ELECTRONIC TECHNICIAN

Including 16 pages of
Circuit Digests

Trouble Shooting a Scope-75

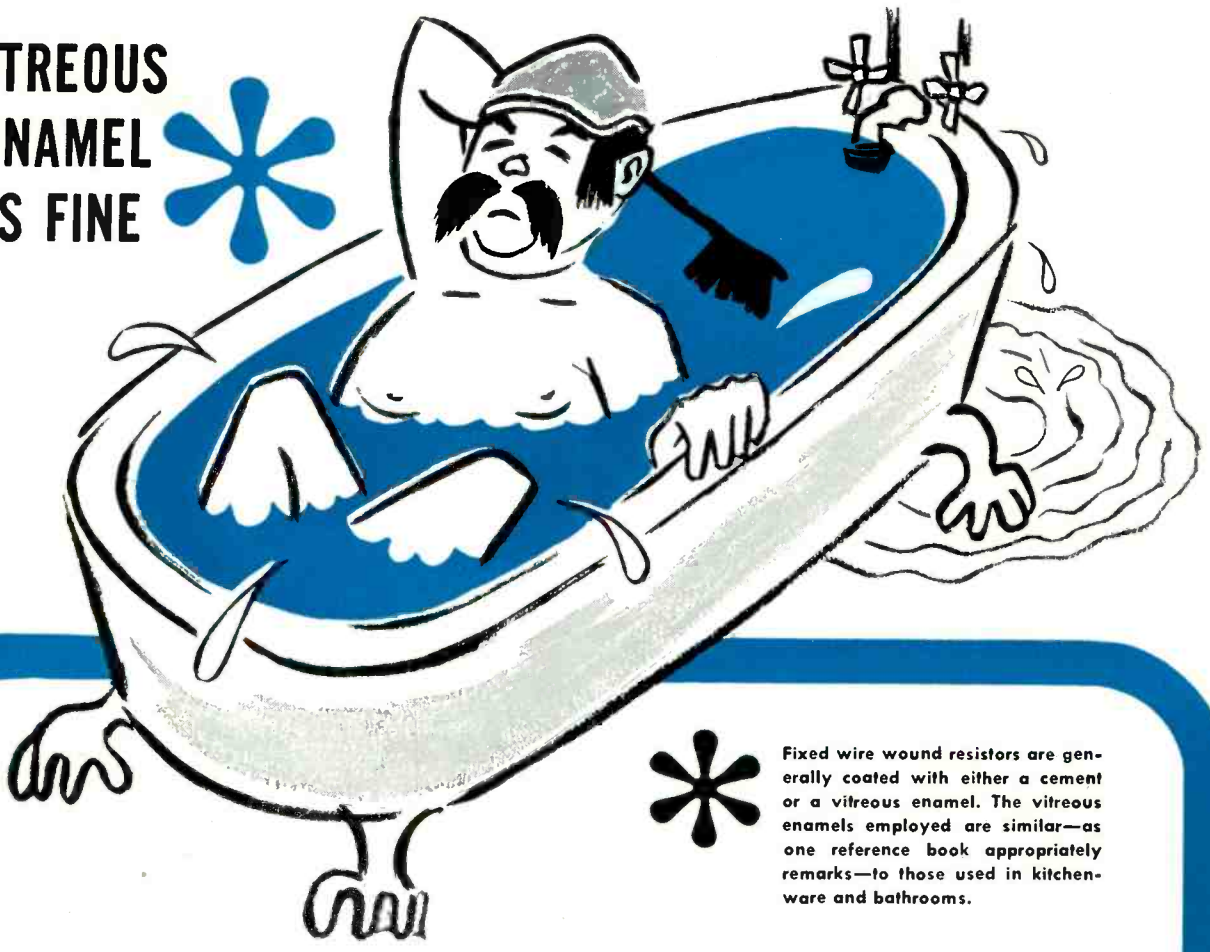
New Design Trends in TV and Hi-Fi

50¢

July • 1958

IF YOU NEED A BATH

VITREOUS ENAMEL IS FINE *



* Fixed wire wound resistors are generally coated with either a cement or a vitreous enamel. The vitreous enamels employed are similar—as one reference book appropriately remarks—to those used in kitchenware and bathrooms.

But for Power Resistors you need IRC® Resisteg Coating

Since you have a service reputation to maintain, IRC exclusive RESISTEG Coating for power wire wound resistors will interest you. Unlike vitreous enamel coatings, the IRC RESISTEG Coating is cured at only 205°F; and windings do not shift during the curing cycle, do not tend to arc-over after you've installed them. Furthermore, with IRC you have the assurance of conservative ratings, high stability, and high reliability.

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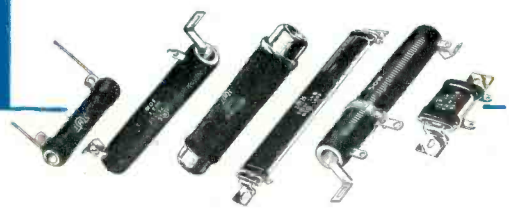

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Printed in U.S.A. by Hildreth Press.

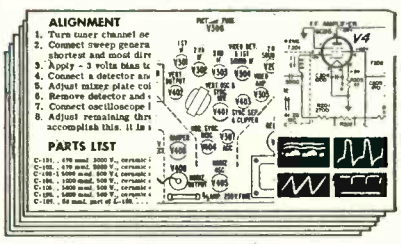
July, 1958

FRONT COVER This year's new TV and hi-fi lines—just introduced for fall and winter sales—are offering some radical changes. New designs in stereo, TV sets, tape cartridges and picture tubes should draw considerable consumer and trade interest. See pages 23 and 48.

FEATURES and ARTICLES

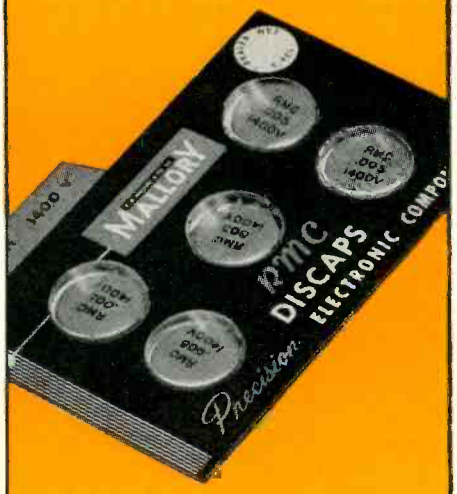
DEPARTMENTS

CIRCUIT DIGESTS



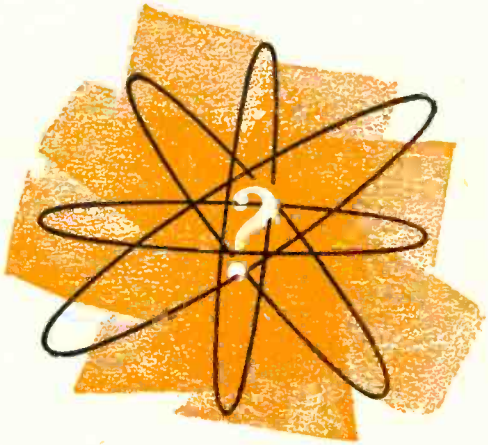
This new dual-concentric control by Mallory enables a distributor to custom-build an exact replacement from selected units, rigidly locked together, in just 30 seconds. You can stop "touring the town" looking for hard-to-find "factory-built" replacements when you start using the new Mallory "Sta-Loc" controls.

Tops in capacitors for every service need . . . the Mallory FP line. Now, the new and improved design gives you even greater dependability, lighter weight, and longer life, thanks to the exclusive new internal structure that eliminates "potting". Still retains the exclusive etched cathode construction . . . hum-free performance.



Long the original equipment standard, now available for service . . . it's the Mallory-RMC Discap, a product of the world's largest maker of ceramic disc capacitors. Look for the handy 3" x 5" file-card package. It's easy to stock, and easy to use. Hangs over your bench, tells you at a glance what capacitors you have.

Look to Mallory...



s on Mallory
housands of
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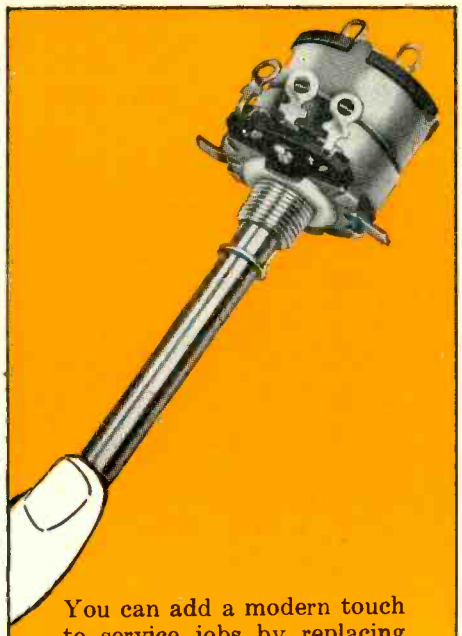
And in your future . . . who knows what electronic marvels will become reality, and thus become new service business for you. Mallory will continue to develop components for new circuits, and replacement parts to service these new needs. You can continue to depend on Mallory leadership, ingenuity, and your Mallory Distributor.

It's a "Gem" of a package—5 Mallory "Gem" tubular capacitors in a trim, easy-to-use dispenser. Keeps your stock clean and fresh—keeps kinks out of lead wires. Look for it on your distributor's self-service display—you can't find a better capacitor than these rugged, moisture-proofed Mallory "Gems".



You can add a modern touch to service jobs by replacing with the new Mallory "push-pull" line switch. The receiver can be turned on or off without rotating the control . . . warms up to the volume level in use when the set was turned off. Mallory offers a complete line of replacement controls featuring this modern touch.

For longer, more trouble-free auto radio servicing, especially on critical jobs, replace with the new Mallory Gold Label vibrator. For economy jobs, use the new Mallory Highlander in the handy ten-pack carton. Both lines feature Mallory's exclusive buttonless contact design for longer, quieter, more efficient service.

. . . for Leadership . . . and Profits

for Innovations to Meet Your Needs . . . Dependable Components of Precision Quality

There is evidence aplenty on these pages of dynamic growth in the Mallory line. All of these are developments of the past 12 months—continuation of years of progressive pioneering by Mallory to meet the needs of the service industry.

As you face the problems of repairing increasingly complex equipment, you can depend on Mallory for the proven quality that prevents "come-backs"—makes your service jobs right the first time! Depend on Mallory, too, for new designs that keep pace,

Perhaps you have associated the Mallory name only with vibrators . . . or electrolytics . . . or volume controls. If so, you should meet the rest of the big Mallory family of service-engineered components. Your local Mallory distributor is prepared to introduce you.

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- Capacitors
- Vibrators
- Resistors
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- Controls
- Switches
- Rectifiers
- Filters

Editor's Memo

Stories of people with hidden talents have long been sources of encouragement and fascination for others. There's the famous Hollywood glamour queen who, as an unknown, was seen sitting at a drug store counter; her partially hidden talents were discovered then and there. There's the condemned murderer who turned out to be an expert on birds. There's the shoemaker with a fabulous knowledge of opera. And on and on.

It may very well be that YOU have a talent that I'm looking for. I don't mean your melodic tenor voice in the shower, or your eagle eye in casting a fish lure. I mean your ability to tell about what you know best—electronics.

Yes, I'm always searching for more technical editorial material from our readers. A good bit of what you read in these pages every month comes from service technicians like yourself. We benefit by the practical experience behind the article; the author benefits by the byline credit . . . and the cold cash in payment.

Now I can just hear you saying that you don't really know how to write an article, that you stare at the typewriter . . . and it stares back at you. Well, don't be dismayed. It happens to those of us who have been writing for years. However writing is only about 2% inspiration, but 98% perspiration. Don't worry if your writing isn't polished; that's what editors are for. Besides, you're sure to improve with experience.

Here's how to start. First work on a short item, such as a Shop Hint that you've seen or used as a worksaver or repair aid. Send it in; it may be worth $3 to $10, with $5 as a typical amount.

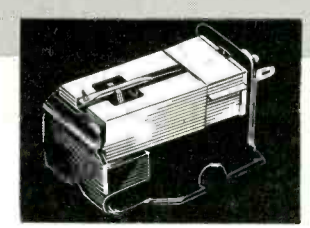
Next, tell about how you licked a Tough Dog through clever trouble-sleuthing. That may add $10 each to your take. Then you may be ready to go into 1000-word articles, after working up a detailed article outline, submitting it to us, and having us approve and modify it.

Then you can write the article. The recognition and dollar stakes now involved are greater than for Shop Hints and Tough Dogs, and so is the risk that the article might be turned down after you've written it. The most successful writers still get rejection slips; beginners get more of them. But remember, we're here to work with you, not against you.

So let's see if you have that hidden writing talent. To get started in writing, two elements must first meet: The seat of your pants and the seat of a chair!

Al Forman

STEREO'S STANDARD



stereo's standard! the Electro-Voice totally compatible stereo cartridge

Model 505 Stereo Control with dual-channel magnetic adapter
Price $11.50 Net

Model 504 single magnetic Adapter only .....Price $3.60 Net

Model 21D Stereo Cartridge with Diamond Stylus ...Price $19.50 Net

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Model 26DST Stereo Turnover to 78 Monaural, Diamond and Sapphire
Price $22.50 Net

Model 26ST Stereo Turnover to 78 Monaural, Two Sapphires
Price $12.90 Net

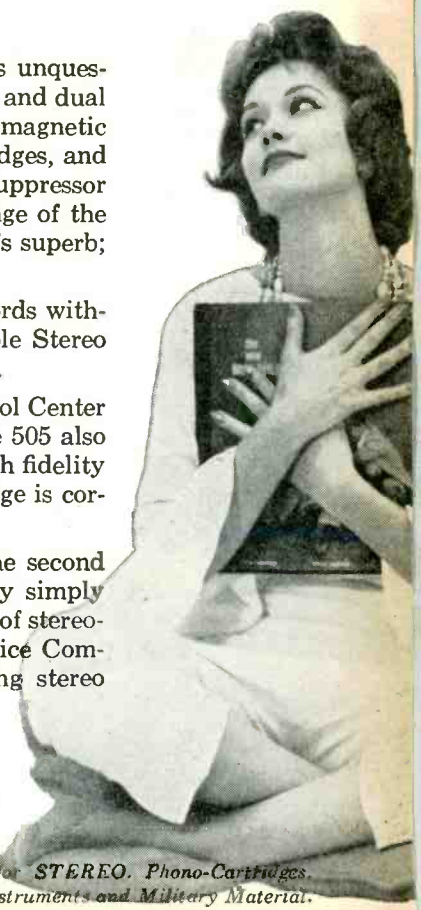
Good stereo depends on these vital features: Range Response: 20-16,000 cps ± 2½ db to RIAA; Distortion: Less than 2%; Channel Isolation: 20 db; Vertical Rumble Rejection: 15 db with 5 meg input; Elements: dual ceramic, (lead-zirconium titanate); Weight: 21D 2.4 grams, 26DST 2.6 grams; Tracking Force: 6 grams; Stylus: 21D—standard .7 mil diamond; 26DST—standard .7 mil diamond—standard 3 mil sapphire; Vertical Compliance: 2 x 10^{-6} cm/dyne; Lateral Compliance: 2 x 10^{-6} cm/dyne; Output: .5 Volt RMS from Westrex standard RIAA Test Record; Capacity: 500 mmfd per element for stereo; 1000 mmfd paralleled for monaural; Mounting: EIA (RETMA) standard ½" and 7/16" centers; Recommended Amplifier Input Impedance: 5 megohms or higher.

Thousands being installed as original equipment attest to industry acceptance; thousands in use prove its unquestioned superiority for monaural as well as stereo. The E-V Stereo Cartridge uses a .7 mil replaceable stylus and dual high fidelity ceramic elements so essential to the exacting demands of stereo reproduction. Pickup from stray magnetic fields is non-existent, hum and rumble are *far* below the level of even the most expensive magnetic cartridges, and PZT ceramic elements deliver a precise RIAA curve. The E-V Stereo Cartridges exclusive Rumble Suppressor (pat. pend.) virtually eliminates vertical turntable rumble without degrading full frequency response range of the cartridge . . . allows you to use it with *any* turntable or record changer. Totally Compatible . . . for stereo, it's superb; for monaural . . . it's superior to even your present cartridge.

THE FIRST STEP TO STEREO. Many fine monaural cartridges are too "stiff" to play stereo records without seriously damaging them; therefore, if you replace your present cartridge with the new E-V Compatible Stereo Cartridge, you may continue playing your present library of LP's plus all the new stereo records monaurally.

THE SECOND STEP TO STEREO. Connect the E-V Stereo Cartridge leads to the 505 Stereo Control Center (net $11.50). You can then select from "monaural," "stereo," or "channel reverse" for easy balancing. The 505 also converts your magnetic input to high impedance ceramic input, if required. Run one lead to your present high fidelity system, run the second channel lead to a second amplifier (and speaker). NOTE: The E-V Stereo Cartridge is corrected for RIAA curve, doesn't need the equalization of a second preamplifier.

If you do not plan to purchase a second amplifier and speaker now, you can still get stereo by running the second channel lead through the 505 to your radio or TV set phono input. You can improve your system later by simply adding a second amplifier and speaker. Stereo records are available now. Why wait? Enjoy the vivid reality of stereophonic sound today. Whether you're purchasing your first system or converting now, use the Electro-Voice Compatible Stereo Cartridge. See your high fidelity dealer, or write Electro-Voice for free booklet on choosing stereo equipment, and a special Stereo Demonstration Record ($1.50 prepaid).



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ELECTRO-VOICE, INC.
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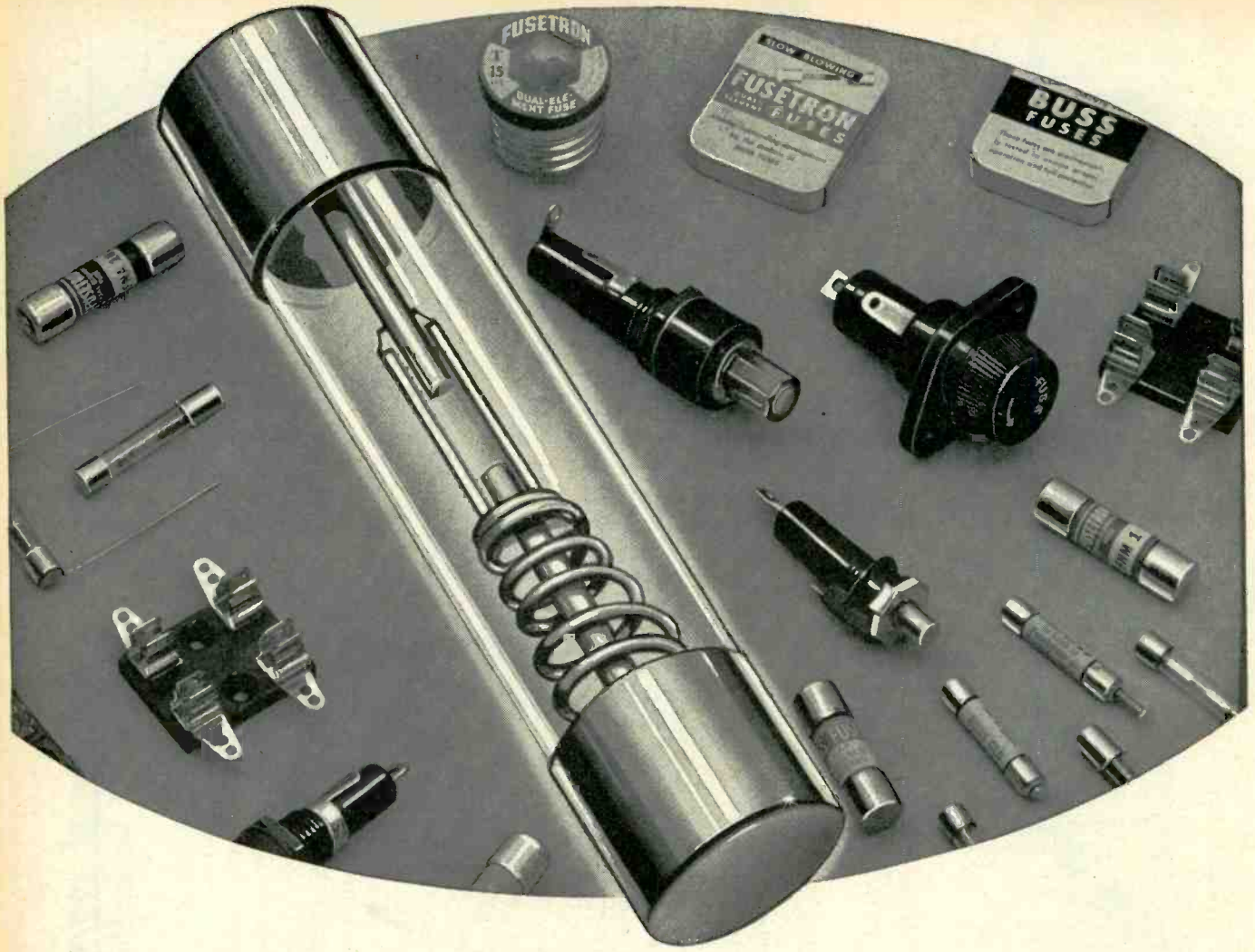
FOREMOST IN ELECTRO-ACOUSTICS—High Fidelity Loudspeakers and Enclosures for STEREO. Phono-Cartridges. Microphones and Public Address Speakers, Marine Instruments, EVI Professional Electronic Instruments and Military Material.

ADD-ON STEREON—THE UNIQUE ELECTRO-VOICE CONCEPT THAT ELIMINATES THE NEED FOR A SECOND FULL-RANGE SPEAKER.



Save Time and Trouble by Standardizing on BUSS Fuses

YOU'LL FIND THE RIGHT FUSE EVERYTIME... IN THE COMPLETE BUSS LINE

By using BUSS as your source for fuses, you can quickly and easily find the type and size fuse you need. The complete BUSS line of fuses includes: single-element (both quick blowing and for normal circuit protection) and dual-element (slow blowing) types . . . in sizes from 1/500 amp. up — plus a companion line of fuse clips, blocks and holders.

BUSS TRADEMARK IS YOUR ASSURANCE OF FUSES OF UNQUESTIONED HIGH QUALITY

Over the past 43 years, millions upon millions of BUSS fuses have operated properly under all service conditions. Thus, BUSS fuses have earned a reputation for accurate and dependable electrical protection.

To make sure this high standard of dependability is maintained . . . BUSS fuses are tested in a sensitive electronic device. Any fuse not correctly calibrated, properly constructed and right in all physical dimensions is automatically rejected.

LET BUSS FUSES HELP PROTECT YOUR PROFITS . . . The dependability of BUSS fuses helps you avoid 'kicks' and complaints that the fuses you sold or installed failed to protect or blew needlessly. This safeguards you against costly adjustments and 'call-backs'. It pays to refuse to take a chance with anything less than BUSS quality in fuses.

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

Bussmann Mfg. Division McGraw-Edison Co., University at Jefferson, St. Louis 7, Mo.

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

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FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
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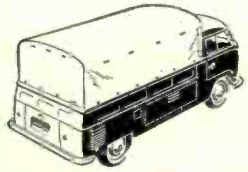
BUSS MAKES A COMPLETE LINE OF FUSES FOR HOME, FARM, COMMERCIAL, ELECTRONIC, AUTOMOTIVE AND INDUSTRIAL USE.

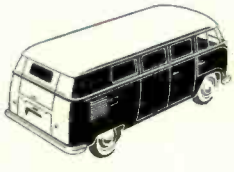
SENSIBLE • HONEST • DEPENDABLE . . . and ECONOMICAL

Volkswagen Light Trucks have all these virtues . . . outstanding gas economy . . . air-cooled engine . . . no radiator problems . . . sturdy construction that takes the bumps of rough terrain. Volkswagen has unusual visibility and ease of driving and parking. The Volkswagen Panel Delivery gives electrical contractors a whopping big 170 cu. ft. of usable storage space. It loads from wide side doors, as well as the rear loading door. You can install a complete test shop inside . . . save time- and dollar-wasting trips. Top and sides . . . front and rear give you a bonus in free space for distinctive advertising. But above all, remember: *a Volkswagen costs less to buy, run and maintain*. This we can prove! Sales and Service in 48 states. Look for the Authorized Volkswagen Dealer with this VW emblem.

VOLKSWAGEN DELIVERS THE GOODS . . . FOR LESS!



PICK-UP—1764-lb. payload . . . 45 sq. ft. floor area plus 20 sq. ft. in a lockable weather-tight compartment underneath. Sides and back drop down for easy loading.



KOMBI—it's even more than a Panel Delivery. It converts into a comfortable station wagon in minutes . . . just by putting the seats back in.

VOLKSWAGEN

LETTERS

To the Editor

Tube Tip

Editor, ELECTRONIC TECHNICIAN:

I was very interested in Mr. Goldman's letter, May issue, on the multiplicity of tubes. I would like to assure him that the tube companies have not gone berserk. In fact, it is to their great benefit to have fewer tube types because profits in production only accrue from making an extremely large quantity of any particular tube. More tube types mean a lesser quantity. Thus, new tube types are mainly the result of set manufacturers' efforts to simplify circuits. Unfortunately, as a result of this struggle many tubes are developed which never achieve very large popularity.

BILL HAMLIN

CBS-Hytron
Danvers, Mass.

Loudest Squealers

Editor, ELECTRONIC TECHNICIAN:

The comments on Consumers Union are very amusing. It seems the one who squeals the loudest is the handler of TV sets not rated with the top two or three. I do not sell. I repair any make. In my extreme fringe area, CU separates the men from the boys. More people should consult their findings before they start crying about their purchases. Let the chips fall where they may.

C. E. EBY

Morehead, Ky.

Tester Schematics

Editor, ELECTRONIC TECHNICIAN:

Would you consider publishing schematics of the more popular electronic test instruments?

RALPH P. FROHWERK

Portland, Ore.

• *In our feature articles we publish information applicable to practically all instruments, instead of puffing up one manufacturer. That way every reader can get something out of it. New products are shown in a separate section. A few years ago we asked our readers if they wanted to see instrument schematics in Circuits Digests. To do this we would have to cut down the number of bread-and-butter TV-radio-hi-fi sets covered, so the answer was no. However, if enough readers now want the change, let us know so we can reconsider.—Ed.*

(*Continued on page 12*)

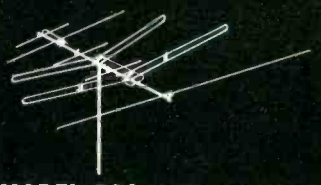
NEW WINEGARD SCOTCHMAN TV ANTENNAS

are making the antenna business easier, more profitable

MODEL 503: Near fringe and suburban area, all-channel 5-element antenna with new improved Vee driven elements. Can be used with attachment Kits A, B, C or D. Ideal for stacking.

$14.95 list

Priced as low as $6.95 LIST

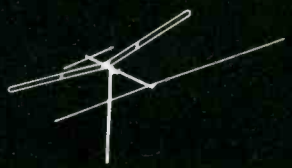


MODEL 504: All-channel, high performance, 7-element fringe area antenna. Exclusive impedance-compensated Vee driven elements and patented* Electro-Lens design. Easily converted to 13 element antenna for tough reception areas with Kit A.

$19.95 list

MODEL 502: 4-element with new improved Vee driven element design for city and suburban areas. Exceptionally good reception on the high channels . . . almost bi-directional on low channels. Higher gain and better ghost rejection than conicals. A natural with Kit D.

$9.95 list



MODEL 501: 3-element antenna recommended for use in place of conicals. New Vee driven element design. Smooth forward response lobes and accurate impedance match on both high and low bands. Cuts ghosts. No finer antenna for city and suburban areas at this low price.

$6.95 list

Now—with just 4 basic Scotchman all channel antennas and attachment kits—you can handle every possible reception and installation problem—simply, more effectively, and at lower cost than ever before.

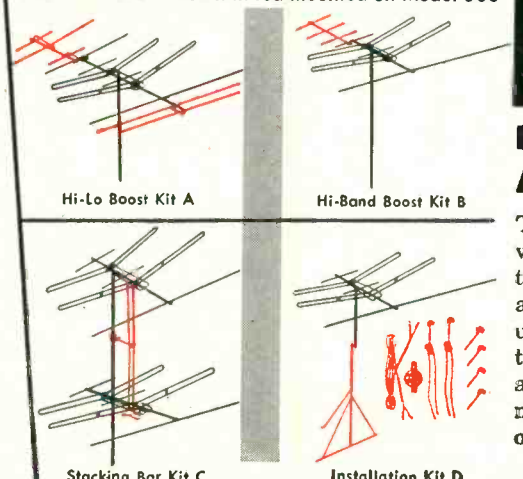
For average installations, all you need is one or a stack of the versatile Scotchman antennas. And for those tough reception problems, where you need more gain or higher front to back ratio, the easy-to-use plug-in Scotchman attachments let you *tailor-make* a special antenna to suit your requirements. But that's not all! Scotchman antennas are completely factory pre-assembled . . . have such quality features as unbreakable TDM styrene insulators, fatigue-resisting aluminum tubing, closed element and boom ends.

Never before could you get such outstanding performance, adaptability and quality at such low cost!

Get Free Gifts With Scotch Stamps!

In every Scotchman antenna carton, you get valuable Scotch stamps—and they're worth plenty! Turn them in for more antennas or take your pick of handy Pegboard Tool Sets or other merchandise. Start saving Scotch stamps today!

Attachment kits shown in red mounted on Model 503



New Scotchman Attachment Kits

These 4 attachment kits combine with the basic Scotchman models to give you more than 30 different antenna combinations! They can be used to increase the gain or front-to-back ratio of any model, stack antennas, to increase sensitivity or mount your antennas on any type of surface.

*U. S. patent 2,700,105

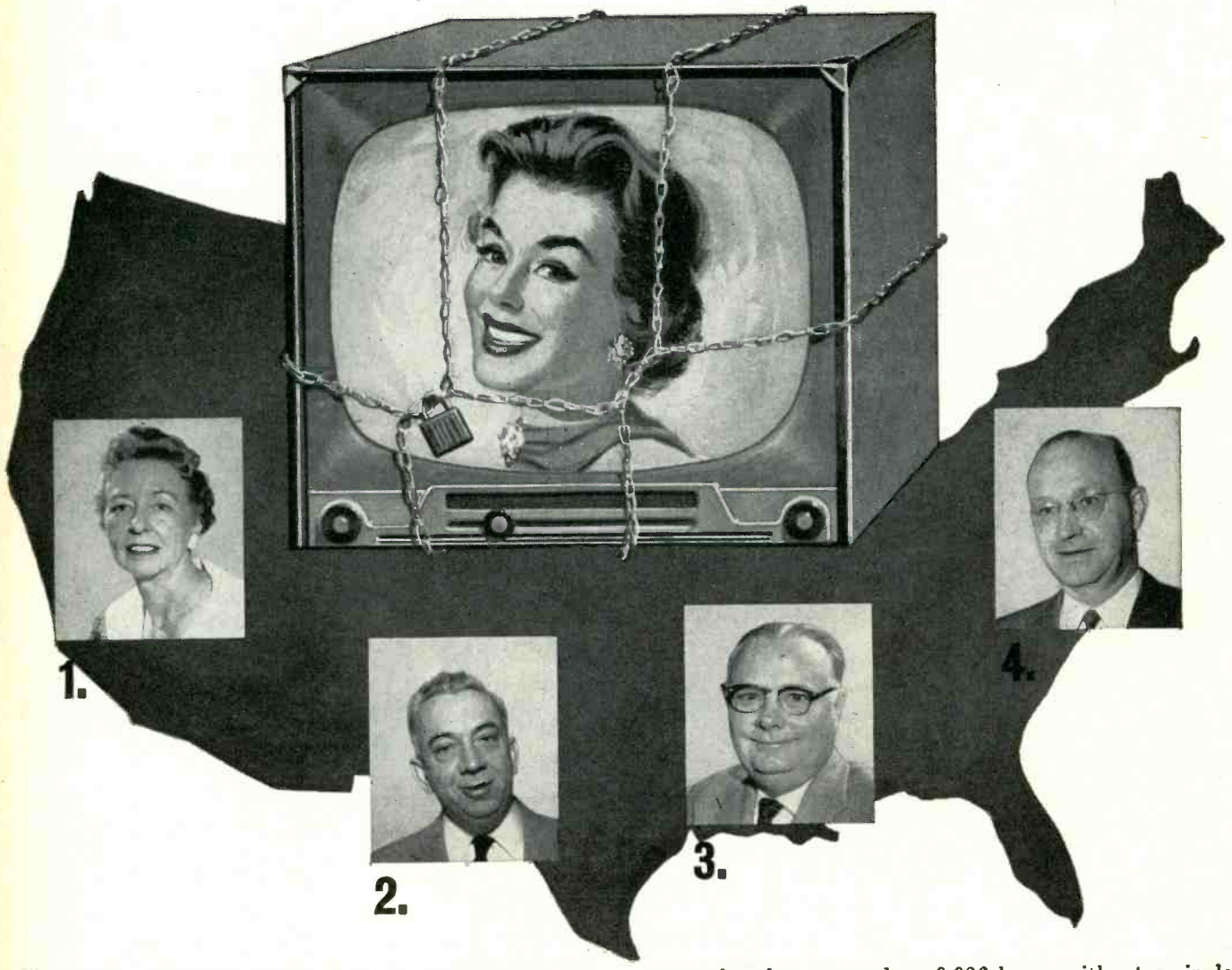
Write for Technical Bulletin No. WSC-500

Winegard Co.

3019-7 SCOTTEN BLVD. BURLINGTON, IOWA

ASK THOSE WHO "TORTURE TEST" WESTINGHOUSE RELIATRON® TUBES!

From coast-to-coast, TV tube distributors are putting Westinghouse RELIATRON Tubes through the most grueling "torture test" ever devised. Locked inside 87 standard make TV sets, these tubes have racked up an amazing total of 425,000 hours' *continuous* operation—and are still going strong! Visual proof that when it comes to cutting call-backs... you can rely on RELIATRON Tubes.



1. Louise Miller of Miller's Radio & Television Supply, Oakland, Calif., says: "I padlocked Westinghouse RELIATRON Tubes inside a TV set 8,436 hours ago . . . turned the set on . . . and it's been running ever since! No wonder my Westinghouse Tube sales are booming!"

2. Bill Sutton of Sutton Radio-TV Company, Ft. Worth, Texas, says: "My 'Locked TV' has been operating steadily for 8,916 hours with RELIATRON Tubes! At this rate, my service dealers will certainly cut call-backs."

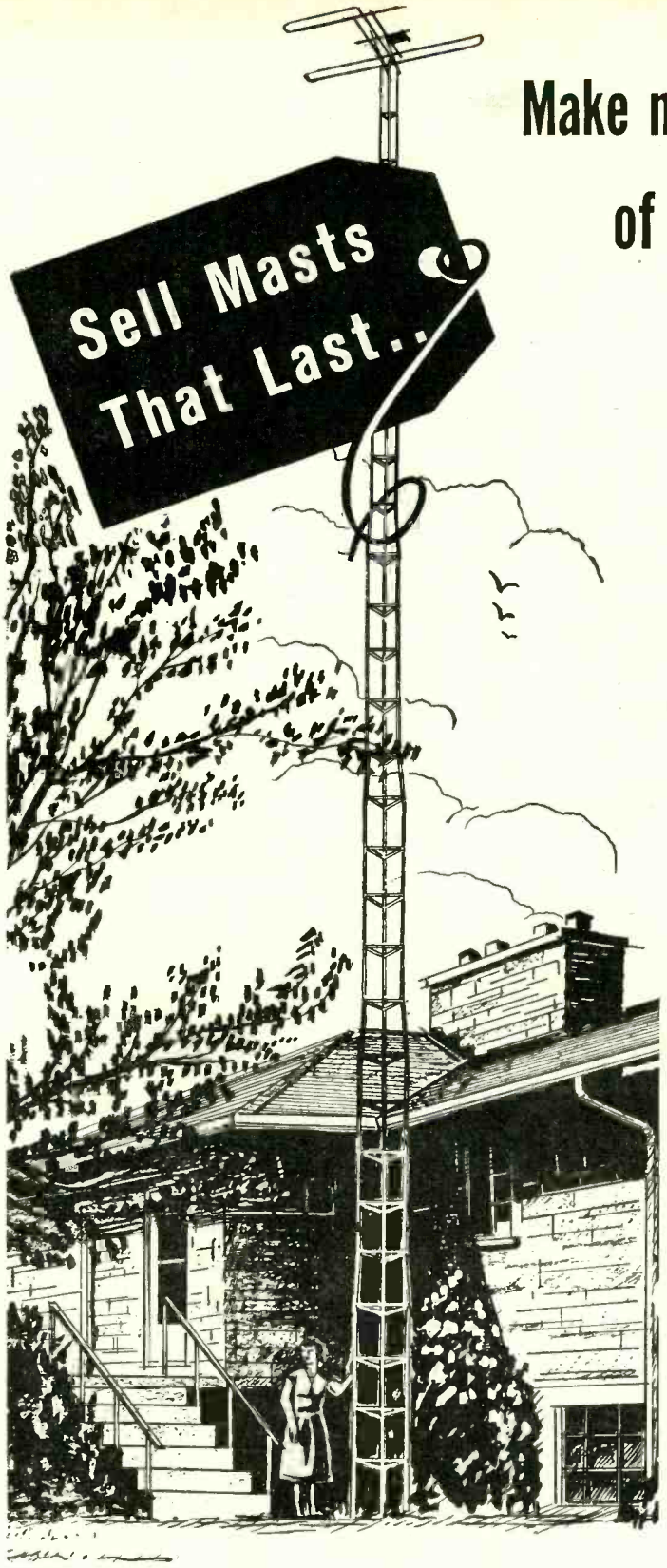
3. Charlie Goebel of Manhattan Radio Equipment Co., Kansas City, Missouri, says: "My 'Locked TV' set has been turned on 9,936 hours without a single RELIATRON Tube failure! How's that for long tube life!"

4. I. Goldenberg, Sherwood Distributors Inc., Union, New Jersey, says: "8,649 hours have passed since I turned on my 'Locked TV' and it's still working fine. That's one reason why I've been selling more RELIATRON Tubes than ever before."

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

Westinghouse

Electronic Tube Division, Elmira, New York



Make more profit with masts, towers of Armco ZINCGRIP Steel Tubing

When you stock TV masts and towers made of Armco ZINCGRIP® Tubing here's why you make more profit:

- their attractive appearance and durability make them easy to sell. *They move fast.*
- they keep customers satisfied, bring buyers back to your shop for additional sales and service.

ZINCGRIP Tubing Resists Rust

Armco ZINCGRIP Tubing has a special zinc coating that gives long-time protection against rust. Masts keep their attractive appearance much longer than those made of electro-galvanized or painted tubing. And the tough zinc skin doesn't crack or peel when towers or masts are fabricated or erected.

ZINCGRIP Tubing Is Strong and Light

Armco ZINCGRIP Steel Tubing gives masts and towers the strength and rigidity to resist driving winds and snow and ice loads. It's light in weight for easy erection even where maximum heights are required.

Sell masts that last—masts and towers made of Armco ZINCGRIP Tubing. Let us send you the names of manufacturers of profit-making TV masts and towers made of this durable Armco steel tubing. Just fill out and mail the coupon.

New steels are born at Armco

ARMCO STEEL CORPORATION, 2488 Curtis St., Middletown, Ohio

Send me names of manufacturers who make masts and towers of Armco ZINCGRIP Tubing.

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(*Letters. Continued from page 8*)

Independents Back Us

Editor, ELECTRONIC TECHNICIAN:

I have just finished Harry Goldman's letter, which took ELECTRONIC TECHNICIAN apart for its so-called "bleeding heart" attitude toward manufacturers, compared to its report on the infamous Consumers Union. Of all the trade magazines, ELECTRONIC TECHNICIAN is the ONLY one which has fought the battles of the independent service technician. The rest of them have been like ostriches with their heads buried in the sand, not able or willing to see the problems of their customers. Keep up the good work. I am sure you will have the backing of every independent service technician.

JOHN P. GRAHAM
Editor, ARTSD "News"
Associated Radio & TV Service Dealers
Columbus, Ohio

• *For more on technician-manufacturer problems, see this month's editorial, page 21.—Ed.*

FCC on Illegal Radiation

Editor, ELECTRONIC TECHNICIAN:

[Concerning the April 1958 editorial on illegally radiating devices such as garage door operators—"It's Time to Enforce the Law."]

The Commission is concerned with the innumerable radiating devices such as TV receivers, electrical appliances, power lines, garage door control devices, etc. that cause interference. Many of these devices are operated by persons who do not realize that they are capable of causing interference; therefore, the publicity such as you have given in your magazine article is appreciated. However, we desire to call to your attention the fact that we have taken action designed to control this situation by the adoption of Rules and Regulations (see Parts 15 and 18 of our Rules). It is hoped that the Commission's Rules governing the operation of incidental and restricted radiation devices (Part 15) will be just as effective in controlling interference as the rules for industrial heating and diathermy equipment have been (Part 18).

Manufacturers have been co-operative to a large extent, in designing devices and equipment to meet the operating requirements of our Rules. However, many older devices remain potential sources of interference and some time will be required before these older radiating devices reach the end of their useful life and are discarded. Our Rules require, however, that the operator take prompt steps to eliminate harmful interference regardless of when the device was manufactured.

In the San Diego garage door interference case to which you referred in your article, the Commission sought and obtained the co-operation of all persons

(*Continued on page 16*)

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See Electro-Voice public address projectors. They offer perfect voice penetration and full-range "musicasting." They're weatherproof, splashproof and blastproof.

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Model 848LT Long Throw CDP* (With 1000-cycle concentrating horn). For projecting intelligible, extended-range sound over great distances.

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Model LS-12. For interior installations requiring full-range response.

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THESE ELECTRO-VOICE MICROPHONES ARE ESPECIALLY OUTSTANDING FOR PUBLIC ADDRESS

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Model 664 Cardioid Dynamic. Broadcast-quality for every public address installation.

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Model 951 Cardioid Crystal. Excellent, wide-range, all-purpose microphone.

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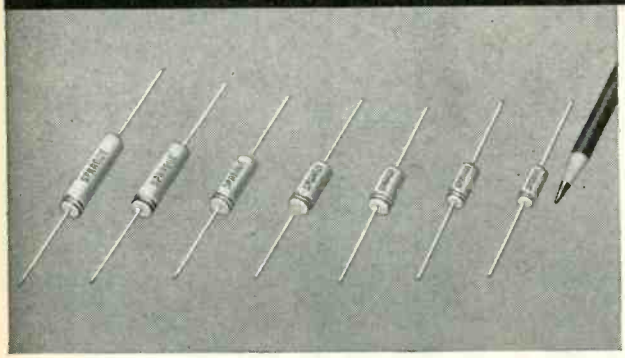
MINIATURE ELECTROLYTICS FOR MINIATURE SETS

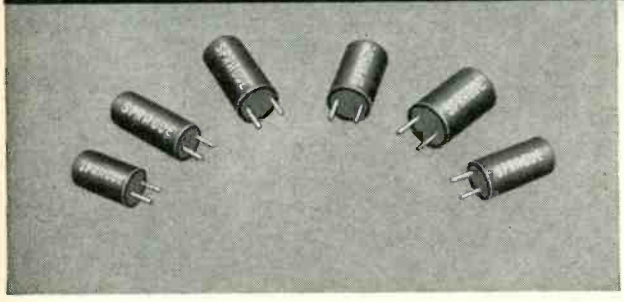
designed for transistorized radios, hearing aids, wireless microphones, miniature tape recorders, auto receivers, and similar miniature electronic products.

FOR POINT-TO-POINT WIRING AND FLAT MOUNTING ON PRINTED WIRING BOARDS



Sprague's new and improved 85°C Littl-lytic* Capacitors are the *tiniest* reliable electrolytic capacitors made to date . . . and their performance is better than ever. Their remarkable dependability is the result of a new manufacturing technique in which *all the terminal connections are welded. No pressure joints . . . no "open circuits" with the passage of time.* Littl-lytics are hermetically-sealed and aluminum-encased. And check this for low leakage current: for a 2μf, 6 volt capacitor . . . only 1.0 μa max.; for a 300 μf, 6 volt capacitor . . . 3.5 μa max.! There are no transistor burn-out troubles when you use Littl-lytics. Available in the largest list of ratings in the industry! Request Bulletin M-753.

FOR UPRIGHT MOUNTING ON PRINTED WIRING BOARDS



Space-saving Verti-lytic* Capacitors are designed for easy manual upright mounting on printed wiring boards. Keyed terminals assure fast mounting and correct polarity. Their low leakage current and high purity aluminum foil construction provide top performance and excellent protection against expensive transistor burn-outs. Sturdy premolded phenolic shell with resin end-fill gives excellent protection against drying-out of the electrolyte or the entry of external moisture. The phenolic case eliminates the necessity for any additional insulation. Request Bulletin M-757.

Be sure to see these new and improved 'lytic capacitors at your distributors. Check Sprague's other transistor capacitors while you're at it. You'll find that Sprague has the most complete ratings in the industry. Ask your distributor for your copy of Sprague's Bulletins M-753 and M-757, or write Sprague Products Co., Distributors' Division of Sprague Electric Company, 65 Marshall Street, North Adams, Massachusetts.

*Trademark

don't be vague . . . insist on

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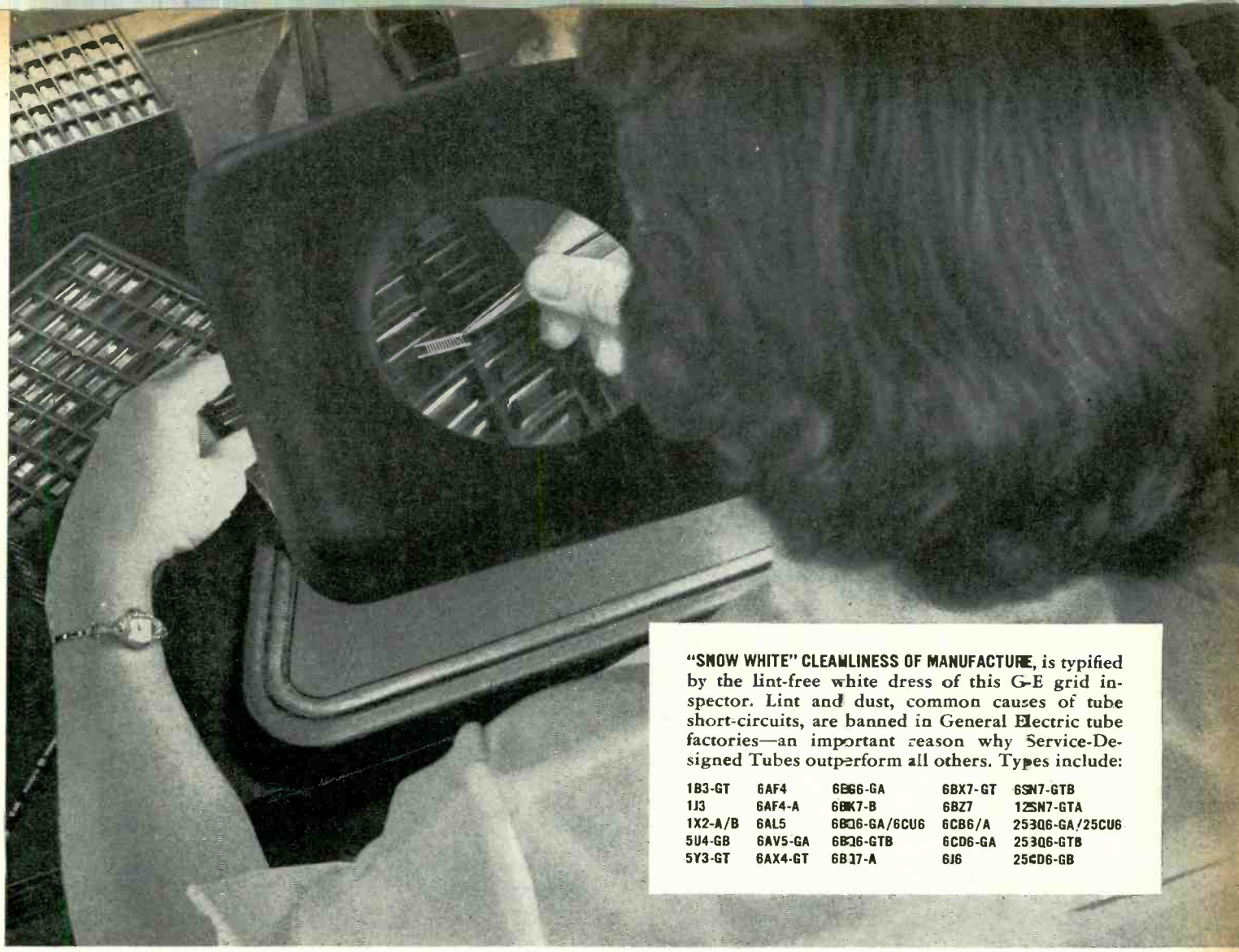

"SNOW WHITE" CLEANLINESS OF MANUFACTURE, is typified by the lint-free white dress of this G-E grid inspector. Lint and dust, common causes of tube short-circuits, are banned in General Electric tube factories—an important reason why Service-Designed Tubes outperform all others. Types include:

1B3-GT	6AF4	6BG6-GA	6BX7-GT	6SN7-GTB
1J3	6AF4-A	6BK7-B	6BZ7	12SN7-GTA
1X2-A/B	6AL5	6BQ6-GA/6CU6	6CB6/A	25BQ6-GA/25CU6
5U4-GB	6AV5-GA	6BQ6-GTB	6CD6-GA	25BQ6-GTB
5Y3-GT	6AX4-GT	6BZ7-A	6J6	25CD6-GB

Individual grid inspection! 300 such quality checks mean fewer callbacks with G-E Service-Designed Tubes!

More than 300 inspections, checks, and tests are given General Electric Service-Designed Tubes before they are approved for shipment.

Prior to assembly, tube materials are exhaustively analyzed, weighed, and tested. Parts—like the grids shown above—are inspected for accurate workmanship. Pre-assembly checks on a 6BQ6-GA sweep tube, for example, total 215 . . . definite proof how wide is the range of General Electric's quality control!

A 6BQ6-GA still must pass 109 successive inspections during tube assembly—must undergo 13 final electrical and mechanical tests, *every tube,* before shipment. Other General Electric Service-Designed types are given inspections and tests that are equally exhaustive.

Fewer servicing callbacks? You can rely on this, with testing so extensive and rigid. Yet Service-Designed Tubes cost no more. Phone your G-E tube distributor! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Kentucky.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

(*Letters. Continued from page 12*)

concerned, including manufacturers, distributors and users to reduce the radiation from offending receivers. The case has recently been brought to a successful conclusion by making relatively minor adjustments in the devices in question without requiring that these devices be taken out of service.

Since December 21, 1955, the Commission has had specific rules which would control interference caused by incidental radiation devices, and radio receivers. Subsequently, specific rules were promulgated to control radiation from community antenna television systems and low power communication devices. In addition, there is a general provision covering this area which has been in effect since 1938. Studies are continuing in the preparation of detailed rules for other types of restricted radiation devices.

Additional corrective action in the subject is one properly for the Congress to consider. At the present time, the Federal Communications Commission has no authority under the Communications Act to go to the source, in this case the manufacturer, in order to secure compliance with the Commission's Rules and Regulations. At present, compliance with the Commission's Rules and Regulations is on a purely voluntary basis as far as manufacturers are concerned. Admittedly, it may seem unfair that the buying public should bear the brunt of our enforcement procedures, but under the Communications Act of 1934, as amended, this Commission has no alternative. Authority to go to the source which creates the device causing radiation would make the Commission's responsibility for the most effective use of the spectrum much simpler and more effective. Should Congressional activity be initiated looking toward this objective, this Commission would support such a proposal.

By Direction of the Commission
JOHN C. DOERFER
Chairman
Federal Communications Commission
Washington, D.C.

Congressional Reaction

Editor, ELECTRONIC TECHNICIAN:

Chairman Doerfer sent me a copy of the Commission's letter to you. Under Section 4(k) of the Communications Act of 1934, as amended, the Federal Communications Commission has the affirmative responsibility of making "specific recommendations to Congress as to additional legislation which the Commission deems necessary or desirable." I have so informed the Federal Communications Commission.

SENATOR WARREN G. MAGNUSON
Chairman
Committee on Interstate and Foreign Commerce
United States Senate
Washington, D.C.

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Dr. T. V. SPARK SAYS...

YOU can check your own picture tube

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New Books

INDUSTRIAL CONTROL CIRCUITS. *By Sidney Platt. Published by John F. Rider Publisher, Inc., 116 W. 14 St., New York 11, N.Y. 200 pages. Soft cover. $3.90.*

With increasing numbers of electronic technicians getting into industrial electronic maintenance, a book devoted to the basic technical aspects of control circuits is most welcome. Any technician reasonably familiar with radio-TV fundamentals will find this volume easy to understand. It covers relays, timing circuits, photoelectric and power controls, gas tubes, motor and welding controls, and control instrumentation. Circuit functions and applications are clearly explained. We heartily recommend this volume. If you are casually interested in industrial electronics it will make informative reading. If you plan to get into industrial work, it's almost a must.

ELECTRONIC MEASURING INSTRUMENTS. *2nd Ed. By E. H. W. Banner. Published by The MacMillan Co., 60 Fifth Ave., New York 11, N.Y. 512 pages. Hard cover. $7.95.*

Here is a comprehensive book for the advanced instrument technician. It covers a wide range of devices such as indicators, hot and cold tubes, CRT's, photoelectric devices, rectifiers, meters, counters, radiation detectors and gauges.

IMPEDANCE MATCHING. *By Alexander Schure. Published by John F. Rider Publisher, Inc., 116 W. 14 St., New York 11, N.Y. 128 pages. Soft cover. $2.90.*

Impedance matching can be easy, or it can be tricky. But one thing is sure; it's an important part of circuit work that you encounter quite frequently. In this volume, the author explains impedance matching at audio, radio and high frequencies. With the aid of tables and sample computations, the text presents a helpful reference for solving matching problems. Among the many circuits covered are transformers, bridges, tubes, modulation circuits and resistance networks.

HOME AIR CONDITIONING. *By Joseph Derman, Floyd Makstein and Harold Seaman. Published by John F. Rider Publisher, Inc., 116 W. 14 St., New York 11, N.Y. 160 pages. Soft cover. $3.50.*

Installation and repair of air conditioners is not only a profitable sideline for service technicians, but a business booster during those warm months when radio-TV repair may slacken. This practical book covers the various components and electrical connections a technician should understand. It tells how to compute the air conditioner size required. Also discussed are such basic physical properties as heat, temperature, humidity and pressure. Both the illustrations and text are well presented.

(Continued on page 53)

Sylvania comparisons point out—

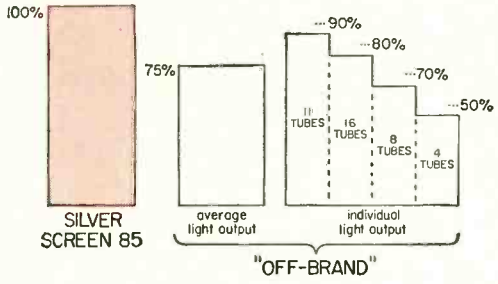
The big difference in Picture Tubes!

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

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

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

LIGHT OUTPUT



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

FOCUS

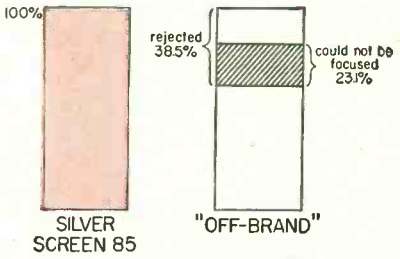
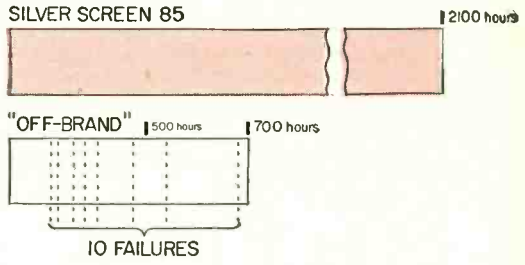


Chart 2 shows how these same 39 tubes stacked up to registered limits on focus voltage. 38.5% were rejected under these limits. Over half of all those rejected could not be focused in a TV receiver. Small wonder then that "Silver Screen 85" pictures are sharper, brighter, clearer.

LIFE TEST



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

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

SYLVANIA

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

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ELECTRONIC TECHNICIAN
Including Circuit Digests

Appliance Servicing:

Opportunity and Opposition

A growing number of electronic service outlets have added the profitable sideline of electrical appliance repair to their list of income sources. The reasons are readily understood:

DIVERSIFICATION: The broader the base of income, the greater the stability of your business. And of course, there is better opportunity for higher dollar volume.

LEVEL INCOME: The repair cycle of electrical appliances does not coincide exactly with electronic devices such as TV, hi-fi and radio. Consequently, certain normally slump months can be turned into good months. For example, in the slower summer period, air conditioner and fan repair and installation take up the slack.

CUSTOMER RELIANCE: The more your customers rely on you as the repair center for a variety of broadly related devices, the more they will likely stay with you. From another viewpoint, if a customer has to come to you to fix an electrical appliance because his regular technician handles TV exclusively, there is a fair chance that he will become your regular customer for his electronic products as well.

Statistical Survey

We recently conducted a nationwide survey of our readers to find out how many service outlets repair electrical appliances. Here are the results:

47.3% DO repair appliances
52.7% DO NOT repair appliances

On the basis of 62,000 total service outlets in the U.S., these figures indicate that over 29,300 repair electrical appliances, particularly small appliances.

You may be interested to know how the regional patterns compare to the national average. In large cities, more technicians do repair these appliances. In medium-sized cities, fewer than the average repair appliances. And in sparsely settled areas, substantially more outlets repair electrical appliances.

Short-Sighted Manufacturers

From time to time you have probably noticed announcements of appliance repair catalogs available to electronic technicians. They come from those enlightened manufacturers who realize the need for quick repair right at the neighborhood level. Shipping or carrying an appliance to a distant manufacturer or distributor is hardly convenient. Neither is waiting for a white goods dealer or discount house to act as the middleman shipper.

In spite of this, a number of appliance manufacturers have set up a repair program which deliberately eliminates the independent service outlet! It's a program of captive service worse than anything ever seen in TV, since these short-sighted companies actually refuse to release technical data to independents. Their arguments that appliances are too complex have no validity; a TV set which independents repair most admirably is infinitely more complex than any toaster ever built.

Fortunately, a sufficient number of appliance makers are cooperative. And some technician ingenuity often covers the products of the secretive ones. This accounts for the 29,300 service outlets which do repair appliances.

If you need information or a special part on a particular appliance, the local distributor in the telephone book should be your source. If you get no cooperation from him or the manufacturer, tell your customer that this brand appears more interested in selling new units instead of allowing independent technicians to offer quick, local repair. And you can also tell the customer of the brands which do help assure proper field maintenance by making parts and data readily available.

Build your appliance repair activities . . . and you will be building a better service business.

Tuning In the

INDUSTRIAL ELECTRONIC sales will increase 50% by 1962, and will exceed $2 billion by 1965, says CBS-Hytron Pres. A. L. Chapman. Industrial tube sales were $250 million in 1957, and should rise to $400 million by 1965.

AUTOMOBILE RADAR that automatically warns the driver of traffic hazards is now undergoing road tests, reports Bendix Aviation. The small dish antenna in the front grille picks up the "beep-beep" signals, which sound louder as a collision threatens.

OFF-BRAND cut-rate picture tubes do not come up to performance ratings of its first-line tubes, reports Sylvania. 92.3% fail to give as bright a picture, 50% fail in life tests before 700 hours, 38% fail to meet focus limits, 48% failed gun tests, 85% failed screen tests, and 43% failed aluminization tests. Most important, 100% failed to measure up to all quality checks.

DEFECTIVE HUMAN ORGANS may someday be replaced by electronic substitutes, predicts RCA Chairman David Sarnoff. "Artificial kidneys, lungs and even hearts may become as familiar as artificial teeth or hearing aids." Such electronic devices may even be provided on a permanent basis.

ELECTRONIC MAINTENANCE and installation has reached the $2.6 billion mark, reports Electronic Industries Association (EIA) Service Committee Chairman Kenneth Brown. This annual business volume represents growth of the service industry by nearly three times in the last seven years. From another EIA authority, Parts Div. Chairman Russell Cramer, Jr., comes the report that 1957 factory sales of electronic parts increased in value by 6% over the record high level of 1956.

"Guess where I found your soldering iron?"

CALENDAR OF COMING EVENTS

Aug.	1-3:	Texas Electronics Ass'n., Clinic and Fair, Statler Hilton Hotel, Dallas, Texas.
Aug.	19-22:	Western Electronic Show & Convention (WESCON), Pan Pacific Auditorium, Los Angeles, Calif.
Aug.	21-24:	NATESA Convention, Congress Hotel, Chicago, Ill.
Aug.	25-28:	Rocky Mountain Parts Conference, Glenwood Springs, Colo.
Aug.	27-31:	Upper Midwest Electronic Service, Conference & Exhibition, Municipal Auditorium, Minneapolis, Minn.
Sept.	24-25:	Industrial Electronic Conference, Rockham Memorial Bldg., Detroit, Mich.
Oct.	8-10:	IRE Canadian Convention, Exhibition Park, Toronto, Can.
Oct.	13-15:	National Electronics Conference, Hotel Sherman, Chicago, Ill.
Oct.	27-29:	Radio Fall Meeting, Sheraton Hotel, Rochester, N. Y.
Oct.	30-31:	Electron Devices Meeting, Shoreham Hotel, Washington, D. C.

Hi-Fi Shows

Sept.	19-21:	Chicago. Palmer House.
Sept. 30-Oct.	4:	New York. (Institute Hi-Fi Mfrs.) N.Y. Trade Show Bldg.
Oct.	10-12:	Philadelphia. (Institute Hi-Fi Mfrs.) Benjamin Franklin Hotel.
Oct.	17-19:	Boston. Hotel Touraine.
Oct.	24-26:	Milwaukee. (Institute Hi-Fi Mfrs.) Wisconsin Hotel.

MOBILE RADIO offers technicians many fine opportunities, states Frank A. Genochio, sales manager of Kaar Engineering Corp., 2995 Middlefield Rd., Palo Alto, Calif. This 22-year-old radiotelephone maker is seeking dealers for its packaged units, which require little or no systems engineering. Inquiries may be addressed directly to Kaar.

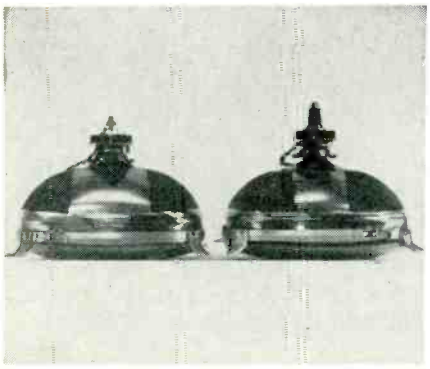
BUSINESS MACHINE methods are being applied by General Electric to keep distributors supplied with the right quantity and types of electron tubes, with less bookkeeping in the process. It's called CARI—Controlled Automatic Replenishment of receiving tube Inventories. In operation, the plan uses a data-processing punched card in each pack of tubes, from 5 to 100 of a type, depending on usual rate of turnover. When the pack is opened, the card is removed and stored in a file box. Periodically, all cards (with type and quantity data already punched) are mailed to GE, constituting an order for replenishing tube types needed.

RADICAL PICTURE TUBE design have been evolved by CRT bulb maker Corning Glass. It's called a "contoured twin panel tube," and consists of a curved, flanged glass plate cemented around the edge to the usual faceplate. The space between the faceplate and second flanged plate is filled with clear mineral oil. There's no magnification, but this new bulb does away with the conventional safety glass. Other advantages claimed are that two dust-catching, inaccessible surfaces are eliminated, reflections reduced, light output raised, and less possible implosion shattering impact. 21-in bulb weighs about 10 lbs. Introduction in some TV set lines during 1959 (1960 models) is probable.

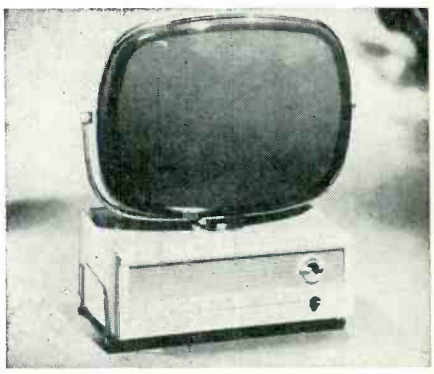
Picture.....

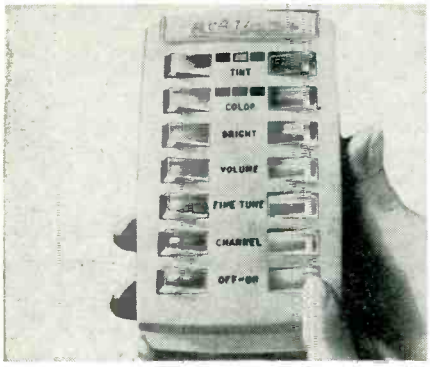
New Design Trends In TV & Hi-Fi

For More Information On Latest Design Trends, See Hi-Fi And Stereo New Products On Pages 48 and 49

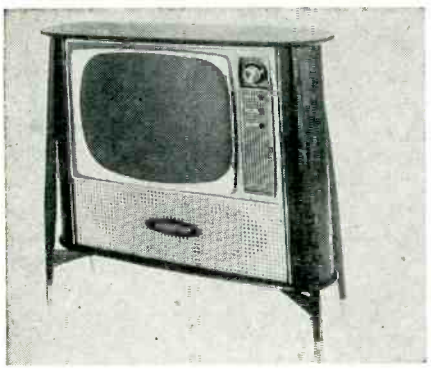


THE "SLIM LOOK" in TV set design gets an extra boost from Philco's development of the SF 110° tube shown at left. This new 21-incher is almost 2 in. shorter than the standard 110° tube beside it. The "Separate Look" is another innovation of the company's Predicta series, as shown by the swivel-mounted tube atop the chassis at right. The chassis slides out like a file drawer for easy access. Another variation allows wired CRT to be moved 25 ft. from the chassis.

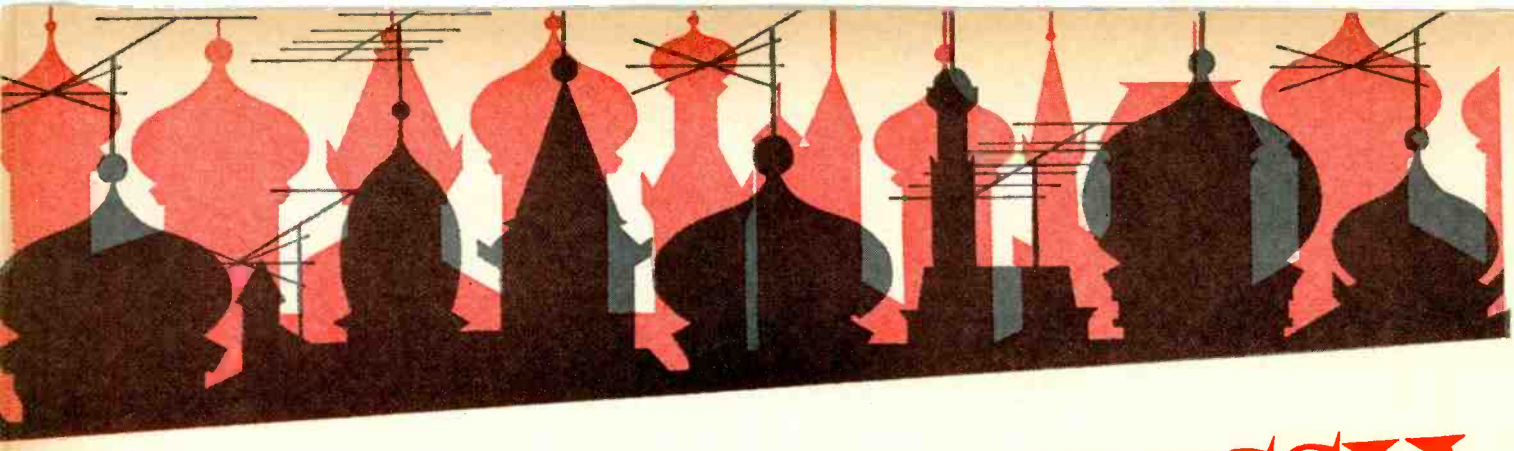




REMOTE CONTROL is nothing new, but the RCA Wireless Wizard control at left is different. This transistor-powered unit controls color TV sets, including "color" and "tint." Other RCA TV design trends are the use of surge resistors and power transformers in all sets, portables with 3 i-f's instead of 2, and a tetrode tuner instead of pentode. 90-day parts & labor warranty was announced. At right is prerecorded 4-track stereo tape cartridge and recorder, which eliminates reel threading.



THE "SLIM LOOK" and the Scandinavian cabinet design of the General Electric TV set at left are readily apparent. Hidden from view, however, is the new giant speaker, 9 by 21 in., coupled with a 4-in. high frequency unit, shown by the young lady on the right. Other speakers in the photo are the 4, 4x6 and 8 in. speakers commonly used in TV. This coaxial arrangement, with 40 to 10,000 cps frequency response, is indicative of the hi-fi influence in current TV set designs.



TV SERVICING IN RUSSIA

Exclusive Staff Report Direct From The U.S.S.R.

• Most Americans know about the Government ownership of the utilities and heavy industries in the Soviet Union. But the absolute Government control of retailing and the service trades has received little attention in the American press.

Just about everyone in the Soviet Union is a Government employee, whether he is a skilled electronic technician or an unskilled bootblack. All trades and services are owned by the Soviet Syndicates, and there is no employee stock ownership or any opportunity for self-owned enterprises.

Cost and Warranty

The character of the Russian TV service trade is determined by Government policy, and type and quantity of available receivers. Practically all of the receivers are table models with a 14-inch picture tube. These receivers, costing the equivalent of $250, are beyond the reach of the average Russian. Each set carries a six-month parts and labor service guarantee to original purchasers. After the warranty period has expired, the owner is charged for service by the hour or flat-rate by the job, depending on the trouble. If the service is given on a job basis, an advance estimate is given to the customer.

Pickup Procedure

In its present period of expansion, the Soviet TV industry is experiencing some of the growing pains reminiscent of the 1939 TV pioneering in the U. S. Generally, there are no house calls for service. The Soviet citizen takes his set to one of the central TV pick-up and delivery points located in the cities where TV is available. These shipping points are austere in appearance, and bear a resemblance to a small-town American post office. The customer receives a ticket giving a date when the set will be returned from the central repair shop.

There is no contact between the customer and the shop manager or bench technician, who will make the repairs. The impersonal and non-competitive character of this system is one of take-it-or-leave-it.

Facilities

Except for a few minor differences the Soviet TV repair center is representative of what could be found in any European city. First, the technical head of the service laboratory is an engineer who wears an army uniform with two stars on his lapel. During our inspection of the facilities, this officer refused to reveal his rank or the TV repair cost schedule. Of the 15 or 16 bench technicians, one-third were women. These men and women are graduates of technical schools and must serve an apprenticeship before qualifying as TV technicians. Their repairs and worksheets are checked by inspectors. This particular shop had a liberal supply of scopes, signal generators, meters and checkers. In appearance, and possibly in design too, their test equipment is quite similar to American products.

Standardization

Circuit problems are at a minimum due to the Soviet standardization on a bare few basic chassis. This shop had two seven-by-seven-foot schematics hanging over the technicians' benches and this simplification makes repair work comparatively easy. Compare this with the thousands of chassis and models the American technician has to cope with. No need for Circuit Digests in the U.S.S.R.!

This central laboratory handles all phases of audio and TV work for its district. A TV projection set with a seven-foot screen was observed and also one twenty-inch receiver. For the future, large-screen sets will be difficult for viewers to carry to the local pick-up station. It is too early to tell how the Soviet Union will cope with the problem of larger sets and the necessity of home servicing. Of course, in these future contacts in the home, the customer "can't win" because the technicians will actually be the representatives of the political powers that be.

Receiver Availability

Our readers may be interested in knowing that the Communists are on a veritable buying binge at this time. The "Goom," the Government department store opposite the Kremlin in Moscow, is so crowded that the merchandise in the store is roped off and the crowds cue up in the entrance lobby in order to wait their turn to inspect the receivers. No twenty-one inch receivers were on display and it is assumed that large screen sets are in very limited supply, and are too expensive for the Soviet citizen. No doubt such receivers are more readily obtained by top party members.

Aside from their standardization in design and the opportunity for employment of women in the service trades, there is nothing America can learn from the Soviet experience. •

How To Repair Your Oscilloscope

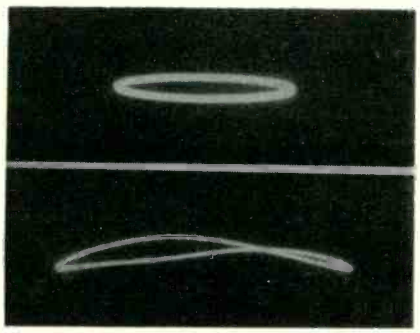
Techniques Used To Service TV Sets Apply.

Guide To Troubleshooting The Oscilloscope.

ROBERT G. MIDDLETON

• Many technicians who tackle a "dog" TV receiver without hesitation tend to throw up their hands when they have to repair a scope. There is little logic in this attitude because scopes are basically easier to repair. As in radio and TV, most faulty operation is due to defective tubes. When tubes are not at fault, any standard trouble-shooting technique will invariably serve to localize the faulty component. Manifestations of hum and distortion in a scope while similar to those found in TV sets do present themselves in a rather unique manner. On the other hand, difficulties such as no high voltage, and displaced beams create no new problems for the TV technician.

Fig. 1—60 and 120 cycle hum in the vertical circuits show up as an ellipse and lazy eight when the horizontal sweep is driven by a 60-cycle sine wave.



Hum

Heater-to-cathode leakage and poor power supply filtering can cause 60 and 120-cycle hum respectively, but since the scope screen is blacked out except for the trace, no telltale hum bars appear on the CRT. The problem now is how to recognize hum, and be able to predict the approximate cause of trouble. One easy way is to use a 60-cycle sine-wave for horizontal deflection. 60-cycle hum in the vertical amplifier, will show up as an ellipse, while 120-cycle hum will look like a lazy-eight, as shown in Fig. 1. To track down 60-cycle hum, remove or replace the vertical amplifier tubes one at a time, starting from the input stage and work back. The hum will disappear when the tube is removed. Another scope can be used to visually track down any type of hum.

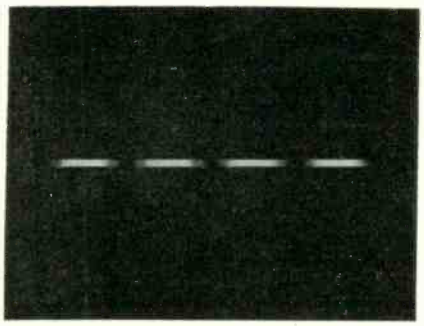


Fig. 2—Intensity modulation may be due to a defective CRT. It shows up best at low sweep rates and at reduced brightness levels.

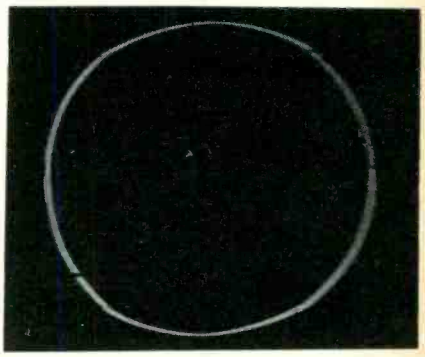


Fig. 3—Astigmatic distortion is evident by inability to focus in both the vertical and horizontal direction at the same time.

When heater-to-cathode leakage is present in a horizontal amplifier tube, in which the cathode operates above ground, the result is a horizontal motion of the beam causing a vertical trace to appear thickened or blurred. To localize this trouble, follow the same procedure described for tracking down hum in the verti-

cal circuit; remove or replace one tube at a time in the horizontal circuits. The thickened or blurred vertical trace will sharpen up when the hum voltage is removed. In order to get a vertical trace during this test, inject almost any signal into the vertical input and reduce the horizontal gain controls to minimum.

It is also possible for faulty filtering to occur in the high-voltage power supply. In such case, hum does not appear as a displacement of the trace, but instead as intensity modulation of the beam, as shown in Fig. 2. Intensity modulation is most evident when the scope is swept at a slow rate, approximately 30 cps, and at a reduced brightness level. Intensity modulation sometimes may be due to a cathode-to-heater leak in the CRT.

Caution: The high-voltage supply has considerable current reserve and can cause severe shock. Discharge capacitors and other high-voltage points before performing any tests or replacements in this circuit.

Astigmatism

Astigmatism is the inability to bring the beam into good focus in both the horizontal and vertical directions at the same time. The circular pattern shown in Fig. 3 is focused at the top and bottom, but not at the sides. The focus control can be adjusted to bring the sides into focus but then the top and bottom will be out. Astigmatic distortion is caused by incorrect voltages on the CRT electrodes.

Many scopes have a potentiometer adjustment for minimizing astigmatism. Older models with single-ended deflection systems display some amount of astigmatism because of unbalanced signal voltages on the deflection plates. Scopes with push-pull amplifiers, and with all electrode potentials properly adjusted, have negligible distortion.

The following, "Guide To Troubleshooting Oscilloscopes," is designed to help localize most of the difficulties encountered. An inspection of this chart will further reveal the similarity of troubles and cures found in scopes and TV sets.

Guide To Troubleshooting The Oscilloscope

Symptom	Cause	Cure
No trace.	Defective CRT. No high voltage. Improper potentials on CRT.	Measure accelerating voltage. It should be approximately 1,000 to 2,000 volts. Measure CRT electrode voltages and compare with service data. Check and replace defective tubes and components in the power supplies. Replace CRT.
Focus control is out of range; focus can be approached but not quite reached.	Resistors changed value, usually in the high-voltage divider, particularly the limiting resistors on either side of the focus control.	Check value of divider resistors against the service data and replace those which are out of tolerance.
Beam can be focused in vertical direction, or in horizontal direction, but not in both.	Astigmatism distortion. If double-ended deflection is used, astigmatism can be almost completely corrected. If single-ended, some astigmatism will always be present.	Adjust astigmatism control. If no control is provided, vary the operating potential of the first anode by changing network resistor values slightly to obtain least amount of distortion.
Beam cannot be brought to a sharp focus; blooming occurs as intensity control is advanced.	Gassy CRT. Weak high-voltage rectifier tube. Faulty components in the high-voltage supply.	Check tubes by substitution. Check value of high-voltage as intensity control is advanced. If voltage does not drop substantially on input side of filter, but drops seriously on output side of filter, replace filter resistor, and filter capacitor, if necessary.
Intensity control is out of range; satisfactory intensity can be approached but not quite reached.	Resistors changed in value in the high-voltage bleeder; especially the resistors on either side of the intensity control. Weak CRT.	Check the values of the bleeder resistors against the service data, and replace those that are out of tolerance. Replace CRT. Booster might help weak CRT.

Symptom	Cause	Cure
Pattern is obtained when checking at the grid of a tube in a TV receiver, but not at the plate.	Leaky or shorted input blocking capacitor to scope's vertical amplifier. D-C plate voltage from test point throws beam off correct operating point.	Replace blocking capacitor.
Beam appears, but cannot be centered.	Leaky coupling capacitor to deflection plate in CRT.	Replace defective capacitor.
Beam sweeps right to left, instead of left to right.	Reversed connections to horizontal deflection plates. 180° rotation of CRT.	Interchange connections from horizontal amplifier to horizontal deflection plates. Reposition tube as required.
Positive input voltage to scope produces downward deflection, instead of upward deflection.	Reversed connections to vertical deflection plates. 180° rotation of CRT.	Interchange connection from vertical amplifier to vertical deflection plates. Reposition tube as required.
Uphill or downhill trace.	Scope case may be slightly magnetized. CRT rotated slightly.	Degauss case. Rotate CRT as required.
Horizontal sweep, non-linear.	Improper horizontal sweep voltage. Operating on non-linear portion of sawtooth wave form.	Check output from horizontal oscillator and amplifier. Replace defective components.
Vertical deflection, non-linear.	Voltage output of vertical amplifier is subnormal.	Check plate and grid voltage of vertical amplifier. Select output tube(s) to obtain one with maximum Gm. Leaky grid-coupling capacitors and gassy tubes are sometimes responsible for non-linearity. Note: Some wide-band scopes are not designed to provide full-screen deflection.
Scope operates normally, except that waveform become limited and clipped short of full-screen deflection.	Weak vertical-amplifier output tube(s), low-plate voltage, incorrect grid bias.	Check tubes, plate-supply voltage, and grid bias. Replace defective parts.
Pattern distorted, vertical amplifier tube overheats.	Low or positive grid bias on amplifier tube.	Check for leakage through grid coupling capacitor with VTVM; replace if bias is low or positive.
60-cycle hum.	Heater-cathode leakage.	Replace suspected tubes with new tubes. Another scope can be used to trace the hum back through the amplifier from the CRT.
120-cycle hum.	Poor filtering of the low-voltage power supply.	Check or replace defective filter capacitors, chokes and resistors in power supply.
Trace is brighter at one end than at the other.	Spurious voltages are gaining entry into the CRT grid or cathode circuit. Waveshape of blanking voltage is incorrect.	Use another scope to check for the presence of a-c voltage on the grid and cathode of the CRT; in some cases, a portion of the horizontal-deflection voltage may find its way into these circuits because of faulty decoupling capacitors. Faults in the blanking-amplifier circuit can also cause distortion and incorrect phasing of the retrace blanking voltage. Replace defective components.
Horizontal spike appears on waveforms when external sweep is used; spike rotates on pattern depending on setting of sawtooth sweep controls.	Crosstalk between horizontal sweep generator and horizontal amplifier.	Check decoupling capacitors common to sawtooth generator and horizontal amplifier. Replace faulty capacitors. Filter output capacitor may be the only decoupling means utilized in low-priced scopes.
Random interference pulses appear in display when operating on sawtooth sweep. Interference sometimes also evident when using external 60-cycle sweep voltage.	Intermittent breakdown in a bypass capacitor.	Use another scope to check across the terminals of suspected bypass and decoupling capacitors. Replace faulty capacitor.
Scope pattern is jittery, and exhibits random breakup when vertical gain control is turned.	Noisy vertical-gain control.	Test potentiometer and replace if found noisy. Check leads for cold-soldered joints, and resolder.
Sawtooth sweep function is erratic, with random out-of sync operation. Pattern cannot be locked on screen steadily, but jumps in and out of sync.	Intermittent feedback capacitor and other components in the multivibrator sweep-oscillator circuit.	Check suspected components by substitution.
Sawtooth sweep subject to slow frequency drift requiring re-setting of horizontal sweep speed.	Defective sweep-oscillator tube. Leaky capacitor, or unstable resistor in the sweep oscillator circuit.	Check suspected component by substitution.
Pattern on scope screen bounces when switches on the power line are turned on or off.	Poor voltage regulation to vertical amplifier, or less frequently, poor voltage regulation to horizontal amplifier.	Check voltage-regulator tube in scope power-supply. Check B+ and bypass capacitors in filter system for leakage. Replace faulty components.
Case of scope is "hot", and shocks operator.	Disconnect test leads from scope, to make sure that voltage is not being applied to scope case from receiver under test. If case is still "hot", a line filter capacitor may be leaky, or the scope's power transformer is defective.	Check line capacitors and replace if defective. Check windings of power transformer for leakage to core. If defective, isolate or replace.

Roving Reporter Asks:

"How Do You

On-the-spot Interviews Across The Country Highlight Different

MIAMI

Orville E. Smith, owner of Accurate, has 20 years experience.

• With 20 years in the field of servicing radio and TV, Orville E. Smith, owner of Accurate Radio and TV Service in Miami, Fla., has evolved a means of lessening the tension between serviceman and customer in cases where the set develops trouble shortly after it has been serviced.

"There is no question that this problem is an aggravating one, both for the customer and the repair man," he said. "We guarantee our work, but we can't afford to make free callbacks to repair troubles which are unrelated to the original trouble."

To protect himself, Mr. Smith has incorporated into his new invoices a clause which guaranteed the labor and the materials for the 90-day warranty period for work specifically described in the invoice. Materials which prove defective within the warranty period will be replaced, but with a necessary labor charge.

To make this effective, it is necessary to list in detail just what service work was done and what parts were used.

Mr. Smith said it is difficult "to set a hard-and-fast rule" in dealing with customers on callbacks or complaints. He tries to arrive at a happy medium. There are times, he pointed out, when to have a satisfied customer it is necessary to go ahead and do some extra work to avoid bad feeling. On the other hand, there are customers who are so unreasonable that firmness is demanded.

Mr. Smith's ratio of callbacks to housecalls runs at a little better than 1 out of 10—"quite a few of these are nuisance calls or are not legitimate complaints." •

SYRACUSE

John J. Golbner, owner of Jack's Radio-TV, checks set.

• John J. Golbner, owner of Jack's Radio and TV Service, Syracuse, N. Y., guarantees his TV repair work for six months.

Like any other TV service technician, he gets his share of callbacks —about two callbacks to every 10 house calls, he figures.

Callbacks for trouble caused by a previously "corrected" malfunction are free of charge for Jack's customers, providing, of course, they occur within the six months' guarantee period. But if the trouble in the set has nothing to do with the old failure, he charges his regular rates.

Of course, some of these callback customers argue the point. But Jack combines a patient manner with a simple, non-technical explanation that has proved successful.

In explaining a case of set failure that has nothing to do with the previously corrected trouble, he tries to relate the breakdown to an experience with which the customer is familiar.

One case he cites involves a customer who had his set corrected for a vertical roll condition. Jack replaced the bad tube that caused the difficulty and the set-owner was pleased for about three weeks. But then—trouble. He called during World Series time and reported the set was on the blink again, that Jack hadn't fixed it properly.

Jack went over to the harassed baseball fan's home and found not vertical roll, but a case of horizontal instability, instead.

A few seconds' time, a new tube and the set was working fine again. But the set-owner steamed when Jack gave him the bill.

Jack was prepared with an answer. He used this example:

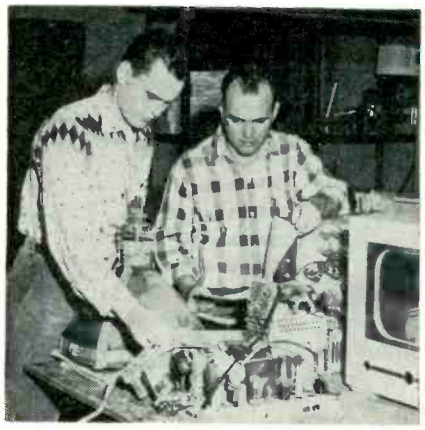
Suppose the set-owner's car radio conked out and a new fuse put it back in operation? In a week, the radio is dead again. But this time it's not a burned out fuse. It's a faulty switch that causes the trouble. Both troubles resulted in a dead radio. But the malfunctions were caused by two separate and distinct trouble spots.

Simple? Yes. Acceptable to customers? Jack says so. •

Handle Callbacks?"

Methods For Handling Sets That Fail After Having Been Repaired.

DETROIT



John Perkovich (l) and Harry Lovell, owner of Beech TV.

• "I've been in the business for six years," says Harry Lovell, owner of Beech TV in Detroit, Mich., "and I've never really found a perfect solution to the callback problem."

The closest he has come to this utopian state is his present system under which he gives a 30-day labor guarantee and a 90-day guarantee on new parts installed by any of the five technicians he employs.

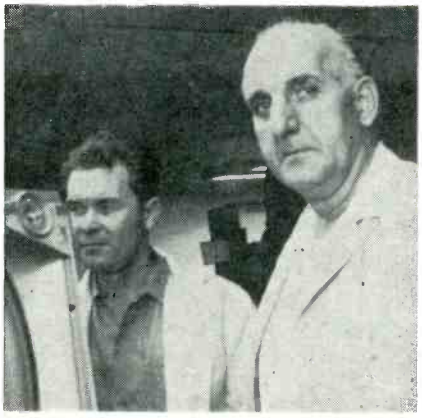
If a set-owner brings his set back to Lovell after it was repaired once, Lovell charges only for parts and not for the labor. Lovell says that at times it does not pay to try to explain to the set-owner that after the set was repaired something else could go wrong with it, and that that something else had nothing to do with the original problem.

"We found that by saying nothing and just repairing the set without labor charge, we have gained many more customers through recommendation," Lovell stated. "But we do charge for new parts if they are necessary."

Lovell says his housecalls to callback ratio is seven to one. "The callback is just one of the problems of TV repair that we absorb and chalk off. But handled properly it does pay off with new customers," Lovell stated.

His five men average about 25 calls a day on TV repairs. Besides doing repair work, Lovell's store features records, phonographs and radios. He employs two girls to help handle sales. •

PHOENIX



Del Sopher (l) and E. H. Boord, service manager of Whitey's.

• Callbacks are often a troublesome problem for TV technicians, and they often involve certain complications that might prove embarrassing if not handled with tact.

But the service department of Whitey's Radio-Television Company in Phoenix, Ariz., which employs 30 personnel and is one of the largest in the city, believes it has the problem under control.

Owned and operated by I. W. (Whitey) Brayer, Whitey's has set up a system that enables his crews to determine the cause and make a general check of the sets which shows which tubes are weak and may go out any time. Records showing all maintenance done on a customer's set are readily available for examination, and a new card is filled out for each call.

Repair work done on TV sets during house calls are guaranteed for 90 days, in line with the guarantees by parts makers.

Whitey's minimizes callbacks before they occur through his systematic check of all tubes with up-to-date tube checkers that show the characteristic of each tube. With this information plainly visible to the customer, service technicians explain that certain tubes are in bad condition. It is then left to the customer's discretion whether or not he cares to have the weak ones replaced.

When the set goes on the blink after a service call, the repairman immediately determines the cause of the new trouble. If there is no connection with the previous repair or service call, an additional charge is made. If the trouble is traceable to the previous call, no charge for the callback is made. Service calls are $5.50 per half hour.

Under this system, Whitey's states the additional charge needs only little explanation, since the customer was alerted on the previous call as to certain weak points in the set. If he failed to heed the warning, he has no one to blame but himself.

Whitey's, which was the first in the city to have two-way radios installed in their trucks, and also has an airplane with which he services the smaller communities of the state, estimates that only one out of every 15 house calls are callbacks. •

Understanding And Troubleshooting AGC Circuits

Basic Knowledge Of Circuit Action And Proper Test Equipment Can Simplify Servicing Simple And Keyed AGC Systems.

AGC Systems

Simple
Delayed
Keyed

TEST Equipment

VTVM
Scope
Bias Box
Capacitor Checker

Procedures

Bias Substitution
Signal Trace
Point-To-Point Checks

SOL LIBES

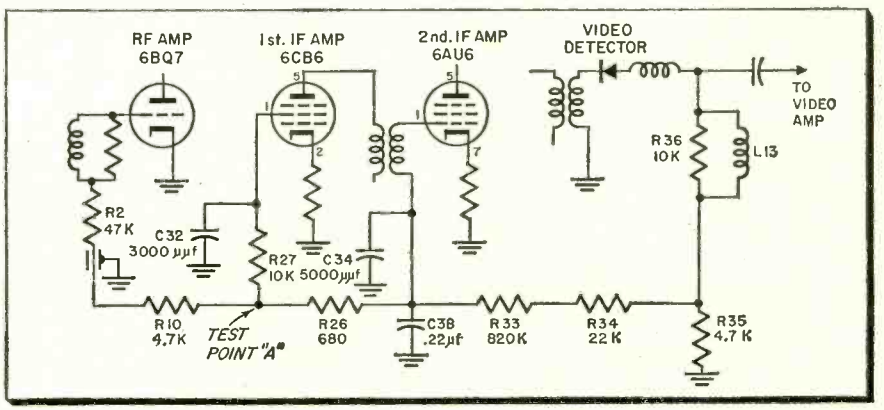
• The agc circuit can create the greatest variety of perplexing TV troubles. These difficulties are all the more vexing because they may be caused by defects in other than the agc circuit, and not all agc symptoms are agc troubles. The technician should know how to quickly recognize actual and apparent agc defects. He should also develop a definite systematic servicing procedure based upon a thorough understanding of the circuitry. This is not too difficult.

There are two basic agc systems in current use; simple, and keyed. A third type, referred to as delayed agc, is in reality a modification which may be incorporated in either of the basic systems. The simple type may be found in some of the less expensive TV receivers. The keyed system offers better noise immunity, is faster acting, and is the most popular.

Simple AGC

The simple type system is similar in appearance and operation to the avc system used in radio receivers. A typical circuit is shown in Fig. 1. The composite video signal at the video detector is used to develop a negative control voltage which is proportional to the amplitude of the video signal. This voltage is developed across resistor R35, and is filtered by resistors R33 and R34 and capacitor C38. The time constant of this network is purposely made long in an attempt to limit variations in control voltage to changes in signal strength, rather than changes in video content. The control voltage is applied to the grids of the r-f, and first and second i-f amplifiers. An increase in signal strength increases the negative control voltage, and decreases the overall gain of the receiver. The converse is also true, a weaker signal increases the gain. Some of the limitations of this system are inability to avoid fluctuation in receiver gain with large variations in average video level,

Fig. 1—The control voltage in the simple AGC system depends upon the composite video signal. It is slow acting and suffers from poor noise immunity.



slow acting, and poor noise immunity.

Delayed AGC

In the simple system some agc voltage is developed at all times, even at low signal level, because this system cannot distinguish between signal, noise and other interference. When the signal to noise ratio is poor, it is desirable to avoid any agc voltage in order to obtain maximum gain. Fortunately it is possible to prevent any control voltage from being developed until a predetermined signal level is received. In most cases this is accomplished by biasing a diode, or bucking out some of the small control voltages with a predetermined amount of B+ voltage.

Part of the 5T8 in Fig. 2 is used as an agc clamper. Approximately 6-volts positive bias is placed on the plate of the diode by the divider network R161, R163, and R164. Under no signal conditions, the diode conducts and drops the agc line voltage to zero volts. When a signal is received, the negative d-c voltage developed across resistor R161 opposes the biasing voltage. As long as the negative control voltage is less than 6 volts the diode will conduct and maintain the agc control line at zero volts. When the negative voltage rises to more than 6 volts it will overcome the positive voltage on the diode and cause it to stop conducting. The agc control voltage can now go from zero in a negative direction. The ability to handle a wider range of signal strengths is thus made possible.

Keyed AGC

This system more closely approximates an ideal gain control arrangement. The developed control voltage is proportional to the actual signal strength and is not affected by the amplitude of the composite video signal and random noise. To accomplish this task sounds more difficult than it really is. The amplitude of the sync pulses varies directly with signal strength and is constant for a given signal level. Noise and video information are constantly varying. Therefore, if the control voltage is made to respond only to the amplitude of the sync pulse, proper gain control action and noise immunity could be achieved. Since the sync pulses occur at regular intervals, all that is needed is a control tube or "keyer" which will conduct only in the presence of sync pulses.

To guarantee that the keyer tube will conduct only during the sync pulse time, and not by high amplitude noise pulses during video information time, plate voltage is applied to the tube only during sync time. It is usually obtained from an added winding on the horizontal output transformer. A popular variation makes use of capacitive coupling from a tap on the horizontal output transformer. In the agc circuit shown in Fig. 3, 600-volt pulses are placed on the plate of the agc keyer tube 15,750 times a second. At the same time, the positive going composite video signal is directly coupled to the control grid of this tube from the video amplifier. The positive d-c voltage placed on the control grid varies between 120 and 170 volts depending upon the setting of the contrast control. The cathode is held at a positive potential of 190 volts. Hence, the control grid is 20 to 70 volts negative with respect to the cathode, and holds the tube at cut-off. The more positive peaks of the composite video signal bring the tube out of cut off, but the tube conducts only when plate voltage is applied. This coincidence occurs only during sync time. The current flow through the tube causes a negative control voltage to be developed across R302 and R308. The remaining action is similar to that described for the simple agc system. A delay feature is also used in this circuit. In addition to the noise immunity, and proper control voltages based upon signal strength, the filter network has a much smaller time constant thus enabling the circuit to respond much faster to changes in signal strength. The pumping action caused by overhead aircraft is considerably minimized if not completely eliminated.

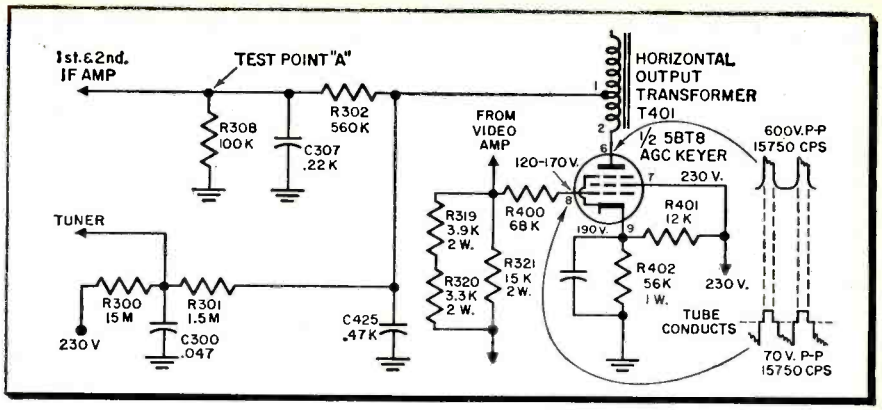
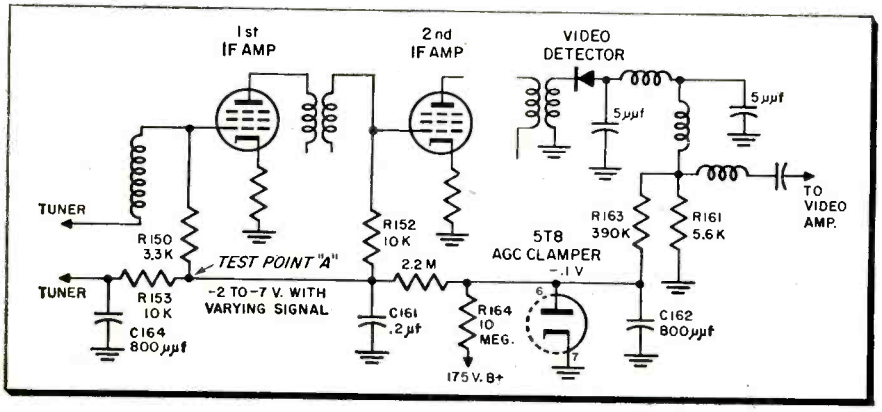


Fig. 3—Horizontal sync pulse triggers the AGC keyer tube so that the control voltage developed is proportional to the signal strength, and not to video information. Also has good noise immunity.

Fig. 2—Delayed AGC helps extend the range of signal strengths that can be handled.



Test Equipment

In order to avoid loading down the agc and grid circuits a VTVM should be used. An oscilloscope is most desirable, and can do much to cut down on the time it takes to find the trouble. However, many agc difficulties can be tracked down without a scope. A bias box is strongly recommended for this type of work, and is well worth the small cost. One can be easily constructed from a battery and potentiometer as shown in Fig. 4. A more convenient rig can be made as shown in Fig. 5.

Troubleshooting

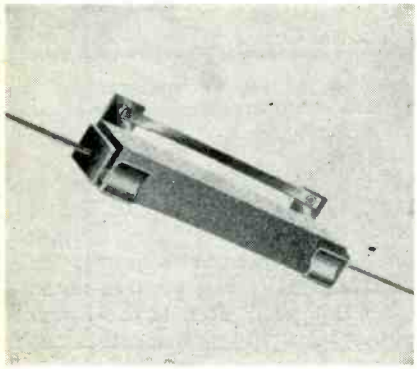
Defective agc action may cause trouble in other circuits. Likewise

(Continued on page 66)

New Electronic Products

G-C SURGISTOR

The Surgistor, a wired-in resistor device, limits initial power surge and prevents the tubes from getting their full electrical load immediately. As the Surgistor warms up, it gradually cuts out of the circuit, leaving the tubes to



perform normally. Only two models handle all service needs. No. 5303, for standard black-and-white TV sets, lists for $1.65. No. 5302, for color TV, lists for $1.95. G-C Electronics Mfg. Co., 400 S. Wyman St., Rockford, Ill. (ELECTRONIC TECHNICIAN 7-54)

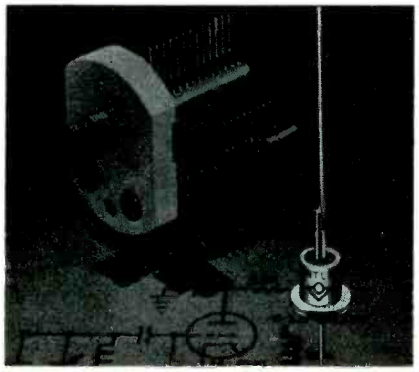
Shell TUBE TESTER

A new low-cost self-service tube tester has just been offered to radio-TV technicians through their jobbers. The Model S-18 has been designed to suit the demand for a more complete self-service tester. The colorful unit employs only 18 tube sockets in which

over 800 tube types can be tested. Three controls are provided so that the customer can check his own tubes quickly and easily. Checks each side of multi-purpose tubes independently, and 6 and 12 volt vibrators. Shell Electronic Mfg. Co., 1688 Utica Ave., Brooklyn, N. Y. (ELECTRONIC TECHNICIAN 7-63)

Int'l Rect. SEMICAP

It is now possible to replace mechanical capacitors and other variable reactance elements with a new silicon high Q variable capacitor. It has a Q of 1,000 plus at 1 megacycle with a 10 to 1 capacity ratio well within its peak in-



verse voltage rating of —200 volts d.c. The small size of the device (only a fraction of the size of the component it replaces), along with its high reliability and low power requirements make it ideal for afc, FM oscillators and filter networks. It also offers such benefits as linear voltage vs. frequency calibration, and virtual insensitivity to variations in temperature. International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif. (ELECTRONIC TECHNICIAN 7-56)

Pyramid "SUPER-MERCHANDISER"

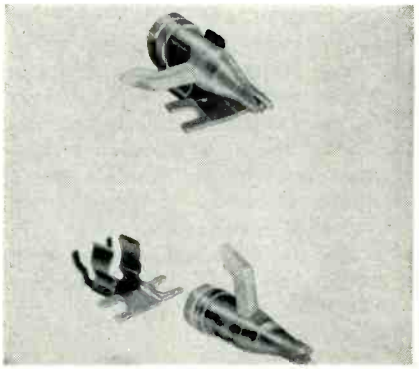
Designed for maximum flexibility, storage capacity and sales stimulation, the Super-Merchandiser consists of two sections 49½" long x 36" wide x 12" deep, each with 14 gravity-fed shelves equipped wih dividers. These sections can be set one on top of the other or side by side to fit individual space requirements. It is possible to set up an efficient, time-saving and profitable capacitor and rectifier sales operation. Pyramid Electric Co., 1445 Hudson Blvd., North Bergen, N. J. (ELECTRONIC TECHNICIAN 7-60)

Stancor TRANSFORMER

A new filament transformer has been designed especially for use with the Eimac 4CX1000A transmitting tube provides center-tapped secondaries of 6.0, 6.5 or 7.0 volts, at 13 amps. Primary is 117 volts, 60 cycles. The P-6463 is designed to withstand 2,000 volts RMS and is unusually compact, measuring only $2\frac{13}{16}$" x $3\frac{3}{8}$" high, it has $2\frac{1}{4}$" x $2\frac{11}{16}$" mounting centers. Chicago Standard Transformer Corp., 3501 Addison St., Chicago 18, Ill. (ELECTRONIC TECHNICIAN 7-59)

Erie STEREO CARTRIDGE

The "Sterieo" cartridge is the result of research work extending over a three year period from its initial conception. Two outputs are produced by a single ceramic element, and appear with respect to a common ground terminal. In



order to obtain maximum separation between channels, a completely symmetrical design has been developed which assures a crosstalk separation of 20 db from 30 to 8,000 cycles. Above 8 kc the crosstalk increases gradually to about 12 db separation at 15 kc. The output is essentially constant above 1000 cycles. Because of this constant output voltage, the element essentially needs no equalization network except bass boost, (7 db @ 100 cycles) which may be obtained by any of the conventional circuits. Available in sapphire and diamond point combinations. LP and 78 RPM or 2 LP points. Erie Resistor Corp., Erie, Pa. (ELECTRONIC TECHNICIAN 7-57)

Mallory CAPACITORS

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

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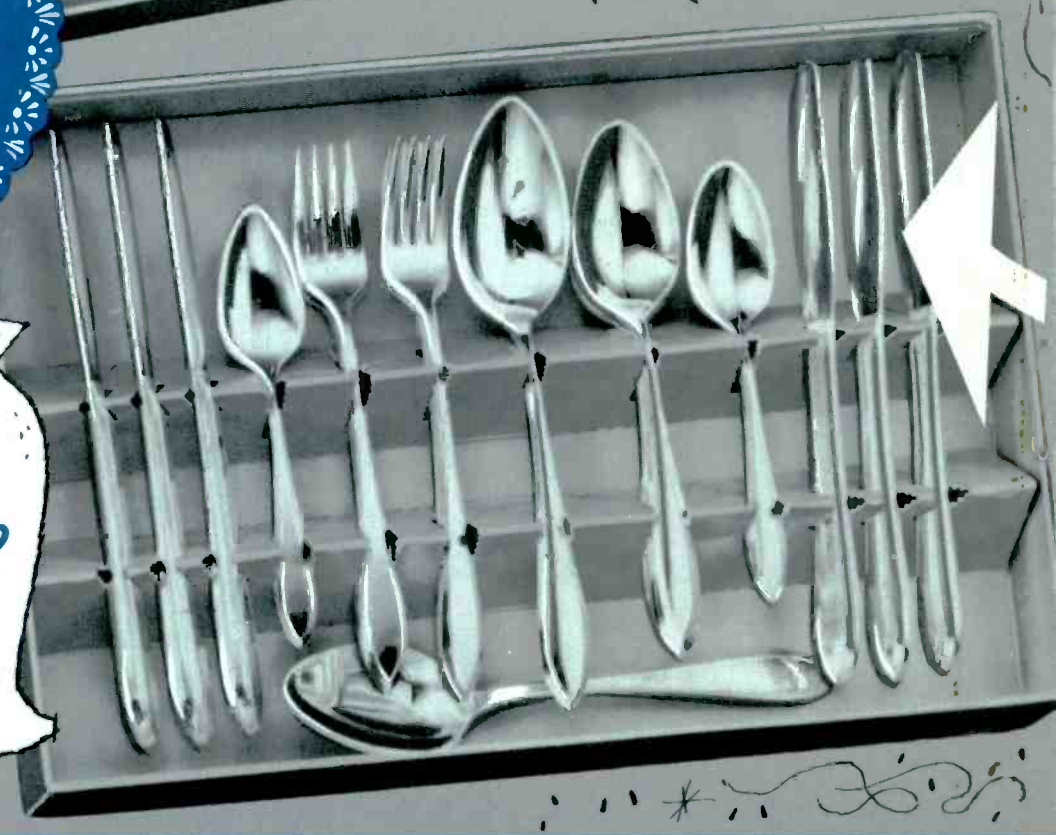

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Difficult Service Jobs Described by Readers

Berserk TV

The customer complained that the TV set was never quite right and finally quit. A Philco model 52T2151, chassis RF 41, and Powr D1, had severe picture pulling. Adjusting the fine-tuning control turned the picture negative. The grid of the first video i-f amplifier was positive. A new coupling capacitor C519 improved performance but the picture was still somewhat faded and jittery at times.

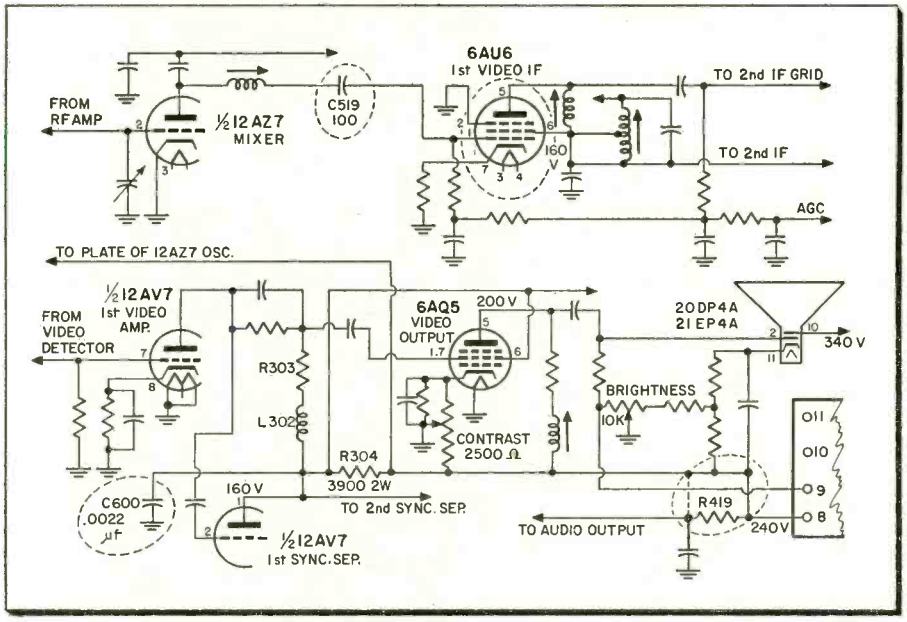
After a considerable amount of checking and comparing the set with the schematic, it was discovered that the B+ connection to the plate of the first video amplifier (half of a 12AV7) and the plate connection of the 6AQ5 video-output tube was improperly made. Instead of going to pin 8 of PL 100, the connection was made through resistor R419, as shown by the dotted line in the diagram. Plate voltage was low.

Correcting this and alignment helped. In the meantime the first video i-f tube quit working and had to be replaced. Finally a point was reached where the set worked fine for the first twenty minutes, then the picture started to pull in the center of the screen when figures and objects moved in the picture. Replacing the coupling capacitor C600 going to pin 2 of the 12AV7 first sync separator corrected this condition. The set worked normal and was delivered.

A week later the customer called back to report that Channel 12 quit working. New oscillator and r-f tubes failed to bring in the missing channel. Voltages were correct. The set went back to the shop! The capacitor C527, a 1 to 6 μμf, slug-tuned job located at the top front portion of the tuner was cracked.

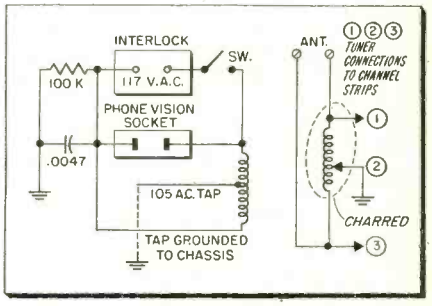
A 3/4" by 1" hole was cut through the top of the tuner at this point around a brass slug and the defective part clipped out. Two short leads were brought up from the clipped ends and soldered to the tabs of an ordinary flat ceramic trimmer. The regular bracket that comes with the trimmer was used to mount it over the hole. Again the set was delivered with all channels working normally.
—Edward F. Tylicki, Milwaukee, Wis.

Berserk TV circuit made sane . . . in a few "treatments."



Hot Ground

The Zenith, chassis 22H23, was sold by us as a used set in December, 1957. The customer complained that he was unable to turn the set off. The switch checked out correctly so I suspected an a-c line filter short to ground. Although the schematic showed there should be one, there was no evidence that there had ever been one in this chassis.



Hot ground and charred parts.

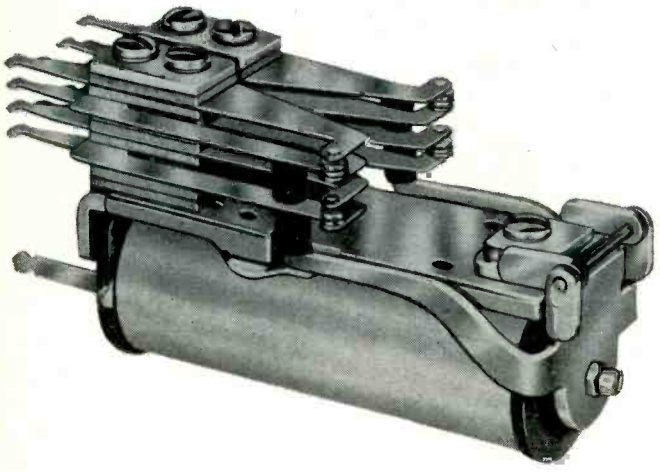
It came to light that the customer's trouble began in the spring of 1958, after he had driven in the ground rod, we had left with him in

(Continued on page 65)

TOUGH DOGS WANTED!

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

Switching & Control Devices In Industrial Electronics



SWITCHES

Electronic

- **Oscillator**
- **Photoelectric**
- **Proximity**
- **Trigger**

Mechanical

- **Electromagnetic**
- **Mercury**
- **Meter**
- **Stepping**
- **Thermal**

ALLAN LYTEL
ELECTRONICS LAB
GENERAL ELECTRIC CO.

• One of the most fundamental of all mechanical devices used in electronics is probably a switch. Like other electronic components it has been refined and developed into many different forms, and applied in a countless number of ways. The mechanical action of the switch can now respond to the touch of the electron as well as to the hand. Some switches have been so modernized that many of them are all electronic and have no moving mechanical parts. Without switches, few if any electronic devices would function or be practical. Modern industrial machinery employs a large variety of switching and control devices in the equipment itself and between the equipment and the process or circuit to be controlled.

The two major divisions into which switches may be classified are mechanical and electronic. From a purely theoretical point-of-view, it is at times quite difficult to assign a switch to a particular category because many mechanical switches have electronic accessories, and vice versa. Matters are somewhat simplified if all switches using movable contacts are considered mechanical and if those without are thought of as electronic. Mercury switches can also be considered mechanical. Generally high speed switching action is relegated to the electronic types. Either type may be used for medium and low speed operation.

Basic elements of several types of mechanical and electronic switches and relays are shown in Fig. 1. Example A is an electromagnetic type. In this case the downward motion of the armature carries one contact with it and opens the circuit to be controlled. Variations of this type includes meter relays and stepping relays. The thermal relay shown in example B has two pieces of unlike metals fastened together and be-

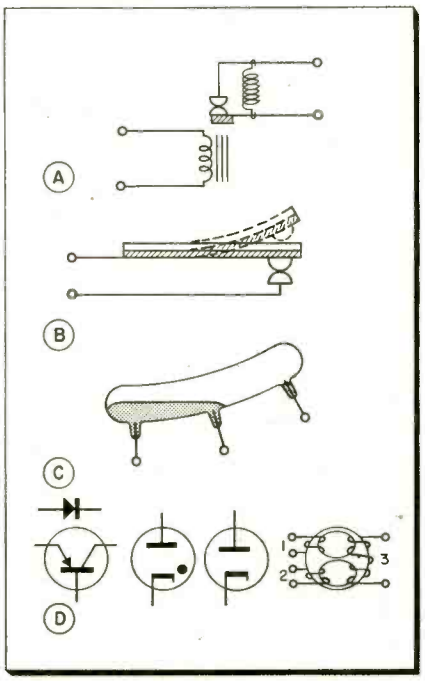


Fig. 1—Basic switching elements. (A) Mechanical Electromagnetic (B) Thermostatic (C) Mercury (D) Semiconductors, Tubes, and Electronic Electromagnetic.

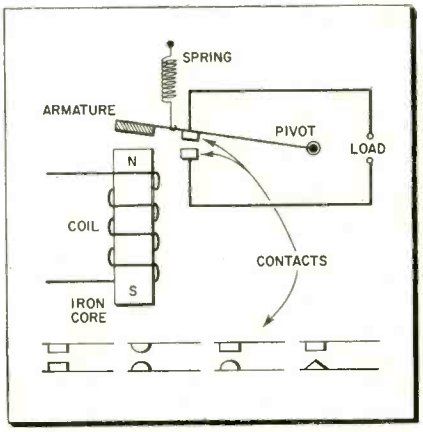


Fig. 2—Electromagnetic relay contains at least one set of contacts which may be flat, half-round, pointed or combination.

ILLUSTRATIONS CREDITS
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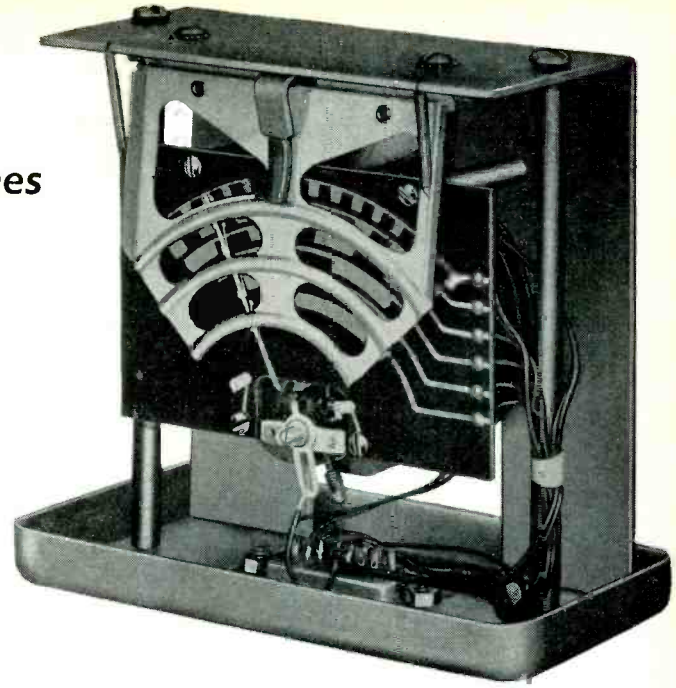
Elements And Functions Of Electronic And Mechanical Switches Used To Actuate Machines, Processes, And Electronic Operations

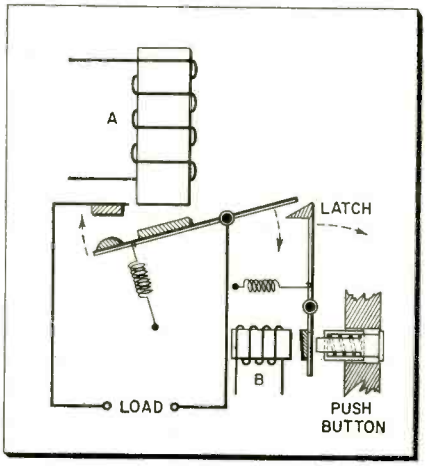


cause of a difference in their coefficient of expansion will bend when hot. Some thermostatic elements may be controlled by internal electric currents, some by external heat conditions, and some by both. The mercury switch shown in example C is quite simple. A pool of mercury makes or breaks contact, depending upon the angle of its glass container. Example D shows semiconductors, tubes and magnetic devices which may be used in electronic switching. Even the most advanced computers, when broken down to their most basic form, consists of a series of switches.

Electromagnetic Types

Thousands of different electromagnetic relay types are in use. However, they all have an electro-

Fig. 3—Latching mechanism holds contacts closed even after coil A is deenergized. Contacts may be opened manually, or by sending an appropriate current through coil B.



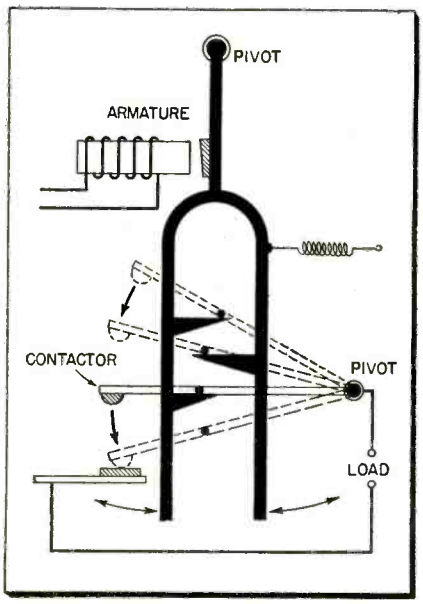


Fig. 4—Simplified version of a stepping relay. Not shown, is provision to return the contactor to its uppermost position.

magnet, an armature and at least one set of contacts, as shown in Fig. 2. The contacts may be flat, half round, pointed, or a combination of these. Flat contacts require heavy pressure; half-round contacts reduce contamination of the contact surfaces, which may eventually hinder relay operation. A sliding or rubbing action between the contacts which occurs on make and again on break, is sometimes built in to achieve some degree of self cleaning. Relay contacts are made of copper, silver, and silver alloys. Copper is preferred when current flow is heavy. Switching arrangements may consist of almost any combination; make-before-break, break-before-make, one or more poles, single or double throw, stepping, etc.

When a set of relay contacts are to be held closed or open for a long time, latching methods are sometimes used. Fig. 3 shows a simple latching mechanism. When coil A is energized the armature is attracted toward the coil and closes the contacts, and is locked in place by the latch. The contacts will remain closed even when the coil is deenergized. It can be opened manually, by a button, or electrically, by energizing coil B.

Fig. 5—When the conventional movable indicator, in the meter relay, contacts a fixed but adjustable arm, the load circuit is completed.

One type of stepping relay is shown in Fig. 4. Each time the armature is moved to the right or left, the contactor drops down another step until the contacts are closed. As the number of steps increase, the mechanism becomes more complex.

Another type of electro-mechanical type of switch often encountered in industrial electronics is the meter

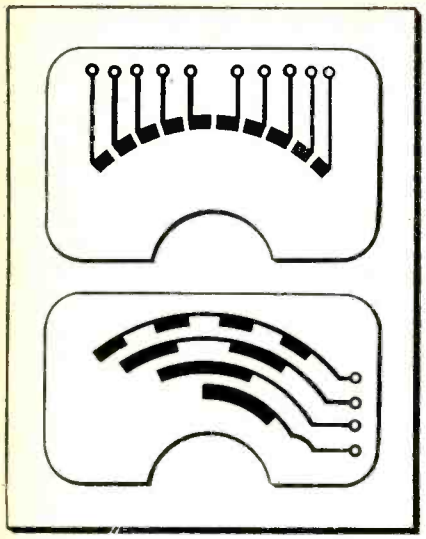


Fig. 6—A large number of switching steps is possible by using different combinations of contacts on a multicontact plate inserted in a meter relay.

relay shown in Fig. 5. One contact of the relay is fixed, but adjustable, the other is carried by the moving element of the meter. The indicating part of the meter is conventional but because of the very low torque of the moving coil it cannot reliably actuate the relay. A locking coil, wound on the indicator coil, holds the contacts together when they touch. Reset (by opening the locked relay contacts) can be either automatic or manual.

Virtually all industrial processes employing meters or relays are potential users of the meter-relay. It can be used as a pyrometer to control heat processes, or serve as a heat alarm device; current from a thermocouple may be used to drive the meter. In vacuum tube circuits a meter-relay can indicate plate-current and shut down the equipment when it is excessive.

There are many applications where a multi-contact meter-relay is required: readings of pressure or liquid level, in steps; grading resistors, according to value by steps; etc. In order to accomplish this series of indications, a printed circuit scale is mounted on the back of the meter. Fig. 6 shows how different combinations of contacts can provide a large number of steps.

Mercury Switches

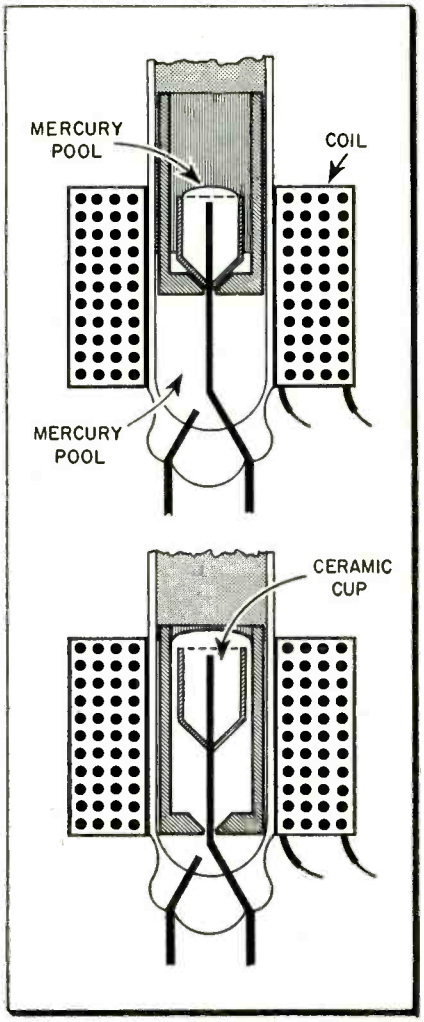
Mercury contacts are used in some relays to take advantage of the liquid-metal conductor. Mercury requires a special enclosure to prevent contamination. Best use is made of the conducting qualities of mercury by maintaining small pockets of the liquid around the electrode for a mercury-to-mercury contact. Note the crescent shape, in Fig. 1, which is characteristic of most mercury switches.

Fig. 7 illustrates the mercury-plunger type of relay. The sealed glass tube is filled with hydrogen. The plunger, inside the tube, is controlled by a magnetic field created by an external coil. One lead to the switch is in contact with the large pool of mercury in the glass tube, and a second lead, which is insulated from the main pool, is connected to a second small pool in a ceramic cup. When the coil is energized the plunger moves down and brings both pools of mercury into contact.

Electronic Switches

The list of electronic switching devices is long, varied, and growing daily. A transistorized Schmitt trigger illustrated in Fig. 8, is the electronic equivalent of a relay. When the input signal is equal to or greater than a predetermined level an output is obtained. Flip-flop, multivibrator, staircase, and blocking oscillator circuits employing tubes or transistors are used widely for switching circuits. The article on Industrial Counting And Frequency

Fig. 7—When the external magnetic field pulls the plunger down in a mercury relay, the level of the main pool is raised, and contacts the smaller pool.



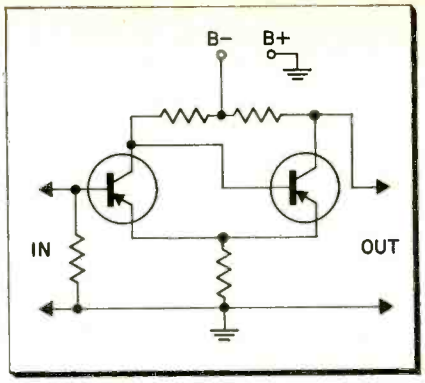


Fig. 8—The transistorized Schmitt Trigger in an electronic relay. An output is obtained when the input is of a predetermined amplitude.

Measuring Devices which appeared in the May 1958 issue of Electronic Technician describes and illustrates operation and application of these switches to high-speed determination of time, number and frequency. A proximity switch is another type of electronic switch. Switches equipped with a mechanical trip lever can be used but proximity switches have the advantage of greater life and are less subject to damage. In one type, an oscillator changes its frequency when a piece of metal approaches a pickup head or other sensing element. The change in frequency is amplified, and sets other relays or machines into action. Another interesting type of electronic switch which has no moving parts and no tubes is a magnetic device with a sensing coil. When a ferromagnetic object moves past a magnetic field, the field is disturbed and the change is recorded.

Photoelectric devices can also be classified as electronic switches. Light sensitive elements enclosed in evacuated tubes or partially gas-filled containers, convert light energy into electrical energy and become the sensing element of some very complex control systems. One important use of photoelectric controls in industrial electronics is in register control of all types of continuous process production machines. All types of paper, plastic films, metallic foils, and cardboard are processed by these machines. Processes may include: sheet cutters, die cutters, embossers, inserters, collators, folders, etc. In a correction type of register control, which is a very exact procedure, preprinted register marks on the material may actuate and control a cutting, printing or other process. Correction is built into the control system to compensate for changes in equipment wear, stretching, shrinking, etc. However, many applications are quite simple, and even the most complex system can be broken down into very simple basic elements. •

Audio SERVICING

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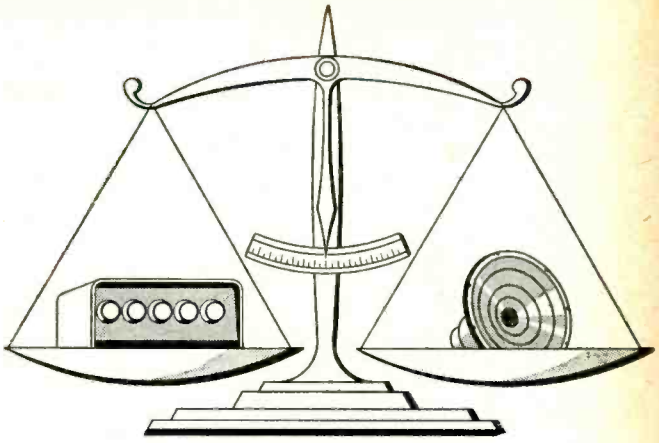

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NORMAN H. CROWHURST

• Stability problems of high fidelity audio amplifiers and other audio equipment are probably the most challenging and most interesting work likely to be encountered by the technician. That this is not necessarily a task which belongs strictly in the manufacturer's laboratory is not readily recognized. High-fidelity amplifiers and other components must in themselves exhibit certain minimum stability characteristics to begin with, or they would not leave the factory. True, inherent characteristics of some designs may display greater unstable tendencies than others, and it is also true that some amplifiers may be so close to borderline that it would require very little external influence to create an unstable condition. Consider the plight of the customer who exchanged a simple 8" speaker for a high-quality three-way speaker system. When he switched on his amplifier the speakers let out a high-frequency squeal. In another instance, under similar circumstances, the system "took off" when the balance control on the tweeter was adjusted to certain positions. The trouble is not always so obvious; the amplifier may not break into continuous oscillation, but the new and better speaker system may sound worse than the original small speaker.

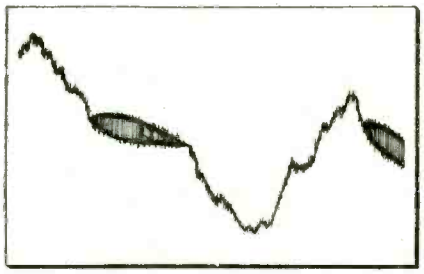


Fig. 1—Undesirable oscillation may occur anywhere on the program waveform as a bulge.

These conditions develop when the amplifier is critical of its output load; not of the impedance, but of the presence of reactive components and their effect on certain frequencies. It doesn't always mean that something went wrong with the amplifier. Generally, the more feedback built into an amplifier, the greater is the tendency to become unstable. What may be an in-phase signal at one frequency may be out-of-phase at another. Therefore, it is quite likely that in a given feedback loop negative feedback could become positive feedback, and oscillation could develop at certain frequencies.

If the amplifier by itself is stable, and if trouble develops, it will usually be in the very low or very high-frequency region and sometimes in both of these areas. Before attempting to solve any stability problems, it is well to be certain that the amplifier is operating properly. This can be done by making a frequency run, and observing the output on a scope to check for distortion. A dummy resistance load on the amplifier can be used for this check. Half the battle is recognizing the problem.

Effects

High End: Continuous oscillation may or may not be audible, depending on the frequency of oscillation. If the oscillation is ultrasonic it will cause the audio program to sound broken up. This can be checked by looking at the output on the scope, with no input to the amplifier. The speakers are not disconnected for this test. A thickening of the line trace may be seen on the scope, the size of which depends upon the amplitude of the oscillation and frequency response of the scope. It may even be possible to determine the frequency of oscillation. It isn't necessary to know the exact frequency; it is sufficient to know which end the trouble is in. Oscillation could also take place at different points on the audio waveform, and shows up as bulges when observing the program wave trace on the scope as in Fig. 1. It may or may not do so continually. Reproduction

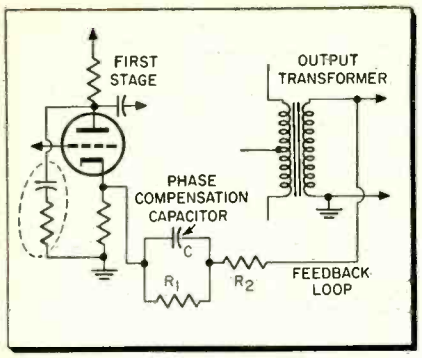


Fig. 2—High end instability can often be eliminated by slightly reducing the amount of feedback or inserting RC network.

will sound harsh, shrill, or rough depending upon the frequency and degree of oscillation. Similar symptoms may be noticed if portions of the high frequency end are drastically peaked. The scope can easily identify which of the two culprits have to be dealt with, peaking or oscillation.

Notice that in the last two cases, oscillation and peaking takes place only in the presence of program or test signals. In the first example oscillation occurs even with no signal input.

Low End: Instability at very low frequencies may manifest itself as motorboating. Often the effect may be insufficient to cause low-frequency oscillation, or the oscillation may have a smooth waveform at too low a frequency to be heard. If the oscillation is continuous but inaudible, the program will sound broken up, in a wavery way. If the oscillation is excited by program material containing instruments which are plucked or struck, trumpets and brass will sound as if the player is spitting into his instrument.

Both Ends: This makes a kind of spluttery sound, usually set off by certain kinds of program material. The sound may be similar to that made by someone trying to fix a bad connection while the program is playing. The scope may show sudden, excessive unnatural and spiky peaks. When instability at both ends is present, they should be treated separately. It is advisable to start at the high end, because it is usually easier to handle and it may be triggering the low end.

Cures

An important part of any complex servicing procedure, is an analysis of the schematic and other manufacturer's notes. It is well to establish a close relationship with the technical department of the various manufacturers. What may be a brand new and difficult problem to the independent may be a routine matter with the set maker. Much time can be saved by consultation. Much of this procedure is cut and try type of work. It may be more economical to try another set of speakers, or even another amplifier. It is well to apprise the customer of the situation. A certain amount of modification work is legitimate and usually profitable endeavor, and therefore should not be turned away.

In addition to the amplifier and speaker system, it is necessary to use the type of program material that triggers the undesirable conditions. Depending upon the type of trouble a signal generator, or a particular recording, or no input is required. Other test equipment would include a scope and VTVM. The work consists of modifying the feedback loop, or interstage coupling networks, or both. It may also include loading the output.

High End: Difficulties in the high end usually involve changes in the feedback loop. The feedback loop, shown in Fig. 2, is typical. Resistor R_2 may or may not be in the circuit.

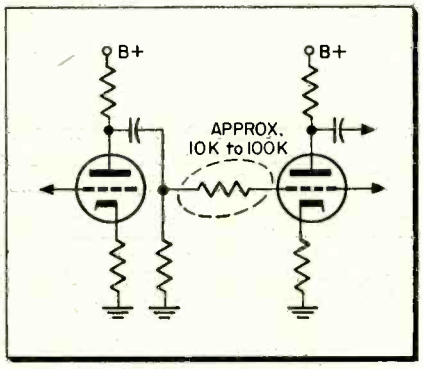


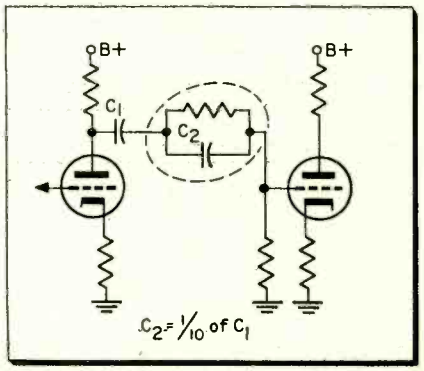
Fig. 3—Addition of a resistor in the grid circuit will help overcome grid blocking.

Stability can usually be improved by reducing the amount of feedback. Doing so also increases both gain and distortion. It is more important to maintain distortion at a minimum, therefore do not remove any more feedback than is absolutely necessary. Feedback can be decreased by substituting a smaller capacitor, or eliminating it, the resistors may be increased in size. If the change required is too drastic and if the instability consists of a high frequency oscillation, some or all of it can be bypassed to ground by placing a resistor and capacitor in series from the plate of the first stage, as shown in the dotted circle in Fig. 2. Insert only as much bypass action as needed. An excessive amount will take a chunk out of the high frequency response. Bypass action is increased as the capacitor is made larger and the resistor made smaller. A parasitic oscillation or other unstable condition may sometimes be present because of a resonant condition, made up of stray capacitance and inductance. Resistors of 100 to 400 ohms may be placed in series with plate, screen and grid leads to suppress this activity. It may be possible to increase as well as decrease capacitance in the feedback loop to bring about stabilization.

Sometimes the unexpected happens because of different phasing effects with different frequencies. Then the only way to correct the trouble is to explore all possibilities until a satisfactory solution is found. Compromises may be necessary. Work at the high frequency end can be watched on the scope. The frequency response should be checked once again after modifications have been completed.

Low End: Correcting the low-frequency end involves changes mostly in the interstage-coupling network. Because low-frequency oscillation and flutter does not produce appreciable voltage on the secondary of the output transformer, the best way to spot this activity is to use the d-c function of a VTVM at the plate of the last single-ended stage in the amplifier—usually the phase inverter. It will show up as a rhythmic back and forth movement of the meter needle. Discount any variations in average level due to changes in program material. Since this is a problem dealing with the phase relationship of certain low frequencies with regard to the average audio frequencies handled by the amplifier, and since it involves the entire amplifier from output-to-input and back to output, it is not possible to single out any one stage as the major cause of instability. Fortunately, this also simplifies matters considerably because a change anywhere in the circuit will alter the phase configuration of the complete loop. Depending upon the type of modifications contemplated, and from an

Fig. 4—Step coupling arrangement used to eliminate flutter.



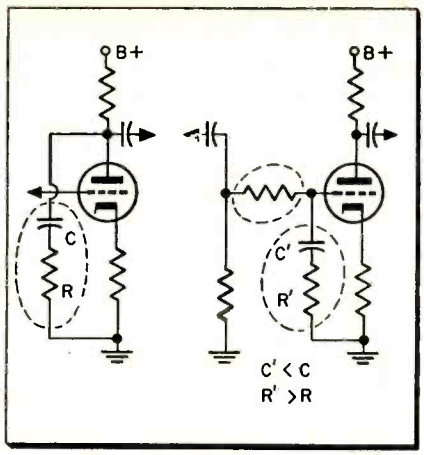


Fig. 5—High frequency response can be improved by shifting RC network from plate to grid when a grid resistor is added.

inspection of the schematic, the technician can select the most convenient stage to work in.

First try different coupling capacitor values, preferably in single-ended stages, as only one needs changing and problems of balance are avoided. Try smaller values first; if it makes matters worse, try larger values. If a larger value is needed to cure the trouble, try playing the amplifier wide open to check the amplifier for grid blocking. This will show up as a brief interruption of the program immediately following a loud peak and sounds like break-up. The usual cure for this byproduct difficulty is to increase the value of, or insert a resistor between the coupling capacitor and the grid as shown in Fig. 3. The values are not critical, so steps of 10K, 22K, 47K, 100K, etc., will do. Continue this process until the blocking effect disappears, or ceases to get any smaller.

If just changing the coupling capacitor will not get rid of the low-frequency flutter, a step coupling arrangement may be tried. This consists of two coupling capacitors in series, with a resistor bridging the smaller one as shown in Fig. 4. The desirable ratio of capacitor values is about 10:1. The larger one should be about the same value as the original coupling capacitor. The resistor value can be found by substitution.

Other Procedures

Another modification that may be of considerable help is to increase the size of the screen and/or cathode decoupling capacitors in single-ended stages. As a last resort, it may help to increase the size of the plate decoupling capacitors.

If the amplifier has a push-pull output stage using common-cathode bias, or if it has a push-pull driver stage with common-cathode bias, consider that some push-pull circuits work best with a bias decoupling capacitor and some without it. The difference occurs mostly at or near maximum output, and can best be checked with a sine-wave input. (A dummy resistive load on the output may be used to avoid the loud sounds.) Try either way and determine which gives better performance. Some manufacturers have left it out to save cost, when it is better in—same have put it in, because of theory, without checking to see if it might be better left out.

Where corrections for stability of both the high and low ends were made, and if a grid resistor were used to minimize blocking, it is possible to improve high-frequency response of the stage by removing the series resistor and capacitor combination, from plate-to-ground, and

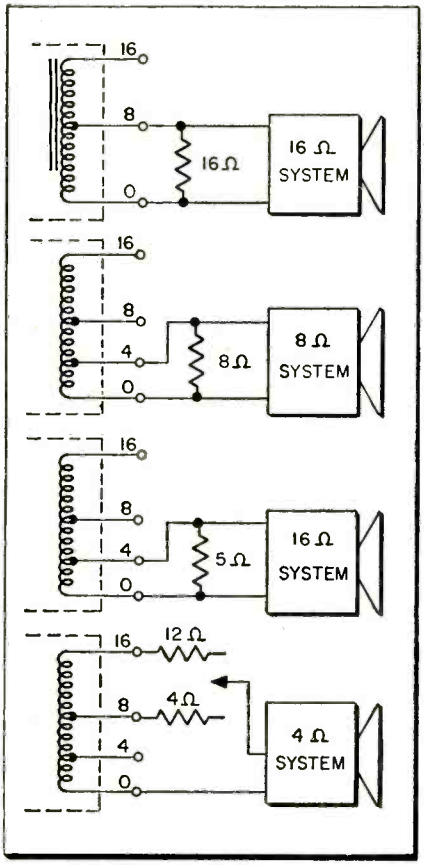


Fig. 6—Possible combinations of partial resistive loading to reduce effects of reactive load.

connecting them in a similar manner from grid-to-ground, as shown in Fig. 5. It is desirable to use a smaller capacitor, and a larger resistor in this network for grid application.

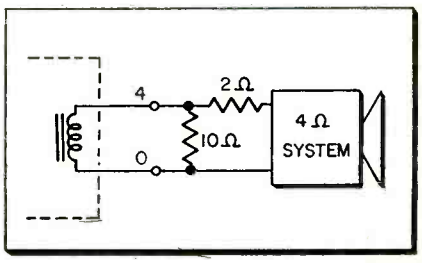
But what can be done if the amplifier has no phase compensating capacitor as shown in Fig. 1, and/or attempts to work on the response at one or both ends prove fruitless? The situation may be alleviated by partial resistive loading as shown in Fig. 6. If the speaker system is 16 ohms, it could be connected in parallel with a 16-ohm resistor across the 8-ohm tap. Similarly, an 8-ohm system can be connected in parallel with an 8-ohm resistor on the 4-ohm tap. As a further extreme, if there is enough reserve power, a 16-ohm speaker can be connected in parallel with a 5-ohm resistor across the 4-ohm tap.

If the impedance of the speaker system is 4 ohms, or the lowest value tap on the amplifier, this method cannot be adopted. An alternative is to connect a resistor in series with the speaker across a higher amplifier tap. This alternative should be used more judiciously. Series resistance may help the amplifier, but it can destroy the loudspeaker damping factor, which may or may not be noticeable.

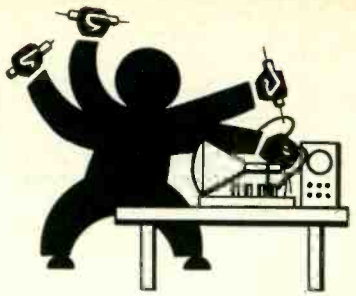
When no other tap is available, or when the speakers match the lowest tap, it is possible to get some relief from an L pad. Use a series resistance of half the speaker impedance (2 ohms for a 4-ohm system) and then a shunt resistance of 2-1/2 times the speaker impedance (10 ohms for a 4-ohm system), as shown in Fig. 7. This will give maximum resistive effect to the amplifier load, while adding minimum damping to the loudspeaker.

These resistors must be capable of dissipating their share of the output power. Such high-voltage, non-inductive resistors may not be readily available. A simple way to make them up, is to use heater-element wire wound on a glass tube or other heat resistant coil form of about ¾" to 1' in diameter. Resistance can be measured on a multi-meter with sufficient accuracy. Fewer turns are desirable to minimize adding even more inductive reactance to the load. It pays to keep notes, for future reference, of the way each amplifier type was modified. Variations exist for each amplifier and speaker system, and how they are interconnected, but once the basic solutions for a particular amplifier have been found, the differences for best performance with various speaker systems are usually small. •

Fig. 7—An L pad used in lieu of a series resistor will minimize loss of damping factor.



SHOP HINTS



Tips for Home and Bench Service

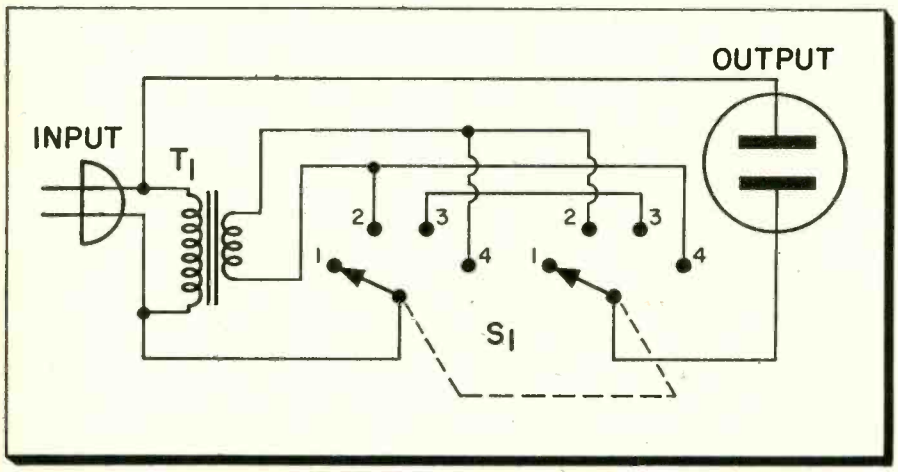
Line Voltage Control

The most useful service-aid I have in my shop is a simple and inexpensive line voltage control. It is quite easily constructed from parts that will be found in any repair shop. The circuit is shown below. With this unit you can either raise or lower the line voltage by six-volts by making the filament transformer output boost or buck the line voltage.

If a portable radio works normally on the high position and it conks-out on the low position, it's probable that the selenium rectifier or the oscillator tube needs replacing.

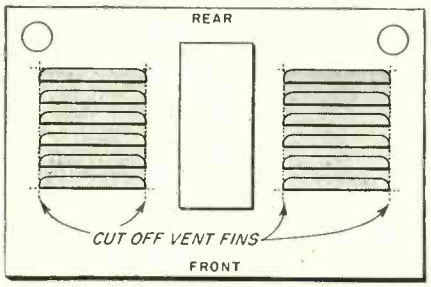
Used in conjunction with a TV it will save both time and money. In the low position there should be a complete raster with no shadows. If the set passes this test you don't have to worry about a call-back for insufficient width, etc. Operating a TV on the high position is one of the best methods I know of to make an intermittent set act-up. Due to increased voltages throughout the chassis a component on the verge of breakdown will be put under extra stress, often enough to cause its failure.—*Albert J. Krukowski, W. Springfield, Mass.*

Line voltage is controlled by boost and buck action. Switch positions are: (1) off; (2) —6v; (3) normal line; (4) +6 v. Two main parts are 6-volt filament transformer, rated 3 amps or more, and double-pole 4-position switch.



Portable TV Access

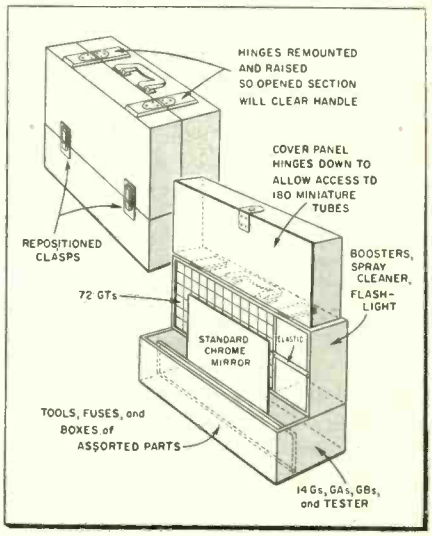
A quick and simple way to replace the tubes in TV portables such as the Admiral 14YP3B is to clip off the bottom ventilating fins. The resulting opening makes all tubes, except those in the tuner, accessible for replacement without pulling off the case and picture tube. A bottom plate can be made of heavy screening to cover the opening. This is a real aid to servicing the portable in the home.—*Joseph L. Barry, Jr., Woburn, Mass.* • *For your own protection, it will help to get the customer to agree to this procedure first.—Ed.*



Bottom view of TV set shows fins which may be cut out so hand can pass tube through.

Caddy Conversion

The usual tube caddy may take up too much room when opened. One way to solve this problem is to convert it to open vertically, instead of horizontally. To do this, remove the clasps from the top and the hinges from the smaller side. Mount the hinges on the top, built up by wood strips in order to clear the handle. Mount the clasps on the side where the hinges have been removed. Add or remove partitions as desired. To prevent the tubes from falling when one is removed, use metal strips between rows. The converted caddy shown takes up no more floor space open than when closed. It is a good idea when using the converted caddy —with its higher center of gravity— to place its back against something to prevent it from being knocked over.—*C. J. Deering, Chicago, Ill.*



Caddy opens up instead of out when hinges and clasps are moved, saving floor space.

SHOP HINTS WANTED!

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

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STEREO 1959 tells you everything you must know about stereophonic sound—that magnificent electronic achievement now sweeping the hi-fi field.

STEREO 1959 is a once-a-year editorial feature, which will be published as a bound-in section of the September 1958 issue of ELECTRONIC TECHNICIAN.

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STEREO 1959 will be printed. In addition to 54,000-plus subscribers to ELECTRONIC TECHNICIAN, over 45,000 extra copies will be distributed to dealers like yourself, and to jobbers and hi-fi specialists, both for your own use and for redistribution to hi-fi consumers. Also, thousands of copies will be distributed from ELECTRONIC TECHNICIAN's display room at the New York High Fidelity Music Show, Sept. 30-Oct. 4, 1958.

Watch for September ELECTRONIC TECHNICIAN. It's an issue you will keep and use for reference in serving the booming hi-fi stereo market!

FREE LITERATURE

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

1 Tube Testers: Colorful literature covers the Atlas U-Check-'Em self-service tube tester. Features a memory bank which guarantees against obsolescence. A simple, patchpanel diagram is furnished as new tubes are developed, enabling easy changeover without using tools, wiring, or soldering. (1B7: Affiliated Television Laboratories, Inc.)

2 Soldering Irons: A 16-page, illustrated catalog describes and gives specifications and prices of soldering irons for practically every hand soldering operation. Included are tips, accessories and irons required for electronic circuits, hi-fi, aircraft, radar and missiles. (2B7: American Electrical Heater Co.)

3 Microphones: A new 2-color catalog, No. 58, consists of 16 pages of detailed information covering: microphones for tape recording, broadcast, public address, and general purposes; handsets; phono cartridges and arms; mobile equipment; and accessories. Prices are included. (3B7: American Microphone Mfg. Co.)

4 Hi-Fi Products: Literature is available covering: New stereophonic tone arm TM-2G (spec sheet EP-581), LH-6 bookshelf speaker system (4-page EP-588), and equipment cabinet EQ-1 (sheet EP-593). (4B7: General Electric Co.)

5 Phono Cartridges & Needles: Cartridge catalog No. 1958 includes: recommended opening stocks; listing with illustrations and exact size drawings; cross reference with other brands; and general information. The Hi-Fi Needle Handbook gives needle illustrations and point sizes, and lists cartridges in numerical as well as alphabetical order. (5B7: Jensen Industries, Inc.)

6 Field Strength Meter: Descriptive literature covers Model TMT. A transistorized, portable field strength meter for VHF TV signal measurements, antenna orientation and performance checks. Weight: 4½ lbs. Price: $109.50 (6B7: Jerrold Electronics Corp.)

7 Baffles: A colorful 4-page circular and single sheets cover: ceiling and wall type baffles; Model PBA Hifilite baffles and outdoor light; and a new microphone receptacle floor outlet unit. The literature is well illustrated and gives descriptions and specifications. (7B7: Lowell Mfg. Co.)

8 Antennas: Catalog No. A-58 consists of 24 pages of information covering the complete line of antennas and antenna kits. Full descriptions, illustrations, specifications, gain data, and prices are included. (8B7: Telco Electronics Mfg. Co.)

9 TV Wiring Kits: Designed to furnish all materials needed for a complete home TV multi-outlet installation, these kits are fully described in a 4-page folder. Illustration sketches, catalog numbers, kit contents and prices are included: (9B7: TeVco Insulated Wire)

10 Terminals: Catalog No. T-70 provides 12 pages of information including illustrations. specifications, stock numbers and prices covering a variety of solderless terminals, connectors, service kits and crimping tools. (10B7: Vaco Products Co.)

11 Replacement Phono Needles: A colorful, compact catalog, designed to hang flat on the wall, lists: needles, by number, with name of cartridge that takes each needle, including foreign-make cartridges; cartridges, by number, with maker's name, replacement needle number, list price and illustrations. Also provides a conventional needle guide and cross reference charts. (11B7: Electrovox Co. Inc.)

12 Power Tubes: A reference booklet, designed to act as an easy guide to aid in the proper selection of tubes for industrial and communication applications, gives descriptions, ratings and interchangeability data on complete line. (12B7: Westinghouse Electric Corp.)

13 Hi-Fi Analyzer: Model 800 hi-fi audio analyzer bulletin describes 6 functions of the instrument: audio VTVM; generator; harmonic & IM distortion meters; wattmeter; and db & noise meter. Gives specifications and prices. (13B7: Winston Electronics, Inc.)

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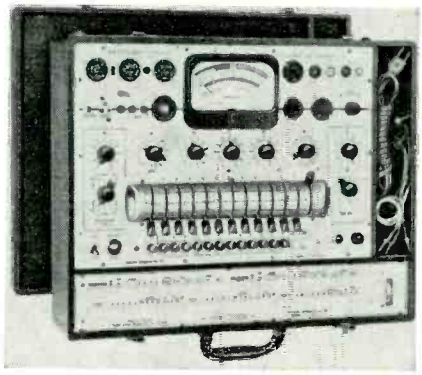
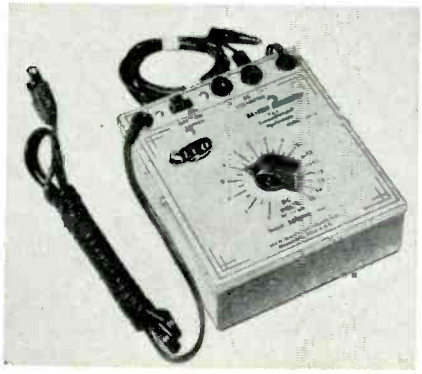
Precision TUBE TESTER →



The model 10-60 "Electronamic" Tube and Transistor Checker provides comprehensive tube, transistor, crystal diode and TV picture tube testing facilities. Features include: CRT beam current test, ultra-sensitive gas test, and functional testing of voltage regulator tubes. Tests all modern tube types, including subminiatures. A five-window, geared roll chart, provides convenient reference for all tube and transistor test settings. Precision Apparatus Co., 70-13 84th St., Glendale, L. I., N. Y. (ELECTRONIC TECHNICIAN 7-21)

Seco BATTERY ELIMINATOR →

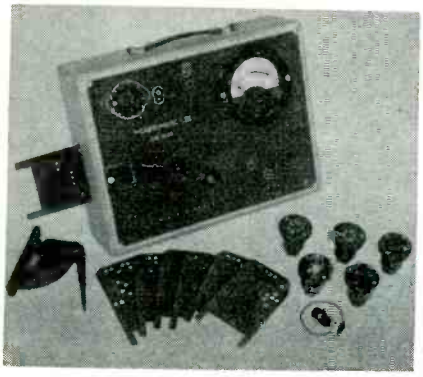


The PS-2 supplies clean, filtered, continuously variable dc from 0 to 15 volts, and cannot be damaged by a short circuit. A line by-pass system eliminates hum modulation. Internal impedance is less than 2 ohms; maximum output is 100 ma; and the output is isolated from the power line by a transformer. It can be used as a bias box for tracking down agc troubles, and alignment in TV sets. Complete with plug-in jacks for external voltmeter, 40-inch leads, and insulated clips. $13.95 net. Seco Mfg. Co., 5015 Penn Ave. South, Minneapolis, Minn. (ELECTRONIC TECHNICIAN 7-22)

Winston HI-FI ANALYZER →

Model 800 Hi-Fi Audio System Analyzer is a complete audio test laboratory in one portable instrument. It incorporates the functions of 6 instruments, including an audio VTVM, audio signal generator, audio output wattmeter, dummy speaker loads, intermodulation distortion meter, harmonic distortion meter, and db and noise meter. The integration of the various functions in one instrument requires only two cable connections for all tests. Winston Electronics, Inc., 4312 Main St., Philadelphia 27, Pa. (ELECTRONIC TECHNICIAN 7-23)

Amperex TUBE TESTER →



All popular American and European receiving tubes can be tested by the new "Cartomatic III," Punched-Card Tube Tester. Pre-punched cards make tube testing a simple, rapid operation. The operator inserts the appropriate card into the machine and presses a few buttons. It comes complete with fifty pre-punched cards for all popular tubes, sixteen adaptor sockets, fifty blank cards and equipment for preparing cards for new tubes. Amperex Electronic Corp., 230 Duffy Ave., Hicksville, L. I., N. Y. (ELECTRONIC TECHNICIAN 7-24)

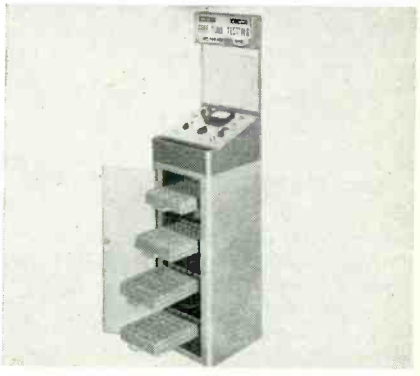
Century TUBE TESTER

The model SS-1 fast check is designed to test and sell radio-TV tubes automatically. It will check: quality, shorts, leakage, and gas content of over 600 tube types with just two settings. The circuitry will allow the tester to accommodate new tube types as they appear in the future. A colorful display tops the cabinet to attract attention to

the tester. The tube storage cabinet holds over 400 tubes. It is also fully protected against accidental burn-out. Floor model SS-1F $134.50. Counter model SS-1C is $98.50. Century Electronics Co., 111 Roosevelt Ave., Mineola, N. Y. (ELECTRONIC TECNICIAN 7-26)

Vis-U-All TUBE TESTER

The new unit, designed for extra simple, easy operation, has six tube sockets, yet checks over 600 types of radio and TV tubes. Available in either floor or counter model, it occupies only 15" x 15". The floor model VII, has a cabinet-type base for tube storage and contains four "egg crate" drawers that hold up



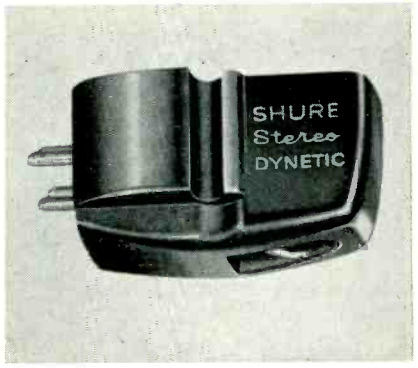
to 200 tubes. Tube chart revisions are promptly provided by the company to keep the tester up to date. Complete with black and white illuminated sign. Vis-U-All Co., 303 Fuller Ave., N. E., Grand Rapids, Mich. (ELECTRONIC TECHNICIAN 7-25)

Audio SERVICING

New High Fidelity

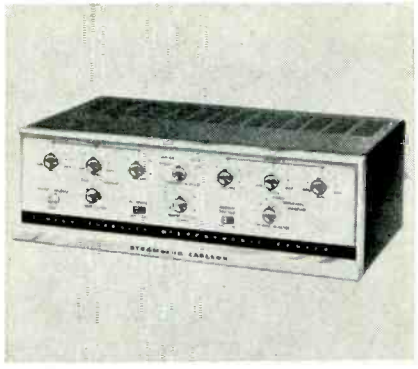
Shure STEREO CARTRIDGE →

Model M3D professional stereo dynetic phono cartridge is designed to connect into magnetic inputs. It will be available in the fall of 1958. Specifications are: channel separation, more than 20 db at 1 kc; frequency response, 20 to 15,000 cps within 3 db; output, 5 mv at 1 kc; vertical and lateral compliance, 3; tracking force, 3 to 6 grams for minimum wear; 4 terminals; 0.7 mil diamond stylus. Price is $45. Shure Brothers, 222 Hartrey Ave., Evanston, Ill. (ELECTRONIC TECHNICIAN 7-31)



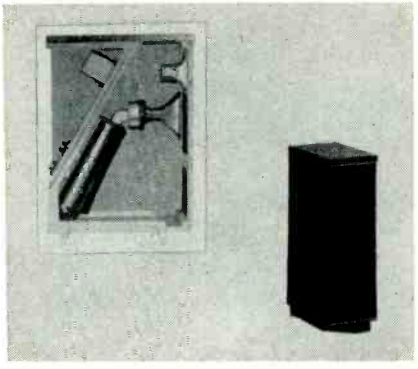
Stromberg HI-FI UNITS →

The ASR-433 two-channel stereo amplifier shown, priced at $119.95, is one of a complete new line of hi-fi components. Other units in the line include: Autospeed changer, wired for stereo, featuring automatic speed selection and pause during change cycle, at $79.95; RF-480 8" speaker at $24.95; 12" from $34.95 to $99.95; RF-484 15" coax at $150; SR-440 AM/FM tuner at $159.95; various amplifiers to $139.95. Stromberg-Carlson, 100 Carlson Rd., Rochester 3, N. Y. (ELECTRONIC TECHNICIAN 7-32)



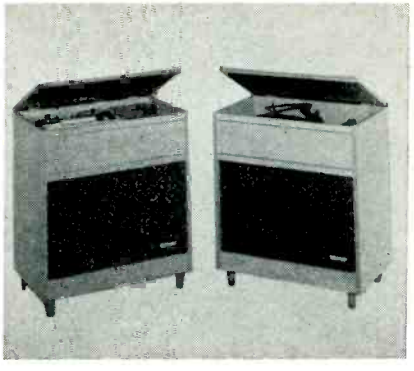
Electro-Voice SPEAKER →

The Stereon is a "second channel" speaker which eliminates the need for a second full-range unit by producing only the frequencies needed for stereo—sounds above 300 cps. Frequencies below 300 cps from both channels are properly phased and directed to the main speaker, a full-range system, through the XX3 Stereon control filter. Concept is based on ear's insensitivity to direction of bass sources. 3-way system, $129.50 and $99.50; XX3, $30. Electro-Voice, Buchanan, Mich. (ELECTRONIC TECHNICIAN 7-33)



Webcor STEREO UNITS →

The Custom 10 monaural phono shown may be converted to stereo with the new A-1931 conversion kit, which carries a retail list price of $29.95. Second unit shown in the photo is the Custom 10 stereo tape recorder system. Also available is the Model 4923 Audio-Mate, a separate console speaker-amplifier arrangement matching the Custom 10; this may be used as a second sound channel for any phono. Webcor, Inc., 5610 W. Bloomingdale Ave., Chicago, Ill. (ELECTRONIC TECHNICIAN 7-34)



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

Vidaire STEREO PHASE SELECTOR

Model SP-5 stereo phase selector simplifies phasing each speaker in a multiple speaker installation. This gold-embossed brass unit will also switch monaural and stereo signals into the same amplifiers and speakers. Vidaire Electronics Mfg. Corp., Baldwin, N.Y. (ELECTRONIC TECHNICIAN 7-44)

Norelco SPEAKER ENCLOSURES

New enclosures feature removable bases to permit horizontal or vertical placement. Designed for 8" and 12" speakers, they range in price from $31.60 to $119.95. The FRS I for 12" speakers is $107.70 in mahogany, $113.35 blond, $119.95 walnut. The FRS II with insert baffle for 8" units comes with legs, and is priced from $65.50 to $73.50. The FRS III with removable base is $31.60 to $35. All match various speaker models. North American Philips Co., High Fidelity Products Div., 230 Duffy Ave., Hicksville, N. Y. (ELECTRONIC TECHNICIAN 7-36)

Webster STEREO TAPE DECK

The Ekotape 340 stereo tape deck employs only two knobs to control the entire unit. With accessories it records and plays back both stereo and monaural sounds. An interesting feature is that either channel can be erased independently. The on-off switch is combined with the speed control to neutralize the drive mechanism when the machine is off. It retails at $99.50; deluxe model at $119.50. Matching preamp and amplifier are available. Webster Electric Co., Racine, Wis. (ELECTRONIC TECHNICIAN 7-37)

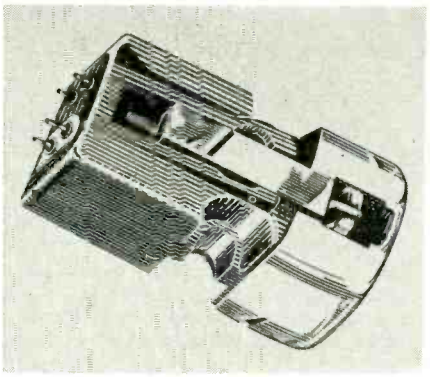
V-M RECORD CHANGERS

The "Stere-O-Matic" Model 1201 automatic record changer includes a stereo cartridge and jacks, and stereo-monaural switch. This 4-speed unit lists for $50 in most states. As a replacement changer on metal base, Model 1226, it's $56. The Model 1202 basic changer without stereo cartridge, but with plug-in head, is $50; Model 1228 version on metal base is $56. Rumble rating is —45 db, tracking angle variation is 2° maximum. V-M Corp., 280 Park St., Benton Harbor, Mich. (ELECTRONIC TECHNICIAN 7-35)

& Stereo Products

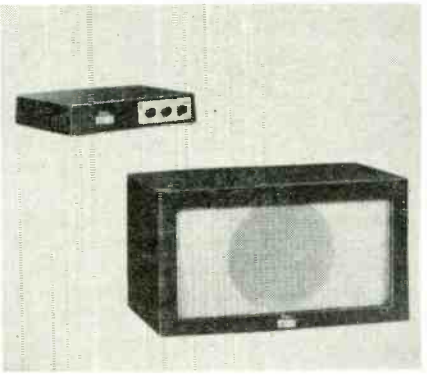
GE HI-FI COMPONENTS →

Golden Classic variable reluctance stereo cartridge shown is the new Model GC-7. With 0.7 mil diamond needle it retails for $23.95. Stereo Classic CL-7 version with sapphire is $16.95. Other units are the LH-6 woofer-tweeter bookshelf speaker from $49.95; in kit, $29.95. The TM-2G stereo and monaural tone arm is $29.95. EQ-1 equipment cabinets are $109.95. General Electric Co., Specialty Electronic Components Dept., West Genesee St., Auburn, N.Y. (ELECTRONIC TECHNICIAN 7-39)



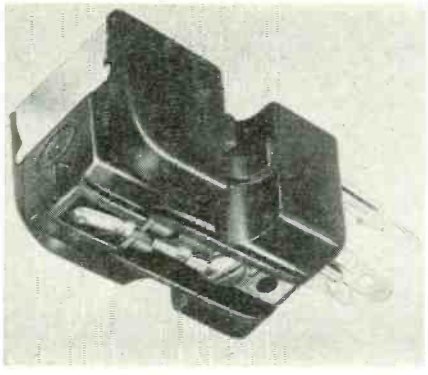
Walco STEREO KIT →

All-purpose stereo conversion kit for present mass-market phonos consists of a 4-watt push-pull auxiliary amplifier with two tone controls for stereo channel, separate speaker in a cabinet, 4-wire ceramic stereo cartridge and hardware. Suggested dealer cost for the entire kit is $39.95. List price is $59.50 plus installation fee, allowing long profit margin for service technicians. Walco Products (Electrovox), 60 Franklin St., E. Orange, N.J. (ELECTRONIC TECHNICIAN 7-40)



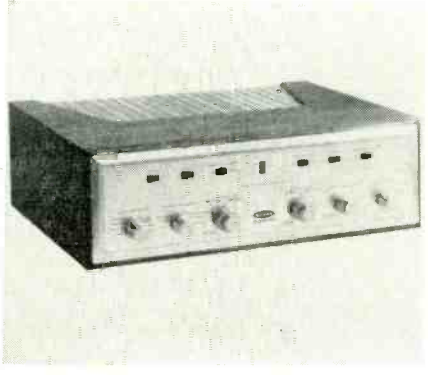
CBS STEREO CARTRIDGE →

Columbia CD—constant displacement—stereo cartridge Model SC-1 is a dual ceramic unit with a unique moving lever system. This provides balanced output voltages which are constant for a given stylus displacement regardless of frequency. Needle is 0.8 mil. Separation exceeds 20 db. Compliance is 2 and output is 0.4 volt. Recommended tracking force is 5 to 7 grams. Uses diamond needle only. It's designed for RIAA equalization. CBS-Hytron, Danvers, Mass. (ELECTRONIC TECHNICIAN 7-41)



Scott STEREO AMPLIFIER →

Model 299 stereo amplifier is a 40-watter consisting of dual 20-watt power amplifiers and preamps on a single chassis. There are two low level or magnetic stereo inputs and three high level. Special tone control calibration enables the 299 to be used as an electronic crossover. Rumble and scratch filters, balance and phase controls are provided. Harmonic distortion is 0.8% at full output. H. H. Scott, Inc., 111 Powder Mill Rd., Maynard, Mass. (ELECTRONIC TECHNICIAN 7-42)



Harman-Kardon STEREO TUNER

The Duet Model T-224 stereo tuner has separate AM and FM channels, three controls, AFC and multiplex adapter jack. Specifications are FM sensitivity, 7 microvolts for 30 db of quieting; selectivity, 240 kc bandwidth, 6 db down; frequency response, 30 to 15,000 cps within 0.75 db; output, 1.5 volts for 100% modulation; IM distortion, less than 0.5% at 100% modulation. Price $114.95. Harman-Kardon, Inc., 520 Main St., Westbury, N.Y. (ELECTRONIC TECHNICIAN 7-43)

Jensen STEREO SPEAKERS

"Stereo Director" reproducers are available as 3-way or 4-way systems. The SS-100 is a single 3-way with a new 12" "Flexair" woofer. The floor firing bass sound is non-directional. The Stereo Director consists of a swivel mounted chassis on which is located an 8" PM midchannel speaker covering 600 to 2,000 cps, a horn type tweeter for 2 kc to 15 kc response, a crossover network and controls. The Director is pivot mounted atop the bass enclosure and directed to aim directional frequencies to any desired location. Two matched systems may be placed anywhere in the room, even in adjacent walls, and the sound then converged in the listening area by simply swiveling the director chassis until the stereo effect is achieved. The DS-100 consists of two 12" woofers and two matched Stereo Directors in one lowboy. Speaker for the SS-200 4-way consists of a 15" woofer, the Stereo Director chassis atop the woofer enclosure, and a new phase correcting supertweeter for response beyond audibility. The SS-200 may also be set in line with the new E-200 equipment cabinet to form an integrated ensemble. Both 12" and 15" systems are available in kit form. Jensen Mfg. Co., 6601 S. Laramie, Chicago 38, Ill. (ELECTRONIC TECHNICIAN 7-45)

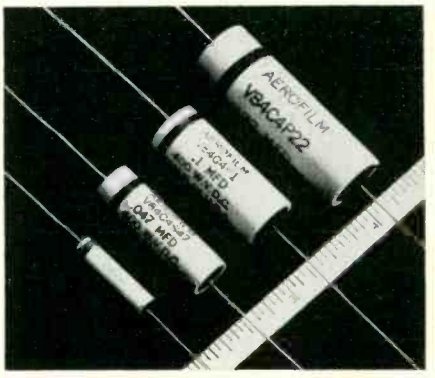
Masco INTERCOM

Called the "Wife-Saver," this home music distribution and intercom system operates seven remotes and one master station. Radio can be fed to any room in the house. The system permits remote-to-remote conversation, private hookup to prevent eavesdropping between master and remote, and morning alarm with the built-in timer. A busy signal indicates when remotes are conversing. Mark Simpson Mfg. Co., 32-28 49th St., Long Island City 3, N.Y. (ELECTRONIC TECHNICIAN 7-38)

New Components

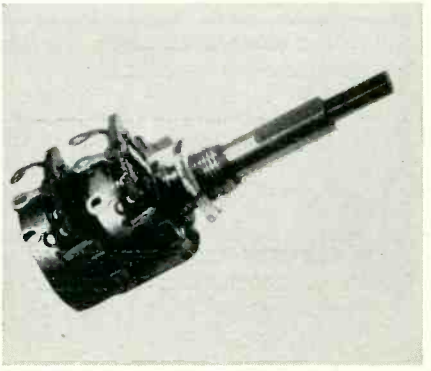
For more information, write in ELECTRONIC TECHNICIAN's new product code number on coupon, on page 46.

Aerovox CAPACITORS →



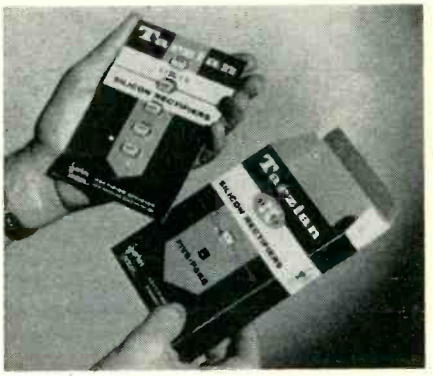
Ceramic-cased Mylar by-pass capacitors at a price no higher than conventional units. Technical advantages of Mylar dielectric help eliminate costly call-backs. Type V84C units are stocked in voltage ratings of 200, 400 and 600 VDC and in all standard capacitances. Some features are smaller size, withstand higher operating temperature, lower dielectric absorption, lower power factor, stability and premium quality. Aerovox Corp., New Bedford, Mass. (ELECTRONIC TECHNICIAN 7-1)

Clarostat CONTROLS →



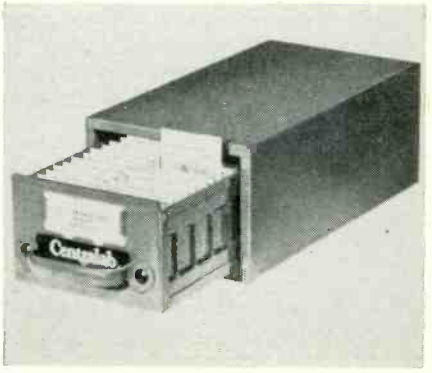
Stereo controls for hi-fi equipment feature individual or combined control of volume in dual-channel amplifiers. The two sections can be operated either simultaneously, or by pulling out the rear shaft ⅛", individually. The sections are operated individually while adjusting for desired balance between the two amplifier channels; then by pushing in the shaft the two sections become locked together for simultaneous and balanced operation. Clarostat Mfg. Co., Dover, N. H. (ELECTRONIC TECHNICIAN 7-2)

Sarkes Tarzian RECTIFIERS →



New shirt-pocket size, match-book style package holds five silicon rectifiers. The 5-Pak package makes a handy, economical way to stock this increasingly popular replacement silicon rectifier. The Paks are enclosed in an attractive three color carton for shipment and storage. The pigtail mounted "K" series silicon rectifiers are compact, versatile and economical. Sarkes Tarzian, Inc., Rectifier Div., Bloomington, Ind. (ELECTRONIC TECHNICIAN 7-4)

Centralab CAPACITORS →



Four new dealer kits for stocking and dispensing Hi-Kap ceramic capacitors are now available. These heavy-gauge steel kits contain balanced inventories of the most frequently used capacitors. Individual values are prominently and clearly labeled so that the right capacitor can be located instantly. New rigid plastic package permanently separates each value. The cabinet, valued at $4.75, is included without charge with each kit. Centralab Div., Globe-Union, Inc., 900 E. Keefe Ave., Milwaukee 1, Wisc. (ELECTRONIC TECHNICIAN 7-3)

PLAIN FACTS ABOUT
THE LEADER

ELECTRONIC TECHNICIAN's high editorial standards have made it the leading publication in the electronic maintenance field.

How much is it ahead? Here are the facts:

CIRCULATION: ELECTRONIC TECHNICIAN's 54,294 paid subscribers (ABC 12/57) are 8% to 107% more than the other trade papers in the field.

ADVERTISING: ELECTRONIC TECHNICIAN's 206 advertising pages in the first five months of 1958 is not only the largest advertising volume in the field, but is a 6% gain over 1957. All other magazines show a 9.2% to 47.4% loss under 1957.

CONCENTRATION: ELECTRONIC TECHNICIAN's professional service technician concentration, defined by us as ABC business categories 1, 2 and 4 for 11/57 (eliminates such groups as students and unclassified) is 94.67% of total paid circulation. Other magazines have 74.69% to 83.28% professional service technician concentration.

COST/M: ELECTRONIC TECHNICIAN's advertising cost of $13.17/M total paid is 4% to 46% less costly than other magazines (based on 1-page rate). The cost of reaching service technicians only is $14.02/M, or 24% to 55% less expensive.

EDITORIAL: ELECTRONIC TECHNICIAN's 255.84 editorial pages in the first five months of 1958 is 38.5% to 135.2% greater than all competing publications.

RENEWAL: ELECTRONIC TECHNICIAN's subscription renewal rate of 51.19%, ABC 12/57, compares with 32.09% to 37.27% for other magazines in the field.

Catalogs & Bulletins

POTENTIOMETER TERMS: A new bulletin explains some 42 technical terms used for potentiometer transducers. Formulas are included. Based on the National Aircraft Standards Committee Specifications NAS 710. Bourns Laboratories, Inc., Instrument Sales Div., P.O. Box 2112, Riverside, Calif. (ELECTRONIC TECHNICIAN B7-2)

PLIERS: Catalog sheet gives features and prices on high voltage insulated plastic pliers. Also outlines special order deal which includes a satellite display free. General Cement Mfg. Co., 400 S. Wyman St., Rockford, Ill. (ELECTRONIC TECHNICIAN B7-4)

TEST EQUPMENT: The new 1958-1959 catalog lists 75 precision electronic instruments on 52 pages. The information is cross indexed alphabetically by instrument function. 19 of the instruments are new. Specifications and prices are included. Kay Electric Co., Maple Ave., Pine Brook, N. J. (ELECTRONIC TECHNICIAN B7-7)

KITS: A 24-page catalog illustrates and describes a large variety of kits, including hi-fi, stereo, transistor radio, ham and test equipment. Also gives an explanation of stereo and how to plan your Hi-Fi system. Heath Co., Benton Harbor, Mich. (ELECTRONIC TECHNICIAN B7-9)

BOOSTERS: Descriptive sheet covers Model B-23 one or two-set TV Booster, giving illustrations, specifications and prices. Also information for Model DA8-B for operating 3 to 8 TV sets. Blonder-Tongue Laboratories, Inc., 9-25 Alling St., Newark 2, N. J. (ELECTRONIC TECHNICIAN B7-1)

PLUGS: A 16-page catalog, designated as MS-E-3, covers a new lighter and shorter version of the MS-E line of plugs which conform to the provisions of Military Standard MIL-C-5015. Cannon Electric Co., 3208 Humboldt St., Los Angeles 31, Calif. (ELECTRONIC TECHNICIAN B7-3)

TV SERVICE SAFETY HINTS: A new pocket-size folder tells the TV technician's story to customers. With humorous text and cartoons, it advises TV set owners "don't do it yourself—call on us," dramatizing the pitfalls of amateur "doctoring" of TV ailments. Space is provided on the folder for the dealer's name. Price is $1.00 for 100. P. R. Mallory & Co. Inc., 3029 E. Washington St., Indianapolis 6, Ind. (ELECTRONIC TECHNICIAN B7-8)

Association News

Canada

Elected at the Annual General Meeting of the Provincial Council of RETA of British Columbia were: Pres., R. V. Mielen; Secy., S. B. Spencer; and Treas., E. Wheeler.

California

A tour of the behind-the-scenes engineering operations of the Burbank, Calif. studios of NBC was enjoyed by members of RTA of Pasadena. A close-up inspection of the studios, cameras, lighting equipment, monitors and controls, film cameras, video tapes, etc., was guided by engineer Palmerston.

A new year—with new officers, new resolutions and new enthusiasms—is now beginning for San Mateo County's Television Service Dealers' Association. Officers elected are: Pres., Winston D. Haines; V. P's, Lloyd Williams and M. W. Kehler; Secy., F. "Mac" McCarthy and Treas., Gordon Cole.

RTASCV passed another milestone with the opening of a headquarters office in downtown San Jose. The headquarters establishes a clearing house for information pertaining to association business activities and opens new avenues of activity which make the Association of far greater value in its service to member firms and the general public. The office is located on the same floor and practically adjacent to the Better Business Bureau. Wes Strouse, who was instrumental in organizing the Association is their better business advisor.

Connecticut

The Television Service Association of Connecticut elected the following new officers: Pres., William F. Stanek; V. P., Joseph J. Francis; Secy., Deane Gould; Treas., Anthony Lackpo; Fin. Secy., Peter Lucas; and Business Agent, Robert A. Steer.

Georgia

The fourth annual election of officers of The Savannah Electronic Technicians Association, Inc. seated: Pres., Clyde Roberts; V. P. Ed Hagen; Secy., Curt Hoffman; Treas., Raymond Davis; Board of Directors: Lamar Partee, James Williams, Dick Beasley, Tom Dubberley, and Joe Winders.

(Continued on page 64)

(BOOKS . . . cont'd from page 18)

FM RADIO SERVICING HANDBOOK. *By Gordon J. King. Published by The MacMillan Co., 60 Fifth Ave., New York 11, N.Y. 192 pages. Hard cover. $5.00.*

Interest in high fidelity has encouraged the use of FM receivers, making this form of reception a more important part of the technician's activities. This text encompasses such subjects as detectors, i-f's, alignment, antennas and frequency changer circuits. It's well written and quite informative, but it suffers from the absence of U.S. equipment. Written in Britain, it naturally uses British gear for illustration. However, this book is sufficiently thorough and informative to be recommended to service technicians—or as they are so aptly called in England—service engineers.

ELECTRONIC PUZZLES AND GAMES. *By Matthew Mandl. Published by Gernsback Library, Inc., 154 W. 14 St., New York 11, N.Y. 128 pages. Soft cover. $1.95.*

Electronically, everything in this book is pretty simple. However, if you would like to put some spare time to use strictly for entertainment, you may find such electronic games as Street Light, Little Thinker or Satellite amusing. Construction details for 20 basic types are clearly explained.

Audio NEWS LETTER

JENSEN INDUSTRIES will increase its plant floor space 50% to 60,000 sq. ft.

LITTON INDUSTRIES is buying WESTREX. Sale is in compliance with 1956 U.S. District Court judgment.

METZNER will make available a new tape transport mechanism. This Starlight 120 model has stacked stereo heads, sells for $179.50.

WALSCO has added 19 phono and recorder drives and belts, replacements for Webcor, Revere, Viking, Crestwood recorders, and Admiral, Garrard, RCA, Webcor, Philco and Monarch phonos.

FM COMES OF AGE. EIA will expand its statistical service to include monthly FM receiver production. There are now 540 commercial FM stations, 145 noncommercial, and 72 construction permits (vs. 23 a year ago).

PILOT RADIO is handling Metropolitan New York sales directly instead of through reps, effective June 1. Territory is covered by following factory men who have been selling in the area: Irving I. Needle, Lewis Abeles and Nelson P. Nelson. Long Island City plant serves as New York sales office.

INSTITUTE OF HIGH FIDELITY MANUFACTURERS is compiling the results of a study of the audio interests of 5,000 electronic-TV service dealers throughout the country. Highlights announced are that 85% install and repair hi-fi components such as speakers, tuners and amplifiers; 65% sell hi-fi components, 45.9% of this group doing $2,000 a year or more in hi-fi component sales, over half of these in turn doing $5,000 a year and more.

OLYMPIC RADIO is importing a British-made stereo phono and radio line, which will be marketed under the Olympic-Continental label.

RADIONIC INDUSTRIES has come out with a line of PA amplifiers, 10, 20 and 30 watts, latter two with phono tops available.

REEVES SOUNDCRAFT is making Magna-See, a solution that makes tape recorded sound tracks visible. It's used in equipment checks and editing.

WABER ELECTRONICS, 105 Heatherwood Rd., Havertown, Pa., has come out with a line of strobe-marked record pads, sound absorbers, FM antenna, connectors and outlet boxes.

AMERICAN MICROPHONE appoints reps: Robert W. Peters, Cleveland; Stan Cluphf, Rocky Mountain; Telesco International, export agency. The company also released a new 16-page catalog on the full line.

MAGNETIC TAPE CARTRIDGES will be big news this fall. Standardization looks promising, with a number of recorder manufacturers rumored to view RCA's design favorably. Cartridges will not be usable with present recorders without substantial conversion.

RCA has unveiled a complete line of stereo products. Stereo Victrolas range from $129.95 for a portable record player to $2500 for the Mark I. Additional speakers are $9.95 to $125.95. 32 stereo tape cartridges are being released this month, listing at $4.95 to $8.95. These interesting plastic magazines employ 4 tracks @ 3-3/4 ips; special recorders for playing these tapes are $295 for semi-automatic, $450 for fully automatic. 55 stereo records are being released, including 17 classical, priced slightly higher than monaural discs.

Electroluminescence

A Progress Report

• The fascinating possibilities of electroluminescence have captured the imagination of architects, engineers and the general public. Recent articles have painted a glowing picture of great things just around the corner—walls and ceilings that glow softly or brilliantly with color and pattern that can be changed almost at will; luminous drapery and wallpaper; light that you can buy by the square inch. However, due to low brightness and low efficiency it has not become popular. For general lighting use, it simply cannot compete with present standard light sources. For example, a high-quality luminous ceiling, using fluorescent lamps, may cost about $1200; annual operation is $60. The equivalent electroluminescent panel ceiling, including the necessary high-voltage, high-frequency power supply, would cost about $12,000; operating cost would be $8000.

Thus we find electroluminescence used today for a few specialized applications in darkened areas—instrument panels, clock faces, and the like. But broad general use must await major developments. Such developments are the objectives of an extensive research program by General Electric.

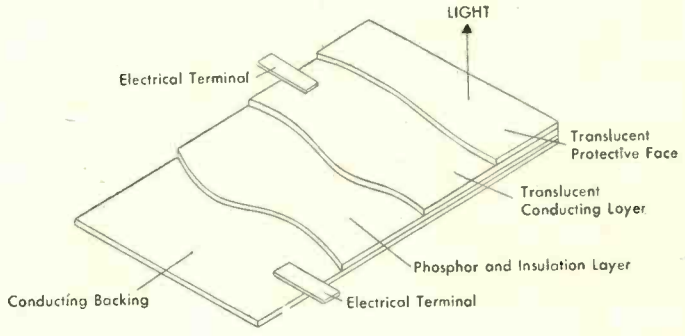
GE reports that present forms utilize crystalline phosphor powders (somewhat like those used in fluorescent lamps) sandwiched between two electrically conducting surfaces, at least one of which is translucent. AC connected to the conducting surfaces causes the phosphor to emit light. The device is electrically similar to a capacitor, and has been called a "luminous condenser."

Perhaps the most unusual thing about electroluminescence is that it converts electricity directly to light. There are no intermediate stages as in incandescent lamps, where the electric current first heats a tungsten wire, thus causing it to glow; not as in fluorescent lamps, where the electrical energy is first converted to ultraviolet radiation, which in turn is converted into light by a phosphor.

In theory, electroluminescence might eventually produce light much more efficiently than any of our present light sources. Incandescent tungsten lamps can convert at most about 10% of their electrical input to light; fluorescent lamps can convert at most about 25%. Ultimately electroluminscent lamps may convert a considerably higher proportion of their input to light.

Three basic structural forms of electroluminescent lamps appear to have possibilities; glass-faced, ceramic-on-metal, and flexible plastic. The essential elements of

Construction of electroluminescent panel shows multiple layers.



an electroluminescent lamp are very thin. For example, the two conductive layers may be separated by only a few thousandths of an inch. Varying amounts of additional thickness are, of course, required for external insulation material and for a backing panel to supply structural strength. At present, an unlighted border one-eighth to one-half inch wide is necessary on all types of panels to allow positive sealing and to prevent electrical breakdown at the edges.

In the principle of electroluminescence, there seems to be no inherent limit to the possible sizes and contours of panels. Panels as large as two feet square appear practical at present. In larger sizes, strength, weight, and uniformity of brightness may become limiting factors.

The color of the light produced by electroluminescent sources depends on the phosphors selected. As with any light source, color filters can be applied over the panels. A further method of modifying the color is to superimpose a translucent layer of fluorescent material which, when activated by radiation from the panel, emits energy at a different wavelength. As the frequency of the applied voltage is increased, spectral distribution of some phosphors tend to shift toward shorter wavelengths.

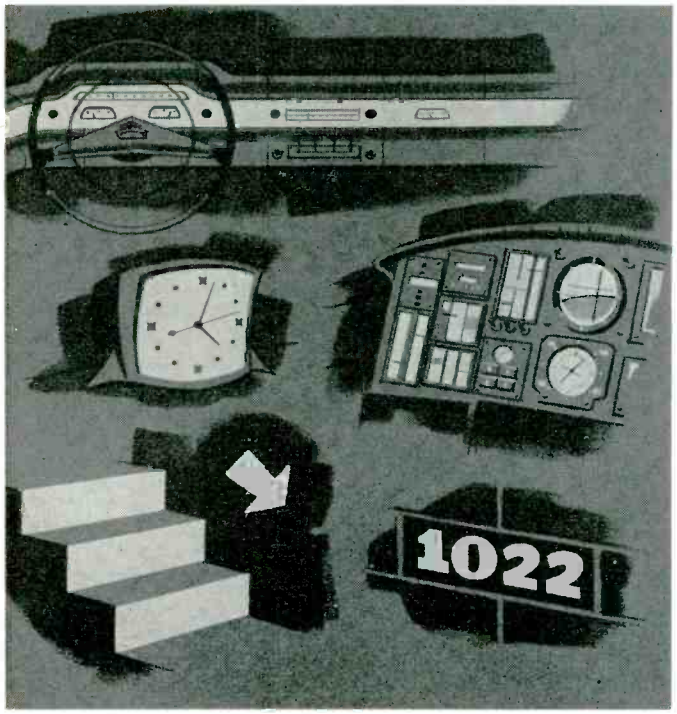
The brightness determines the amount of light emitted. At present, experimental panels operated on regular 120-volt, 60-cycle circuits give three of four lumens/sq. ft. (footlamberts) in green. This is the brightest color, mainly because its energy is in the wavelengths of greatest eye sensitivity. The brightness of white is about one half that of green. Brightnesses of this order are effective only in relatively dark surroundings.

To give some idea of the amount of light generated—it would take 400 sq. ft. of white electroluminescent panels to produce the same amount of light as a 60-watt incandescent bulb.

Useful life of electroluminescent panels is indeterminate, but seems to be in the order of thousands of hours. Failure is gradual, rather than sudden. Light output and efficiency fall off more rapidly during operation at higher

(Continued on page 65)

Electroluminescent lamps are now feasible for applications such as those shown. Ultimately they may become more economical than conventional light sources.



News of the Industry

INSTITUTE OF HIGH FIDELITY MFRS. INC. reports the appointment of FREELON M. FOWLER as Public Relations Director.

SERVICE INSTRUMENTS CORP. announces an increase in sales of 166% for the first quarter of 1958, over any previous quarter.

GENERAL CEMENT MFG. CO. has named ANTHONY C. VALIULIS, Exec. Vice Pres., and RUSSELL D. GAWNE, Vice Pres. and Sales Director.

Q. T. WILES, 38-year old President of GOOD-ALL ELECTRIC MFG. CO., Ogallala, Nebr., has been elected to membership in the Young Presidents' Organization, Denver, Colo. chapter.

GENERAL INSTRUMENT CORP. has named LAWRENCE R. HILL as Divisional Manager of the firm's newly created special division for new product development.

GENERAL ELECTRIC CO. has appointed GEORGE O. CROSSLAND as central region equipment Sales Manager in Chicago, for receiving tubes. He succeeds GORDON E. BURNS, recently appointed Manager of distributor sales at Owensboro, Ky.

ELECTRONIC INSTRUMENT CO. (EICO) has a new point-of-purchase display stand, for the firm's test instruments and hi-fi equipment, available in a package deal to distributors and hi-fi dealers. The company has expanded lab and production space to 45,000 sq. ft.

PHILCO CORP., in reorganizing their Consumer Products Div., has named as Vice Presidents for that division: LARRY F. HARDY, functioning as general manager; HAROLD W. SCHAEFER, for product development and planning for appliances; ARMIN E. ALLEN, product development and planning for electronics; E. S. BROTZMAN, electronic operations; WILLIAM A. McCRACKEN, appliance operations; and HENRY E. BOWES, head of the marketing department. Also the following marketing department personnel: JOHN A. RISHEL, Jr., Manager; GIBSON B. KENNEDY, General Sales Manager, JAMES J. SHALLOW, General Manager of merchandising.

HUGH H. EBY CO. reports that the company has been discharged from bankruptcy as of May 22, 1958.

XCELITE INC. has established complete warehouse facilities in Kansas City, Mo., under the operation of the firm's representatives F. C. SOMERS CO.

COLMAN TOOL & MACHINE CO. has appointed LEE SCHWEITZER as Sales Manager for the electronic replacement market. Sales offices and warehouse space are being added which will increase the firm's floor space by approximately 50%.

Reps & Distributors

WESTCHESTER ELECTRONIC SUPPLY CO., White Plains, N. Y., has appointed LOUIS DAVIS as sales manager and branch co-ordinator.

MAGNECORD DIV. MIDWESTERN INSTRUMENTS has named MARTY BETTAN, Flushing, N. Y., as sales representative in northern New Jersey and Metropolitan New York area.

GENERAL ELECTRIC CO. has opened a new distributor sales office in New Orleans, La., headed by WILLIAM F. FLANAGAN. Two new sales managers have been appointed: DAVID N. PLATT, Atlanta, Ga., and E. KYLE COOPER, Birmingham, Ala. to handle tubes, semiconductors, hi-fi, resistors and lamps.

ALLEN B. DU MONT LABS. INC. announces the following representatives won bronze plaques for top place in 1957 renewal sales: ROBERT E. CLEMENSON of CLEMENSON-LARABEE CO., Kansas City, Mo. for TV picture tubes; and JOHN T. STINSON, Havertown, Pa., for receiving tubes. Award pins were won by 11 other reps.

BOURNS LABS. has added five commercial distributors, bringing the total to seventy-two now handling the new "Trimit" potentiometer: INTERSTATE ELECTRONIC SUPPLY, Wichita, Kan.; and four in Pennsylvania: RADIO DISTRIBUTING CO., Harrisburg; MOYER ELECTRONIC SUPPLY, Pottsville; ALVO ELECTRONICS, State College; and SHELBURNE ELECTRONICS, Wilkes-Barre.

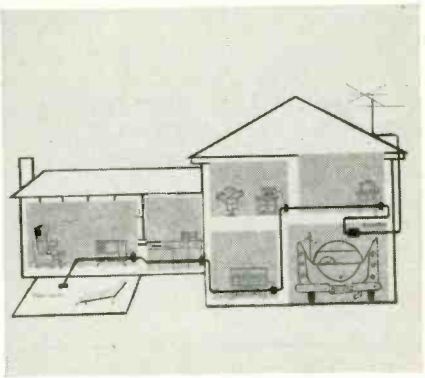
(Continued on page 62)

New Products

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

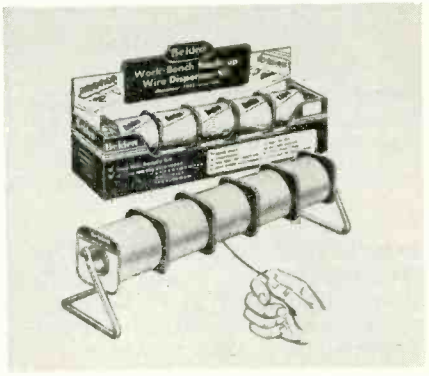
Jerrold HOME SYSTEM →

The TV-FM Amplified Home System takes a unified approach to home entertainment by amplifying and distributing TV and FM signals from rooftop antenna to every room in the home. Signals are amplified through a low-noise, high-gain TV-FM Amplifier before distribution. The entire system is designed for easy installation in existing homes or those under construction, and utilizes regular twin lead-in wire. Jerrold Electronics Corp., 15th St. & Lehigh Ave., Philadelphia 2, Pa. (ELECTRONIC TECHNICIAN 7-11)



Belden DISPENSER KIT →

Hook-up Wire dispenser kit saves time, space and waste. Each kit contains an assortment of hook-up Wire colors and types plus a free metal dispenser rack suitable for workbench or wall mounting. The new kits are available in the 14 most popular assortments of vinyl, vinyl-nylon, textile and teflon insulated wires. They simplify stock maintenance, keep the wire clean and orderly, and help keep the workbench clear. Belden Mfg. Co., 4647 W. Van Buren St., Chicago 44, Ill. (ELECTRONIC TECHNICIAN 7-12)

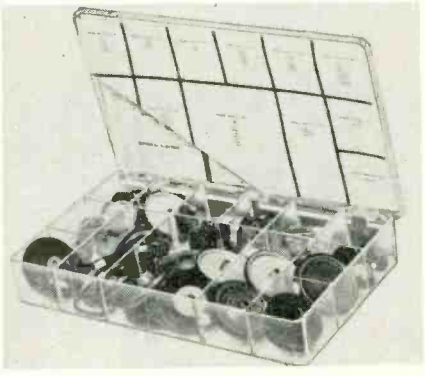


Alpha TEST LEADS →

This new test lead line fills the technician's need for one convenient, centralized source for the variety of professional test leads needed in repair work. It is carefully designed for electro-mechanical competence and versatility, and comprises the 12 most-useful combinations of test prod and meter tip types. The leads are 50 inches long, #18 gauge conductor, flexible stranding, and have a heavy-duty high-dielectric rubber insulation. Alpha Wire Corp., 200 Varick St., New York 14, N. Y. (ELECTRONIC TECHNICIAN 7-13)

Walsco REPAIR KIT →

A sturdy clear plastic inventory case for phono and recorder drives and belts is now offered free to dealers with each order of drives totaling $10.00 or more. Compartmented to keep drives neat and orderly, and compact enough to be carried on house calls, the case ordinarily sells for $2.50. An up-to-date cross-replacement reference chart is included. A complete kit covers 90% of replacement needs. Inventory is easy to maintain. Walsco Electronics Mfg. Co., 100 W. Green St., Rockford, Ill. (ELECTRONIC TECHNICIAN 7-14)



for Technicians

GI RECTIFIER

The PT5 is now available in quantity to the radio and TV replacement market. The top-hat is rated at 130 volts ac @ 500 ma. The new silicon rectifier can be hooked up by simply connecting its pigtail leads to leads removed from the old rectifier. It does not require clips, fins or chassis contact to dissipate heat, or other mounting device. It is hermetically sealed and employs no pressure contacts. General Instrument Distributor Div., 240 Wythe Ave., Brooklyn 11, N. Y. (ELECTRONIC TECHNICIAN 7-7)

Amperex TUBE

EM84/6FG6, a new type tuning indicator tube, features a rectangular indication pattern, for use in broadcast receivers and tape recorders. The blue-white fluorescent pattern changes in length with signal strength. The tube may be mounted horizontally or vertically. The pattern is displayed on the inner side of the tube bulb to which a fluorescent layer is applied. Amperex Electronic Corp., 230 Duffy Ave., Hicksville, L. I. N. Y. (ELECTRONIC TECHNICIAN 7-8)

Perma-Power MAGNEFORMER

Instantly, conveniently and economically magnetize or demagnetize small tools. The Magneformer is portable and can be used in the factory, shop or home. In less than 10 seconds it can magnetize or demagnetize screwdrivers, nut runners, hammers, pliers, small wrenches, probes, tweezers, special instruments, etc. Simply plug in to any 115-volt a-c outlet. List price of the model F-100 is $7.50. Perma-Power Co., 3100 N. Elston Ave., Chicago, Ill. (ELECTRONIC TECHNICIAN 7-17)

Wassco SOLDERING TOOL

Extremely fast miniature soldering tool designed and built for continuous industrial production soldering incorporates all the proven advantages of the resistance soldering principle and does not require a grounding circuit. The tool is especially efficient in soldering miniature connectors and wherever precision, sensitive soldering is performed. The 105-A1 has three heat outputs; 15, 50 and 100 watts. Wassco Electric Products Corp., 204 S. Larkin Ave., Joliet, Ill. (ELECTRONIC TECHNICIAN 7-18)

Triad YOKES

A new yoke replacement kit, making it possible to service literally thousands of different makes of TV sets from a very small inventory is now on the market. The new Yoke Pack contains eight yokes and twenty-five network kits, offering almost unlimited combinations. Packaged in an attractive display case, it offers both 70° and 90° types with inductance ranging from 8 to 30 mh, plus a special unit for 70-degree direct drive applications. Triad Transformer Corp., 4055 Redwood Ave., Venice, Calif. (ELECTRONIC TECHNICIAN 7-58)

Rogers FLYBACK

A new TV flyback transformer, model EFR 143, is an exact replacement for Capehart part number 850274B-1 and is used in their 24 and 27 inch models. It is packaged in a hermetically sealed plastic container. Rogers Electronic Corp., 49 Bleecker St., New York 12, N. Y. (ELECTRONIC TECHNICIAN 7-9)

South River ANTENNA MOUNT

A new Bantam Tower made of hot-dip galvanized tubular steel has been tested under hurricane velocity winds of 90 miles-per-hour for ruggedness and durability, using a 5-element folded dipole antenna for a wind resistance load. Inspection of both the tower and aluminum mast after a 5 hour continuous test revealed no damage. South River Metal Products Co., 377-379 Turnpike, South River, N.J. (ELECTRONIC TECHNICIAN 7-15)

Philco YOKES

Two new 110° yokes: part No. 322-7775 is the replacement for Ram Y-110; Stancor DY27A; Admiral 94D127-1 and 94D147-3; RCA 104482 (792958-3) and 105053 (792958-4, 5); and Packard Bell 29645C and 29696; and part No. 322-776 with plug, is the replacement for Ram Y-111; Stancor DY-26A; and RCA 104078 (792958-1), 104408 (792958-2), 105632 (792958-6) and (792958-7). Philco Corp., Tioga and C Sts., Philadelphia 34, Pa. (ELECTRONIC TECHNICIAN 7-6)

(Reps. & Distrs. Continued from page 59)

ANDERSON SALES CO., rep firm of Boston, Mass., was judged the winner of MERIT COIL & TRANSFORMER CORP.'s 1957-1958 sales contest.

PERMA-POWER CO. has named LAWRENCE B. COLE & CO., Weston, Mass., as their representatives to cover the New England States.

ELECTRONIC PUBLISHING CO. reports the appointment of two new representatives: THE TEXPORT CO., Dallas, Texas; and LAWRENCE B. COLE & CO., Weston, Mass.

ORRADIO INDUSTRIES reports the appointment of C. L. PUGH CO., Columbus, Ohio, as representative for IRISH tape in Ohio, Western Penna., and West Va.

WILLIAM C. WEBER JR. is the newly appointed Exec. Sec'y of THE REPRESENTATIVES OF ELECTRONIC PRODUCT MFRS., INC., Chicago, Ill.

INDUSTRO TRANSISTOR CORP. announces the appointment of E. S. GOULD SALES CO., 3500 Atwater Ave., Montreal 25, Quebec, Canadian representative.

WINEGARD CO. reports that MORRIS GREEN, Pres., ALAMO RADIO CO., Philadelphia, Pa., was the first distributor to take advantage of that firm's "Mink, Money and Metropolitan" promotion at the 1958 Electronic Parts Show.

PAUL HAYDEN ASSOC., representative firm of East Point, Ga., reports that ground has been broken for a new building to be completed in July. There will be 5000 square feet of warehouse area and space for six offices to house the various departments and increased personnel.

GEORGE F. LANDFEAR reports that he has established his new manufacturers rep firm at 165 Franklin Ave., Nutley, N. J., to specialize in electronic test equipment, and to cover southern New York, New Jersey and Eastern Penna.

ERIE RESISTOR CORP., Electro-Mechanical Div., has appointed the following representatives for instrumentation products, manufactured by the Erie-Pacific Div., Hawthorne, Calif.: ATCHESON & ADAMS, Greensboro, N. C.; ARCO ENG'G CO., Washington, D. C.; KENNETH E. HUGHES CO., Union City, N. J.; J. P. PEIRCE CO., Detroit, Mich.; and G. S. MARSHALL & CO. for Calif. and the Southwest.

New Products

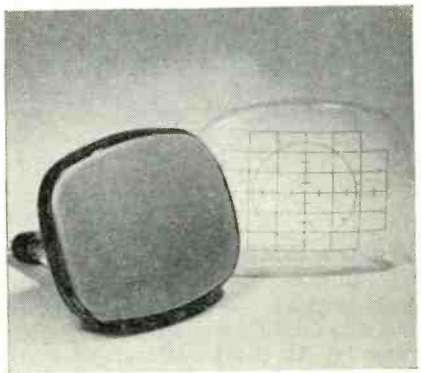
Ungar DE-SOLDERING KIT

This seven piece kit features a variety of specially shaped tips for fast, easy and safe removal of printed circuit components. One tip is slotted so that it simultaneously melts solder and straightens folded or bent tube tabs and other component leads bent against the board. In one operation, a bar type tip

will de-solder straight line components such as resistors, capacitors, etc. Specially designed cup shaped tips will melt solder on all tube tabs and center pin in one operation. Ungar Electric Tools, Inc., 4101 Redwood Ave., Los Angeles 66, Calif. (ELECTRONIC TECHNICIAN 7-51)

CBS CRT

A new aluminized test picture tube, type 8JP4, is designed for servicing 110° TV receivers having picture tubes of any size and type of base. The compact, lightweight tube is portable and easy to use in the service-shop or on home calls. The separate chassis of one of the newer TV receivers can be conveniently transported for bench servicing and the



bulky picture tube and cabinet left in the home. Other time-saving advantages include electrostatic self-focus . . . no ion trap to adjust . . . and no external conductive coating to discharge. CBS-Hytron Div., Columbia Broadcasting System Inc., Danvers, Mass. (ELECTRONIC TECHNICIAN 7-52)

RCA TUBES

7027, a high-perveance beam power tube, for use in push-pull power-amplifier circuits of high-fidelity audio equipment. Features high power sensitivity and high stability. Two 7027's in class AB1 push-pull service with 450 volts on the plate can deliver a maximum-signal power output of 50 watts with total harmonic distortion of only 1.5 percent.

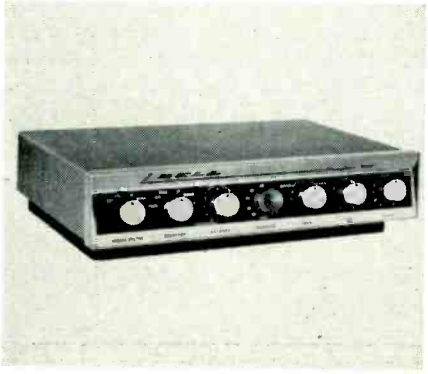
OC2, a cold-cathode, glow-discharge voltage-regulator tube, 7-pin miniature type, will supply a regulated voltage of approximately 75 volts d-c, when cathode currents are within the range of 5 to 30 ma.

7117, a multiplier phototube of the 9-stage type is designed for automobile-headlight-dimming service. It has instantaneous response to meet the timing requirements of headlight-control service and is capable of providing stable performance over long periods.

7163, a cadmium-sulfide photoconductive cell is designed for use in street-lighting control and other light-operated relay applications in industry. Direct relay operation, without the use of an amplifier, is possible in most applications because of the extremely high illumination sensitivity. Other outstanding features are its small size and sturdiness achieved through its compact, space-saving construction. It is enclosed in a metal envelope with a glass window and is hermetically sealed to permit operation under conditions of high humidity. Radio Corp. of America, Tube Div., Harrison, N. J. (ELECTRONIC TECHNICIAN 7-5)

Bell STEREO AMPLIFIER

The new 2-channel stereo amplifier, model 3030, is rated at 15 watts for each channel. It is a complete 2-channel stereo amplifier on a single chassis, with built-in preamplifiers. Stereo function is simplified through the use of only one set of controls for operation for both stereo channels simultaneously. A separate balance control automatically adjusts the volume level between two stereo speakers. The control has a



built-in channel reverse feature. The filter has hi and lo frequency cut-off. A push-pull on/off switch with a continuously variable loudness control compensates for bass and treble at low listening levels. Output parallel switch on rear chassis provides 30-watts of power for monaural listening. Bell Sound Systems, Inc., 555 Marion Rd., Columbus, Ohio (ELECTRONIC TECHNICIAN 7-53)

Rohn ANTENNA MASTS

Mast tubing in a variety of sizes and weights is now available in "Rohnkote" enamel. The new six-step enameling process applies a hard, highly corrosion-resistant coating to the surface. The entire tube is dipped to assure complete and uniform coverage inside and out. Lustrous appearance and weather resistance are achieved by baking the coated tubes. Rohn Mfg. Co., 116 Limestone, Bellevue, Peoria, Ill. (ELECTRONIC TECHNICIAN 7-16)

Hamer-Dril TOOLS

This new model Hamer-Dril has an air-cooled perforated steel handle that stays cool. There are no moving parts to snag clothing. It drills, chips, chisels, rivets, caulks and hammers concrete, stone, metal, marble, brick, and tile, in walls, floors, and ceilings with standard toolbits. It is a sturdy working tool, well engineered, and made of aircraft grade steel. Hamer-Dril Co., 512 Greenwich St., New York 13, N. Y. (ELECTRONIC TECHNICIAN 7-62)

Association News

(Continued from page 53)

Illinois

Several releases from NATESA headquarters are of vital interest to all home electronics service people, "Problems of the Independent Home Electronics Service Industry," covers the 8 "killer" problems. Also a Cost Analysis brochure gives some down to earth data on pricing. Copies of this material, to interested association leaders, at no charge is available from NATESA, 5906 S. Troy St., Chicago 29, Ill. Register early for participation in the National Convention from August 21-24, 1958, and your room in the Congress Hotel in Chicago. The earlier the registration, the bigger the door prize.

New York

CETA and Jerrold Electronics Corp. of Philadelphia, Pa., hosted a technical meeting on, "TV Reception Techniques And Multiple TV Distribution Systems" at the Belmont Plaza Hotel in New York. Jack Beever, Walter Goodman, Selman Kremer, Gene Reich and other Jerrold key personnel were instrumental in presenting a most informative and worthwhile program. An ambitious technical program is planned for the next fiscal year starting in September. Industrial electronics including a course in closed-circuit TV is contemplated. Members are busy placing posters in distributors' stores to encourage qualified technicians to take advantage of the Advanced TV Servicing Techniques Course established by the Electronics Industry Association.

Pennsylvania

Through much deliberation and discussion between members of the former associations in Philadelphia during the formation of the newly consolidated Television Service Association of Delaware Valley, it was mutually agreed that the membership, as a whole, of the Philadelphia Radio Service Men's Association would not conform with, or meet the qualifications as set forth in the adopted By-laws of TSA Delaware Valley. Consequently, it was voted not to accept PRSMA as a group. Individuals who have qualified have been accepted as members of TSA.

TELERAMA for 1958 was held at the Claridge Hotel in Atlantic City, N. J., on June 20, 21, and 22. A fine agenda covered a wide variety of activities, with some events of special interest for the ladies, including entertainment.

Harrisburg now has an active association known as the Mid States Service Dealers Association. Temporary officers have been appointed.

Texas

San Antonio Radio & Television Association, Inc. had a technical meeting on TV Interference, presented by C. O. Bernard of the FCC, which dealt with causes of outside interference, repairs, and how to make extra profits through this service. Thanks for another top-notch meeting went to Paul Burns of Modern Electronics who arranged for Frank Castle, District Manager, CBS Electronics Tube Division, to speak on Business Management and self-service tube checkers. CBS and Modern have given SARTA $500 to use for advertising directing the public to independent service shops to have their tubes checked by qualified technicians. The TEA clinic will be held in Dallas on August 1, 2, 3.

(Tough Dogs. . .cont'd from p. 37)

December to install when the ground had thawed sufficiently. From that information we suspected an a-c short of some nature in the tuner. Subsequent examination showed a badly charred antenna coil assembly and the center tap to ground had been burned off. The three used channel strips were also charred. It now appeared that somehow, a-c was bypassing the switch through the tuner strips to ground, so we went back to the a-c supply. The manufacturer's specs show a 105 v a-c tap hanging in the power supply transformer. The tap wire had been soldered to the chassis. We removed this ground connection, installed a new antenna coil assembly and new channel strips and the set performed perfectly.

We felt the original owner had never bothered to ground his antenna system or that he employed something other than a folded dipole antenna which had kept the chassis from an electrical ground. This may not be a candidate for the Tough Dog's Section, but I'd sure like to know what else could have been the cause of this trouble other than a mistake in wiring, which didn't show up until the antenna had been grounded.—*B. F. O'Connell, Menomonie, Wis.*

(Electroluminescence. . .cont'd from p. 57)

voltages and frequencies, despite the higher initial brightness obtainable under these conditions.

The dielectric properties of the insulating layer determines the maximum voltage that can be used. Overvoltage causes arcing between the two conducting layers, which shows as bright pinpoints of light and leaves blackened spots.

Since the electroluminescent panel is, electrically, a capacitor, the current through it leads the voltage. Therefore, the device has a leading power factor in the order of 30%.

Ceilings lighted by fluorescent lamps behind translucent plastic, as above, may eventually use electroluminescent panels applied much the same as wallpaper.

In addition to standard 120-volt, 60-cycle power, special power supplies providing non-standard voltages and frequencies may be used for increased brightness. Where dc is the primary power, special conversion equipment would be needed for supplying ac.

Even where standard ac is available, it ultimately may be economically sound practice to convert it to higher voltage and frequency for some applications. •

"One thing about Fred . . . he's never stuck for a tube on *any* service call."

AGC Circuits

(Contineud from page 31)

many symptoms which may seem to have their origin in the agc system, do not. Negative picture, poor sync, horizontal pulling, bending, no picture, no sound, buzz in the sound, poor contrast, poor interlace, snowy picture, hum in the picture, or a combination of these troubles may justify an investigation of the agc system. Defective agc provides either excessive or not enough grid bias, and in some instances the control voltage may not be properly filtered.

To quickly isolate the trouble, override or eliminate the agc by connecting an external bias supply to test point A. The set should be tuned to receive an off-the-air signal. Observe polarity when connecting the bias box and adjust gradually while watching the CRT. If the correct bias voltage is known, use the VTVM and set the bias box accordingly. If the trouble persists, it is safe to assume that the agc system is not the cause of the trouble. If the trouble is eliminated, the chances are that agc is at fault.

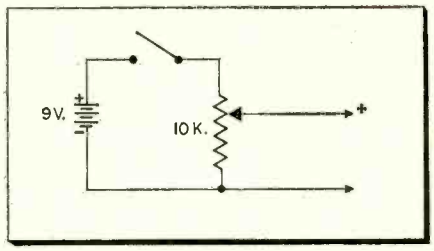


Fig. 4—Simple bias box.

A defect in the signal path from antenna to detector will also upset the agc circuit and cause improper control voltages. This complicates troubleshooting procedure and probably accounts for most of the technician's difficulties. It is therefore advisable to use the bias box to override the agc even when the trouble lies elsewhere in the circuits leading up to the point where agc voltage is developed.

Once the trouble has been isolated to the agc circuit, the VTVM will quickly pin down the problem to either too much or too little control. In many instances this information can be obtained from the way the TV set behaves. The scope comes in handy to trace and examine the detected signal, and the pulse from the flyback, right up to the agc tube. Improper agc filtering action can also be detected when using the scope. As in any electronic circuit using tubes, don't overlook checking the tube and replacing it with one known to be good.

Further isolation of the defect is thus made easier, and a final check with an ohmmeter should single out the defective component. A capacitor checker with ability to detect high resistance leakage paths in capacitors is also advisable. Because of the high impedance character of the agc circuit, capacitor leakage becomes an important factor.

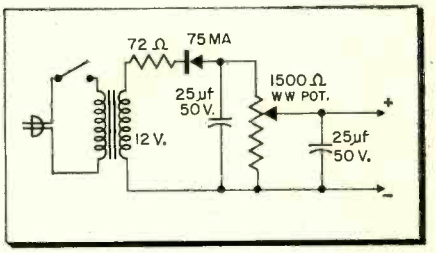


Fig. 5—Improved bias box.

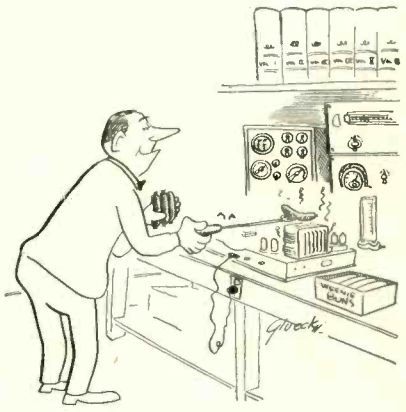
An interesting agc situation may sometime develop when repairing a set with a high voltage problem. When replacing a horizontal output transformer, care must be taken to obtain the correct polarity from the agc winding. Pulses going in the wrong direction will not permit the keyer tube to conduct.

With patient application of a few basic principles and the right test equipment, even agc problems can be simplified. •

Coming in September

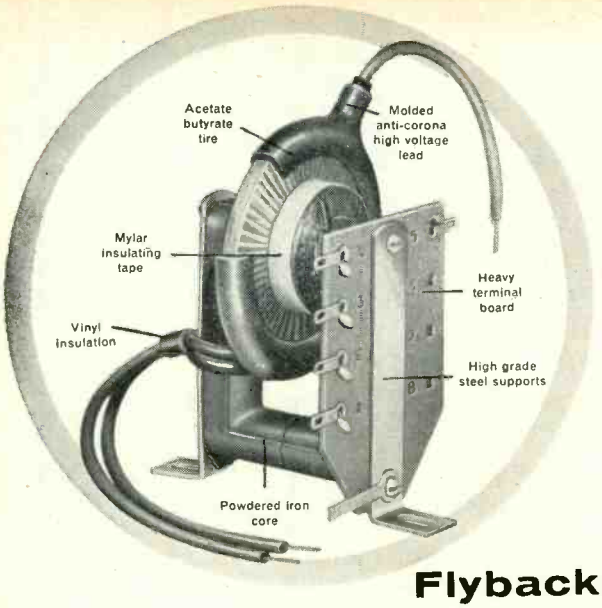
STEREO 1959

See page 45 for details

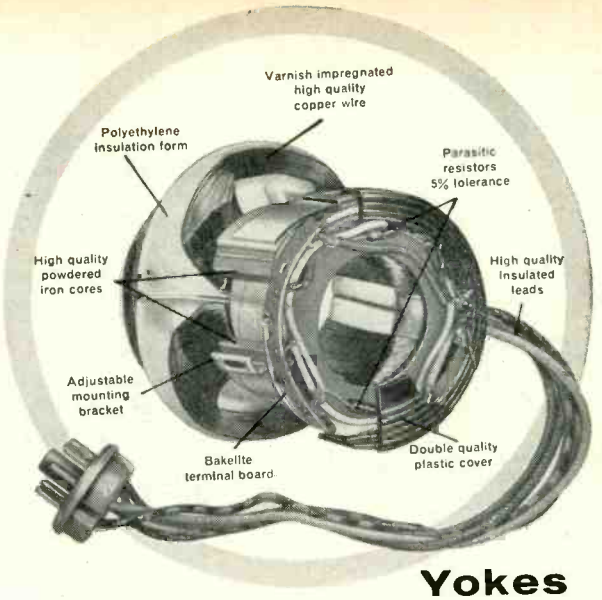


INDEX TO ADVERTISERS
July, 1958

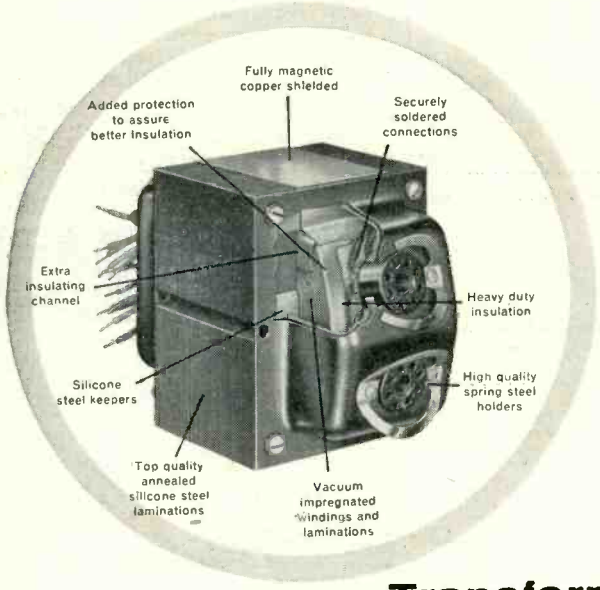
While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.



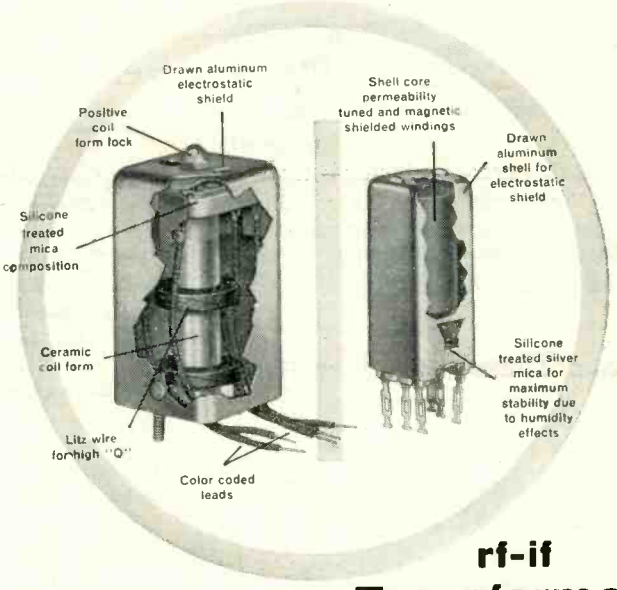
Flybacks



Yokes



Transformers



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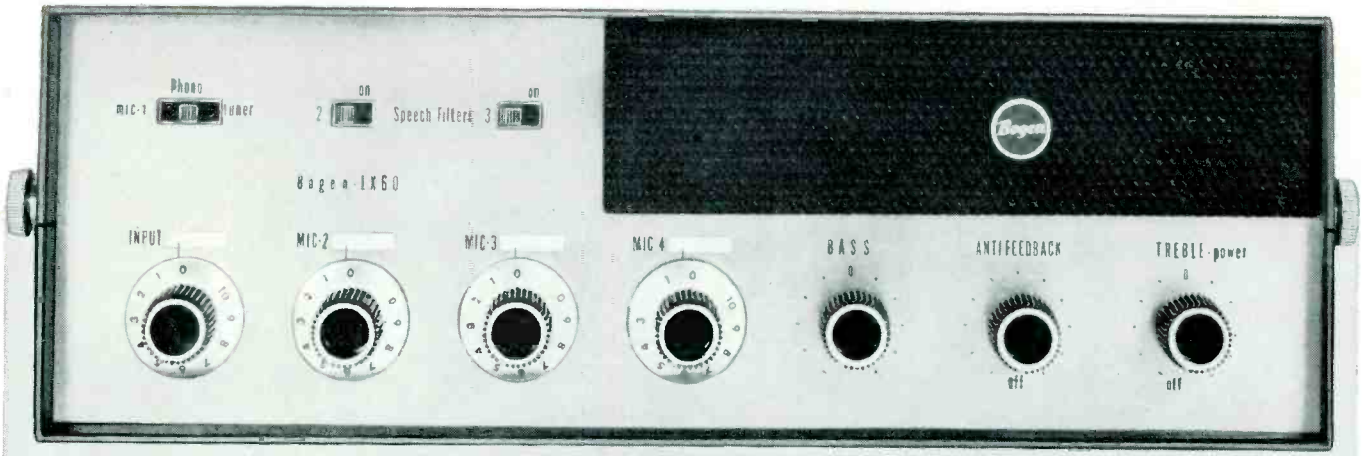


pre-engineered to serve 90% of your sound installations

Deluxe LX30 30-Watt Amplifier

4 Microphone Inputs (panel switch converts one microphone channel for phono or tuner); Built-In Remote Gain-Control Circuit; Exclusive Anti-Feedback Control; Speech Filters; Separate Bass and Treble Tone Controls.

H. 5⅜". W. 16¼", D. 13". Wgt.: 25 lbs.

Superb L330 30-Watt Amplifier

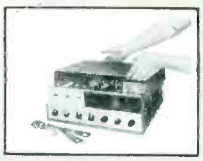
3 Microphone Inputs (panel switch converts one microphone channel for phono or tuner); Speech Filters; Separate Bass and Treble Tone Controls.

H. 5⅜", W. 14¼", D. 13". Wgt.: 24 lbs.

BOGEN'S FLEX-PAK LINE has the flexibility you need to meet virtually every PA installation problem. Flex-Pak units are light, compact, portable, and can be used separately or grouped together. The amplifiers are available in every popular price range and power output . . . 13 models in all. That's why, with Flex-Pak, you can tailor the sound system to fit the job, with none of the fuss and bother of custom installations.

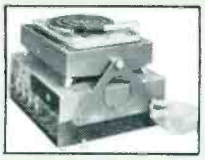
And remember—you can look to Bogen for *all* your sound equipment needs . . . speakers, microphones, turntables, tuners, and accessories. See your Bogen distributor today.

EASY SERVICE . . . EASY INSTALLATION



Loosen 4 thumbscrews and the lid's off for fast, easy servicing.

Folds back when not in use in easy-sliding wall-mount bracket.



4 thumbscrews attach accessory record player mount.

Easily erased write-in's on gain controls mark level settings.

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A Division of The Siegler Corporation

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David Bogen Company, Paramus, N. J., Dept. P-7

Gentlemen: Please send me descriptive catalog on your BOGEN FLEX-PAK *Public Address Equipment and 24-page, illustrated brochure, "What You Should Know About Sound Systems."*

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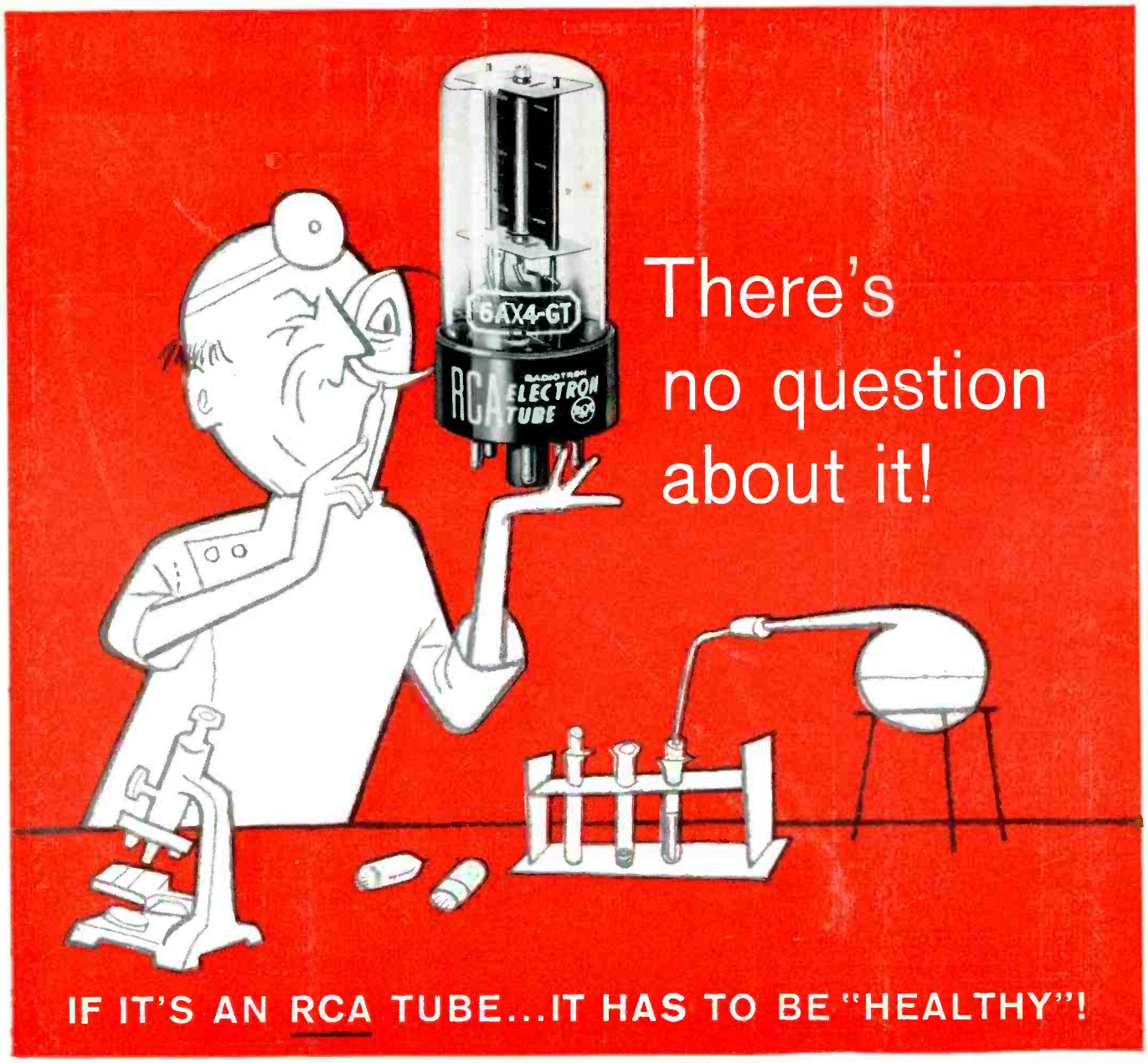

RCA *specializes* in the production of *"healthy"* tubes. Take the RCA-6AX4-GT, for example. It features important built-in safety factors that minimize internal breakdowns and "arc-over", reducing early-hour failures—while providing reliable performance in TV damper circuits. Here are some of the ways RCA builds this "good health" into the 6AX4-GT:

Heater wire has been specially developed to improve welds, thereby reducing early-hour failures due to an open circuit at the weld point. Heater-spacer assemblies are pre-fired to eliminate leakage-producing contamination during tube production. And micas are specially sprayed to control plate-to-cathode leakage.

These are some of the reasons why many designers and manufacturers of TV sets specify RCA's 6AX4-GT—the very same reasons why you should always ask your RCA Tube Distributor to *"Ship RCA Only"!*

RCA Technical Booklet Available

RCA Receiving Tubes and Picture Tubes for AM, FM, and Television Broadcast (1275-H) . . . includes socket information and useful data for more than 700 tube types. Ask your RCA Tube Distributor for your copy today!

RADIO CORPORATION OF AMERICA

Electron Tube Division — *Harrison, N. J.*