at 5.2 mc insures true waveform reproduction. Vertical amplifier sensitivity of .017 volts RMS for one inch deflection on wide band (without band switching) is found only on scopes costing hundreds of dollars more. High input impedance of 2.7 megohms shunted by 99 mmfd (or 27 megohms with 9 mmfd with built-in low capacity probe), insures minimum circuit loading. For the first time, waveforms can be viewed in TV horizontal and vertical output circuits with the low capacity probe that will withstand up to 5000 volts peak to peak. To top that, the vertical amplifier attenuator controls are calibrated directly in peak to peak volts for fast direct reading of all peak to peak voltages.

Horizontal amplifier extended sweep range from 5 to 500 kc in five overlapping steps and frequency response from 10 CPS to 1 mc within 3 DB insures linear sweep and positive sync. External inputs for horizontal sweep and sync, intensity modulation, and smart two-toned case and "designer" styled controls brands the PS127 a truly professional oscilloscope.

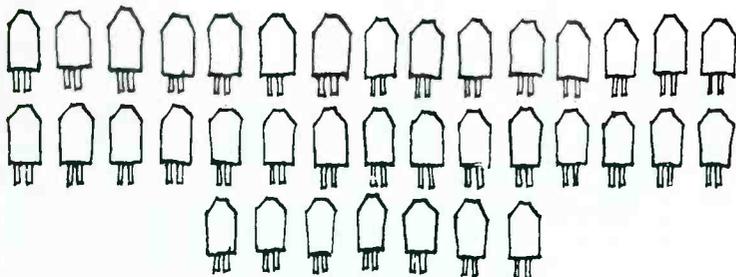
PS127 \$169.50



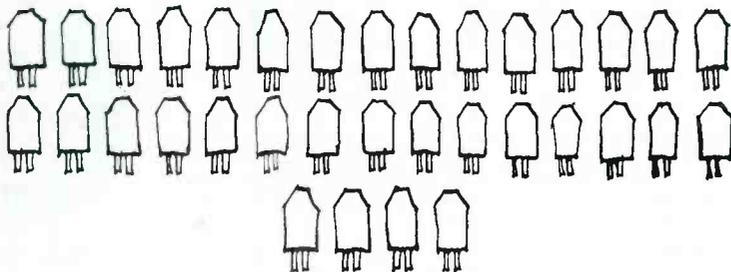
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This Sonotone cartridge can replace



37 Brand A types



34 Brand B types

and itself!

The 2TA pictured above is just one member of the Sonotone line, the most versatile cartridge line available today.

The Sonotone cartridge line offers the electrical and mechanical flexibility to substitute for dozens of competitive types. Of course, Sonotone cartridges are direct replacements in over 14,000,000 phonographs that use Sonotone cartridges as original equipment, too. Which means: If you stock the compact Sonotone line, you'll have replacement cartridges for just about every phonograph that comes into your shop. You'll also have the famous **Sonoflex**®, the needle that puts an end to profit-robbing callbacks caused by bent and broken shanks.

The Sonotone Cartridge Replacement Manual tells you what Sonotone cartridge to use. Want an idea of how simple life can be with Sonotone? For a limited time, we'll be glad to send you a **free** copy of the manual—normally, it's 50 cents. Write:

Sonotone

Sonotone Corporation, Electronic Applications Division, Elmsford, New York
Cartridges • Speakers • Microphones • Headphones • Hearing Aids • Batteries

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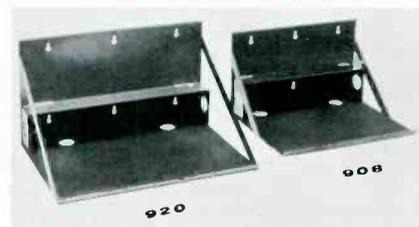
NEW PRODUCTS



forated metal back and front comes off by removing 4 tapping screws. Overall size is 5 x 5 x 3 in. Metal Works, Inc.

MOUNTING SHELVES 204

Two wall shelves were recently introduced. They are said to be ideal for mounting amplifiers, port-



able TV or programmers, radios, etc., in supermarkets, variety and department stores, plants and factories. The units come assembled and ready to mount on the wall, both in standard sizes or they can be fabricated to specifications. Metal Works Inc.

CORD ACCESSORY 205

An accessory that helps eliminate tangled and twisted soldering iron cords is announced. Simple, fast,



add-on installation is a prime feature of Coil-A-Cord is claimed by the manufacturer. With the device installed, tangled electrical cords are automatically kept out of the way of the operator. It also helps to eliminate the occasional burned



COLORMAGIC

Patent Pending

FHR

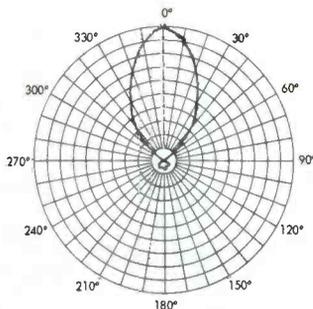
FUNDAMENTAL HARMONIC RESONANCE...GC'S EXCLUSIVE DESIGN PROCESS!

Colormagic elements resonate on the fundamental harmonics within both the high and low bands. Colormagic FHR outperforms the average second harmonic TV element by producing a tight, laser-linked directivity of signal...higher gain! It's in the elements!

GC "GOLD-GUARD" anodizing process guards against pitting, chipping, rust and corrosion...makes the Colormagic series the best protected, all-weather line available!

GC "SOLID-SEMBLED" construction insures quick, easy installation...rigid-lock elements snap securely into place!

Compare! Colormagic Antenna Systems offer pencil-point polar patterns...laser-linked directivity...flat plateau response curve...no traps or peaks...excellent for color or black & white TV reception.



15 All-New Colormagic Combo-Couplers permit cross-direction reception of UHF-VHF-FM antenna combinations...each unit encased in high-impact polystyrene case...supplied with stainless Steel mounting strap. Complete sales program available.



See your GC Distributor! He'll fill you in on this "prestige" package. **CONSIDER THE ELEMENTS INVOLVED!** ...then GO COLORMAGIC! If not stocked locally, write us for name of Distributor nearest you.

GC ELECTRONICS CO.
Division of Textron Electronics, Inc.

Western Plant: 3225 Exposition Place, Los Angeles 18, Calif.
MAIN PLANT: 400 S. Wyman St., Rockford, Ill., U.S.A.

NEW SECO MODEL 107B TUBE TESTER

SPEEDS REPAIRS, DETECTS SLEEPERS

● 8 sockets wired to 14 lever type pin selectors for testing tubes circuit by circuit!

● 40 prewired sockets accommodating 63 basic arrangements for testing thousands of popular tube types with no set-up data required!



FOOLPROOF READINGS—all test information reads on one meter and one scale! Eliminates errors that can be made reading off closely packed multiple scales. Wide sweep increases accuracy of readings.

3 COMPREHENSIVE TESTS find tube faults that slip by other testers that cost much more. Pull out more "sleepers" on your first try—save time and call-backs.

● **GRID CIRCUIT TEST** makes up to 11 simultaneous checks for leaks, shorts and grid emission—indicates "hard to find faults" that conventional short tests pass by.

● **DYNAMIC MUTUAL CONDUCTANCE TEST** indicates relative transconductance—incorporates gas error test.

● **CATHODE EMISSION TEST** provides the best method for testing pulse amplifier, power output and damper type tubes.

Readings can be made for element identification and analysis of elements for shorts. A "life" test checks for allowable drop in mutual conductance or emission current under reduced heater supply conditions. The exclusive Grid Circuit Test above is a test originated and patented by Seco.



PLUG-IN-SOCKET CHASSIS is easily replaced or interchanged to accommodate the widest possible range of tubes. In addition to 8 sockets, panel has 3 pin straighteners for 4 most popular types. Inexpensive and easy to keep up to date as new tubes appear. Plug in chassis can be customized at low cost to fit your needs.

WIDE RANGE of tube types tested includes all modern TV, radio, industrial and foreign tubes using the following sockets—seven pin, nine pin, octal, loctal, novar, nuvistor, compactron, magnoval and ten pin. Special circuit for low voltage hybrid types. Complete set-up data book is included—pages covering new tubes that appear are mailed periodically to all registered owners at no charge.

See Model 107-B, Booth 3112, Exhibition Hall
May Parts Show, Hilton Hotel, Chicago, May 18-20



Model 107B **\$189⁵⁰** NET

For complete information see your distributor or write:

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1211 S. Clover Drive, Minneapolis 20, Minnesota
A DIVISION OF DI-ACRO CORPORATION

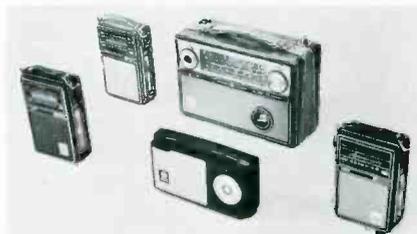
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NEW PRODUCTS

cord that occurs when an operator accidentally lays a hot iron on or near the loose cord. In addition to soldering irons, the device can be used on other electrical hand tools and appliances. It will fit either standard two wire or three wire grounded cords. Ungar.

MULTIBAND RADIOS 206

Five short-wave portable radio models and three FM/AM sets are announced in a 19-model portable



line. Prices range from \$29.95 to \$125.00. General Electric.

SPECTRUM MONITOR 207

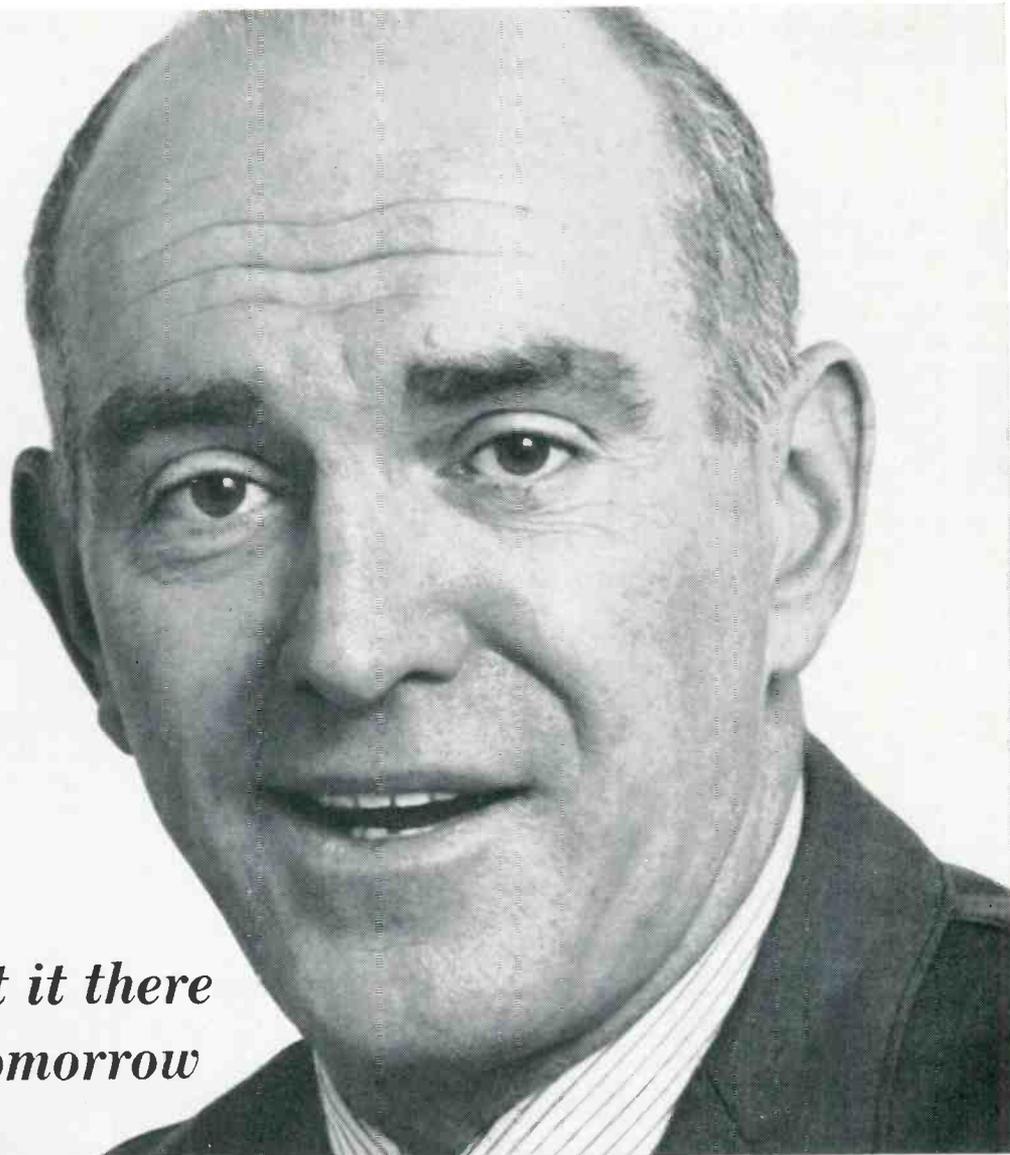
A spectrum monitor called "Ham-Scan," in easy-to-build kit form, is introduced. It is reported



to be a useful accessory that will greatly increase the versatility and enjoyment of all amateur radio and CB operations. It is designed to operate with all receivers in service today and permits visual observation of band activity up to 50 kc above and below the frequency to which the receiver is tuned, the maker claims. Heath.

COLOR ANALYZER 208

The Model 900 reportedly provides for the dynamic check of color, video and picture tube circuits as well as the overall performance of color TV sets. Tests are made in just minutes for control



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tomorrow*

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You can depend on Greyhound Package Express to get your shipment where it's going, FAST! Packages you ship hundreds of miles, often arrive the very same day.

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PITTSBURGH— CLEVELAND	15	2 hrs. 55 min.	1.60	1.85	2.15
INDIANAPOLIS— CHICAGO	10	4 hrs. 15 min.	1.70	2.00	2.30
DALLAS— SAN ANTONIO	10	7 hrs. 15 min.	1.90	2.15	2.41

*Other law rates up to 100 lbs.



One of a series of messages depicting another growing service of The Greyhound Corporation.

--- for more details circle 33 on post card

NEW PRODUCTS

grid voltage, color gun screen voltage and current, focus voltage, cathode voltage and emission, as well as control grid emission current according to its maker. It is said that an exclusive circuit eliminates the need of range switches putting the meter on the right range automatically and a special safety feature allows the safe measurement



of up to 7000 v of the focus grid of the color tube. The #900 gives fast push-button readings of both current and voltage automatically according to the company. \$44.95 Mercury.

CB RADIO

209

Announced is the FS-23 citizens band transceiver which has 23 crystal controlled channels. The unit includes a low-noise dual-purpose transistor power supply, low-noise Nuvistor receiver RF stage, provisions for accessory VOX control & 2-tone squelch, the specifications indicated. Complete with micro-

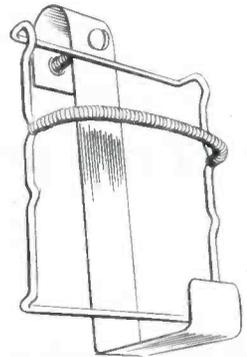


phone, power supply cables, and mobile brackets, \$299.95. Sonar.

PORTABLE HOLDER

210

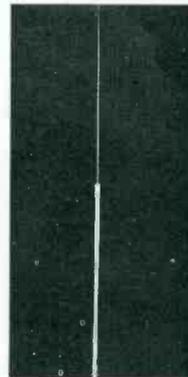
The 765X transistor radio carrier is ideal for attaching transistor radios to bicycles, cars, boats and



other convenient places says the manufacturer. It is finished in mirror chrome plate. A coiled spring across front is said to hold radios securely and cushion any shock. A curved hook and a bolt attaches to bicycle handle bar or without the bolt, the hook clips over any convenient edge. Washburn Co.

CB ANTENNA

211



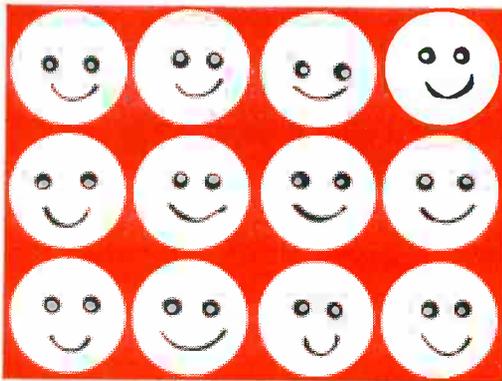
A center-fed sleeve-monopole mobile CB antenna with low-angle radiation is announced. The sleeve-monopole antenna is reportedly designed to increase useful signal strength and extend range for

look what happens when you
buy a
dozen
vu-brites...



You get the magnifying glass free...

handy for home, shop, and service calls. Two inch diameter, handsome leatherette case. Yours free with the purchase of 12 Vu-Brites.



You get twelve happy customers...

because 12 CRT's will be given an extra lease on life, 12 households will enjoy TV more, thanks to the brighter picture you (and Perma-Power's Vu-Brite) have provided.

what a deal!

For a limited time, Perma-Power is offering you this wonderful gift absolutely free with the purchase of 12 Vu-Brites at the regular price. Vu-Brites are the Briteners that really do a job—on parallel or series sets (Model C401 for parallel; Model C402 for series). They come colorfully packaged in individual boxes... and are priced at \$9.95 the dozen, net.

Perma-Power
COMPANY

5740 N. TRIPP AVENUE
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Hurry—this special gift offer will end when current stocks are gone. Call your distributor today.

--- for more details circle 46 on post card

What's all this talk about "exact replacement" Twist-Prong Electrolytics?

What is an "exact replacement?" To CDE it's the proper capacitor to do the job intended—available when you need it. To others, it means number matching by the service technician—matching the numbers on the old unit with those of the replacement—without regard to availability or cost. CDE's new Twist-Prong line is based on our service-oriented definition.

Matching numbers may be fun, but there comes a time when it's a losing game. In Twist-Prongs the growth in ratings used in original equipment has been phenomenal. Even the loudest advocates of number matching have to hedge. One advertises over 1700 "exact replacements" — catalogs about 1200—and, of that 1200, lists possible alternates for 297 "if the listed capacitor is not available." Then, there's the problem of popular and "less popular items"—or, you're lucky if your distributor has the number you're trying to match in stock.

To Cornell-Dubilier, the availability of a proper replacement to do the job intended is most important. That's why we've designed a complete new Twist-Prong line for the professional electronic service technician. It's a line that recognizes the broad tolerances inherent in electrolytic manufacture and widely recognized throughout the industry—a fact you've used repeatedly in making replacements. It's a line that enables your distributor to have a complete stock so units will be available when you need them. It's an "exact replacement" line in the proper sense of the word.

Only the CDE Twist-Prong line is designed to make your job easier. A new Twist-Prong Replacement Guide and Cross Reference details manufacturers recommended in-stock replacements for every current Twist-Prong rating. The line is listed, too, in the new CDE Replacement Component Selector. Ask your distributor for copies today and end the old fashioned matching numbers game.

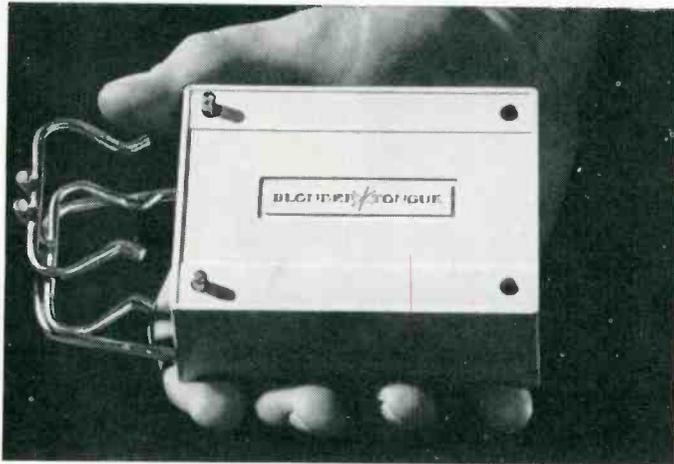


CDE **CORNELL-DUBILIER**

INNOVATION WITH RELIABILITY

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"Here it is. An all channel UHF amplifier."



"So what?"

"So, Bob, it's the world's first two transistor UHF amplifier."

"Big deal."

"Gives twice the gain of those one transistor jobs."

"Go on, Harry. Go on."

"It's the first to deliver peak performance on all UHF channels."

"So what does it all mean to me?"

"Cleans up fuzzy pictures, brings in distant signals sharp and clear."

"Now you're really talking."

"Remote power supply, Miracle Mount for instant mounting, 300 ohm stripless screws."

"I'm sold. What's it called?"

"The **Blonder-Tongue Able - U2**. Only \$44.95* at your TV dealer."

"Did you say Blonder-Tongue? Great! I can use it with my Blonder-Tongue Golden Dart UHF antenna."

"Hey, Charlie! Here it is. An all-channel UHF amplifier!"

"So what?"



Blonder-Tongue Laboratories,
9 Alling St., Newark 2, New Jersey

- - - for more details circle 18 on post card

*list

80

NEW PRODUCTS

more readable communications over longer distances in the citizens band service. Mid-point excitation is said to lower the angle of radiation to concentrate maximum signal along the horizon. The feed point is several ft above the ground plane of the vehicle. Overall height is 6 ft. The bottom sleeve section is tubular aluminum alloy. A 17-ft 52-Ω coaxial cable extends from the base of the sleeve for connection to the CB unit. B & K/Mark.

STEREO CARTRIDGE 212

Positive scratch protection is claimed as one of the features of this stereo ceramic cartridge. This



unit, contained in a ten-pack carton that converts to a merchandising display device, is currently being offered with a supply of point-of-sale literature. It is reported that positive scratch protection is assured by a spring-suspension mechanism that permits the cartridge to pivot when sudden force is applied, bringing the front end (and therefore the stylus) up off the record surface and bringing a soft "sole" to bear on the record surface. The Featheride is offered in two types, usable in phono units tracking at



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Masts and towers of Armco ZINC-GRIP® Steel Tubing are strong. They keep antenna aligned despite wind and snow loads. And a durable zinc coating protects them against rust, retains their good looks.

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Armco Division

NEW PRODUCTS

any force between 2 and 6 g. It can be mounted in any modern tone arm having standard 1/2 or 7/16-in. mounting centers. Electrovoice.

BOOSTER-COUPLER 213

Designed to run one to four TV or FM sets, the BC-208 coupler,



now available, has +8db gain to each output according to its maker. Ampliframe shielded triode tubes used are designed with high input impedance and extremely low interelectrode capacitance for high

gain at TV/FM frequencies. A balanced resistive method is used for isolation between outlets. This circuit isolates sets in the system preventing interaction the maker claims. A larger chassis dissipates heat for longer component life, all terminals are no-strip and unused terminals need not be terminated; wiring is precision module type and provides optimum control over variables according to the company. It is said that it can be used in fringe, near-fringe and even close-in installations because strong signals won't overload it and that it takes up to 350,000 μ v of signal input. List price of the BC-208 is \$29.95. Winegard.

More useful than ever!

ALL
New!
COMPLETELY
INTEGRATED

B&K

CRT 445

Checks and Corrects
B & W and COLOR
Picture Tube Troubles



THE INDUSTRY'S STANDARD

*Most Widely Used Today
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Includes all desired features. Does the job in a few minutes right in the home without removing tube from TV set.

**SAVES CUSTOMERS—ADDS SERVICE INCOME
MAKES NEW TUBE SALES EASIER**

Gives new life to weak or inoperative tubes. Checks for leakage, shorts, open circuits and emission. Removes inter-element shorts and leakage. Repairs open circuits and low emission. Restores emission and brightness. Life Test checks gas content and predicts remaining useful life of picture tube. Quickly pays for itself.

Net, \$74.95

TESTS AND REJUVENATES

all picture tubes at correct filament voltage from 1 to 12 volts.

TESTS AND REJUVENATES

all Hi G-2 and Lo G-2 picture tubes, including tubes that require as low a G-2 voltage as 30 volts. Supplies all three necessary voltages: Hi G-2, Low-1 G-2, and Lo-2 G-2.

TESTS AND REJUVENATES

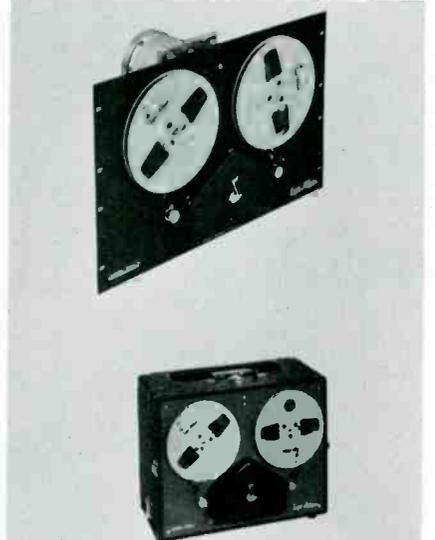
110° tubes and the new 19" and 23" tubes.

TESTS AND REJUVENATES

color picture tubes, including the new 90° 23" 23BG22. Checks and corrects each gun of color tube separately.

TAPE PLAYER 214

A magnetic tape playback deck featuring a pulse-initiated repeating program is announced. It is said



the player will accept programs of any duration from 20 sec to 8 hours, recorded on a suitable 1/2 track recorder at speeds of 1-7/8, 3-3/4, or 7-1/2 ips. A program can be started by an external momentary pulse of 6 to 12 v ac/dc to the player via a built-in connector; the entire program is then played to the end of the recording, the tape reverses and immediately shuts off, waiting for the next "start" pulse, specifications indicated. Tape-Athon.

DISPLAY 215

This UHF converter display is designed to fit on a counter or in a window according to its maker. The die-cut, display is one of several

Subscribe to
New
Picture Tube
Information
Service

UP-DATE YOUR B&K CRT WITH THESE ACCESSORIES

Model C40 Adapter. For use with previous Models 400 and 350 CRT's—to test and rejuvenate TV color picture tubes and 6.3 volt 110° picture tubes. Net, \$9.95

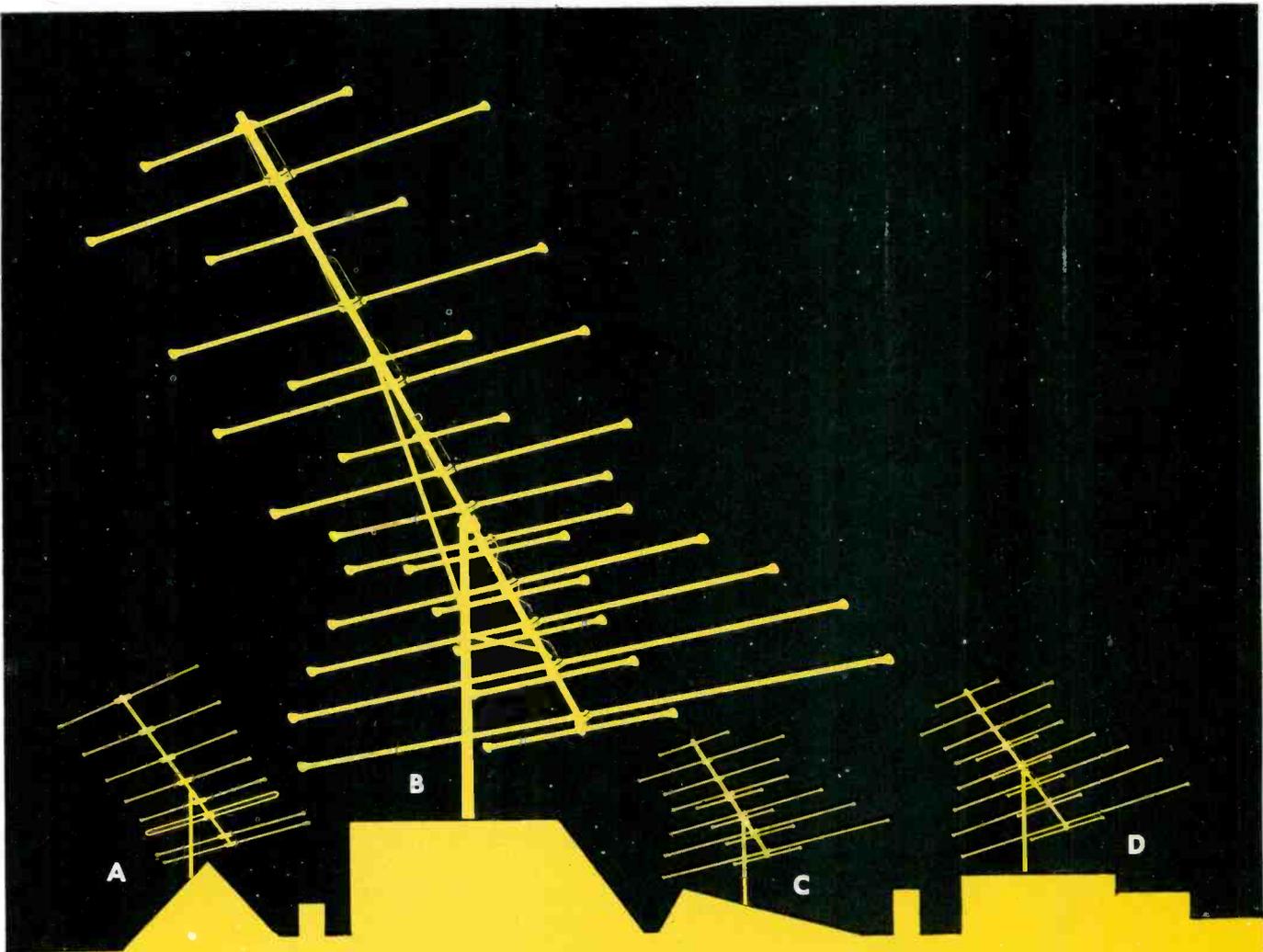
Model CR48 Adapter. For use with previous Models 400 and 350 CRT's—to test and rejuvenate 110° picture tubes with 2.34, 2.68, and 8.4 volt filaments. Net, \$4.95

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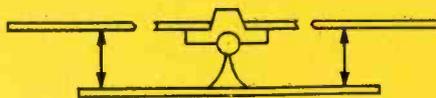


RCA OUTDOOR ANTENNAS

the name...the features...the line that sells

Now you can select the best model for your customer's location from this new RCA outdoor antenna line that combines all-channel yagi and multiple cross-driven types. Satisfy them with the sharpest color and black-and-white pictures.

Explain the RCA *exclusive* feature in customer language. Only RCA antennas feed energy directly into the transmission line from low band driven elements. These are capacitively coupled, positioned directly above high band driven elements. RCA, of course, phases low and high band directors for best high band performance.



CAPACITIVELY COUPLED

In addition, RCA's electro-lens director system absorbs maximum incoming signal power, gives extremely high gain across the VHF band, offers excellent forward gain on the front end.

More customer interest! A gold anodized finish protects every RCA antenna from weather corrosion. Wrap-around mast clamp aligns antenna on mast, prevents boom crushing.

Just call your RCA Victor distributor. Look at and learn about RCA 200, 300, 400 antennas... from the color TV pioneer! From there on... sell!

A. RCA 500 FM antenna. Eight-element yagi. Acute directivity, 88 to 108 MC. VSWR 1.25:1. Average eight db gain.

B. RCA 400 antenna. 19 elements, for fringe area or distant reception.

C. RCA 200 antenna. 14 elements, for local reception.

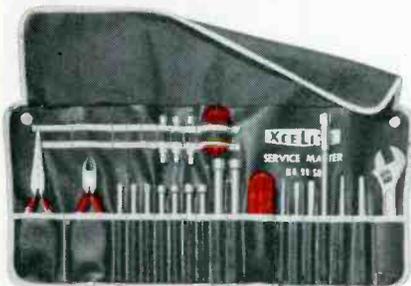
D. RCA 300 antenna. 13 elements, for suburban and near fringe area locations.

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... 2" Stubby. Inter-
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spring holds snap-in
tools firmly in place.

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High Nickel chrome
finish, $\frac{3}{16}$ " to $\frac{1}{2}$ "

3 STUBBY

NUTDRIVERS:
 $\frac{1}{4}$ ", $\frac{3}{16}$ ", $\frac{3}{8}$ "

EXTENSION BLADE:

Adds 7". Fits
both handles.

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Two slotted...
 $\frac{3}{16}$ ", $\frac{1}{2}$ "
#1 Phillips

2 REAMERS:

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ADJUSTABLE WRENCH:

6" thin pattern,
1" opening

LONG NOSE PLIER:

"Cushion Grip",
2 $\frac{1}{4}$ " nose

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NEW PRODUCTS



aids being offered by the Company
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MINIATURE OSCILLATOR 216

Model TC-3 oscillator is said to
be ideal for engineers, technicians
and radio amateurs for alignment of
TVs, for frequency standards, and
as a marker generator or signal
source for marine band operation.
It is 2 $\frac{1}{4}$ x 2 $\frac{1}{4}$ x 5 in. and comes
with battery. The TC-3 oscillator
also includes choice of three stand-

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J-Tran
top-tuned
miniature
IF
transformer

Dimensions:
 $\frac{3}{4}$ " by $\frac{3}{4}$ " by 2" high

If both ends are accessible it can be tuned from
both ends, but if access to one end is restricted
or inconvenient, both cores can be tuned from
the same end.

TOP-TUNED MINIATURE IF TRANS

Cal. No.	Item
14-H1	262 kc Input I.F.
14-H2	262 kc Output I.F.
14-H6	262 kc Output I.F.*
14-C1	455 kc Input I.F.
14-C2	455 kc Output I.F.
14-C6	455 kc Output I.F.*
14-C7	455 kc Input I.F. Battery Radios
14-C8	455 kc Output I.F. Battery Radios
14-C9	455 kc Input I.F. AC-DC Radios
14-C10	455 kc Output I.F. AC-DC Radios
6270	4.5 Mc Input or Interstage
6271	4.5 Mc Ratio Detector
1457	10.7 MC Input or Interstage
1458	10.7 MC Discriminator
1459	10.7 MC Ratio Detector
1464-WB	10.7 MC Discriminator 900 kc P to P
1465-WB	10.7 MC Ratio Detector 800kc P to P
6230	TV Converter I.F.
6231	TV 44 MC First I.F. Trap
6232	TV 42.5 MC Second I.F. 41.25 MC
6233	TV 45.5 MC Third I.F. 47.25 MC
6234	TV 44 MC Fourth I.F.

PRINTED CIRCUIT IF TRANS

Cal. No.	Item
16-PH1	262 kc Input I.F.
16-PH2	262 kc Output I.F.
16-PH6	262 kc Output I.F.*
16-PC1	455 kc Input I.F.
16-PC2	455 kc Output I.F.
16-PC6	455 kc Output I.F.*
16-PC7	455 kc Input I.F. Battery Radios
16-PC8	455 kc Output I.F. Battery Radios
16-PC9	455 kc Input I.F. AC-DC Radios
16-PC10	455 kc Output I.F. AC-DC Radios
6270-PC	4.5 Mc Input or Interstage
6271-PC	4.5 Mc Ratio Detector
6230-PC	TV 44 MC Converter I.F.
6231-PC	TV 44 MC First I.F. Trap
6232-PC	TV 42.5 MC Second I.F. 41.25 MC
6233-PC	TV 45.5 MC Third I.F. 47.25 MC
6234-PC	TV 44 MC Fourth I.F.

*with diode filter capacitors

Miller general catalog

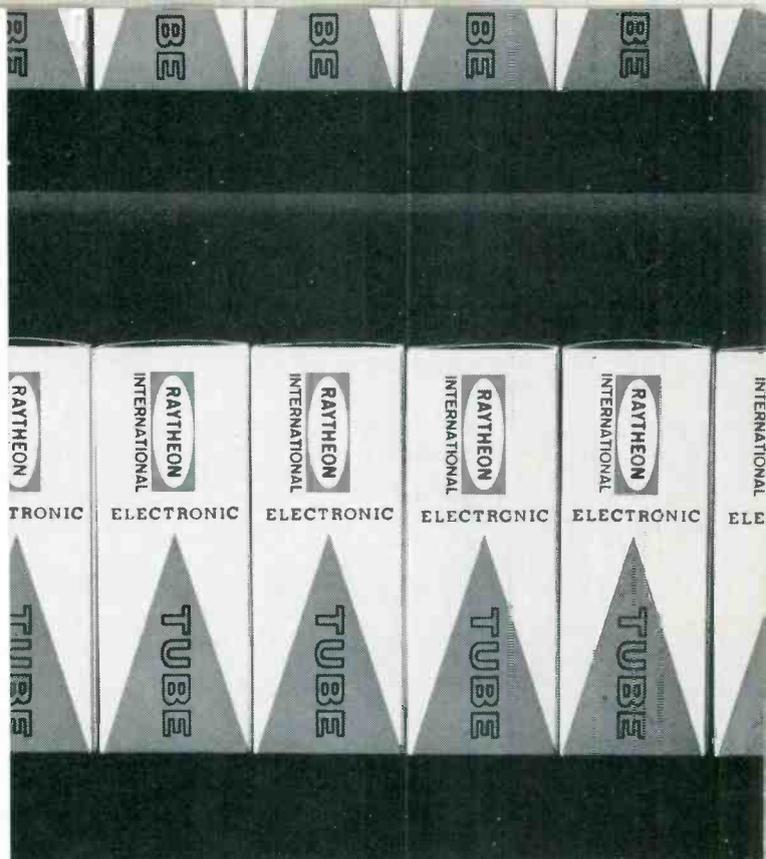
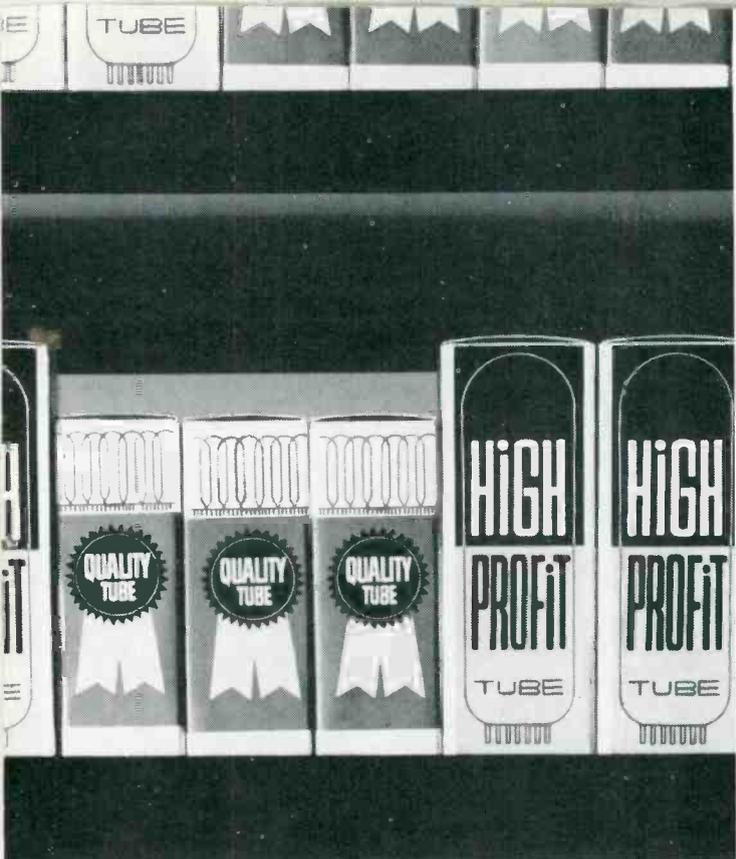
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304

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NEW PRODUCTS



ard frequency crystals. Additional crystals are available and will be factory calibrated. Frequency range of the TC-3 is from 200 kc to 3 Mc. \$29.95 Texas Crystals.

DUAL CONE LOUDSPEAKER 217

A line of speakers called the DELTA Series is announced. This Series consists of the Model DL-

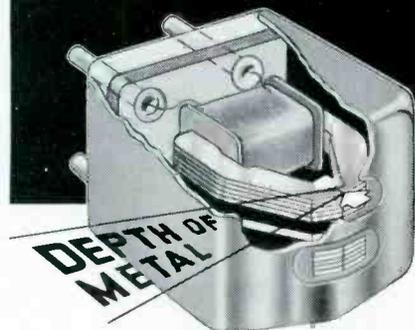


220, a 3-element, 12-in. coaxial unit priced at \$34.75; Model DL-120, a dual-con, 12-in. speaker priced at \$21.50; and Model DL-80, a dual-cone, 8-in. loudspeaker priced at \$15.24. The Model DL-220 is said to provide 25 cycle resonance and has a compression HF unit with midrange radiator. The frequency range is reportedly 25-16,000 cps and comes equipped with an adjustable high frequency balance control on a 30-in. cable. \$34.75 Jensen.

TRUCK RADIO 218

A self-contained radio for trucks, featuring all-transistor construction is announced. The manufacturer says the unit provides excellent tone, volume and sensitivity, plus low-

ALL TAPE HEADS WEAR OUT



... and that means **solid profit for you!**

Magnetic tape itself is the real cause of head wear! The abrasive action of tape as it passes over the head face gradually wears away the **depth of metal** found on a new head (see above). Wear is nearly always uneven, and as the head wears out, it becomes impossible to achieve good contact between the head gap and the signal recorded on the tape. Poor tape-to-gap contact causes severe high frequency losses and erratic outputs — when this occurs, the brilliant realism of tape is lost! Head wear should NOT be permitted to reach this point — much less go beyond it to the limit where the gap actually begins to open up.

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By replacing worn heads with new Nortronics professional type laminated heads, total sound response — particularly in the higher frequencies — is immeasurably improved, and your customers can once again enjoy maximum performance from their tape systems. Laminated heads have the added feature of longer life due to 50% more **depth of metal** at the gap than the solid-core heads. The Nortronics Tape Head Replacement Program, with "Quik-Kit" accessories, makes it possible for you to offer replacements for more than 500 different recorders . . . opens up new sales and service business! CHECK into the profit-packed Nortronics Tape Head Replacement Program NOW!

Planning to attend the May Parts Show?

Stop at Exhibition Hall Booth 3527 and see the Nortronics Head Replacement Program. We'll be looking for you!

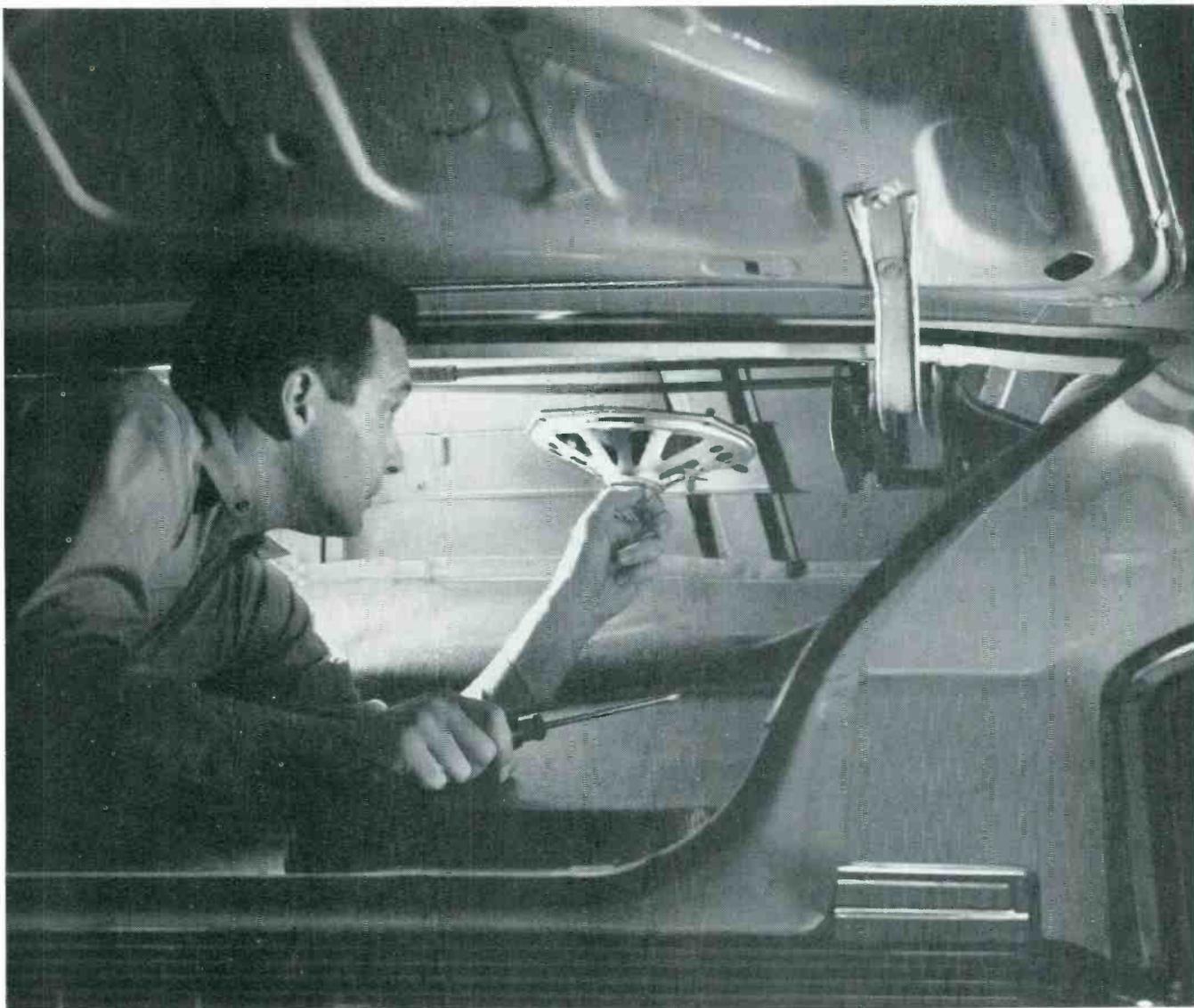
"Music sounds best on Tape—
Tape Sounds Best with Nortronics Heads!"

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ELECTRONIC TECHNICIAN



How to make some sound money

Talk up rear-seat speakers! Here's a good profit item you can sell to your car-owning customers. And spring is the time when everyone wants one. If he doesn't have a rear-seat speaker now he's probably already half sold, just waiting for someone to ask him to buy.

The Delco Radio Universal 8-10-OHM 6"x9" Rear Speaker Package #6122 contains all material necessary for a quick, easy one-man installation. Will take "tip jack", "blade", or

solder connection. And you're sure of selling the "right kind" because these speakers are acoustically designed for use in cars.

This spring make some sound money on rear-seat speakers. For full information on the complete Delco Radio line of speaker packages and accessories, call your United Delco supplier.

DELCO RADIO, Division of General Motors, Kokomo, Indiana

simply say **Delco**

Delco Radio Automotive Radio Service Parts and Electro-Mechanical Devices are distributed nationally through **United Delco**



Winegard

Dealer of the month

No. 16 of a Series

George Ellis says: "Winegard is better than anything, and I've tried 'em all. Nothing touches it."



Winegard salutes the Aidrite Corp., Boulder, Colorado, the first dealer with Winegard Antennas in the Boulder area.

Owner George Ellis has been building up business at Aidrite over the past 8 years by providing outstanding service and the finest products for his customers. Winegard has been proud to be associated with Mr. Ellis over these years, and to have grown with him in this tough reception area.

Location of an antenna is often a tricky problem in this mountainous terrain. "Out here you really have to search for a signal," says Mr. Ellis. The Winegard Colortron is an outstanding antenna that handles this rugged job beautifully."

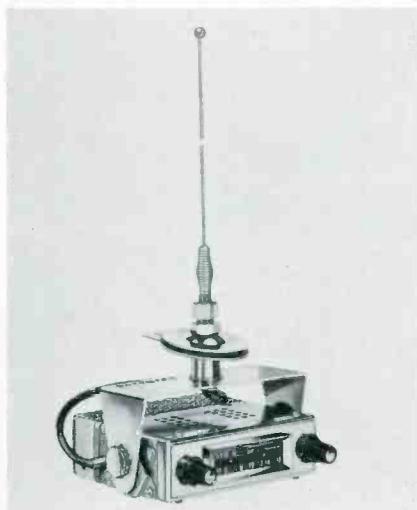
A perfect example of why Mr. Ellis is so strongly in favor of Winegard antennas was illustrated recently when he was called in to solve a family's problem of 1 channel reception in their 4 channel area. By installing a Winegard Colortron, Mr. Ellis brought this family sharp, clear pictures on all 4 channels.

Winegard Co.
ANTENNA SYSTEMS

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NEW PRODUCTS



cost, one-hole mounting in cab roof. The company claims that overhead mounting brings source of sound nearer to the ear and the driver never has to take his eyes off the road to tune and adjust the set. The unit contains five transistors and two diodes. Lock-nut and washers hold radio set securely to



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65MC to 100MC Fifth Overtone 6.00 ea.
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All-transistor 25 watt mobile PA amplifier featuring low current drain from 10 volt DC and 120 AC. Available with phono top.

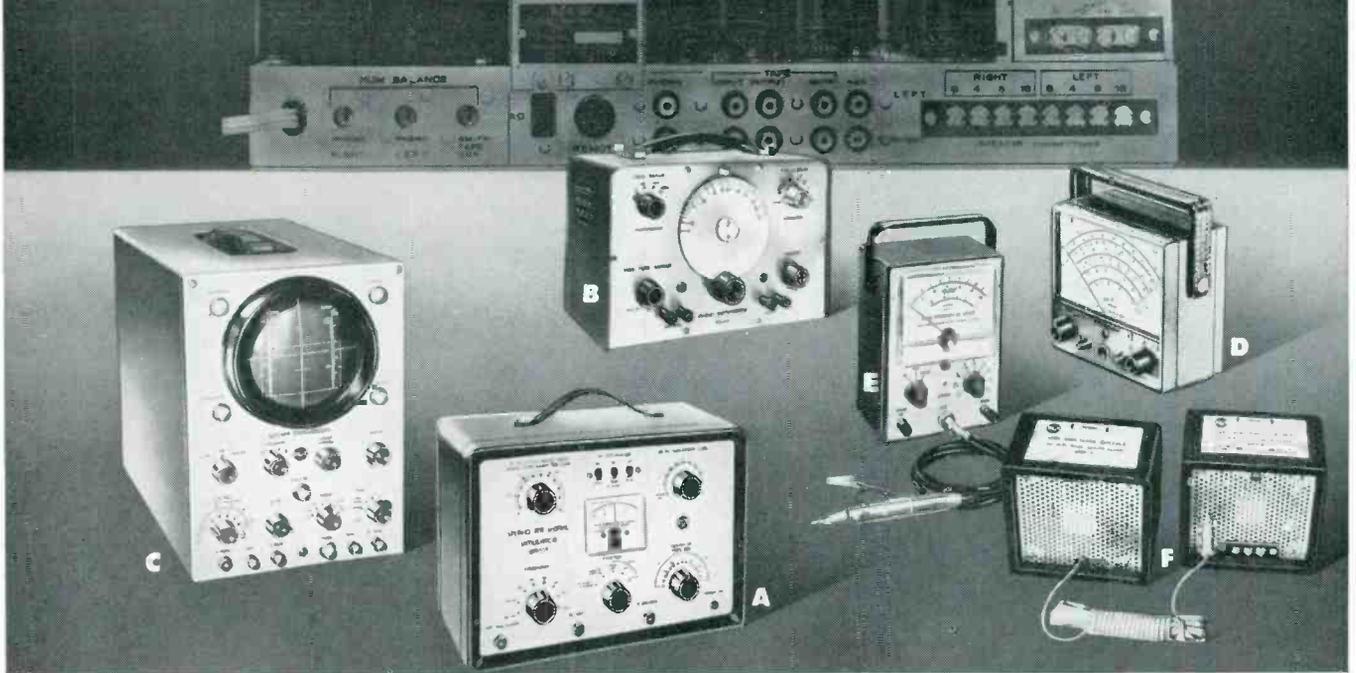
Write for Popular PA and Professional Sound catalogs.

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Let **RCA** equip you with **EVERYTHING YOU NEED FOR STEREO SERVICING**

RCA—entertainment leader of the world—now offers you a complete set of test instruments to put you in the stereo servicing business. And now's the time to get in because it's growing bigger and more profitable by the day.

A. NEW! RCA WR-51A FM STEREO SIGNAL SIMULATOR

Generates signals necessary to service and maintain stereo multiplex FM receivers and adaptors. Generates... Choice of 4 FM signals—Left Stereo, Right Stereo, Special Phase Test, Monaural FM • Choice of 8 sine-wave frequencies (400 cps, 1Kc, 5Kc, 19Kc, 28Kc, 38Kc, 48Kc, 67Kc) available separately or for modulating FM signals • 100 Mc carrier tuneable ± 0.8 Mc to permit selection of a quiet point in the FM band • 19 Kc subcarrier, crystal-controlled within ± 2 cps • 100 Mc sweep signal adjustable from 0-750 Kc at 60 cps rate • Choice of 3 composite stereo output signals—Left Stereo, Right Stereo, Special Phase Test • Choice of 3 sine-wave frequencies for composite stereo

signals • Crystal controlled markers for receiver if and rf alignment • Zero-center meter for checking the balance of stereo amplifier output. **\$249.50***

B. RCA WA-44C AUDIO GENERATOR

Generates sine-wave and square-wave signals over range of 20 to 200,000 cps to test audio systems. Can be used to measure intermodulation distortion, frequency response, input and output impedance, speaker resonance, transient response and phase shifts. Less than 0.25% total harmonic distortion over range of 30 to 15,000 cps. **\$98.50***

C. RCA WO-91A 5" OSCILLOSCOPE

A high-performance, wide-band scope—serves as a visual VTVM. Choice of wide band (4.5 Mc—0.053-volt rms/inch sensitivity)

or narrow, high-sensitivity band (1.5 Mc—0.018-volt rms/inch sensitivity). New 2-stage sync separator provides solid lock-in on composite TV signals. **\$249.50***

D. RCA WV-98C SENIOR VOLTOHMYST®

For direct reading of peak-to-peak voltages of complex waveforms, rms values of sine-waves, DC voltages, and resistance. Accuracy: 3% full-scale on both AC and DC, with less than 1% tracking error. Color-coded scales differentiate peak-to-peak from rms readings. New 0.5 volt full scale DC range for use with low-voltage transistor circuits. $6\frac{1}{2}$ " meter. **\$79.50***

E. RCA WV-76A AC VTVM

Measures voltages down to 0.001 volt. Decibel scale for measure-

ments from -40 to +40 db. Built-in amplifier which may be used separately as a preamplifier. Typical applications include: frequency response tests of preamplifiers, power amplifiers and tone control circuits, signal tracing; measurements of audio level, power level and gain; amplifier balancing applications and general audio voltage measurements. **\$79.95***

F. RCA WG-360A STEREO PHASE CHECKER

A quick, simple, positive way to check phase alignment of low and mid-range speakers in stereo systems. Completely "sound-powered". Snag-proof recessed grille design. For use with a VOM, VTVM, or oscilloscope. **\$14.95***

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*User price (optional)



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Where there's a contact... or a relay...

Service with Contact Shield! Protective! Corrective! It not only cleans and safeguards contacts better on TV, radio, and hi-fi sets; on all relay-operated electrical equipment, regular protective maintenance with this versatile cleaner prevents sticky relays—while corrective servicing unsticks them... **in seconds.** Promotes greater conductivity, keeps relays working smoother, longer. Contact Shield—the professional service man's cleaner.

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For handy guidebook to better servicing, write **Channel Master Corp., Ellenville, N.Y.**

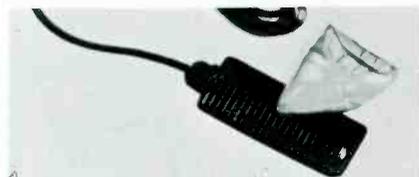
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NEW PRODUCTS

cab ceiling through 5/8 in. hole drilled in roof. The 33-in. stainless steel antenna bends in any direction. Retail \$44.95 ATR Electronics Inc.

FOOTSWITCH 219

A footswitch measuring 5 x 2 x 1/4 in. is easily taped or cemented to any floor, the maker says. It is



reported that reliable operation is assured without operator fatigue, since this switch is activated by slight toe or heel pressure. Electrical rating is one amp at 117 vac (or 28 vdc) for loads up to 100 w, or it is used to provide momentary switching for a control circuit to handle larger loads, the announcement said. Tapeswitch Corp.

... CHOOSING CONTROLS

Continued from page 45

taper can be simplified by plotting resistance readings versus percentages or degrees of rotation. Mounting a dial plate on the control bushing and using a pointer knob would facilitate plotting. The dial plate could be marked in increments for each 10 percent rotation or in degrees of rotation. Percent of rotation is more readily used, however.

Only two or three readings should be required to identify taper and compare on the taper charts. It should be kept in mind, however, that the readings obtained will not correspond exactly to the anticipated resistances, because of allowable resistance tolerances. EIA standards permit a ± 20 percent tolerance on all controls with a total resistance of 100K or less, ± 30 percent above 100K. These variations will generally be in the total resistance, however. The nature of the control construction is such that the variation in taper resistance is much less.

Linear and left-hand (modified clockwise) log tapers should be plotted by measuring the resistance

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Model UC100A. Modern, 2-tone design with brushed gold knobs.

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Installation is easy, too. Use just a screwdriver to connect the antenna lead and 300 ohm lead to any TV set.

And the remarkable Admiral price makes your "profit picture" look better than ever before.

Economy model UC100B also available... contact your Admiral Distributor now... start pocketing bigger profits right away!

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between the left (LT or CCW) terminal and the center (CT) terminal while progressively rotating the shaft clockwise from the CCW end. A 10 percent of total resistance at 50 percent rotation (plus or minus 3 percent rotation or 9 deg) would indicate a 10 percent log taper or C2 as indicated in Fig. 1, whereas a 50 percent of the total resistance would indicate taper to be linear, C1 or C7.

Right-hand or modified counter clockwise log tapers should preferably be plotted from the CLOCKWISE end by plotting the resistance gradient versus rotation in counter-clockwise rotation of the shaft. Total resistance should be measured between the right (RT or CW) and the center terminals.

Obtaining the taper characteristics of a "tapped" control is somewhat simpler as it is usually only necessary to measure the resistance between the tap terminal and either the CCW or the CW end terminal. For example, if the total resistance between terminals LT and RT (Fig. 5) is 810K and the resistance between LT and the 50 percent tap is approximately 400K, our correct taper choice would be C11 (Fig. 2). If the reading is approximately 80K, however, the correct taper is C15. On the other hand, if we have a 63 percent tap with the above 400K readings, our replacement choice should be taper C16 (Fig. 2). Should our tap happen to be in the 37 percent CW position, and we have a reading of about 170K (20 percent of 810K total), our correct replacement choice would be taper C12 (Fig. 2).

As another example, let us assume that our tapped control is a popular two-tap type having 15K total resistance and tap resistances of 5K and 10K. This would specifically be C55 (Fig. 4). To determine verification for a replacement, we would: 1) measure the total resistance between LT & RT (Fig. 5), e.g. 15K ± 20%, 2) measure resistance between LT and the 37 percent tap (e.g. 5K ± 20%) and 3) measure resistance between LT and the 63 percent tap (e.g. 10K ± 20%).

From the preceding, it can be seen that identification of the proper taper is a relatively simple matter. If you can figure simple percentages, you can easily determine variable resistor tapers.

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Prices are for service and unmodulated units. Missing, broken and damaged major parts, defective tubes charged extra at LOW net prices. We ship C.O.D.

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- Quality control FINAL CHECK ALL UNITS, UHF-VHF

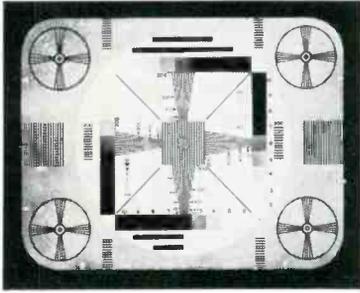
IMPORTANT: Ship complete. Include all broken parts. State model and complaint. Package well to avoid transit damage.

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TV TIPS FROM TRIAD

"SPECIAL"



"Haven't you fixed that kluge, yet?" the senior PTM said to Joe.

"No, Bill, it shrinks a little horizontally after it's on for an hour, and I see 'Callback' written all over it."

"What are you going to do next?" queried Bill, as he poured himself a cup of coffee.

"I've already done it," said Joe with a grin. "I knew you'd show up if I waited."

"All right, what do you know about the chassis for sure?" said Bill.

"Well," Joe recited, "New Charley Dog Six, flyback, and damper tube, high voltage ok, boost a little low after an hour, screen ok —"

"How do you know the screen is ok?"

"The service folder says so. It says the screen voltage should be 165 and this one measures about 178, which is within ten percent."

"Let's use the Check Chart* on it," said Bill.

"Here we go. Set off. Screen resistance?"

"8.2K," replied Joe.

"Set on? Voltage across screen resistor?"

"192."

"Chart shows current is 23 ma. Measure screen to ground."

"Still 178," Joe said.

"Wattage dissipated in screen 4.3. Max safe level 3 watts. *Expected tube life probably less than one hundred hours!*"

"What's next?"

"Let's try it with a 10 watt 18 K. Voltage across resistor?"

"210."

"Current 12 ma. Voltage to chassis?"

"160," Joe said, surprise in his voice.

"Screen wattage 1.9, width better, and boost normal," said Bill, as he finished his cup of coffee. "Now, you could have done that yourself, couldn't you?"

*Triad Callback Stopper, that is.

MORAL: The Triad Callback Stopper Check Chart may be just as useful to you as it was to Bill and Joe. Get yours from your distributor, or write to us and we'll send you one. Triad Distributor Division, 305 North Briant Street, Huntington, Indiana.

A DIVISION OF LITTON INDUSTRIES 

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MAY 1964

... TECHNICIAN'S DIRECTORY

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Actual Size
Only $1\frac{1}{8}$ inches long . . .
Extends just $\frac{29}{32}$ inch
behind front of panel

- Fuseholder takes $\frac{1}{4}$ x $1\frac{1}{4}$ inch fuses. Converts to $\frac{9}{32}$ x $1\frac{1}{4}$ inch fuses simply by changing screw type knob. Holder is rated at 30 ampere for any voltage up to 250.
- Also available in military type which meets all requirements of MIL-F-19207A.

BUSS Write for BUSS
Bulletin SFH-10

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

Premium Offering

A versatile premium program offering valuable prizes to distributors, their salesmen and TV radio service dealers for selling G-E receiving tubes is announced by C. A. Richardson, distributor field sales manager of the company's Electronic Components Sales Operation. With each purchase by a distributor of a quantity of tubes, the company offers Pleasure Pak prize folders listing 48 premiums ranging from ladies' gold-mesh purses to chromium-plated axes, with values from \$8.95 to \$15.95. In addition, each time a distributor qualifies for 20 folders he receives a special distributor salesman prize book. Each of the books contains a Pleasure Pak coupon. Three coupons will bring the holder one of the prizes listed in the respective books. A dealer holding only one or two coupons may make up the difference in cash. The program is offered through May.

Servicers Meet

Independent Service dealers from ten states recently met to discuss problems, debate issues, and help steer the Independent Service Industry along more prosperous paths. This was the first Board of Directors Meeting in 1964 of the National Electronic Association, Inc. (NEA). NEA is the national representative for thousands of TV-radio and allied electronic servicers in the U. S. Organized along state lines, it is composed of affiliated state service associations as members.

BUSS: 1914-1964, Fifty years of Pioneering...

NEWS OF THE INDUSTRY

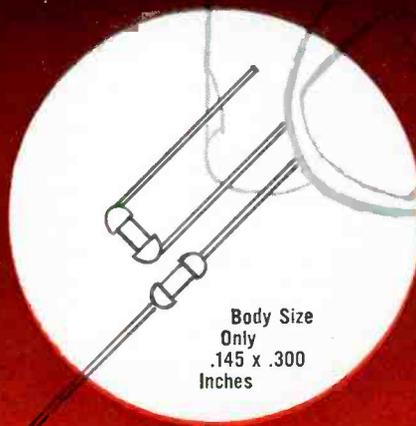
Antenna Fleet

M. L. Finney, Jr., general manager of Finco, announces purchase and equipping of nine heavy duty station wagons with lab equipment. New equipment will include improved 60 ft extension tower, adjustable engineering antennas, special field meters, scopes, VHF/UHF TV set, FM tuner, amplifier and other technical instruments capable of detecting and solving TV and FM reception problems in the field. Each unit will be under the supervision of a Finco regional manager and an engineering assistant. The mobile units will also be available for distributor "open house's," service-dealer clinics and meetings by advance appointment.

14,000,000 Radios Imported

The 14 million radios imported during 1963 almost equaled the 18 million produced in this country, it was reported recently. Cheaper transistor receivers undoubtedly would account for a large percentage of the import business. It was estimated that imports were partly responsible for a drop of 1 million units in domestic production.

BUSS Sub-Miniature PIGTAIL TRON FUSES



Body Size
Only
 $.145$ x $.300$
Inches

Tron fuses are so small they can be used as an integral part of circuit—to protect miniaturized devices—or gigantic multi-circuit electronic devices, without sacrifice of space.

They are hermetically sealed for potting without danger of sealing material affecting operation and have high resistance to shock or vibration. Operate without exterior venting. May be teamed with other components in replaceable unit.

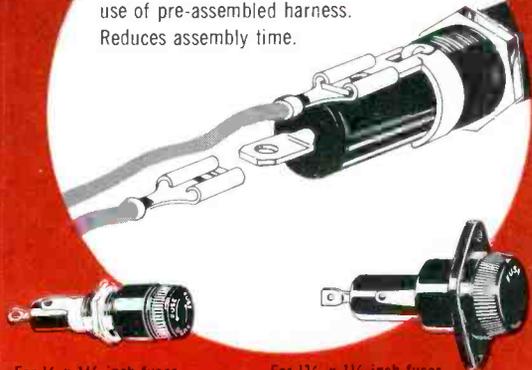
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ELECTRONIC TECHNICIAN

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local TV stations. TAME made it clear that it regarded this proposed legislation as "inadequate" and that it does not provide necessary safeguards to which the viewing public is entitled.

Three-D TV System

Sylvania Electric Products demonstrated a three dimensional television system at the 1964 Convention of International Electrical & Electronics Engineers (IEEE) in what is believed to be the industry's first application of a 3D technique using a color TV tube.

Files Counter Claim

Kay-Townes Antenna Company, Rome, Georgia, files a counter claim against the Channel Master Corporation of Ellenville, New York in certain patent litigation now pending in the United States District Court, Northern District of Georgia, Rome Division. The counter claim alleges that Channel Master Corporation deliberately breached certain contractual obligations with Kay-Townes Antenna Company.

Import Trouble Brewing?

Indications are that the Federal Trade Commission is focusing hard on foreign components used in TV sets, radios, phonos, tape recorders, etc., carrying U. S.-made labels. In addition, FTC is investigating practice of those manufacturers who label foreign

.. New Developments in Electrical Protection

Varistored VOM

Precision Apparatus announces it is incorporating a specially designed silicon varistor into two of its VOMs to prevent damage to meter-movement even when subjected to accidental transient overloads of 1000 times or more, it was said.

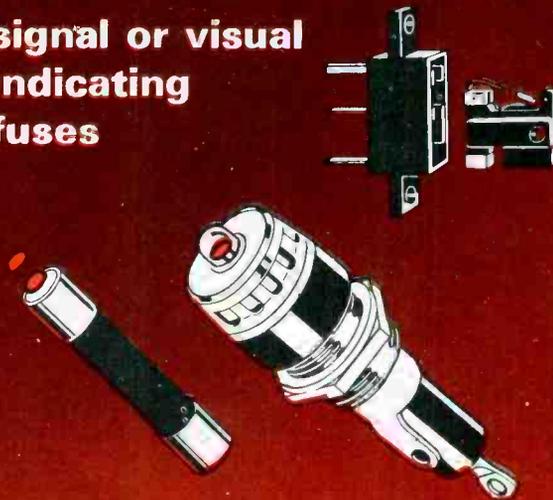
Cornell Wins Patent Rights

Robert Cornell, former executive vice president and general manager of TV Development Corporation, New Hyde Park, New York, was declared the inventor of the product "Colorgrams" by the Nassau County Supreme Court. He is the sole and exclusive owner of the patent and patent rights. The court also awarded Mr. Cornell money damages for wrongful breach of his employment agreement.

Tame Meets With FCC

A special delegation from TAME, Television Accessory Manufacturers Institute, met with FCC Chairman E. William Henry and Commissioner Lee Loevinger to give their views on the proposed FCC/CATV legislation. The group included Robert Fleming of Winegard, Edward Finkel of JFD, Sam Schluskel and Russ Oberlin of Channel Master and Mort Leslie of JFD, TAME's Acting Chairman. The legislation, worked on by CATV interests, dwells largely on the element of program duplication so as to protect the

signal or visual indicating fuses



Indicating fuses provide quick, positive identification of a faulted circuit. There are fuses that give a visual signal; fuses that activate an alarm; — and fuses that give a visual signal and activate an alarm.

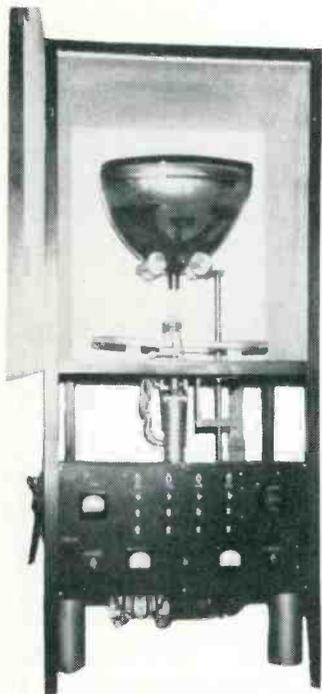
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NEWS OF THE INDUSTRY

merchandise "Made in U.S.A." Some manufacturers are dicker with the idea of a voluntary program to identify equipment using imported parts in order to discourage passage of regulations and laws which would probably carry fines or even imprisonment penalties.

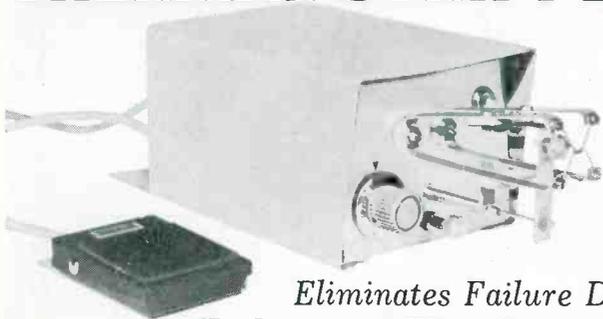
Old Radios

Supreme Publications says there are millions of pre-war radios, now over 22 years old, still in use. The company publishes service manuals and schematics that cover practically every popular set of this period.

Meet With Distributors

A committee composed of St. Louis-TESA members have held a series of meetings with the local electronic parts distributors. These meetings were held at the request of TESA to discuss technician and distributor relationships. It was reported that each distributor was cooperative in giving and receiving information that should result in continued good relationship between distributors and service people.

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*Eliminates Failure Due
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The new Sentry W-4 Thermal Wire Stripper is a foot switch, bench model especially designed for industrial wire stripping operations and will not nick, cut, stretch, or scrape the wire in any manner. Meets requirements of NASA specifications. It does not require adjusting for different sizes. Micrometer adjustment and rheostat temperature control.

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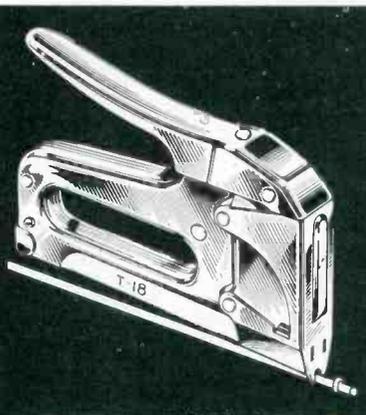
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- Jam-proof patented mechanism for trouble-free operation.

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ELECTRONIC TECHNICIAN

Dealers To Visit Rome

More than 1,000 Admiral dealers will visit Rome in 1964 after qualifying for the all-expenses paid trip in a merchandising program, it was announced recently. The dealers will be guests in the Cavalieri Hilton hotel in Rome and will visit many historic shrines during their visit.

Color Ups Sales

Zenith Radio Corporation's record sales in 1963 received their biggest boost from color TV which "experienced a period of unparalleled growth and activity," Chairman Hugh Robertson and President Joseph S. Wright stated in the company's 1963 Annual Report issued recently.

CATV Law Enacted

The National Community Television Association, Inc., reports that the Honorable Donald Russell, Governor of South Carolina, has approved an act adopted by the General Assembly of South Carolina prohibiting injury to and the tapping of CATV cables. Violation of this law is a misdemeanor and, upon conviction, shall be punished by a fine not exceeding one thousand dollars or by imprisonment for not more than one year, or both, in the discretion of the court.

TV Production-Sales Up

Distributor sales and production of b/w TV sets during February were substantially above the figures for February 1963, according to a report from the Electronic Industries Association's Marketing Services Department. Distributor sales of radio receivers were up some but total radio production was down slightly, compared to the same period in 1963. Color sets produced in January and February this year amounted to 179,827 units. Total b/w TV sets produced in Jan/Feb 1964 was 1,232,617 units, compared to 1,039,820 for Jan/Feb 1963. Total radios produced for Jan/Feb 1964 was 2,781,155 compared to 2,619,159 in Jan/Feb 1963.



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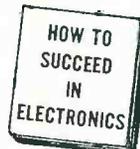
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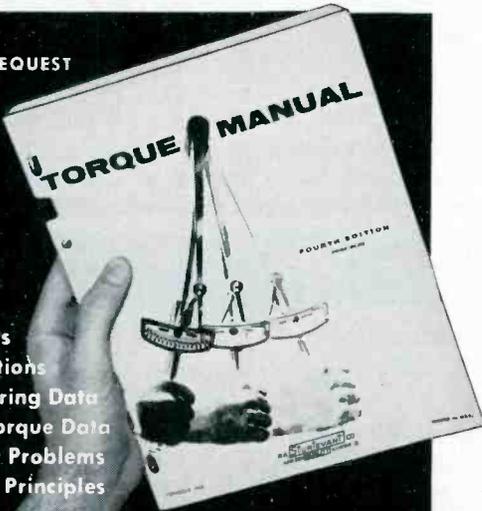
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Hallmark has done it again! Here's the CB transceiver everyone has been waiting for! Hallmark's famous top performance and rugged reliability built into the superlative new Hallmark 1250 in a compact size!

Consider the size: so compact it will fit into the smallest vehicle, yet the 1250 is a complete 12-channel, dual-powered 5 watt unit. Hallmark's creative engineering and production skills have achieved this through rugged modular construction. **Performance?** Unequaled! Hallmark's unique squelch circuit, already the best in the field, has been further improved in the Model 1250. Sensitivity equals or excels any present specifications in the Hallmark line (better than $0.3 \mu\text{v}$ for 10 db S+N/N ratio). Adjacent channel rejection is in excess of 30 db.

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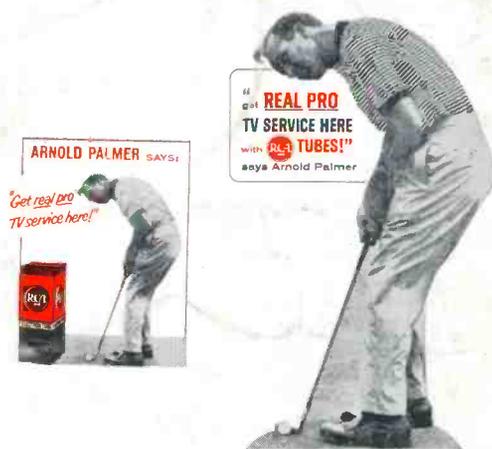
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