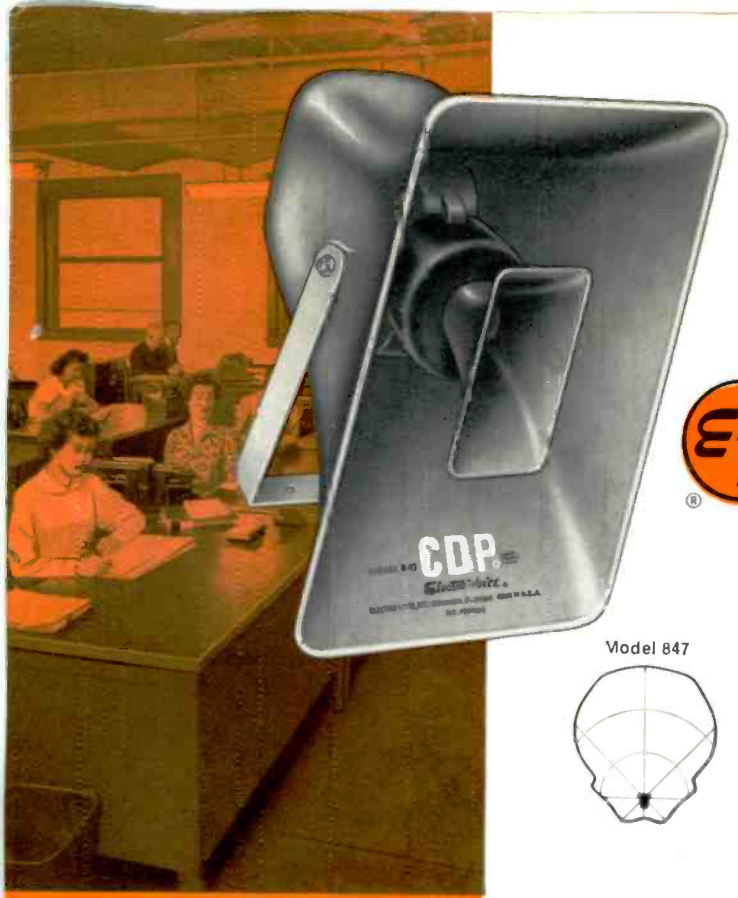
ELECTRONIC TECHNICIAN

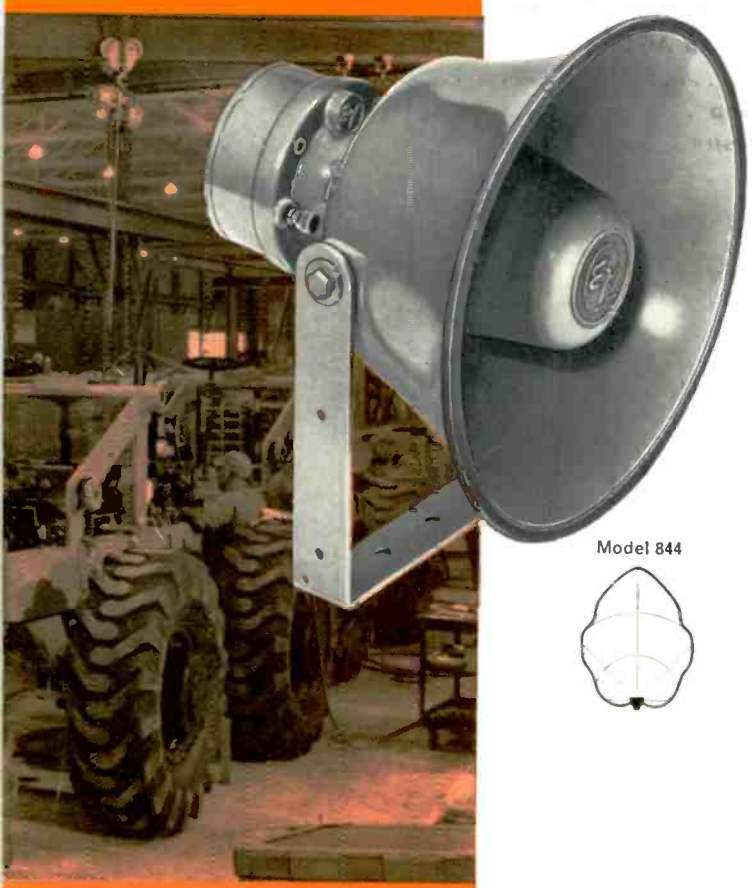
Now Including
SERVICE
Magazine

PROGRESS in PRINTED WIRING

50¢
June • 1959



Model 847



Model 844

843 CDP

848L CDP

Musicaster

HEAR PAGING
Clearer...Easier

SAVE MONEY, TOO!

advanced engineering assures
CLEARER COVERAGE with FEWER SPEAKERS
...improves efficiency...reduces listener fatigue

Every installation further proves the efficiency, utility, and economy of E-V sound projectors. Messages become easier to understand without listener fatigue. At the same time, you save cost by using fewer speakers for proper coverage of the listening area. Wherever paging is required, get the benefit of natural voice reproduction.

Choose the Type Designed to Meet Your Paging Needs

WIDEST DISPERSION. Exclusive CDP dual-diffraction design* gives uniform, wide angle coverage at all frequencies . . . no dead spots, no hot spots. Exclusive E-V compound horn reduces compression distortion to as low as 2% at full power—thus assuring minimum listener fatigue at any sound level. High efficiency performance cuts the need for costly high power amplifiers.

CONCENTRATED COVERAGE. E-V newly designed reentrant projector provides highest intelligibility at lowest cost where sound must be concentrated. Handles twice the power of conventional speakers, for greater penetration.

Model **847** 25-watt CDP. Has two coaxially-mounted horns working from opposite sides of a single diaphragm. Special edgewise-wound voice coil provides 18% greater efficiency. Wide-range response: 250-10,000 cps. Sound pressure level: 114 db. Dispersion: 60° x 120°. Imp.: 16 ohms. Indestructible fiberglass horn. Size: 11¾" x 7¾" x 10¼" deep. Net wt. 6½ lbs.
List Price, $46.33

Model **847-45** CDP with 45-ohm voice coil for intercom applications.
List Price, $47.83

Model **844** 30-watt Reentrant. Diecast aluminum horn, with removable driver, and universal mounting bracket. Designed for easy servicing with field-replaceable voice coil. Wide-range response: 250-10,000 cps. Dispersion: 90°. Sound pressure level: 120 db. Imp.: 8 ohms. Size: 9⅛" diam. x 8¼" deep. Net wt. 5 lbs. 10 oz. List Price, $34.50

Model **844-45** Reentrant with 45-ohm voice coil for intercom use.
List Price, $36.00

(Sound pressure level measured at 4 ft. on axis from 500 to 1500 cps with full rated input.)

E-V sound projectors are extra-rugged for long-life service indoors or outdoors. They are weatherproof, blastproof, splashproof. Actual comparison on the job proves their superiority.

*Design Patent 169,904

Write for Bulletin 258A to Dept. 69-T

No Finer Choice than **Electro-Voice®**

Other Popular Models in the Complete E-V Line

For large area sound reinforcement: Model 848 30-watt CDP or Model 848LT 30-watt Long-Throw CDP, at $75.00 list. For high-fidelity voice and music: the E-V Musicaster at $80.00 list. Remember too, you get even better sound when you choose an E-V high-fidelity professional microphone from today's most complete line.

ELECTRO-VOICE, INC. • BUCHANAN, MICHIGAN

ELECTRONIC TECHNICIAN

Now Including SERVICE Magazine

World's Largest Electronic Trade Circulation

ELECTRONIC TECHNICIAN & Circuit Digests, including Service, June, 1959. Vol. 69, No. 6. $.50 a copy. Published monthly by Electronic Technician, Inc. Publication office, Emmett St., Bristol, Conn. Editoriol, advertising ond executive offices, 480 Lexington Avenue, New York 17. Telephone YUkon 6-4242.

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

June, 1959

FRONT COVER Printed circuit manufacturers are becoming more service-minded. As greater accessibility and schematic information are built into these boards, technicians will find that printed circuits pose fewer troubleshooting difficulties than before. See pages 31 and 34.

FEATURES and ARTICLES

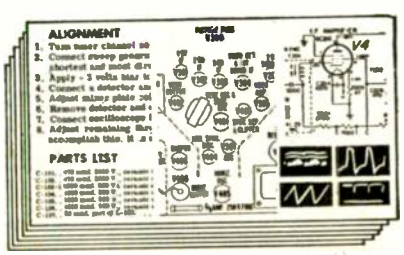
Printed Circuits. Your IQ. (Editorials) 31
"Tuning in the Picture" 32
Printed Circuits and The Electronic Technician ..... S. R. Mihalic 34
Benchman's View of Keyed AGC ..... Perry Sheneman 36
Guide to Foreign Tubes ..... Robert Cornell 38
The Elusive Ground Loop ..... Mannie Horowitz 40
X-Rays at Work in Industry ..... Allan Lytel 42
Free Literature 44
Building a Technical Library 52
Microminiaturization 55
Shop Hints ..... L. C. Huneault, R. L. Goodman 57
TV Antennas for Durability ..... F. R. Voorhaar 58
New Tubes and Transistors 59
Internal Resistance of Dry Cells ..... Nat'l Bureau of Standards 60
"Tough Dog" Corner ..... L. A. Conner, Ivan Ruggles 64

DEPARTMENTS

Editor's Memo 5
Letters to the Editor 8
News of the Industry 20
Reps. & Distrs. 22
Catalogs & Bulletins 22
Audio Newsletter 26
Calendar of Coming Events 33
New Products 66
New Books 72
Association News 73

CIRCUIT DIGESTS 89

IN THIS ISSUE



(16 pp. latest schematics—see last page)

ADMIRAL: TV Chassis 15A2, 15B2, 15B3
ANDREA: TV Chassis VR 121 Series
GE: TV Chassis M5
MOTOROLA: TV Chassis TS434
PHILCO: Transistor Radio Model T-50
PILOT: Hi-Fi AM-FM Tuner Model FA-680
RCA Air Conditioners & Electronic Filter Models C-7100-2; C8150-2; CH-775-2; CH7100-3; CP-8100-2; D-8100-3; D-8150-3

Or Raytheon Pays!

Only Raytheon dares to make this offer:

No if's, and's or but's. If any Raytheon picture tube fails within one year of installation, the Bonded Service Dealer who installed it *will be reimbursed for the cost of his time in making the call-back.*

Of course, he also gets a new picture tube free, as provided by the warranty.

Raytheon distributors are authorized to issue a full $5 credit memo. All you do is fill out the form. The tube must work without a fuss, or you charge the call-back cost to us.

Raytheon makes this offer only because of the outstanding quality of its picture tubes, manufactured to meet strictest original equipment manufacturers' requirements. No other picture tube ever undergoes more torture tests, more inspections, more rigid, rugged double-checks before it comes to your shop.

That's why Raytheon, and only Raytheon, dares to make this offer. When you buy a Raytheon picture tube, you *know* it will perform, or we cover the call-back. Raytheon tubes are made to *last . . . and the price is right, too.*

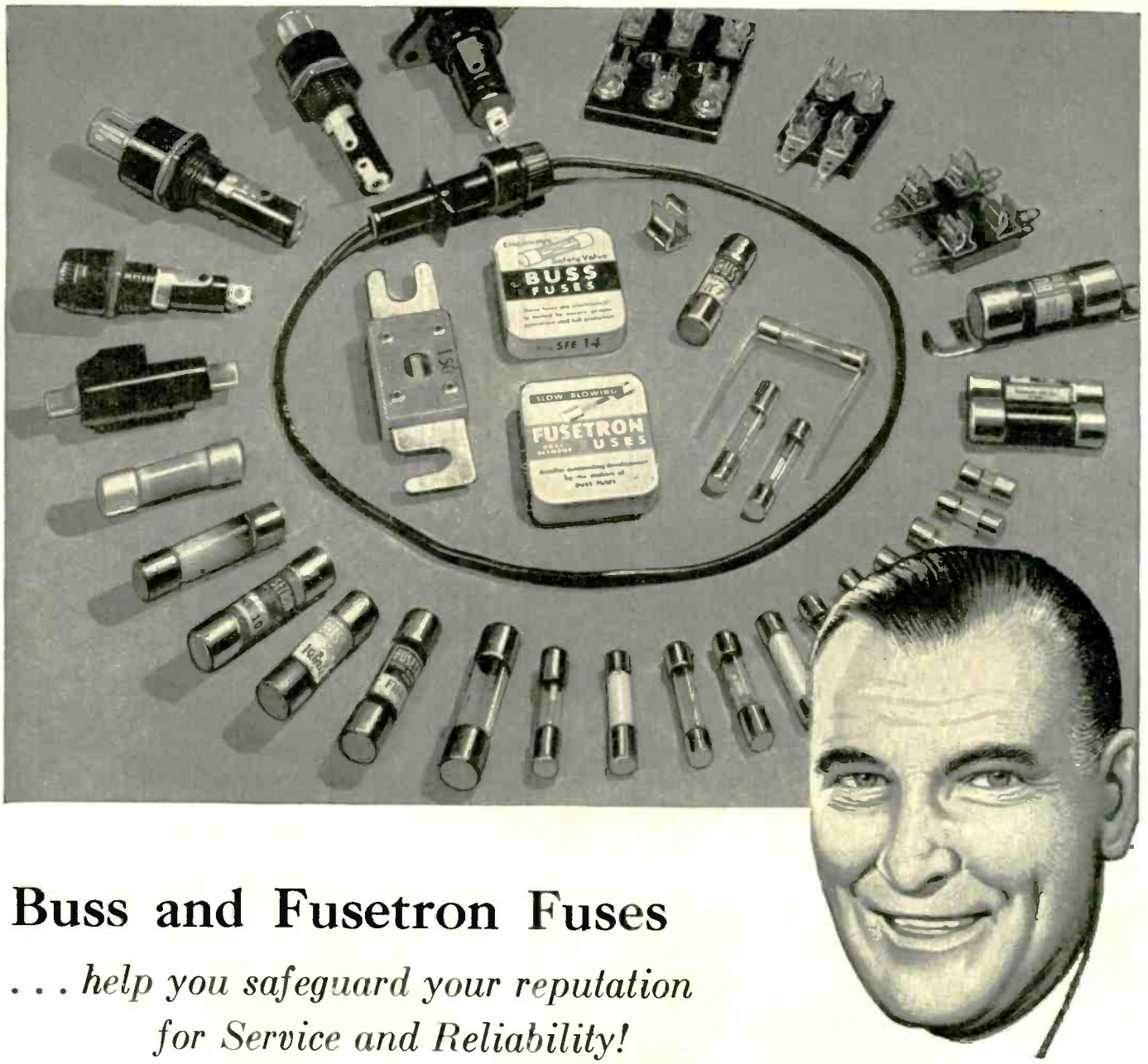
RAYTHEON BONDED TV-RADIO SERVICE

A One-Year Call-Back Guarantee

This offer is made to Raytheon Bonded Dealers only, because of Raytheon's willingness to stand back of the integrity of its Bonded Dealers. See your Raytheon distributor and learn how *you* can become Bonded, too.

Or Our Money's On The Line!

RAYTHEON



Buss and Fusetron Fuses

. . . *help you safeguard your reputation for Service and Reliability!*

Undoubtedly, you take pride in the good name your business has established for sales and service . . . and try to avoid handling any products that could result in customer dissatisfaction . . . which in turn can affect your sales curve.

That's why it doesn't pay to gamble with fuses that could be faulty and create trouble for you and your customers — either by failing to protect and causing useless damage to equipment, or by blowing needlessly and causing unnecessary shutdowns.

With BUSS and FUSETRON fuses safe, dependable electrical protection is assured. Before one of these fuses ever leaves our plant, it is electronically tested to make sure it is right in every way . . . to make sure it will protect, not blow needlessly.

When you sell or install BUSS or FUSETRON fuses, you can forget about customer complaints and costly call-backs. You are sure too, that you provide your customers with the finest electrical protection possible which, in turn, helps protect your reputation for service and reliability.

To meet all fuse requirements, there's a complete line of BUSS and FUSETRON fuses in all sizes and types . . . plus a companion line of fuse clips, blocks and holders.

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

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

659

BUSS fuses are made to protect - not to blow, needlessly.
BUSS makes a complete line of fuses for home, farm, commercial, electronic, electrical, automotive and industrial use.

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS
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Editor's Memo

Here is a most exciting story of basic scientific discovery. No multi-million dollar atom smashers were used. Instead, a relatively simple light and filter system—plus an inquisitive mind—unearthed some startling facts which completely upset our entire classical concept of color. Three primary colors are *not* needed to produce all other colors!

As described in the May 1959 issue of *Fortune*, Dr. Edwin Land, founder of Polaroid Corp., was experimenting with a three-color projection system. He blocked off the blue light while a red image was on the screen. When he removed the green filter, white light flooded the screen, washing out the red. Land's assistant asked why she could still see a variety of colors, including blue and green. Land replied that eye fatigue was the reason.

But his scientist's conscience kept troubling him. At 2 A.M., too troubled to sleep, he returned to the lab to repeat the experiment, this time dimming the white projector so it would not overpower the red. Instantly, the projected scene burst into lifelike color.

Land's finding showed that the color "laws" scientists have followed since Newton's prism discoveries 300 years ago, and Maxwell's color photography "laws" of 100 years ago, did not really explain color. Interestingly enough, even Land's findings were not really new. In 1914 and again in 1929 patents were issued for color photo systems similar to Land's, but scientists missed their significance.

Here is how Land's color system works. Two black-and-white photo separation negatives of a scene are taken (instead of the usual three). One is through a red filter, the other through a green filter (the usual blue filter is eliminated). A black-and-white separation positive is made of each. The positive picture from the red-filtered negative—the long wavelength record—is projected on a screen through a red filter. The positive from the green-filtered negative—the short record—is projected without any filter. The resulting "two-color" projection of red and white light produces practically all colors of the original scene.

Land's discovery may greatly affect the design of color TV years hence. What amazes me is that with all the research effort expended on color TV development, the two-color approach remained unnoticed. Newton's findings were apparently good enough.

Al Forman

These valuable service aids can be yours

FREE

when you purchase RCA Receiving Tubes

In old Baghdad "genies" made life easier and more convenient. And that's exactly what RCA's new Service Aids Campaign will do for you. These service aids will make your job a little easier and a lot more profitable. They're available from authorized RCA Tube Distributors participating in this program.

FREE
when you purchase 75 RCA Receiving Tubes*

The RCA Triple Pindex

At your fingertips—base diagrams for over 1500 receiving-type tubes; base diagrams for over 400 picture tubes; base-diagram references for over 200 industrial receiving-type tubes; PLUS base-diagram references for over 200 foreign receiving-type tubes cross-referenced to U.S.A. types. If you've ever thumbed through a tube manual from one base diagram to another and then back again, you know what a valuable tool the Triple Pindex is for the busy technician.

Refer to any three base diagrams simultaneously

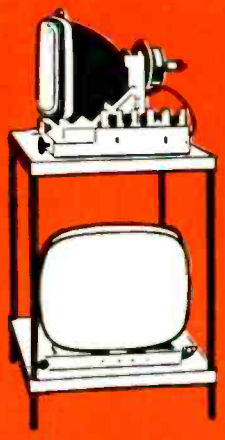
Offer for limited time only...Contact your

FREE
when you purchase
425 RCA
Receiving Tubes*

The RCA TV-Toter Table

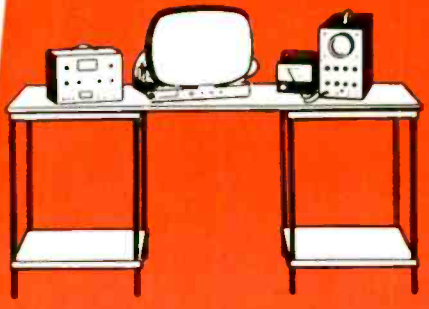
SAVE LABOR! SAVE TIME! One of the most useful tools you've ever had in your shop, the RCA TV-Toter Table is constructed of 20 gauge reinforced steel with chrome-plated hardened-steel tubular legs, has a durable office grey hammer tone finish. Each table comes complete with four leg extensions and four casters to permit easy change-over from no-tilt table to handy roll-about unit. Measuring 24" x 24" x 33½" high, the RCA TV-Toter Table supports a TV chassis at convenient bench height.

The handy, convenient-TV-Toter Table



Increase your storage facilities

Increase your service facilities

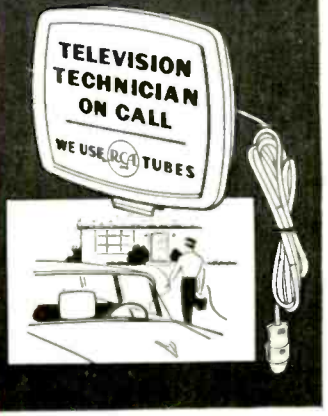


Use two TV-Toters as a fixed bench

Use three TV-Toters as a test bench with roll-out center section

Also available to build business

is the new RCA TV Service Auto Light. A rugged plastic display with built-in light and magnetic base, the TV Service Auto Light is a practical and convenient way to advertise your services and products to everyone who sees your parked car or truck. Also ask your RCA Tube Salesman about the many other RCA sales and servicing aids available to you all year 'round.



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

*Suggested Value

Authorized RCA Tube Distributor for details today!!

LETTERS
To the Editor

Safety Repairs

Editor, ELECTRONIC TECHNICIAN:

In answer to the April letter from fire insurance inspector Soukup opposing so-called unauthorized repairs to fire protection devices, needless to say, all replacements should be capable of fulfilling UL requirements without nullifying any protective qualities of the complete unit. In my Feb. article, if the relay in question failed to function, the controller would not allow the main fuel valve to open. In addition, there are no less than six other safeties in series with this unit, and failure of any one would cause the controller to shut the furnace down. Common technical ethics should forbid the replacement of any part in such an important device with a sub-standard or improper part.

JACK DARR
Ouachita Radio-TV Service
Mena, Arkansas

Pix Tube Contract

Editor, ELECTRONIC TECHNICIAN:

In answer to the charges made by Mr. O. J. Coombes in your April letters, if he had read our later ads offering picture tube replacement contracts instead of going off half-cocked, he would have been enlightened by the fact that the warranted tube is replaced only if the TV chassis is brought to our service counter. Any additional services performed are charged at regular rates. Our replacement contract offer is a sales promotion device. We feel contract holders will refer their service repairs to us. Most readers are reliable and will not willfully defraud us by submitting applications for non-functioning picture tubes. To date we have received no complaints from any Chicago newspaper, nor from our many applicants. Mr. Coombes is the only exception, and our records are open for him to scrutinize.

LARRY NATHAN
TV Service Center
Chicago, Ill.

• *One-year contracts offered are: 10-12", $5; 14-17", $7.50; 19-21", $10; and 24", $15.—Ed.*

Free Literature

Editor, ELECTRONIC TECHNICIAN:

Thanks for having started several years ago the opportunity to build up service literature. I had been trying to get some from one company for more than six months, without success. But your effort got it for me almost at once. Thanks again.

FRED J. WILL
Will's Radio & TV Service
E. St. Louis, Ill.

(Continued on page 14)

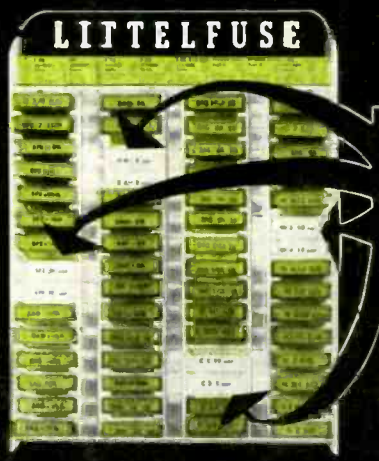
dealer-serviceman's fuse rack . . .

. . .for wall mounting

most needed

most wanted

. . . the FUSEMASTER!



dealer-serviceman's fuse requirements at a glance

Returns of Tung-Sol Tubes are consistently lowest of all!

How about your returns?

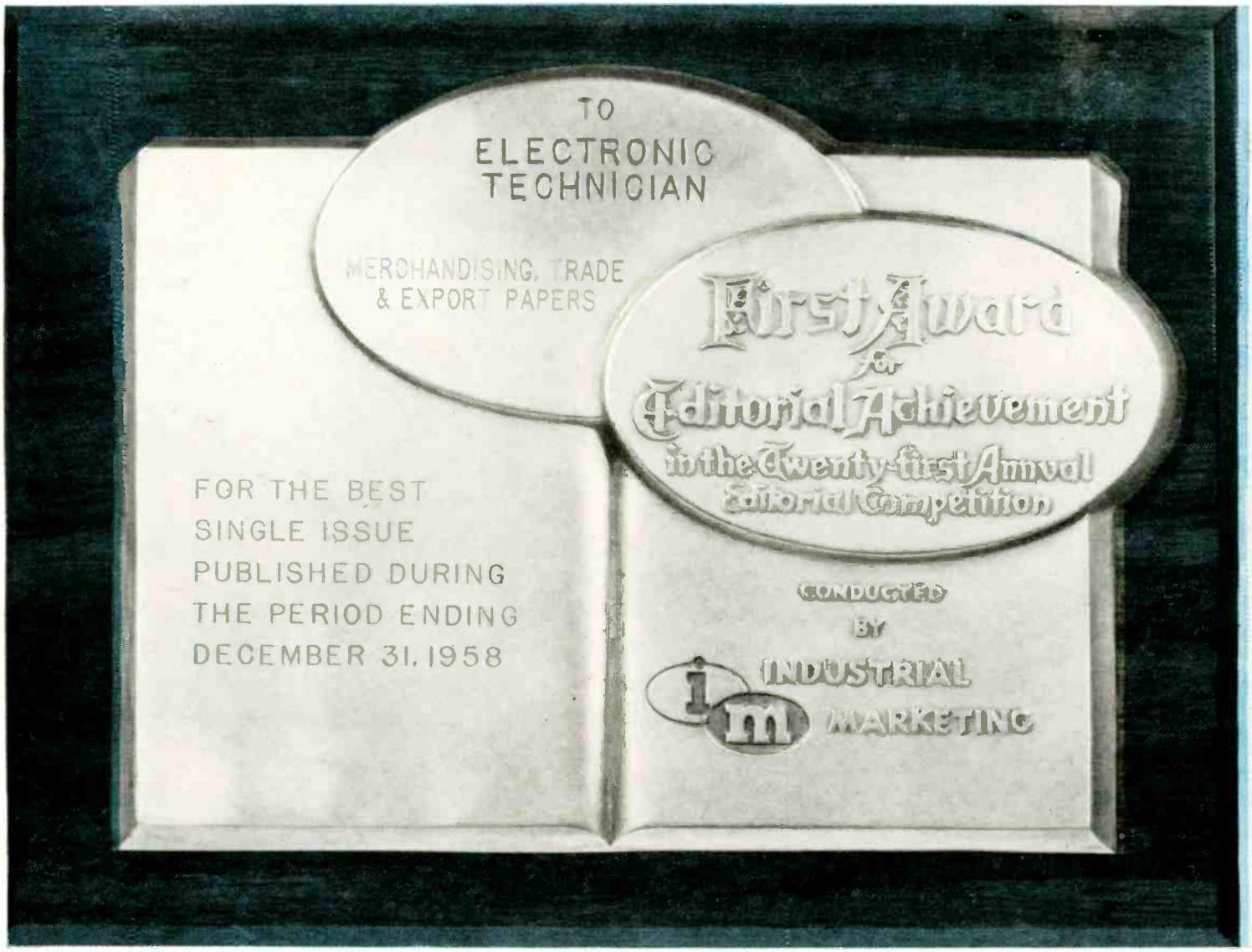
It's no accident when servicemen the country over find that Tung-Sol Tubes consistently have the lowest return rate of all.

There's a reason for this outstanding record of performance and dependability: It's Tung-Sol *one-grade* quality. This one and *only one grade* of tubes is engineered to the highest initial equipment specifications. As a result—when you install Tung-Sol Tubes, you're installing the same type of tubes leading set makers have relied upon for a long time, too.

If call backs are costing you time, money and aggravation, it's probably time you told your distributor you'd rather have Tung-Sol Tubes. Tung-Sol Electric Inc. Newark 4, N. J.

TUNG-SOL®

Blue Chip Quality ELECTRON TUBES • SEMICONDUCTORS



for EDITORIAL EXCELLENCE

to ELECTRONIC TECHNICIAN

In the 1959 Industrial Marketing Annual Editorial Competition for Business Papers there were five hundred fifty-five entries. This annual event in the publishing field is the counterpart of the "Oscar" and "Emmy" awards in the entertainment field. The coveted FIRST PRIZE in its division for the BEST SINGLE ISSUE published in 1958 was awarded to ELECTRONIC TECHNICIAN—for its monumental September Issue on the subject of Stereo.

A RECORD of FIRSTS and EXCLUSIVES

It's no accident that Electronic Technician took first prize. E.T.'s record of industry leadership in its editorial service and beyond the printed page are indicated by these firsts and exclusives:

1. E.T.'s Annual Buyers Directory is the only one in the industry.
2. E.T.'s Circuit Digest Section is the most costly reader aid in the field.
3. E.T.'s Business Statistics are industry standards, included every year in such references as the World Almanac.
4. E.T.'s exposure of the reprocessed tube racket, its test report on consumer ratings, and disclosure of illegal radiation reflect aggressive and constructive journalism.

SHEER EDITORIAL INTEGRITY is the basic reason why

* MORE ELECTRONIC MAINTENANCE TECHNICIANS SUBSCRIBE TO ELECTRONIC TECHNICIAN THAN TO ANY OTHER ELECTRONIC TRADE MAGAZINE IN THE WORLD.

* MORE ADVERTISERS PLACE MORE ADVERTISING IN ELECTRONIC TECHNICIAN THAN IN ANY OTHER ELECTRONIC MAINTENANCE TRADE PUBLICATION.

Circulation—80,000* ABC PAID. (Publisher's Estimate subject to ABC Audit)

TECHNICIAN

480 Lexington Avenue, New York 17, N. Y. • YUkon 6-4242

(Continued from page 8)

Against Associations

Editor, ELECTRONIC TECHNICIAN:

I admit that you write good sense in your editorials. However, I take issue with one point. You seem to believe in and stress service organizations quite often. However, I don't believe there's anything to be gained by joining a service association. At the beginning of TV, servicemen were—and still are—called crooks and a few unprintable names. The shops deserving these names blamed everyone but themselves. In an effort to restore their "good names," they decided to organize, and the shops that needed an association most were the ardent instigators. For the past 15 years, our store has maintained a well equipped service shop and depended on the customer's repeat business. When the public became angry with servicemen generally, our business increased. We had built a reputation. Why soil it by joining up with those who need the stature they think an association brings?

CLYDE D. MARVIS
Redtop
McKeesport, Pa.

• *Everyone has the right to express an honest opinion. We still firmly believe that the industry and public benefit from the stature and information exchange provided by associations.—Ed.*

Circuit Problem

Editor, ELECTRONIC TECHNICIAN:

I have been having quite a time with a Zenith Model T2222R chassis 17T20. I have a schematic, and after checking all vertical components still cannot get the 6AU8 vertical oscillator plate voltage to operate at +65 v and still get enough height. For full vertical deflection this must be 190 v, which pushes the grid down to —48 v instead of —27 v called for. The 12B4 vertical output is OK, except that the cathode voltage operates at +37 v instead of +25 v. The vertical circuit is not the same as the folder I have. Can you help me?

ROBERT J. WILSON
New Richmond, Wis.

• *Zenith's schematic calls for about 35 v on the 12B4 cathode, not the voltage shown on your schematic. While voltage measurements are generally helpful, in this case a scope may be your best bet. Look for a 142 v p-p trapezoidal waveform on the 6AU8 plate. The p-p grid and plate voltage of the 12B4 should be about 140 and 820, respectively. Also, don't be surprised if the damper circuit is the troublemaker. —Ed.*

(Continued on page 18)

Invader Auto Antennas

The striking new "makes-em-want-to-buy" packaging on TELCO INVADER AUTO ANTENNAS is sure to increase your impulse sales, step up your profits. Colorful "picture-window" skin-packs give your customers a clear view of these top quality antennas, a new development by the leading manufacturer of high quality antennas . . . Telco Electronics.

WRITE today for complete details on TELCO's new auto antennas and merchandising aids. Do it now!

MERRY-GO-ROUND DISPLAY gets these antenna out where they can be seen . . . and sold.

GC-TELCO **Telco Electronics Mfg. Co.**

Division of GC—Textron Inc.

West Plant: Los Angeles 18, California Main Plant: ROCKFORD, ILLINOIS, U.S.A.

Better than ever-- GENERAL
Bigger than ever-- TOTAL

Ready to do a better job in more sockets—G-E Service-Designed Tubes for TV!

1B3-GT	3CB6	6AF4	6BQ7-A	6CY5	6U8-A
1H2	3DT6	6AF4-A	6BU8	6DN7	6V6-GT
1J3	5AQ5	6AL5	6BZ6	6DQ6-A	6X8
1K3	5BK7-A	6AQ5-A	6BZ7	6DT6	12AT7
1X2-B	5CG8	6AU4-GTA	6CB6-A	6EA8	12AU7-A
2AF4-B	5EU8	6AU6-A	6CD6-GA	6EU8	12AX4-GTB
3BN6	5U4-GB	6AX4-GTA	6CG7	6J6	12BY7-A
3BU6	5U8	6BK7-B	6CG8-A	6SN7-GTB	12DQ6-A
3BZ6	5V3/5AU4	6BN6	6CL8-A	6S4-A	19AU4-GTA
	5Y3-GT	6BQ6-GA	6CX8	6T8-A	

:LECTRIC SERVICE-DESIGNED TUBES!
)F 70 LOW-CALLBACK TYPES!

Check the improvements in three popular Service-Designed Tubes at left! These typify quality features that mark the entire line. Over 1,000 advancements give General Electric Service-Designed Tubes top performance, extra reliability!

Install them to *save!* Callbacks are less; your time is kept free for new service work. Install them to *profit!* Service-Designed Tubes cost you no more—customers prefer them—the satisfaction they give builds repeat business for you.

General Electric is broadening constantly the value of these tubes to technicians, by developing additional types to meet growing replacement needs. Now 12 high-quality tubes for hi-fi and radio supplement the extensive Service-Designed TV line.

Here is full coverage of your servicing requirements! Every job you undertake, now can have the benefit of finer, more dependable tube performance. Insist on Service-Designed Tubes! See your G-E tube distributor! *Distributor Sales, Electronic Components Division, General Electric Co., Owensboro, Ky.*

TELL YOUR STORY OF QUALITY SERVICE with this colorful leaflet! Slip it in with invoices, mail it with letters, leave it on calls! Available in quantities from your General Electric tube distributor.

Now...for finer performance...G-E Service-Designed Tubes for Hi-Fi and Radio!

6AV6	6BE6	12AU6	12AX7/7025	12BE6	35W4
6BA6	6L6-GC	12AV6	12BA6	35C5	50C5

In addition, several General Electric Service-Designed Tubes for TV are equally fine performers in hi-fi or radio equipment: namely, Types 5Y3-GT, 6AL5, 6AQ5-A, 6AU6-A, 6T8-A, 6V6-GT, and 12AT7.

Progress Is Our Most Important Product

GENERAL ELECTRIC

2-111-221

(Continued from page 14)

Industrial Booster

Editor, ELECTRONIC TECHNICIAN:

My copy of ELECTRONIC TECHNICIAN is the one magazine most technicians go for in my department. Industrial electronic maintenance is the field you want to follow up. This impresses me as a shot in the arm, and is the material technicians are looking for. Thanks for your foresight in the right direction.

HENRY G. ROSNER
Radio-TV Service
Spencer, Mass.

Circulation Short

Editor, ELECTRONIC TECHNICIAN:

Having three-year subscription to both ELECTRONIC TECHNICIAN and SERVICE—I understand the two magazines are now one—I would like to bring to your attention that I have been receiving two copies of ELECTRONIC TECHNICIAN. If you will just put the two subs end-to-end instead of side-by-side, or connect them in series instead of parallel, you will have my undying gratitude.

B. H. MILLER
Hinkley, Calif.

• *Our apologies. The subscriptions have been reconnected in series . . . no doubt a more suitable impedance match for your reading habits.—Ed.*

Tragic Electrocution

Editor, ELECTRONIC TECHNICIAN:

The enclosed newspaper item should add ammunition to your fight against hot chassis TV sets.

A. I. MALTBY
Radio Television Service
Evanston, Ill.

• *Item from May 4 CHICAGO DAILY TRIBUNE tells about the death of 17 year old Pamela Dobbertin, electrocuted while watching TV. Her right foot was touching a metal encased TV set on a wrought iron stand, while her left hand was touching an iron lamp. A short in either appliance could have caused the death.—Ed.*

"Have you considered the possibility that it might be a condenser?"

News of the Industry

ALPHA WIRE CORP. has promoted DON RAPPAPORT to Asst. Sales Mgr.

SERVICE WIRE CORP. has promoted has added a new factory building to its facilities.

MOTOROLA, INC. reports the appointment of GERARD MC GONAGLE as New England Dist. Sales Mgr. for the Semiconductor Products Div.

MOSLEY ELECTRONICS, INC. has begun work on a 45,000 sq. ft. addition to their present facilities.

SIMPSON ELECTRIC CO. has purchased a new building with over 250,000 sq. ft. of office and production space.

GENERAL INSTRUMENT CORP., Radio Receptor Div. reports the appointment of ARNO NASH as Vice Pres. and Gen. Mgr.

HEATH CO. has named DANIEL P. KNOWLAND, JR. Vice-Pres., and promoted RICHARD L. JACOBSON to Dealer Sales Administrator.

ASTRON CORP. has named RUDOLPH E. MOTTOLA Sales Mgr. of the ASTRON SALES CORP., the Distributing Div.

WELLER ELECTRIC CORP. named JOHN W. HAND Regional Sales Mgr. for the Rocky Mtn. and West Coast areas.

ALLEN B. DU MONT LABS., INC. has appointed FRED C. ZORN to the new post of Asst. Mgr. of the Industrial Electronics Div.

AUDIO DEVICES, INC. made the following appointments: A. J. ROMANO, Sales Mgr. and E. J. BRANDT, Mfg. Mgr., both of the Rectifier Div.

AMPEREX ELECTRONIC CORP. Pres., FRANK RANDALL, has been elected Vice-Pres., NORTH AMERICAN PHILIPS CO., INC.

CHEMTRONICS, INC. announced the the appointment of A. D. ADAMS ADVERTISING as the firm's advertising, merchandising and public relations agency.

INT'L. TELEPHONE & TELEGRAPH CORP. announces the opening of a sales office at 4600 S. Tripp Ave., Chicago, with the following sales engineers: JOSEPH J. KIRSHER, ROBERT E. MARQUART and FRED WAGNER.

GENERAL ELECTRIC CO. will hold the fifth demonstration in the "General Electric Television Serviceability" series May 27th, Essex House Hotel, Newark, N.J. The Receiving Tube Dept. has appointed WILLIAM M. RAMEY as Dist. Sales Mgr. for five states surrounding Minneapolis.

RAYTHEON MFG. CO. reports further promotion of the Bonded Dealer Program through a written 90-day repair bond with which the service dealer will warrant his work to the customer. Raytheon's subsidiary, APPLIED ELECTRONICS CO., has purchased assets of WEBSTER MFG. CO., retaining T. M. WEBSTER as Gen. Mgr.

RADIO CORPORATION OF AMERICA announces the following four appointments; for the Electron Tube Div., Distributors Products Dept.; JOSEPH A. HAIMES, Mgr., Administration & Controls; GERALD G. GRIFFIN, Mgr. Mdsg.-Parts & Equipment; JOSEPH J. KEARNEY, Mgr. Mdsg.-Entertainment Tubes; MORRIS S. LEWIS, Mgr. Mdsg. Coordination. RCA SERVICE COMPANY announced the following: GERALD W. PFISTER, Vice Pres. and Operations Mgr.; LAWRENCE G. BORGENSON, Vice Pres., Consumer Products Service; ROBERT C. GRAY, Mgr. Consumer Products Field Operations; and HOWARD W. JOHNSON, Mgr. of Appliance Service.

GONSET DIV. YOUNG SPRING & WIRE CORP. has appointed WILLIAM E. HUNTER Gen. Sales Mgr. and JOSEPH A. FRABUTT, Gen. Mgr.

TUNG-SOL ELECTRIC, INC. has elected MILTON R. SCHULTE, Pres. and LOUIS RIEBEN, Chmn. Bd. of Directors.

OXFORD ELECTRIC CORP. has named TOM D. BROWN Vice-Pres. of OXFORD COMPONENTS, INC., as subsidiary.

ADMIRAL CORP. has announced the appointment of CLYDE J. SCHULTZ to the newly created post of Sales Prom. Mgr. for the national service, parts and accessories div.

CBS HYTRON is marketing nationwide the CBS Palomar, a new budget-priced line of picture tubes which complements its line of Silver Vision tubes. The budget line features a completely new electron gun and phosphor screen and is backed by a full 12-month warranty.

VIS-U-ALL PRODUCTS CO. has a new address: 640 Eastern Ave., S.E., Grand Rapids 6, Mich.

BELDEN MFG. CO. reports the following appointments: WAYNE HERNLEY, Dist. Sales Mgr. of newly created S.E. Central Dist. consisting of Ind., O., Ky., and parts of Ill. and Tenn.; GORDON SHIRREFFS for industrial accounts in a newly created territory covering parts of Ill. and Wisc.; CHUCK ATWATER for industrial accounts in parts of Ind. and Ky.; HOWARD BARON to cover parts of Ill. and Wisc.; DICK FRITZE to cover parts of Ind., Ky., and Tenn.; and JOHN BARTHELMY to cover Fla. and parts of Ga. and Ala.

CBS-HYTRON is changing its name to CBS ELECTRONICS, effective July 1st and is expanding its semiconductor operations with construction of a new $5 million, 160,000 sq. ft. plant in Lowell, Mass. L. H. NIEMANN will serve as Sales Mgr. for Semiconductors and ROSS YEITER, Mgr. Mktg. Admn., Semiconductor Operations. Other appointments announced are: JOHN A. MAYBERRY, Mdsg. Mgr. for dealer products; O. LEE BALLENGEE, Equip. Sales Mgr. for receiving tubes; JOE C. HARMONY, Dir. Gen. Engineering, receiving tubes; HERBERT G. RYAN, Asst. Dir. general engineering, receiving tubes.

Reps & Distributors

T. V. PARTS, INC. appoints IRV URBAN Sales Mgr. and moves to larger quarters in Brooklyn, N.Y.

CLAROSTAT MFG. CO., INC. has appointed BEIL & WHITAKER, INC. as distributor-sales rep for eastern Pa.

H. W. KNAGGS CO. mfr. rep firm, has added a Kansas City, Mo. office headed by BOB BAUER.

XCELITE announces the appointment of JERRY KIRSHBAUM & CO. to handle sales to distributors in metropolitan N.Y.

SILICON TRANSISTOR CORP. appointed two rep firms: JACK BERMAN CO., southern Calif.; and D. DOLIN SALES, Chicago area and eastern Wisc.

CONNELLY SALES CO., is a new rep firm with headquarters at 14529 Manecita Dr., La Mirada, Calif. Territory: southern Calif., southern Nev., and Ariz.

VIS-U-ALL PRODUCTS CO. reports the appointment of HERBERT W. KNAGGS CO. as their rep in Mo., Kans., Ia., Neb. and southern Ill.

DUTREX INDUSTRIES, INC. reports the appointment of three reps for DUMONT pix tubes: KENNETH L. BROWN, Me., N.H., Vt., Mass. and Conn.; LE ROY & MC GUIRE, INC., upper N.Y. state; and ROBERT W. PETERS CO., O., western Pa., and W. Va.

HOFFMAN ELECTRONICS CORP. Semiconductor Div. names three southwest distributors: RADIO SPECIALTIES & APPLIANCE CORP., Phoenix metropolitan area; RADIO SPECIALTIES CO., INC., N.M.; STANDARD RADIO PARTS, INC., southeast Ariz. The Consumer Products Div. appointed three distributors: CLADCO DISTRIBUTORS, INC., N.Y. and northwest Pa.; HASSCO, INC., Colo., Neb., and Wyo.; NEWBURGH DISTRIBUTING CO., southern N.Y. state.

Catalogs & Bulletins

For more information, write in ELECTRONIC TECHNICIAN's new product code number on coupon on page 44.

MOBILE RADIO: A repeater unit for extending communications range from the base station to mobile which functions also as a mobile relay for extended car-to-car communications, is described in the new brochure "Repeater Operation in the Mobile Services." Kaar Engineering Corp., 2995 Middlefield Rd., Palo Alto, Calif. (ELECTRONIC TECHNICIAN B6-6)

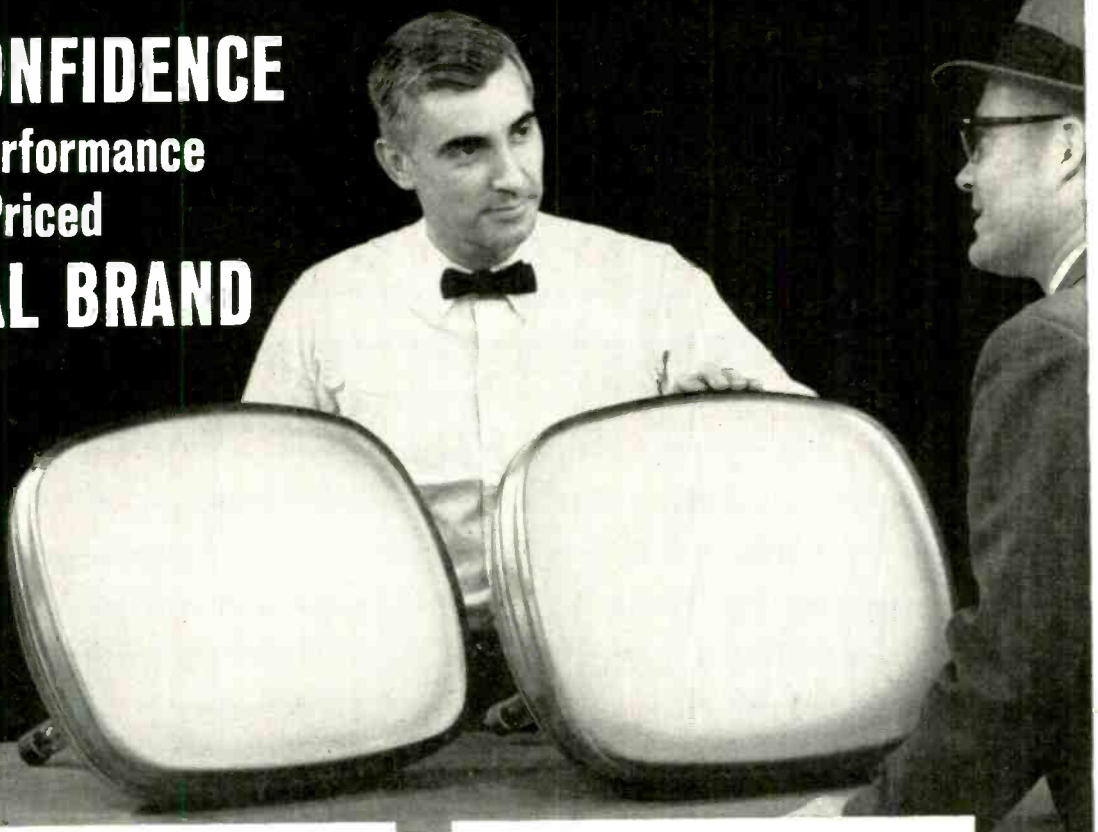
HI-FI: A colorful new catalog covers a wide range of kits including a complete stereophonic hi-fi system package containing cabinet, stereo amplifier, stereo record changer, crossover network and speakers. Also an FM Tuner kit—complete with automatic frequency control and flywheel tuning. Heath Co., Benton Harbor, Mich. (ELECTRONIC TECHNICIAN B6-4)

PHOTOTUBES: Revisions and additions, over the first edition published in 1956, are contained in the new 90-page multiplier phototube catalog. Information includes: operational theory; applications for standard and special multiplier phototubes; typical response curves. Also: illustrations; graphs; circuit diagrams and specifications. Allen B. Du Mont Labs., Inc., Electronic Tube Div., 750 Bloomfield Ave., Clifton, N. J. (ELECTRONIC TECHNICIAN B6-3)

(Continued on page 24)

SELL WITH CONFIDENCE

Premium-Performance or Budget-Priced NATIONAL BRAND PICTURE TUBES



PREMIUM-PERFORMANCE

CBS

Silver Vision

- Brighter silver-activated AG-905 screen
- Sharper pin-point focus electron gun
- Nationally advertised brand
- Meets performance specifications of all leading TV set manufacturers

BUDGET-PRICED

CBS

PALOMAR

- All-new electron gun
- All-new phosphor screen
- Full 12 months warranty
- Backed by CBS Electronics, a Division of Columbia Broadcasting System, Inc.

For over a year, the combined sales appeal of CBS Silver Vision and CBS Palomar picture tubes has been field-tested on the West Coast. Now this proven sales approach originated by an independent tube manufacturer is available to all independent service-dealers.

Does your customer demand the finest in performance, or is he budget-minded? You can make the sale with CBS Silver Vision . . . or with CBS Palomar. Either is easy to sell because of top brand prestige. Either stays sold because of top performance in its field.

And their dependable CBS national brand assures you of profit without callbacks. Play safe. Sell premium-performance CBS Silver Vision or budget-priced CBS Palomar with confidence.

THE CBS FAMILY • CBS ELECTRONICS • CBS INTERNATIONAL • CBS TELEVISION NETWORK • CBS LABORATORIES • CBS NEWS • CBS RADIO • CBS TELEVISION STATIONS • COLUMBIA RECORDS • LEADERS IN ELECTRONIC COMMUNICATIONS

ELECTRON TUBES

CBS

SEMICONDUCTORS®

CBS ELECTRONICS formerly CBS-HYTRON
Danvers, Massachusetts
A Division of Columbia Broadcasting System, Inc.

(Continued from page 22)

POTENTIOMETERS: Construction features, specifications and photos are included in a new 2-color, 4-page brochure covering the Bourns line. Schweber Electronics, 60 Herricks Rd., Mineola, L. I. N. Y. (ELECTRONIC TECHNICIAN B6-11)

TUBES: Available is a new 20-page catalog with convenient order forms. It is No. 159. Items covered include: tubes; kits; components and accessories. Zalytron Tube Corp., 220 W. 42nd St., New York 36, N. Y. (ELECTRONIC TECHNICIAN B6-12)

RESISTORS: DC8 is a new catalog sheet describing the multi-range resistor line and the multi-range kit. The complete line, which is also available in the kit package, comprises five basic units providing 200 fixed resistance values. International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa. (ELECTRONIC TECHNICIAN B6-5)

TRANSISTORS: 500 JEDEC types with their direct replacement or nearest equivalent are listed in a new interchangeability chart. Transistor numbers, dimensional diagrams and intended applications are included. Kahle Engineering Co., 3322 Hudson Ave., Union City, N. J. (ELECTRONIC TECHNICIAN B6-7)

TUBES: A 4-page, 2-color, illustrated folder lists more than 70 standard industrial and Gov't cathode ray tubes. Types and technical data are catalogued by application. Continental Electronics Corp., Industrial & Gov't Div., 2724 Leonis Blvd., Los Angeles 58, Calif. (ELECTRONIC TECHNICIAN B6-2)

TAPE RECORDERS: "22 Ways to Enjoy the Roberts" is a new 24-page booklet stressing the advantages of owning a recorder. Features include: ways to record and play monaural and stereo, and other uses of the firm's equipment. Price 25¢ a copy. Order direct from Roberts Electronics Inc., 1028 N. LaBrea Ave., Los Angeles 38, Calif.

GRILLE CLOTH: "Pic-A-Pat," the new full color catalog of Acoustone's Famous 50 line of acoustic grille cloth has been announced. Newcastle Fabrics Corp., 80 Wythe Ave., Brooklyn 11, N. Y. (ELECTRONIC TECHNICIAN B6-9)

MOTORS: A new catalog describes the firm's complete line of small AC motors and rotating devices, according to military and commercial specifications. Rotating Components, Inc., 267 Green St., Brooklyn 22, N. Y. (ELECTRONIC TECHNICIAN B6-10)

CAPACITORS: A new 4-page brochure, J-1, covers subminiature capacitors. Capacitances range from 2.5 μμf to 0.1 μf with sizes starting at ⅛" square. Axial and radial leads, multiple units and various terminal arrangements are described. Mucon Corp., 9 St. Francis St., Newark 6, N. J. (ELECTRONIC TECHNICIAN B6-8)

WIRE: A new 1-page combination table ZK5 provides sizes and decimal equivalents of standard annealed copper wire. Diameter in inches, area, weight, length and resistance can be quickly located from the AWG number. Alpha Wire Corp., 200 Varick St., New York 14, N. Y. (ELECTRONIC TECHNICIAN B6-1)

"He said, 'No, thanks!' "

SUPERIOR'S NEW MODEL TW-11 STANDARD PROFESSIONAL

TUBE TESTER

★ Tests all tubes, including 4, 5, 6, 7, Octal, Lock-in, Hearing Aid, Thyratron, Miniatures, Sub-miniatures, Novals, Sub-minars, Proximity fuse types, etc.

★ Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TW-11 as any of the pins may be placed in the neutral position when necessary.

★ The Model TW-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.

★ Free-moving built-in roll chart provides complete data for all tubes. All tube listings printed in large easy-to-read type.

NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

EXTRAORDINARY FEATURE

SEPARATE SCALE FOR LOW-CURRENT TUBES: Previously, on emission-type tube testers, it has been standard practice to use one scale for all tubes. As a result, the calibration for low-current types has been restricted to a small portion of the scale. The extra scale used here greatly simplifies testing of low-current types.

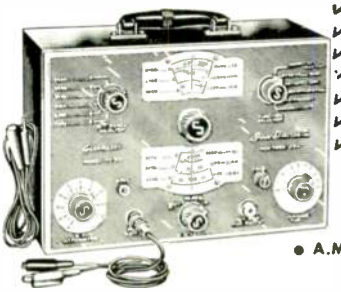
The Model TW-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover.

$47.50

SUPERIOR'S NEW MODEL TV-50A

GENOMETER

7 Signal Generators in One!



- R.F. Signal Generator for A.M.
- R.F. Signal Generator for F.M.
- Audio Frequency Generator
- Marker Generator
- Bar Generator
- Color Dot Pattern Generator
- Cross Hatch Generator

This Versatile All-Inclusive GENERATOR Provides ALL the Outputs for Servicing:

● A.M. RADIO ● F.M. RADIO ● AMPLIFIERS ● BLACK AND WHITE TV ● COLOR TV

R. F. SIGNAL GENERATOR: 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

VARIABLE AUDIO FREQUENCY GENERATOR: Provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.

MARKER GENERATOR: The following markers are provided: 189 Kc.; 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency.)

BAR GENERATOR: Pattern consists of 4 to 16 horizontal bars or 7 to 20 vertical bars.

DOT PATTERN GENERATOR (FOR COLOR TV): The Dot Pattern projected on any color TV Receiver tube by the Model TV-50A will enable you to adjust for proper color convergence.

CROSS HATCH GENERATOR: The pattern consists of non-shifting horizontal and vertical lines interlaced to provide a stable cross-hatch effect.

The Model TV-50A comes complete with shielded leads and operating instructions. Only **$47.50**

SUPERIOR'S NEW MODEL 77

VACUUM TUBE VOLTMETER

WITH NEW 6" FULL-VIEW METER

Compare it to any peak-to-peak V. T. V. M. made by any other manufacturer at any price!

• Uses new improved SICO printed circuitry. • Employs a 12AU7 as D.C. amplifier and two 9006's as peak-to-peak voltage rectifiers to assure maximum stability • Meter is isolated from the measuring circuit by a balanced push-pull amplifier. • Uses selected 1% zero temperature coefficient resistors as multipliers.

AS A DC VOLTMETER: The Model 77 is indispensable in Hi-Fi Amplifier servicing and a must for Black and White and color TV Receiver servicing where circuit loading cannot be tolerated.

AS AN ELECTRONIC OHMMETER: Because of its wide range of measurement leaky capacitors show up glaringly. Because of its sensitivity and low loading, intermittents are easily found, isolated and repaired.

SPECIFICATIONS

• DC VOLTS — 0 to 3/15/75/150/300/750/1,500 volts at 11 megohms input resistance. • AC VOLTS (RMS) — 0 to 3/15/75/150/300/750/1,500 volts. • AC VOLTS (Peak to Peak) — 0 to 8/40/200/400/800/2,000 volts. • ELECTRONIC OHMMETER — 0 to 1,000 ohms/10,000 ohms/100,000 ohms/1 megohm/10 megohms/100 megohms/1,000 megohms. • DECIBELS —10 db to + 18 db, + 10 db to + 38 db, + 30 db to + 58 db. All based on 0 db = .006 watts (6 mw) into a 500 ohm line (1.73v). • ZERO CENTER METER — For discriminator alignment with full scale range of 0 to 1.5/7.5/37.5/75/150/375/750 volts at 11 megohms input resistance.

AS AN AC VOLTMETER: Measures RMS value if sine wave, and peak-to-peak value if complex wave. Pedestal voltages that determine the "black" level in TV receivers are easily read.

Comes complete with operating instructions, probe, leads, and steamlined carrying case. Operates on 110-120 volt 60 cycle. Only.. **$42.50**

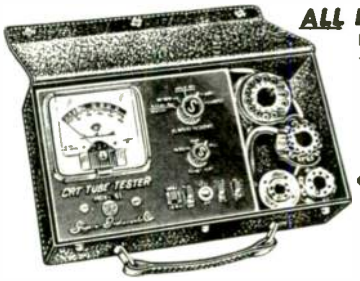
SUPERIOR'S NEW MODEL 83

C.R.T. TESTER

Tests and Rejuvenates ALL PICTURE TUBES

ALL BLACK AND WHITE TUBES

From 50 degree to 110 degree types —from 8" to 30" types.



ALL COLOR TUBES

Test ALL picture tubes—in the carton—out of the carton—in the set!

- Model 83 is not simply a rehashed black and white C.R.T. Tester with a color adapter added. Model 83 employs a new improved circuit designed specifically to test the older type black and white tubes, the newer type black and white tubes and all color picture tubes.
- Model 83 provides separate filament operating voltages for the older 6.3 types and the newer 8.4 types.
- Model 83 employs a 4" air-damped meter with quality and calibrated scales.
- Model 83 properly tests the red, green and blue sections of color tubes individually — for each section of a color tube contains its own filament, plate, grid and cathode.
- Model 83 will detect tubes which are apparently good but require rejuvenation. Such tubes will provice a picture seemingly good but lacking in proper definition, contrast and focus. To test for such malfunction, you simply press the rej. switch of Model 83. If the tube is weakening, the meter reading will indicate the condition.
- Rejuvenation of picture tubes is not simply a matter of applying a high voltage to the filament. Such voltages improperly applied can strip the cathode of the oxide coating essential for proper emission The Model 83 applies a selective low voltage uniformly to assure increased life with no danger of cathode damage.

Model 83 comes housed in handsome portable Saddle Stitched Texon case—complete with sockets for all black and white tubes and all color tubes. Only **$38.50**

SHIPPED ON APPROVAL

NO MONEY WITH ORDER — NO C.O.D.

Try any of the above instruments for 10 days before you buy. If completely satisfied then send down payment and pay balance as indicated on coupon. No Interest or Finance Charges Added! If not completely satisfied return unit to us, no explanation necessary.

MOSS ELECTRONIC, INC.
Dept. D-623 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked on approval. If completely satisfied I will pay on the terms specified with no interest or finance charges added. Otherwise, I will return after a 10 day trial positively cancelling all further obligations.

Name .....

Address .....

City ..... Zone.... State.....

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

☐ Model TW-11 Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.

☐ Model TV-50A... Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.

☐ Model 77... Total Price $42.50 $12.50 within 10 days. Balance $6.00 monthly for 5 months.

☐ Model 83 Total Price $38.50 $8.50 within 10 days. Balance $6.00 monthly for 5 months.

Audio NEWS LETTER

FAIRCHILD RECORDING names Gene Rosen & Associates mid-Atlantic reps.

ORRADIO names Wm. A. Fink as Sales Manager, Professional Products.

PRECISION ELECTRONICS appoints Robert Bach rep in metropolitan N.Y.

CLEVITE-WALCO announces the Microgram stylus pressure gauge @ $1.50.

ALTEC-LANSING is rumored to be planning to drop GRAY-BAR ELECTRIC as national distributor, at least in certain areas.

VIDARE introduces the DL-3 dummy load, a speaker saver device which dissipates up to 40 watts of excess power without mismatching impedances.

MASCO announces the Stereo Broadcaster @ $24.95. It connects to the second Channel of a stereo cartridge, and transmits the signal wireless up to 200' on any standard AM radio frequency.

MAGNAVOX will enter the jobber market with its speaker line. Previously they were sold only in quantity to manufacturers. Company claims to have made 75,000,000 speakers since 1911.

DE WALD introduces the Model N-1000-B AM/FM stereo tuner @ $99.50. Ratings are 3 μv sensitivity for 20 db quieting, hum −70 db. Unit features afc, 4 i-f stages, 8 tubes, diode and rectifier.

GRANCO will produce a stereo FM adapter for moderately priced FM radios. The device is expected to sell for $20. This development is the outgrowth of a licensing agreement with CROSBY LABS.

LOWTHER SALES, Jersey City, announces two English-made speaker systems. Model TP-1 corner enclosure with dual horns is rated at 25 watts; Acousta model employs folded horn, is available in kit form.

JAMES B. LANSING SOUND has been awarded a plaque for "The Most Outstanding and Successful Business" at the Southern California Business Show. JBL Pres. William H. Thomas was cited as "Business Man of the Year." Awards reflect growing recognition of hi-fi industry.

CBS-HYTRON publishes a 4-page bulletin E-325, "Why a Ceramic Cartridge?" Here's an interesting quote: "Just because it has been true that some of the better cartridges have been magnetic and some of the poorer ones have been crystals is no reason for jumping to the conclusion that magnetic cartridges are inherently better than crystals." William Horn, ex-Philco, named ad & merchandising manager of CBS-Hytron phono dept.

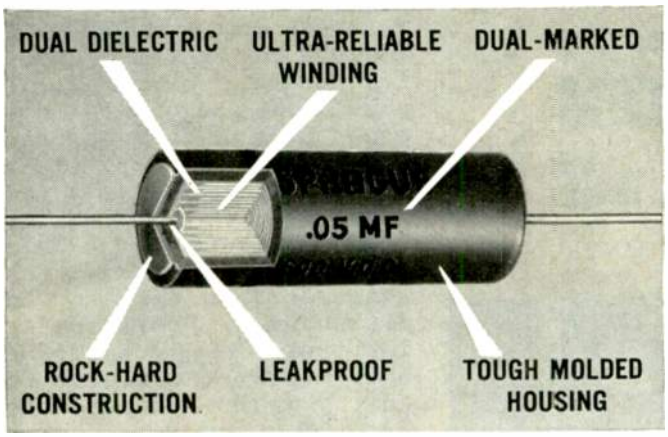
(Continued on page 28)

NEW DIFILM® BLACK BEAUTY®
MOLDED CAPACITORS

BEAT THE HEAT AND HUMIDITY!

Now Sprague's new DIFILM BLACK BEAUTY MOLDED CAPACITORS have taken the steam out of heat and humidity problems. These capacitors are so good you can *boil 'em* for 24 hours without affecting their performance.

Unlike straight polyester film tubulars, these capacitors operate in a 105°C environment *without derating.*



Look for the RED markings on the black case.

And the heart of these new DIFILM capacitors can't be beat. It's a dual dielectric which *combines the best advantages of both Mylar* polyester film and the highest grade of paper dielectric.* A rock-hard solid impregnant fills voids and pinholes in the film.

Talk about *reliability!* . . . these capacitors have it. DIFILM capacitors are actually low cost versions of the Sprague capacitors now being used in every modern military missile. The basic reliability and outstanding performance of missile-type Sprague capacitors are all yours in this outstanding new development. Why take chances when you can get the best—DIFILM BLACK BEAUTY MOLDED TUBULARS . . . at regular prices.

For the complete DIFILM BLACK BEAUTY story, write for Bulletin M-759 to Sprague Products Company, 65 Marshall St., North Adams, Mass.

*DuPont trademark

The major capacitor improvements come from

SPRAGUE®
world's largest capacitor manufacturer

SPRAGUE RESEARCH IS CONSTANTLY PRODUCING NEW AND BETTER CAPACITORS FOR YOU

(Continued from page 26)

AUDIOTEX Div. of GC-Textron publishes a 16-page catalog covering 150 hi-fi accessories.

GENERAL INSTRUMENT'S new one-tube FM tuner front end sells to manufacturers for less than $3 less tube, about $1 more for afc.

ELECTRO-VOICE releases 24-page catalog 120A, a descriptive guide to the firm's professional microphones.

ROBINS INDUSTRIES will market the MICHIGAN MAGNETICS line of exact replacement recording heads through its radio accessory distributors.

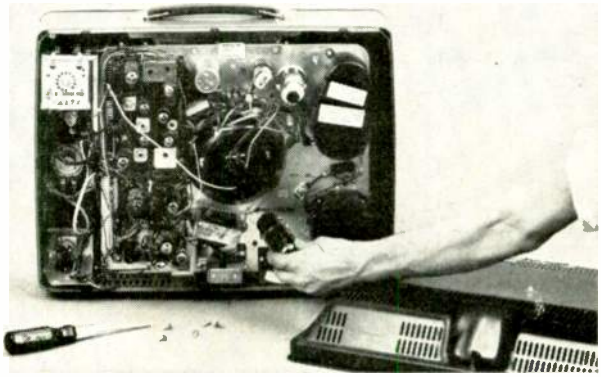
UNITED AUDIO names reps for Dual changer & Wigo speakers: Robert Stang, met. N.Y.; Roland Olander, S. Cal., Ariz., S. Nev.; Robert Peters, O., W. Pa., W.Va.; Harry Estersohn, Dual in S. N.J., Del., Md., D.C., Va.

AN INDUSTRY IN SEARCH OF RECOGNITION. Hi-fi manufacturers have not yet succeeded in convincing the public of the virtues of component quality. One of the several important reasons for this shortcoming is the failure to develop an industry auditing or monitoring plan along the lines we proposed last year. In essence, this plan would impartially certify the advertised performance claims and ratings of various components. Think it can't be done? Let's take a lesson from the Air Conditioning & Refrigeration Institute which independently tests the claims for unit type air conditioners. 33 participating manufacturers will carry a Seal of Certification attesting to the fact that the capacity has been correctly rated and other performance requirements have been met. Hi-fi producers can do this too. With our industry buzzing about the prospective build-up of a national promotion fund, now is the time to develop a certification program to give components the recognition they deserve.

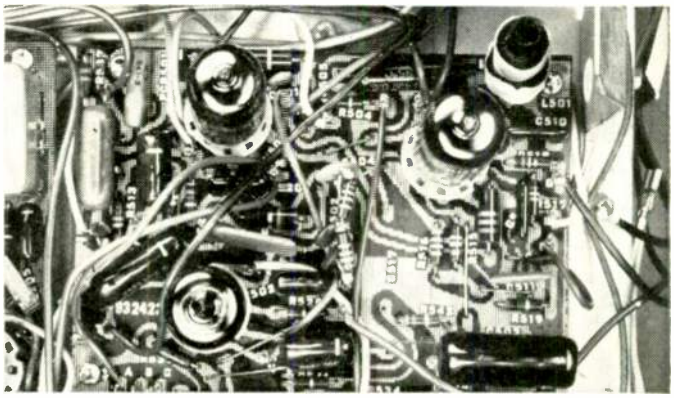
A new kind of TV

RCA VICTOR SPORTABLE TV!

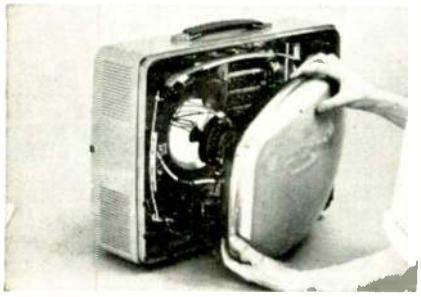
the easiest-to-service portable in TV history...



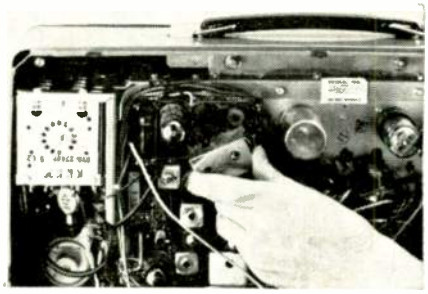
1. **98% OF ALL SERVICE** can be done from rear of set with back cover removed! All fuses, tubes and most other parts are easy to reach. No need to remove the chassis.



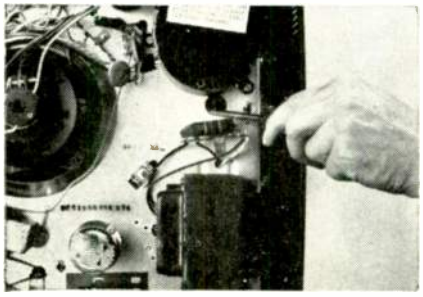
2. **WIRING PATTERN** is traced in white on the exposed side of the Security Sealed Circuits. New "road-map" technique and clearly marked component numbers provide easy location, easy repair.



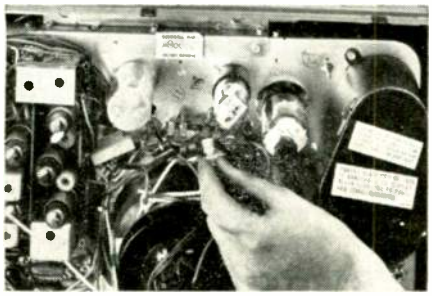
3. **KINE CAN EASILY BE MOVED** forward in operating condition! No "patch" cables needed. Just plug in a cheater cord.



4. **DIODE DETECTOR SHIELD** removes without cutting or unsoldering. Just slip the shield off and go to work!



5. **SPECIAL APERTURE** enables technician to discharge kine before service.



6. **FOCUS-VOLTAGE** selector strip offers a range of voltages for fine focusing.

OTHER IMPROVED FEATURES:

- Reach the most-used technician controls—AGC, vertical height and linearity *without removing back cover!* You can adjust horizontal drive and width easily with back cover off.
- Socket connections handy for quick, easy probe-testing.
- Power-transformer chassis for greater safety and speedy location for tube replacements.
- Epoxy-coated capacitors are four times more moisture-resistant than old-style capacitors. Reduce service problems and give longer operating life to the set.
- RCA chemical fuse gives complete protection—doesn't "blow" from nondangerous momentary power overloads that open ordinary fuses.

RECOMMEND THE PORTABLE THAT MAKES YOUR SERVICING JOB EASIER— NEW SPORTABLE TV!

RCA VICTOR
RADIO CORPORATION OF AMERICA

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And when you install a JFD Exact Duplicate Replacement, you earn a handy profit, both on the antenna and the servicing operation. You eliminate profit-less competition with local drug stores and other discounters selling conventional indoor antennas.

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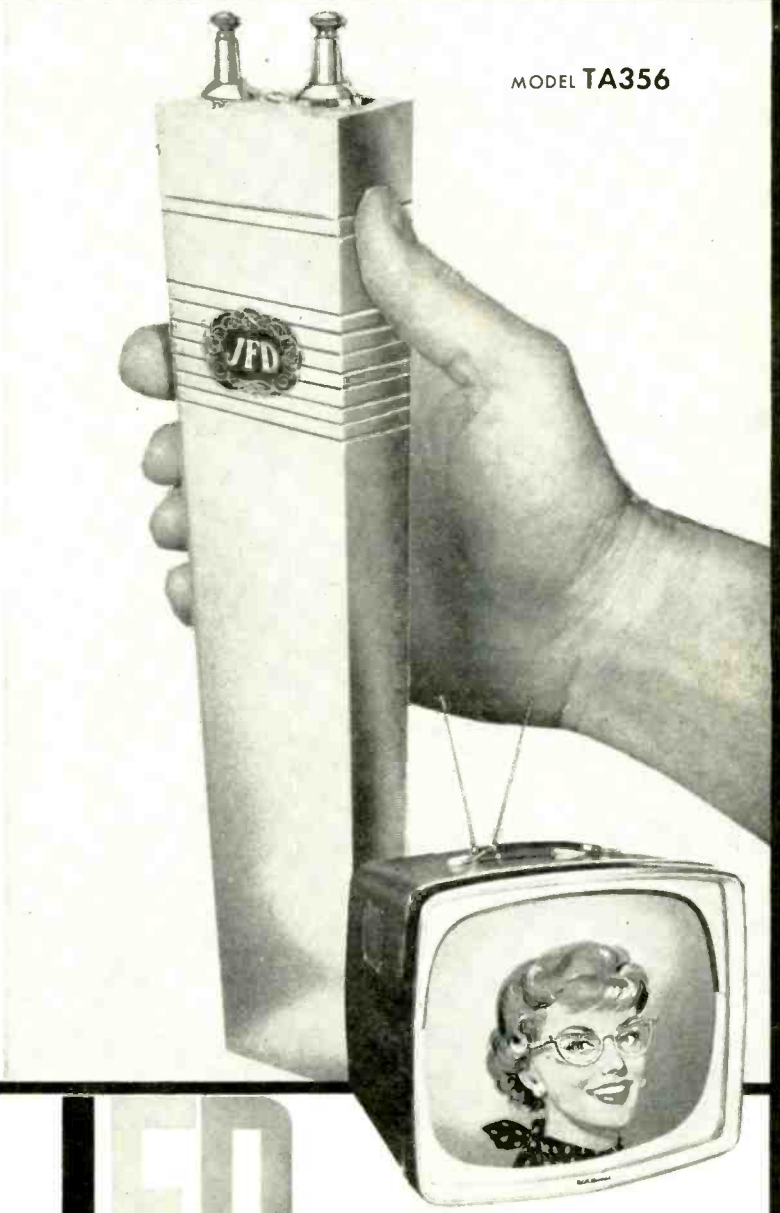

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Printed Circuits

For some time, service technicians have complained about the difficulties encountered in trouble-shooting printed circuits. For the most part, these complaints have been justified.

However, a different attitude has been developing among technicians. According to some recent surveys, most servicers no longer dread those little component-mounted boards.

There appear to be two major reasons for this happy change in attitude. First, manufacturers have begun to design printed circuits with future servicing in mind. Early boards were manufactured primarily with production cost savings in mind—and to heck with the fellow at the repair bench. But more and more set makers have learned that poorly thought out designs and irritated technicians don't aid product reputation or sales. Some of the printed circuit design improvements of note are better accessibility, components on one side of the board, color-coded "road maps," and in prospect, even voltages and waveforms printed right on the board. These are real aids to technicians, and consequently to the public.

The second major reason for a more receptive attitude toward printed circuits is that technicians have learned more about them. The boards are no longer unfamiliar ogres. And very important, more practical chemical repair kits and soldering/de-soldering tools have been made available.

For a fuller discussion of this problem, read the article, "Printed Circuits and the Technician," in this issue.

Your IQ

A recently published book notes that the Intelligence Quotient for the average American is 100, while that of top business executives is about 120. Of particular interest is the report that radio-TV technicians average 117, based on the Army General Classification Test. While this was lower than certain professions such as accountant (129), mechanical engineer (128) and teacher (124), the electronic technician's brainpower ranked above other skilled trades such as machine operator (103), auto mechanic (102) and house painter (99).

Of course, these are average figures, with plenty of extremes up and down. The point is that there are plenty of good minds in the electronic maintenance field. Let's apply our minds to increasing income and improving recognition of our skills.

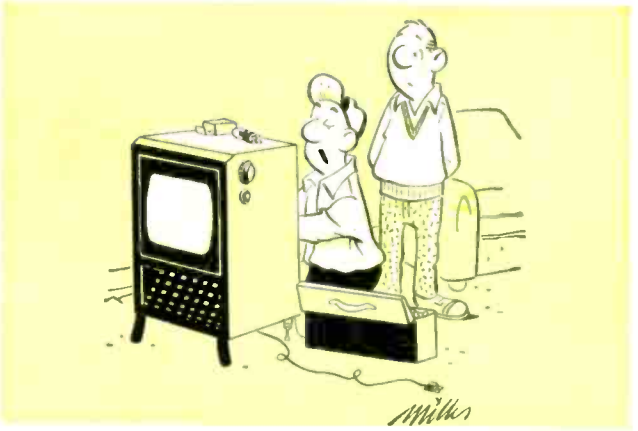
Tuning In the

COLOR TV set sales have probably been running slower than most industry market research people have guessed. Dominant producer **RCA** has never released official figures, but one top company official, Frank Folsom, gave the offhand estimate that **RCA** would sell 80,000 to 85,000 color sets in 1959, an improvement over last year. The break-even point of 100,000 sets is expected to be passed in 1960. On another color front, Donald Kunsman, Pres. of RCA Service Co., reports his firm is now servicing less than half of the color sets in use, and currently nearly two-thirds of new color sets are installed and serviced by independent dealers and servicers. Interestingly enough, color sets account for 25.6% of RCA Service Co. contract volume, though only 12.3% of contract sets are color. Mr. Kunsman states that all of his branches are available to independents for free color consultation.

REPAIR PRICES paid by Philco to the 5600 independent service outlets with signed agreements to handle 90-day radio warranty service have been revised to apply to the type of work performed rather than the type of product. The new rates range from $2 for radios not requiring chassis removal from the cabinet, to $5 for various repair combinations. Rates are based on customers bringing in the radio.

COMPUTERS aid the blind. **IBM** has developed a computer system to translate English texts to braille for the nation's 350,000 sightless persons. There is a serious shortage of braille translators. The computer operator need not have any knowledge of this finger-feel method of reading.

More than 40,000 voiceless people can speak again with the Electro-Larynx developed by Gilbert Wright and Kett Engineering. The portable instrument is held against the throat to vibrate a column of air in the esophagus. By lip, tongue and mouth motions, the sound is modulated into intelligible speech.



"Yes, we have terms—cash or certified check."

JAPANESE ELECTRONIC manufacturers produced $492,200,000 worth of electronic equipment last year, and they expect the total to reach $700,000,000 in 1959. In 1958, Japan made 5,270,000 radios, of which more than 2,500,000 were exported to the U.S.; they expect this figure to climb to 3,600,000 this year. Of particular note is the active transistor industry which turned out 26,730,000 in 1958, up five times from the previous year. As a matter of fact, one Japanese set maker is said to be readying a 32-transistor TV with 8" screen, priced at about $100.

3-D RADAR: detects airborne targets at extreme range and for the first time simultaneously computes distance, bearing, and altitude. Frescanar, developed by Hughes Aircraft Co., is the eyes of the "Missile Monitor," an Army air defense guided missile fire distribution system for mobile use with a field army. Frescanar concentrates all available power in sharp pencil like beams of energy flashing on and off in a fan-shaped array to pinpoint targets at great distance with extreme accuracy. Conventional systems need two or more radars, operators and master consoles to achieve similar results. Frescanar needs only one of each. All three types of data, range, bearing, and altitude, are transmitted to missile batteries. The electronic beam scans rapidly and greatly increases the number of targets which can be tracked at the same time. Better separation of closely-spaced targets with minimum ground clutter is possible.

NEW MARKET RESEARCH service has been set up by the Electronic Industries Assoc. It's called **BID**—Buying Index of Distributors—and furnishes a county-by-county sales barometer for the industry. There are semi-annual overall indices, as well as product and class indices, covering parts and sound distributors. Each participating company, which need not belong to EIA, makes a confidential report of its sales to BID.

Picture.....

DISTRIBUTOR Bursma Radio Supply Co., Grand Rapids, Mich., has come up with a program for independent service dealers to combat drug store tube testers. After meeting with shop owners, Bursma placed large newspaper ads listing the name, address and business hours of service outlets offering free tube testing during the campaign. The benefits of professional assistance in testing tubes was stressed. Cooperating dealers displayed large banners.

TRAFFIC SAFETY REMINDER. During 1958, traffic accidents caused 2,825,000 injuries, up 12% over the previous year. Deaths totaled 36,700, down 5% from 1957. Drivers under 25 were involved in 27% of fatal accidents, though they constitute only 14% of licensed drivers. Accident causes: speed, 40%; right-of-way, 25.2%; reckless driving, 10.4%; cutting in, 4%; improper signaling 3.6%. Weather was clear in 84.2% of fatal accidents. Moral: Take It Easy on the Road.

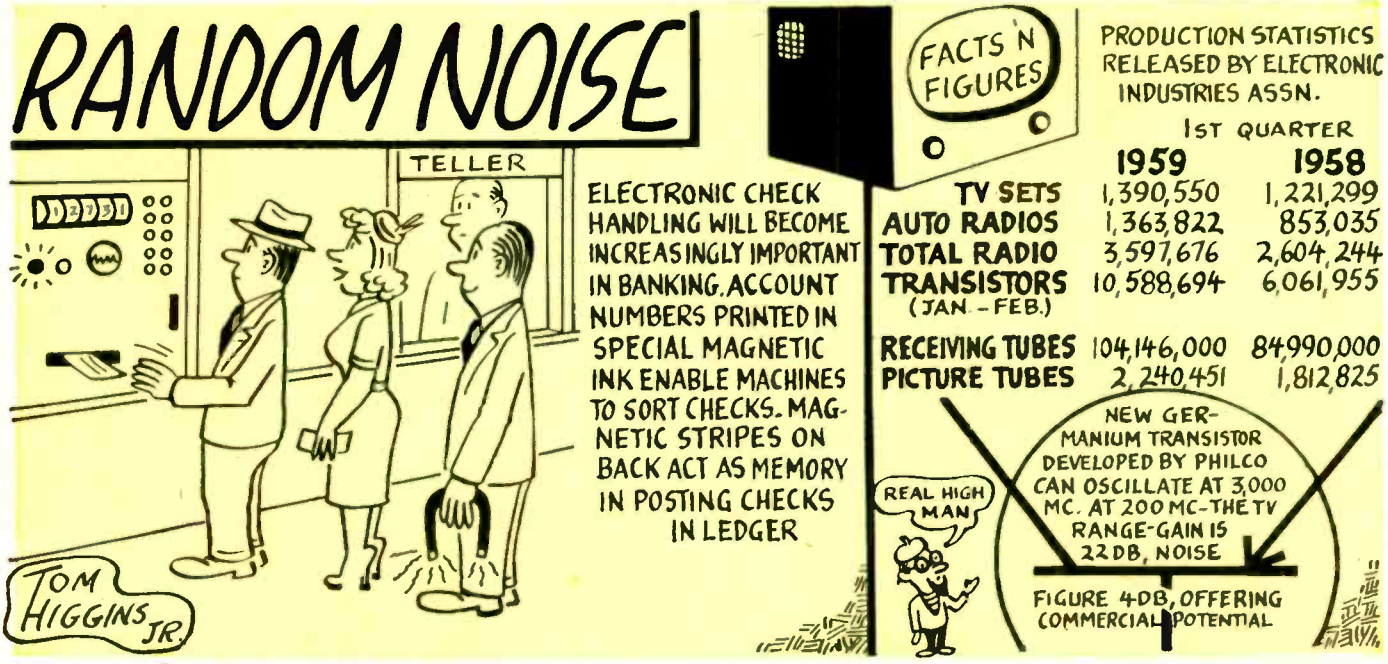
REVOLUTIONARY COMMUNICATIONS link between Washington and Pearl Harbor will be set up by the Navy next year. The system will use the moon as a passive relay station, which is considered to be virtually jam-proof. Also, it is more reliable than ionospheric reflection. The radio signals will be sent from an 84' dish antenna, and will make the 460,000-mile trip to the moon and back in about 2.5 seconds. The direct distance from Washington to Pearl Harbor is 4,519 miles.

CALENDAR OF COMING EVENTS

July	3-18:	The Associated Radio & TV Servicemen, Illinois, Navy Pier, Chicago, Ill.
Aug.	18-21:	Western Electronic Show & Convention (WESCON), Cow Palace, San Francisco, Calif.
Aug.	21-24:	NATESA Convention, Congress Hotel, Chicago, Ill.
Sept.	21-25:	Instrument Society of America, International Conference and Exhibit, International Amphitheatre, Chicago, Ill.
Sept.	30-Oct. 1:	Industrial Electronics Symposium, Mellon Institute, Pittsburgh, Pa.
Oct.	5-7:	Fifth National Communications Symposium, Hotel Utica, Utica, N. Y.
Oct.	5-10:	1959 New York High Fidelity Music Show, New York Trade Show Bldg., New York, N. Y.
Oct.	7-9:	IRE Canadian Convention, Toronto, Ontario
Oct.	12-14:	National Electronics Conference, Hotel Sherman, Chicago, Ill.
Oct.	15-18:	Texas Electranics Assn., Houston Chapter, Rice Hotel, Houston, Texas
Nov.	3-5:	MAECON (Mid-America Electronic Convention), Kansas City, Mo.
Nov.	4-6:	National Automatic Control Conference, New Sheraton Hotel, Dallas, Texas
Nov.	9-11:	Radio Fall Meeting, IRE:EIA, Syracuse Hotel, Syracuse, N. Y.

June is Portable Radio Month.

EDUCATIONAL TV will receive a boost if a bill introduced by Sen. Warren Magnuson passes. It provides states and territories $1 million each to expedite the use of TV in schools. Last year, a similar bill was passed in the Senate, but was lost in the House adjournment rush.



Printed Circuits And

Technicians' Demand For Greater Accessibility

STEVEN R. MIHALIC
MANAGER, PRODUCT SERVICE
TV RECEIVER DEPT.
GENERAL ELECTRIC CO.

• To begin, there is a distinction to be noted between "printed circuitry" and the laminated, or copper-on-phenolic board system in use today. The former refers to the technique of imprinting resistors, capacitors, inductors and conducting material directly on the surface of a non-conducting material. This technique is not used in radio and TV sets to any significant extent. Thus, the term "printed circuits," when used to identify the boards used in receivers, is actually a misnomer. The term laminated wiring is more nearly correct.

The TV industry is a very young one, as industries go. Yet, those of us who have watched it grow have witnessed a remarkable progression in the art. In just over a decade, we have seen the product change from a 10-inch receiver selling for $400 to a 21-inch receiver selling for $200. To put it another way, the consumer cost per square viewing inch has decreased from $5.00 to $0.80 in just over 10 years. And, the present product is far superior to the original in terms of performance, picture size, ease of operation, styling, and overall appeal.

The progress made in TV, is a real tribute to the excellent work of a host of engineering, manufacturing, servicing and other related professional personnel. They have wrought real benefits for the consumer, and are directly responsible for the rapid increase of the TV receiver population. The direct relationship between receiver population and the size of the service business should not be overlooked. Progress benefits the consumer and is important to men as individuals, to industries as a whole, and to individual companies. In the TV industry, some of the milestones of technical progress have been intercarrier sound, the aluminized picture tube, and increased use of solid-state rectifiers and multi-purpose tubes. Manufacturing techniques have also improved, and have contributed to the overall increased value of TV. The dip-solder process and laminated wiring may be counted among these. They have made cost savings possible. But, more important, these savings have found their way to the consumer in terms of more features, and better design which continually reflect the progress being made.

PRINTED CIRCUIT PROGRESS

Two recent surveys conducted by the Institute of Printed Circuits (IPC) and the National Alliance of TV Electronic Service Associations, (NATESA), have highlighted both the progress and the problems of the industry. Eight of ten manufacturers indicated that equipment with printed circuits now being shipped from their plant is more reliable than equipment with similar hand wired chassis. Technicians reported that they are not so much opposed to printed boards as they are to the applications of these boards. Four major problems listed were, accessibility, component failures hard to pinpoint, conductors lifting during servicing, and board breakage. An educational program, which is to include qualified speakers, slide films and booklets is being organized to keep the industry informed of the latest developments and other techniques.

In addition to the reports of improved reliability, the IPC Survey indicates that 60% of the manufacturers find that the printed circuit board requires less service than hand wired models. Only 10% found an increase, and 20% said it was the same.

NATESA received 1,870 replies to the 2,500 surveys issued. Of 90,660 service calls rendered by the respondents in one week, 471 were directly attributable to printed board failure. 35% felt that service problems were due to the circuit board; 85% believed improper board mounting to be the cause. 56% said printed board sets require more service, and 42% found no significant change.

Decision

The decision to use laminated wiring was not taken lightly. Years of planning and preliminary work with related techniques were accomplished. The work of measuring results and appraisal has not ended. Even so, the plain fact is that the quality level today is higher than ever before. As we shall see, laminated wiring has been an important contributor to the substantially improved quality level.

The emergence of laminated wiring may be traced to World War II where its use was extensive in applications where light weight, compactness, reliability and uniformity were prime design criteria. Hand

The Electronic Technician

And Improved Standards Has Alerted Many Producers

soldered connections have always been troublesome from a quality control standpoint simply because control of the factors governing the quality of a soldered connection was in the hands of individual production workers. Temperature and application time are most important factors, and, even with a given individual operator, they vary widely under the best conditions. It was apparent that if these factors could be closely controlled, the quality of soldered connections would improve. Production techniques for the construction of laminated board varies. One laminating and etching process in use today produces conductor strips in the required pattern. First, a solid layer of copper is placed on the board. The solid copper sheet is bonded to the board much as a veneer is laminated to base material. Next, holes are punched to index silk screens. The copper layer is silk-screened with an "acid resist" which covers only the copper area to be retained as conductor strips. An acid bath then removes the unwanted copper. The acid resist is washed away, and another silk-screening deposits "solder resist" over the entire board, except for the areas where solder fillets will be produced. At this point, holes are punched into the board for mounting purposes, and for acceptance of component leads.

Despite claims to the contrary, several facts about the quality of laminated wiring boards have been established. Because customer satisfaction is so important, absolutely nothing may be gained by any company keeping its corporate head in the sand when evaluating its product quality. Indeed, the primary function of a product service group is to be critical of the product, and to seek correction of problems. Many sources of information are used to evaluate product quality. For example, in several areas of the country, a record is kept of every receiver sold and every service job performed on these receivers during the first 90 days. All the information is fed into RAMAC which produces a compilation resulting in a report showing:

1. Average calls per receiver per 90 days.
2. Average faults per call.
3. Average time per fault.
4. Ranking of faults.
5. Parts and tubes usage.
6. Total average service time per receiver per 90 days.

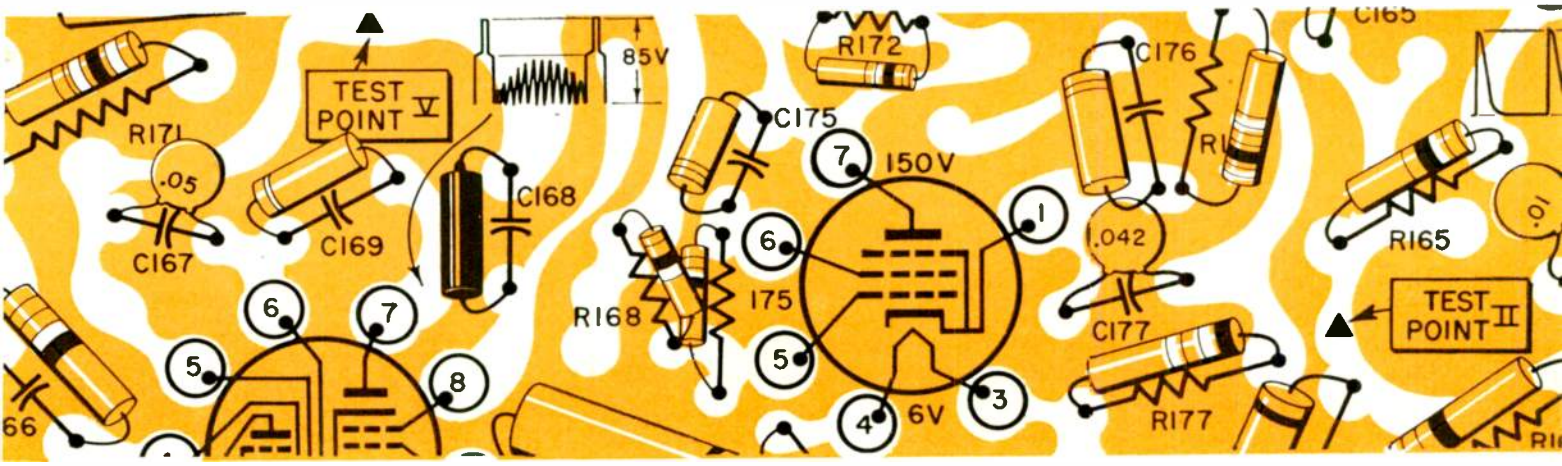
It may be seen that the application of an average cost per productive hour in the customer's home will yield period service cost per receiver, cost per call, and cost per fault. This data proves conclusively that laminated wiring has not increased the service expense of TV receivers; in fact, it has contributed to the marked reduction of average service expense over the past several years. For instance, on consoles, the average service time required during the first 90 days has gone from 57.6 minutes to 25.8 minutes, with less than two minutes of that related to laminated wiring boards for any and all reasons. The reduction is even more pronounced on portables.

Production quality control records further substantiate this conclusion. These records prove that laminated wiring is 7 times freer of older connection problems than are hand-soldered connections.

Laminated wiring has also bought

(Continued on page 68)

Much progress has been made in printed circuit boards and their applications. More reliability and easier accessibility are built into the new units. They also contain schematic information and road-map like data. Colored circuit paths simplify tracing.



Benchman's View of Keyed AGC

Simplified & Practical Approach To Troubleshooting

AGC Circuits. Short Cuts May Reduce Bench Time.

Troubleshooting AGC

Bias Substitution

Keying Action
- **Pulse Functions**

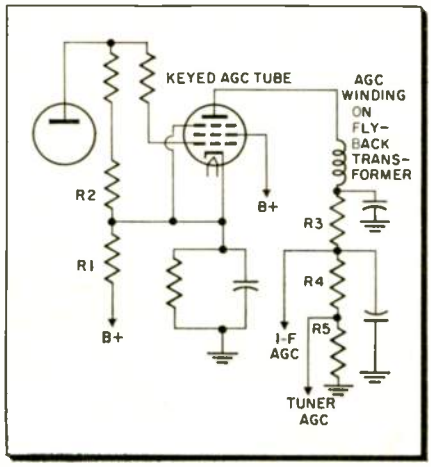
Current Detection
- **Gassy Tubes**
- **Leaky Capacitors**

Test Equipment
- **Bias Box**
- **Scope**
- **VTVM**

PERRY SHENEMAN

• AGC troubles cause much grief because they upset other circuits, which in turn upset agc. To many this "rat-race" action is most confusing. For example improper agc voltage could cause overloading of the r-f and i-f stages, sync compression, and still more incorrect agc voltage. The effects of this vicious cycle can produce a host of symptoms, which include: too much or too little contrast, negative picture, poor definition, smear, snow, buzz, poor sync, no picture on strong channels, no picture or sound, distortion of the picture and sound, etc. Many TV troubles can be found by looking for correct operating voltages, but to troubleshoot a keyed agc circuit quickly and intelligently, a knowledge of how the circuit operates is required.

Fig. 1—AGC tube conducts only in the presence of proper, simultaneous signals on the grid and plate. Shorting the grid to the cathode helps localize trouble.



Keyed Circuit

A keyed circuit, perhaps it would be better to say a keyed tube, is simply a tube that does not have steady applied voltage values to permit it to conduct. Conduction, under these circumstances, can only take place when another voltage or signal of the proper polarity and amplitude is applied. Cathode, grid, screen or plate voltage may be of such value as to keep the tube at cut off. The keying voltage or signal figuratively opens the tube and permits conduction by correcting the cut-off condition. Keying pulses can control conduction timing both as to sequence and duration. Although a keyed tube generally conducts for only a short period of time, when it does, it behaves in essentially the same manner as in an ordinary amplifier application. With this in mind, examine Fig. 1. At first glance it looks like an ordinary pentode amplifier. However, note that the cathode is connected to B+ at the junction of R1 and R2, and has a considerable amount of B+ applied. The control grid is connected directly to the plate of the preceding tube. While this places a high B+ level on the grid, the grid is still negative with respect to the cathode, enough to keep the tube at cut-off. The tube will remain at cut-off until the positive going sync pulse overcomes the bias voltage, providing of course that everything else is right for tube conduction. But the plate has no B+, and without plate voltage this tube can not cause any current flow in the plate circuit, regardless of the size of the signal on the grid. Unless current flows in the plate circuit, no agc voltage can be developed. The key lies in the agc winding in the plate circuit, which may be physically a part of the horizontal output transformer. The polarity and size of the pulse developed across this winding, are proper to drive the plate positive and permit the tube to conduct. But the pulse is relatively very narrow and occurs at the horizontal line frequency. Therefore, the tube is in a position to conduct only for this limited time. It can now be seen that

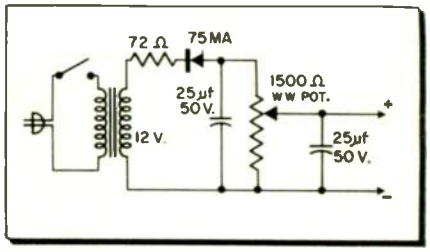


Fig. 2—Simple low-impedance bias box may be readily constructed. It is a most useful aid for troubleshooting AGC circuits.

two things must be present simultaneously. For conduction to take place, the tube must have: (1) the sync pulse on the grid; and (2) the flyback pulse on the plate. The two pulses must also be of the same frequency of proper phase, and proper amplitude. Because the size of the sync pulse varies directly with signal strength, and because the size of the flyback pulse is relatively constant, the amount of conduction will be proportional to the amplitude of the sync pulse.

AGC Voltage Source

When the tube conducts, the d-c return path for the plate is through resistors R3, 4 and 5. The voltage developed across these resistors is in proportion to the amount of current flow, and the value of the resistors. The polarity is such that the plate side of the resistors is negative with respect to ground. This is the agc voltage. A major advantage of this circuit is that noise pulses arriving at random times will not cause the tube to conduct and produce a voltage which could affect the receiver. In addition to noise immunity, this keyed agc circuit produces a voltage which reflects actual strength of the signal, and not its video content. Different average video levels would normally affect simple agc and avc type of circuits. Since the keyed agc circuit conducts only on sync pulses, and since these pulses are of constant amplitude, for a given signal strength, variations due to other than changes in signal strength normally have no effect. There are many different modifications and configurations, some of them quite sophisticated, but the basic concepts remain essentially the same.

Dynamic Troubleshooting

In spite of all the symptoms which may indicate agc troubles, there is no point in troubleshooting an agc system that has nothing wrong with it. Therefore, it is best to first determine what type of trouble the set has. A low impedance bias box may be used to apply fixed bias voltages to the stages controlled by agc. Even a battery will do, but a bias voltage source similar to the one shown in Fig. 2 is convenient. The r-f and first two i-f amplifiers are usually controlled by agc voltages. Approximately minus 3 volts will do the trick. If the set responds to the bias box and begins to behave in a more normal manner, the chances are that there is a defect in the agc system. Since the bias box does at least in part what agc is supposed to do, if the set doesn't respond, the chances are that there is nothing wrong with the agc circuits and they would function properly if the proper signals were present . . . look for trouble in the signal circuits. If it is determined that there is an agc problem, some short-cut type of tests may save time, but like many short cuts, the road may be a bit bumpy.

Because the tube needs two separate pulses to operate, it is desirable to see if they are present. A scope could do this easily, but here's a little gimmick which should bring delight, if it works. Connect the negative lead of a VTVM to the agc bus, the other lead to ground, and short the grid of the tube to the cathode. The grid and cathode are now at the same potential. If the screen and the plate voltages are correct the tube may conduct. If it does, a negative voltage will develop on the agc line, and will be indicated on the meter. This voltage may be a bit higher, negatively, than normal, but it will indicate that the flyback pulse is present. In addition to indicating that the tube is conducting it may also show that the rest of the agc system is able to function normally. What has been done here is to overcome the bias on the tube and eliminate the need for the incoming sync pulse to cause conduction. If conduction does start up it is a fairly good indication that there was something wrong with the incoming sync pulse. Of course an upset in bias may also be overcome by this test, but a voltmeter check can quickly identify which of the two situations has to be dealt with. Once again, remember that this type of test is a gimmick, but it may do much to cut down bench time. There is really no substitute for proper calibrated test equipment.

If the sync pulse signal is missing, it is a simple matter to track it down with the scope, clear back to the tuner if necessary. To overcome improper agc voltages on the controlled stages, hook up the bias box and leave it there until the trouble has been found. This will permit the signal to get through in a more normal manner. The same thing holds true for tracking down the flyback pulse. Because of high peak voltages in around the flyback, exercise normal high voltage precautions, and look for the possibility of pulse damaged components. When connecting the bias box, avoid going directly to the grid of the tube, as it will bypass any signal that may be present. Connect as shown in Fig. 3. Where different voltages are developed for the r-f and i-f stages,

(Continued on page 78)

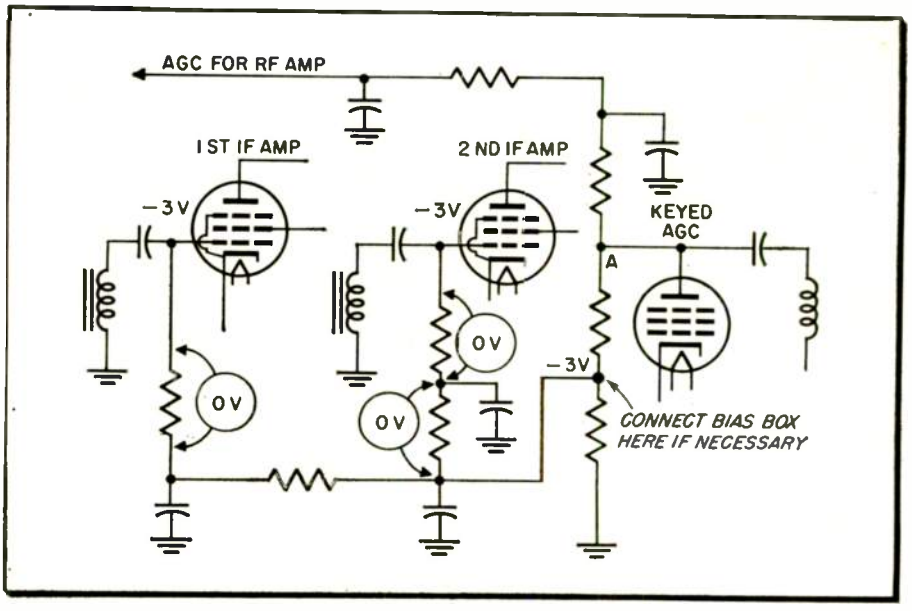
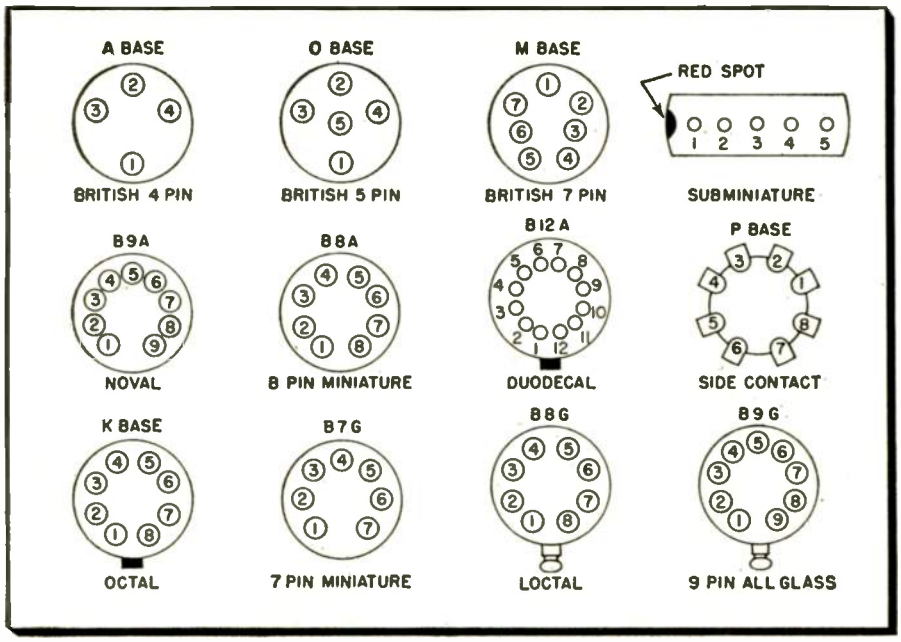


Fig. 3—In order not to bypass any signal with the bias box, some isolation is desirable. Several injection points are available. The more resistance between the grid and bias box, the better.



FOREIGN TUBE GUIDE

An Electronic Technician Magazine scoop when first published in November 1956, and since reprinted by tube manufacturers, distributors, engineering handbook publishers, and catalog services, the Guide To Foreign Tubes is now revised and enlarged to consider the newer tube types. The information presented here is based upon the latest data available. The various tube manufacturers may be contacted directly, for specifications, possible solutions to problems of availability, tube tester settings, additional interchangeability information, etc.

Guide To Foreign Tubes

Substitution Guide, Nomenclature Guide, American Equivalents, Base Diagrams

ROBERT CORNELL
TECHNICAL EDITOR
ELECTRONIC TECHNICIAN MAGAZINE

• The increasing number of foreign made radios and high fidelity sets on the American scene are providing the technician with additional sources of income. As in our own domestic equipment the greatest amount of servicing required is tube replacement. There is really no reason to send the set back to Europe because the tube markings indicate an EB91 instead of a 6AL5, or an EBC90 in lieu of a 6AT6.

Table 2—Nomenclature Guide

1st Letter Heater or Filament Voltage or Current	2nd, 3rd & 4th Letters Tube Type*	1st Figure Tube Base	2nd & 3rd Figures
A—4.0 V	A—Single Diode	2—B8G	Design or Development Serial Number
C—200 ma	B—Double Diode	3—Octal	
D—.5 V to 1.5 V	C—Triode	4—B8A	
E—6.3 V	F—Voltage Amplifying Pentode	5—B9G and Special Bases	
G—5.0 V	H—Hexode	6—Sub-Miniature	
H—150 ma	K—Heptode or Octode	7—Sub-Miniature	
K—2.0 V	L—Output Pentode	8—B9A	
P—300 ma	M—Tuning Indicator	9—B7G	
U—100 ma	N—Thyratron		
	Q—Nonode		
	Y—Half-wave Rectifier		
	Z—Full-wave Rectifier		

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

European & American Equivalents

You can service these foreign made sets in the same profitable manner. Table 1, is a substitution guide and will enable you to determine the American equivalent. In compiling this information, only those tubes are listed which require no modifications, and where direct interchangeability is possible. There are other combinations of interchange which can be made, in some cases requiring rewiring and socket modifications. Some minor differences in nomenclature were found, however these appeared to be the exceptions to the rule. Since it is intended that the interchangeable table be of maximum utility these numbers are also listed. Differences do exist from tube-to-tube *(See Substitution Guide on following page. Text continues on page 50.)*

AMERICAN & FOREIGN TUBE SUBSTITUTION GUIDE

American	Foreign
OE3	85A1
OG3	85A2
1A3	DA90, 1D13
1A7	DK32
1AB6	DK96
1AC6	DK92, X18, 1C2
1AD4	DF62
1AF4	DF96
1AH5	DAF96
1AJ4	DF96
1AN5	DF97
1B3	DY30, U41
1C5	DL35, N14
1E3	DC80
1H5	DAC32, HD14
1HR5	DAC32
1L4	DF92, 1F2
1M3	DM70
1N5	DF33
1Q5	DL36
1R5	DK91, X17, 1C1
1S2	DY86
1S4	DL91
1S5	DAF91, ZD17, 1FD9
1T4	DF91, W17, 1F3
1U4	DF904
1U5	DAF92
1X2	DY86
3A4	DL93
3A5	DCC90
3B4	DL98, HD30
3C4	DL96
3Q4	DL95, N18
3Q5	DL33
3S4	DL92, N17, 1P10
3V4	DL94, N19, 1P11
5AR4	GZ34
5U4	GZ34, U52
5V4G	GZ32
5Y3	U50
5Z4	GZ30
6A8	ECF80
6A8	X63
6AB4	EC92
6AB8	ECL80, LN152
6AG5	EF96
6AG6	EL33, KT61, N147
6AJ8	ECH81
6AK5	DP61, PMO5, EF95
6AK8	EABC80
6AL5	EB91, DD6 D77, D152, ED2, EAA91
6AM5	DDR7, EL91 N77, N144, 7D9
6AM6	EL33, EF91, SP6 Z77, 6F12, 8D3, PMO7
6AQ4	EC91
6AQ5	BPMO4, N727, EL90
6AQ8	ECC85, B719
6AT6	EBC90, DH77
6AU6	EF94
6AV6	EBC91
6BA6	EF93, PMO4
6BD7	EBC81
6BE6	HMO4, EK90
6BE7	EQ80
6BJ5	N78
6BL8	ECF80
6BM8	ECL82
6BN5	EL85
6BQ5	EL84
6BR5	EM80
6BW4	EZ81
6BX6	EF80, Z152, Z719
6BY7	EF85, W179
6C4	EC90, L77
6C9	ECH42
6CA4	EZ81
6CA7	EL34
6CD7	EM34, 64ME
6CH6	EL821, EL822
6CJ6	EL81
6CK6	EL83
6CN6	EL38
6CQ6	EF92
6CS6	EH90
6CW5	EL86
6D4	EN93
6DA5	EM81
6DA6	EF89
6DC8	EBF89
6DJ8	ECC88
6DL8	ECF80
6E8	ECH35
6ER5	EC95
6ES8	ECC189
6F5G	H63
6FG6	EM84
6F6	KT63
6F15	EF41
6H6	EB34, D63
6J5	L63
6J6	ECC91
6J7	Z63
6K7	KTW63
6L6	EL37, KT66, 5881
6M6	EL33
6N8	EBF80
6Q4	EC80
6Q7G	DH63
6R3	EY81
6R4	EC81
6S2	EYB6
6SL7	ECC35
6SN7	ECC33, B65
6T8	EABC80
6U3	EY80
6U5G	Y61, Y63, 6MI, 63ME, EM35
6U8	ECF82
6V4	EZ80
6X2	EY51
6X4	U78, V2M70, EZ90
6X5	EZ35, U147
7AN7	PCC84, 30L1, B319
7C6	DH149, EBC33
7G7	EF22
8A8	PCF80, LZ319, 30C1
9A8	PCF80, LZ319, 30C1
9AK8	PABC80
9AQ8	PCC85
9U8	PC182
12AC5	U141
12AT6	HBC90
12AT7	ECC81, B152, B309
12AU6	HF94
12AU7	ECC82
12AV6	HBC91
12AX7	ECC83
12BA6	HF93
12BE6	HK90
12SN7	B36
14K7	UCH42, HCH42
14L7	UBC41
17Z3	PY81
19T8	HABC80
19X3	PY82
19Y3	PY82, U154, U319
21A6	PL81
25L6	KT32
35W4	HY90
50BC7	HY209
50C5	HL92
1639	EBC33
5545	MT5545
5643	EN70
5647	EA76
5672	DL620
5678	DF60
5696	EN92
5727	PL21, 2D21
5802	ME1401
5861	EC70
5920	E90CC
6058	EB91, DD6 D77, D152, ED2, EAA91
6252	QQVO3-28, QQVO3-20A
6267	EF86
6360	QQVO3-10
6373	DL70, EL70
6374	EY84
6375	DC70
6574	EN32
6688	E180F
6922	E88CC

Foreign	American
B36	12SN7
B65	6SN7
B152	12AT7
B309	12AT7
B319	7AN7
B719	6AQ8
BPMO4	6AQ5
D63	6H6
D77	6AL5, 6058
D152	6AL5, 6058
DA90	1A3
DAC32	1HR5, 1H5
DAF91	1S5
DAF92	1U5
DAF96	1AH5
DC70	6375
DC80	1E3
DCC90	3A5
DD6	6AL5, 6058
DDR7	6AM5
DF33	1N5
DF60	5678
DF62	1AD4
DF91	1T4
DF92	1L4
DF96	1AF4, 1AJ4
DF97	1AN5
DF904	1U4
DH63	6Q7
DH77	6AT6
DH149	7C6
DK32	1A7
DK91	1R5
DK92	1AC6
DK96	1AB6
DL33	3Q5
DL35	1C5
DL36	1Q5
DL70	6373
DL91	1S4
DL92	3S4
DL93	3A4
DL94	3V4
DL95	3Q4
DL96	3C4
DL98	3B4
DL620	5672
DM70	1M3
DP61	6AK5
DY30	1B3
DY86	1S2, 1X2
EA76	5647
EAA91	6AL5, 6058
EABC80	6AK8, 6T8
EB34	6H6
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EBC33	7C6, 1639
EBC81	6BD7
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EBC91	6AV6
EBF80	6N8
EBF89	6DC8
EC70	5861
EC80	6Q4
EC81	6R4
EC90	6C4
EC91	6AQ4
EC92	6AB4
EC95	6ER5
ECC33	6SN7
ECC35	6SL7
ECC81	12AT7
ECC82	12AU7
ECC83	12AX7
ECC85	6AQ8
ECC88	6DJ8
ECC91	6J6
ECC189	6ES8
ECF80	6A8, 6BL8, 6DL8
ECF82	6U8
ECH35	6E8
ECH42	6C9
ECH81	6AJ8
ECL80	6AB8
ECL82	6BM8
ED2	6AL5, 6058
EF22	7G7
EF41	6F15
EF80	6BX6
EF85	6BY7
EF86	6267
EF89	6DA6
EF91	6AM6
EF92	6CQ6
EF93	6BA6
EF94	6AU6
EF95	6AK5
EF96	6AG5
EH90	6CS6
EK90	6BE6
EL33	6AG6, 6M6
EL34	6CA7
EL37	6L6
EL38	6CN6
EL70	6373
EL81	6CJ6
EL83	6CK6
EL84	6BQ5
EL85	6BN5
EL86	6CW5
EL90	6AQ5
EL91	6AM5
EL821	6CH6
EL822	6CH6
EM34	6CD7
EM35	6U5G
EM80	6BR5
EM81	6DA5
EM84	6FG6
EN32	6574
EN70	5643
EN92	5696
EN93	6D4
EQ80	6BE7
EY51	6X2
EY80	6U3
EY81	6R3
EY84	6374
EY86	6S2
EZ35	6X5
EZ80	6V4
EZ81	6BW4, 6CA4
EZ90	6X4
GZ30	5Z4
GZ32	5V4
GZ34	5AR4, 5U4
H63	6F5G
HABC80	19T8
HBC90	12AT6
HBC91	12AV6
HCH42	14K7
HD14	1H5
HD30	3B4
HF93	12BA6
HF94	12AU6
HK90	12BE6
HL92	5DC5
HMO4	6BE6
HY90	35W4
HY109	50BC7
KT32	25L6
KT61	6AG6
KT63	6F6
KT66	6L6
KTW63	6K7
L63	6J5
L77	6C4
LN152	6AB8
LZ319	8A8, 9A8
ME1401	5802
MT5545	5545
N14	1C5
N17	3S4
N18	3Q4
N19	3V4
N77	6AM5
N78	6BJ5
N144	6AM5
N147	6AG6
N727	6AQ5
PABC80	9AK8
PCC84	7AN7
PCC85	9AQ8
PCF80	8A8, 9A8
PCF82	9U8
PL21	5727
PL81	21A6
PMO4	6BA6
PMO5	6AK5
PMO7	6AM6
PY81	17Z3
PY82	19X3, 19Y3
QQVO3-10	6360
QQVO3-20A	6252
QQVO3-28	6252
SP6	6AM6
U41	1B3
U50	5Y3
U52	5U4
U78	6X4
U147	6X5
U154	19Y3
U319	19Y3
UBC41	14L7
UCH42	14K7
UF41	12AC5
V2M70	6X4
W17	1T4
W179	6BY7
X17	1R5
X18	1AC6
X63	6A8
Y61	6U5
Y63	6U5
Z63	6J7
Z77	6AM6
Z152	6BX6
Z719	6BX6
ZD17	1S5
1C1	1R5
1C2	1AC6
1D13	1A3
1F2	1L4
1F3	1T4
1FD9	1S5
1P10	3S4
1P11	3V4
2D21	5727
6F12	6AM6
6M1	6U5
7D9	6AM5
8D3	6AM6
30C1	8A8, 9A8
30L1	7AN7
63ME	6U5
64ME	6CD7
85A1	OE3
85A2	OG3
5881	6L6

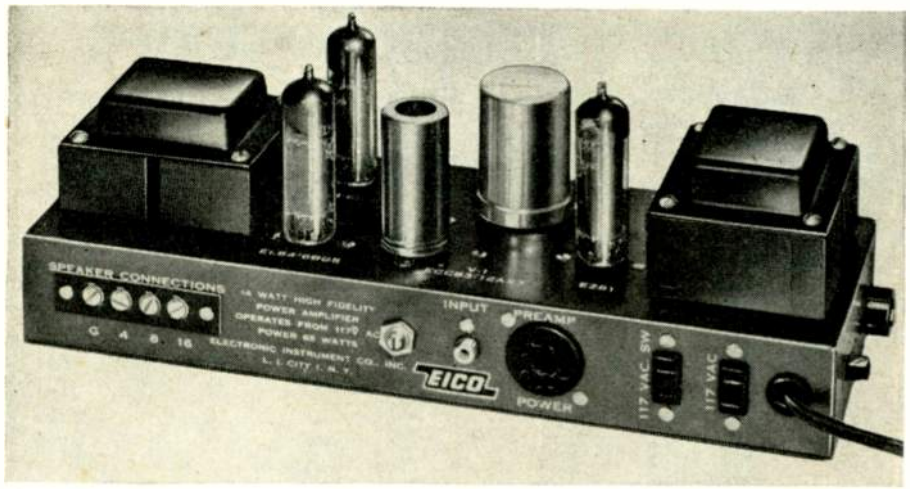


Fig. 1—Hum currents in the transformer laminations also circulate through the chassis. The chassis acts like another lamination. Interaction between transformers can be minimized by wide spacing, and rotation. Transformers having small flux densities and proper shields induce minimum hum.

The Elusive Ground Loop

Internal And External Loops Can Wreck A Sound System. How To Identify And Deal With Hum Circulating Currents.

MANNIE HOROWITZ
Project Engineer
Electronic Instrument Co.

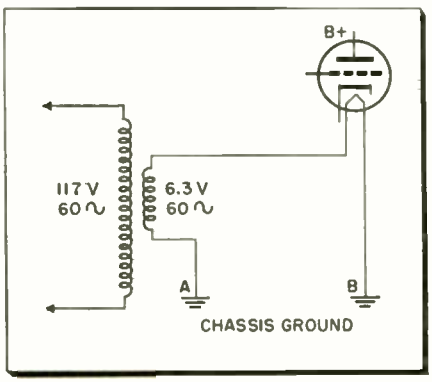
• Considering the many possible causes of hum in audio amplifiers, perhaps the most difficult to locate and correct is the ground loop. Both the designer and technician find this to be a rough problem in the monophonic high fidelity setup, and the complexity is increased considerably with stereo.

Chassis Currents

Alternating current at the power line frequency is always present in an electronic equipment chassis and if permitted to mix with the signal, the chassis currents will appear as hum at the output of an audio amplifier. Much of these currents are produced by the power transformer. When the power transformer is mounted as shown in Fig. 1, the laminations are parallel to the chassis. The chassis will act as if it were one of the laminations. The currents at power line frequencies (assumed to be 60 cycles) are thereby induced into the chassis. Because the chassis is usually a good magnetic and electric conductor, these undesirable currents will circulate freely.

Although the reasons may not be as obvious in the case of other mounting configurations, circulating currents due to the power transformer, are still present. Even transformers having very small flux densities, and copper bands to confine the flux induce some currents into the chassis. Adjacent power lines and other nearby electrical equipment may also induce hum.

Fig. 2—The common practice of using the chassis as a conductor introduces a direct hum voltage. Solution is to use a wire conductor and remove all ground connections except one.



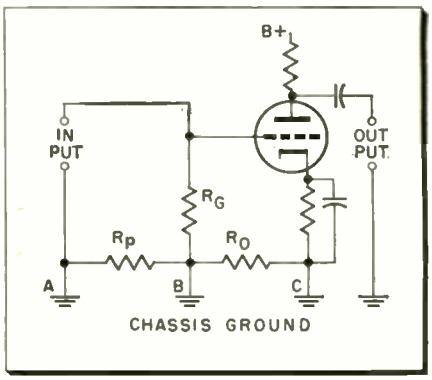


Fig. 3—Resistors R_P and R_O represent the small but finite resistance between the separate ground points A, B and C. Voltages developed across these resistors combine with the signal and appear at the output.

A more direct source of chassis currents is encountered when the chassis is used as a conductor or return path for some of the 60 cycle and other currents. Consider a very common practice of connecting one side of the filament supply voltage to ground as shown in Fig. 2. One side of the heater, and one side of the power transformer are connected directly to the chassis at different points. There obviously has to be a current flowing through the chassis between these points.

A possible solution to the problem would be to remove the power trans-

Ground Loop

Chassis Currents
- **Direct**
- **Induced**

Hum Voltage

Isolating Hum
- **Ground Loop**
- **Power Supply**

Ground Loops
- **Accidental**
- **Internal**
- **External**

former from the main amplifier chassis. However, it is more convenient and economical to have but one chassis. In order to prevent induction from nearby power lines, an amplifier may be located in a relatively field-free spot in a room. Esthetics, convenience and the wife dictate the placement of an amplifier, not the location of stray electric fields. Fortunately, with a little insight into just how these currents affect the hum characteristics of an amplifier, the annoying hum at the output may be reduced or entirely eliminated.

Hum Voltage

An ohmmeter will read zero resistance between any two points on the chassis. There is nevertheless a small finite resistance which can be measured by sensitive instruments. The 60 cycle chassis current passing through this small resistance produces a minute voltage drop between the cathode and grid in a vacuum tube circuit, the 60 cycle power line frequency would be amplified along with the desired signal. This condition is illustrated in Fig. 3. Points A, B and C represent the ground return for signal, grid, and cathode respectively. Resistors R_O and R_P represent the small resistance in the chassis between these points. The voltage across these resistors combine with the signal and appear as hum at the output. Two sources of hum due to ground loops are demonstrated in this one example. The importance of it depends largely upon the sensitivity of the particular amplifier stage and relative strength of the desired signal. In the power output stages where signal levels are high, little or no effect may be noticed. In the phono, tape or microphone preamplifier stage, this condition becomes intolerable.

A method which can be used to eliminate hum in this example is to connect all ground returns to one point on the chassis. If, for the convenience of wiring and layout, it is not expedient to connect all these leads to one point, connect each lead to an insulated tie lug, then connect the tie lugs with one wire, and ground the wire at the signal input point A in Fig. 4. All ground leads will then be connected together, but wil. be connected to the chassis at only one point.

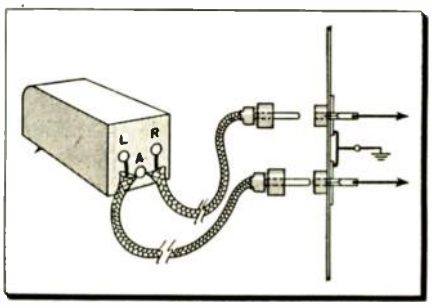


Fig. 5—Loops may be created when shields are used to carry signal. One solution is to disconnect one shield at point A.

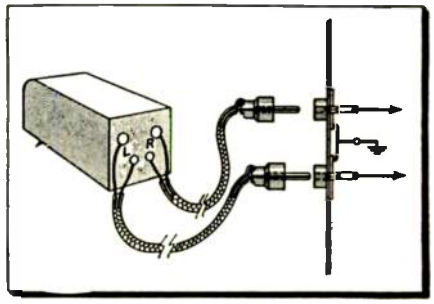


Fig. 6—Shields should not be used as signal return paths, and should be insulated from each other, except at the chassis.

It is best to avoid chassis currents as much as possible. This is easily accomplished in the circuit shown in Fig. 2. Connect both sides of the filament winding on the power transformer directly to the filament lugs on the tube socket, using insulated wires. Then connect one filament lug to the chassis ground at one point. Current will flow only through the wires, and the filaments will not float because of the connection to the chassis.

Isolating Hum

In the service shop, it should not be too difficult to isolate hum caused by ground loops from other types of hum. Ground loop hum is hum at the power line frequency, and not double or other frequency. A Lissajous pattern on the scope, or other simple scope technique can spot the troublesome frequency. A common hum frequency is 120 cycles, but this is usually due to defective filtering in the power supply, and not a ground loop. Conventional servicing techniques can readily clean up the power supply.

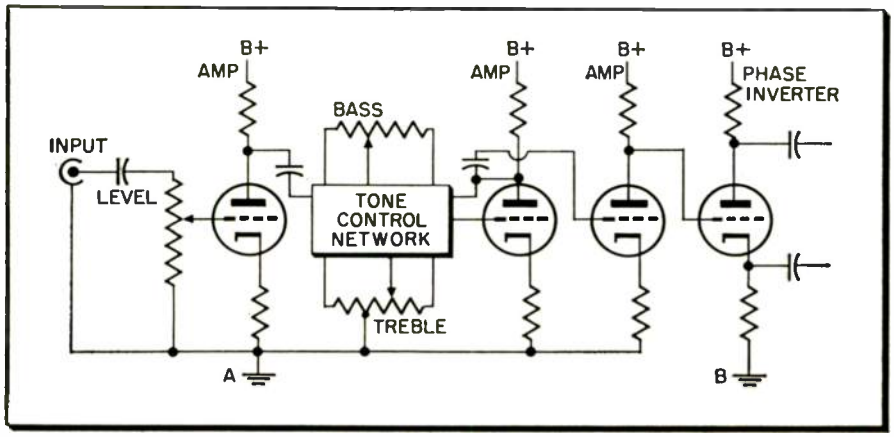
If the hum is of the 60 cycle variety, it still may not be due to a ground loop. Heater-cathode leakage; lead dress, particularly near low-level stages; and absence of appropriate shields may singly or combined, induce 60 cycle hum. Once these points have been checked and the 60 cycle hum is still excessive, it is fairly certain that the difficulties are caused by ground loops.

Accidental Ground Loops

The source of an accidental ground loop is usually difficult to locate. An accidental drop of solder during manufacture may create another

(Continued on page 76)

Fig. 4—Modern wiring techniques usually have but one ground connection at the input, point A. High level output stages are normally not troubled by ground currents, and can be returned directly to ground point B.



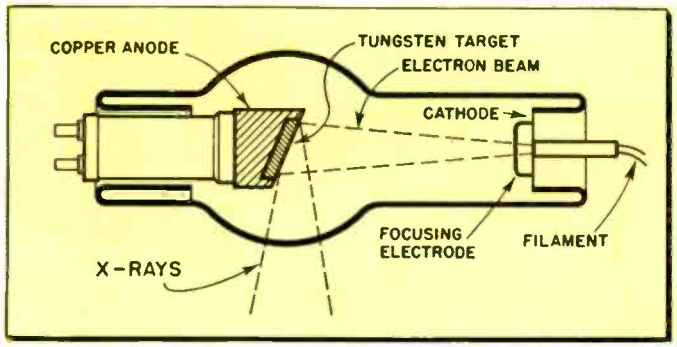


Fig. 1—Electron beam bombards target at a great force. Reflected X-rays are useful for industrial applications, as well as for medical purposes. While equipment is impressive, its circuits should present no new problems to the Electronic Technician.

Electron Beams Used To Penetrate Solid Objects Provide Opportunities For Equipment Maintenance By Electronic Technicians

X-Rays At Work In Industry

ALLAN LYTEL

• X-rays are an important means of inspection for industry as well as for medicine. Roentgen or X-rays are electro-magnetic radiations much the same as radio waves but of much shorter wavelengths. The X-ray band is above the ultra-violet region in the electronic spectrum, having a wavelength in the order of 10^{-7} to 10^{-9} cm. Professor Wilhelm Roentgen accidentally discovered X-rays as early as 1895. The development of modern type tubes started with the work of Coolidge, who in 1913, produced the tube shown in Fig. 1. Electrons from the heated cathode bombard a solid target at a great force, and produce X-ray radiation. Targets of high atomic weight yield more X-rays, and the greater the electron speed the harder and more penetrating the X-rays are. Because of the tilt of the anode surface the beam of radiation is directed outside the tube. Very high voltages (10,000 to 2,000,000) are used. Because of the high voltage and heat developed specially designed tubes and anodes are required. Some anodes are solid tungsten and others are made with a tungsten target mounted in solid copper for better heat conduction.

Transformer oil or water may be pumped through the anode. Gas such as sulphur hexafloride may be used. Combinations of cooling methods are possible. In some commercial applications the tube, and all of the associated high-voltage components are mounted in an oil-filled case. Such a tube head is shown in Fig. 2. X-rays used in industrial applications fall into 3 large classifications.

(1) *Industrial Radiography:* Use of X-ray for inspection of opaque objects. Metal castings or welds can be inspected by this means and defective parts can be located before they cause costly failures.

(2) *Thickness Gauge:* A means of continuously checking the thickness of metal sheets in rolling mills. The X-rays are passed through the rolling sheet and measured by a Geiger

Fig. 2—X-ray tube head, containing tube and all high-voltage components, can be seen through the large opening in the king-sized boiler.

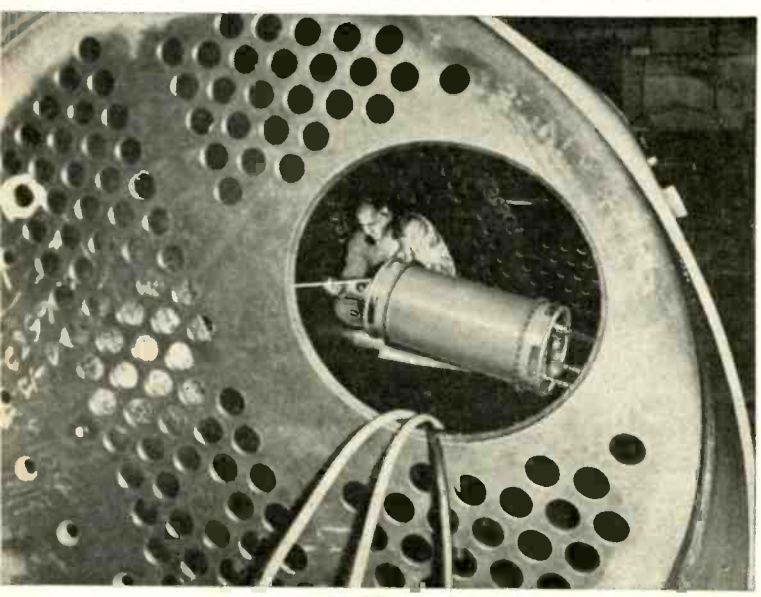
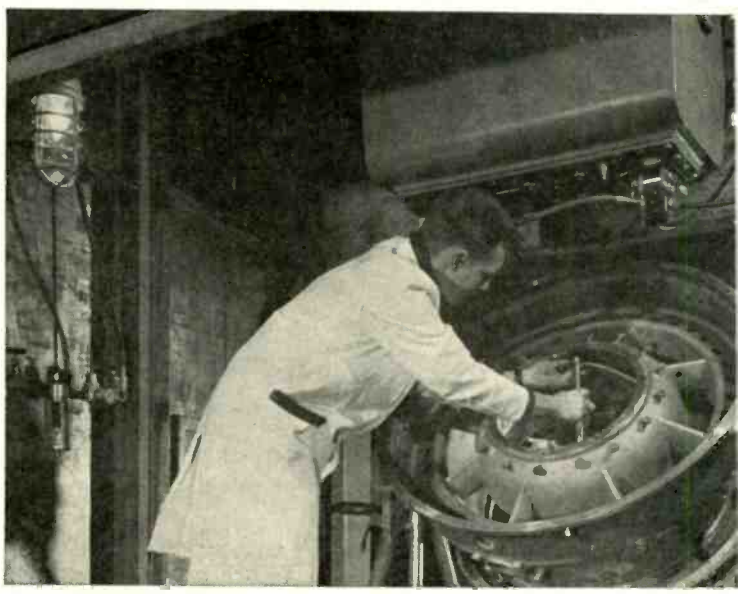


Fig. 3—A self-contained industrial radiographic machine is used here to look for material defects in aircraft engine parts.



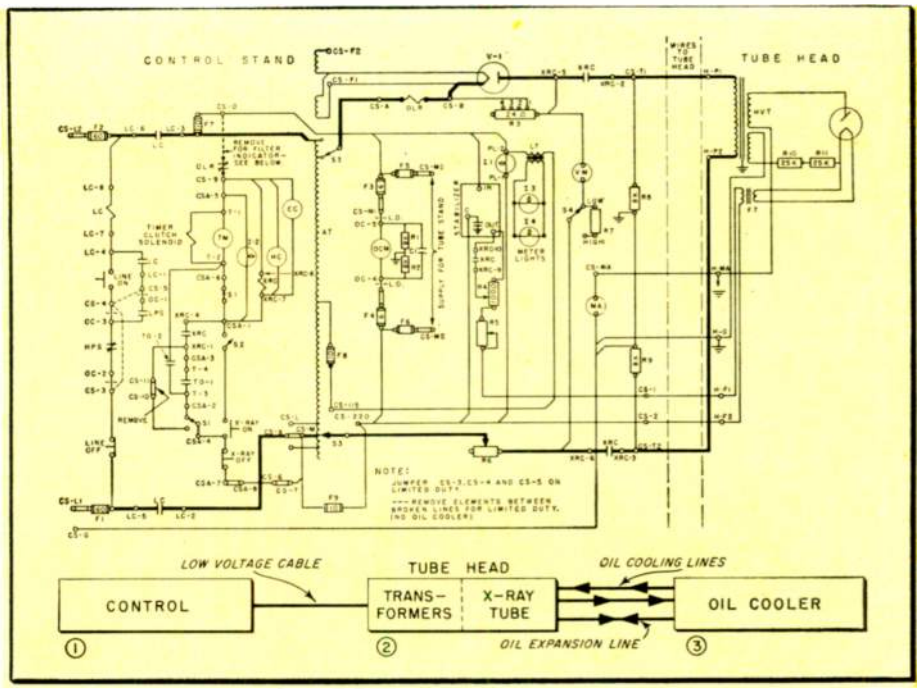


Fig. 4—Symbols used in industrial type schematics are a bit different, but can be easily understood. The control unit and tube head of an industrial radiograph is in many respects less complex than a TV receiver.

Counter, or other similar device. The counter is calibrated to indicate thickness.

(3) *X-ray Diffraction:* A method of measuring scattered radiation when X-rays pass through a substance. By photographically recording these scattered rays and comparing them to standards, the material may be identified.

An example of an industrial radiographic machine is shown in use at the Ford Motor Company's Aircraft Engine Division in Fig. 3. It is a self-contained unit operating from a 200-260 volt 50/60 cycle single-phase a-c line. All parts which operate at high-voltage (60,000 to 250,000 volts) are enclosed in an oil-filled tank. The tube is also mounted in oil to prolong its life and to prevent overheating. The 3 major sections of the radiograph are shown in Fig. 4. Also shown is an industrial type schematic of the control unit and tube head. Note that the tube head contains the high voltage supply as well as the X-ray tube, and avoids the need for having long high voltage cabling between sections.

Control Unit

Controls and indicators are all in one location. The line switch turns on both the oil cooler and tube filaments. A voltmeter is provided to read the X-ray tube voltages. A filament control adjusts the operation of the tube by controlling filament current. A Kilovolt Selector is used to obtain the proper high voltage. While in standby, filament current is reduced to lengthen the life of the X-ray tube. The X-ray Switch turns on the high voltage, and starts a timer. The timer automatically shuts off the high-voltage, after a pre-set interval.

Tube Head

Two transformers are used in the tube head. The high-voltage transformer, HVT, has the center-tap grounded through a milliammeter mounted on the control unit. This places the meter at ground potential. The safety factor is evident. The X-ray tube acts as a self-rectifier, and conducts only when the anode is positive. FT is the filament transformer. Both transformers are connected to voltage controls at the control panel.

Oil Cooler

Much of the energy from the electron beam falling on the anode is converted into heat. Oil surrounds the tube and transformers in the head. The cooling is carried into the tube by a coil built into the anode itself. Flexible hoses carry the oil under pressure, into the anode and then through the cooling unit. A third hose is also used to permit the oil to flow in either direction due to expansion or contraction. The cooler has a radiator, pressure unit, fans, oil gauge, filter, and oil cap for adding more oil when required; transformer oil is used.

INDUSTRIAL X-RAYS

Applications

Radiography
Thickness Gauge
X-Ray Diffraction

Major Sections

Tube Head
Control
Cooling

Types

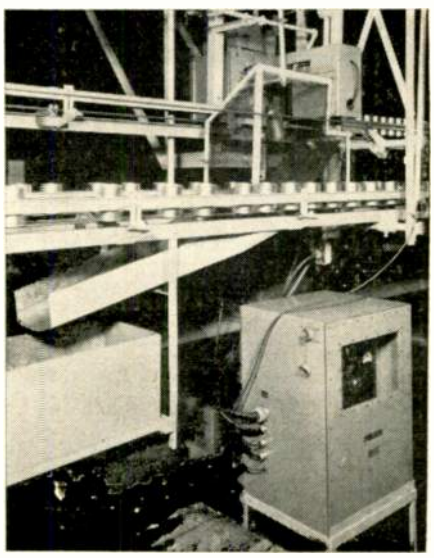
Portable
Medium power
High Power

Special Types

Because of the growing number of applications of industrial X-rays, many different types of units are being developed, some very small and portable, and others that are giant sized. A 2,000,000 volt industrial radiographic unit can penetrate very thick opaque materials. It uses a resonant transformer for generating high voltage, and is designed to operate from a 3-phase 440 volts,

(Continued on page 56)

Fig. 5—Low intensity X-rays determine height of fill in sealed containers. Air blast pushes rejects down the chute.



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2 **Controls:** A supplement to "Auto Radio Control Replacement Guide" lists over 60 replacement applications for on-off push-button radio switches. (2B6: Centralab)

3 **Radios:** A new line of distinctively designed, all transistor portable radios is described and illustrated with prices in a colorful circular. Models range from a miniaturized pocket size to a full size table portable. (3B6: Channel Master)

4 **Couplers:** The Wizard 300 TV-FM multi-set coupler is covered in an illustrated circular. 2 or 20 sets can be operated from one antenna, without amplification. Reception on all channels. There is no interference between sets. (4B6: Charles Engineering, Inc.)

5 **Hi-Fi:** Just announced is catalog 134—a colorful 28-page guide to the firm's line of hi-fi speakers, enclosures and systems. Also contains an introduction to stereo and illustrates proper placement of speakers. (5B6: Electro-Voice, Inc.)

6 **Antenna Equipment:** Literature covers a line of master TV antenna equipment. Includes: complete line of outlets in all attenuations from 10 to 30 db; antenna filter and filter base; and the SA-23 amplifier. (6B6: Entron, Inc.)

7 **Tube Saver:** A technical bulletin illustrates how the CTS Save-A-Tube reduces color and black and white TV tube failures. Included are prices and typical TV circuit applications. (7B6: G-C Electronics)

8 **Transmission Line:** A new catalog sheet covers transmission line for TV lead-in, community TV transmitter feed lines or antenna elements. A second sheet is devoted to spiral wrap—the spirally cut polyethylene tubing for cabling loose wires. (8B6: Illumitronic Engineering)

9 **Antenna:** Literature and specification sheets describe Channel King indoor TV antenna. Features include: extension to 42"; retraction to 0"; single dial adjustment; and fast, positive, wide range tuning. (9B6: Marjo Technical Products)

10 **Truck Bodies:** Information covering Service-Master truck bodies is contained in a new 6-page folder. The bodies are available in two models—four sizes—for ½, ¾, 1 and 1½ ton chassis. (10B6; McCabe-Powers Body Co.)

11 **Magnetic Tape:** Interesting literature shows how service dealers can sell tape profitably. Package program provides for substantial discounts, sales aids and recorder repair manual. (11B6: ORRadio)

12 **Vibrators:** There is a replacement type for every 6- and 12-volt application. They are all listed in a new Vibrator Replacement Guide. (12B6: Radiart Corp.)

13 **Communication Units:** Packmaster, a portable FM communication unit, and Minipak FM Radio Phone, a light weight portable radio communication unit for use by personnel in remote areas, are described in two new circulars. (13B6: Radio Specialty Mfg. Co.)

14 **TV Wiring Systems:** Installation information, with specifications, diagrams and illustrations for concealed TV wiring systems are provided in a 4-page brochure. Catalog sheets describe couplers, wall plates and clips. Prices included. (14B6: TeVco Insulated Wire Co.)

15 **Panel Instruments:** Catalog No. 59-1, just released, covers a wide range of panel instruments. Includes a newly announced line of 4-inch Unimeters. (15B6: Triplett Electrical Instrument Co.)

16 **Test Equipment:** 4-page brochure and 4 engineering data sheets give general description and applications, technical description and technical data on the firm's line of pocketscopes, panelscopes and the TV & Hi-Fi craftscope. Other items described are cathode ray tubes, kits and probes. (16B6: Waterman Products Co.)

17 **Hand Tools:** Literature is available covering a full line of hand tools designed for radio, TV and electronic technicians. Tools can be purchased individually or in kit form. (17B6: Xcelite, Inc.)

CUT HERE

This coupon must be used before July 20, 1959

1. Circle free literature numbers. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

2. For more data on new products and bulletins write in code numbers .....

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3. Fill in your name and address. Mail promptly.

Name .....

Position ..... Firm .....

Address .....

City ..... Zone ..... State .....

1. Circle numbers of free literature desired.

2. For more data on new products and bulletins described in this issue, write in ELECTRONIC TECHNICIAN, 480 Lexington Ave., end of each item.

3. Fill in name and address. Mail to ELECTRONIC TECHNICIAN, 480 Lexington Ave., New York 17, N. Y.

LOOK what's behind SYLVANIA'S dramatic new consumer advertising!

ANNOUNCING THE

SYLVANIA

$2. Combination

America's biggest magazines deliver this business-building offer to over 100 million readers!

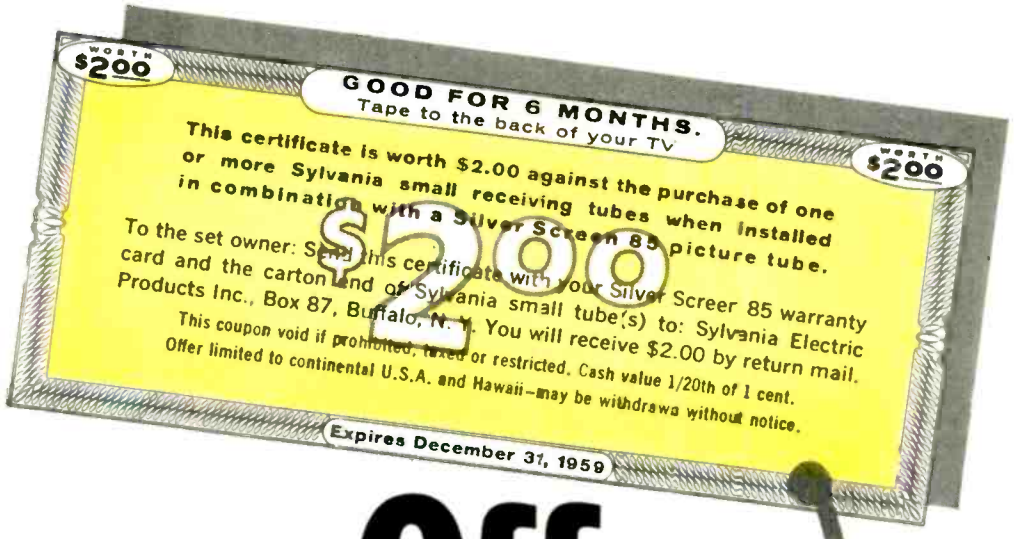
Look for this ad in these leading national magazines.

On June 20th Sylvania launches the dramatic combination coupon offer appearing in America's biggest weekly magazine, *TV Guide*, and America's biggest monthly magazine, *Reader's Digest*—plus *Sunday* and *Parade* newspaper supplement magazines.

Your Service shares the spotlight with top-quality Sylvania picture tubes and receiving tubes in a three-point program to make your customer's old TV set *better than when it was new.*

Month after month, more set owners will be saving the $2.00 coupon. Many will attach it to the back of their TV set so it's there for you to see.

You can identify yourself with this program by featuring Silver Screen 85 and Sylvania receiving tubes. Get behind the biggest, most practical, business-building offer ever made to the Service industry.



Coupon Offer

Sells your service and Sylvania receiving tubes in combination with every Silver Screen 85 you install

Here's an action-packed offer that can add an average of $3.00 to $6.00 in receiving tube business every time you install a Silver Screen 85 picture tube.

Sylvania urges your customers to have their receiving tubes checked to make sure they get full performance from their new Silver Screen 85. And, to emphasize the importance of replacing weak tubes, Sylvania offers to pay $2.00 toward the cost of Sylvania receiving tubes installed in combination with a Silver Screen 85.

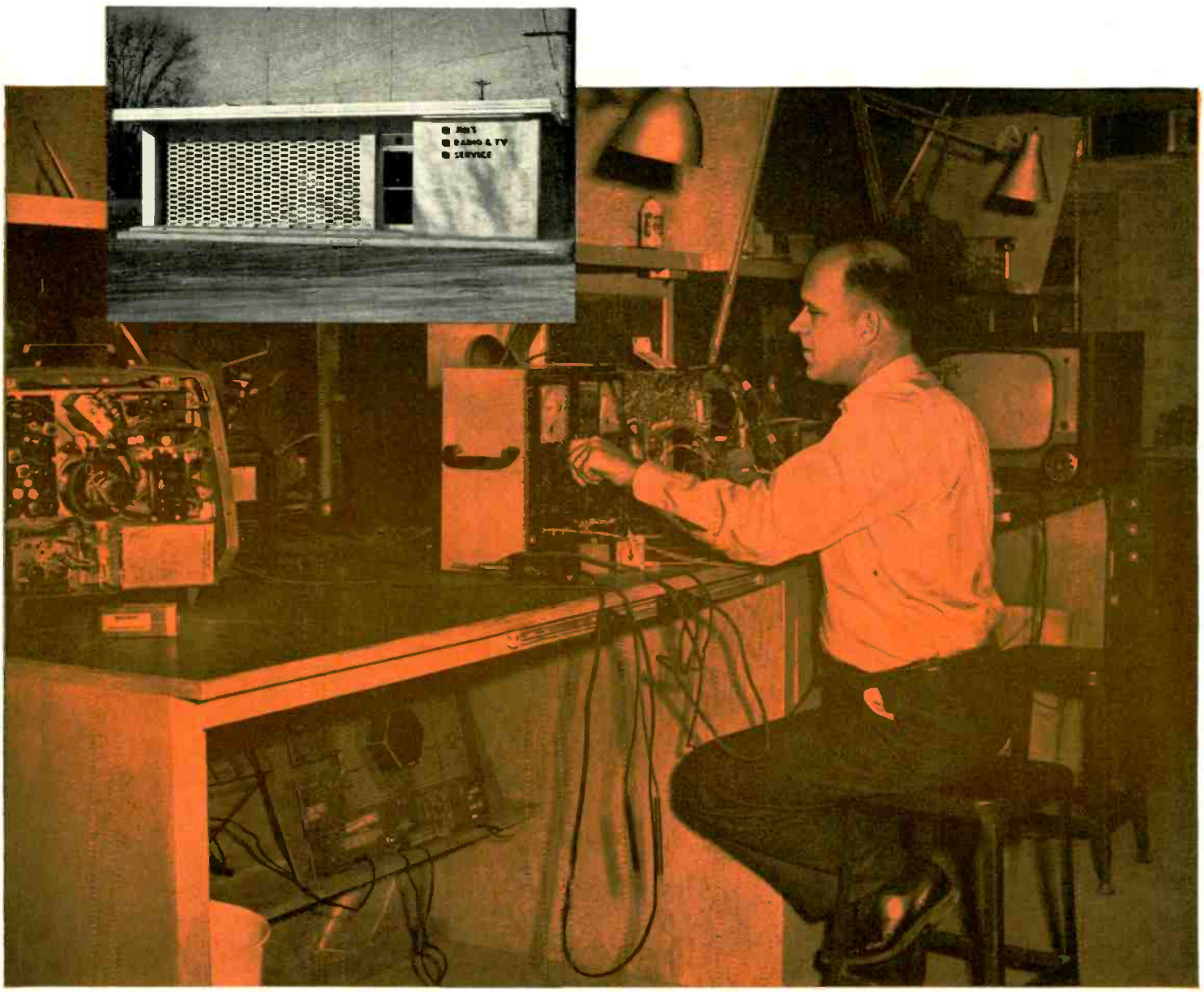
Your customers mail the $2.00 certificate directly to Sylvania with the picture-tube warranty card and receiving-tube carton end. Nothing for you to sign or send.

Stock up on Sylvania. Be prepared for greater-than-ever consumer demand for America's Number One picture tube and receiving tubes.

SYLVANIA
Subsidiary of
GENERAL TELEPHONE & ELECTRONICS

TV Technician JIM CARPENTER says...

"Service Is Our Only Business... That's Why We Use Mallory



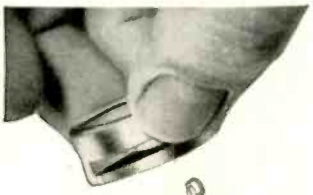
Jim Carpenter started his own business—Jim's Radio & TV Service—in Springdale, Arkansas. Over a period of ten years it has grown from a one-man operation to a firm that employs six full-time men. Recently Jim moved to the new building shown above.

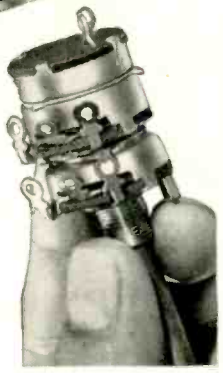
Concentrating on dependable service gave Jim a reputation which allowed business to grow quickly. Jim and his men handle radio and television service throughout their trade area.

Jim is a Major in the active Army Reserve. He carries a commercial card and is branching out into commercial mobile work.

Quality Parts"

"When a shop concentrates on service, it can't afford to take chances with customer satisfaction. So we depend on Mallory components. They're always consistent in quality. And I always feel 'safe' about a job when I've used Mallory components . . . there's no worry about costly, time-consuming callbacks. Mallory has been giving me the same quality and dependability since I started in business . . . quality and dependability that I've come to take for granted."





When it comes to controls, for instance, hundreds of technicians like Jim choose low-noise, long-lasting Mallory Sta-Loc* controls. In just 30 seconds their distributor can give them the exact replacement they need . . . of any of over 30,000 combinations. No need to wait days for out-of-stock controls. What's more, Sta-Loc design lets you replace the line switch by itself, without unsoldering control connections.

Whatever your service needs, Mallory provides the widest selection of quality components at sensible prices. And every Mallory component is service-engineered to assure long, trouble-free life.

*Trademark

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

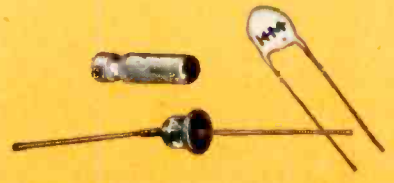
Put an end to callbacks with these quality Mallory products...

Gems—5 rugged, moistureproof, Mallory "Gem" tubular capacitors in an easy-to-use dispenser that keeps your stock fresh and clean—easy to find—no more kinks in lead wires. They're your best bet for outstanding service in buffer, by-pass or coupling applications.

RMC Discaps®—are a product of the world's largest producer of ceramic disc capacitors. Long the original equipment standard, Mallory RMC Discaps are now available for replacement. They come in a handy 3" x 5" file card package . . . easy to stock, simple to use.

® Registered Trademark of Radio Materials Company, a P. R. Mallory & Co. Inc. Division.

FP Electrolytics—The Mallory FP—the original 85°C capacitor—now has improved shock-resistant construction and leakproof seal. Its etched cathode construction—standard in all FP's—assures hum-free performance. High ripple current ratings fit the toughest filter circuits.



Silicon Rectifiers—New Mallory design gives far longer life, lower forward voltage drop and reverse leakage current than conventional types . . . exceeds the requirements of military humidity tests. In convenient kits for replacement of selenium rectifiers in radio and TV.

TC Tubular Electrolytics—provide the same high quality and performance characteristics that are found in all Mallory components. They are now available in the handy twin pack.

Foreign Tubes

(Continued from page 38)

and particularly from tube type-to-tube type. Whenever a substitution is contemplated, a comparison of characteristics is recommended and a critical examination of circuit operation should be made.

Nomenclature Guide

Table 2 is a nomenclature guide. The tube type is indicated by a series of letters and numbers such as ECC82. It generally consists of 2 or 3 letters followed by 2 or 3 figures. The first letter indicates filament voltage or current. The second and subsequent letters indicate the general class of tube. The first figure represents the type of base. The second and third figures are serial numbers indicating a particular design, as demonstrated in the following examples.

EABC80	E	6.3 V. Heater.
	A	Single diode.
	B	Double diode.
	C	Triode.
	8	B9A base.
	0	Serial number.
PL820	P	300 ma heater.
	L	Output pentode.
	8	B9A base.
	20	Serial number.
UCH42	U	100 ma heater.
	C	Triode.
	H	Hexode.
	4	B8A base.
	2	Serial number.

The European "valves" are usually quality tubes, and in many cases design features are incorporated in them to improve performance. There are many tubes, both domestic and foreign, which can be interchanged, not only for the purpose of restoring operation of apparatus, but in many cases to obtain improved performance characteristics . . . less noise, more gain, more stability, etc. If tubes are substituted and difficulty is encountered such as unstable oscillators, inherent tube noise, microphonics, distortion, and other subtle discrepancies, then the most logical procedure would be to use an original replacement. •

PRICE TRENDS

PRICE TRENDS, courtesy Audio-File div., United File - O - Matic: MARANTZ stereo console 7C increased to $249. HARMAN-KARDON enclosures FW-30 & WW-30 decreased to $29.95 ea.

FISHER amplifiers 80-R & 125-A discontinued.

GRANCO: FM tuner T-160 discontinued.

BOZAK speaker system B-300 decreased to $158.50

VIKING OF MINN. tape deck 95 increased to $465.

DUOTONE needles 808/DS & 812/S increased to $11.

WEATHERS speaker system SE-100B decreased to $139.

ALTEC-LANSING cabinet 873B-C increased to $81.

SHURE Models 61B & 98B99 increased to $58.50 and $66.

SONOTONE speaker CA-12 discontinued.

V-M phono 625 & changer 1250 discontinued.

FERRODYNAMICS 0.5 mil mylar tape 5S7M increased to $6.45.

FANON: Junction boxes JO and SB weatherproof discontinued.

CONNOISSEUR turntable C-100 increased to $119.50.

GE mono amplifier PA-20 discontinued.

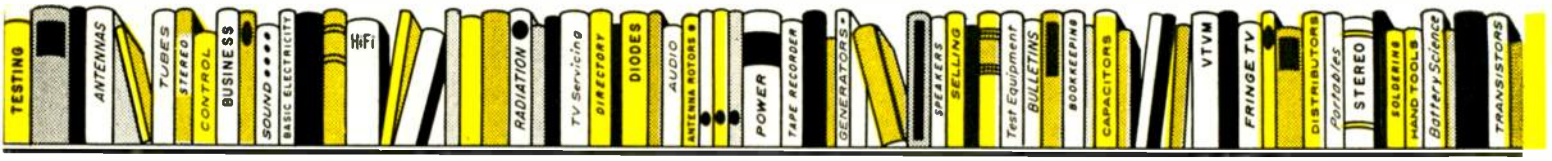
ELECTRO-SONIC stereo cartridges C-100 & P-100 decreased to $69.95 and $79.95, respectively.

BLONDER-TONGUE amplifier A-1 & tuner T-88 decreased to $42.40 & $34.15. WEATHERS model SE-50 decreased to $29.75.

BOGEN amplifier DB130 discontinued. BOZAK stereo system B-304 decreased to $620. NORTH AMERICAN cartridge AG3121 discontinued. FISHER master control 90C & amplifier CA40 discontinued. AUDIOGERSH stereo kits XA/CK & XM/CK decreased to $14.50.

Improve Your Skills By

Building a Technical Library



HOME AIR CONDITIONING INSTALLATION & REPAIR

By J. Derman, F. Makstein & H. Seaman. Both theory and practical construction designs are examined, along with maintenance techniques and procedure for determining size of air conditioner required. Covers motors, compressors, condensers, evaporators, regulating valves, circuits and other system elements. Soft cover, 160 pages. Price $3.50.

INDUSTRIAL CONTROL CIRCUITS

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

REPAIRING HI-FI SYSTEMS

By David Fidelman. How to find and correct troubles in hi-fi equipment with either little or elaborate test equipment. Among the many subjects covered are servicing amplifiers, preamps, tuners, tape recorders, changers, pickups and speakers. Construction and custom installations are discussed. Soft cover, 212 pages. Price $3.90.

FUNDAMENTALS OF RADIO TELEMETRY

By Marvin Tepper. This well-illustrated basic book tells how missiles and satellites relay data to earth. Topics include multiplexing, receiving stations, data recording and digital techniques. Telemetry standards and bibliography in appendix. Soft cover, 136 pages. Price $2.95.

SHOOT TV & RADIO TROUBLE FAST

By Harry G. Cisin. The first part of this book relates to symptoms, faults and remedies for ac-dc radios. The second part covers TV, with each practical test and repair explanation related to a specific problem. Printed circuits are discussed. Soft cover, 40 large pages. Price $1.50.

BASICS OF DIGITAL COMPUTERS (3 vols.)

By John S. Murphy. Using the easy-to-learn picture book technique, these three volumes explain the theory and functions of digital computers. Very little mathematics. Covers counting systems, computer language, programming, memories, logic diagrams, flip-flops, clamping, input-output and data processing. Soft cover, 416 pages. $7.50/set.

IMPEDANCE MATCHING

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

RADIO OPERATOR'S LICENSE Q & A MANUAL

By Milton Kaufman. This sixth edition gives you the information you need to pass FCC license examinations. In question and answer form similar to actual FCC tests, all eight elements are covered, including law, radiotelephone, radiotelegraph, aircraft and ship radar. Abbreviations, code, etc. included. Hard cover, 736 pages. Price $6.60.

HOW TO SERVICE TAPE RECORDERS

By C. A. Tuthill. Starting with basic magnetic principles, the test goes through the recording operation, recorder mechanisms and circuitry. In addition to an explanation of the functions of the various recorder elements, the techniques for repairing various troubles and making tests are presented. Soft cover, 160 pages. Price $2.90.

A-C CIRCUIT ANALYSIS

By Alexander Schure. That most basic of electronic functions, alternating current, is fully discussed. In addition to covering RLC performance in circuits, a clear explanation is given of the "j" operator in vectorial presentation. Q & A at each chapter's end show how a-c circuit problems are solved. Soft cover, 104 pages. Price $1.80.

GUIDE TO MOBILE RADIO

By Lee Sands. This fundamental, yet practical book on 2-way radio covers base stations, transmitters, receivers, antennas, remote controls, power supplies, portable gear, field survey, selective calling, licensing and maintenance. One section examines useful test instruments. Soft cover, 160 pages. Price $2.85.

AUDIO MEASUREMENTS

By Norman Crowhurst. This informative book explains practical techniques for installing and repairing hi-fi equipment. Topics include test instruments, amplifiers, transformers, pickups, changers, recorders, etc. There is helpful data on using the audio generator, distortion meter and scope. Soft cover, 224 pages. Price $2.90.

ELECTRONICS IN INDUSTRY

By George Chute. How various electronic devices operate, and how they are employed in industry is clearly explained with little use of mathematics. Subject matter includes rectifiers, time delays, gas tubes, welding controls, ignitrons, heat and light relays, thyratrons, motors, servos and others. Hard cover, 431 pages. Price $8.00.

OBTAINING & INTERPRETING TEST SCOPE TRACES

By John F. Rider. This handbook shows how to get the most out of your oscilloscope. Over 800 traces are shown, including sine, square, rectangular, trapezoid, sawtooth differentiated and integrated types. Explains scope connections, manipulating controls and test setups. Soft cover, 190 pages. Price $2.40.

SMALL APPLIANCE SERVICING

By P. T. Brockwell, Jr. This volume gives you professional small appliance servicing techniques and business procedures. Illustrated instructions tell how to test units. Covers irons, toasters, mixers, roasters, coffee makers, waffle irons, rotisseries and others. A profitable sideline for TV technicians. Hard cover, 180 pages. Price $4.50.

ELECTRONIC TECHNICIAN editors have carefully selected these books by the world's leading technical publishers. Order direct from our Book Department. Fill in coupon or separate sheet. Money-back guarantee.

SERVICING TRANSISTOR RADIOS

By Leonard D'Airo: After a brief discussion of fundamentals, the text goes into radio circuits, servicing techniques, tests, measurements and dictionary of transistor terms. Interchangeability chart covers a variety of close replacements, including number and type. Soft cover, 224 pages. Price $2.90.

HOW TO RUN A SMALL BUSINESS

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

Books Described Previously

BASIC TELEVISION (5 vols.)	$10.00
INTRODUCTION TO PRINTED CIRCUITS	$ 2.70
BASIC ELECTRONICS (5 vols.)	$10.00
INTRODUCTION TO COLOR TV	$ 2.70
INTRODUCTION TO UHF CIRCUITS & COMPONENTS	$ 7.50
PROFITABLE RADIO TROUBLE-SHOOTING	$ 5.95
ELEMENTS OF MAGNETIC TAPE RECORDING	$ 7.95
MANDL'S TELEVISION SERVICING	$ 6.50
CLOSED CIRCUIT & INDUSTRIAL TV	$ 4.95
ELECTRONIC MUSICAL INSTRUMENT MANUAL	$ 7.50
REPAIRING RECORD CHANGERS	$ 5.95
TRANSISTORS IN RADIO AND TELEVISION	$ 7.00
HANDBOOK OF BASIC CIRCUITS, TV, FM, AM	$ 7.50
PINPOINT COLOR TV TROUBLES IN 15 MINUTES	$ 5.95
PORTABLE AND CLOCK RADIOS	$ 2.75
PINPOINT RECORD CHANGER TROUBLES	$ 3.95
TV DOCTOR	$ 1.00
VACUUM TUBE CHARACTERISTICS	$ 1.80
BASIC PULSES	$ 3.50
STEREOPHONIC SOUND	$ 2.25
FUNDAMENTALS OF TRANSISTORS	$ 3.50
INDUSTRIAL ELECTRONICS HANDBOOK	$22.50

To order above books, write in title and price on coupon.

ELECTRONIC COMMUNICATIONS

By Robert Shrader. Starting with electronic fundamentals, this comprehensive reference test goes through transmitters, FM, antennas, TV, shipboard radio, loran, radar and communication law. Chapters end with two sets of questions, one to prepare the reader for commercial FCC exams, the other for amateur licenses. Hard cover, 937 pages. Price $13.

TV CONSULTANT

By H. G. Cisin. Rapid TV trouble-shooting methods used here pinpoints cause of problem according to 24 sound symptoms, 213 pix symptoms and over 75 raster symptoms. Checks for each problem are noted. Also presented are explanations of rapid alignment technique and UHF servicing. Soft cover, 70 large pages. Price $2.

Also See New Books on Page 72

FREE!!

STATION LISTINGS BOOK

With every book order for $7.50 or more, you will be sent—without charge—a copy of the 64-page reference book, "Jones North American AM-FM-Radio-TV Station Listings." It lists over 5000 stations from official FCC information. Covers the United States and possessions, Canada, Cuba, Mexico and West Indies. Stations are cross-referenced by geographic location, by frequency and by call letters. Lists AM and TV network affiliations and AM operating power. A wealth of broadcasting information!

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6-59

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I plan to build my technical library. Please send me the books I have indicated below. You will pay postage. I understand that if I am not satisfied with any book for any reason, I may return it to you prepaid in good, clean condition within 7 days of receipt and receive a complete refund. If my order is for $7.50 or more, I will receive a free copy of the Station Listings Book.

Enclosed is my check or money order, in full payment, made out to ELECTRONIC MARKETERS.

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___Repairing Hi-Fi Systems ..... @ $3.90
___Fundamentals of Radio Telemetry ..... @ $2.95
___Shoot TV & Radio Trouble Fast ..... @ $1.50
___Basics of Digital Computers .. @ $7.50
___Impedance Matching ..... @ $2.90
___Radio Operator's License Q & A Manual ..... @ $6.60
___How to Service Tape Recorders @ $2.90
___A-C Circuit Analysis ..... @ $1.80
___Guide to Mobile Radio ..... @ $2.85
___Audio Measurements ..... @ $2.90
___Electronics in Industry ..... @ $ 8.00
___Obtaining and Interpreting Test Scope Traces ..... @ $ 2.40
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___TV Consultant ..... @ $ 2.00

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R and D Labs
Engineers...
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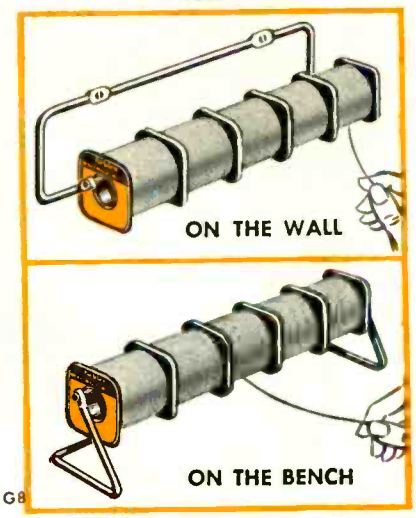
NEW Belden

WORKBENCH HOOK-UP WIRE DISPENSER KITS

Belden Dispenser Kits solve the problems of waste and inconvenience for all users of Hook-Up Wire and are available in the 14 most popular assortments of Vinyl, Vinyl-Nylon, Textile, and Teflon* insulated wire for every requirement.

Each kit contains an assortment of Hook-Up Wire colors and types plus a portable metal dispenser rack for workbench or wall mounting. The dispenser rack provides a complete, compact, and convenient wire department for every working area at the user's finger tips, simplifies user Hook-Up Wire stock maintenance, and helps keep wire clean and orderly while keeping the workbench neat and efficient. Available at all Belden jobbers.

* Du Pont trademark



One Wire Source for Everything Electrical and Electronic

Magnet Wire • Lead Wire • Power Supply Cords, Cord Sets and Portable Cord • Aircraft Wires Electrical Household Cords • Electronic Wires Welding Cable • Automotive Wire and Cable

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WIREMAKER FOR INDUSTRY
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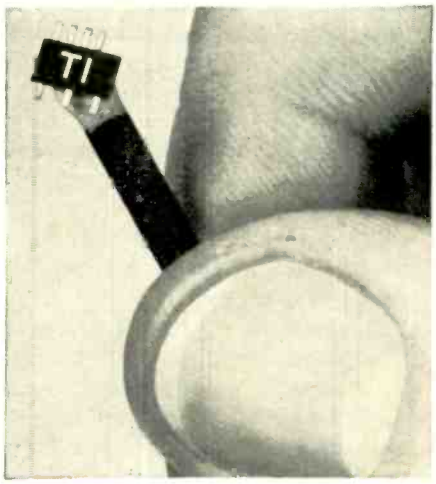
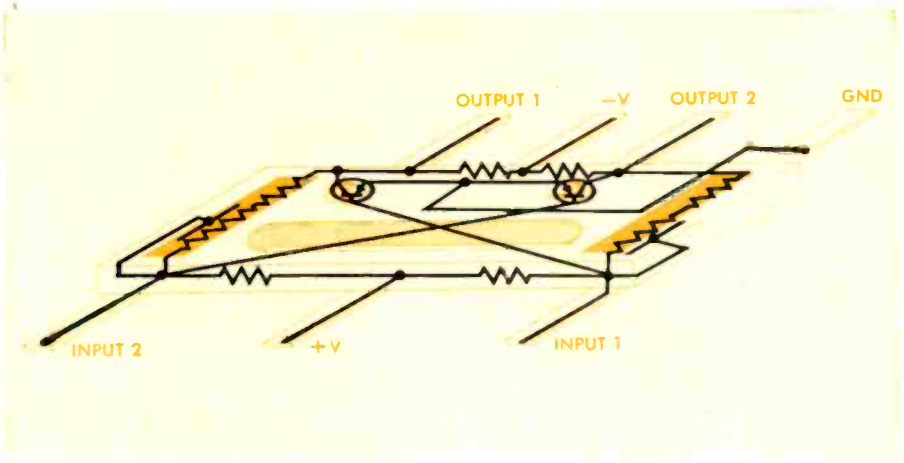


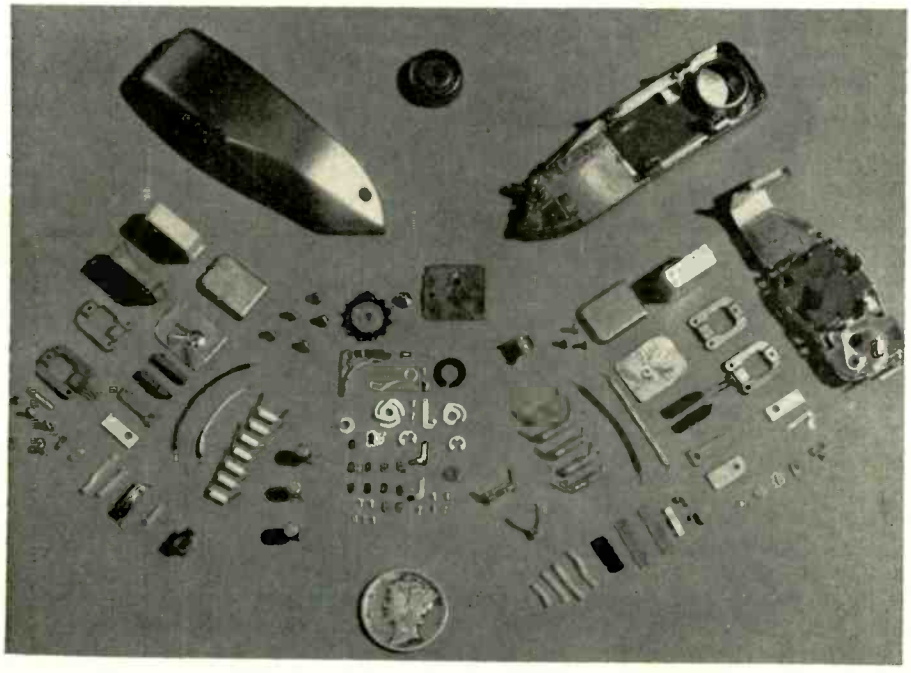


Match-head size unit at left is a silicon solid circuit multivibrator developed by Texas Instruments. Though measuring only 1/4" x 1/8" x 1/32", it contains the equivalent of 12 components—2 diffused-base transistors, 2 capacitors and 8 resistors. Component densities range up to 34 million per cu. ft. Enlarged drawing in color at right shows how silicon slab has been selectively etched to form the "mounds" which function like the circuit elements shown in black.

Microminiaturization

Tiny Components Open New Design Horizons

Present commercial application of miniaturization is this three-transistor Sonotone eyeglass hearing aid, containing some 150 components. Another hearing aid, not shown, is the size of a man's thumbnail, and is worn entirely in the ear.



• When electronic components began to be made smaller, they were called "miniature." Further size reduction brought forth the label "subminiature." Current progress results in the description "microminiature." It would not be surprising to see "ultramicrominiature" used before long. Some engineers have simplified the vocabulary; they refer to the miniscule electronic parts as "glob" circuits.

Developments in microminiaturization have been prompted by the design needs of missile electronics and computers. In time we expect this technique to find increasing application in commercial and entertainment electronic products. This will call for new servicing procedures—tiny probes, module replacement, and even magnifying glasses.

Engineers have already succeeded in putting the equivalent of a roomful of standard parts—1,000,000 of them—into 1 cu. ft. of space.

Representative of microminiature components are a Mallory solid tantalum capacitor, rated up to 15 μf-volts, measuring only 0.028" thick, and a mercury battery 0.135" thick and 0.305" in diameter.

A micro-module, which may contain several encapsulated or sealed micro-elements such as transistors, capacitors and diodes, as well as printed circuits, is replaced in its entirety when one of the components in the module goes bad.

Illustrated here are several other micro-elements which are making possible the production of extremely small electronic products. •

X-Rays At Work

(Continued from page 43)

25 amperes per phase power line. Its major components include: control unit, auxiliary panel, motor generator set and starter, X-ray transformer, X-ray tube, water cooling system and a portable gas supply and evacuating pump.

The X-ray tube is made up of many sections. Each section has an accelerating voltage ring to further increase the speed of the electrons. Advantages of this high-voltage operation include: fast radiography, which can shorten exposure time as much as 97%; increased sensitivity and allowable exposure range; and greater coverage. The head is about 8 feet long and 5 feet wide. It is usually located in a room above and focussed on work below. Two beams (reflected and transmitted) are produced and both of them are used. Simultaneous use of a reflected and a transmitted beam permits multiple inspection. The reflected beam lays down a 360° pattern about 30° wide. Its intensity is about 70% of the transmitted beam. The transmitted beam produces a cone pattern of nearly 60°, and is characterized by uniformity and high penetration which permits inspection of steel up to 10 inches thick.

In contrast to the high power equipment, the size of the tubehead in a portable unit is only 17 inches in diameter and 44 inches long. An electronic high-voltage power supply operates at approximately 1,000 cps. Operation at this frequency, instead of 60 cycles, reduces the size and weight of the transformer. A Wein-Bridge type oscillator is used to drive the high voltage circuits. The anode of the X-ray tube is operated at ground potential. Cathode voltage can be varied from 75 to 275 kilovolts.

An important application of industrial X-rays is in the inspection of closed containers such as canned milk, beer, baby foods, etc., for height of fill. Low intensity X-rays are passed through each container as shown in Figs. 5 and 6. Cadmium selenide crystals detect the X-rays after they pass through the containers. Because the signals from the crystals can discriminate between fills of different heights improperly filled cans can be rejected. Causes for rejection are either too high, too low, or both depending on the fill applications and the equipment used. To measure underfills the X-ray beam center passes through the container just below the correct level. In all cases the beam passes through the can parallel to the liquid level. As the containers pass down the conveyor a photoelectric relay senses the presence of a container and turns on the X-ray beam at the proper instant. Air pressure can be used to push rejected containers aside. Inspections up to 900 per minute with an accuracy within a few grams of container fill are possible with this rapid automatic system. •

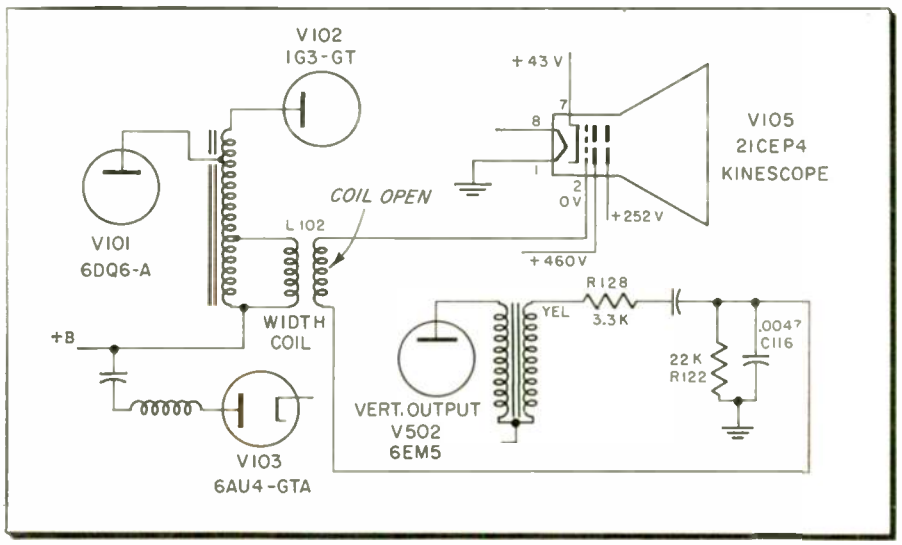
PASS THE SCREWDRIVER!

The sets I most frequently
Have to attack
Are the ones with an excess
Of screws on the back!

—P. Barlow

SHOP HINTS

Tips for Home and Bench Service



Open horizontal blanking takeoff coil affected agc as well as control of brightness.

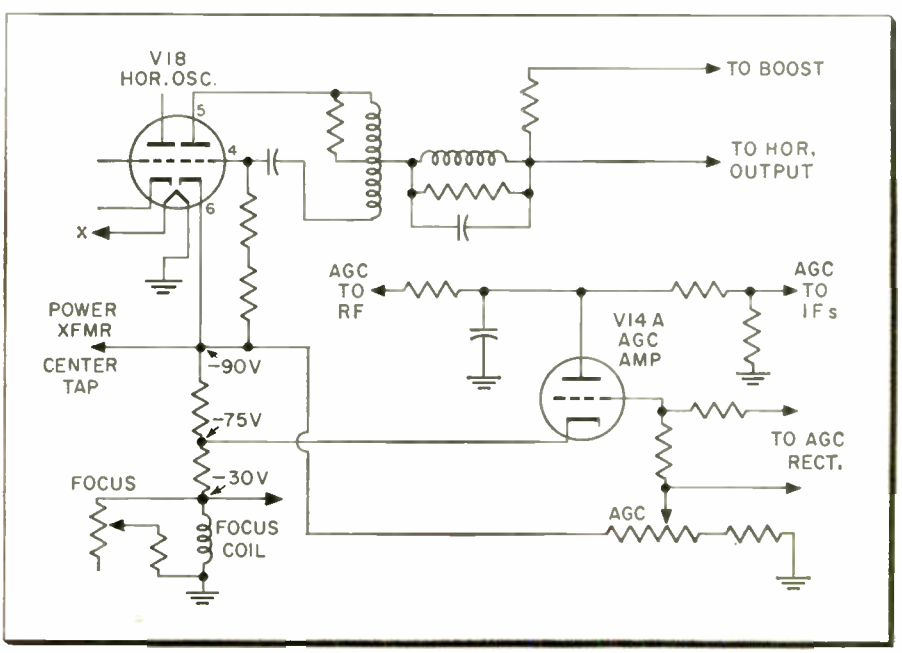
AGC & Horizontal Blanking

One of the most unusual service problems I have ever encountered concerns an RCA TV set, chassis number KCS-122-BC. This set has a keyed agc system and uses one-half of a 6BU8 tube. The set was in use for about 3 weeks when a complaint of no picture and distorted sound, came in. By adjusting the fine tuning control a negative picture could be obtained, but no vertical or horizontal lock, and the sound was still distorted. The components in agc, i-f, sync circuits and tuner all checked out normal. The only other clue I had was that the brightness control had very little effect. I had been using a VTVM to make voltage measurements but could not find the trouble. After working on the set for an hour at a time, I would stop and repair other sets. I happened to have a VOM handy when I decided to try again. I used it to check voltage on pin 2 of the CRT. When the test probes were attached, the set returned to almost normal operation. After a further check I found this set had a winding on the width coil for horizontal retrace blanking. An open coil was responsible for the loss of sync, negative picture and distorted sound. Bias was upset on the CRT, as well as agc voltage.—*Robert L. Goodman, Pineville, La.*

Horizontal Oscillator Kills AGC

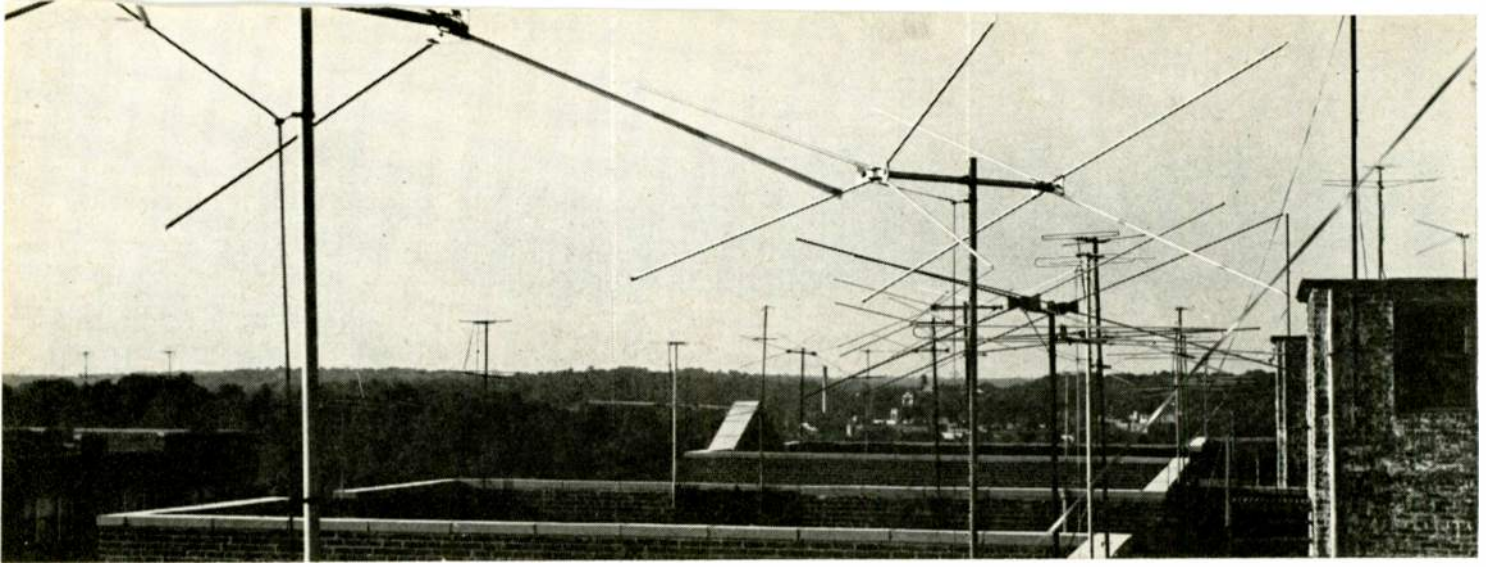
A Canadian Westinghouse model 1201A-X came in with a perfect raster and no video information on the CRT. A check of tubes and components in the tuner, i-f, video and agc circuits showed all parts to be normal. To make a long story very short, I found a defective 6SN7 tube in the horizontal oscillator. The tube had a cathode-to-heater short which virtually grounded the cathode, pin 6. The cathode is connected to the minus 90-volt terminal on the voltage divider in the power supply. The agc threshold control in the grid circuit of V14A agc amplifier is also returned to this minus 90-volt terminal. This upset the agc amplifier sufficiently to drive the i-f tubes beyond cutoff.—*Lambert C. Huneault, Windsor, Ontario, Canada.*

Cathode-to-heater short in the horizontal oscillator tube virtually grounded the —90 volt bus and upset agc voltage enough to cutoff the signal in the i-f amplifier.



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.



TV Antennas For Durability

Good Antenna Installations Depend Upon Technical Competence, Quality Workmanship & Materials

FRED R. VOORHAAR
Technical Appliance Corp.

• The use of aluminum for constructing TV antennas, and because of this metal's durability, the reasons for rapid deterioration of antennas is frequently overlooked. Perhaps the worst situation exists in those parts of the country where TV made its first in-roads . . . the metropolitan areas. Much could be learned from an examination of the many rooftop installations. The mess that exists can be attributed to neglect, overcrowding, poor workmanship in both antennas and installation, material defects, and strong signals. There is nothing wrong with strong signals, but the consumer would be the first one to complain if he couldn't get his favorite channel, and would therefore focus attention on the antenna. Most antenna installations are far enough away from the transmitter sight to warrant this attention even with the high-power transmitters in use.

Appropriate consideration of workmanship and quality of materials can do much to eliminate a great many of the mistakes that have been made in the past. Many of the early antennas suffered from the following structural weaknesses:

(1) Having been manufactured shortly after the war-time controls were removed from aluminum for non-military applications, many producers of antennas sprung up, and the scarcity of materials caused them to use thin-walled aluminum, and alloys which did not have enough tensile strength to stand up under wind and ice loading conditions.

(2) For the same reason of scarcity, iron brackets were used to assemble the elements of the crossarms. Even though the brackets were plated, rusting was a major factor contributing to the horizontal tendencies of masts, and missing elements.

(3) Crossarms and booms were no better off, they too were made of iron, and sometimes of wood.

(4) The use of dissimilar metals, rivets, screws, nuts, etc., set up electrolytic actions which acted in collusion with its first cousin . . . rust.

Many antenna producers who entered the field in the early days have subsequently discontinued the manufacture of antennas. If another king-sized demand should suddenly develop, it is hoped that the rush to produce and satisfy the market will not cause the same mistakes to be made again. Color TV or an awareness of high fidelity TV reception could easily spark another aluminum rush.

Design Factors

There are still a few local producers, but there are less than 10 manufacturers of TV antennas who might be considered as major sources in the field. Comparing this with the more than 150 manufacturers in the business less than 10 years ago, it can be seen that there must be more to the design and construction of an antenna, than the economics of the product. Essentially, antenna installers have learned through experience that there is more to an antenna than outward appearance. The alloy used; the thickness of the

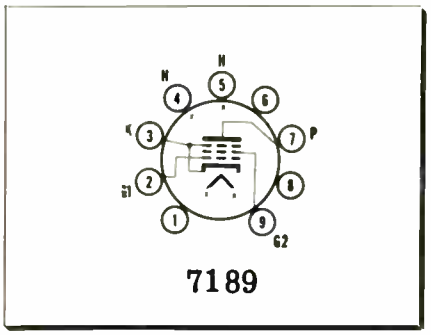
(*Continued on page 75*)

New Tubes & Transistors

For more information, write in ELECTRONIC TECHNICIAN's new product code number on coupon, on page 44.

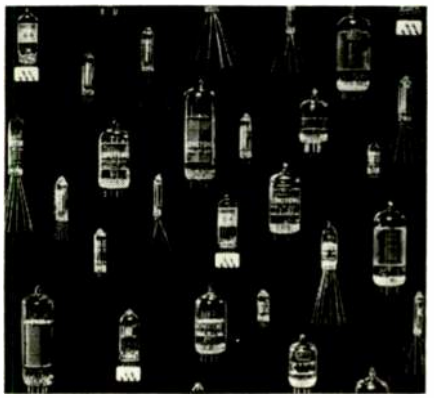
CBS BEAM POWER PENTODE →

Type 7189 is a new 9-pin miniature beam power amplifier featuring high power output and high power sensitivity. Its maximum plate voltage rating is 450v. Its 6.3-v heater draws 760 ma. Two 7189 tubes operating in push-pull, with a peak a-f input voltage (grid-to-grid) of 29v, provide 24 watts at less than 4% distortion. The new 9-pin miniature mounts in any position. CBS-Hytron, Danvers, Mass. (ELECTRONIC TECHNICIAN 6-9)



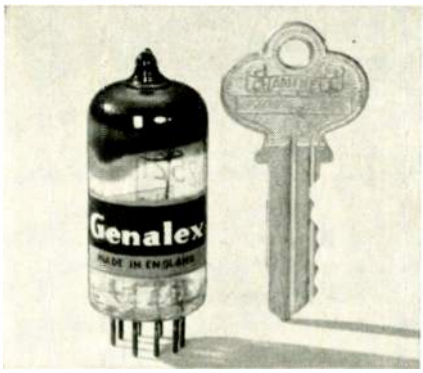
Sonotone ELECTRONIC TUBES →

Shown are some of the approximately 100 types of electronic tubes now available in the firm's expanded line. Included in the line are miniature and subminiature tubes for entertainment, commercial and military purposes. Three types, 6J4WA, 5840 and 5639, are manufactured under the U.S. Army Signal Corps RIQAP (Reduced Inspection Quality Assurance Program), monitored by the U.S. Army Signal Supply Agency. Sonotone Corp., Elmsford, N. Y. (ELECTRONIC TECHNICIAN 6-10)



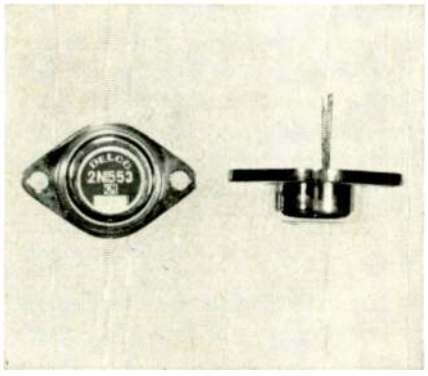
Genalex TRIODE →

A new high transconductance, low-noise triode, the Genalex A2521, is now available for use as a grounded grid r-f amplifier at frequencies up to 1000 mc. Manufactured by GE of England, it has a transconductance of 12,000 micromhos and a plate dissipation of 2½ watts. Noise factors are 9 and 12 db at 500 and 900 mc respectively, and the tube is free of microphonics. At 900 mc for power gains of 6 and 16 db, the available bandwidths are 80 and 4 mc, respectively. British Industries Corp., Port Washington, N. Y. (ELECTRONIC TECHNICIAN 6-12)



Delco TRANSISTORS →

Three new power transistors are the 2N1172, 2N1159 and 2N1160. The 2N1159 and 2N1160 are formulated especially for switching. Already available is the 2N553 (shown) which operates in the 2 to 3 ampere range. The new one-half to one ampere transistor is the 2N1172, which can serve as a driver unit or for medium power audio output. These units fill in the complete line of power transistors. Delco Radio Div., General Motors Corp., Kokomo, Ind. (ELECTRONIC TECHNICIAN 6-11)



Westinghouse 110° CATHODE RAY TUBES

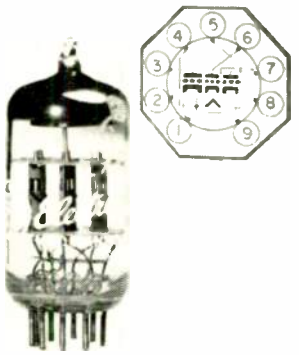
Two new 110° deflection picture tubes (types 17DHP4 and 21EMP4) are for portable TV. Over-all length: 11-¼" for the 17-inch tube; 13$^{3}/_{16}$" for the 21-inch tube. New electron optical design reduces the spot size and results in more picture detail. Operated at 6.3v, the heater of the 17-inch tube uses only 0.450 amps; the 21-inch tube uses 0.60 amps. Each tube is suitable for use in both parallel and series string sets. Westinghouse Electronic Tube Div., P.O. Box 284, Elmira, N.Y. (ELECTRONIC TECHNICIAN 6-14)

Motorola AUDIO TRANSISTORS

A new series of low cost germanium transistors 2N1191, 2N1192 and 2N1193 are designed for general purpose audio applications. Max. ratings: collector to base voltage 40v; collector to emitter voltage 25v; collector dissipation @ 25°C ambient, 175 mw. Current gain ranges are tightly controlled with 2.5:1 or less spread. Motorola Inc. Semiconductor Products Div., 5005 E. McDowell Rd., Phoenix, Ariz. (ELECTRONIC TECHNICIAN 6-15)

General Electric TRIODE

The 6EZ8 is claimed to be the industry's first triple triode receiving tube. It can serve as a one-tube tuner for frequencies as high as the FM band. This 9-pin miniature packs a cumulative plate dissipation of 5 watts in one T-6½ envelope. The cathodes of two of



the three sections have a common connection; the third section's cathode is brought out to a separate pin. Possible applications include: (1) r-f amplifier, oscillator and mixer; and (2) oscillator, mixer and afc tube. General Electric Co., Owensboro, Ky. (ELECTRONIC TECHNICIAN 6-13)

Internal

Resistance Of Dry Cells

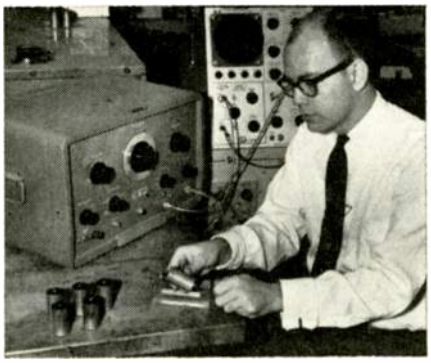


Fig. 1—Measuring the internal resistance of dry cells with a non-destructive pulse method. In the foreground is the cell holder, at left is a pulse generator.

• The National Bureau of Standards has developed a non-destructive technique for measuring the true internal resistance of dry cells by applying a repetitive pulse. The technique has proved useful in determining how internal resistance changes as the cell is discharged under various standard test conditions on continuous or momentary current drain. Results of such tests show that increase of internal resistance depends on the type of discharge, cell size, and variations in manufacture. The method was developed by R. J. Brodd of the Bureau's electrochemistry lab.

The internal resistance of a dry cell and its measurement have been subjects of study for many years. A number of methods are currently employed to make this measurement. Among the more common of these are techniques that require (1) measuring the open circuit voltage and the voltage when a moderate, known current is drawn from the cell, (2) measuring the open circuit voltage and the short circuit current, (3) charging a condenser, (4) using a Wheatstone bridge or various types of a-c bridges, or (5) measuring the IR drop when short pulses are drawn from the cell. However, each of these methods is subject to errors and uncertainties. For this reason, the Bureau developed a technique in which errors caused by polarization of electrodes are reduced to a minimum and large numbers of cells may be tested quickly.

Equipment And Procedure

The experimental equipment and procedure are simple. The circuit consists of a pulse generator, a resistor of known value, and the test cell, all connected in series. An oscilloscope is the only additional piece of equipment required.

In the first step of a two-step procedure, the oscilloscope leads are connected to the cell terminals, and with the pulse generator applying a train of pulses to the cell, the instantaneous IR drop is recorded at the trailing edge of the pulse displayed on the oscilloscope screen. This "instantaneous" drop of the oscilloscope pattern occurs in about 10^{-7} sec. In the second step, the oscilloscope is connected across the known resistor, the instantaneous IR drop is noted, and the current through the resistor is calculated from Ohm's law. Then knowing the current in the pulse, the resistance of the dry cell is calculated by applying Ohm's law to the IR drop in the cell in the first measurement.

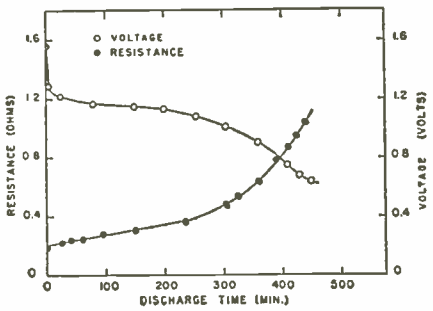


Fig. 2—Typical behavior of size C cells as they were discharged on the 4-ohm test.

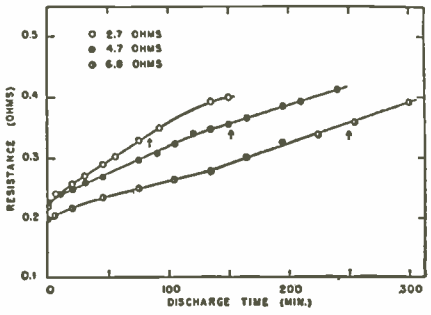
Measurements

To be sure that the resistance of a cell measured by the pulse technique has the characteristics of a pure resistance and does not include other impedance components, the effects of varying the experimental parameters were investigated. The current in the pulse was varied from 0.008 to 3.96 amp with no change in the internal resistance of the cell. Likewise, there was no resistance change when the direction of the pulse was reversed or when the frequency of the pulse was altered from 100 to 5000 cps. The measured internal resistance did not change when the pulse length was varied from 1 to 10 μsec. Thus the measurement of the dry cell by this method appears to fulfill the conditions for measuring only the purely resistive portion of the cell; that is, variations in current, current direction, frequency, and length of the pulse have no effect on the measured internal resistance.

Life Tests

The pulse technique has proved a valuable tool for investigating the effects of momentary or continuous drain on the internal resistance of dry cells. In one series of tests, a loading resistor was connected across the cell, and the current flow accurately measured. Internal resistance was then determined while the current was flowing with the pulse technique. These measurements were made as rapidly as possible so that

Fig. 3—Behavior of the internal resistance of size C cells as they were discharged continuously through the fixed resistance as noted. Arrows indicate the point at which the cell voltage was 0.8 volts.



the electrical capacity of the cell would remain essentially unchanged. Measurement of the highest drain was made first, the lowest drain last. Internal resistance with no load was measured after each current drain.

The internal resistance of the dry cells was also determined as the cells were discharged on the general purpose 4-ohm intermittent test, the general purpose 2.25-ohm test, and the light industrial flashlight (LIF) test. The cells were periodically removed from the life test racks, internal resistance measured with the pulse technique, and the cells replaced. This procedure was repeated throughout the lives of the cells.

Results of these life tests fail to reveal any general relation between the internal resistance at the beginning and at the end of any particular

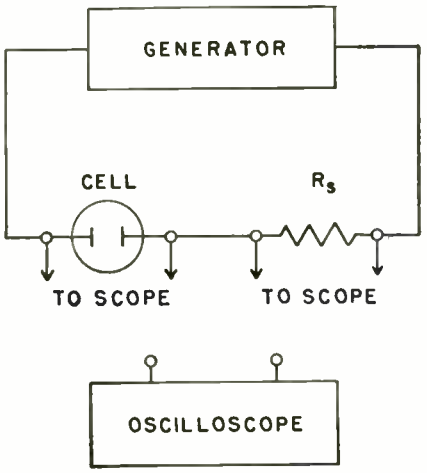


Fig. 4—Circuit for determining the internal resistance of dry cells by the pulse technique.

test. When data on all cells were compared, it was noted, as expected, that the short circuit current increases as the internal resistance decreases, and that the internal resistance of all the cells increases on discharge.

In a series of tests where current drain was momentary instead of continuous, it was found that the internal resistance of all sizes of cells remained essentially constant at all current drains, with a slight tendency to increase at the highest current values.

One interesting possibility suggested by the results of the tests is that the internal resistance measurement of a cell might be used to determine its life expectancy. Unfortunately, variations in cell resistances between manufacturers make impossible any general prediction formula.

MANUFACTURERS SERVICE

Record Changer Speed

The stated speed of any record changer is the nominal or average speed under average operating conditions. In addition to the normal manufacturing tolerances on motors, turntables and bearings, the actual speed will vary with line voltage and with the number of records on the turntable. The following tabulation will be found helpful in determining whether a claimed condition of "incorrect speed" may actually be a normal condition.

Nominal Speed	105 V. Full Record Load
78 rpm	75.8 rpm
45 rpm	43.9 rpm
33 1/3 rpm	32.7 rpm
16 2/3 rpm	16.1 rpm

Nominal Speed	117 V. 50% Record Load
78 rpm	80.1—77.3
45 rpm	46.0—44.3
33 1/3 rpm	34.1—31.8
16 2/3 rpm	17.4—16.4

Nominal Speed	125 V. One Record
78 rpm	80.9 rpm
45 rpm	46.7 rpm
33 1/3 rpm	34.6 rpm
16 2/3 rpm	17.5 rpm

Wax Bound Tuning Core

A thin coating of wax is often applied to adjustable coils to secure the initial setting of the tuning core and provide protection from humidity. On occasion the wax may be a little thick and cause the core to bind and resist adjustment. Don't force the adjustment. The coil can usually be freed by holding a soldering iron close to the coil and softening the wax. In particularly stubborn cases heat may be conducted to the immediate area of the core by inserting a metal tool, such as an allen wrench, into the core adjustment slot and heating it with a soldering iron. This will usually loosen the core so that adjustment can be readily performed. If difficulty is encountered, check the core; if it is cracked, the coil should be replaced.—*RCA, Camden, N.J.*

NOTES

Weak UHF Reception

On models using the Standard Coil VHF tuner with a piggyback tuner, weak snowy pictures may be due to poor contact between the adapter fingers and the i-f coil board in the tuner. The adapter has three fingers which contact the three additional contacts on the coil board in the tuner. Two of the three fingers are used to apply the B+ voltage to piggyback tuner while the third is used as the input to the coil board.

Two of these contacts can be checked on the top of the adapter. There is a 47,000 ohm resistor across the top terminals on the adapter. In the UHF position there should be approximately 135 volts on one terminal and 75 volts on the other. The voltage in any VHF position will be 135 volts and 10 volts. The 10 volts serves to to keep the 6AF4A drawing a small amount of current. Should the contact fingers not make contact in the UHF position, only 10 volts would be applied to the piggyback tuner. This will normally result in no signal.

The chassis must be removed to check the input contact to the coil board. Remove the cover from the tuner and rotate the tuner in and out of the UHF position. There should be a noticeable movement of the contact fingers as the coil board passes them, if this is not true bend the fingers to make proper contact. CAUTION. Do not bend the fingers too far as the tuner will catch. The tuner must be free to rotate in either direction.

5AU4-5V3 Tubes

Field reports indicate that premature failure of these rectifier tubes may be caused by lack of solder in the base pins of the tube. Both of these tubes produce a considerable amount of heat. This heat in some cases can cause the solder to seep out of the pins and result in an open filament. The cure is to heat the pins of the tube and allow additional solder to flow up into the pins. The above should be checked when these tubes fail for no apparent reason.—*Hoffman Electronics, Los Angeles, Calif.*

Difficult Service Jobs Described by Readers

No Vertical Sweep Due To Open Flyback

The OAR-3 Bendix had sound, no raster and no high voltage. Tubes were substituted without any luck. I could smell a resistor burning. I pulled the chasis and went to work on it. A 2,200 ohm, 2-watt resistor R100, from B+ to the 6W6, vertical output tube V19, was overheating and smoking. While I didn't believe that this had anything to do with the loss of high voltage, I decided to tame the overheating condition before any more damage set in. Another 6W6 tube did not help, neither did resistance checks for leakage of capacitors C63, C65 and C42B. As suspected, plate and screen voltage of the 6W6 measured low. More voltage checks revealed no negative voltage on the grid which probably meant the absence of drive voltage. Capacitor C64 was checked and exonerated. Still working with the voltmeter, I worked back to the plate of the 6SN7, V18B. Sure enough no B+. Going down the line toward the 6AX4, there was no B+ not even on the cathode or plate of the damper. Terminal #4 on the horizontal output transformer was also void of B+, but #7 had it. It didn't take much to confirm the open circuit between terminals 4 and 7. Replacing the flyback eliminated both troubles, the overheated resistor in the vertical circuit and the loss of high voltage. The resistor overheated because of the lack of drive to the vertical output tube. Not really too tough, but a very interesting case of side effects which helped lead to the source of trouble.—*Ivan Ruggles, Lubbock, Texas.*

Flux Troubles

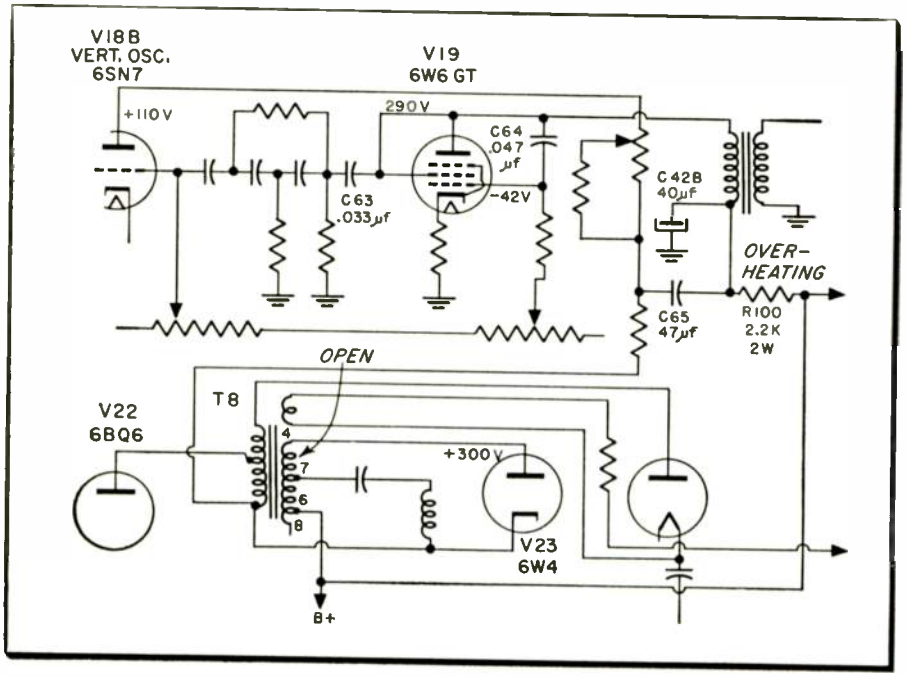
An Admiral model PI7E31 portable TV set had the following symptoms: when the set was first turned on, the raster had an indication of 60 cycle hum, the upper portion was dark while the lower portion was light: slight traces of video, and vertical and horizontal sync pulses were barely visible: sound was weak and distorted: and approximately 1 minute after the set was turned on, the sound, and the faint video and sync would disappear leaving only a raster which was half black and half white.

As the set warmed up, the faint traces of video, sync and sound would begin to reappear, and the 60 cycle hum would decrease. After the set had been on for about 5 minutes, its operation would become normal.

First, all tubes were checked for heater and cathode shorts. Since the set was normal after warmup, I placed the chassis in the refrigerator and changed each tube, including the CRT, with tubes we knew were good, but with negative results. Still using the "Frappe" technique I substituted electrolytic capacitors one at a time . . . same negative results. I then placed the chasis on the bench and hooked up the oscilloscope and used a CO-2 fire extinguisher to cool off sections of the chasis. Upon cooling the section around the video detector, a pronounced increase in the 60-cycle hum could be seen. So I changed the video diode detector, and checked the coil connections . . . result negative. Next I shorted the

(*Continued on page 65*)

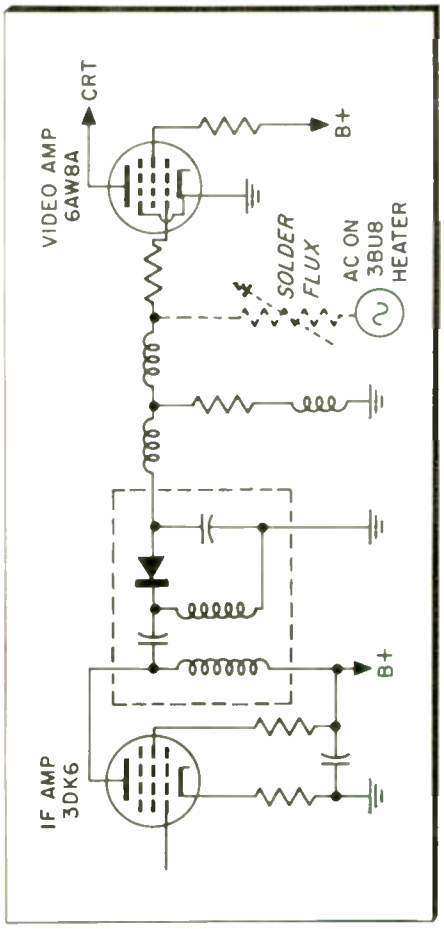
No. B+ on vertical oscillator tube V18B, deprived the 6W6, vertical output tube, of proper drive signal. Excessive current overheated resistor R100 . . . all due to open flyback.



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.

input grid of the video amplifier. The raster turned a normal white. This indicated that the trouble was in the grid circuit of the video amplifier, or somewhere before it. Removing the short the hum was once again



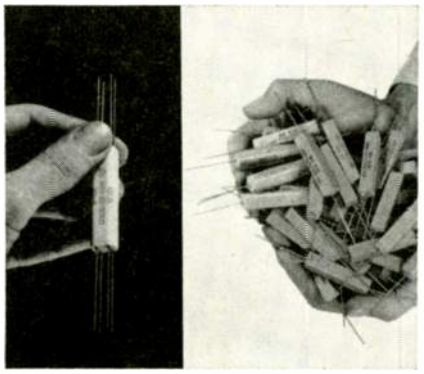
Hot and cold solder flux induced intermittent AGC and hum troubles. Refrigerator and fire extinguisher helped cool this tough dog.

quite evident. The scope showed a fairly hum-free indication on the last i-f amplifier. Now I had the culprit fairly well isolated to the detector and input of the video amplifier. I checked the printed board, and all resistance readings were normal. Since I could find nothing wrong, and the scope definitely indicated that I was on the right track, I decided to rewire the grid circuit. I cut the printed conductor at each connection, and ran wires. That did it. It even worked when I tried the set once again in the refrigerator. Now I was certain that I had circumvented the trouble, but I still didn't know why. After some more checks I found rosin between a filament connection on the 3BU8 sync tube socket and the grid of the 6AW8. The resistance between these two points varied from 50,000 ohms to approximately 650,000 ohms, as the temperature increased.—*Louis A. Conner, New Orleans, La.*

New Components

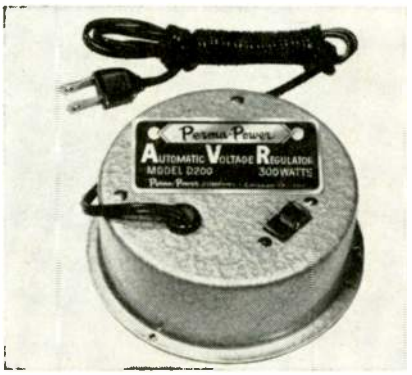
IRC MULTI-RANGE RESISTORS →

The ideal answer to the problem of exact-value replacement is claimed for this new Multi-Range resistor line in which only five basic units deliver 200 fixed resistance values. 4 separate 10 watt wirewounds are sealed in a single steatite housing. All types are one size for easier handling. Twin Handy-Pak for 0.5-15,000 ohm range is $1.20; pair covering 3-50 K are $1.80. International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa. (ELECTRONIC TECHNICIAN 6-1)



Perma-Power VOLTAGE REGULATOR →

Model D-200 is a new automatic voltage regulator for use on any appliance or TV set rated up to 300 watts. Maintains normal operating voltage on overloaded circuits or in areas where line voltage regulation is poor. Boosts line voltage 10v when line is below 110v. Automatically feeds the line direct without boost when the line returns to normal voltage. It has no tubes, ballasts, relays or moving parts. Perma-Power Co., 3100 N. Elston Ave., Chicago 18, Ill. (ELECTRONIC TECHNICIAN 6-4)



Triad POWER TRANSFORMER

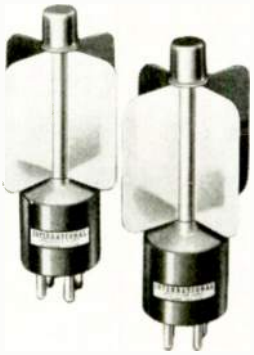
Development of voltage doubler circuits using silicon rectifier power supplies is now possible with the new Triad R-93A power transformer. It provides taps on both primary and secondary windings to allow several variations of output voltage, and is electrostatically shielded. Rated at 110/120v, 60 cps primary and 150/160/170v @ 500 ma secondary, it also supplies filament power of 6.3v-6A center tapped for hum reduction. Triad Transformer Corp., 4055 Redwood Ave., Venice, Calif. (ELECTRONIC TECHNICIAN 6-6)

Hamilton-Hall RESISTORS

A new 2 watt wirewound resistor is available in 3 tolerances: ±5%, 10% and 20%. Range of resistance: from 0.270 ohms thru 4700 ohms. Rectangular shape. 5/16" high x 5/16" wide x 7/8" long. It is highly resistant to humidity. Priced at 5% to 27% below carbon resistors with the percentage of savings dependent upon quantity ordered, and the tolerance and resistance required. Hamilton-Hall Resistor Corp., 227 N. Water St., Milwaukee 2, Wisc. (ELECTRONIC TECHNICIAN 6-5)

Int'l Rectifier
SILICON CARTRIDGE RECTIFIERS

Type ST-7 silicon cartridge replacement is a multiple junction, hermetically sealed rectifier equipped with radial cooling fins for optimum power dissipation. Temperature range —65° to



+75°C. Current rating at rated peak inverse voltage, 250 ma @ 6400 PIV. Max. occupied volume, 22 cu. in. Weight, 7 oz. Directly replaces Type 866 rectifier tubes. International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif. (ELECTRONIC TECHNICIAN 6-2)

Clarostat POTENTIOMETERS

Features of the new Series 57 line of miniature precision potentiometers include: a new rotor and brush assembly and new Hi-Load winding element for maximum reliability and stability; new cover assembly with terminals molded in place; body ½" dia. x ½" long; rated 1.5 watt @ 40°C. Stocked values from 50 ohms to 50K ohms in 2 different bushing and shaft configurations—standard and shaft locking. Packaged in a transparent plastic box. Clarostat Mfg. Co., Dover, N. H. (ELECTRONIC TECHNICIAN 6-7)

G-C AUTO RADIO SWITCHES

Announced is a new line of auto radio on-off switches, said to cover vitually every replacement need. It is a companion line to the recently introduced G-C auto radio controls. Each style is individually packaged, with full details

on the car radio it is intended for as a replacement. Dealer helps in the form of literature, cross reference guides and displays are now available. G-C Electronics Mfg. Co. (Div. GC-Textron, Inc.) 400 S. Wyman St., Rockford, Ill. (ELECTRONIC TECHNICIAN 6-3)

Printed Circuits

(Continued from page 35)

the advantage of uniformity, which is important for two reasons.

1. *Design*—It comes as no surprise to the reader that the proximity of wires and components to one another in a TV receiver is important. If the physical relationship of these items could remain fixed in any given chassis, there would be considerably less need for wide performance tolerances due to variable distributed capacity. The laminated wiring board precisely locates every component and every conductor on the board with the result that inter-component influences are closely predictable and more stable, and design engineers are able to more nearly approach the full capability of their circuitry. This translates into better average performance, and narrows the spread between high-limit and low-limit receiver performance.

2. *Manufacture*—Since every item has a precisely defined location on the board, it is easier for line operators to check their own work, and, therefore, line inspectors find fewer missing items and incorrect values in production work. Fewer errors mean less rework, higher quality, and, consequently, less cost. Still another benefit accrues from the uniformity of laminated wiring. A new design can and does start off with a significantly higher general quality level than was the case before laminated wiring.

Today's high level of quality didn't simply happen. Indeed, design criteria in laminated wiring techniques were not easily established. Just as has been the case in very nearly every significant advance in the art, the laminated wiring board and its present-day technology has developed markedly over the past few years. In fact, the difficulties presented by early "printed circuitry" applications, and the large investments of time and facilities they demanded may well have dissuaded the less resourceful manufacturer from continued "printed circuitry" development. Persevering men of vision, tackled and solved each difficulty in turn. Every major manufacturer of TV and radio uses con-

struction similar to laminated wiring somewhere in their TV or radio lines.

Developments

Perhaps a short sketch of some of the laminated wiring developments which have eliminated or greatly reduced the early printed circuitry shortcomings would be illuminating.

1. *Board Hole Size*—It has been clearly established that optimum solderability occurs when a precise ratio of board hole diameter to component lead diameter exists.

2. *Copper Pattern Configuration*—The conflicting requirements of narrow conductors for desirable solder fillet build-up and wide conductors for maximum conductor strength and adhesion has been solved through the use of solder masking.

3. *Eutectic Solder*—The problem of minimizing cold solder joints involves the length of time required for solder to go from the liquid state to the solid state. Eutectic solder has been found to go through the transition period directly from the liquid to the solid without passing through the intermediate semi-liquid or mushy stage.

Several other very promising developments are in prospect. Much of life is a series of compromises. A decision to proceed with a particular development or course of action is made when advantages outweigh disadvantages. Then the obviously "right" thing to do is to attack the disadvantages, and reduce or eliminate them.

Disadvantages

What is the score on laminated wiring disadvantages? Certainly their early application included shortcomings. The flow of circuits in a chassis lost virtually all semblance of order. Perhaps you have shared the experience of the technician who had removed a component from a laminated wiring board, plus inches of conductor strip; or the high wattage irons which obliterated conductor strips beneath a sheet or solder; the hours spent hunting an intermittent caused by a hair-line conductor crack, or a poor solder connection; the feeling of being a spectator at a ping-pong tournament when circuit tracing a laminated wiring board. Some of

these disadvantages may never be completely overcome. But let us take a look at what *has* happened.

Improvements

1. *Quality Improvement* — The messy problems stated above happen less frequently or not at all, chiefly as a result of improved solderability and solder masking. The two-hour plus job will come to you now and again, but as we have seen, the average total minutes of repair time required in a given period has reduced on current models. And, the reduction is a significant one.

2. *Accessibility*—Many new sets are so constructed that ready access to all laminated wiring board mounted components is provided when the receiver back is removed. These components may be replaced without removing the chassis. This is a giant step in the right direction. The laminated wiring boards are more openly mounted, yet with better support. Of course, no TV set is supposed to survive a drop from a 14-foot height, whether it uses laminated wiring or not.

3. *Tube Sockets*—A socket is used in some current receivers which will not "death-grip" tube pins. Boards are not overstressed by tube insertion or removal. This too is an important advantage.

4. *Field Soldering Techniques*—The use of low-wattage soldering irons in laminated wiring work is now common practice. Also, new soldering tip shapes are coming into use, such as the bar and disc, which facilitate removal of multi-contact components. Again, no one can deny that removal of such components requires the exercise of more care and special tools, but both ingredients are being acquired to an increasingly greater degree. As a matter of fact, proper tools and techniques have made such jobs directly comparable and, in many cases, even easier than similar operations on hand-wired chassis.

5. *Circuit Tracing*—First and foremost, laminated wiring board layouts are becoming more sophisticated. By their very nature, however, in-line circuit flow is not yet a reality. The problem may be eased considerably by application of the devices found in manufacturers service notes. Laminated circuitry boards have brought about the shad-

ow diagram with multi-color layouts, and the grid coordinate system of component identification.

The industry is keenly aware of the needs of technicians. In some new sets, the servicing technician can work on both sides of the laminated wiring boards without removing the chassis. Both circuit tracing and component replacement may be performed on the laminated wiring boards as soon as the receiver back is removed, without removing the chassis. More than any other feature of "printed circuitry," lack of accessibility has been the most prevalent complaint. It is evident that some manufacturers are making an honest effort to improve serviceability and accessibility.

6. *Broken Boards*—One manufacturer recently reported that exactly 2 boards were replaced in 10,000 service calls. If a technician can handle 40 calls per week, 50 weeks per year, or about 2,000 calls per year, at this rate he would replace a board on the average of once every 2½ years. Another report from Wisconsin tells about a TV set that was hurled 175 feet by a tornado. It landed in the mud and was exposed to wind and rain for a period of eight days. The set still worked when it was plugged in. Much of this receiver's durability was attributed to the use of printed boards.

Quality is better than ever, and improving steadily. Through lower cost and service expense, more features, ever-fresh designs and higher quality, laminated wiring allows a net gain to the consumer.

Whatever are our personal and individual feelings in the matter, all of us need guide our efforts toward satisfying the customer, and each of us has an important role. The long-range growth of the service industry depends upon the growth of the electronic device population. The service industry in turn affects the acceptance of electronic devices. We are in the midst of an electronic revolution and we can expect that the product, and the way it is made, will continue to change. The degree to which each of us will enjoy success in this new age will depend upon the degree to which we are willing to and capable of keeping pace with the art and with each other. •

New Books

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

***BASIC RADIO AND RADIO-RECEIVER SERVICING.** *By Paul B. Zbar and Sid Schildkraut. Published by McGraw-Hill Book Co. 142 large pages, soft cover. $2.25.*

This is the second edition of the lab manual for technicians. It was prepared under the sponsorship of the Electronic Industries Association as part of its vocational education program. Students will find the circuit discussions, descriptions of step-by-step bench procedure and questions of real value in their practical schooling. Among the many subjects covered are i-f, avc, loop antenna, alignment, measurements, defect analysis, ac/dc sets, auto radio, short wave, FM, printed circuit repairs and transistor radios. Under each of 25 different radio repair jobs presented, there is a well written examination of the important technical factors affecting the receiver's performance.

***AIRCRAFT COMMUNICATIONS SYSTEMS.** *By J. H. H. Grover. Published by Philosophical Library. 134 pages, hard cover. $6.*

Based on British equipment, this book is divided into three parts. The first part examines the circuits, and operation of various aircraft transmitters particularly those made by Marconi and Standard. The second section covers operating instructions and procedures. The last part discusses associated gear and briefly describes some American equipment made by Collins and Bendix. This volume is more of an equipment manual than a truly basic text, but the thorough coverage of those units described should be of interest to technicians specializing in aircraft communications.

RADIO AMATEUR'S HANDBOOK. *Prepared and published by the American Radio Relay League, West Hartford 7, Conn. 746 pages, soft cover. $3.50 in U.S., $4 in U.S. Possessions & Canada, $4.50 elsewhere.*

Over 1300 illustrations are included in this annual bible of the ham radio field (1959 is its 36th edition). In addition to much construction data for ham gear, there is considerable material of interest to all technical people. Subjects include basic electronic principles, semiconductors, ham equipment, modulation, single sideband, wave propagation, measurements, interference and station operating procedures.

To increase your know-how, see "BUILDING A TECHNICAL LIBRARY" on Pages 52 and 53.

Association News

California

RTA of Santa Clara Valley elected Nick Suto to its Board of Directors. Color TV keynotes technical lectures. KNTV Channel 11 and Leo J. Meyberg Co. of San Francisco covered the problems of getting a good color signal on the air, and the basic setup of a color receiver, respectively.

SRTT picks Television Center of Corona as "Shop of the Month." Remi Chagnon and Ken Whitcomb built up their business around the slogan, "The Business Built on Service." The association is sponsoring a TV technicians qualifications program. Applicants must achieve a grade of 90% on a written test. There are 80 questions, but only 50 have to be answered. Examination fee is $3.00. Approved Technican cards, and newspaper publicity is contemplated.

Indiana

TVB of Elkhart new officers are: Pres., Dean R. Mock; V. P., Wilbur Wenger; Sec'y., Wayne Clem; Treas., Harry Carmen; and Directors Floyd Menges, Willis Roberts and La Mar Zimmerman.

RTSEA of Logansport officers are: Pres., Kenny Smiley; V. P., W. L. Boller; Sec'y., Don Hineman; Treas., Glen Ogle; and Sgt. at Arms, Tom Cline.

Michigan

TSA to affiliate with NATESA, and elects Patrick Laforet as President. Retiring Pres., Karl Heinzman was honored and presented with a gift. Also elected were: V. P.s, L. Nelson, C. Longton, C. March, L. Hudson and T. Goode; Sec'y, M. Graham; Treas., T. Katuah; and Board Members, K. Heinzman, A. Weiss, E. Brown, J. Kippinger and E. Zecman.

New York

RTG of Long Island recommends $5.50 minimum for service call. Survey reveals cost of making a call to be $5.62. Present average charges range from $3.50 to $4.00, with many shops charging $3.00. Some shops are already increasing their rates.

ESFETA re-elected its officers: Pres., Robert Larsen; V. P., Irving J. Toner; Sec'y., George Carlson; Treas., Dan Hurley; and Sgt. at Arms, Frank Kurowski.

CETA invited other technicians associations to meet with them and listened to the engineers and sales managers from Blonder-Tongue Labs and Shamark Dist. tell about the opportunities in closed circuit TV, and observed a demonstration of their equipment. ESFETA's Presi-

(Continued on page 74)

dent Bob Larsen (also of RTG) addressed the group of over 300 technicians and stressed the need of uplifting the profession. Larsen was accompanied by the Guild's Sec'y., Bob Henderson. This meeting's theme was "Diversification and Friendship." The more the different associations can get together, the better will be their understanding of each other, and the easier will be their task of raising industry standards. Paul Zbar was awarded a plaque for devoted service and a $50.00 war bond. The New York Trade School and Electronic Technician Magazine were each awarded plaques in appreciation for their encouragement and cooperation.

North Carolina

NCFEA has set a membership goal of 28 local associations by the September annual meeting. Surrey County was welcomed as a new member at the last meeting. Pres., Garland Hoke reports that the organization is making good progress, and appointed 6 different committees.

Oregon

OTSA to form as a state-wide organization and is looking for information and help from other associations which are already formed and active. A convention is contemplated around mid September. Contact Colin Gregory, 711 North 99th St., W. McMinnville, Oregon.

Pennsylvania

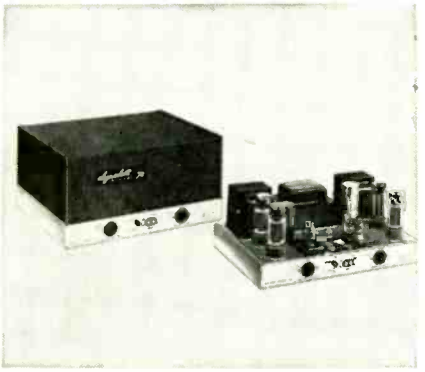
TSA of Delaware Valley new officers are: Pres., Sam Brenner; V. P., Tony D'Annibale; Rec. Sec'y., Ray Fink; Corr. Sec'y., Louis J. Smith; and Treas., Ralph Newby.

Washington

TESA-King County reports that Seattle area service charges for most established and reputable service shops are $6.75 and $6.95 for standard home service call. Some shops are charging $7.50 for color, Hi-Fi, and after-hour calls. If a 2.5 times the basic cost figure is used, a $3.00 per hour man would have to earn an average $7.50 per hour for labor charges.

Dynakit AMPLIFIER

The Stereo 70 contains two independent power amplifiers capable of 35 watts of continuous power on each channel. Front panel switch permits parallelling the inputs for 70 watts of power in monophonic use. Has factory assembled prewired printed circuitry. Average construction time is about 5 hours. Special features include matched tubes, dual Dyna Biasets for non-critical adjustment, provision for powering two preamps without interaction, fuse post, stereo-mono switch, and on-off switch. Price including protective cover: $99.95 (West Coast $104.95) Dynaco Inc., 617 N. 41st St., Philadelphia 4, Pa. (ELECTRONIC TECHNICIAN 6-25)



Antenna Durability

(*Continued from page 58*)

wall; the material used for brackets, hardware, insulation, etc.; and good electrical and mechanical design are of extreme importance to the performance of the antenna and the reputation of the installer.

Anodizing

Another protective feature now built into some antennas, to increase life and improve service, is aluminum anodizing. Some manufacturers have added a dye to the finishing operation for product identification and appearance. The color of the antenna and the anodizing itself have relatively little to do with each other. While color added during the anodizing process helps to identify the antenna, it also enables the public to recognize that the product is anodized. The anodizing itself is colorless. If the colored dye should fade in sunlight, even if it faded out completely, the anodized protection would still be there. The only possible way protection would be lost is by scraping the surface of the metal to a depth below the level of the anodize penetration.

An inorganic dye is used to provide the color. This dye is the same coloring material added to anodized aluminum panels employed in modern office buildings, and is designed to retain its color without fading. Some commercial anodizing introduces a resistance to the flow of electrical current. For that reason some anodized antennas are masked at the points of electrical contact during the anodizing operations and subsequently cleaned so there is direct aluminum-to-aluminum contact. Further protection to exposed metal parts which are subject to corrosion may be accomplished by using a plastic spray designed for this purpose. There are other anodizing processes which have no electrical resistance characteristics, and do not require masking and cleaning.

Generally, labor is the most expensive ingredient in most jobs; it is false economy to compromise on the material. A good antenna installation is often the best antenna salesman a technician can acquire. •

Ground Loop

(*Continued from page 41*)

ground connection within the chassis, and to make matters worse it may only be an intermittent connection. If this same drop of solder were located in the B+ or signal circuits, it would attract immediate attention, but in the ground circuit, it may not be readily detected. First, it would have to be determined that another ground point exists, then it would have to be found. A rosin path may cause just as much trouble. Input jacks are another source of accidental ground loops. They are frequently insulated from the chassis. While working on these jacks, they may be moved enough to cause them to make contact with the chassis. Finding the extra ground could be quite tedious, as it may be necessary to unsolder all chassis ground connections from the jacks and lugs, and check the resistance of these tie points to ground. It should be high.

In stereophonic amplifiers, ground loops can be very perplexing. Should each amplifier be connected to its own individual ground point on the chassis? If not, near which amplifier should the chassis ground be made? Should the power transformer be removed from the main chassis to really eliminate hum? Should only d-c be present on the chassis? These problems can be solved and indeed in many stereophonic units, the hum is down to the level of its monophonic predecessors.

Power transformers can be mounted on the chassis, and oriented so that it contributes a minimum amount of hum. In the majority of cases, however, the technician can do little with this. Once a transformer is mounted on the chassis, it is usually impossible to change its position. It is up to the manufacturer to anticipate this problem in advance. Some transformers induce more hum than others, and a possible solution would be to install a new transformer. Experience has shown that the proper approach in an integrated stereo amplifier is to keep each amplifier group separate. Connect the negative returns of each string of amplifiers separately. When properly wired, one lead from each amplifier will be seeking a proper ground point on the chassis. Connect both of these leads to one point on the chassis next to one of the phono preamplifier stages.

External Ground Loops

Ground loops plague stereo reproduction from another important source. In a monophonic unit, only one pair of leads are required to connect a phonograph or tape player to an amplifier. With stereo, two pairs are required, one for each channel. Some stereo cartridges have a common terminal for both elements which is normally connected to the ground, as shown in Fig. 5. Two shielded leads are used to connect the cartridge to the stereo amplifier. The two shields are connected to the common cartridge lug at point A. The shields are again connected in the amplifier. Even when a common ground is provided in the chassis a complete ground loop exists, composed of the shielded

wires. This loop is in a sensitive circuit, and power line frequency current from most any source may be induced in it. The result is usually quite audible.

There are several possible solutions. The amount of induced current is directly related to the area in the loop. To minimize the current, the two insulated leads may be twisted together, but it will not necessarily eliminate the hum entirely. A better solution is to break the loop so that current cannot flow. Just disconnect one shield return at point A. The cartridge will still be connected to the amplifier through the other shield, and the loop will be avoided. In the case of the 4-terminal cartridge, the ground return from each element is separate, and it is best to keep them that way until they are joined in the amplifier, as shown in Fig. 6. Where possible grounded shields should not be used as a return path for the signal. If another shield is provided, and there are enough leads to carry the signals, the outer braid is used for shielding purposes only. It should be connected to the amplifier only. If single conductor shielded wire is used for each channel the ground connection from the cartridge to the amplifier should be completed by just one shield as just mentioned, and the shields on each wire should be insulated from each other.

4-Pin Heads In 3-Pin Arms

Many phonograph arms are supplied with cartridge heads which have 3 contacts. When using a 4-terminal cartridge in these heads connect the 2 ground lugs together at the cartridge, and treat it as if it were a 3-terminal unit.

It is advisable, and frequently necessary, to connect the motor and tape or phono chassis to ground. Use a separate piece of wire for this connection. Do not use the shields around the phono leads for this purpose. It is also important to avoid ground loops when connecting different pieces of equipment. The amplifier could readily serve as the common ground connection for the system. Remember, to avoid hum from ground loops, never permit a closed circuit to be formed in which a power line frequency current can flow. If there is no complete circuit, current cannot flow. •

Keyed AGC

(Continued from page 37)

normally more than one external voltage would be required. It is sometimes possible to feed a larger bias voltage at the top of the divider, at point A, for example, and rely upon the voltage divider action to develop proper voltage for the various controlled tubes.

Grid Current

Another fault finding technique is to remember that at no time, under normal operating conditions, is there any appreciable grid current in the agc controlled stages, and therefore there is normally no appreciable d-c voltage drop across the grid and other filter or isolation resistors in the agc bus. If a VTVM connected across any of these resistors, shows a voltage drop on the order of 1 or more volts look for defective tubes and leaky filter capacitors. A positive voltage on the grid (with respect to cathode) leaking through from the plate of the previous stage, can also cause grid current. Gassy tubes, which can escape detection in a tube checker, can upset the agc voltage by permitting grid current to flow. If more than one tube is faulty in this manner, as is sometimes the case, substituting one tube at a time will not lead to the trouble. It is just like having two open heaters in a series string; unless both tubes are substituted simultaneously, the string will still be open. Of course it is possible to have a batch of known good tubes to insert in the agc controlled circuits, but it is simpler to just look for a voltage drop across the grid resistor of each tube. Because of the high resistance values used in these circuits, a small amount of current can develop a significant voltage; even so, this voltage would be completely lost to detection if the voltmeter loads down the circuit. The importance of using

a high impedance meter to measure this voltage should not be overlooked.

Pulse Polarity

Peak-to-peak voltage values on the plate of the agc keyer tube may run from 300 to 900 volts, depending upon the design of the set. Regardless of the reading, it should generally be from 50 to 100 volts higher than the screen. If the pulse voltage is low and is taken from a separate coil, there is a possibility that the coil is defective. Proper polarity was mentioned before, but more than one tough dog has been traced to a flipped winding. Having a horizontal flyback pulse that is proper in every respect, except that it is going to the wrong direction may turn many a technician's head gray. No amount of component checking will reveal this trouble, because everything will measure normal, even the coil with the reversed leads. An agc problem may suddenly be introduced to a receiver when changing a flyback transformer because of a high voltage difficulty. Naturally if a new trouble appears when a new part is installed, look to the part. Not all agc trouble is limited to an absence of agc voltage. Far from it. In fact many times more difficulties may be experienced if the agc voltage is too high, or too low, than if it were completely absent. The usual wide range of component and voltage tolerance values found in a TV receiver may be enough to cause agc problems, especially where the tolerance of the various components is in the same direction. Closing the tolerance gap by replacing borderline components is time consuming, but sometimes may be the only proper solution. However, as in most other cases of breakdown, it can reasonably be expected that only one part is causing the trouble. Parts do not always break down of their own accord, so try to determine the cause. Replacing a burned out resistor without looking for an excessive current drain path, is inviting a call back. •

Rogers TRANSFORMERS

A new high voltage and horizontal output transformer, the EFR 144, is an exact replacement for GE parts numbers RTO 125, 126, 127, 129, and 130. Comes complete, ready for identical connection-by-connection replacements of the GE equivalents, and is packaged in a hermetically sealed plastic container. Rogers Electronic Corp., 43 Bleecker St., New York 12, N. Y. (ELECTRONIC TECHNICIAN 6-35)

Belden CABLES

8787 is a new stereo control cable. It has 10 flexible stranded conductors and an OD of only 0.330"; 2 unshielded #22 AWG conductors; and 2 groups of four #24 AWG conductors shielded to prevent interference and insure noise free reproduction. 8421 is a new hi-fi connecting cable. It is chrome vinyl jacketed; has 3 strands of tinned copper and 4 strands of tinned copperweld for increased tensile and mechanical strength. Available on 15, 25, 50, 100 and 500-ft spools. Belden Mfg. Co., 415 S. Kilpatrick Ave., Chicago 44, Ill. (ELECTRONIC TECHNICIAN 6-21)

Audiotex TAPES & RECORDS

For testing stereo and monophonic tape machines and associated hi-fi equipment, in the home, Model 30-206 Audiotester Tapes is priced at $6.50. Model 30-208 is the professional version selling at $8.25. Both models provide head alignment, resonance, frequency response, NAB equalization, intermodulation, flutter, metronome balance, and distortion. An unbreakable 12" LP test record with stereo and mono tests on opposite sides is priced at $4.98. Audiotex Mfg. Co., 3225 Exposition Place, Los Angeles 18, Calif. (ELECTRONIC TECHNICIAN 6-26)

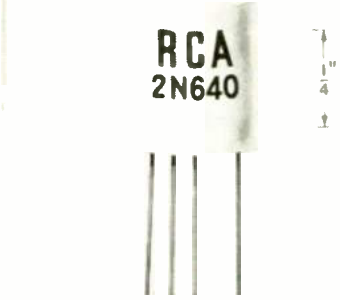
Allied TUBE CHECKER

Knight-Kit "400" tube checker in kit form is priced at $19.95. It will check for filament continuity, shorted elements and cathode emission on 400 tubes. This compact (2⅜ x 9½ x 8") unit weighs only 5¼ lbs. The unit has 4 sockets, red-green scale, and special scale for checking diodes. The "400" employs universal-type selector slide switches, used in conjunction with Flip-Cards, for rapid selection of any combination of pin connections. Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill. (ELECTRONIC TECHNICIAN 6-38)

"I don't care if it's a weak 6BQ6 or a 5U4, . . . Just watch the play."

RCA TRANSISTORS

New germanium p-n-p drift transistors are intended for AM auto radios. The 2N640 (shown) is designed for r-f amplifiers, the 2N641 for 262.5kc or 455kc i-f, and the 2N642 for converter service. They make practicable 5-transistor receivers utilizing an audio driver stage and a single-ended output. The 2N456 and 2N457 germanium p-n-p alloy junction transistors are intended for use in power-switching, voltage-regulator, multivibrator, dc-to-dc converter, and power-supply circuits, and as relay-actuating devices in industrial equipment. These transistors may also be used in large-signal class A or class



B push-pull audio-frequency oscillator service. The 2N649 n-p-n germanium is designed for class B complementary-symmetry power output stages of compact, transformerless, battery-operated portable radios and phonos. The 2N1067, 2N1068, 2N1069, 2N1070, and 2N1092 are initial units of a new line of silicon transistors. These five types are n-p-n diffused-junction transistors using mesa construction. They are designed for use in a wide variety of applications such as multivibrator, dc-to-dc converter, dc-to-ac inverter, and relay- and solenoid-actuating circuits. Radio Corp. of America, Semiconductor Div., Somerville, N. J. (ELECTRONIC TECHNICIAN 6-17)

Switchcraft Y ADAPTERS

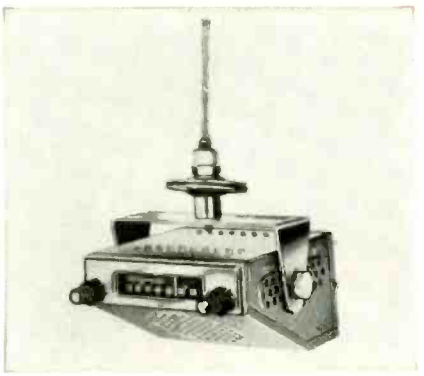
Y Adapters simplify connection of two channels to one. 3 new types have dual phono or microphone inputs and 2 different standard phono plug outputs. They are the 330PJ, 330M at $1.90 list, and the 330F at $1.75 list. The adapters are completely shielded. Switchcraft, Inc., 5555 N. Elston Ave., Chicago 30, Ill. (ELECTRONIC TECHNICIAN 6-36)

EMC VOM

Model 102F is the firm's Model 102 with a fused meter added. It has 5 a-c and d-c voltage ranges to 3,000 v, 3 a-c and d-c current ranges and 2 resistance ranges to 1 meg ohm. It uses a deep etched panel and is housed in a polished, high-inpact bakelite case. Kit, $13.10. Wired $15.55. It is also available with a large 4½" meter, designated as model 103F. Kit, $15.50. Wired, $19.40. Electronic Measurements Corp., 625 Broadway, New York 12, N. Y. (ELECTRONIC TECHNICIAN 6-37)

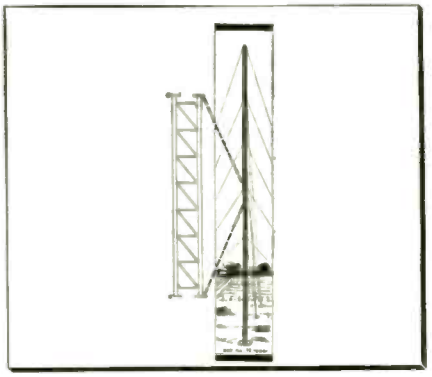
ATR TRUCK KARADIO →

Model TR-1279 is a new compact self-contained airplane-style radio for trucks, boats, station wagons and small automobiles. Features include large, easy-to-read dial, extra large Alnico 5 magnet PM speaker, 6-tube superhet receiver (utilizes 2 dual purpose tubes) with 8 tube performance and new one-hole mount antenna design. It has excellent sensitivity, tone and volume. $59.95. American Television & Radio Co., 300 E. 4th St., St. Paul 1, Minn. (ELECTRONIC TECHNICIAN 6-30)



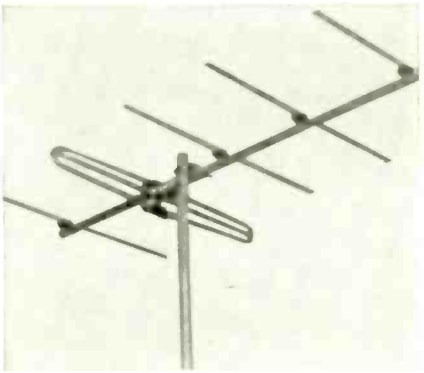
Rohn TOWER →

The No. 50 is a new extremely heavy-duty tower for a wide range of communication uses, including the mounting of antennas for micro-wave, radio communications, and TV reception. It utilizes the No. 5 section of the Rohn Self-Supporting tower and provides outstanding rigidity and strength in heights up to 450 feet. It features a 15½" equilateral triangular design with solid steel rod zig-zag cross-bracing. Rohn Mfg. Co., 116 Limestone, Bellevue, Peoria, Ill. (ELECTRONIC TECHNICIAN 6-31)



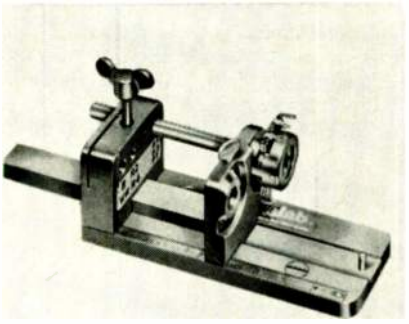
Winegard YAG! →

"K Series" is a new line of low-cost 5 and 10-element "Z" type yagi antennas, consisting of 24 out-of-channel and 14 broad-band yagis covering all VHF channels. All are full size with elements precision tuned, wide spaced, and matched at 300-ohms. Features include a new type impedance-matching rod that snaps out and a newly designed wrap around mast clamp. Winegard Co., 3000 Scotten Blvd., Burlington, Iowa. (ELECTRONIC TECHNICIAN 6-32)



Centralab SHAFT-KUT TOOL

Precision cutting of control and switch shafts to an accuracy of 1/64", in a few seconds, is claimed for the new tool. The control or switch is inserted into the tool, the jib is set at the length desired on a scale, and the excess shaft is sawed off. Constructed of case-hardened steel to withstand hard usage.



$4.95. Also offered for free with the purchase of the new Fastatch FDK-100 Dual Control Kit containing 24 controls and 9 switches which can be assembled into 720 different dual control combinations. Centralab, a Division of Globe-Union Inc., 900 E. Keefe Ave., Milwaukee 1, Wisc. (ELECTRONIC TECHNICIAN 6-28)

Xcelite SEIZER TOOL

This new tool handles like a scissors. Made of perfectly tempered stainless steel, it is 6" long and is available in curved or straight nose style. It has a stepped clamp, and holds momentarily or indefinitely; and releases easily. Its

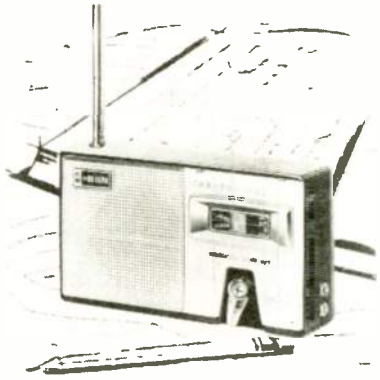
many applications include: holding dial cords, pig tails and wires for soldering; and acting as a heat sink. No. 42H, straight nose, $5.70. No. 43H, curved nose, $5.90. Xcelite, Inc. Orchard Park, N. Y. (ELECTRONIC TECHNICIAN 6-29)

Tenna ANTENNA

The all new Miracle line of VHF and UHF TV antennas, equipped with the new Miracle Reflector System, provides cut-channel and all-channel models to fit every possible installation need. Features are high front-to-back ratio, high directional characteristics and high gain. Tenna Mfg. Co., 7580 Garfield Blvd., Cleveland 25, Ohio (ELECTRONIC TECHNICIAN 6-33)

Channel Master RADIO →

New transistor radios include: a cordless table model 6511; a two-band model 6514 for standard broadcast and marine frequencies; a two-band model 6512 (shown) for standard broadcast and world-wide shortwave; and model 6503 for AM broadcast. The 6511 has a 5" speaker, 6 matched transistors, 1 diode, and 1 thermistor provide high sensitivity. Power is furnished by 4 1½ volt flashlight batteries. Prices range from $29.95 for the #6504 (6503 less accessories) to $74.95 for the 6514. Channel Master Corp., Ellenville, N. Y. (ELECTRONIC TECHNICIAN 6-16)

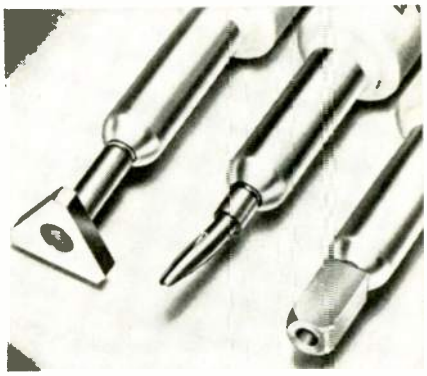


RSM FM DEVIOMETER →

Designed for use in adjusting FM transmitters within the new narrow band requirements, the Deviometer uses an oscilloscope to present instantaneous peak deviation. Maximum communication range and utility, and better signal to noise ratio can be obtained. Frequency range is 25 to 55 mc and 145 to 175 mc, with provisions allowed for later installation of a 450 mc tuner. It has its own power supply operating from standard 60 cycle 110 v source. Radio Specialty Mfg. Co., 2023 S. E. 6th Ave., Portland 14, Ore. (ELECTRONIC TECHNICIAN 6-27)

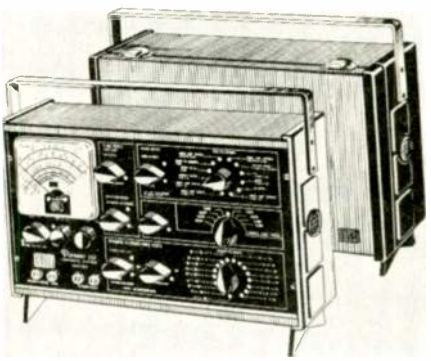
Ungar DE-SOLDERING TIPS →

Three new, special de-soldering tiplets are: A triangle to melt solder, simultaneously, from electrolytic capacitor leads which are in a triangular pattern, and also for multiple in-line terminal leads ⅝" apart; a small ⅛" diameter offset slotted tiplet straightens leads and tube tabs, and removes excess solder on wire connections; and a cube tiplet that removes center pins of tube sockets and harness leads. Unger Electric Tools, Inc., 4101 Redwood Ave., Los Angeles 66, Calif. (ELECTRONIC TECHNICIAN 6-19)



Doss SWEEP QUANTALYST

A way of making a dynamic, quantative analysis of the entire horizontal sweep circuit is provided by the Pioneer 250. It eliminates locating key test points, and provides a technique of isolating failures to a single component. Each test is made by moving function switches. With the TV set operating in



the cabinet, some 20 major in-circuit tests can be made, including checks of filter capacitor, output resistors, supply and boost voltages, cathode current, bias, drive signal, oscillator frequency, yoke and many others. Doss Electronic Research, Inc., 820 Baltimore, Kansas City 5, Mo. (ELECTRONIC TECHNICIAN 6-18)

UTC MINIFILTERS

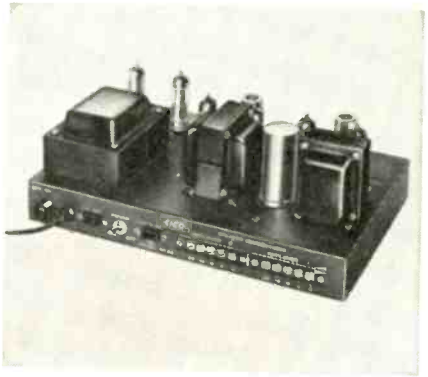
A new series of Minifilters is available in a wide range of stock frequencies. Hermetically sealed, they fall into 3 basic categories: BPM (band pass) provide 2:1 gain in vacuum tube circuits, also tapped for transistor applications, attenuation approx. 2 db. HPM (high pass) and LPM (low pass) units are for 10,000 ohms in and out, have a loss of less than 6 db at cutoff frequency and an attenuation of 30 db at .67 and 1.5 cutoff frequency, case is 1 x 1 x 1⅜". United Transformer Corp., 150 Varick St., New York 13, N. Y. (ELECTRONIC TECHNICIAN 6-8)

Kit-Tronics TRANSISTOR TESTER

The TT-2 is a precision tester which measures basic characteristics of transistors. First the transistor is checked for short, open and leakage, and then a reference bias is established, using 1% calibration components. A known signal is automatically applied and the current gain is indicated on the Beta scales. An alpha range of 0.9 to 0.990 is also displayed over most of the meter scale using a log calibration. In a sense, the TT-2 is comparable to a mutual conductance tube tester. Kit, $39.95. Wired, $59.95. Kit-Tronics, 2315 Hendola Dr. N. E., Albuquerque, New Mex. (ELECTRONIC TECHNICIAN 6-34)

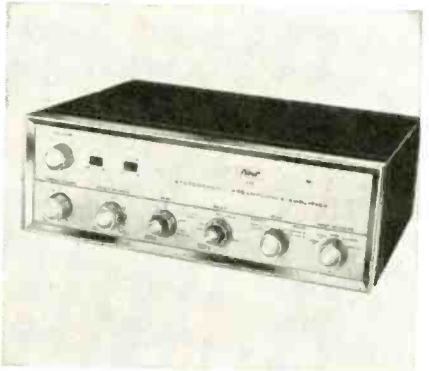
For more information, write in ELECTRONIC TECHNICIAN's new product code number on coupon, on page 44

Eico AMPLIFIER →



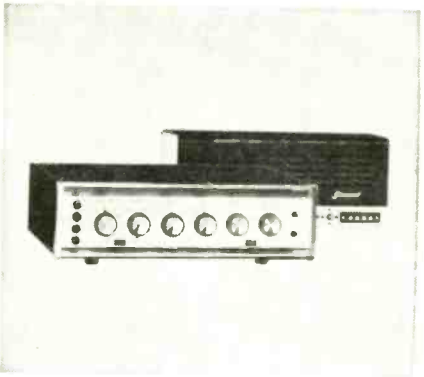
Model HF86 stereo dual power amplifier is designed for use with model HF85 stereo dual preamplifier or on any good self-powered preamp. It features identical Williamson-type push-pull EL84 power amplifiers, rated at 14 watts, which may be operated in parallel to deliver 28 watts for nonstereo use. Either input can be made common for both amplifiers by a service selector switch. Kit, $43.95. Wired, $74.95. Electronic Instrument Co., 33-00 Northern Blvd., Long Island City 1, N. Y. (ELECTRONIC TECHNICIAN 6-22)

Pilot STEREO AMPLIFIER →



Model 240 is a two-channel, 30-watt, stereo preamplifier-amplifier featuring automatic shut-off which permits the record changer mechanism to also turn off the amplifier after playing the last record. Each channel has 5 inputs, including 2 pairs of phono inputs for connection of both a record changer and turntable, and permits the use of either. Frequency response is ±1 db from 20 to 20,000 cycles. Harmonic distortion is less than 1%. Hum and noise are 80 db below full output. $129.50. Pilot Radio Corp., 37-06 36th St., Long Island City 1, N. Y. (ELECTRONIC TECHNICIAN 6-23)

Sherwood AMPLIFIER →



Model S-4400 is a 36-watt add-on basic amplifier and stereo preamp to convert existing monophonic hi-fi systems to stereo. Has all dual controls, stereo normal/reverse switch; phase inversion; dual monophonic; and other controls. Power output is 36 watts/channel @ 1½% IM distortion. Frequency response @ 36 watts is 20 cps to 20 kc ±1½ db. Sensitivity on radio 0.25v; phono 2½ mv. Max hum and noise on radio 80 db; on phono 60 db. $159.50. Sherwood Electronic Labs., 4300 N. California Ave., Chicago 18, Ill. (ELECTRONIC TECHNICIAN 6-24)

INDEX TO ADVERTISERS

JUNE, 1959

Alliance Manufacturing Co. . . . Cover III
American Telephone & Telegraph Co. 50
American Television & Radio Co. . . . 76
Arco Electronics Inc. 70
Armco Steel Corp. 10
Astatic Corp. 21
Atlas Sound Corp. 86

B & K Manufacturing Co. 56
Barry Electronics Corp. 87
Belden Manufacturing Co. 54
Blonder-Tongue Laboratories, Inc. . . . 67
Bogen-Presto Co. 81
Bussmann Manufacturing Co. 4

Castle TV Tuner Service 85
CBS Electronics 23
Centralab Div., Globe-Union, Inc. . . . 61
Channel Master Corp. . . 20, 22, 24, 26
Chemical Electronic Engineering, Inc. 78
Chicago Miniature Lamp Works 79
Chicago Standard Transformer Corp. 75
Clevite 'Walco' 77
Cornell-Dubilier Electric Corp. 8

Duotone Co., Inc. 85

EICO 69
Electronic Technician 12, 13
ElectroVoice, Inc. . . . . Cover II
Entron, Inc. 73
Erie Resistor Corp. 63
E-Z Hook Test Products 81

GC-Telco 15
General Electric Co. 16, 17

Heath Co. 65

Jackson Electrical Instrument Co. . . . 18
Jensen Industries, Inc. 83
Jensen Manufacturing Co. 88
Jerrold Electronics Corp. 51
JFD Electronics Corp. 30

Littelfuse, Inc. 9

Mallory & Co., Inc., P. R. 48, 49
Marjo Technical Products Co. 83
McCabe-Powers Body Co. 74
Moss Electronic Distributing Co. . . . 25

ORRadio Industries 5

Perma-Power Co. 78
Philco Corp. 66
Pilot Radio Corp. 84

Quietrole Co. 81

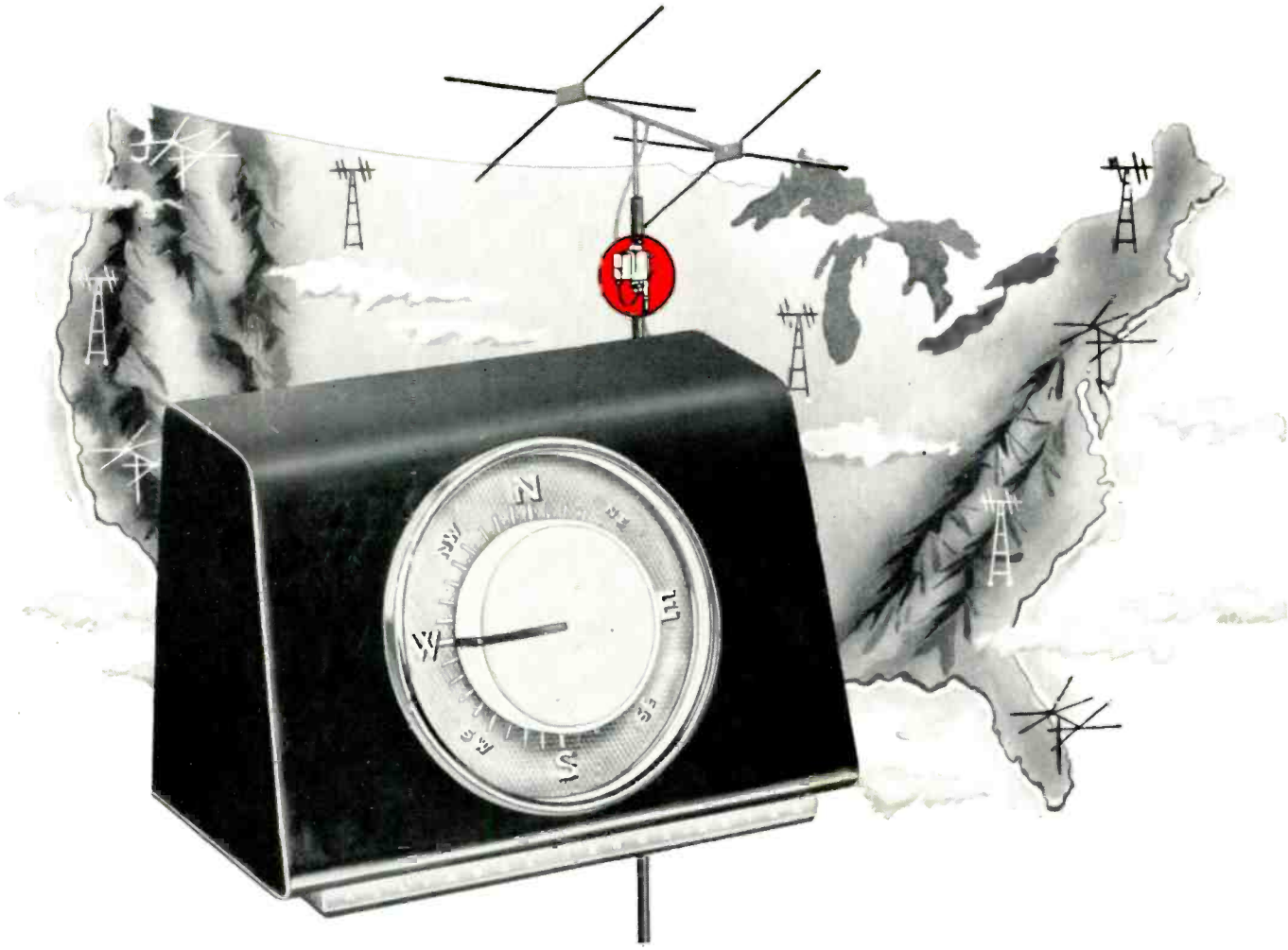
Radio Corporation of America
6, 7, 14, 29, 71, Cover IV
Ramo-Wooldridge 83
Raytheon Manufacturing Co. 2, 3
Rider Publisher, John F. 72
Rohn Manufacturing Co. 19

Service Instruments Corp.
75, 76, 78, 82, 84, 86
Simpson Electric Co. 62
Sonotone Corp. 82
Sprague Products Co. 27
Sylvania Electric Products Inc.
45, 46, 47, 68

Technical Appliance Corp. 77
Telco Electronics Mfg. Co. 15
Tenna Manufacturing Co. 28
Tung-Sol Electric, Inc. 11

Ungar Electric Tools, Inc. 80
United Catalog Publishers 87
University Loudspeakers, Inc. 79
Vis-U-All Products Co. 87
Walco Needles 77

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



ALLIANCE TENNA-ROTOR

Increases Your Antenna Profits

Now is the time for you to get into the profitable antenna rotator market. Day by day, color TV, channel changes and new stations are increasing the need for this important antenna accessory.

You not only increase your profits by selling Alliance Tenna-Rotor . . . you also insure better viewing for your customers regardless of future changes in station locations or color.

Alliance Tenna-Rotor is your logical choice because it's the leader—backed by years of product research, national advertising and more than 4 million installations. Alliance Tenna-Rotor makes selling easy with a *complete* line, better design, competitive prices, sales helps and free ad mats. Write for dealer information.

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MODEL U-98 the first and finest fully automatic rotator control. Smartly styled in Mahogany, Ivory and Forest Green.

MODEL T-12 with exclusive Tenna-Teller Pointer. Strikingly modern in Mahogany, Ivory and Forest Green.

MODEL K-22 the pacesetter in economy and style. Now with convenient indicator light. Mahogany finish only.

THE ALLIANCE MANUFACTURING COMPANY

(Division of Consolidated Electronics Industries Corp.) Alliance, Ohio

How to keep your profits from going to the "dogs"!

AVOID CALLBACKS DUE TO PREMATURE TUBE FAILURE...

...when you replace a defective horizontal output tube check operating cathode current.

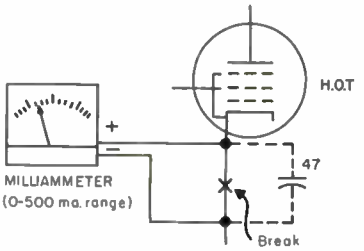
Premature horizontal output tube ("H.O.T.") failure can be caused by excessive cathode current—*higher than recommended by the manufacturer*—due to misadjustment or defective components in the horizontal output stage. Whenever you replace the "H.O.T.", protect your profits with these precautions: (1) measure "H.O.T." cathode current; (2) if excessive, find the trouble and fix it; and (3) adjust Horizontal Drive, Width, and Linearity.

Keep your hard-earned profits to yourself. Take time to check "H.O.T." cathode current. And, do as most successful service technicians do: always replace defective horizontal output tubes with *power-to-spare* RCA tubes. They pay off in fewer callbacks, finer reputation, and bigger profits.

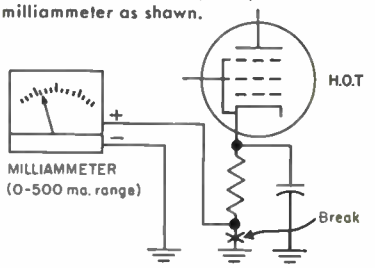
RCA-6DQ6-A—typical of RCA's excellent tube quality. Mount structure is designed to give maximum heat dissipation, prevent "hot spots" on the plate, allow cooler operation of the grids—help cut callbacks! Available at your RCA Tube Distributor.

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

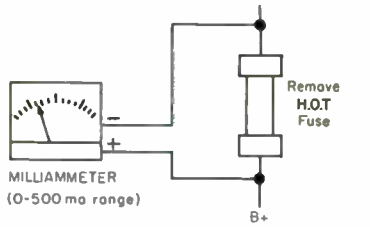
4 SIMPLE WAYS TO MEASURE "H.O.T." CURRENT



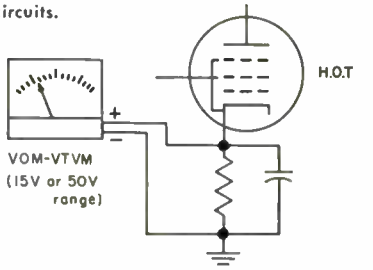
Disconnect cathode circuit at the "H.O.T." socket. Connect 0.47 μf capacitar and dc milliammeter as shawn.



If "H.O.T." circuit has bypassed cathade-bias resistar, connect milliammeter as shawn.



Remave "H.O.T." circuit fuse. Cannect meter acrass fuse holder as shawn. Indicated current will be slightly higher than actual cathade current because it includes baasted "B" current to vertical ascillatar and/ar ather circuits.



Measure dc-valtage acrass "H.O.T." cathade-bias resistar. Valtage should not exceed value shawn in service data far the set. Campute cathade current by dividing the valtage by the resistance.

TYPICAL RCA "H.O.T." TYPES AND MAX.▲ DC CATHODE CURRENT (MILLIAMPERES)	
6AU5-GT	110
6AV5-GA	110
*6AV5-GT	110
*6BG6-G	110
6BG6-GA	110
*6BQ6-GT	110
6BQ6-GTB/6CU6	112.5
*6CB5	200
6CB5-A	220
*6CD6-G	200
6CD6-GA	200
6DQ5	285
6DQ6-A	140
12AV5-GA	110
12BQ6-GTB/12CU6	112.5
12DQ6-A	140
17BQ6-GTB	112.5
17DQ6-A	140
*19BG6-G	110
19BG6-GA	110
*25BQ6-GT	110
25BQ6-GTB/25CU6	112.5
25CD6-GA	200
25CD6-GB	200
25DN6	200

*Discontinued RCA Type—Replaced by RCA "A" or double-branded version.

▲Values shown are measured with the receiver operating at a line voltage of 117 volts, 60 cycles.