ELECTRONIC TECHNICIAN

Including
SERVICE
Magazine

INDUSTRIAL ELECTRONIC MAINTENANCE Edition

Big Summer Business

TRANSISTOR SALES & SERVICE

June • 1960

50¢

Here is the new Standard Coil Tuner Replacement and Repair Program that enables you to offer better service to your customers at greater profit. Now Standard Coil Products provides the tools that will enable you to cash in on the profitable tuner repair and replacement market.

TUNER REPLACEMENT LISTING IN SAMS PHOTOFACT

Starting in January, Standard Coil tuner replacement listings will appear in all Sams TV Photofact. Tuner replacement information will be right at your finger tips. Standard Coil is the *only* manufacturer ever to provide this service.

NEW TV TUNER REPLACEMENT GUIDE

Lists original equipment TV tuners with the Standard Coil equivalent replacement for each. Also includes major mechanical replacement parts for all Standard Coil Tuners —those used in original equipment as well as the universal replacement. Eliminates all guesswork—minimizes your tuner repair and replacement problems.

48 HOUR FACTORY GUARANTEED REPAIR SERVICE

Standard Coil's special service department set-up assures factory guaranteed repairs—*on a 48 hour in-plant cycle!* All repaired tuners carry a *six month warranty* on defective workmanship and parts failure (excluding tubes). Gives you more time for additional service calls—promptly returns your customer's set to like new operating condition.

DEFECTIVE TUNER TRADE-IN ALLOWANCE

Tuners which can *not* be repaired can be traded in against a new replacement tuner which carries a full *twelve month factory guarantee*. See your Standard Coil Distributor for complete details on how trade-ins can increase your tuner sales and profits—create greater customer satisfaction.

JUMP ON THE STANDARD COIL PROFIT WAGON TODAY!

For additional details, see your authorized Standard Coil Distributor or write to:

Standard

Coil Products Co., Inc.

2085 North Hawthorne Avenue, Melrose Park, Illinois

For more data, circle 6-C2-1 on coupon, p. 49

ELECTRONIC TECHNICIAN

Including SERVICE Magazine

World's Largest Electronic Trade Circulation

Address all mail to
480 Lexington Ave., New York 17, N. Y.
Telephone YUkon 6-4242

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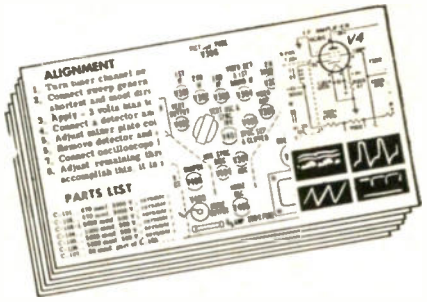
June, 1960

FRONT COVER Transistor radio repairs and battery sales are making summer seasons pleasantly profitable. The recipe is simple: cautiously mix transistor circuitry operation with some vacuum-tube test methods; add an adequate supply of batteries; stir vigorously with advertising. See article starting on page 30.

FEATURES and ARTICLES

DEPARTMENTS

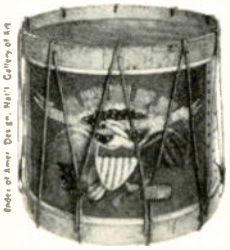


IN THIS ISSUE

(16 pp. latest schematics & data)

ADMIRAL: TV Chassis 15G1
HOFFMAN: TV Chassis 360
MOTOROLA: TV Chassis TS & WTS564
MUNTZ: TV Chassis T37L05, T37L4U, T37P05, T37P04U, T37S05, T37S04U
TRAV-LER: TV Chassis 1150-59

EVERY DAY DURING BOTH POLITICAL CONVENTIONS BETTY FURNESS WILL SELL FOR YOU!



Now "Miss Westinghouse" is going on the air with the biggest, most powerful Westinghouse TV and Radio Tube promotion ever for Service Dealers! Daily during both political conventions—beginning July 9 (Democrat) and July 24 (Republican)—she'll blanket the country over a 204-sta-

tion CBS-Radio network reaching more than 11 million listeners per broadcast. The result will be a tremendous parade of customers looking for their local Service Dealer who sells Westinghouse TV and Radio Tubes. Get ready to cash in on this profit opportunity. Put up the special Westinghouse Tube displays. Tie in with your own advertising. BUT FIRST—call your Westinghouse Distributor and place your tube order right away! You're going to need a lot!

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

Westinghouse Electric Corp., Electronic Tube Division, Elmira, New York
Tune in Westinghouse-CBS TV-Radio Coverage, Presidential Conventions, July 10-29.

For more data, circle 6-3-1 on coupon, p. 49

Editor's Memo

As any good technical specialist or businessman will tell you, proper attention to detail is an important element in successful operations. It's surprising how many people who should know better fail to take care of a detail which can turn out to be fairly important.

Take the service technician who does an excellent troubleshooting job, and then fails to spend the extra two minutes necessary to clean up the cabinet and the floor near the set. The customer gets the impression that the technical work was just as sloppy.

I have had a number of readers write to me asking a question which is evidently important to them. They simply forget to include their name or address in the letter.

Manufacturers often go to great expense to design a decent product. Some of them stop at the 99% mark by failing to put in that extra little effort necessary to produce a good instruction manual, so the product can be used as the designer intended.

Neglect of detail in the management of one railroad produced a funny, but certainly illuminating situation. The friend who told me this story insists that it happened to him, though I suspect that this story has been going around for some time.

The friend, let's call him Ken (because that happens to be his name), took a sleeper on an overnight train trip. As he crawled into bed, lo and behold, he had company in the form of several bedbugs. Appalled at sharing his bed with uninvited livestock, he decided to write to the president of the railroad as soon as he returned.

Ken's letter to the railroad told the president in no uncertain terms what he thought of the sleeping accommodations.

In a few days a letter arrived from the president's assistant. The text was friendly, sympathetic, and very disconcerted that such a situation could exist on that railroad. The letter vowed that this unusual condition would be investigated immediately, and all necessary steps taken to prevent another occurrence.

Thanks to the oversight of some secretary, attached to the letter was a memo of the president of the railroad to his assistant. The memo instructed: "Send bedbug letter."

Al Forman

For more data, circle 6-5-1 on coupon, p. 49 ➤

YOU'LL BE GLAD TO KNOW THAT AMPEREX AMPLIFRAME TUBES ARE USED IN THE BEST TV SETS YOU HANDLE!

thanks to 6 NEW

Amperex®

AMPLIFRAMES*

you can look forward to...

1. **TV sets with gain to spare!**
2. **TV sets with greater reliability—BECAUSE AMPLIFRAMES MAKE CIRCUITS SIMPLER—have fully proven their reliability in critical military and industrial applications!**
3. **TV sets that are much easier to service—because the extraordinary uniformity of AMPLIFRAMES almost invariably eliminates the necessity for re-alignment when changing tubes!**

OUTSTANDING FEATURES SHARED BY THE NEW AMPEREX TV-IF AMPLIFRAME TYPES 6EJ7, 4EJ7, 3EJ7, 6EH7, 4EH7 and 3EH7:

- 9-pin construction; 2 cathode leads
- Internally shielded
- Low microphonics
- Internally neutralized screen grid

NOW
all AMPLIFRAME IF tubes are automatically mass-produced for maximum uniformity and lower cost

NOW
Ampliframe tubes will provide 55% higher gain-bandwidth product than conventional IF tubes

NOW
compare the performance of Ampliframe tubes with conventional IF tubes and consider what this added design freedom can mean in the sets you service and sell

IF	GAIN	BANDWIDTH
3 x AMPLIFRAME	3500	4.5 mc
3 x Conventional	3500	2.5 mc
2 x AMPLIFRAME	1200	2.5 mc
2 x Conventional	350	2.5 mc

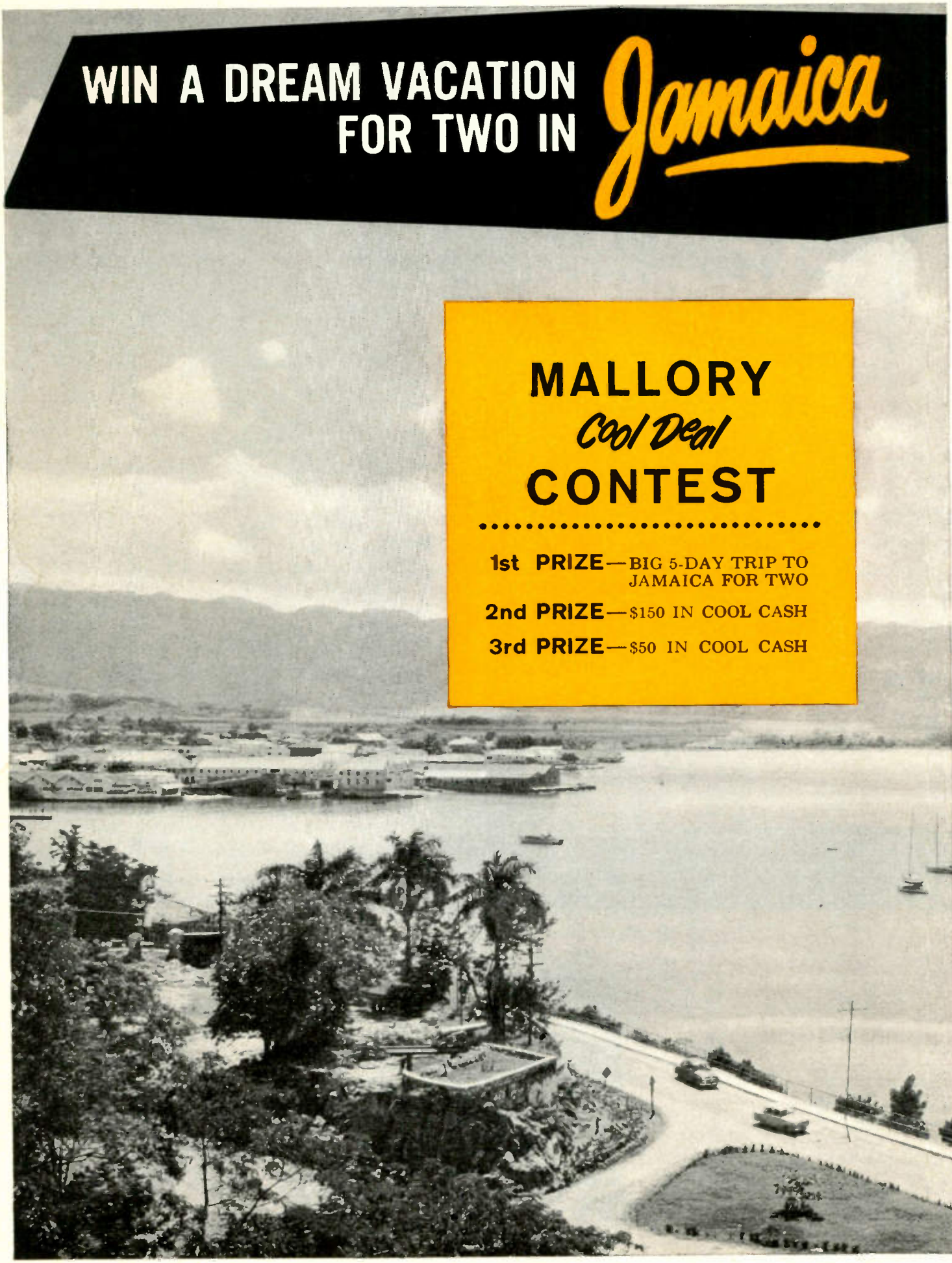
*AMPLIFRAME, a new concept in electron tubes, designed and mass produced exclusively by Amperex, incorporates the unique FRAME GRID...the closest approach to the ideal "Physicists' grid"—electrical characteristics but no physical dimensions. The FRAME GRID results in: **• higher transconductance per milliampere • tighter G_m and plate current tolerance • low transit time • low capacitances • lower microphonics • rugged construction**

ask Amperex

about Ampliframe tubes for TV and other entertainment applications

AMPEREX ELECTRONIC CORPORATION
230 DUFFY AVENUE, HICKSVILLE, L. I., N. Y.

WIN A DREAM VACATION FOR TWO IN *Jamaica*



MALLORY *Cool Deal* CONTEST

1st PRIZE—BIG 5-DAY TRIP TO JAMAICA FOR TWO

2nd PRIZE—$150 IN COOL CASH

3rd PRIZE—$50 IN COOL CASH

WITH THE MALLORY Cool Deal

Mallory has done it again . . . with the coolest deal this side of the moon . . . a real bargain in parts, a free cooler, and a chance to win a fistful of cash or a 5-day trip to a tropical wonderland!

VOODOO COOLER

MALLORY COOL DEAL is out of this world! For only $24.88, a smart serviceman can latch on to more than $48 (list) worth of parts . . . snag a beautiful "Voodoo Cooler" for free . . . and line up a big fat chance to win himself some loot or a huge 5-day ball under Jamaica skies. (Bring your own bongos!) What a deal.

a $48.82 value $24.88

LOOK WHAT'S IN THE VOODOO COOLER: "Gem" Packs, FP Electrolytics, TC Tubular Electrolytics, Gold Label® Vibrators, Mercury Batteries, RMC Discaps,® Vitreous Resistors, and Carbon Controls and switches . . . $48 worth of parts for less than $25!

PICNICKERS TAKE NOTE: the free "Voodoo Cooler" is made of sturdy, insulated, waterproof plastic . . . keeps things hot or cold . . . would even make a good tube caddy (if the little woman doesn't see it first!).

PLAY IT COOL . . .
SEE YOUR DISTRIBUTOR TODAY . . .
CASH IN NOW ON THE MALLORY COOL DEAL

Distributor Division
Indianapolis 6, Indiana

P.R. MALLORY & CO. Inc
MALLORY

For more data, circle 6-7-1 on coupon, p. 49

LETTERS

To the Editor

Sex In Ads

Editor, ELECTRONIC TECHNICIAN:

Regarding your Editor's Memo in the April 1960 issue, our hat is off to you. There is already too much filth in present day advertising. For the past three years, a local supplier has been mailing out a so-called joke book with cartoons. Real filth. I mailed it back with a religious calender that we use every year, asking them which they would like to have received in the mail for their families to see. They discontinued the use of the joke book this past year.

E. J. DYMERSKI
Eddie Radio Co.
Pittsburgh, Pa.

. . . May we compliment you for your stand in your April issue regarding the degredation of sex in advertising. It is inspiring to know that in the laxity of the age we live in, a magazine which depends on advertising revenue to exist, has the moral fortitude to reject such low caliber advertising. Some years ago, I made up my mind not to read any catalog or advertising material employing this type of approach. At this time, I can honestly say that to the best of my knowledge, I haven't missed a thing.

JOE BELL
Spokane Radio Supply
Spokane, Wash.

. . . Your approach to the problem regarding sex in advertising was very appropriate. In my opinion, sex cheapens the product being sold. It should be against the law for some of the pictures taken and used in advertising. The majority of people that subscribe to the magazine want to read facts and not be diverted by the pictures of half-naked women. Keep up the good work.

J. J. SZOMOLYAI
Lincoln Park, Mich.

. . . Thank you for your stand regarding the type of advertisements that were trying to get into your magazine. I am not a prude, but I feel that there is enough of this type junk on the magazine dealers' shelves and we don't need it here. I think it lowers the standard set by the magazine.

B. B. L. NORCROSS
Atlantic City Electric
Atlantic City, N. J.

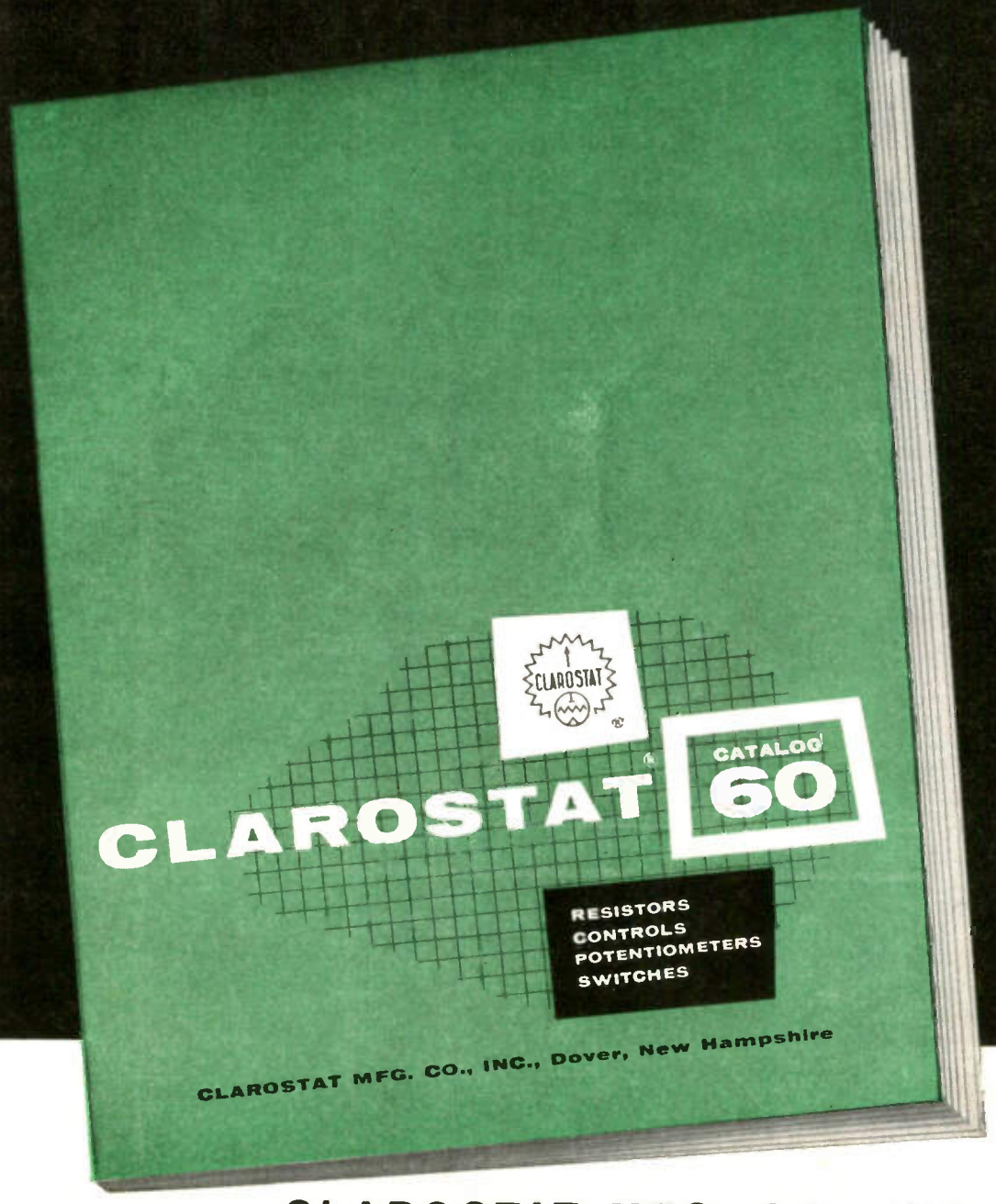
. . . Congratulations for what I think is an excellent editorial. If a fellow wants to look at girls, there are plenty of places for him to do so. Don't foul up your wonderful magazine with some flashy, come-on advertising.

EDWARD M. WEIL
Weil's Audio Video Service
Philadelphia, Pa.

(Continued on page 10)

BIGGER and BETTER than ever

...Ready right now—at your Clarostat distributor, or write for your free copy—the most complete resistance device catalog ever published—yours for the asking...



CLAROSTAT MFG. CO., INC.,
DOVER, NEW HAMPSHIRE

CLAROSTAT®

For more data, circle 6-9-1 on coupon, p. 49

(Continued from page 8)

. . . May I add my voice to the many that must be pouring in, praising your stand in refusing the sexy advertisement. This makes me proud to be one of your subscribers. My boys (4) age 1 month to 13 years, who will some day be standing beside me at the service bench, already thumb through my magazines. God bless you and reward you for your courageous stand.

ARNOLD PANCRATZ
Lake Helen, Fla.

. . . It is about time an editor of a widely read trade magazine came out against sex-gestive advertisements. I've always been skeptical of the quality of merchandise where the advertiser uses this method of advertising. The young learners in the trade are interested in the picture. Ask them what was advertised—they don't know.

JOHN A. STEHLE
Stehle's Automotive Service
Philadelphia, Pa.

. . . What we need is more people of your stature to put the smut merchants where they belong—back in the gutter. It seems that so many advertising agencies think that the American people are a crowd of morons who will not notice an ad unless it reeks of vulgar sensationalism.

LEO J. BURT
Plymouth Meeting, Pa.

. . . You have "not one of the best magazines" for TV and radio, but "The Best." In regard to your April Editor's Memo, I say Bravo. Let's keep this one away from sex. I like to read the ads. That way I know what's new and if it is something to better service. Let's keep it that way.

ADAM W. MILLER
Meadville, Pa.

. . . Good for you. We don't need sex in this publication. You are doing a good job. Keep it up.

DAVID P. SAND
Racine, Wisc.

. . . Your Memo in the April issue was a pleasant surprise. I agree with you 100%.

ARTHUR R. MC COURT
Butte, Montana

. . . I agree with your editorial comments re advertising copy.

VERNON HOPHAN
Moonachie, N. J.

. . . Regarding your article in the April issue—we agree wholeheartedly!

HERBERT F. TURNER
Granada Hills, Calif.

● *We are most grateful for the strong show of reader support. We received only one letter critical of our rejection of heavy-handed sex ads — but that writer was anonymous. Though we may withhold names on letters when so requested, we will not publish anonymous letters.—Ed.*

(Continued on page 13)

NEW ILLUMINATED DEALER SIGNS!

pick

the one for your store!

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

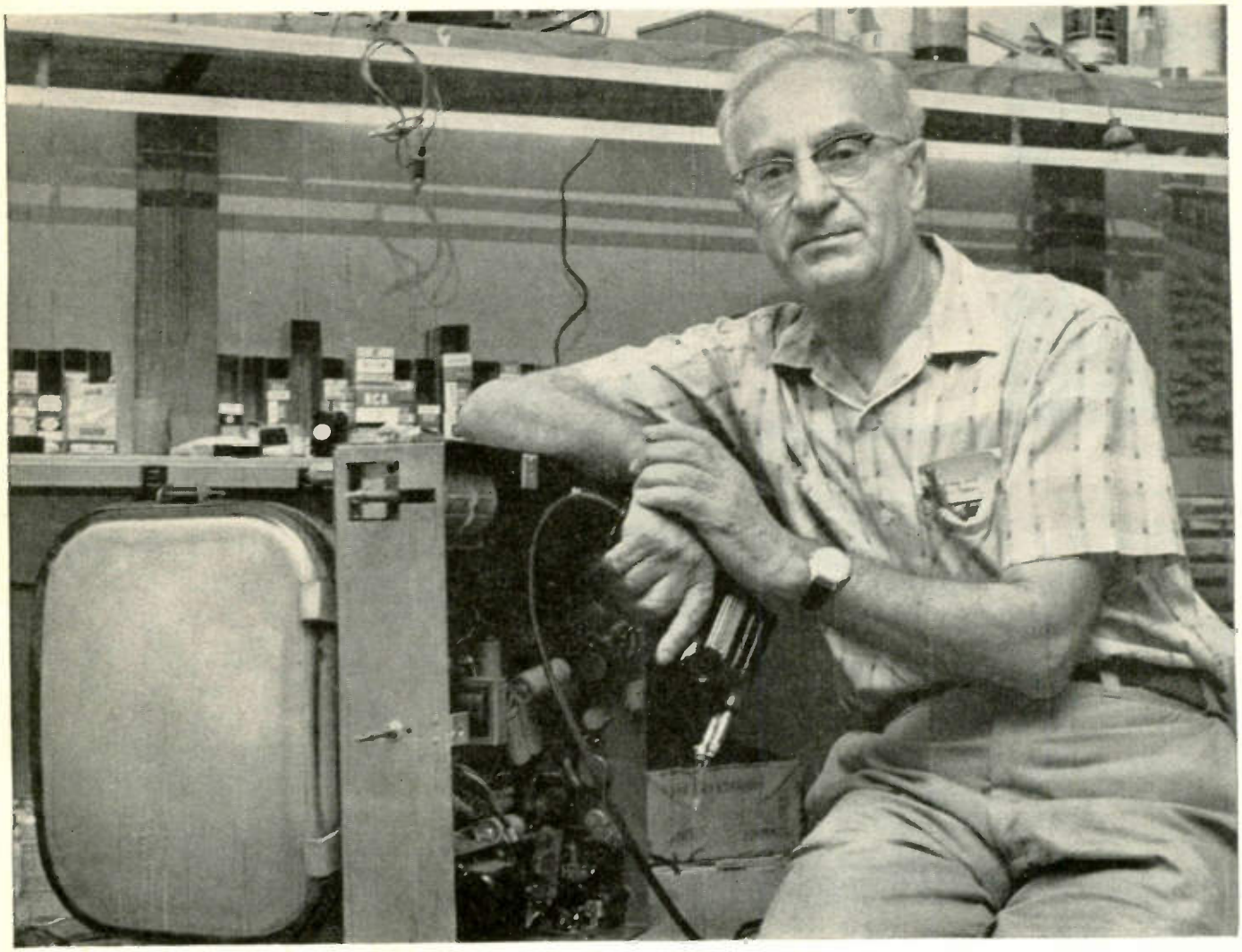
ALL THREE SIGNS IN BRILLIANT BLUE AND RED ON A WHITE BACKGROUND.

Double-faced 3' x 6'
Deluxe outdoor sign

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

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

Call your Channel Master distributor today



"75% of our service calls come in through the Yellow Pages!"

says Nick Baratta, Prop., Nick Baratta Radio & TV, Phoenix, Arizona

"We average fifty to sixty service calls a week from our advertising in the Yellow Pages. How do we know? We ask people how they found us, and again and again they answer—through the Yellow Pages.

"Here's further proof that our Yellow Pages advertising gets results. We opened a new store about 4 miles from here, but it was after the new Phoenix directory had gone to press. I continually got calls and the people said, 'I looked under Baratta but did not find your new store listed.'"

The Yellow Pages takes your advertising message right into the homes of your best prospects. That's why they're likely to call you at the time they need your services. To build a greater AWHERENESS of your business . . . location . . . services and telephone number—call the Yellow Pages man at the Bell telephone business office. He'll be glad to plan a Yellow Pages advertising plan for your business.

EXPERIENCE PAYS OFF when people know you have it! This display ad (reduced) gives people in need of electronic service good reason to call Nick Baratta. He is also listed under the trade-marks of General Electric Appliances and TV, RCA TV and Webcor Hi-Fi Equipment.

Display this sales-building emblem wherever your prospects can see it. The Yellow Pages representative will gladly supply as many as you need.

For more data, circle 6-12-1 on coupon, p. 49

(Continued from page 10)

Parts Number Corrections

Editor, ELECTRONIC TECHNICIAN:

This letter is in regard to the article, "Mobile Radio Universal Test Box," by Larry Critchlow in the October 1959 issue. The control and power plugs for the Motorola Models T41G and T51G series are listed wrong.

Model T41G—Control plug should be part No. 1V810424 instead of 28C802820 as shown.

Model T51G—Control plug should be part No. 28B890846 instead of 9A890787 and the power plug should be 9C830033 instead of 28A890788 as shown.

These are the only two models I could check on, and now I am wondering if the plugs for the DuMont, Link, and the other Motorola model are correct.

HARRY HUDSON
Hudson Electronics
Algonac, Mich.

. . . The parts numbers listed for the Motorola radio cable hook-up are all chassis receptacles and plugs, and cannot possibly be used as a cable plug for any Motorola sets or any other for that matter. I have not checked on the other plugs listed to see if they are cable plugs or chassis receptacles. I feel that a correction in your magazine might save someone else considerable time and some expense if they decided to build the test box and order the listed plugs without checking in the various service manuals.

I would also like to say that the 80D power cable cannot be used on the T51 G series sets. The control cable may be used, but there is one mistake in the wiring shown. Connection No. 8 must be grounded to provide use of the speaker. I also do not believe the 41G and 41V cables will interchange but I have not yet checked into that.

This is a very useful piece of equipment once all the bugs are ironed out.

WILLIS M. MUSIC
Music Mobile Radio Service
Sheridan, Wyo.

● *Author Critchlow reports that the following corrections in Table 2 should also be made: Motorola part No. 28C802820 should be No. 9C801050; Motorola part No. 9A980787 should be No. 28B890846: Motorola part No. 28A890788 should be No. 9C830034.—Ed.*

Arise Men!

Editor, ELECTRONIC TECHNICIAN:

I'll tell you the truth. It's my wife. I'd love to renew the magazine subscription, but she says no. The trouble is, I absolutely refuse to dispose of one once I get it. I have a five room house, three rooms are already full of technical magazines from as far back as 1929. She swears if I take any more, she will take her mother and move out.

W. T. MAYFIELD
Mayfield Radio & TV Service

(Continued on page 14)

Letters to the Editor

(Continued from page 13)

Kansas City Licensing

Editor, ELECTRONIC TECHNICIAN:

Under the heading of "Association News" in the February issue of your magazine, you reported incorrectly upon the status of the Ordinance to license electronic technicians in Kansas City. Mayor Bartle has appointed the commission to administer the ordinance as reported in the January-February issue of our publication, "The Supreme Effort." Mayor Bartle and the City Council are confident that the bill is constitutional, being almost a parallel with other City Ordinances which have been tested in the courts of Missouri. City Commissioner A. G. Hays has instructed the License Board to proceed with all possible haste in setting up the required procedures and completing the examination of all applicants, mentioning April 1st as a date by which time he would like to see this work completed.

As in many other cases of record, the source which you have quoted has again proved something less than reliable. We are aware that the entire country is watching the developments resulting from this bill in Kansas City; therefore, we hope that you will consider the correction of this error.

J. ALEX EARP, President
Television Service Engineers, Inc.
Kansas City, Mo.

. . . The March-April issue of "The Supreme Effort," Kansas City, mentioned a letter sent to you which was supposed to point out that your source of information (me) was inaccurate. Let me assure you that I can furnish affidavits or other legal proof of the veracity of my statements in "TEAM News." There are witnesses to the fact that H. Roe Bartle, Mayor of Kansas City, said that he would not reveal the names of the men selected as Board members while the Ordinance was in litigation. A short time later he did reveal the names and the city proceeded with the Ordinance in spite of a Temporary Injunction granted by Judge Stubbs, except in the case of the two plaintiffs. The Chief of Police and the License Commissioner said they would not enforce the law while the suit was pending. In a recent discussion with our attorney, the City Counselor acting as spokesman for those two, said they meant that they would not make arrests, but that had nothing to do with the mailing of notices and the tests, etc.

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

● *Our report of association activities and opinions is a news gathering function, which implies neither agreement or disagreement.—Ed.*

(Continued on page 16)

2 great SPRAGUE DIFILM® tubulars are tops in their field . . . take your choice!

For maximum reliability and performance under toughest conditions

SPRAGUE DIFILM® BLACK BEAUTY®

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

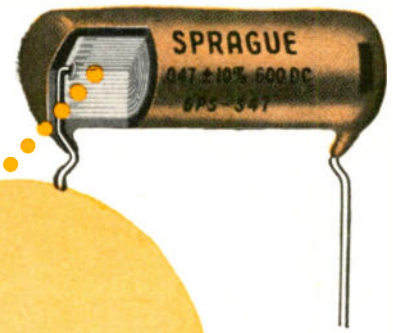
Difilm Black Beauties are engineered to withstand the hottest temperatures to be found in TV or auto radio sets—in the most humid climates. Further, unlike straight polyester film tubulars, these capacitors operate in a 105°C environment —without derating!

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

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

For extremely small size and exact original replacement

SPRAGUE DIFILM® ORANGE DROP®



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

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

±10% CAPACITANCE TOLERANCE IS STANDARD AT NO EXTRA COST

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

SPRAGUE®
THE MARK OF RELIABILITY

For more data, circle 6-15-1 on coupon, p. 49

(Continued from page 14)

"Sneaky Pete"

Editor, ELECTRONIC TECHNICIAN:

I read the Blonder-Tongue ad on page 74 in the April issue on "Sneaky Pete" antennas by Robert Cornell. He describes the trouble he had in locating a customer's antenna through a maze of antenna wires. A very useful and simple way to locate one customer's antenna would be as follows. Take a step-down bell transformer. Plug it into the a-c near the TV set. Take the antenna of the TV set and connect it to the step-down side of the transformer. Go up to the roof with a bell or buzzer and tap the lines. When the antenna is the correct one, your buzzer or bell would ring.

BILL FRANKEL

Elm Radio & TV, Inc.
Flushing, N.Y.

Prize Winner

Editor, ELECTRONIC TECHNICIAN:

Thank you for the $10.00 Shop Hint Contest prize. This is the first time I have ever won anything in my life. Hope that you have continued success with this wonderful technical magazine.

JAMES L. SAWYER

North Miami, Fla.

Bad Business

Editor, ELECTRONIC TECHNICIAN:

In your January 1960 issue there appeared an advertisement from the Glenn R. Uertz Company of Utica, New York, on page 72. Their ad advised that they would repair tuners for $9.95 plus a $.95 handling charge.

I mailed a 40 MC tuner with a check to their company in the amount of $10.90 on February 23rd. My check was subsequently cashed on February 27th by a Mr. Andrew Bevirne. Not having heard from the company or receiving the tuner, I wrote a letter to them on April 4th and contacted our local Post Office. I have still had no word from the Uertz Company.

EUGENE J. JAEGER

Flint, Mich.

● *There have been several complaints about this company. We are taking the necessary action to protect our readers. Other tuner repair firms advertising in ET are providing reliable service.—Ed.*

Bad New Tubes

Editor, ELECTRONIC TECHNICIAN:

Thank you for helping me out on my Crosley 356-1 TV. After doing all the things you suggested, I still was where I had started. I re-read your letter and came to the part where you said to re-substitute the new tubes I had put in. Who would have thought that the new horizontal output 6CD6 and horizontal oscillator 6SN7 would be bad? I had never thought to substitute them again. What threw me was that I had good negative voltage on those two tubes. Also, I couldn't get over the fact that I was getting 400 volts from the power supply when the schematic showed 310 for B+. It just made me go around in circles. So thanks again for helping, and keep up the good work.

PAUL SHOFFLER

Springfield, Va.

"I suggest you buy a tool box."

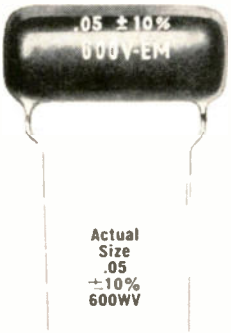
52,745,000
IN
OPERATION

the
BIG SWITCH
is to
MINIATURIZED
ELMENCO
capacitors

AVAILABLE AT ARCO
DISTRIBUTORS EVERYWHERE

ARCO
electronics inc.

64 WHITE ST., NEW YORK 13, N. Y.
Branches: Dallas 19, Los Angeles 35



ELMENCO
MYLAR*-PAPER DIPPED CAPACITORS

RELIABILITY
Elmenco dp Mylar*-Paper Capacitors have achieved a reliability that meet missile and computer requirements. They are thoroughly and continually tested during production to insure outstanding performance. For example a 0.1 mfd. dp capacitor operated at full rated voltage and at 105° C will have a life expectancy of more than 7,168,000 unit hours.

MOISTURE-PROOF
Elmenco dp Capacitors are specially processed and vacuum dipped to obtain solid impregnation and a rugged moisture-proof coat designed to withstand 4 times more humidity than the best molded capacitors used in the past.

MINIATURIZED
These capacitors are up to 50% smaller than other brands and can be used in printed circuit and transistor applications.

*DuPont Reg. Trademark

Write for catalog dp 110.

ELMENCO
CERAMIC DISC CAPACITORS

RELIABILITY
The use of special ceramic materials in Elmenco Disc Ceramic capacitors impart longer life and greater stability. Higher voltage ratings greatly improve reliability by providing extra reserve for resistance to surges and temporary overloads.

MOISTURE FESISTANT
Elmenco Disc Ceramics are processed with a rugged phenolic coating and high temperature wax impregnation which gives them a superior moisture resistance and physical strength.

SPACE SAVERS
Elmenco Disc Ceramics are smaller than comparable capacitors of the same value. The miniature size is designed to offer greater service convenience with complete safety of operation.

Write for catalog CC115.

For more data, circle 6-17-1 on coupon, p. 49

News of the Industry

HICKOK has named PAUL P. RADECKY as Manufacturing Supt. of The Meter Dept.

INT'L. RECTIFIER has named WILLIAM SEARLS Field Sales Rep. in the S. Calif. sales region.

P. R. MALLORY & CO. has announced the election of G. BARRON MALLORY to the office of Pres.

BLONDER-TONGUE is celebrating its 10th anniversary in the TV electronics industry.

KAAR ENGINEERING announces the promotion of FRANK GENOCHIO to Vice Pres. in charge of sales for the company.

SANGAMO ELECTRIC has announced a 10% increase in the selling price of paper and plastic film capacitors, mica capacitors of all types, and electrolytic capacitors.

UNGAR ELECTRIC Div. of ELDON INDUSTRIES has announced the election of WILLIAM L. NEHRENZ as Vice Pres. of ELDON INDUSTRIES, INC. He will continue as Gen. Mgr. of UNGAR.

INT'L. RESISTANCE has elected DR. SIDNEY J. STEIN, Dir. of Research & Engineering, as a Vice Pres. The Distributor Div. has been expanded in scope with TOM DAVIS and VINCENT FOLEY named to the newly created positions of Marketing Mgrs.

WESTINGHOUSE Electronic Tube Div. has named FREDERICK H. TOWNSEND Mgr. for entertainment equipment sales. The following three new appointments to the sales staff have been announced: RAYMOND E. WARNER, Dist. Mgr. of Midwest Region; ROBERT G. HOFF, renewal tube sales rep. in N. Y. state; W. G. MORAN, power tube marketing specialist.

RAYTHEON has announced the election of CHARLES F. ADAMS to the newly-created position of Chmn. of the Bd. and RICHARD E. KRAFVE as Pres. of the company. Sales for the first quarter of 1960 were $134,752,000 compared with $113,302,000 in the same period a year ago. MARVIN C. LEWIS has been promoted to the new corporate position of Mgr. of Commercial Marketing Research. The Distributor Products Div. has appointed the following Dist. Mgrs.: JOHN J. LUCY, Carolina Dist.: ROBERT A. CHALMERS, Ga. & Fla. territory; THOMAS MICHAEL MULLIN, St. Louis, Mo. Dist.; and ROBERT EARL THOMPSON, Tulsa, Okla. and parts of Kans. and Mo.

(*Continued on page 20*)

(Continued from page 18)

CHANNEL MASTER Pres. HARRY RESNICK was the subject of a profile in BUSINESS WEEK magazine, March 19th.

BIDDLE CO. announces that WILLIAM W. TAYLOR, formerly with SANGAMO ELECTRIC, has joined the Bloomington account executive staff.

GENERAL INSTRUMENT Semiconductor Div. has appointed BERNARD I. BELASCO as Advertising & Sales Promotion Mgr.

DAYSTROM Weston Instruments Div. has named EDWIN O. BROWN Philadelphia Dist. Mgr., and L. P. DUCK Mgr. of the Syracuse Distr.

DELCO RADIO DIV. has announced the opening of a Detroit office for semiconductor sales and applications located at 57 Harper Ave. and headed by RALPH DUKE.

JERROLD System Sales Div. reports the following two appointments: LEE ZEMNICK, Mgr. of Community Sales Dept.; and JEREMIAH E. HASTINGS, Mgr. of Military & Industrial Closed Circuit Systems Dept.

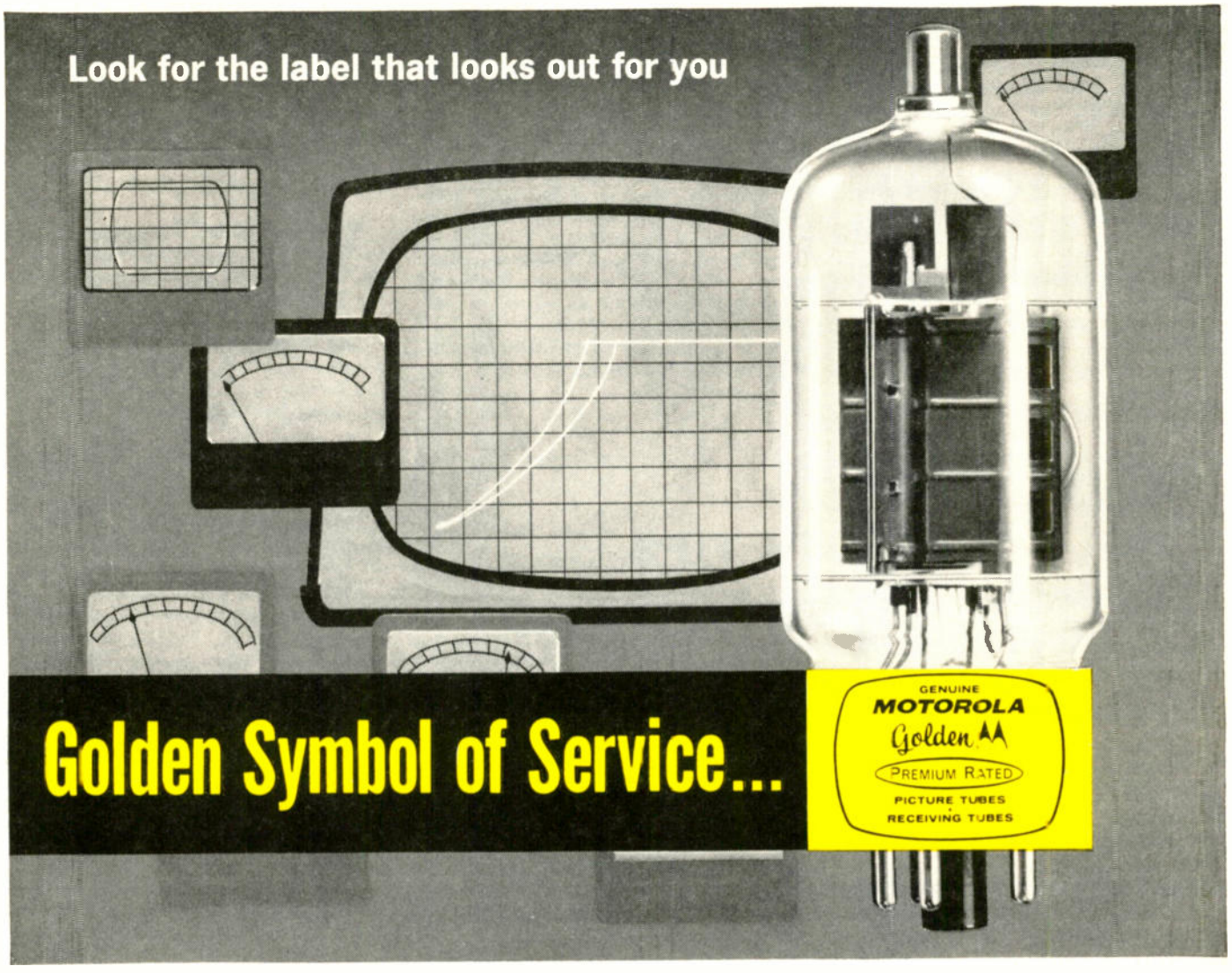
AEROVOX Vice Pres. CHARLEY GOLENPAUL celebrates his 30th year with the corporation. Known for many industry activities, he was an original organizer of the Sales Managers Club, now called P.A.C.E.

RCA has won a special citation in the 1960 Hess Brothers' "Versatility in Design and Use Contest" with the RCA Victor Hillsborough, a TV set that hides away in a high-style living room table when not in use.

INT'L. CORRESPONDENCE SCHOOLS announces the appointment of RONALD D. CLARK as head of the Education Dept. He will continue to serve as Dir. of Educational Research for ICS.

(Continued on page 22)

"... IT SOUNDS LIKE ..."



Now you can sell tubes tested to twice maximum ratings ...the most reliable tubes ever!

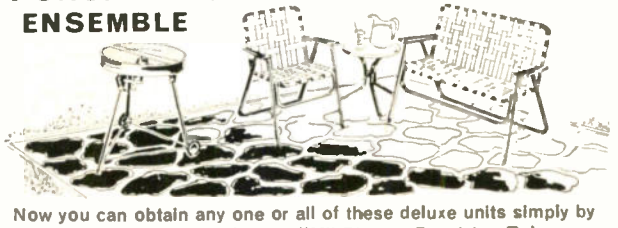
MOTOVAC, a Motorola-created electronic brain, torture-tests Golden "M"® Tubes to specifications that are the highest in the entertainment-type tube industry.

Result? The most reliable tubes you can buy! So do yourself a real service . . . specify Motorola Golden "M" Tubes for more customer satisfaction and more *profit!*

Contact your Motorola distributor today for further details on fabulous Golden "M" Receiver Tubes . . . and Golden "M" Picture Tubes as well.

SPECIAL OFFER *for a limited time only*

PORCH 'N' PATIO ENSEMBLE



Now you can obtain any one or all of these deluxe units simply by ordering a supply of Golden "M" Picture/Receiving Tubes. Contact your Motorola Distributor today for details.

MOTOROLA

CONFIDENCE BRAND NAMES SATISFACTION REG. PENDING

PARTS AND ACCESSORIES, FRANKLIN PARK, ILLINOIS

For more data, circle 6-21-1 on coupon, p. 49

(Continued from page 20)

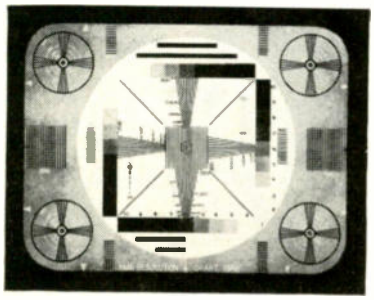
MICHIGAN MAGNETICS announces the following two appointments: GORDON PARKER, Vice Pres. and WAYNE COLE, Asst. Treas.

MOTOROLA Semiconductor Products Div. has named GLEN E. SCHAFER Dist. Sales Mgr. of its Midwest Regional Sales area.

PENTRON ELECTRONICS Executive Vice Pres., IRVING ROSSMAN, has been elected Pres. of the ASSOC. of ELECTRONIC PARTS & EQUIPMENT MFGRS., INC.

CENTRALAB has announced appointment of the following two Sales Managers: HARVEY SCHMIT, engineered ceramics; EARL CLEMICK, packaged electronic circuits.

GENERAL ELECTRIC has expanded its Syracuse, N. Y. manufacturing and warehousing operations to increase production of replacement TV picture tubes for the N.E. and Middle Atlantic states. The Semiconductor Products Dept. has announced its second major price reduction in two months on low current silicon rectifiers, affecting 39 models reduced in price by 4-50%.



TV TIPS FROM TRIAD

NO. 8 IN A SERIES

"I was doing a little 'government' work for my grandmother last night," said Joe, the Junior PTM as he and Bill prepared to go to lunch. "She's a mystery fan and when one of those dark, low key, scenes is on the screen she has a crooked dirty gray line that wanders down the center of the picture. I've seen it on other sets, but it bothers more on that kind of show."

"I know what you mean," said Bill, "It's a type of malfunction caused by overshoot from sync spiking the blanking pedestal, and this can originate in either the transmitter or receiver if video overshoot is present. Sets without horizontal CRT blanking show it most. Sounds like you'll have to install a little pulse source to keep her happy."

"I wouldn't mind putting in a width coil," Joe said, "with a secondary winding because there is a mounting hole available next to the flyback, but since the set is a three way console I don't want to bring the chassis in, and the way the boss has the scope 'lashed up' for alignment I don't like to have to take it out to her house. If I could take the chassis out, connect up the parts and know I had the blanking polarity right I could do the job in 'jig' time."

"Polarity is no problem," said Bill, "you know that every tap on an autoformer type flyback between boost and the cathode of the damper is positive going with respect to the boost tap, and you can see the 'Start of Winding' of the width coil Primary and Secondary windings. If, for instance, you connect the 'Start' of the primary of the width coil to a more positive point on the flyback than the 'Finish,' the 'Start' terminal of the width coil secondary will be positive with respect to the 'Finish' terminal."

"I didn't know that, and I hope I can remember it when I get there," said Joe, and as his face lit up with a crafty smile, "How about coming along with me tonight?"

"No such thing," said Bill with a laugh, "I know she makes wonderful cake and coffee, but I'm leaving on a long vacation and just won't be available."

* * *

MORAL: You may not remember the polarity relations as Bill outlined them, but Triad explains Flyback polarities in PTM #1 and width coil relations on the Instruction Sheet which is packed "In The Box" with the product. If you would like copies of these charts and sheets drop a line to **Triad Transformer Corporation,** 4055 Redwood Avenue, Venice, California, and we will mail them to you.

For more data, circle 6-22-1 on coupon, p. 49

Reps & Distributors

CENTRALAB reports the appointment of the NEWHOPE CORP. as sales reps in the metropolitan N. Y. area.

HAYDEN ASSOC. announces the appointment of RAYMOND WAITE as a field rep working out of the East Point, Ga. headquarters.

TECHNITROL announces the appointment of S. A. M. ASSOCIATES as a sales rep in the Northern N.J., N.Y.C. and Long Island territories.

MORRIS F. TAYLOR CO. has reported the presentation of gold service pins to its Sales Mgr., RICHARD E. TYDINGS, and Dist. Mgr., JAMES J. FAHY.

ART CERF & CO. has announced the following appointments to the sales staff: JACK K. POFF, Baltimore-Wash.-Va. area; and HERBERT DIENES, Philadelphia.

CBS ELECTRONICS Sales Corp. announces a week-long Seminar for Electronic Distributors Management scheduled for June 12-17 at Clarkson College of Technology, Potsdam, N. Y.

CUMMING ASSOC. announces a partnership arrangement with JOE H. MORIN, whose responsibilities will include sales promotion, merchandising and sales training at the distributor level.

PHILCO announces THE JOHN M. OTTER CO., independent distributor for the company in the Philadelphia-Trenton area, will enlarge its operations to include the New York and Newark areas formerly handled by Philco Distributors, Inc.

U. S. TRANSISTOR has named the following three new distributors to handle its line of germanium alloy junction and silicon mesa transistors: ARTHUR NAGEL, INC., Chicago; AMERICAN ELECTRONICS SUPPLY, INC., Rochester, N. Y.; ZACK ELECTRONICS, San Francisco. The company reports the appointment of HAROLD NEWNAN as sales rep for the Northern Calif. region.

NEDA announces the establishment of their 29th chapter, The Central Illinois Chapter, with the following officers: HAROLD BRUCE, BRUCE ELECTRONICS, Dir.; ROBERT BRIDGEWATER, UNITED TV CO., Alt. Dir.; BEN KLAUS, KLAUS RADIO & ELECTRIC CO., Pres.; ELMER C. HARDING, WARREN RADIO CO., Vice Pres.; V. R. LAMPLEY, LAMPLEY RADIO CO., Sec'y.-Treas.

(Continued on page 24)

Remember us? We're still cutting call-backs...

. . . because I've got new coil heaters. You can wave goodbye to your front-end troubles.

Your CBS 6BQ7A

. . . because my new plates behave like plates . . . not filaments. You can forget your low-voltage rectifier problems.

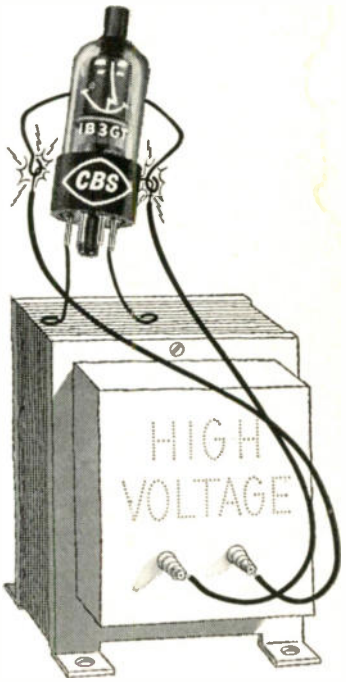
Your CBS 5U4GB

. . . because you get no fireworks with me. That means no more damper arcing for you.

Your CBS 6AX4GT

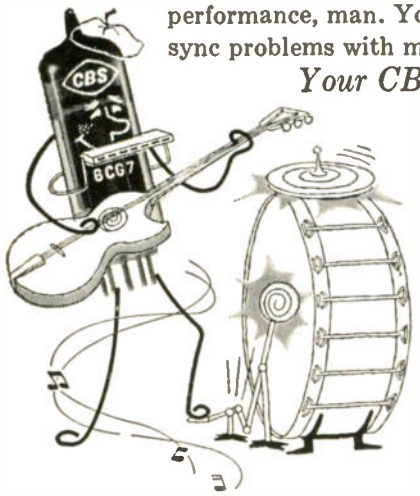
. . . because I *like* high voltage. So stop worrying about arcs and burnouts.

Your CBS 1B3GT



. . . because I'm loaded with performance, man. You buy no sync problems with me.

Your CBS 6CG7



TOTAL RELIABILITY ... proved in performance

Yes, we are typical CBS receiving tubes especially designed to cut your call-backs. We offer you *total reliability* . . . proved in performance by leading TV set manufacturers — and service technicians too. *You* can profit more from the *total reliability* of CBS tubes. Just make it a habit always to replace with us . . . and with other dependable CBS tubes.

COLUMBIA NEEDLE CATALOG

COLUMBIA NEEDLES NOW AT YOUR ELECTRONIC PARTS DISTRIBUTOR

The Columbia phonograph needle line is now available from your local distributor of CBS Electronics products. You'll find it a complete line . . . a quality line . . . with a famous name, a proud name known and respected by your customers. Ask *your* distributor for dependable Columbia needles.

CBS ELECTRONICS, Danvers, Mass.
A Division of Columbia Broadcasting System, Inc.
Receiving, industrial and picture tubes • transistors and diodes • audio components • and phonographs

For more data, circle 6-23-1 on coupon, p. 49

GRANCO has named JOHN W. WALTERS as its distributor for metropolitan New York.

ELECTRONIC PUBLISHING has announced publication of new catalogs for the following firms: EAST COAST RADIO & TELEVISION CO., INC.; HUGHES PETERS INC.; MOUNTAIN ELECTRONICS CO., INC.; WEDEMEYER ELECTRONIC SUPPLY CO.; and ZACK ELECTRONICS. The company reports the appointment of W. B. PRAY SALES CO. as sales reps in the New England states.

ERA urges the industry to write to Congressmen, not Senators, expressing opposition to the enactment of H.R. 9996, which would amend the existing importation law to permit the importation of surplus electronic and other gear in all cases except where the Secretary of Commerce determines that the "Importation of such property would be injurious to the economy of" the United States. The description on the front of the bill is misleading, according to ERA, and gives the impression that H.R. 9996 strengthens the present law, whereas the reverse is true. ERA requests a blind carbon copy of all letters be sent to the National Office.

Catalogs & Bulletins

RECTIFIERS: "Properties of Rectifier Systems and Means to Improve Voltage Division" is the title of a 5-page article contained in Rectifier News, Spring Edition, RN-360. International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif.

For more data, circle 6-24-2 on coupon, p. 49

RESISTORS: Articles on metal film type resistors, new ¼-watt molded composition resistors, miniature rheostat, and king-size dummy antenna are included, with other items, in a recent issue of the firm's newsletter. Ohmite Mfg. Co., 3603 Howard St., Skokie, Ill.

For more data, circle 6-24-3 on coupon, p. 49

ELECTRONICS CATALOG: Announced is the second printing of the firm's 308-page, 1960 Electronics Catalog. Products covered include those in the stereo, high-fidelity, electronic kit, instruments and industrial electronics fields. Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y.

For more data, circle 6-24-4 on coupon, p. 49

SEMICONDUCTORS: Greatly expanded over previous issues, the sixth edition of the firm's semiconductor directory and pricing guide provides 16 pages of information on transistors, diodes and rectifiers. Covers semiconductors of 18 major American manufacturers. Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.

For more data, circle 6-24-5 on coupon, p. 49

WIRE & CABLE: Supplement 108A augments Catalog No. 108 and includes a number of items not shown in the catalog such as Citizens Band antenna kits, heavy duty 20' white plastic cord, remote switch for controlling appliances 15 feet away from the wall plug, etc. Columbia Wire & Supply Co., 2850 Irving Park Rd., Chicago 18, Ill.

For more data, circle 6-24-6 on coupon, p. 49

VERTICAL SWEEP SYSTEM: "Servicing the Vertical Sweep System" is the title of Vo. 4 of Stan Cor's Corner. This booklet contains such valuable information as: practical hints on how to locate defects in the vertical deflection system of TV sets; techniques for determining suitable replacements and causes of various defects. Chicago Standard Transformer Corp., 3501 W. Addison St., Chicago 18, Ill.

For more data, circle 6-24-7 on coupon, p. 49

STEREO PHONO-RADIO: Literature is available covering model YP-500 portable, 9-transistor, 2-band, 3-speed stereo phono-radio. Also, model YT-300 portable, 9-transistor, 2-band portable radio with transistorized telephone pickup. Yashica Co. Ltd., 234 Fifth Ave., New York 1, N.Y.

For more data, circle 6-24-8 on coupon, p. 49

For more data, circle 6-25-1 on coupon, p. 49 →

The Lid's Off!

JERROLD announces the all printed circuit antenna . . . the first new concept in TV-FM reception in 10 years!

Indoor Antenna—Outdoor Design! Jerrold's new Magic Carpet* is a flat, flexible all printed circuit antenna based on a broad-banded dipole design. Installed indoors in attic, crawl space, closet or any upper level location in the home, it offers performance comparable to a conical type outdoor antenna (mounted in the same location)** at a fraction of the cost.

A report on the Magic Carpet in the May issue of Electronics World states "Gain characteristics across all frequencies are very close to those of standard outdoor conicals." No more need for unsightly rooftop or indoor antenna (up to 30 miles from the TV transmitter). The Magic Carpet opens up a whole new antenna market for the TV and FM Serviceman.

9.95
LIST

Get the full story of the magic of its performance . . . the potency of its sales appeal, see your Jerrold Distributor or write today

JERROLD Electronics Corporation, Distributor Sales Division, Dept. IDS-32 Philadelphia 32, Pa.

Jerrold Electronics (Canada) Ltd., Toronto Export Representative: CBS International, New York 22, N. Y.

↓ (illus. shows upper section of Magic Carpet) *Trade Mark Patent Pending **Data certified by American Electronic Laboratories Inc.

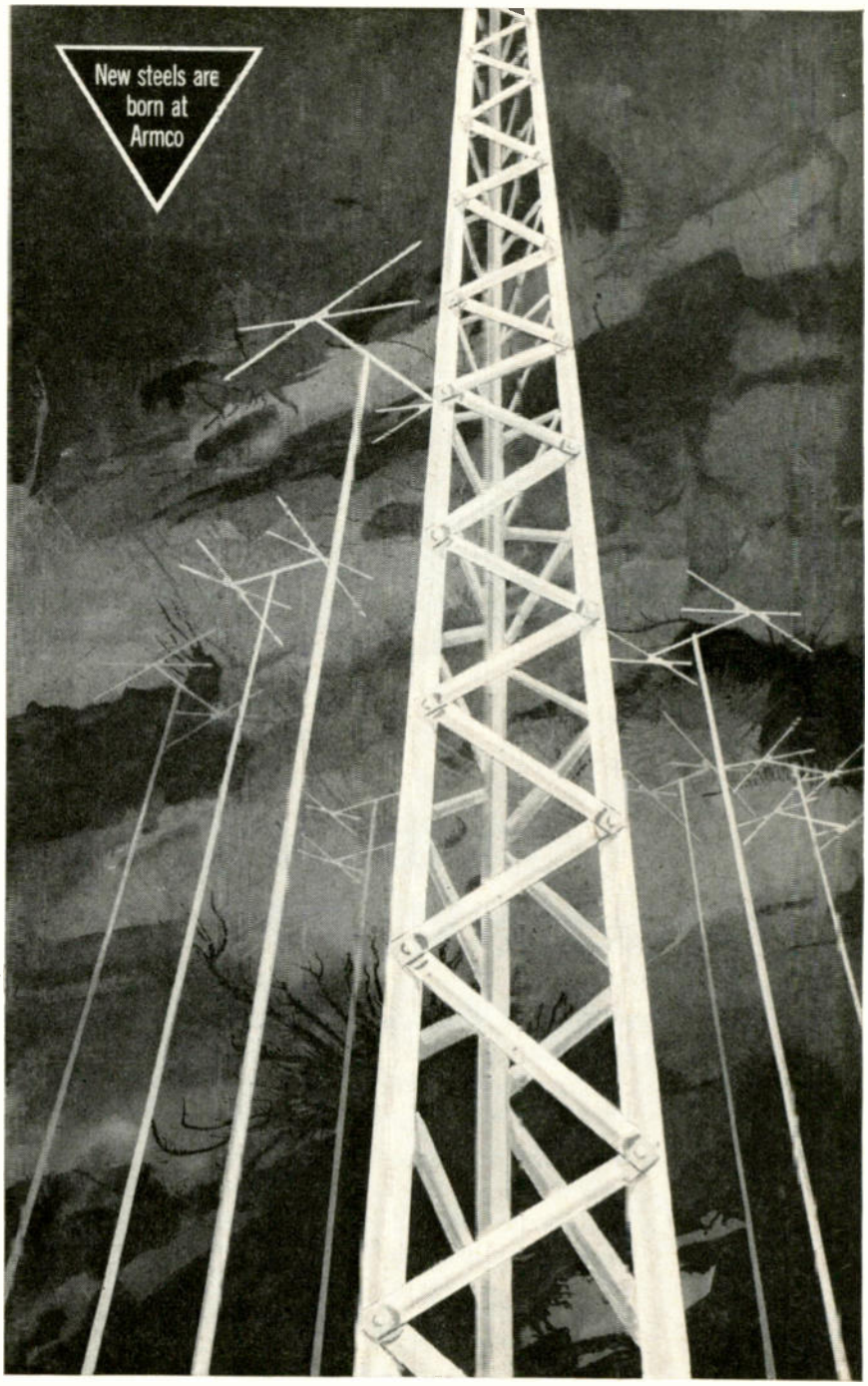
Masts and Towers Made of Armco ZINCGRIP Tubing Sell Easier, Maintain Customer-Confidence

TV towers and masts made of ZINCGRIP® Steel Tubing give you many sales advantages because they have the rugged strength of steel plus built-in ability to resist rust and corrosion.

It's easy to show customers how rigid and strong ZINCGRIP Tubing masts and towers are . . . how they keep antennas in alignment despite iceloads and wind. They can see for themselves that the durable hot-dip protective zinc coating hasn't flaked or peeled during fabrication. It stays on during erection, too.

After the sale, ZINCGRIP Tubing will help maintain customer confidence in you and the products you sell. Masts or towers stay free of rust for many years, look much better much longer than those made of painted or electro-galvanized tubing.

Sell TV towers and masts made of Armco ZINCGRIP Tubing. They will help you make profit-boosting sales and uphold your reputation for quality and service. Just mail us the coupon for names of manufacturers of TV towers and masts made of Armco ZINCGRIP Tubing.



ARMCO STEEL CORPORATION
1650 Curtis Street, Middletown, Ohio
Tell me the names of manufacturers who make towers and masts of Armco ZINCGRIP Tubing.

Name_____

Firm_____

Street_____

City_____ Zone___ State_____

Galvanized Steel

ARMCO STEEL

ARMCO®

Armco Division • Sheffield Division • The National Supply Company • Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation

For more data, circle 6-26-1 on coupon, p. 49

ELECTRONIC TECHNICIAN
Including SERVICE Magazine

Death Of A License Bill

After much preparatory work by the Attorney General's office in New York, and after many hours of consultation with service associations and other interested groups, a bill to license TV service technicians was drawn up.

The bill was introduced in the legislature, and there it died.

Men have always had respect for death in battle, but there was no battle to speak of with this bill. It passed into oblivion through lack of interest and attention on the part of those people who would be most seriously affected.

There was a small amount of opposition, but it was enough to bury the bill. Distributors in some areas voiced their opposition, no doubt because they thought it would affect their business. A retail merchants association voiced a mild protest, mostly on the general principle of opposing such legislation. The service associations, including those who devoted time to the preparation of the bill, stood mutely by instead of mobilizing their efforts and sending a delegation to the capital.

We believe that service associations, regardless of whether they favor or oppose licensing, should learn the basic elements of politics as it is practiced in a democratic society.

Legislators are elected by the people, and are swayed by the expression of opinion presented to them. In a sense, each assemblyman and congressman depends on the letters, petitions, and testimony of his constituents to show him the way. After all, isn't he representing them?

The term "pressure group" does not have a melodious ring, but it has evolved into the accepted practical means for voicing our political viewpoints.

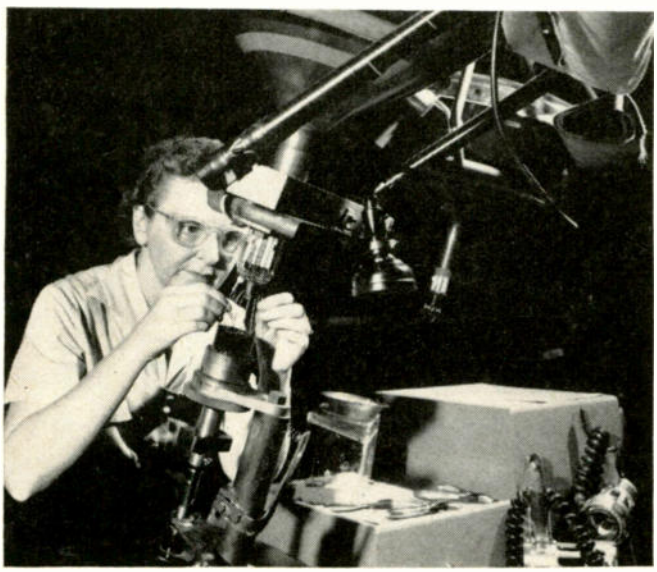
We hope that the death of the New York License Bill will be a valuable example to all electronic service technicians. Association leaders in particular should recognize that the way to support or fight proposed legislation is to arouse people to action.

When your very livelihood is at stake, it is no time to remain passive and inert. Your letter, your 'phone call—they can mean the difference between passage and rejection of legislation. It's the American way.

Tuning In the

HIGH POWER RADIO HAZARD is being discussed in London in connection with forward scatter transmitters being erected in Britain as part of the new NATO communications network. The projectors differ from other transmitters by sending out a radio beam of such high frequency and power that part of the pulse scatters around the curvature of the earth and does not fly into space. The equipment operates at about 30,000 megacycles, making it necessary to fence off an area almost a mile in front of the transmitters. The British Post Office, which has charge of communications, puts the upper limit for continuous daily exposure at ten milliwatts (ten thousandths of a watt) for every square centimeter of body area in the path of the beam.

COLOR TV UPSWING



RCA Lancaster, Pa. tube plant employee threads lead wires into the tube base of a nearly completed 21-inch color TV picture tube. Production has been increased to keep pace with the 40% rise in color receiver sales.

NO LITERARY MASTERPIECE producer, but perhaps the answer to breaking the babel barrier, is the new electronic translator developed by the Air Research and Development Command. Capable of turning Russian into English at the rate of 35 words a second, the translator's "heart" is a "photoscopic memory" which is a transparent disc 10" in diameter. This dictionary unit can store 550,000 Russian-English words in an area the size of a postcard. As a Russian word is fed into the translator via a punched tape, it is "read" by the machine and converted into electrical signals. Any word in the dictionary disc can be located by the machine in less than one-300th of a second.

SUBSCRIPTION TV will be tested in Hartford, Conn. during a three year trial run by Zenith Radio Corp. and RKO General, Inc. Zenith's "over-the-air" Phonevision system will be used in this first large scale operation of subscription TV over a broadcast station.

JAPANESE TV will be in stores here by late summer under the Delmonico International label, including an 8-inch transistorized portable TV made by Victor Co. of Japan listing at $199.95. 21-inch color sets may be sold on the American market by the end of this year.

FREE ENTERPRISE approach to servicing is strongly supported by the influential National Appliance & Radio-TV Dealers Association. In a policy statement, NARDA affirms that, "any given dealer, excepting those who lack the ability to perform within reasonable standards, is entitled to have open to him the same opportunity to service the merchandise that he sells that is open to any other dealer who obtains identical merchandise through identical trade channels, including the same considerations in the form of warranty allowances and parts availability, as is offered to any other dealer who obtains identical merchandise through identical trade channels."

Picture .....

HUMAN ERROR causes more than 85% of highway fatalities, according to Traveler Insurance Companies' 1960 statistical report on U. S. highway accidents during 1959. There were 900 more deaths and more than 50,000 additional injuries last year than the year before. Fatalities climbed to 37,600 and more than 2,870,000 were injured as a result of automobile accidents. Next time you are out on a service call, take it easy.

TUBE BILL reported in ELECTRONIC TECHNICIAN January 1960, which requires the labelling of receiving and picture tubes, has now become New York law known as Chapter 983 of the Laws of 1960. As soon as it becomes effective, it will prevent deceptive sales of tubes.

BIG-SCREEN TRANSISTORIZED TV revealed by Motorola has a 19AEP4 CRT (with 114° deflection), 23 transistors and 12 diodes. An optional silver cadmium energy cell permits "battery-operation" for 5 to 6 hours. Recharge time is 3 hours per discharge hour, accomplished when the set is "off" and the line cord is connected to the wall outlet. The 40 pound a-c/energy cell portable (including 5 lb. cell) is to be sold with a 1 year factory guarantee.

COOL CHASSIS is the feature of Philco's new "Custom Compact 19" line of TV receivers. Second anode voltage is 18,500 volts. The CRT is aluminized and has a deflection angle of 114 degrees.

CALENDAR OF COMING EVENTS

June 20-24: American Institute of Electrical Engrs. Summer General Meeting, Chalefont-Hadden Hall Hotel, Atlantic City, N.J.

June 22-24: 1960 Conference on Standards & Electronic Measurements, NBS Boulder Labs., Boulder, Colo.

June 24-26: Electronic Service Industry's 1960 Tele-Rama, Shelburne Hotel, Atlantic City, N.J.

June 27-29: Fourth National Convention on Military Electronics; Sheraton-Park Hotel, Washington, D.C.

Aug. 1-3: Fourth Global Communications Symposium, Statler Hilton Hotel, Chicago, Ill.

Aug. 6-9: National Audio-Visual Association Convention & Exhibit, Morrison Hotel, Chicago, Ill.

Aug. 19-21: NATESA Annual Convention, Sheraton Towers Hotel, Chicago, Ill.

Aug. 23-26: Western Electronics Show & Convention (WESCON), Ambassador Hotel, Memorial Sports Arena, Los Angeles, Calif.

Sept. 7-9: Joint Automatic Control Conference, Mass. Institute of Technology, Cambridge, Mass.

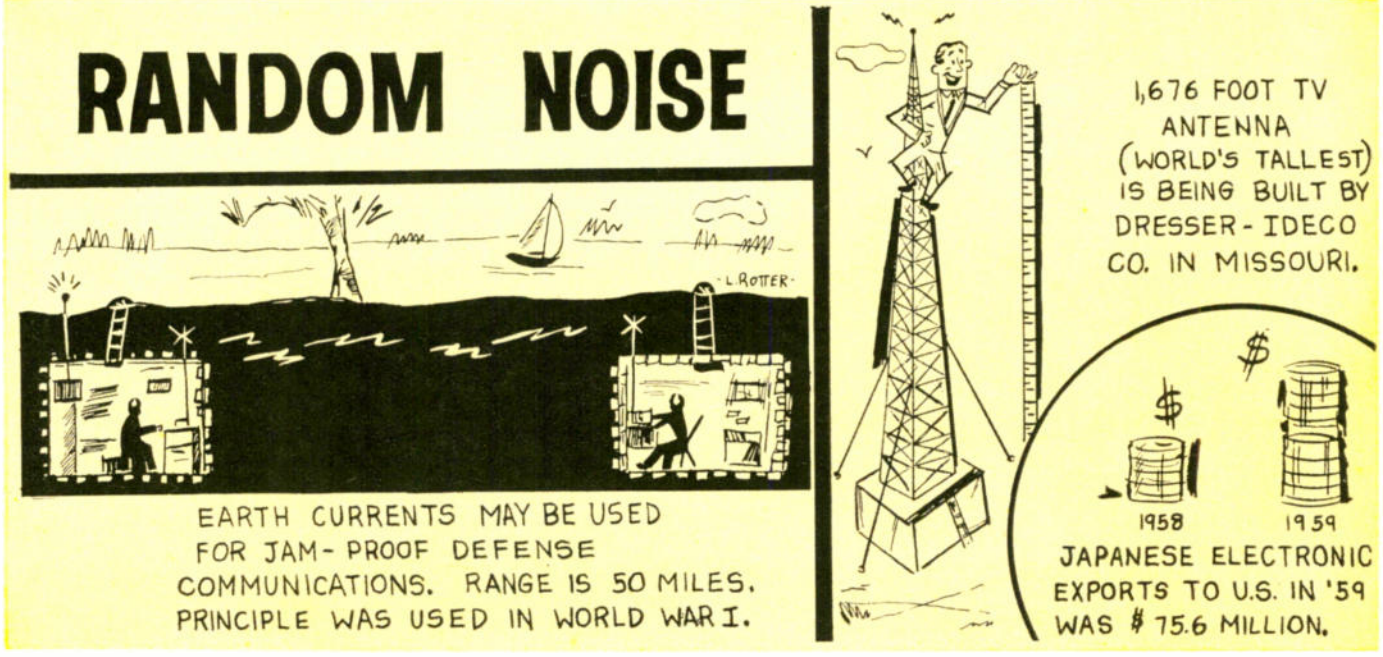
Sept. 15-16: Eighth Annual Eng'g Management Conference, Morrison Hotel, Chicago, Ill.

Sept. 15-17: Upper Midwest Electronic Conference and Exhibit, Minneapolis Auditorium, Minneapolis, Minn.

Sept. 21-22: Industrial Electronic Symposium, Sheraton Hotel, Cleveland, Ohio

Sept. 26-29: American Welding Society Fall Meeting, Penn-Sheraton Hotel, Pittsburgh, Pa.

Sept. 26-30: Instrument Society of America Conference, Exhibit and Fifteenth Annual Meeting, The Coliseum, New York, N.Y.



Repairing Transistor Portables

Time-Shrinking Test Techniques

Can Make Miniature Radio Servicing Profitable

LEO G. SANDS

• Now that the all-transistor portable radio has almost completely replaced tube-type portables, the service technician is faced with the problem of servicing these miniature devices. These sets vary from plastic-cased, pocket-size units weighing only 10 ounces to 16 inch long receivers in fancy wooden cabinets. Many are made in Japan, even if they bear American names. Most of the parts are identical or at least directly replaceable by American-made parts.

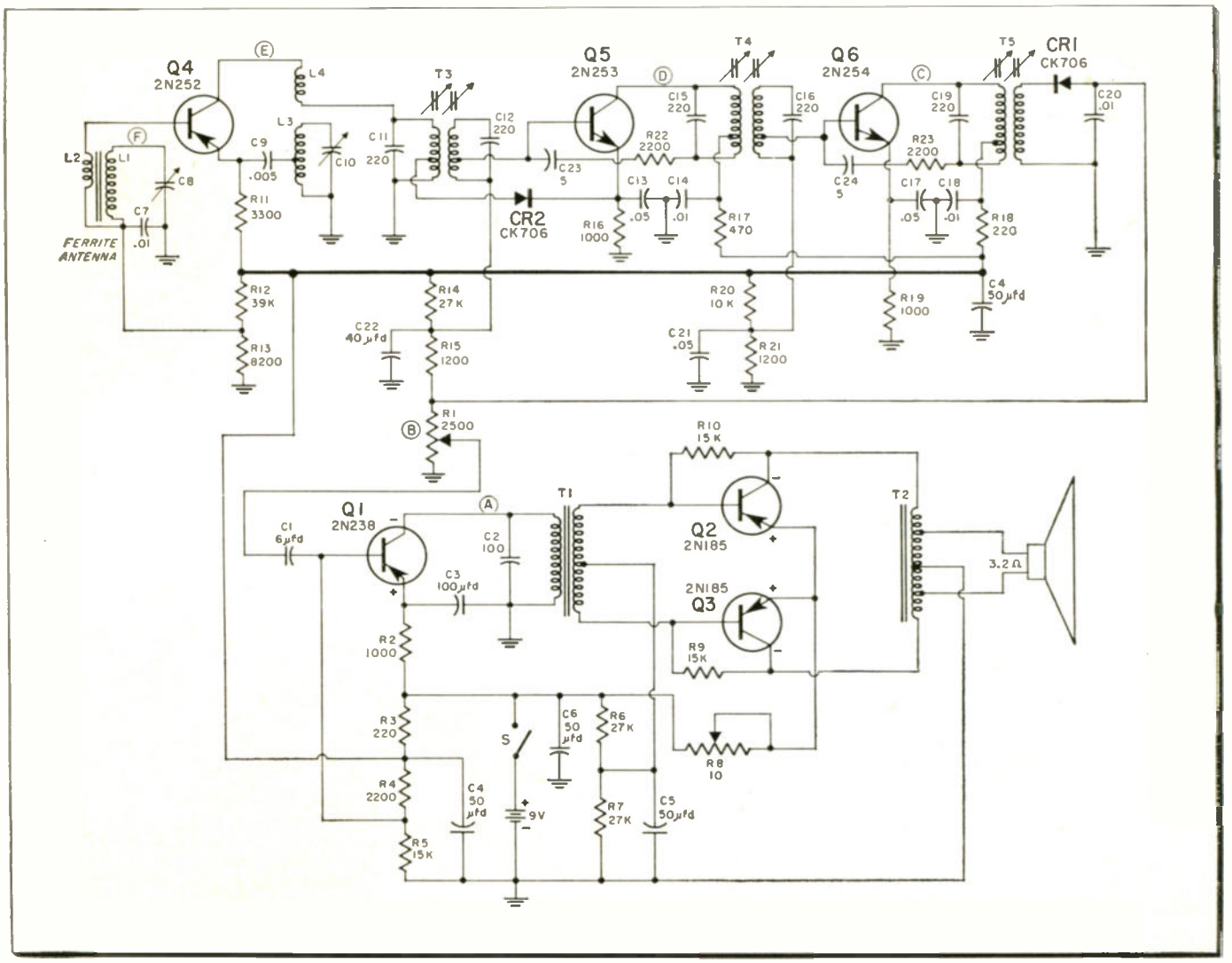
Nearly all employ conventional superheterodyne circuits. They differ mainly from older portables in that transistors are employed in lieu of tubes. And, they are usually much smaller and generally employ printed circuits.

Because of low voltages, capacitor troubles and resistor charring seldom occur. Many of the troubles are apt to be mechanical in nature. Transistors, of course, may fail, and coupling capacitors develop low resistance leakage. Experience has shown that speaker troubles are frequent. Speakers sometime develop "rattles."

Speaker rattle can also be caused by twisting of the plastic case, which may not be sufficiently rigid.

The normal small hand tool complement is required for disassembling and re-assembling. A very small soldering iron of the pencil type (30-50 watts) is a necessity. A

Fig. 1—Schematic of a typical transistor radio employing two N-P-N and P-N-P type transistors.



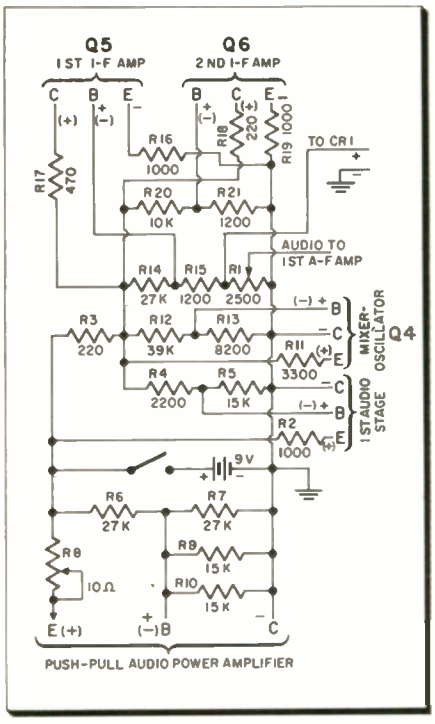


Fig. 2—Voltage current divider network indicating transistor element polarities.

larger iron is difficult to use and its greater heat can easily damage the transistors. Special soldering irons and de-soldering kits are helpful.

Very little test equipment is required. A conventional signal generator is necessary for signal tracing and alignment. Handy, but not absolutely essential, is an in-circuit transistor checker. A volt-ohm-milliammeter is an essential instrument.

Typical Circuits

A typical transistor radio schematic diagram is shown in Fig. 1. Q1, the first audio stage, is transformer-coupled through T1 to Q2 and Q3, which operate in push-pull. Instead of a conventional output transformer, T2 is an auto-transformer. Its full winding is the primary, the load to which the output of the push-pull transistor stage is fed. The center tap is grounded and the speaker is fed at 3.2 ohms from taps on the winding.

When using PNP transistors, the collector is negative with respect to the base. The emitter is positive with respect to the base. As shown, the collectors of Q2 and Q3 are connected through their load (T2) to the negative battery terminal, which is grounded. Positive battery is connected to the emitters of Q2 and Q3 through R8, a small value variable resistor. The bases are connected through the secondary of T1 to a point on the voltage divider (R6-R7) that is more positive than the collectors and more negative than the emitters. Therefore, the collectors and the bases are negative with respect to the emitters. (The collectors are slightly positive with respect to ground because of the voltage drop in T2.)

The collector of Q1 is connected to the negative battery terminal (circuit ground) through its load, the primary of T1. Its emitter is connected to positive battery through R2. The base is connected to the junction of R4 and R5, which together with R3 form a voltage divider across the battery. The voltage at the junction of R4-R5 is positive with respect to the collector and negative with respect to the emitter. The base and collector are therefore negative with respect to the emitter.

Many technicians turn down transistor radio repair jobs, unaware that a loss of TV business can result from this attitude. These half-pint packages can be serviced at a reasonable profit by understanding transistor circuit operation and applying short-cut test methods. Since transistors are current-operated devices, checking current drain with a milliammeter becomes a significant troubleshooting method.

Q4 is the mixer-oscillator, Q5 and Q6 are i-f amplifiers and CR1 is the AM detector. Q4 is a PNP transistor and its d-c voltages are of opposite polarity to those of Q5 and Q6, which are NPN types.

The collector of Q4 (PNP) is connected to negative battery (circuit ground) through L4 and the primary of i-f transformer T3. The emitter is connected through R11 to positive battery, and the base is connected through L2 to the junction of the voltage divider R12-R13. Thus, the collector is negative with respect to the base, and the emitter is positive with respect to the base.

The two i-f amplifiers, Q5 and Q6, are NPN transistors whose emitters are grounded through R16 and R19 respectively. Their collectors are connected to positive battery through

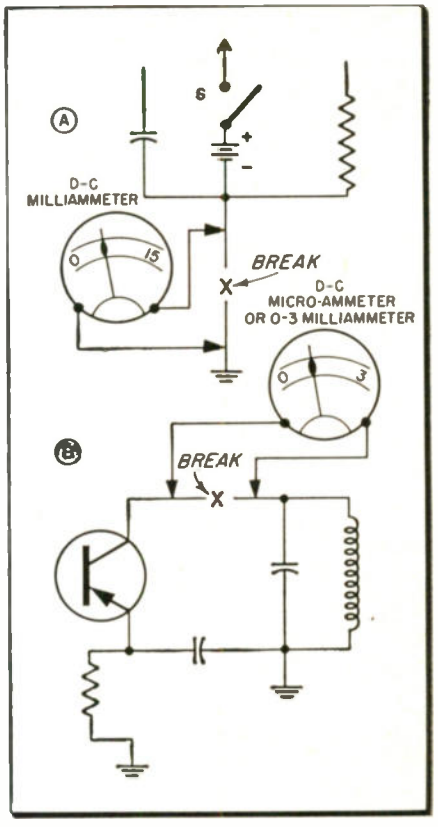
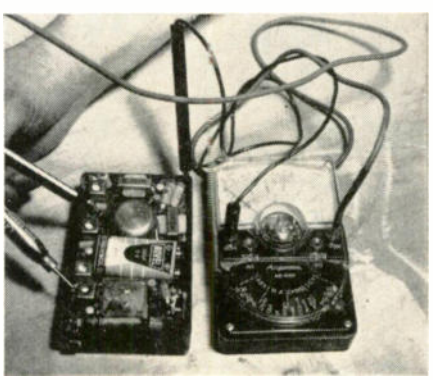


Fig. 3 (A)—A milliammeter is used to make over-all current drain check. (B)—Current drain by an individual transistor is made with a microammeter or 0-3 milliammeter.

decoupling resistors (R17 and R18). Collectors of these transistors are positive with respect to their bases, just the opposite of Q1, Q2, Q3 and Q4.

The emitter of Q5 is negative with respect to its base since the base is biased by a positive voltage obtained at the junction of R14 and R15. The base of Q6 receives a positive voltage from the junction of voltage divider R20-R21 to provide a similar polarity relationship. The emitter of Q5 receives an additional positive voltage from CR2 to provide

Fig. 4—Signal tracing and stage gain measurements can be performed with a "mosquito" type signal injector and VOM.



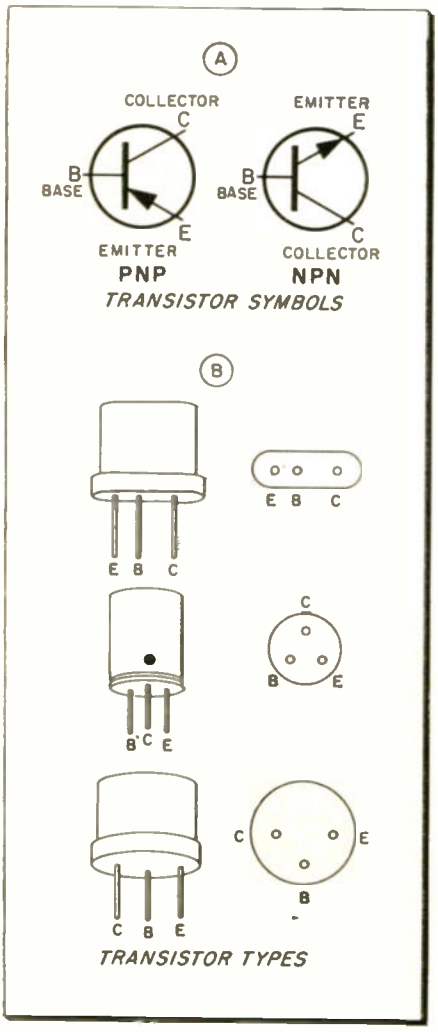
avc action. By making the emitter more positive with rising signal voltage, the base becomes more negative and gain is reduced.

Even the diode detector (CR1) is biased. Its anode is made slightly positive with respect to its cathode (and ground) by placing volume control R1 in series with the voltage divider R14-R15. This forward bias causes the diode to conduct slightly even when there is no signal. This makes the detector more sensitive to weak signals.

Voltage/Resistance Measurements

In a circuit using a PNP transistor, a small voltage reading should be obtained when the meter's positive lead is connected to the emitter and the negative lead to the base. With the positive meter lead to the base and the negative meter lead connected to the collector, a somewhat higher voltage should be indicated. In a circuit using an NPN transistor, just the opposite is true. A small d-c voltage reading should be obtained when the positive meter lead is connected to the base and the negative meter lead is connected to the emitter. A larger voltage reading should be obtained with the negative meter lead connected to the base and the positive lead connected to the collector.

Fig. 5 (A)—Middle letters of transistor designations, "N" and "P", are keys to bias polarity of the collector. "N" type requires a negatively biased collector and "P" type a positively biased collector. (B)—Some popular transistor element arrangements, including bottom views.



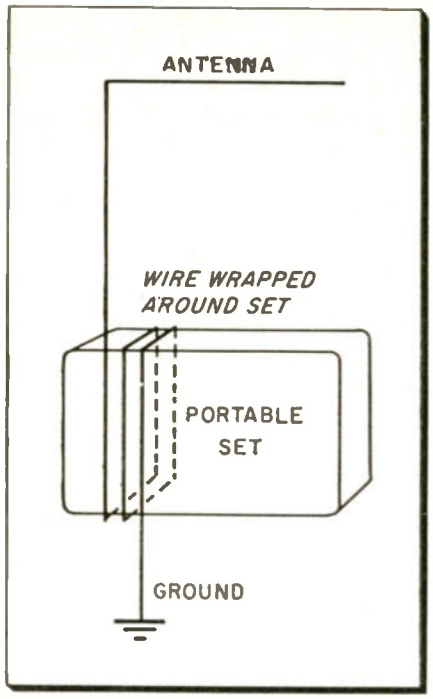


Fig. 6—A few turns of insulated wire wound around the transistor radio and grounded will often increase receiver range.

Element voltage polarities to the various transistor elements are shown in Fig. 2. The letters C, B, and E, indicate collector, base and emitter respectively. The + and — signs as well as (+) and (1), indicate voltmeter test lead polarities for making voltage measurements at the terminals of the various transistors.

It can be seen in the simplified d-c voltage distribution diagram that the battery is bridged by five voltage dividers, providing the required voltage and polarity relationships. To avoid interaction between circuits, a single multi-tap voltage divider will not suffice, since varying currents flow through each section.

Although the receiver circuit shown is typical, it is not directly applicable except to one particular receiver. However, it illustrates the types of circuits used and the d-c relationships to be anticipated.

The use of an ohmmeter for troubleshooting a transistor receiver is not recommended except in checking out-of-circuit components. Otherwise extreme care should be exercised in its use. An ohmmeter essentially consists of a milliammeter, resistor and battery in series. When the ohmmeter test leads are applied across a circuit, current flows through it, if the circuit is not open. A voltage is also applied to the circuit. When the test leads are reversed, current flows in the opposite direction, and the polarity of the applied voltage is also reversed. In transistor circuits, if the voltage thus applied is too high or of the wrong polarity, transistors can be damaged. A VOM or VTVM set on a low resistance scale *can* damage a transistor.

In any case, if an ohmmeter is used, always remove the receiver batteries so that d-c voltages will not be present. The battery voltage could damage the ohmmeter, or when added to the ohmmeter voltage could cause too high a voltage to be applied to a transistor.

Troubleshooting

A highly significant check to be made on any troublesome transistor radio is a total current drain check. Shorted or low resistance leakage in capacitors, defective transistors and other high current drain conditions can be detected by this test.

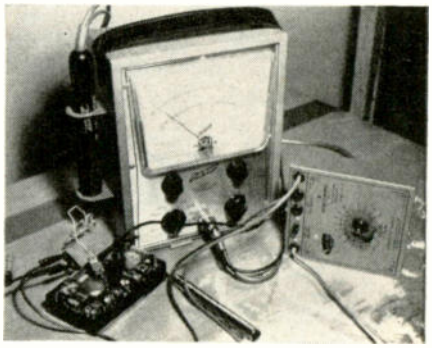


Fig. 7—Substituting a battery eliminator while servicing the transistor radio will preserve the customer's battery.

The over-all current drain check is made as illustrated in Fig. 3A. The average transistor radio will draw between 8 and 12 milliamperes with no signal input, varying slightly with the particular design. Manufacturers generally specify total normal

(*Continued on page 74*)

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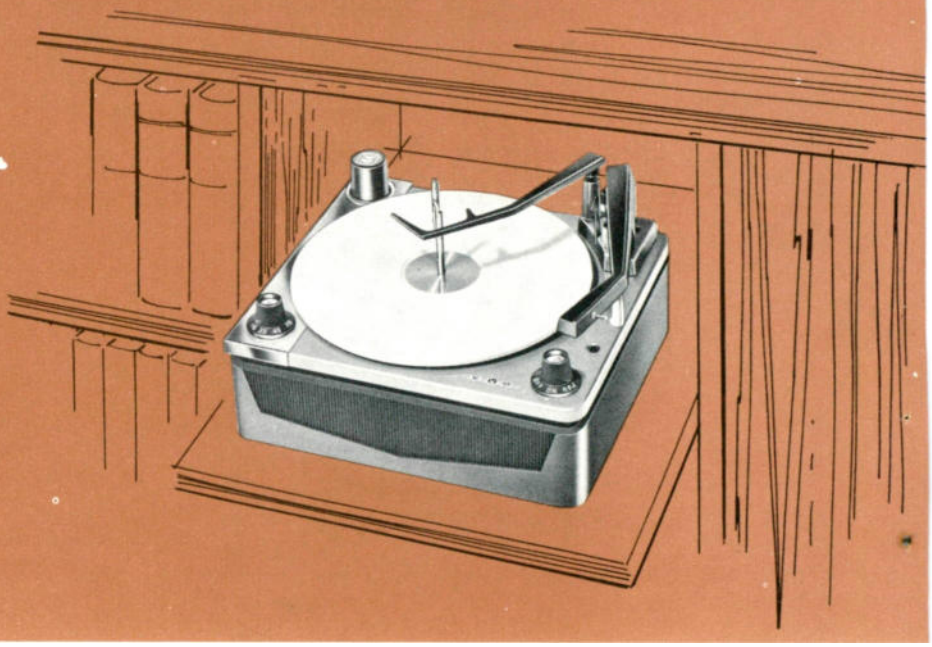

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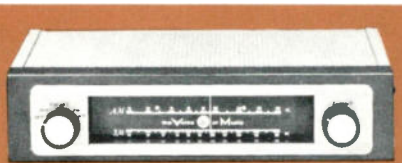

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Analyzing Hi-Fi Power Supplies

Tackle Audio Rectifier Circuits By Applying Basic Power Supply Principles

MANNIE HOROWITZ

• Power supplies associated with hi-fi equipment are generally similar to those employed in TV receivers. Basic troubleshooting techniques are therefore similar. There are some fundamental differences, however, which are sometimes reflected in more refined test methods.

Hi-fi power supplies generally include full-wave rectifiers. As all technicians know, the a-c input to the rectifier's plates is converted to pulsating d-c, which appears at the tube's cathode. This pulsating voltage is normally filtered by using a pi type network and the resulting voltage is fed to various B+ distribution lines by means of a voltage divider network. If all components in the power supply are normal, then the hi-fi amplifier should perform within the manufacturer's minimum power supply hum level specifications.

To fully understand why this type of power supply is necessary and desirable, a brief review of power supply fundamentals may prove helpful at this point.

Some simplified half-wave rectifier circuits are shown in Fig. 1. With 60 cycle a-c voltage applied, polarity of the rectifier tube's plate changes from positive to negative. When the positive half of the a-c sine wave appears on the plate, the tube conducts and current flows. When the negative half of the a-c sine wave appears on the plate, the tube stops conducting. The resultant output at the cathode appears as illustrated in Fig. 1-B. This is normally defined as a pulsating d-c voltage.

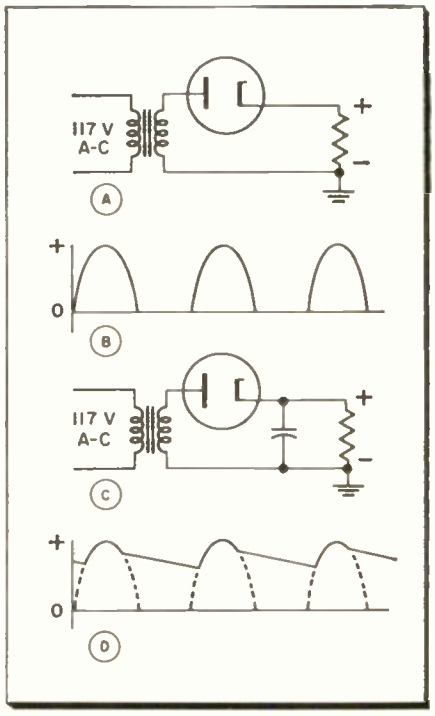


Fig. 1—Half-wave rectifier tube conduction. Addition of filter lowers ripple content.

When a filter capacitor is placed across the load resistor, as shown in Fig. 1-C, the ripple peaks are partially smoothed and the waveform at the cathode assumes a character somewhat nearer pure d-c, as illustrated in Fig. 1-D.

If this type power supply is connected to a hi-fi amplifier it would produce considerable 60 cycle hum. This hum can be further reduced by adding additional filters, but this is not a practical approach to the problem.

A better approach is to design a full wave rectifier power source, as illustrated in the simplified circuit in Fig. 2. In this design, one tube conducts on the positive a-c cycle and the other tube conducts on the negative cycle, resulting in an output at the cathodes, as shown in Fig. 2-B. Under normal conditions the hum ripple from this type of rectifier will be 120 cps. By adding a pi network filter the ripple amplitude can now be more effectively lowered and a closer approximation to pure d-c is possible.

Selenium and silicon diodes can serve in place of tube type rectifiers, as shown in Fig. 3. Another type of rectifier network, the bridge, using four solid state rectifiers, is shown in Fig. 4. This circuit is generally employed with equipment requiring a high degree of regulation, i.e., a more stable voltage output under varying load conditions.

Tube types used in modern rectifier circuits include 5Y3, 5U4, 5AR4, GZ34, 6BW4 and EZ80 and 81.

Typical Power Supply

A typical hi-fi power supply circuit appears in Fig. 5. The rectifier, V-7, is in a full wave circuit. Ripple is filtered by various sections of capacitors C-11 and C-24, arranged in multiple pi networks that utilize resistors R-48, R-49, R-50 and R-51. These resistors also serve as a voltage divider to furnish proper voltages required at various points throughout the amplifier.

The power transformer secondary is tapped at a low voltage point. This voltage is rectified by a selenium diode, CR-1, supplying bias to the

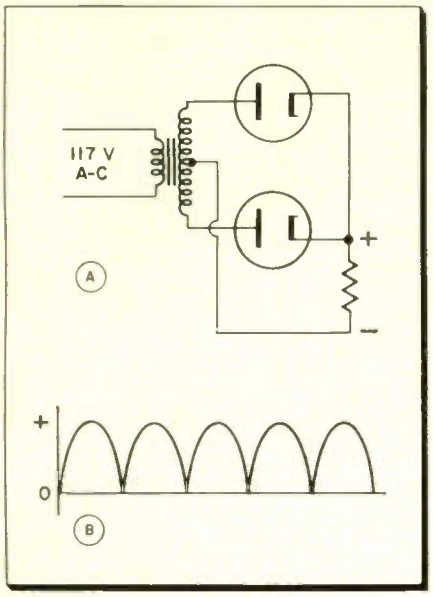


Fig. 2—A full-wave rectifier tube, conducting alternately on positive and negative cycles, results in low a-c ripple.

push-pull amplifier grids, as shown in Fig. 6. C-13, C-10, R-52 and part of R-18 serve as a pi filter network. The required voltage for bias to the output tubes is taken from potentiometer R-18.

To minimize hum, a balancing potentiometer is shunted across the amplifier heater supply and connected to the amplifier grid bias. A static shield, included in the power transformer between the primary and secondaries, as well as C-21, minimize the amount of line noise entering the amplifier.

Hum Problems

The power supply is usually the first section suspected when hum arises. Actually, the fault is frequently elsewhere. For example, heater-cathode leakage in one of the amplifier's tubes. Hum from this source will always be 60 cycles. Strongest hum from a full wave rectifier power supply will always be 120 cycles—except when one half of the rectifier is defective and inoperative. In this case, the hum would be 60 cycles.

Since hum can be greatly amplified by a preceding stage, filtering across an early stage in the amplifier is extremely important. Filters in the d-c lines powering these stages should receive careful attention.

D-c current unbalance in the push-pull output tubes is a frequent cause of hum. In the amplifier illustrated in Fig. 5, hum can often be reduced by carefully adjusting R-38, the d-c balance control. When there is no balance control, a pair of matched output tubes can be selected.

Should hum still persist, a voltage check could be made at point "Z". If the voltage is low, it is likely that only ½ of the rectifier tube is operating. Before substituting a new rectifier tube a VOM check should be made across the highest B+ point and B−, otherwise a new rectifier tube may be damaged by a short in the power supply load.

If no overload exists and V-5 checks good, substitute another capacitor for C-11A. When substitution of this capacitor is accompanied by an increase in rectifier output voltage, and a decrease in hum, it is a good indication that the suspected capacitor is defective.

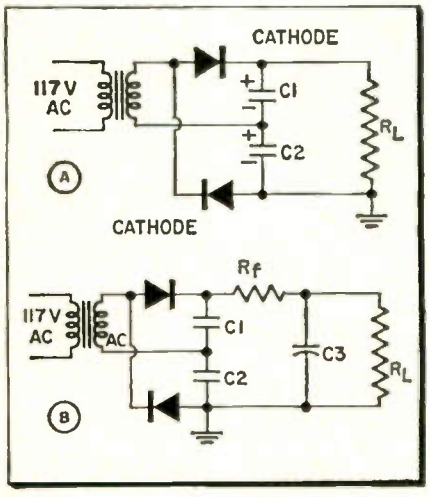


Fig. 3—Silicon and selenium units can perform effectively as rectifiers in hi-fi power supplies.

Ripple Measurements

Since the average human ear finds a 120 cycle ripple more objectionable than 60 cycles, when both are of equal amplitude, 120 cycle hum in a hi-fi amplifier should be kept 80 db or more below the d-c voltage at normal load. Ripple voltage in db's below total d-c voltage is computed as follows:

$$db = 20 \log_{10} \frac{d\text{-}c}{a\text{-}c}$$

When d-c is the total power supply voltage measured under load, and a-c is the total ripple voltage measured on the VTVM. A millivolt or even a microvolt scale may be necessary when measuring ripple content of voltages furnishing B+ to early hi-fi amplifier stages. A low reading VOM will suffice for ripple meaurements on an amplifier's output stage.

Ripple can also be determined in percentage, as follows:

$$\% \text{ ripple} = \frac{a\text{-}c}{d\text{-}c} \times 100$$

Percentage of ripple in the power supply section connected to a typical hi-fi output stage will vary between 2 and 5%. Preceding stages, of course, must have successively less % of ripple.

A VTVM connected across the power supply load, with a large value (4 to 8 μf) oil filled capacitor in series with one of its leads, can be used to determine both ripple percentage and db level, as shown in Fig. 7. A sensitive d-c coupled scope with calibrator can also be used to measure the amount of ripple in a power supply.

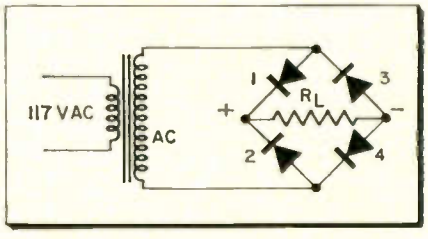
Other Problems

Lower than normal voltage can also indicate that too much current is being drawn from the power supply by the amplifier. A leaky C-11A or C-11B can result in high current drain. Each should be disconnected individually from the circuit and an external unit substituted while noting any change in voltage. The rectifier should be observed for red plates, indicating excessive current passing through this tube.

Output tubes are the largest consumers of d-c power supply current. If the bias is too low, excess current will be drawn by the output tubes, resulting in lower voltages throughout the amplifier. In the unit shown in Fig. 6, this problem is usually corrected by adjusting the bias control, R-18. A defective cathode bias resistor can cause this condition in a self-biased amplifier stage. Replacement of the resistor will correct the condition.

A more elusive cause of excess current drain can frequently be found by checking the grids at the output tubes. If a positive voltage exists at the grid (measured with a VTVM), remove the coupling capacitors C-18

Fig. 4—Solid state rectifiers in a bridge circuit provides a compact power supply.



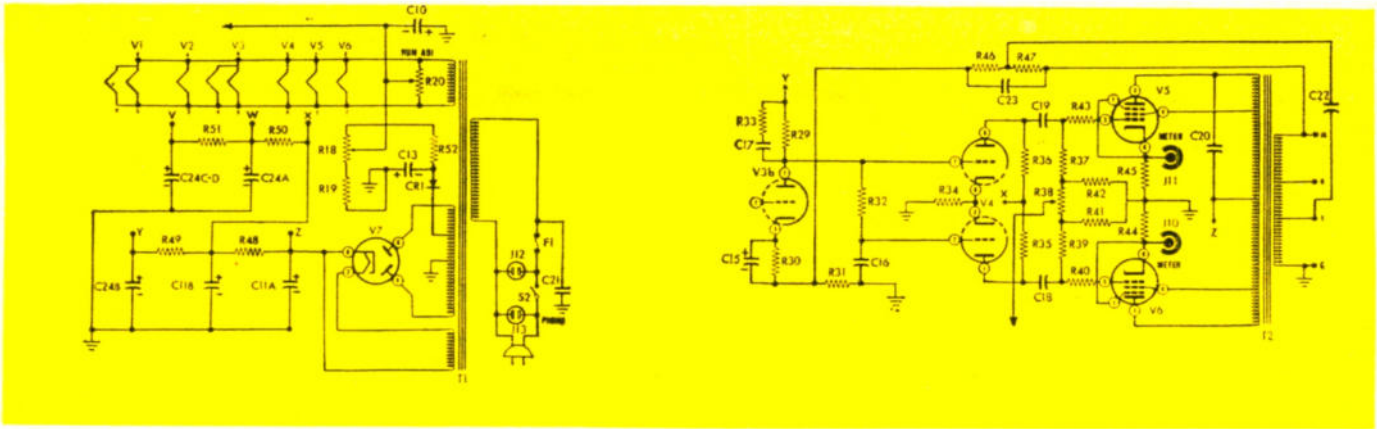


Fig. 5—Typical full-wave power supply employed in a hi-fi amplifier.

Fig. 6—Push-pull hi-fi amplifier receives bias from power supply.

and C-19. If a positive voltage still exists at the grids, this probably indicates gassy tubes and they should be substituted. If removal of the coupling capacitors eliminates the positive voltage, install new capacitors.

Low current drain on a power supply with poor voltage regulation can cause higher than normal d-c voltages. Low current consumption is generally caused by: over-biased output tubes, some tubes in the amplifier not conducting, open filaments, resistors decreased in value, and leaking coupling or bypass capacitors.

Blown Fuse

A blown fuse does not necessarily indicate a serious problem. If it blows immediately after replacement, however, then abnormal current drain is indicated. After turning the set off, the first step is to remove the rectifier tube, V-7, and check the power supply with a VOM across the highest B+ point and B—. A very low resistance reading across these points indicates trouble. Do not replace the rectifier tube until the short is located. Normal troubleshooting procedures are employed, beginning with successive resistance measurements from B— across each section of the voltage divider, disconnecting one at a time if necessary, until the filter, decoupling capacitor or other defective component is located.

Power Transformer Defects

If a power transformer is believed defective, turning the set on with the rectifier tube removed will immediately determine if certain types of shorts exist in the transformer. The indication will be another blown fuse.

The next logical step would require disconnecting the power transformer's secondary leads from its various

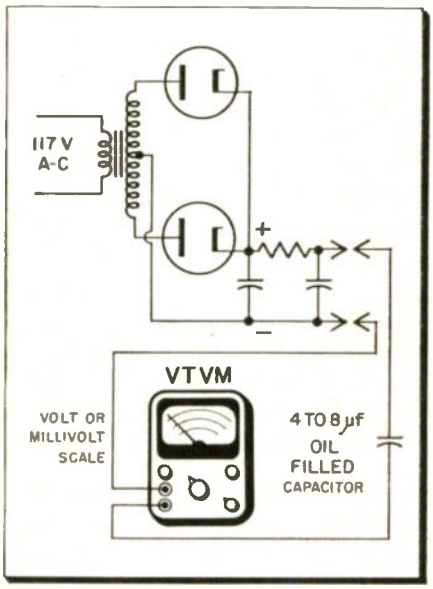


Fig. 7—Test set-up for checking % of ripple and level in decibels.

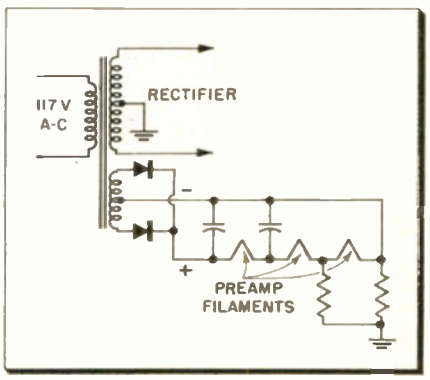
connection points. When all the leads are removed (replacing fuse), set is again turned on. If the fuse still blows, the power transformer secondary may be shorting. The fuse may not blow with normal load removed from the secondary. Under such critical circumstances, substitution of a new power transformer may be necessary if a load-check meter is not available for precise measurements.

Solid State Rectifiers

A VOM forward and reverse resistance check will indicate if a selenium or silicon unit is definitely bad, but it will not determine if a unit is definitely good. When doubt exists, after checking the rectifier unit with a VOM, a known good unit should be substituted after determining that no high current condition exists at the power output. A new unit can then be quickly "patched" into the circuit with clip leads. If high B+ increases by 10 or more volts, the weak unit would normally be replaced. It is generally poor technical practice to replace one unit without replacing the other when two units are employed. In a bridge circuit, all rectifiers should also have approximately equal output characteristics.

Many manufacturers have responded to consumer demands for better power supply specifications by providing d-c for preamp tube filaments. It's not unusual to find hi-fi power supplies with various rectifier components, such as: 5U4 rectifier for high B+, silicon rectifier for low B+ and high current, low voltage selenium rectifiers for preamp—and sometimes all—tube filament supply. A basic circuit is shown in Fig. 8. •

Fig. 8—Low voltage, high current diodes are employed as rectifiers in modern power supplies to furnish d-c to tube heaters.



Service Citizens Band Radios

Typical Class D Transmitter-Receivers Analyzed

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PART ONE
of two parts

PART TWO—Next Month:

- **Circuitry**
- **Preventive Maintenance**
- **Tuning**
- **Alignment**
- **Frequency Standards**

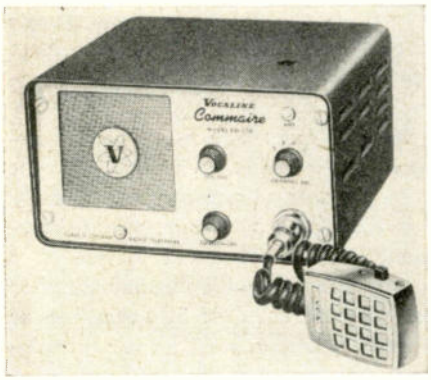
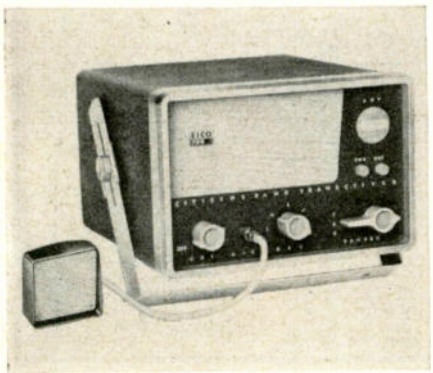


Fig. 1—Vocaline, ED-27M, has a double-conversion superheteradyne receiver.

Fig. 2—Eico, model 760-series packages are available in kit or wired form.



• Class D, 27 mc citizens band radios are available either completely assembled or as kits. Transmitters are both single-channel and multi-channel; receiver sections may be single-channel, multi-channel, or all-channel. Transmitters must employ only a-m type modulation and power input to the final amplifier must not exceed 5 watts. Some typical receiver-transmitter type packages are shown in Figs. 1 to 6.

Receiver Types

The receiver section may be a superheterodyne or a super-regenerative type. A regenerative receiver has fewer stages because of its inherent high-gain. *Regenerative receivers,* as the name implies, use feedback which amplifies a small incoming signal, feeding this signal back, (from the output) to the input, where it is amplified again. Feedback on regenerative type receivers is kept below the point of oscillation for phone reception. Because the circuit is most sensitive at the point of oscillation, both simple regenerative and super-regenerative receivers have very high gain. In addition, these receivers have a relatively high s/n ratio.

There are some disadvantages to receivers of this type. They are not as selective as superheterodyne receivers and require r-f amplifier stages to prevent the oscillating detector from radiating signals through the antenna.

Superheterodyne receivers operate in the normal manner, having an oscillator which beats with the incoming r-f signal to produce the i-f frequency. Receivers of this type can be fixed crystal-controlled local oscillators, to cover one or more channels, or they can use tunable oscillators to cover the entire band. Output from the oscillator-mixer is at the i-f frequency or difference between the signal frequency and the oscillator frequency. Most of the signal amplification takes place at this frequency. Because of the i-f's relatively low frequency, high gain is not difficult with only a few i-f amplifier stages.

Selectivity, the ability of a receiver to separate and receive signals from transmitters on different, but closely related frequencies, is quite important to CB radio. The channels are only 10 kc apart and tuned transformer coupling rejects interference from other channels.

Detectors in the superheterodyne receiver are usually diode sections of a multipurpose tube. The detected signals are amplified and fed to a speaker; in some cases the microphone doubles as the speaker. Additional circuits include squelch, AVC, and noise limiters. The squelch circuits operate in either of two ways: 1) they can turn on the audio stage when a signal is received or, 2) they can be noise-operated so that the non-signal turns off the audio amplifier when no signal is being received. Both methods reduce noise when there is no transmission.

Automatic volume control circuits operate as expected; they employ a small part of the signal to provide negative bias for the i-f amplifiers, hence allowing more gain for weak signals and less gain for strong signals.

Fig. 3—Gonset, G-11, "Communicator," is powered for fixed or mobile use.

Noise limiters used are clippers which remove the peaks of high-amplitude noise. They effectively blank-out the receiver during sharp noise pulses.

Typical Transmitters

Typical transmitter units employ a crystal oscillator, an r-f amplifier frequency-tripler and an r-f output amplifier, or power amplifier. In some transmitters the original crystal frequency may be doubled, tripled, or it may drive the PA directly.

The tube which impresses the audio on the PA is the modulator. The PA may be modulated in a number of ways. One method is to modulate the grid; another is to plate modulate the PA. Percentage of modulation is a measure of how much of the available r-f is used for carrying the audio. Because overmodulation will cause splatter, or radiation of signals outside of the assigned channel, transmitters are designed for modulation efficiency between 75% to 85%, with provision for never exceeding 100% modulation.

Wide-range fidelity speech is neither desirable nor required for CB radio. Experimental work by telephone companies has shown that the range from 300 to 3,000 cps is sufficient for ordinary speech. This means that the bandwidth of the transmitted signal need not exceed 6,000 cps, which is twice the highest necessary audio frequency. This also eliminates the need for a speech amplifier or microphone with exacting frequency response characteristics.

Troubleshooting

Adjustment or repair to the frequency determining elements of a transmitter must be done by a properly licensed technician or by a qualified technician working under the direct supervision of a properly licensed person. The technician will normally have three necessary qualifications for servicing: 1) adequate test equipment, 2) a proper FCC license, and 3) the manufacturer's servicing data and schematic diagrams. A 20,000 ohm per volt VOM or a VTVM and signal generator is generally sufficient for locating ordinary circuit failures, although other instruments are often helpful and sometimes essential.

An equipment fault should first be isolated to either the receiver, transmitter or power supply. It is unusual for trouble to appear in more than one unit at a time. Before attempting to troubleshoot a unit, remove the antenna and connect a dummy load across the transmitter's antenna terminals. An ordinary 117v "night light" or pilot type lamp from 5 to 7½ watts will suffice. When the lamp is connected across the antenna terminals and fully loaded by the PA output, the lamp will then emit a glow near 50% of normal brightness, depending upon its wattage and the output of the transmitter.

Troubleshooting CB radios is not difficult for the experienced TV-radio technician. Simple preliminary procedures for isolating many troubles are given in Chart I.

There are a few things to watch out for: 1) Tubes which check "good" on a tube tester may not work in the radio. Substituting a known-to-be-good tube is a better test. 2) Vibrators are frequent offenders and can be quickly checked by substitution. 3) Defective components which "look good" are best checked by carefully following a manufacturer's schematic diagram, test voltage and resistance chart.

Do not attempt to change crystals unless the replacement crystal's frequency is known to be accurate, or the crystal has been supplied by the radio manufacturer or other dependable source. •

CHART I

Trouble Indication	*Check*	*Method*
1. No operation of Transmitter or receiver.	Power sources and supply.	Check power source, power supply, vibrator, and rectifier in this order.
2. Transmitter trouble, receiver ok.	R-f output.	Check with neon bulb for power output.
	Modulation	If there is r-f power output, check microphone, audio tubes, cable connections.

Fig. 4—RCA, CRM-P2A-5, has a telescoping antenna built into unit.

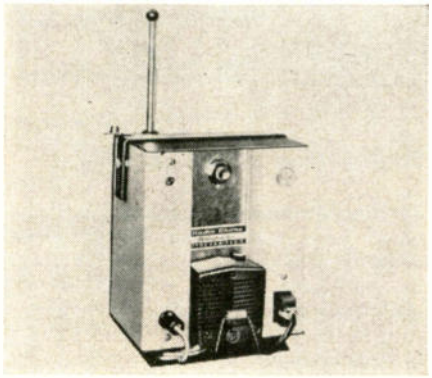


Fig. 5—Raytheon, "Raycom," operates on four channels.

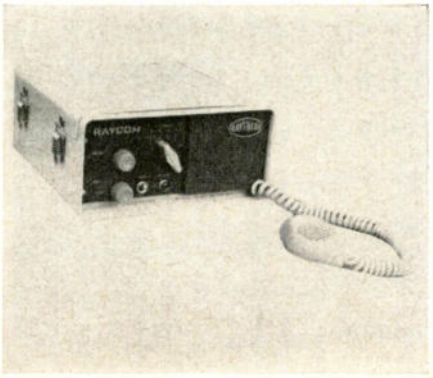
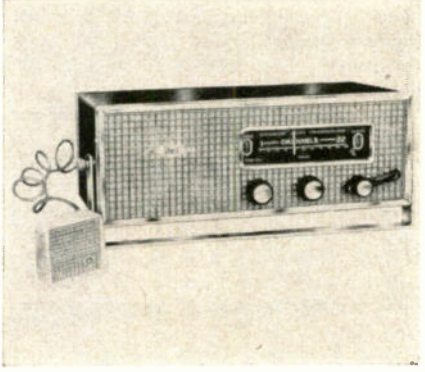


Fig. 6—Shell transceiver has a super-regenerative receiver.

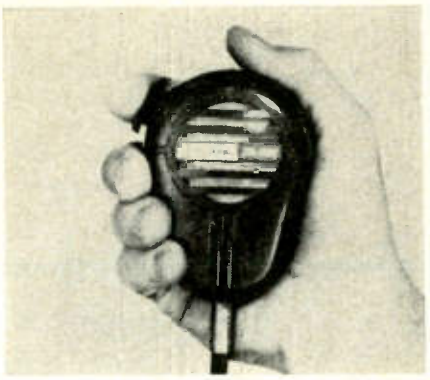


New Audio Products

Shure MICROPHONES

A new line of mobile communications microphones, featuring a practically indestructible high impact plastic housing, is announced. Model 405 series of the "Ten-Four" microphones replaces the discontinued model 505 series. The new series is electrically identical to the old one and sells at the same price. Designed for mobile radios in cars, trucks, planes, ships and the armed forces, the new series is available in controlled magnetic, carbon and transistor-amplifier models. Weight, 8 oz. Shure Brothers, Inc. Evanston, Ill.

For more data, circle 6-40-1 on coupon, p. 49



Astatic PHONO NEEDLES

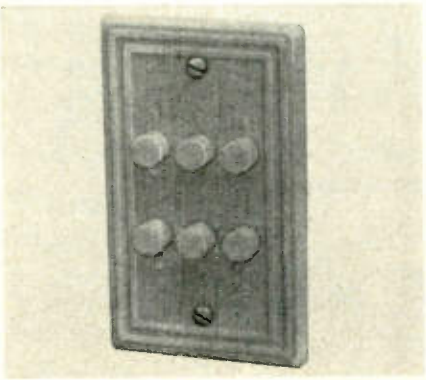
Announced is a new line of 450 needles to fit precisely every cartridge and record groove in use today. It is claimed to be the industry's first ultra-complete needle line from a single manufacture (including even exotic types). Each needle is mounted in a 2" x 2½" plastic package to which is attached an index tab. Information on the tab includes: needle model number; original cartridge number; model numbers of competitive brands which can be replaced with the needle in the package; list price; needle tip data and name of original manufacturer. Astatic Corp., Conneaut, Ohio

For more data, circle 6-40-2 on coupon, p. 49

Mosley SWITCH

Push-button selection of any combination up to six remote speakers is possible with the new FAS-6 flush wall plate switch. Designed for use with home speaker systems, it controls the entire system from one location. The FAS-6 switch kit includes switches, mounting brackets and precision-molded flush-mounting face plate in either ivory or brown polystyrene. Also, not shown, new outlets for portable speakers: FAS-1PK one-speaker outlet; and FAS-11PK two-speaker outlet. Mosley Electronics, Inc., 4610 N. Lindbergh, Bridgeton, Mo.

For more data, circle 6-40-3 on coupon, p. 49



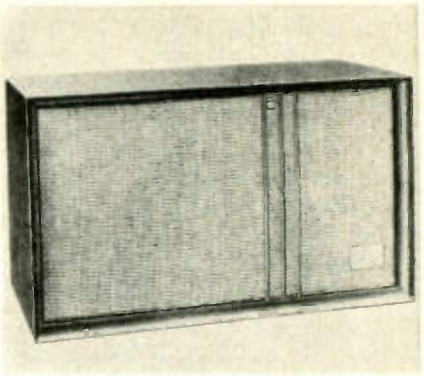
Jensen PHONO NEEDLES

A new economy-priced line of Perfectone phonograph needles, in both sapphire and diamond tips, has been introduced. Mounted on 12" x 10" counter cards, they are available in three display combinations: 12 packages of sapphire needles to a card in the two most popular types, the CRA-55LP, $2.50; and the S-66 at $3.50 each; choice of 10 diamond needles, five monaural and five stereo. In addition to counter displays, the line will be in regular shelf inventory and consist of 800 different types. Jensen Industries, Forest Park, Ill.

For more data, circle 6-40-4 on coupon, p. 49

E-V SPEAKERS

Introduced is the "Regal 300" bookshelf speaker system. Foam-cone woofer has a 4 lb, 10 oz. ceramic magnet. There



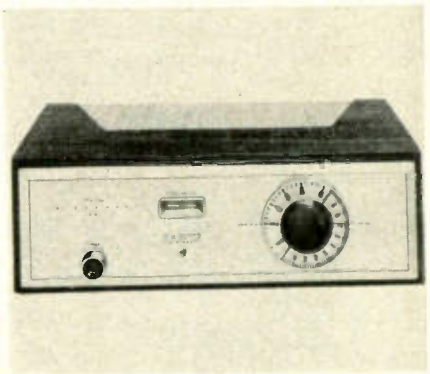
is an 8" midrange and HF driver. Power rating is 70 watts program. Response, 30-18,000 cps. Electro-Voice, Inc., Buchanan, Mich.

For more data, circle 6-40-5 on coupon, p. 49

For More Information On NEW PRODUCTS Circle Code Numbers, p. 49

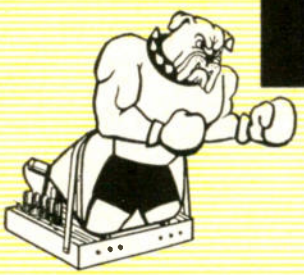
Scott FM TUNER

Model 314 FM tuner, incorporating the firm's exclusive wide band design, features: usable sensitivity of 2.5 μv by IHFM standards; silver plated front



end; temperature compensated components; new wide band circuit; two stages of full limiting; full shielding; and multiplex output. $114.95. H. H. Scott, Inc., 111 Powdermill Rd., Maynard, Mass.

For more data, circle 6-40-6 on coupon, p. 49



"Tough Dog" Corner

Difficult Service Jobs Described by Readers

Vertical Drift

The customer's complaint on this Philco 8L41 was "slow vertical roll after 10 minutes." I asked the customer to continue to play the set until I arrived. The condition was therefore present when I came to the home.

Rotating the vertical hold control indicated the picture would not lock,

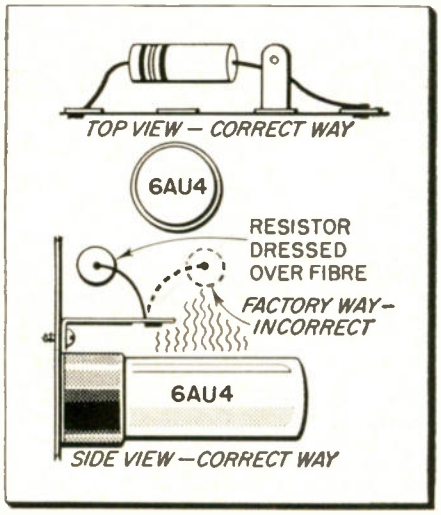


Fig. 1—Moving resistor away from damper-tube heat emission cured vertical sync drift.

and continued to drift in one direction. Replacing the vertical oscillator-output tube (6CS7), the picture locked in at one end of the control. The customer did not want the set removed from the home for further repair, so I collected my repair charge and left.

A day later the customer called and consented to have the set serviced at the shop (with the home service charge applied to the shop repair bill).

In the shop, I allowed the set to cook for over three hours. Vertical hold was still maintained in the center of the control, although the drift was supposed to start after ten minutes. All wave forms and voltage readings approximated those in the manufacturer's specs. Considering this was a vertically mounted chassis, I simulated actual cabinet working conditions on the bench. After about ten minutes the picture finally began rolling vertically.

Referring to the schematic, I took voltage readings at various points in the oscillator circuit. The plate voltage was below specified value. A resistance check of the 1.8 meg cathode resistor indicated it had changed to 400K. Close visual inspection revealed no discoloration. Inspection did reveal, however, that one end of the resistor went to a tie-point directly above the damper tube. Now I felt I had the solution. I thought, perhaps the intense heat created by the damper tube caused the resistor to change value, thus the vertical drift.

My assumption was obviously correct, as replacement of the component cured the trouble. At the time I replaced the part, I also repositioned it away from the rising heat of the damper tube (Fig. 1). Feeling it needed a higher wattage resistor, I used a one watt in place of the original ½ watt unit.— *William A. Pisciotto, Jr., Elmont, L. I. N. Y.*

• *Indiscriminate replacement of defective parts with higher wattage substitutes may at times be unwise. Many designs use ½ watt resistors as safety devices should the circuit malfunction.—Ed.*

Intermittent Horizontal Pulling

I recently ran into a case of intermittent horizontal pulling that had me baffled for too many hours.

The set was a Westinghouse chassis V-2314-25 which would operate for days without any trouble. Suddenly, it would develop an extreme "S" curve in the picture. This would go away just as suddenly.

All of the components in the horizontal afc circuits were checked and found to be good. During one of the

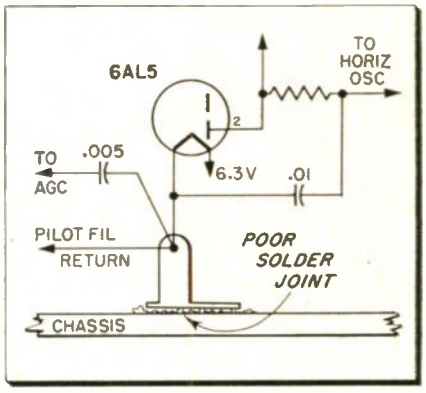


Fig. 2—Cold solder joint in horizontal discriminator circuit induced a-c ripple voltage, causing picture bends.

times that the set was acting up I found that grounding out the horizontal control tube grid would straighten the picture, but grounding the afc at the discriminator tube would not. Apparently, a small a-c voltage was getting into the circuit.

My ohmmeter showed that pin 2 of the 6AL5 was grounded. However, running a separate ground lead from pin 2 to ground cleared up the trouble. So did soldering the high resistance grounding lug to chassis! —*Felix Grumann, Laona, Wis.*

How To Install TV Roof Antennas

Fig. 1—Installation vehicles usually include a ladder as standard equipment. A magnesium or aluminum type offers easy maneuverability because of its light weight.

"Field Tested" Mounting Techniques, Equipment & Reception Aids For Better Antenna Performance

DAN GEORGE

• A proper antenna installation is the key to good set performance. This is measured in many ways; antenna site, mount vulnerability, lead length, etc. The experienced technician, with a sweeping glance, can usually anticipate the final result.

However, it is no reflection on a man's ability if he asks questions. You may have to install an antenna in a strange locale. The logical place to obtain information on TV reception conditions in any location, is the local parts distributor. He can be a reservoir of pertinent information.

Ladders

Standard equipment carried by most installation vehicles includes a ladder. For all practical purposes, an aluminum or magnesium 40 foot extension type ladder is ample. See Fig. 1. It can be maneuvered by one man, and will support a heavy man with ease. Your ladder should be treated with care. Someday your life may depend on its sturdiness. The angle the ladder is positioned in relation to the side of the building will govern how safe your ascent may be. Having a ladder too close to the building at too sharp an angle, or too far away at too wide an angle is dangerous. A practical, yet safe, angle for the ladder is about 35 degrees. Few technicians bother to take this precaution and thereby extend the accident hazard. See Fig. 2. Do not, under any circumstances, place a ladder on the same side as the a-c feed line.

Chimney Mounts

Vulnerability of most antenna installations rest with the mount durability. If not properly secured, the slightest wind could produce gale force results. Every mount has a basic procedure which should be adhered to. Some deviation is possible, but don't sacrifice quality for time gained.

Fig. 2—Ladders should not be placed where they can fall across power lines.

A hammer, drill and a pair of overalls do not make an installation technician. Although the job requires muscle, technical knowledge is also needed to insure good set performance from an antenna. Transients, standing waves, picture hopping, insecure mounts, etc. can be avoided by antenna installation "know how."

The easiest type mount to secure is the chimney strap, consisting of a Y or Z shaped bracket, attached to a metal band. From past experience, I have found it advisable to straighten the rolled band by reverse rolling, before ascending the roof. Prepare as much as you can on the ground. The simplest act may become a trying task, working from a ladder. While on the ground, gather tools needed for the job. Screwdriver, slip joint pliers, cutting pliers, adjustable crescent, spintite, and open end wrench should cover any problem that may arise. A handy cowhide case, similar to a telephone lineman's, should be strapped to the installer's

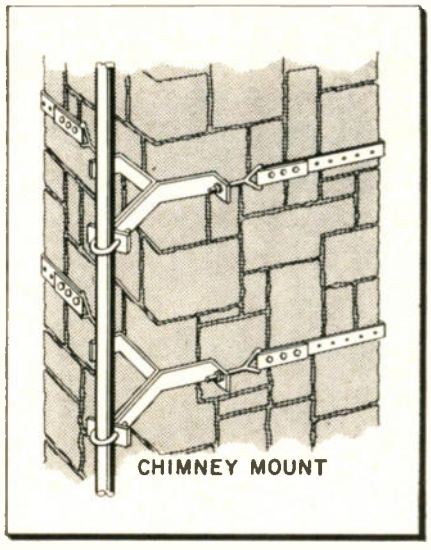


Fig. 3—Chimney mounts are secured by take-up action of the mount accessories.

belt. This allows maximum mobility. Also, tools stuffed into pockets have a tendency to fall out at the least opportune moment.

Once all preparations have been attended to, ascend your ladder. At the chimney, take one band and drape it around the chimney. It is advisable to start with the lower mount. This is usually placed about 18 inches from the top of the chimney. In the mount kit, the manufacturer included hardware necessary to secure the band. The previously mentioned list of tools are now put to use. Unless the chimney is of abnormal size, a section of the band will have to be trimmed away. This can easily be accomplished with cutting pliers. The clip found in the kit is now used to hold your remaining metal in place. With the use of a crescent or spintite tool, the band is tightened due to action of the bracket accessories. See Figs. 3 & 4.

The entire procedure is repeated during the mounting of the second band. This is usually placed about a foot above the first. Good balance is the key to antenna stability, thus the space between bands. After a few antenna installations, the chimney mount should be secured in about 15 to 20 minutes.

Wall Mounts

Securing a "wall mount," be it on a roof parapet, house gable, or side-wall, constitutes using a little more muscle than the chimney mount. With this one (Fig. 5), holes must be drilled or hammered. Yes, I said hammered. If an electric drill chuck is not available, muscle and perspiration are the source of power. Standard procedure calls for the use of the following tools: masonry drill bits, electric one-half inch chuck, hand brace for masonry bits, and a 2-4 lb hammer.

Where no electricity is available, the combination of the star drill bit and hand brace is most often used. See Fig. 6. After marking your intended hole area, those shoulder, back and forearm muscles are ready for a workout. The brace is held

Fig. 4—Team work shortens installation time. A spintite or open-end wrench is advisable, replacing pliers used in this illustration.

against the marking and is struck with a solid blow from the hammer. During this action, the brace is rotated slightly, first to the right and then left. This motion will help prevent the drill bit from becoming wedged in the hole, and at the same time keep the hole circular. A hole about one to one and a half inches deep must be hammered out. Either expansion shields or rawl plugs are used for securing the mount to the wall, as shown in Fig. 7.

Holes must be hammered in brick or mortar installation sites. The individual technician will decide which

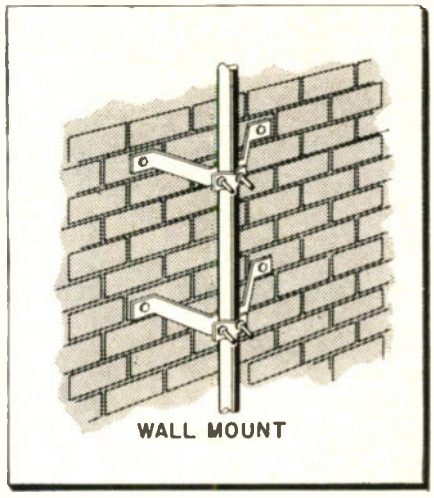


Fig. 5—Wall mounts are usually used in parapet, gable and side-wall antenna installs.

offers the best mount support. Personally, I find the mortar between the bricks in the newer buildings unsuitable to hold an antenna sturdy during a howling wind. Any antenna installation should be evaluated on its ability to withstand adverse weather conditions.

If the mortar between bricks has a suitable cement composition, there is a third mounting implement that can be readily used. The experienced technician has often used "Odegaard nails" to secure his lead-in wire by hammering these nails to the side of a building. I have supported mounts with these nails in many mortar type installations. Two nails held at each bracket hole, hammered into the mortar, will hold well if the mortar does not crumble as it is penetrated by the nail. The shape of the nail

(*Continued on page 68*)

Fig. 6—Masonry bits are used to hammer holes in brick or mortar. A rotating action of the brace prevents tool wedge.

Exterminate Those Video Bugs

Practical Troubleshooting Data Compiled During Video String Repairs

HAROLD WEST

What do employers mean when they advertise for "Experienced TV Benchman?" They want a man who can bypass standard troubleshooting methods because he's familiar with repeated defects unique to specific sets. His experience immediately directs him to the contrast control which always opens; the sound circuit's B+ resistor that knocks out video, etc. Repair data in this article may mean the difference between the so-so tech and the veteran.

• A potential breakdown area in any TV receiver must include the video string. This section, with its stages of i-f amplification, detection, and additional output amplification, determines the quality and appearance of the picture on a TV screen.

Since most sets designed today are of the inter-carrier type, video troubleshooting can frequently become complicated. Split sound and bleeder network B+ feed lines seem to be a thing of the past. Today, circuits are employed that develop chain reaction effects when a component breaks down.

Each TV design has its characteristic potential trouble spots. The video string is no exception. This doesn't necessarily mean poor design or inferior quality merchandise. The situation is similar to that of the automobile manufacturers who have problems with their early-run production "lemons."

Memory is a great aid to the bench technician servicing a specific brand set. Usually, the set in question has a repeated breakdown point, and after servicing a few sets, the technician's instinct alone frequently directs him to the defective component. But what of the technician who services *all* brands? His job will consist mainly of employing basic troubleshooting techniques. He must, therefore, approach the task armed with a schematic, VTVM, signal generator, and scope.

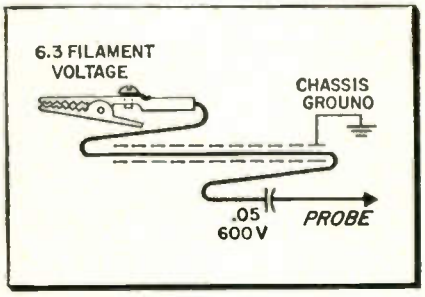


Fig. 1—A handy video tracer for signal substitution servicing.

The technician, particularly a man servicing all makes, needs "short cut" service aids. A very handy gadget for the shop or home servicing is shown in Fig. 1. This 60 cycle hum bar signal device will allow rapid detection of faulty video stage operation. Connecting the shielded wire clip lead to ground and the inner lead clip to a source of filament voltage, provides a simple signal generator for checking operating conditions of a video stage. The capacitor clip is applied to the plate and grid of successive stages in the string. Appearance, absence or degree of darkness of the 60 cycle hum bar on the CRT screen, will indicate condition of a stage. See Fig. 2.

Chronic Breakdowns

Although fundamental troubleshooting procedures should form the hard core of a technician's investigation of an inoperative TV set, it would be foolhardy to ignore known chronic breakdowns learned through experience. This knowledge can alter a technician's troubleshooting method, since he will frequently ignore

Fig. 2—Inserting a filament voltage via a coupling capacitor to test video circuits from detector through CRT. Proper stage operation will be indicated by horizontal bars.

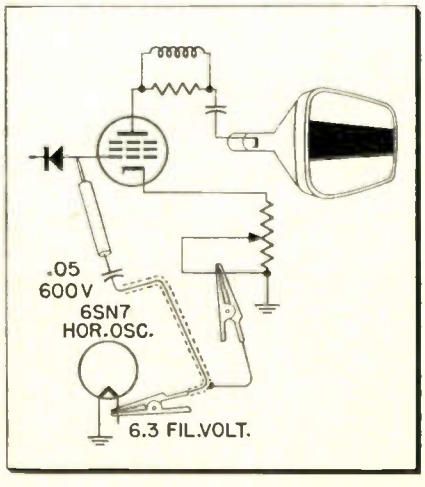
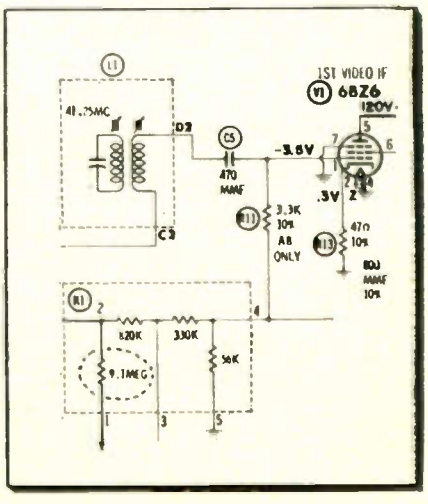


Fig. 3—When the 9.1 meg resistor opens or changes value, the i-f and r-f agc will be adversely affected, causing poor video.



formal repair approach and immediately investigate the area that consistently breaks down, based on previous experiences with the same model.

Examples of video failure currently being encountered by many in the field include the following TV receivers.

The Magnavox series 30 chassis (Fig. 3) employs a 9.1 meg resistor as an r-f biasing device, and this component often changes value. Should its value increase to, or above, 15 megs, the set will appear snowy and video level will become weak. Everything points toward the tuner or antenna as the defective section. Don't be fooled; head right for this resistor. It may be the culprit.

Another source of repair headache in this set is the contrast control circuit. Physically, the tuner and the controls are mounted separately from the chassis. Inter-chassis connection is made using cables. The ground connection for the contrast control in this cable has a tendency to break. See Fig. 4. The result will be loss of video and sound. (The video output tube might as well be out of its socket.) Don't rush to the agc system for your trouble. Employing signal substitution will readily show the video output circuit defective, but finding the reason for this malfunction may become a problem. This is not a one-set example, but the result of many repairs to chassis of this model.

Manufacturers today, namely, *G-E, RCA, Admiral, and Zenith,* are using the cathode voltage of the audio output tube as a source of B+ supply for the video i-f's, and in some cases for certain sound stages in some sets. When this audio tube fails to light, or has no output, B+ on the video i-f line is also disturbed. Watch for this—it's a good way to employ a voltage divider system, but unfamiliarity with circuit operation may add a few gray hairs to the technician before he solves his problem (Fig. 5).

In the *RCA KCS 126 series,* a couplate is employed as a coupling device for agc voltage. This is fine, but the hitch is: the component is wired in the sound i-f circut B+ supply. Breakdown of this couplate not only causes sound trouble, but we lose our video as well (Fig. 6).

The new *Emerson* line has a trouble which is very common in many of its sets. A 4700 ohm resistor in the plate circuit of the video output tube frequently opens after the set is a few weeks old. This part is of the 2 watt variety and replacement with a 5 or 10 watt resistor usually cures the chronic trouble. See Fig. 7.

Crystal Diodes

Most receivers of the vintage after inception of the inter-carrier chassis use a crystal diode as a video detector. Considering this component from a manufacturing point, it certainly has an advantage over its predecessor. Servicing a set using a crystal diode, however, increases the technician's problem.

Years ago, if the detector was suspect, the 6AL5 or 6H6 was substituted and suspicions were confirmed or proven erroneous. Today, the technician must occasionally search for the diode (it may be hidden in the third i-f output stage).

After locating it, he must either cut or desolder one lead for testing. When desoldering diodes, under no circumstances apply heat directly to the diode. Employ a pair of long nose pliers to act as a heat dissipator, while applying heat to the terminal connection. Using a VOM or VTVM for resistance measurement, a good diode will have a reverse polarity rating (back-to-front ratio) of 1 to 100 (for example, 100 ohms to 10k

(Continued on page 48)

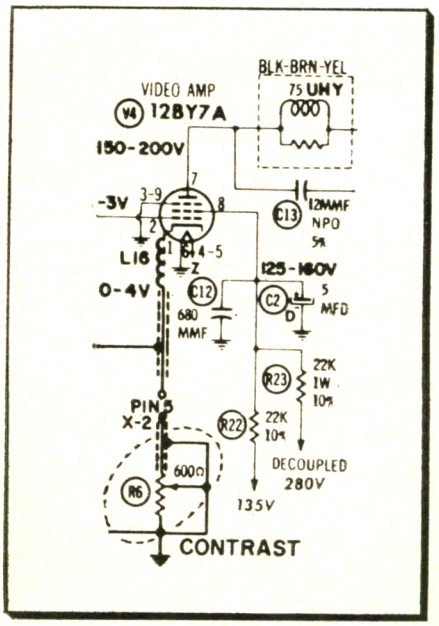


Fig. 4—The inter-chassis cable shield soldered to the contrast control arm frequently breaks, causing video and sound loss.

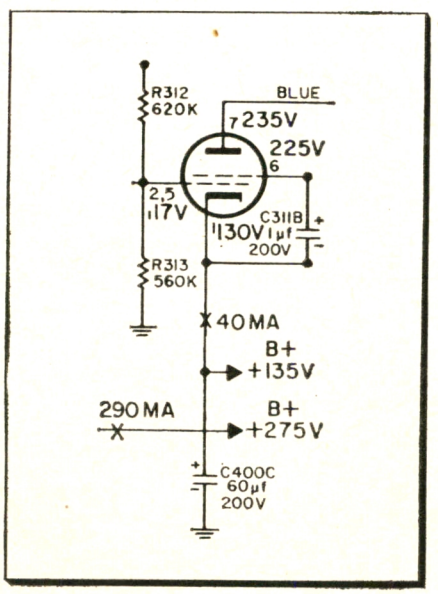


Fig. 5—Audio output tube failure could cause loss of video, since many manufacturers use its cathode voltage as a source of secondary B+.

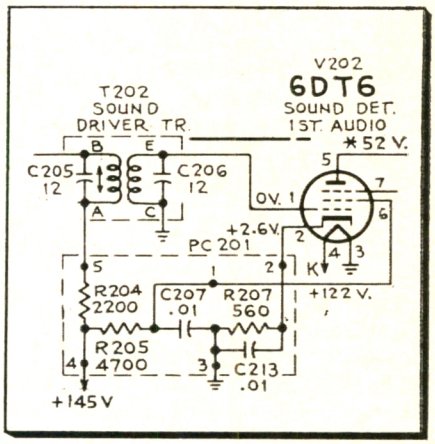
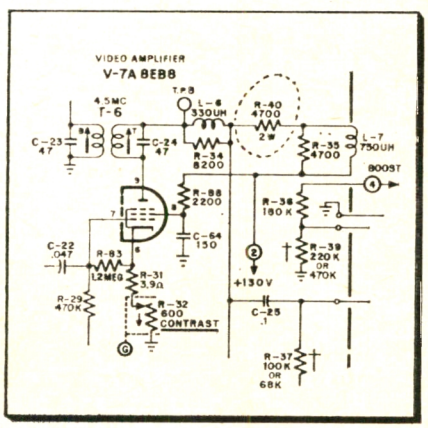


Fig. 6—Shorting or open audio circuit couplates may cause sound distortion and video loss.

Fig. 7—Opening of the circled 4700 ohm resistor is a frequent offender, with loss of video B+.



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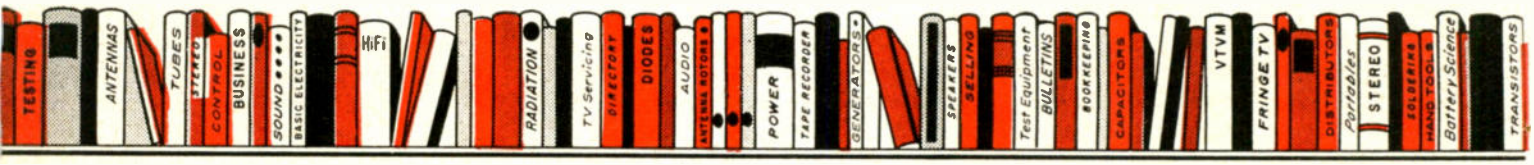

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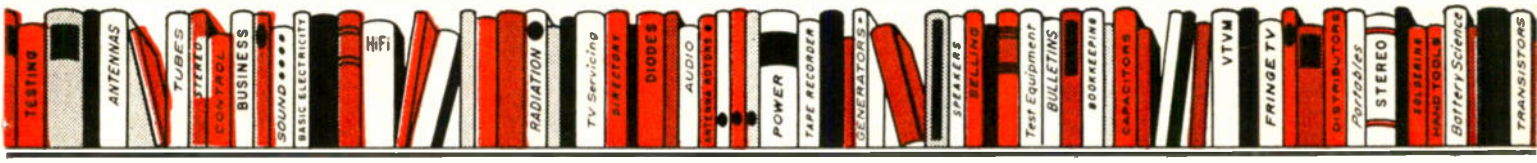

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Video Bugs

(*Continued from page 45*)

ohms). See Fig. 8. Any diode for TV whose ratio substantially differs from this figure should be replaced.

Diode trouble can reveal itself in many ways. The open diode usually causes loss of video and audio. A partially open diode may cause weak video. A shorted component generally causes a condition of over-riding buzzing sound, loss of sync, and picture overloading. Should a diode be inserted into a circuit with reversed polarity, it acts the same as a shorted diode.

Polarity of a diode depends on two factors: is the video information fed to the CRT's grid or cathode? And, how many stages are after the diode detector? Fig. 9 gives examples of proper diode insertion in each case.

The service technician in many respects is comparable to the surgeon. As the surgeon associates a given symptom with its usual ailment, so must the technician have this knowledge. Each may rely on intuition, prior experience, and fundamental knowledge. The degree of success of each is usually measured by his clientele's confidence. •

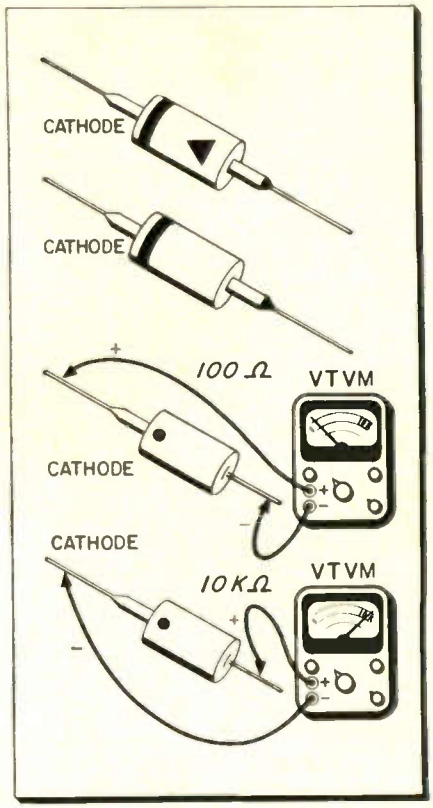

Fig. 8—Resistance measurement of a diode should have a front to back ratio of approximately 1-100. Ohmmeter test leads are reversed when checking diode.

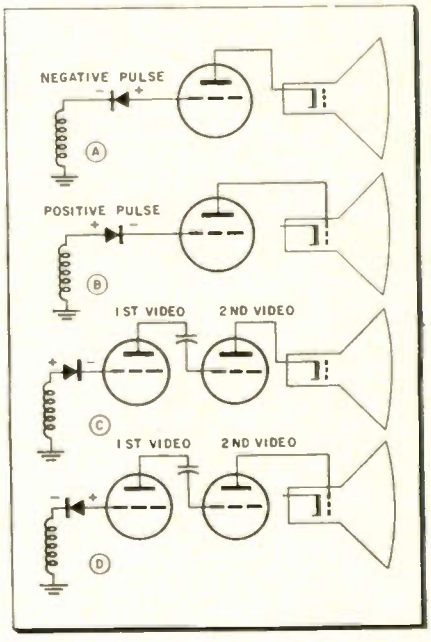

Fig. 9—Polarity of the crystal diode depends on the number of stages after the diode, and CRT element for video information input.

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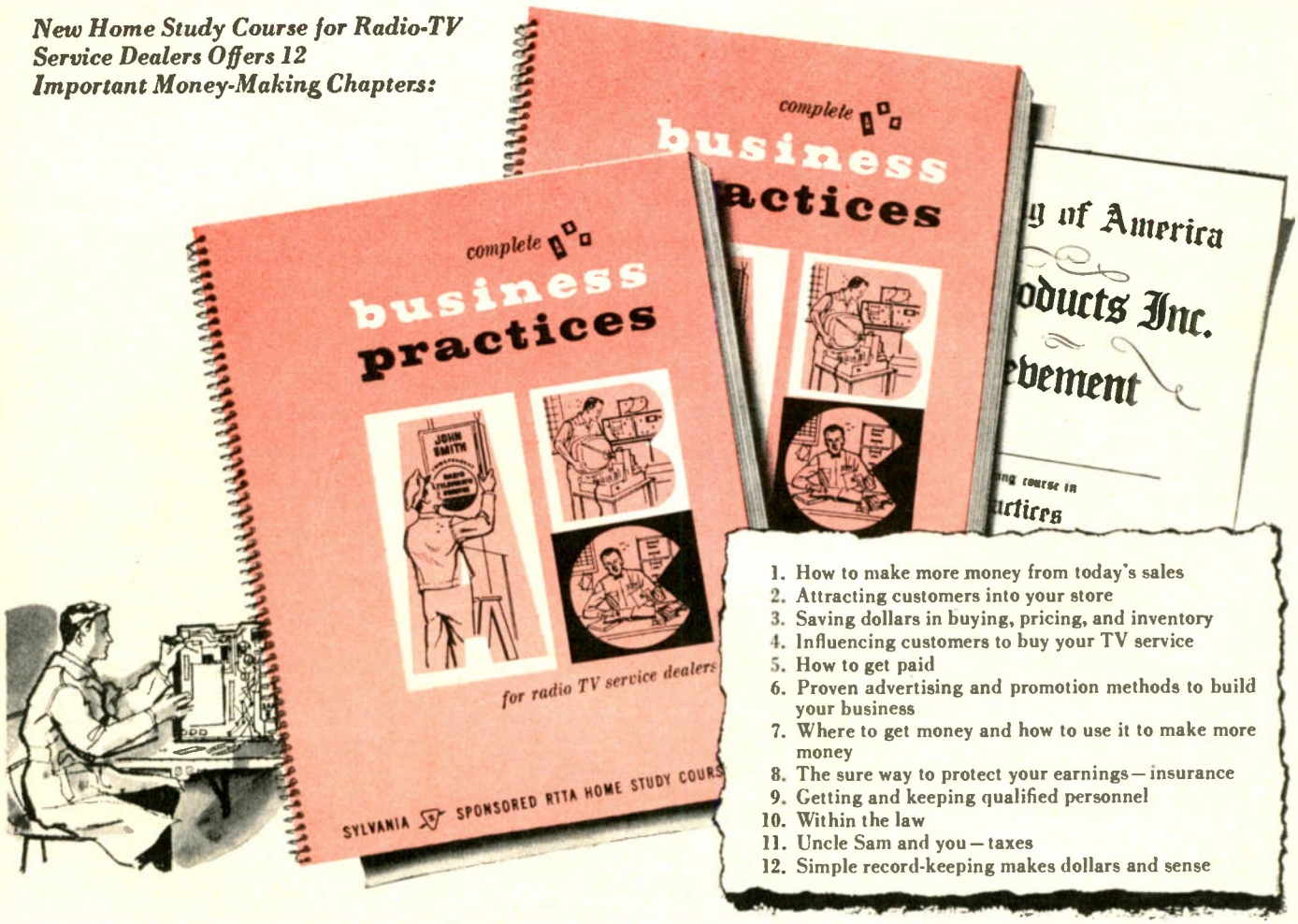

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SHOP HINTS

Tips for Home and Bench Service

Testing PC Components

A problem encountered in trouble-shooting printed circuits, as compared with conventional hand-wired sets, is the difficulty of isolating a stage drawing excessive current because of a leaking or shorted component. For example, if an i-f transformer is suspected of high resistance leakage it is not practical to remove the transformer from the board merely for testing or for a substitution check.

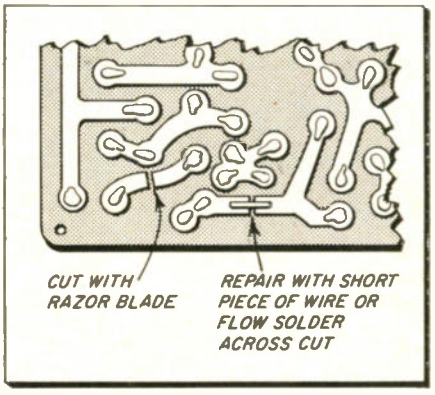

Fig. 1—Components in PC are quickly isolated for testing by cutting with razor blade.

Another example is where a transistor drawing excessive current is soldered into the board. The transistor may be ruined if removed for a check or substitution.

In all cases I use a very sharp, thick type, razor blade to cut through the printed circuit foil. The i-f is cut from ground and the emitter of the transistor drawing excessive current is opened (or one of the other elements, depending on transistor type and application).

After checking a component, this narrow cut in the printed circuit is then easily bridged with a piece of tinned hook-up wire, or in the case of low current lines, with only a bit of solder flowed across the cut, as shown in Fig. 1. This system often prevents unnecessary loss of time.—*Louis C. Maly, Iron Mountain, Mich.*

Antenna Attachment Jig

When the back is removed from many TV sets having a vertical chassis, it is necessary to detach the short antenna lead connector going to the tuner. This makes it difficult to attach the antenna for testing the set. I have solved the problem by making a jig, illustrated in Fig. 2, which I keep in my tube caddy.

Two alligator clips are soldered to the inside lugs of a regular screw-type antenna terminal strip. When the short lead from the tuner is detached and the set's back removed, the antenna can be easily connected to the strip and the connector tips from the tuner lead can be grasped by the alligator clips. The tuner lead is held taut, the leads kept well separated, minimizing the possibility of shorting the antenna leads.—*Edward J. Comeau, Haverhill, Mass.*

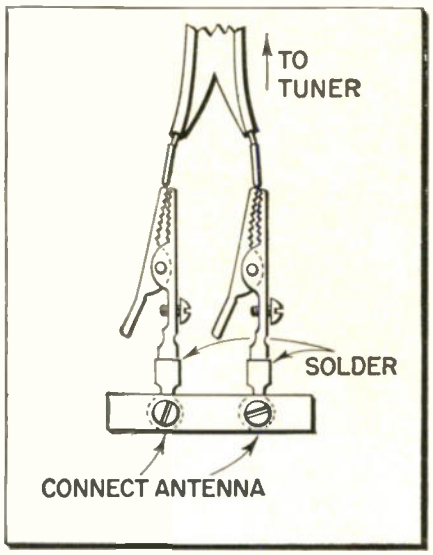

Fig. 2—An antenna is easily attached to a vertical TV by a jig made with two alligator clips and a spare terminal strip.

Iron Cord Holder

To prevent a soldering iron cord from tangling with components on the work bench or burning its own cord, I use an ironing cord holder, as shown in Fig. 3. The holder is a rod attached to a flexible spring and the spring can bend in any direction. This holder can be purchased at almost any department store and clamps easily to the edge of the bench.—*Ralph Rinaldi, Saddle Brook, N. J.*

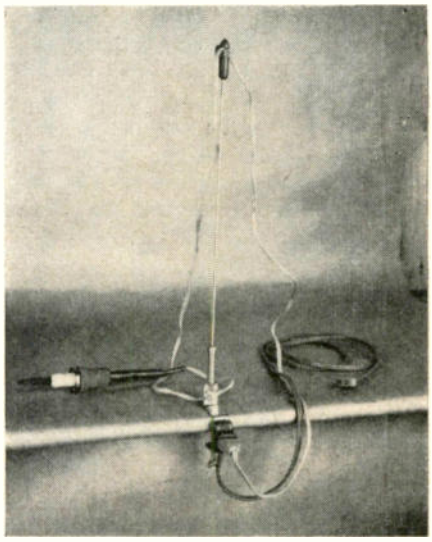

Fig. 3—Cord holder prevents burning and tangling with components on work bench.

Faster Tube Tester Set-Up

Roll charts on roll-type tube checkers grow longer every year, making it difficult to quickly locate a particular tube type.

I've abbreviated this time-consuming process to a great extent as follows: When installing a new tube checker roll chart, mark the designations of the most frequently used tubes on the roll. When the roll chart is spun around to locate the tube type and tube checker settings, the marked designations aid in rapidly locating the desired infor-

(*Continued on page 54*)

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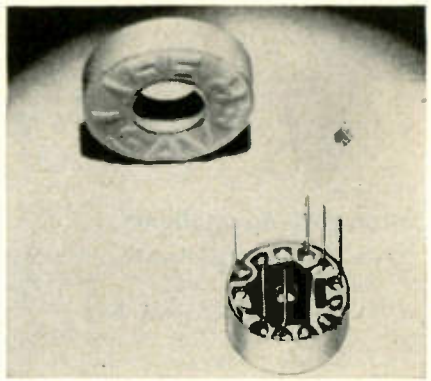
The TA-12, claimed to be the smallest 4-stage transistor amplifier ever constructed, can be used wherever an ultra-miniature, high gain audio amplifier is desired. Diameter, 0.531". Height, 0.228". Gain, 73 db. Input impedance,



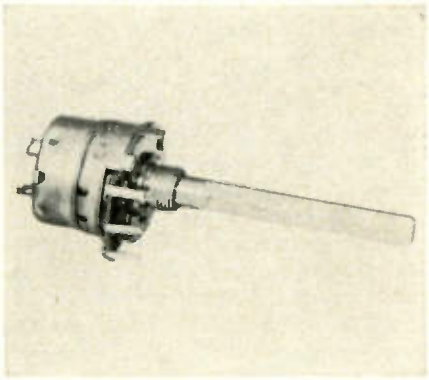
2,500 ohms nominal, power output up to 5 μw and a frequency characteristic of ±5 db, 300-20,000 cps. The single unit integrates, by means of packaged electronic circuitry, 12 resistors, 5 capacitors, and 4 transistors. Component density, 357 per cubic inch. $45.00. Centralab Div. Globe-Union Inc., 900 E. Keefe Ave., Milwaukee 1, Wis.

For more data, circle 6-52-3 on coupon, p. 49

For more data, circle 6-52-1 on coupon, p. 49

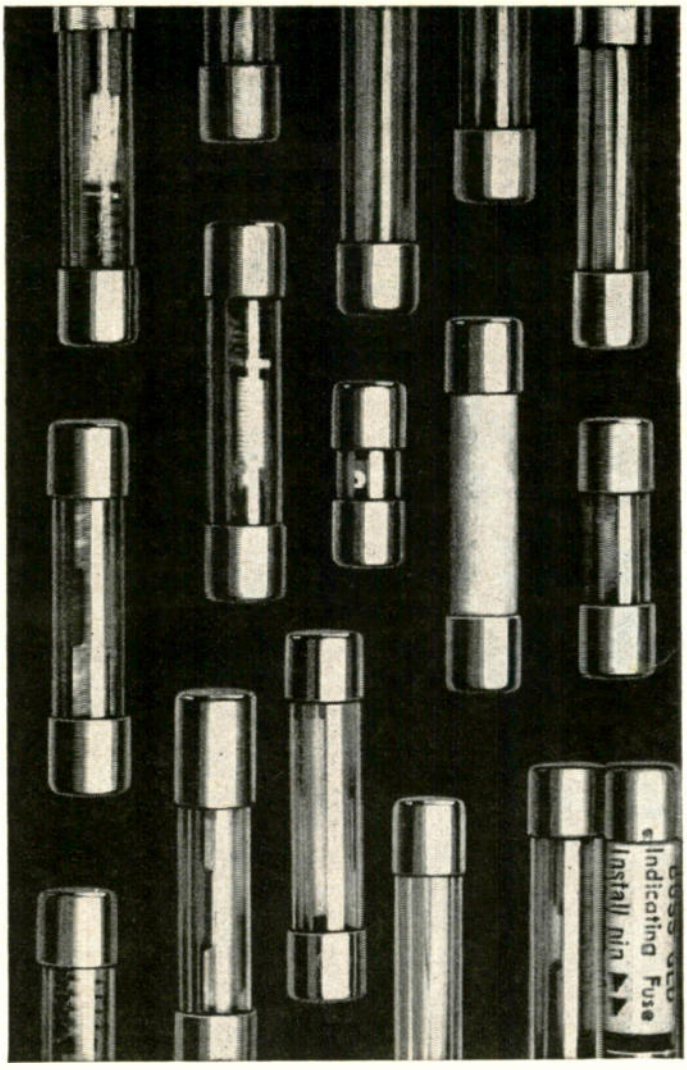
Clarostat SWITCH/CONTROL ASSEMBLIES

A complete range of resistance values, in two basic assemblies, include both the volume control and a push-pull switch. The use of this newest assembly permits switching a circuit on and off without disturbing a pre-selected vol-



ume level. Available with the firm's standard Series 43, 2-watt wirewound potentiometer and Series 47, ½ watt, composition element potentiometer. Delivered complete with standard bushing configuration, or other mounting hardware as required. Controls are available in all popular ohmages and tapers. Clarostat Mfg. Co., Dover, N. H.

For more data, circle 6-52-4 on coupon, p. 49



Why "Experiment"...

with electrical protective devices

when BUSS fuses have proven their dependability?

With the many types of electrical protective devices on the market, perhaps you have asked yourself, "Which line is best for me?".

It doesn't pay to "experiment".

Protective devices that fail to protect or that open needlessly often require a time-consuming call-back that can mean loss of full profit. Your reputation for service and reliability also may suffer.

BUSS and FUSETRON fuses, on the other hand, do provide dependable electrical protection under all service conditions . . . and have for the last 45 years in the home, in industry and on the farm.

Electronic testing assures dependability.

Every BUSS and FUSETRON fuse is tested in a sensitive electronic device that automatically rejects any fuse not correctly calibrated, properly constructed and right in all physical dimensions.

The time you save, the trouble you avoid, the satisfied customers you keep and the full profit you make are why it's just good business to standardize on BUSS.

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

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

660

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 BUSS — TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION — McGRAW EDISON

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Shop Hints

(*Continued from page 51*)

mation. The tube numbers are either underlined or boxed in with a red pencil, as illustrated in Fig. 4. This

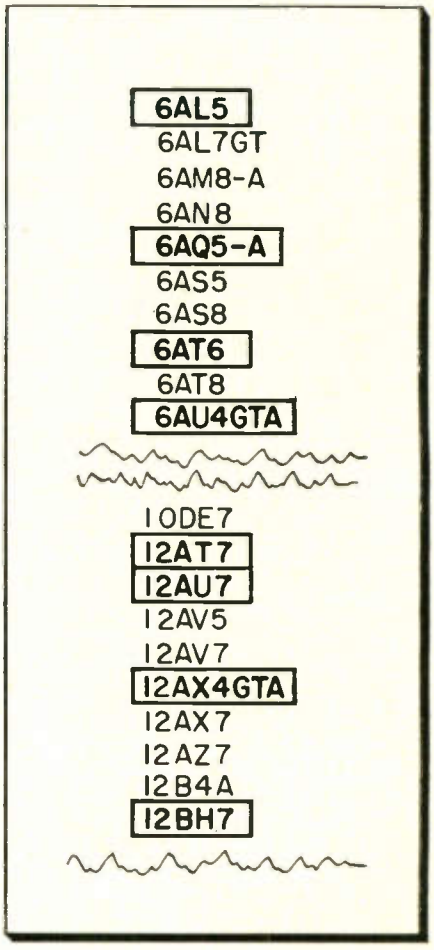


Fig. 4—Rapid location of tube data on a roll chart is facilitated by enclosing frequently used tube designations with red pencil marks.

is done after installation of the roll chart, but before placing the roll back in the case.—*William Dews, Hawthorne, Calif.*

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.

ERRATUM

Circuit Digest Issue 91
March, 1960

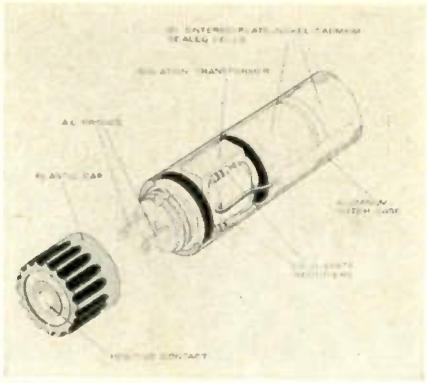
Circuit Digest #554

General Electric TV Chassis M569 should read: Canadian General Electric . . .

Sonotone
FLASHLIGHT BATTERY CARTRIDGE

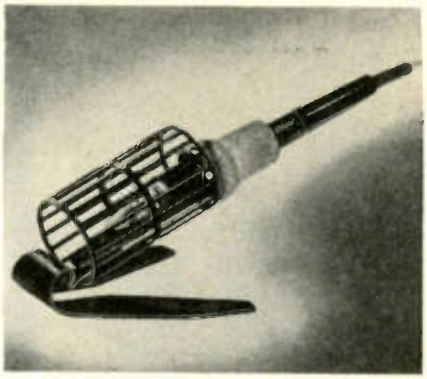
Model FC-3 heavy-duty, rechargeable, flashlight battery cartridge may be used in any flashlight, or in any other device, powered by 2 "D"-size cells end to end. Used with a PR-4 bulb, or the industrial type PR-6 bulb, it will give approximately 3 hours of steady light on a 16-hour charge. Longer charging will increase the hours of light. Can be recharged many hundreds of times by plugging into any 115v a-c outlet. $9.95. Sonotone Corp., Elmsford, N. Y.

For more data, circle 6-56-2 on coupon, p. 49



Ungar
SOLDERING IRON HOLDER

Designed for rugged day-in, day-out production line use, #8000 soldering iron holder features an exclusive safety guard design to protect the operator against "hot top" burns. This new

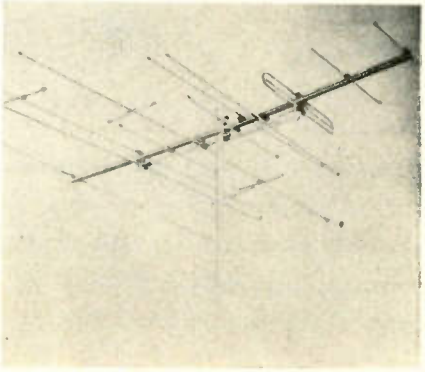


holder keeps the soldering iron cradled safely and securely in one convenient place. It may be attached to the top, side or underside of the bench, or to the wall and the angle of the holder is adjustable. $2.00. Ungar Electric Tools, 4101 Redwood Ave., Los Angeles 66, Calif.

For more data, circle 6-56-3 on coupon, p. 49

JFD ANTENNAS

A new series of eight TV antennas combine the major elements of the firm's best-known designs. The new Hi-Fi Fireball antennas contain reverse-phase low band and 600 ohm high band dipoles which work individually and jointly for ghost-free VHF signal

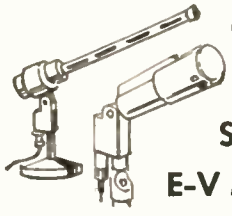


pickup on all channels. The Hi-Fi Satellite-Helix dipole system has now been combined with the Fireball design for a powerful long-range interference-rejecting antenna design. Prices range from $15.30 to $45.00. JFD Electronics Corp., 6101 16th Ave., Brooklyn 4, N. Y.

For more data, circle 6-56-4 on coupon, p. 49

For More Information On NEW PRODUCTS Circle Code Numbers, p. 49

The Sounding Board



"Accidental" Tests Prove Superiority of E-V Microphones

Electro-Voice conducts many microphone tests to determine durability. Occasionally, though, we hear of a field experience more effective than anything performed in our laboratories. Take, for instance, the time a local engineer, preparing for a game at a high school stadium, accidentally dropped a microphone down a flight of concrete steps. The case was damaged, but lack of time forced him to hook up the one he dropped. His worry about failure proved unnecessary because the microphone performed without the slightest loss in quality.

Such unusual and unexpected circumstances come to our attention because we are asked to ascertain the condition of microphones after mishaps. We were not surprised at the durability exhibited because of our own unique method of testing every E-V microphone model. We drop it, we roast it, freeze it, drench it with salt water, explode guns near it, test for pressure at high altitudes, and subject it to abrasive wear and tear.

Now, we don't suggest you abuse your E-V microphones as we do when testing. But, should an accident occur, it's nice to know the chances of anything affecting performance are limited.

The cited example is only one of the many requests received to check over field equipment and provide consultation in the field when desired. Lou Burroughs, one of the founders of E-V, and Vice-President of Broadcast Engineering, has retained intensive contact with TV and Broadcast Engineers. His on-the-scene consultation has enabled him to help in the solution of many ticklish problems and has kept him abreast of situations which require special microphones.

The 30W — A Woofer for the Wildest Audiophile

The creation of a large, low-frequency speaker is not unique to Electro-Voice, nor is the 30W the largest speaker ever built. E-V, however, did recognize the inherent advantages a woofer of this size could have over a smaller speaker. Such a woofer, because of its ability to reproduce efficiently the lowest bass frequencies without distortion—would offer the ultimate clarity desired by high-fidelity perfectionists.

Electro-Voice, committed for many years to ultra-rigidity in speaker construction, produces a complete line of speakers having rigid, one-piece, die-cast frames. There is no exception to this.

It was inconceivable that an exception could be made with a giant woofer just because of its size. Actually its great size demands extra rigid construction to insure smooth response. Regardless of the extensive and expensive tooling required in shaping the die, core, and die frame, the 30W is now here. It is the world's largest and finest woofer, complete with an absolutely rigid die-cast frame and super bass voice. The die press required to produce the frame is one of the largest in the industrial state of Michigan.

Equal care and design went into all phases of the 30W development. It includes a super-heavyweight (9¼ lbs.) ceramic magnet to increase efficiency and minimize distortion. The new, super-stiff cone of polystyrene foam was originally designed for the 30W. It has almost three times the cone area of an 18-inch woofer and moves an amazing column of air without extra demand on the amplifier. The true-piston performance made possible by the die-cast frame and foam cone enables this speaker to perform beyond the demands of the most confirmed audiophile—absolutely distortion-free to below 25 cps.

FOAM CONE: *Engineering Breakthrough for* Better Bass

The "foam cone", just recently introduced in super-quality Electro-Voice low-frequency woofers, represents a major breakthrough in loudspeaker design—and a marked improvement in the delivery of clear, transparent, undistorted bass.

Rigidity of the cone is essential for smooth response. Until the advent of foam, larger woofers were forced into some sort of compromise between acceptable weight and high rigidity. Conventional "paper" cones in smaller diameters can be thickened to the point of inflexibility without undue weight increase, but this is not true of cones with larger diameters—and it is in these larger cones that the resultant "muddy" sound is the most pronounced. Conventional material, in the thickness required for absolute rigidity, would be beyond the weight limitation which is fixed by magnet size and available amplifier power (without expensive redesign of both components.)

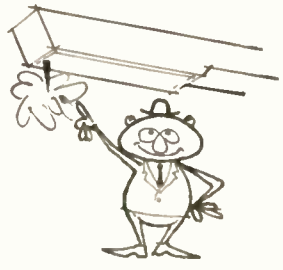
Exhaustive research turned up "foam". Its correct name is polystyrene (a very hard plastic)—and the word "foam" is related to the form of the material in its final state. Air is entrained in it by agitation while it is liquid. When it cools in the mold, it retains the "foam" structure (internally)—along with its exceptional hardness and stiffness. Thus a thickness —and a stiffness—many times that of "paper" is possible with no increase in weight.

Furthermore, the ratio of stiffness to weight and thickness is completely predictable and calculable. The engineer can specify the proper thickness for the required rigidity. Weight will stay well within limits—and the molding of the cones can be controlled to sub-microscopic accuracy.

The result is a true inflexible cone—which operates as a piston. There is no distortion of shape and none in the resultant sound. It all came about because Electro-Voice is dedicated to achieving perfection demanded by the Audiophile—and has the engineering talent in quality and quantity to solve the problem.

For more data, circle 6-57-1 on coupon, p. 49

DID YOU KNOW?



A phonograph needle (stylus) travels and tracks between 500 and 600 yards every time one side of an LP record is played and heat at the tip approaches 1000° F. This high temperature is the basic cause of needle wear. The diamond, with its resistance to heat and abrasive wear and its unequaled hardness, is the ideal stylus to keep record wear at a minimum. It lasts 20 times longer than a sapphire, too. Ask for Electro-Voice Power Point Needles and prolong your record life.

Want more information on any of the items mentioned in the Sounding Board? Simply check the appropriate boxes below and mail the coupon to Dept. 60T, Electro-Voice, Inc., Buchanan, Michigan.

- ☐ Foam Cones
- ☐ Microphones
- ☐ 30 W
- ☐ Needles & Cartridges

NAME_____

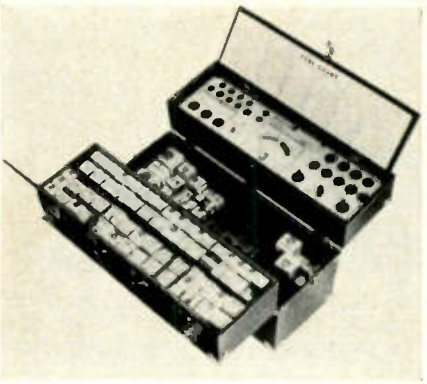
ADDRESS_____

Electro-Voice®

ELECTRO-VOICE, INC.
BUCHANAN, MICH.

Shell TUBE TESTER

"Test-O-Matic Tube Cadi-Tester," model TC-18, is an all-in-one portable unit with ample tube and tool storage. It tests more than 800 tube types; tests each side of multi-purpose tubes;



emission tests all tubes; tests 6 and 12v vibrators. It uses just 18 sockets to test all tube types; has 3 easy-to-use controls and a fool-proof test meter. Operates on 110-120v a-c. 20⅜" x 14" x 8". $69.95. Shell Electronics Mfg. Corp., 112 State St., Westbury, N. Y.

For more data, circle 6-58-3 on coupon, p. 49

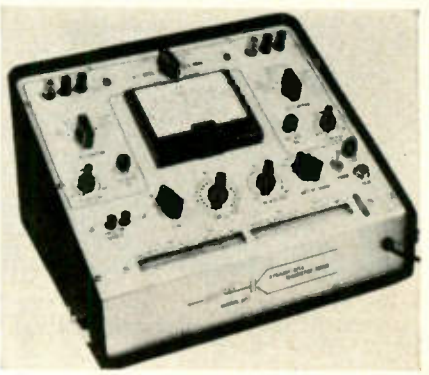
Raytheon RECEIVING TUBES

Seven new receiving tubes are: four entertainment-type replacements, 7-pin miniatures: 18FY6 double-triode for detector-amplifiers; 18FW6 pentode for r-f and i-f amplifiers; 36AM3 halfwave rectifier and 18FX6 heptode for use as a pentagrid converter; currently used in many TV receivers, 6FV8 9-pin miniature triode-pentode designed as a combined oscillator-amplifier and the 6FH5 7-pin miniature for grounded r-f amplifiers in UHF tuners, the latter tube is similar to the 6ES5, except that it is designed for 135v plate operations; 5CU4 cathode-type full-wave rectifier for circuits requiring up to 425 ma output or 300v d-c. It can replace the 5U4GB and 5Y3GT. Also introduced, a new rust-proof version of the OZ4, a full wave gas rectifier used principally in auto radios. Raytheon Co., Distr. Products Div., Westwood, Mass.

For more data, circle 6-58-4 on coupon, p. 49

Hickok TRANSISTOR TESTER

Model 870 tests transistors according to manufacturer's specifications. Collector current and collector voltage can be varied to provide the proper conditions for correct beta measurements. It



measures large signal d-c beta on power transistors, also small signal a-c beta on low and medium power transistors. Collector test current, variable up to 2 amperes. Three Icbo ranges, 0-100 μa, 0-1 ma, 0-10 ma. Two beta ranges 0-100 and 0-300 incorporated with a feature to permit half calibration effectively increasing the upper beta range to 600. Built-in roll chart shows over 1,500 test settings. Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland 8, Ohio.

For more data, circle 6-58-5 on coupon, p. 49

Lowell COMMUNICATION CENTER

The MIA communication center, for ceiling or wall installation, is designed for terminals and public buildings. One easily installed unit provides mounting for two clocks, bi-directional speaker systems and back-lighted space for advertising. Light gray finish with charcoal gray speaker grille. All welded 18 gauge steel construction. Mounts with two ½" pipes from the top of the unit. Electrical connections to the three elements are contained in the pipes. Lowell Mfg. Co., 3030 Laclede Station Rd., St. Louis 7, Mo.

For more data, circle 6-58-6 on coupon, p. 49

Now–more profit from a single sale

...than 20 pairs of single-life "D" cells pay you!

To recharge, just unscrew cap...

and plug overnight into any 110-120-volt AC outlet.

HEAVY-DUTY SONOTONE Rechargeable Flashlight Battery Cartridge

- A new, multi-use adaptation of the patented Sonotone sintered-plate, nickel-cadmium battery used in space missiles and jets.
- Gives at least 3 hours of strong, continuous light from a single charge with PR-6 bulb—or 1½ hours with full-powered PR-2 bulb.
- Dependable in extreme temperature and weather conditions.
- Can be recharged hundreds of times at about ¼¢ per charge.
- Sturdy, leakproof construction – aluminum jacket – electrically shockproof.
- Full-year guarantee under heavy industrial use – backed by Sonotone's leadership of over 30 years in precision engineering and service.

A completely new concept in long-life flashlight power! Replaces and outmodes any two "D" cells, for any purpose, in end-to-end use. Rechargeable overnight simply by plugging into any 110-120-volt AC outlet. Gives users a lifetime of service – gives you more profit than you make from selling 20 pairs of industrial "D" cells! Retail price, **Model FC-3**, $9.95. (Also **Standard Model FC-2** for home use—light lasts at least 1½ hours with PR-6 bulb – $7.95 retail.) Order from your supplier now.

Sonotone® CORP.

Battery Division, Dept. 89-60

ELMSFORD, NEW YORK

Leading makers of fine transistor hearing aids, ceramic phonograph cartridges, speakers, microphones, electronic tubes, sintered-plate, nickel-cadmium batteries.

For more data, circle 6-59-1 on coupon, p. 49

19" TRANSISTOR TV

• Last year's introduction of a transistorized TV portable by Philco presaged the introduction of other transistor TV receivers. Motorola's "Astronaut," Model 19P1, a 23 transistor, 12 diode receiver, confirms this prediction.

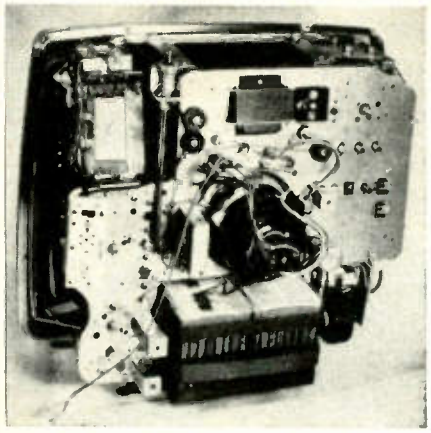


Fig. 1—Rear view of the "Astronaut." Silver-cadmium energy cell, good for a minimum of 2,500 hours actual operation, is centered at bottom of chassis. Yardney makes cell.

Sporting a 19" CRT ensconced in typical slim-line styling, an optional energy cell makes it a completely portable unit for beach, picnics, etc. It can be used for a-c operation also, and when the switch is off, automatically recharges the energy cell.

Fig. 1 emphasizes the barren view offered by a vertical chassis with transistors instead of vacuum tubes. Another interesting view, aside from the physical one, is the 1 year factory guarantee declared by Motorola.

Excepting the vacuum tube high-voltage rectifier, which may be seen in Fig. 2, semiconductors are used throughout the receiver. This extends to the tuner, shown in Fig. 3.

As indicated by the block diagram of Fig. 4, the set's operation basically conforms to vacuum tube receivers. A turret type transistorized three stage tuner is used which allows easy conversion to UHF channel operation by inserting channel strips into unused VHF turrets. The tuner consists of an r-f stage, mixer and oscillator. This is followed by a 3-stage i-f amplifier with 41.25 to 45.75 mc response. The r-f amplifier and first two i-f stages are tied to keyed agc.

A conventional diode detector and a two stage video amplifier carry the video information to the cathode of the 19XP4 CRT. Contrast control is obtained by varying the bias of the second video amplifier. Picture brightness is varied by changing the cathode bias of the picture tube.

The sync circuits and the vertical oscillator and output circuit operate conventionally. As in many vacuum tube sets, a dual-diode phase detector is employed as a horizontal discriminator. Following the horizontal blocking oscillator are a buffer, driver and output stage driving a flyback-type deflection and high-voltage transformer. The flyback provides a high degree of high-voltage regulation to assure an almost constant 15 kv voltage to the picture tube.

An additional winding on the flyback energizes a separate power supply circuit which provides the G2 voltage for the CRT. A third power supply, energized from a tap on the transformer, is used to furnish the

(*Continued on page 62*)

Fig. 2—Hand-wired, vertical chassis contains only one vacuum tube at lower left.

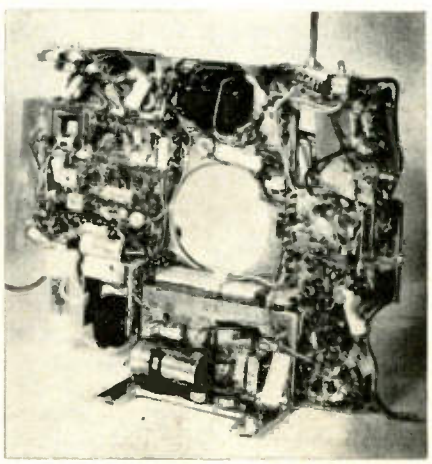
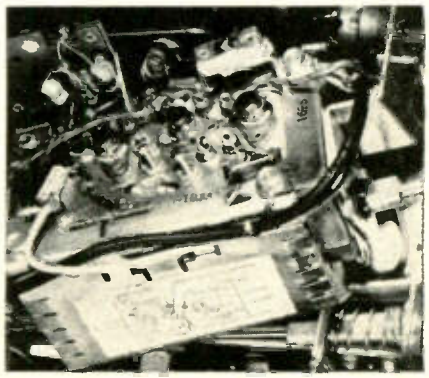


Fig. 3—Close-up of turret-type tuner shows three high-frequency transistors.



If you've been showered with callbacks, get under an umbrella of Tung-Sol Blue Chip quality. You know a single callback will drown out the profit on the next three service calls. That's why it's a good idea to use Tung-Sol tubes for all radio, tv and hi-fi replacements. They're made to set manufacturers highest original equipment standards so that you can keep your service profits dry and high. Tung-Sol Electric Inc., Newark 4, N. J.

Tell your jobber you'd rather have

TUNG-SOL®

Blue Chip Quality · TUBES · TRANSISTORS · DIODES

For more data, circle 6-61-1 on coupon, p. 49

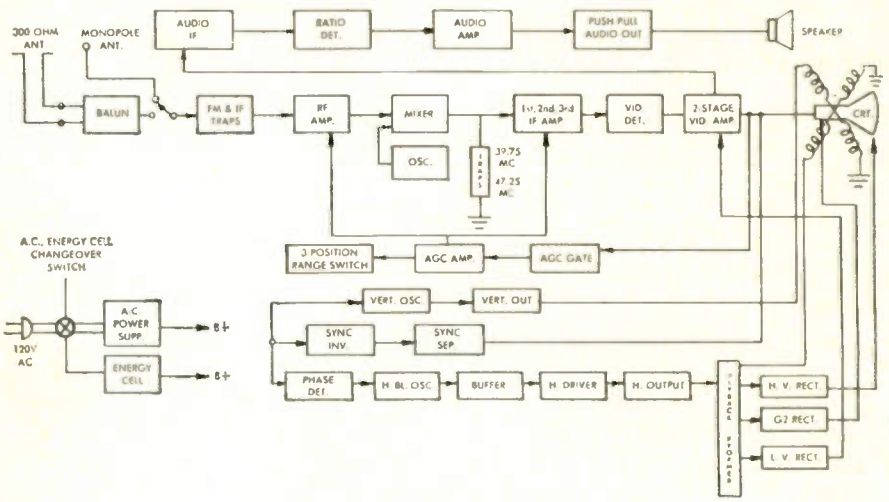
19" Transistor TV

(Continued from page 60)

relatively high voltage required by the video output stage.

The low voltage power supply is transformer operated, with a full-wave rectifier and capacitor input filter. A transistor is employed as an active filter in place of the usual choke. Mechanically, the circuit is designed so that the set operates from the energy cell until the auxiliary line cord is plugged into a receptacle on the rear of the chassis. The act of plugging in the cord activates a d.p.d.t. switch which simultaneously disconnects the energy cell and closes the power transformer primary. A relay in the charging circuit automatically interrupts the charging current when the cell is fully charged. •

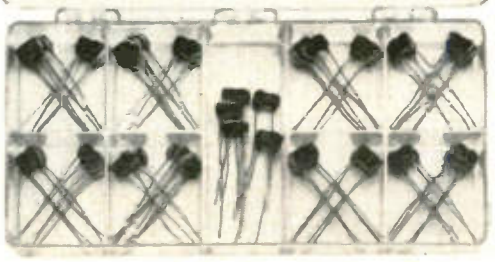
Fig. 4—Block diagram of Motorola 19P1 Transistor TV. Note flyback's three voltage taps.



CDE's NEW MINIATURIZED DIPPED MICAS

YOU GET . . .

. . . ALL 500V. 5%	Five CD15-5T22 220 mmfd.
Five CD15-5Q56 56 mmfd.	Five CD15-5T33 330 mmfd.
Five CD15-5Q82 82 mmfd.	Five CD15-5T39 390 mmfd.
Five CD15-5T1 100 mmfd.	Five CD19-5T47 470 mmfd.
Five CD15-5T18 180 mmfd.	Five CD19-5T68 680 mmfd.



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

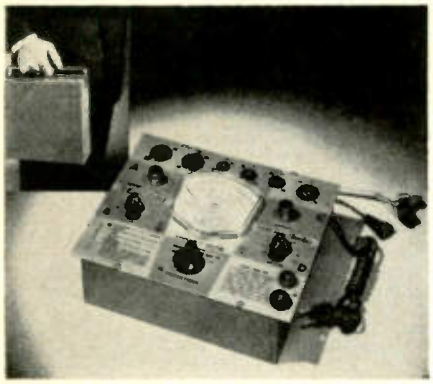
CDE dipped micas save you time because they're TINY. They'll slip into a tight chassis or crowded printed board with ease. They replace ANY mica or ceramic capacitor—and you get all 45 of these 500V., 5%, dipped micas, in a convenient clear plastic box, for only $10.20. Call or write your distributor.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

CDE **CORNELL-DUBILIER ELECTRONICS DIVISION**
Federal Pacific Electric Company

For more data, circle 6-63-1 on coupon, p. 49

Sencore TUBE TESTER

Mighty Mite compact tube tester measures 8"x9"x2½", weighs less than 8 pounds and checks over 1,300 tubes for cathode emission, shorts between all elements, gas, grid emission, and grid leakage as high as 100 megohms. Locates tubes causing normal trouble and,

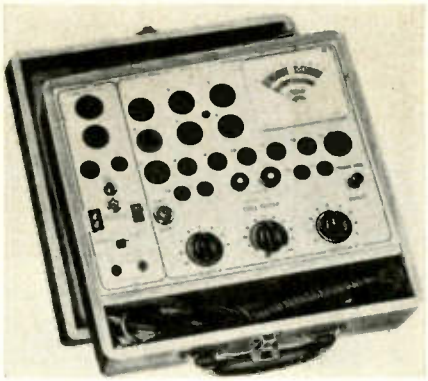


at the same time, weeds out the "tough dogs." Set-ups are made from a small attached booklet. New set-up charts are provided free of charge by registering with the company. Features include: 3½" D'Arsonval meter that glows in the dark; stainless steel mirror in cover and separate inner chassis. Unit can be easily installed in technician's caddy. $59.50. Sencore, Addison, Ill.

For more data, circle 6-64-2 on coupon, p. 49

Mercury TUBE TESTER

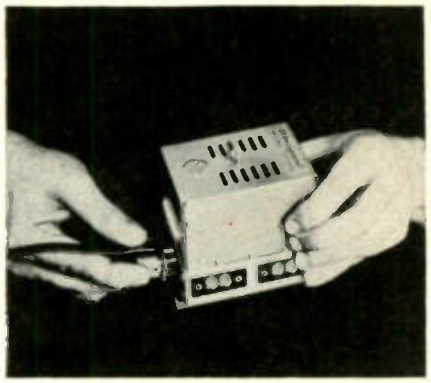
Model 102-P, deluxe multiple-socket portable, tube tester checks emission of over 700 tube types including the newest series-string TV tubes, OZ4's, gas regulators, hi-fi and foreign tubes. Checks each section of multi-purpose tubes separately. Checks for inter-element shorts and leakages. Checks crystal diodes, all power rectifiers, pilot lamps, auto and TV fuses and provides for quick check of tube filament continuity. Appliance power outlet built into panel. Meter scales, tri-colored. Insulated test leads for extended continuity checks are provided. $59.50. Mercury Electronics Corp., 77 Searing Ave., Mineola, N. Y.



For more data, circle 6-64-3 on coupon, p. 49

Winegard BOOSTER-COUPLER

First of an advanced series of TV-FM accessories is the WBC-4 amplified booster-coupler for one to four TV and/or FM sets. Delivers up to 12.5 db gain, all channels, on one set, or 6 db gain of each of two, three or four sets. Uses powerful frame grid ECC 88 tube, shielded and protected (trans-conductance, 12,500 micomhos). 4½"x3½"x 2½". Mounts anywhere. Has disconnect plug for antenna lead-in. Uses no-strip lead-in terminals. Has an off-on switch and a cord and plug for 117v, 60-cycle power supply. Claimed to be the only distribution amplifier in its price range that will drive up to 4 sets. $27.50. Winegard Co., Burlington, Iowa.



For more data, circle 6-64-4 on coupon, p. 49

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and now . . .
an independent tone arm that measures up to
SHURE STANDARDS

new safety for records

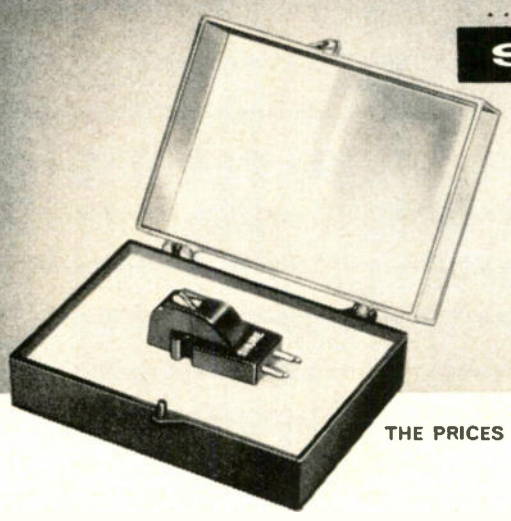
Surface wear is held to absolute minimum through flawless tracking made possible by an ingenious and unprecedented combination of adjustments. Optimum static and dynamic balance, precise height, correct cartridge "overhang," and incredibly accurate stylus force are quickly achieved and easily maintained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

new sound from records

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

new simplicity in installation and operation

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



. . . an incomparable combination when used with

SHURE *Stereo Dynetic*

PHONO CARTRIDGES

Overwhelming first choice of the critics. Painstakingly tested, proved, perfected—these superb Shure Stereo Dynetic moving-magnet cartridges are designed specifically to satisfy the critical ear of the most discriminating music lover . . . the most exacting audiophile. They separate disc stereo sound channels with incisive clarity. They are singularly smooth throughout the normally audible spectrum . . . and they are superior to other separate stereo cartridges in the re-creation of clean lows, true-to-performance mid-ranges and brilliant highs. Completely compatible.

THE PRICES

TONE ARM	M232, for 12" records	$29.95 net
	M232-7 (with M7D cartridge installed)	$53.95 net
	M232-3 (with M3D cartridge installed)	$74.95 net
TONE ARM	M236, for 16" records	$31.95 net
	M236-7 (with M7D cartridge installed)	$55.95 net
	M236-3 (with M3D cartridge installed)	$76.95 net

M3D Professional Cartridge..$45.00 net M7D Custom Cartridge..$24.00 net

Literature available / SHURE BROTHERS, INC., 222 HARTREY AVENUE, EVANSTON, ILLINOIS

For more data, circle 6-65-1 on coupon, p. 49

ADVANCE NOTICE TO SUBSCRIBERS

PRICE TO BE INCREASED

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

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

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

NEW RATES		CURRENT RATES
$5	1 year	$4
$8	2 years	$6
$10	3 years	$8

The above rates are for U. S., possessions and Canada. New rates for all other locations will be $9 (1 year), $14 (2 years), and $18 (3 years).

MONEY SAVING OPPORTUNITY

The reason for this advance notice to readers is to give you the opportunity to renew your subscription NOW at the lower old rates. Not only will you save money, but you will insure yourself against any interruption in service; you won't miss a single issue.

For example, if your present subscription expires in 1961, you can extend your subscription now for, say, 3 years, thereby assuring continuous service at the current price until 1964. Normally, renewals are not invited until a subscription is about to expire. However, you are being offered the chance to renew well in advance because we believe it to be a publication's obligation to protect its current subscribers as much as possible.

Here is all you need do to renew now. Simply cut out your address label from the cover of your last issue, paste it on the postage-free envelope facing this page, and fill in the appropriate blanks. Of course, be sure to enclose your check or money order.

ELECTRONIC TECHNICIAN

World's Largest Circulation Electronic Trade Publication

480 Lexington Avenue, New York 17, N. Y.

ASSOCIATION NEWS

California

TSDA, San Francisco, elected the following members to its board of directors: Dan Bestwick, Charles Bleile, Bill Finerty, Ned Gramlich, George Hagosian, Edwin Hawkins, Ed Luzzi and Bill Nash. Because of business pressure Gramlich and Nash submitted their resignations from the new board. President Finnerty appointed Louis Lopez and J. Jerold Strauss to serve in their place.

District of Columbia

TSA, Washington, D.C., has re-elected B. W. Bognovitz and reaffirmed its strong support of the Foley bill, HR 7714, now in Congressional Committee. Other officers elected were: V.P., J. C. Pumphrey; Treas., Robert Peters. Carl Johnson was elected a director of NATESA.

Florida

TESA, Broward County, elected the following officers: Pres., Harry C. Richardson; 1st V.P., Jack Wolmer; 2nd V.P., John Miller; Rec.-Sec'y., Hamilton Boyd; Corr.-Sec'y., Bob Kelly; Treas., Ken Weiss.

Illinois

Jobbers Subvert NY License Law

NATESA, Chicago, Exceutive Director, Frank J. Moch, writes: "A hot war has finally emerged from the long continuing subversive opposition of NEDA to the interests of independent service, as a result of anti-license resolutions passed by a large number of Rochester, Buffalo and New York City alleged wholesale members of NEDA . . . To protect their interests, the independent service people must make sure they support those parts houses which support them, even if they have to go to other cities [for supplies]."

Moch also announced that a special award, an all-expense trip to Tulsa and return, went to Eastern Secretary George Carlson of Jamestown, New York, for carrying out the most effective and aggressive activity for the period since the 1959 convention.

Indiana

RTSA, Evansville, reports its membership has voted to affiliate with the state IESA. RTSA is said to be the oldest association in the state, having been formed in August 1931.

Mfrs. Aid TV Theft

IESA, Indianapolis, points out that "Most TV manufacturers are guilty of aiding the criminal that is stealing their dealers blind. By not branding their sets with permanent serial numbers, these set makers actually are encouraging the theft of their products." Both IESA and NATESA have passed resolutions urging manufacturers to stamp serial numbers in the chassis metal.

Louisiana

NATESA, New Orleans, secretary general, Benny Benoit, recently wrote an interesting letter to Joseph Blink, Chicago, describing operation of the Louisiana state licensing law. Benoit referred to a number of specific points of interest: "Legitimate part-timers are not discouraged. If they can qualify under the law with previous apprenticeship training, etc., they are given an opportunity to take an examination. . . . The licensing board has sincere letters of commendation from numerous parts distributors who have been working toward better relations with the service people. . . . We have some consumers in Louisiana who are mighty happy we have a license board. . . . A technician, un-

(Continued on page 78)

TV Roof Antennas

(*Continued from page 43*)

causes it to act similar to an expansion shield as a pressure hold is acquired. Eight nails take about 20 to 25 minutes to hammer into the wall, whereas holes for raul or expansion shields take a great deal longer.

Mounting a bracket to a wood building is accomplished using Lag screws. A good start with a few hammer blows and the screws are tightened by employing either a plier, crescent wrench, or open-end wrench. As the screw is turned, its biting action in the wood secures the mount.

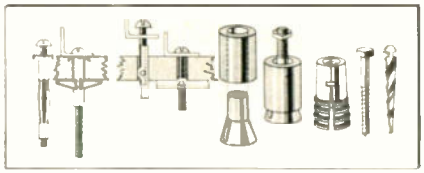
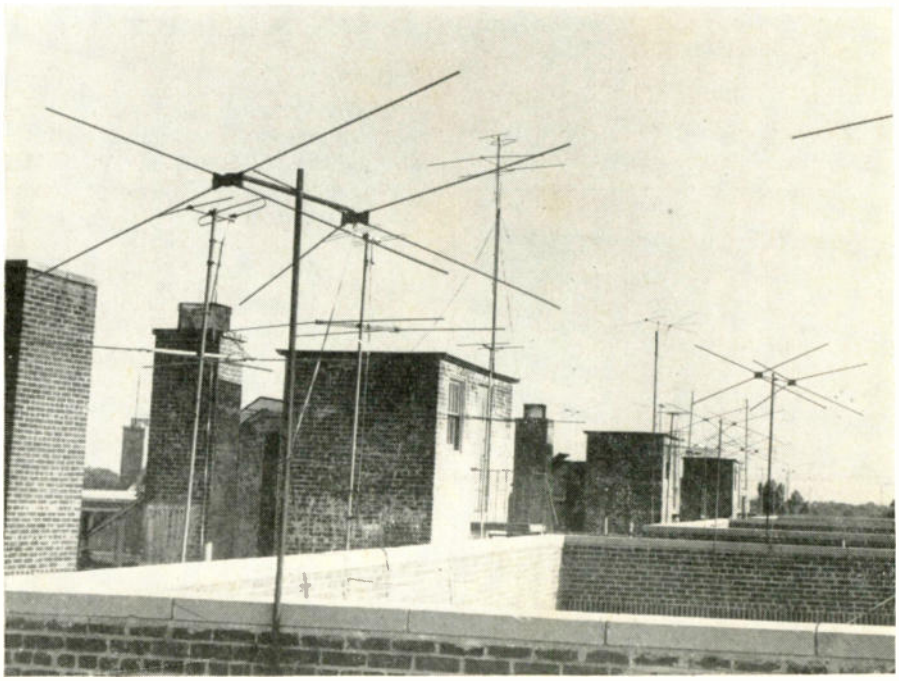


Fig. 7—Rawl plugs, expansion shields and Odegaard nails are employed for securing wall mounts.

After the mount is in place, the antenna mast with antenna and wire are positioned. In my own case, I usually have a helper assemble the antenna, secure it to the mast, and connect the wire to the terminals while I secure the mount. Team work will minimize time loss with each installation. Sending one man to install a complete system could make a one or two hour job a half day

Fig. 8—Existing antennas on this roof are a good guide for antenna positioning and orientation. The blank wall of this roof may indicate a ghost or interference trap.



The Businessman in the Serviceman suit knows five million TV antennas are in need of replacement. For his installations he relies on the superior performance and quality of JFD Hi-Fi Colortennas to guarantee complete customer satisfaction... guard his reputation.

HI-FI HELIX

HI-FI BANSHEE

HI-FI FIREBALL

THE BRAND THAT PUTS YOU

JFD

IN COMMAND OF THE MARKET

JFD ELECTRONICS CORPORATION
BROOKLYN 4, NEW YORK

project.

Today, with the use of "double V," "conical," and "yagi" arrays, the technician needs some gimmick to check lead-in continuity. The old "folded dipole" antenna, being a closed circuit, would indicate normal operation by a 2 ohm reading. Any break in the line would, therefore, cause infinite resistance. I have found inserting a 100K resistor across the antenna terminals of current models (conical, etc.) permits a basis for determining antenna function, since they are open circuits. Performing normally, the antenna should read 100K when a 100K resistor bridges the terminals. A break in the line is indicated by an infinity reading.

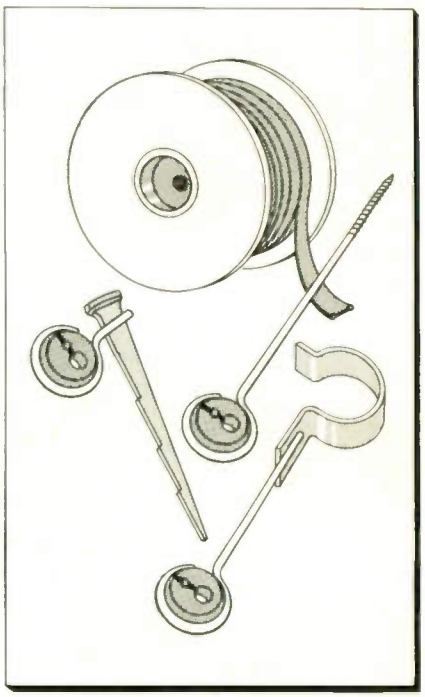


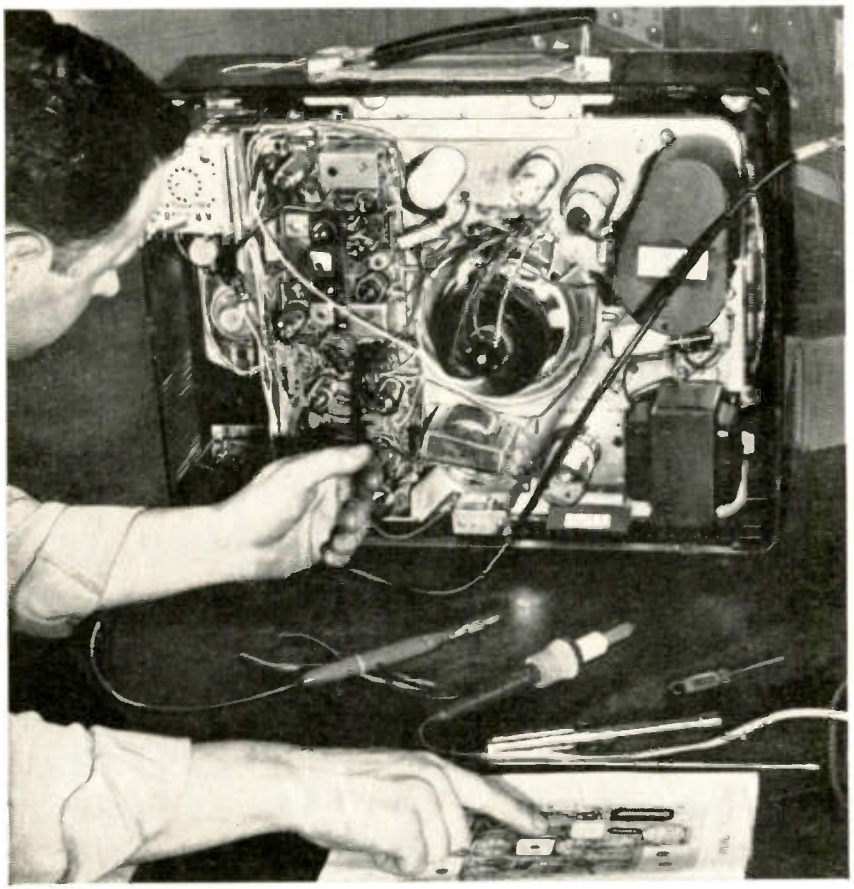
Fig. 9—"Pole" and "screw eye" standoffs are commonly used for lead-in securing.

Lead Connections

Attaching 300 ohm twin lead using the following method, will increase the strength of the connection. Cut the lead through the center about four inches long. Expose about three-fourths inch of wire on each strip. Connect one lead to each terminal. Through the center of this "Y" shaped figure, bring the wire over the terminal bar and make one complete cycle. Tape this loop to the bar and your antenna connection is now very strong. Wind will not play havoc with this connection.

To eliminate the possibility of

RCA VICTOR "Road Maps" make servicing easier!



"Road Map" technique assigns letters and numbers to each component, traces circuits for instant location. Just service one, to see what a time-saver it is.

To help servicemen locate components, trace wiring circuits, every set has a "Road Map" right on the face of the board

RCA Victor has proved, through more than 20 million actual-use tests, that Security Sealed Circuitry results in less "down time" for TV sets when repairs are required. And these copper-bonded, double-soldered circuits have advanced in quality to such a degree that in a recent 6-months survey of over 1,000,000 service calls, *less than 3 out of 10,000* required replacement of the panel itself.

RCA Security Sealed Circuitry is one of the reasons why you can make repairs more quickly and put RCA Victor TV sets back into operation in minimum time . . . one reason why RCA Victor has sold more television sets than any other manufacturer.

The Most Trusted Name in Television

RADIO CORPORATION OF AMERICA

standing waves, as the lead-in is secured along the mast and on its run to the set, take a half twist in the wire as it is run off. This continuous change of direction causes 180 degree out-of-phase standing waves and they cancel each other.

After mast, antenna and wire are fastened, make your antenna lead run as direct as possible. Avoid right angle changes of direction, as this is a haven for standing waves and antenna gain would noticeably decrease.

After completion of the installation, if one channel does not perform up to par, different means of trapping could be employed.

A four inch piece of aluminum foil, wrapped around the lead wire at the set, and slowly slid along the line, will pass a place where signal strength will increase. At this point, secure the foil. You've made a wave trap at minute cost. Where interference or signal strength needs additional compensation, use one of the standard traps available at your local distributor.

Positioning the antenna in a multi-dwelling area is quite simple, as shown in Fig. 8. As a start, refer to existing antenna installations for proper direction. Don't start an installation on a roof away from the chosen section of your predecessors. The area left clear might be a ghost trap. True, the lead length should be made as short as possible, but if the intended site has no antennas mounted, be wary. Your lead may be longer, but the finished product will have no undesirable by-product. Then orient for best performance.

No reference has been made to "pole or screw eye" stand-offs as shown in Fig. 9. Naturally, the installation team will secure the lead-in wire to the mast using pole stand-offs. A method to tie down the lead on its run to the set is accomplished by screw eyes or Odegaard nails.

Lightning arrestors should always be included in any TV installation. They are generally built into currently sold antenna array. Should none exist, it is advisable to insert one in the line as a precaution.

Many prospective customers also own hi-fi-tuners. It may pay-off to suggest installing an FM antenna on the mast you are mounting. We all know a two set coupler could be utilized, allowing the TV antenna to act as both sources of signal. How-

For more data, circle 6-73-1 on coupon, p. 49 ➤

NEW! WINEGARD BOOSTER COUPLER WBC4

Operates 1 to 4 TV Sets and delivers more signal power. Amplifies all channels 2-13 plus FM.

More features, more power, easiest to install

• For operating one set, WBC4 delivers up to 12.5 DB gain all channels, operates 2, 3, or 4 sets with up to 6 DB gain for each set • Powerful frame grid ECC88 tube, shielded and protected (trans-conductance 12,500 micromhos) • Ultra low noise figure • High quality steel housing with baked enamel finish • Compact, only 4¼"x3½"x2½" • Mounts anywhere, behind TV set, in attic, on baseboard • Quick disconnect plug for antenna lead-in • No-strip lead-in terminals • On-off switch • Cord and plug for 117 volt—60 cycle power supply.

Now with one compact package of power, you can install one to four TV sets and get sharper, clearer TV reception even in fringe areas. Ordinary couplers reduce signal going to the set, but the Winegard WBC4 gives the signal power boost you need for perfect television. Installs quickly, easily—4 no-strip terminals, for 4 TV sets, 2 on each side.

$27.50 LIST

FREE! SPECIAL INTRODUCTORY OFFER
For a limited time only, Winegard is including a Solid Brass Wall Plate and plug free with each WBC4 Booster Coupler. $3.50 value FREE!

Winegard ANTENNA SYSTEMS
THE WINEGARD COMPANY • BURLINGTON, IOWA
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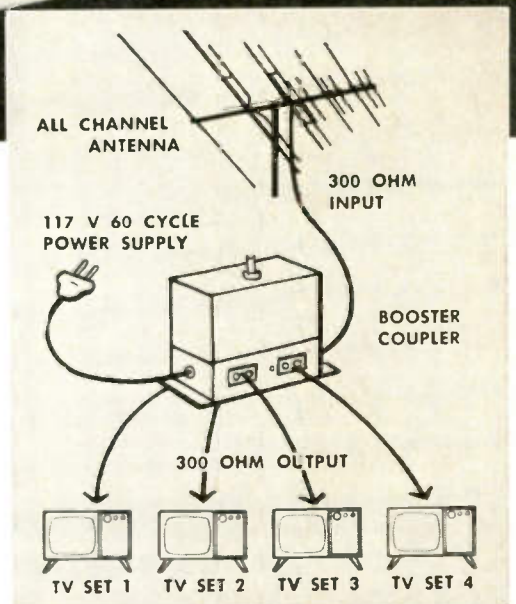
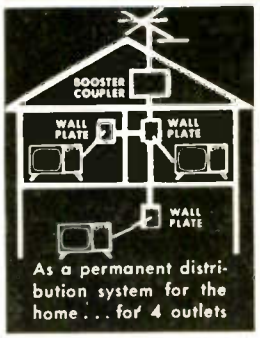
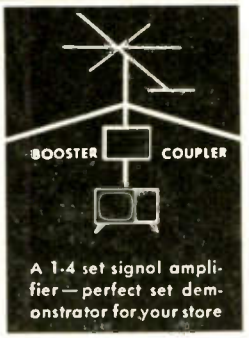




As a permanent distribution system for the home . . . for 4 outlets



A 1-4 set signal amplifier—perfect set demonstrator for your store

ever, today's customer is sufficiently versed in FM reception principles to understand that a separate antenna will produce the best set performance. A substantial increase in business may result due to customer approval of a "combination" installation price.

Speaking of customer approval, always remember, the customer is the one that will observe the reception resulting from your installation. Should one channel or more warrant improvement, allow *him* to choose which channel(s) he is willing to sacrifice. The customer's positive O.K. should be received before leaving every installation job. Rehashes cut deep into profits. •

Transistor Portables

(*Continued from page 32*)

current drain in their service data. Appreciably higher than normal current drain will indicate some fault in the receiver.

Individual transistor current drain can easily be made as illustrated in Fig. 3B. Again the type of transistor and its individual circuit configuration and application, will determine the amount of current being drawn. It will normally vary between 500 microamperes and 2 milliamperes, under no signal input conditions.

Signal tracing is a natural for troubleshooting transistor receivers. Signal tracing with a signal generator or self-contained pen-type oscillator is the most practical way of isolating a defective stage. (See Fig. 4.) To obtain an indication of the gain of various stages a signal can be injected successively to each stage and measured with an a-c voltmeter connected across the speaker leads.

Referring to the receiver schematic, for example, the signal generator probe is touched first to point A, using a low level input signal. If audio output voltage exists, touching the probe to point B (with volume control turned up) should produce more audio output. As the probe is successively touched to points C, D, E and F, the output voltage should rise.

When a conventional signal generator is used for circuit tracing, or for i-f alignment, its output should be adjusted to the lowest practical level, and the ground lead connected to the ground bus of the receiver. The "hot" signal generator output lead may then be connected through a 100,000-ohm or higher value resistor to points C through F. Obviously, the signal generator should be tuned to the receiver's i-f for points C, D and E, and to a point in the broadcast band, to which the receiver is tuned, when feeding a signal to point F.

It is usually impractical to remove transistors for testing. The signal tracing technique may be used for locating defective transistors. However, if you have an in-circuit transistor checker, you can test transistors without removing them from the set. Disconnect the receiver batteries and connect each transistor, one-at-a-time, to the checker's test leads. If the transistor is OK it will oscillate as indicated by the neon lamp on the checker.

The technician frequently finds it somewhat difficult to identify tran-

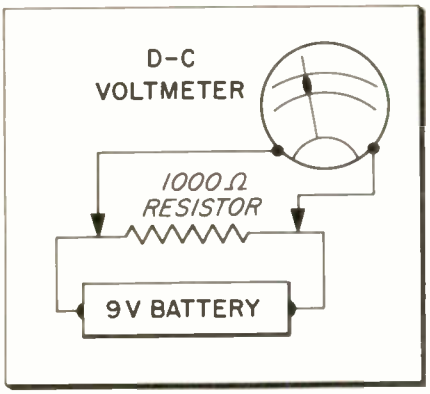


Fig. 8—Batteries can be tested under "load conditions" by shunting a resistor across it. The resistor's value approximates 100 ohms for every volt of the battery's rating.

sistor types and element contacts. Transistor circuit symbols and lead contact configurations for some popular transistor types are in Fig. 5.

When necessary to replace parts or transistors, great care should be exercised to avoid damaging transistors by application of excessive heat from a soldering iron. Heat should be applied to soldered joints only for the minimum practical time. Use a pair of long nose pliers to hold the lead (on the transistor side of the connection) so that the pliers will absorb some of the heat. It is important that the jaws of the pliers be clean so that good thermal contact is made with the lead.

Other Precautions

During winter, when static discharges are apt to occur, care should be taken to neutralize static charges before touching the transistor input circuits. Touch a grounded object first to make sure you are not charged to a high potential. Otherwise, you might damage a transistor when you probe within the receiver. This has happened. A technician walking over a carpeted floor touched the base lead of a transistor. The ensuing spark discharge destroyed the transistor.

It has been found that some pocket-size transistor receivers do not work well after being carried in a pocket close to a person's body during hot weather. After being allowed to dry out and cool off in an air conditioned room, normal performance was restored.

The sensitivity of most transistor portables is excellent, notwithstanding the small size of the built-in ferrite antenna. However, reception inside a shielded building or at considerable distances from broadcasting stations, may be inadequate.

Where it is feasible, an external antenna will frequently give an amazing increase in signal strength. It is not necessary to connect the antenna directly to the receiver. It can be coupled to the receiver with a few turns of wire. A ground is sometime helpful. The antenna may be a conventional outdoor antenna or a 10-foot or longer piece of insulated wire. One end of the wire, or the antenna lead-in, is wrapped around the set near the location of its built-in ferrite antenna. Two or three turns will suffice. The open end of the wire is connected to ground to form a complete circuit. Thus, by inductive coupling, the signal picked up by the wire or antenna is fed to the receiver. See Fig. 6.

When it is not convenient to install this kind of antenna for the customer, placing the set adjacent to a telephone cord often brings a big

boost in reception.

Many transistor receivers are susceptible to interference caused by fluorescent lights, even more so than sets that are connected to the a-c line. This kind of trouble can be corrected by grounding the lighting fixture or installing appropriate filters. It can often be alleviated by turning the receiver so that its built-in antenna is oriented so as to pick up a minimum of noise from the lighting fixture.

Batteries

In the shop, transistor portables can be checked using a rectifier power supply in lieu of batteries as a power source (see Fig. 7). This permits extended operation of the set without using up the customer's batteries. It also enables the technician to check receiver performance at reduced and higher-than-normal input voltages to get a relative measure of receiver function. A typical pocket-size portable, which uses a 9-volt battery, may function with 4 volts input though it operates much better with 9 volts input. However, a set that won't budge at 50% of rated voltage may have ailing transistors or other faults which should be checked out.

Since transistor portables consume very little current, there is little excuse for not replacing batteries when they deliver less than adequate voltage. Dry cells and dry batteries can be checked with a d-c voltmeter under open-circuit conditions. The voltage should not be below 1.45 volts per cell. In the case of a 9-volt battery, which consists of six 1.5-volt cells, the output voltage should be at least 8.7 volts. When a battery tests bad under no load it can be assumed, without doubt, it is defective. If it checks good, however, it can *still* be bad. More meaningful tests can be made by measuring battery voltage under load. The load may be a resistor whose value is approximately 100 ohms for each volt of battery rating. To test a 9-volt battery, shunt a 1000-ohm resistor across it, as in Fig. 8, and measure the voltage across the resistor. If the reading is less than 6 volts, the battery should be replaced. Underload battery testers are frequently incorporated in tube-tester/multimeter combinations. They are also available as separate checkers. •

Cornell-Dubilier SILICON RECTIFIERS

Two new lines of silicon rectifiers for medium power applications are announced. One, up to a maximum of 6 amperes; the other up to 12 amperes. Both available in ½" hex ceramic insulated or 7/16" hex styles in eight PIV ratings from 50-600 volts. Cornell-Dubilier Electric Corp., Semiconductor Div., Norwood, Mass.

For more data, circle 6-76-2 on coupon, p. 49

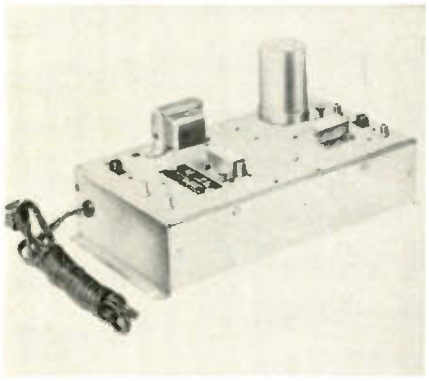
IRC POWER RESISTORS

Twenty-two types of resisteg coated PWW power resistors, which need no derating, are announced. Resisteg is an exclusive IRC coating, cured at temperatures below 250°C, more than 1,000°F cooler than required for other power resistor coatings. Resisteg coating is standard on all IRC tubular power resistors of both the fixed and adjustable types. International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa.

For more data, circle 6-76-3 on coupon, p. 49

Blonder-Tongue AMPLIFIERS

Announced are: model BT-3 all-transistor TV/FM amplifier. Claimed to achieve maximum gain, low noise, a new high in reliability, high output capability with low cross modulation and minimum operating costs. Gain, from 18 to 15 db on channels 2 to 6; 19 db

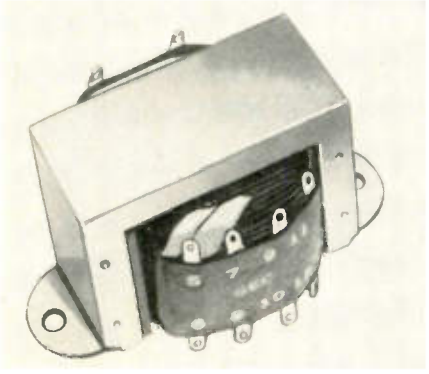


from channels 7 to 13 and 15 to 9 db from 88-108mc. $99.50. Also, not shown, model CB single-channel, antenna-mounted TV amplifier. $52.50. Model HAB all-channel TV/FM amplifier. $69.50. Blonder-Tongue Labs., 9-25 Alling St., Newark 2, N. J.

For more data, circle 6-77-2 on coupon, p. 49

Stancor OUTPUT TRANSFORMER

Multi-rate vertical deflection output transformer, part No. VO-109, is designed to provide a single unit that covers 54 different turns ratios for two-winding isolation type connections. An



equal number of turns ratios are available for connecting the VO-109 as an auto-transformer. It is expremely compact, measuring only 2"x3¼"x2" high. Chicago Standard Transformer Corp., 3501 Addison St., Chicago 18, Ill.

For more data, circle 6-77-3 on coupon, p. 49

Autenna Industries ANTENNAS

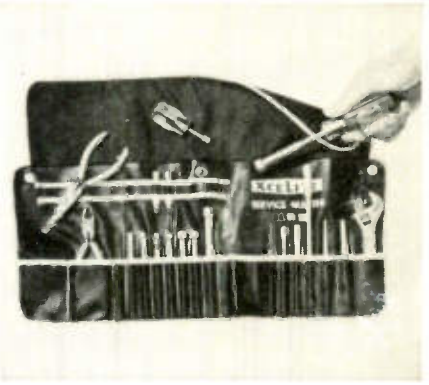
Twelve different auto antennas and three replacement masts are announced as the first in the new Titan line. Two series, the Thrifty 2000 and the Thrifty 4000, are included. The Thrifty 4000 antennas feature completely flexible masts with "magic spring" construction. Features include triple chrome plating, seamless brass tube mast sections and waterproofed coaxial cables. Individually clear-skin packaged on colorful display cards. Autenna Industries, 3455 Vega Ave., Cleveland 13, Ohio

For more data, circle 6-77-4 on coupon, p. 49

Xcelite TOOL KIT

Model 99SM, a 23-piece Service Master kit, provides every tool required by technicians on 99% of their calls. It contains 2 shockproof plastic handles each with a patented spring device that holds 12 snap-in nutdrivers, 3 screwdrivers, 2 reamers, and a 7" extension blade firmly in place. Also long nose and diagonal pliers and an adjustable 6" thin-pattern wrench. Regular 4" handle and 2" Stubby included. High carbon steel shafts, chrome finish. Plastic-coated canvas case. Weight, 2-¾ lbs. Xcelite, Inc., Orchard Park, N. Y.

For more data, circle 6-77-5 on coupon, p. 49



Association News

(Continued from page 67)

justly accused, can also clear himself through board actions. . . . We hope to get our law completely state-wide in the next legislative session. . . ."

Michigan

License Bill Defeated

TSA, Detroit, reports that a combination of time, taxes and politics caused the defeat of Michigan's TV licensing bill. It was said that neither political party would make a stand for the bill, allowing it to be pigeonholed at deadline time. Service dealers expressed the opinion that another attempt will be made to pass the bill next year.

Missouri

TESA, St. Louis, elected the following officers: Pres., Ken Jean; V.P., R. B. Johnson; Sec'y-Treas., Wilford Stone; Sgt.-at-Arms, C. R. Peterson. Gene Hoss was elected NATESA delegate.

Pennsylvania

ESDA, Harrisburg, presented a plaque award to Howard A. Reed, publisher of ELECTRONIC TECHNICIAN Magazine for "outstanding courage and efforts in behalf of all independent Service Dealers in the country." Previous to this award by ESDA of West Pennsylvania, The Federation of Pennsylvania had honored Mr. Reed with the Annual FRTSAP plaque for 1960. The association reported that licensing is now in full operation in the Pittsburgh. Allentown and Harrisburg areas. Each community reports a boon to their business and ethics and the public indicates a respect for service technicians similar to that of other licensed trades.

Tax Law Explained

TSADV, Philadelphia, at a recent meeting the head of the legal department of the Pennsylvania tax office, explained pertinent points of the state's tax laws. Discussion included registration of business for collecting taxes on material and labor, and illustrated failure to do so is punishable by law. It was also pointed out that the law is being broken every day by collection of taxes at the wholesale level. Association members instituted a "selective buying" program with many cooperating distributors. A large number of these wholesale distributors joined TSADV members at their annual "Night of Fun" banquet at the CR Club in Philadelphia.

New Books

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

***INTERNATIONAL ELECTRONIC TUBE HANDBOOK.** *Published by De Muiderkring N.V. 402 pages, vinyl cover. $4.00.*

An unusual format is used by this American-Foreign tube manual: diodes, triodes, etc., are numerically grouped by different color bands. If you want diode information, for example, just flip to the pages with orange trim. Another feature of the manual is the manner in which tube voltages and amperages are listed. A schematic drawing of the specific tube socket with a commonly used circuit stage is illustrated, with volt/amp values listed right next to the pin number. Therefore, it's not necessary to constantly shift your line of sight from base diagram to listings in order to obtain desired information. There is an index of tube listings at the conclusion of the manual. The preface, explaining how to use the manual, is written in ten languages. As far as the rest of the manual's contents is concerned—electronics is the same the world over.

***MAGNETIC AND ELECTRICAL FUNDAMENTALS.** *By Alexander Efron. Published by John F. Rider Publisher, Inc. 132 pages, soft cover. $2.50.*

A clear cut explanation of magnetics, with minimum use of mathematics, is presented. Subjects include magnetism, electrostatics, electromagnetism, charge displacement, electrical circuits and instruments. The format follows the same instructional pattern as is found in other volumes of the Basic Science series.

***TV SERVICING SHORT CUTS.** *By Milton S. Kiver. Published by Howard W. Sams & Co., Inc. 104 pages, soft cover. $1.50.*

Over 65 individual TV repair case histories are presented in this revised, updated edition. The methods used to track down the defects, based on the various symptoms encountered, can enlarge the reader's practical service background. Illustrations aid the text when needed.

1960 RADIO AMATEUR'S HANDBOOK. *Prepared and published by the American Radio Relay League, West Hartford 7, Connecticut. 728 pages, soft cover. $3.50 in the U.S.; $4.00 in U.S. possessions, and Canada; $4.50 elsewhere.*

This technical Bible of ham radio contains a wealth of data of interest to any electronic specialist. There are over 1300 illustrations, 500 tube base diagrams, many construction articles and a most lucid explanation of electrical and electronic functions. The theory of radio communications has been brought up to date, as has the chapter on tube charts.

***RADIO CONTROL FOR MODEL BUILDERS.** *By William Winter. Published by John F. Rider Publisher, Inc. 228 pages, soft cover. $4.25.*

The text of this book is a utopia for the "radio control" plane, car and boat model hobbyist. Chapters on transmitters, receivers, actuators, installation, etc., are fully covered. FCC regulations and requirements are discussed. Most popular control systems are explained—from the simplest single channel equipment that operates a steering device—to advanced equipment that simultaneously operates multiple controls. Written for the hobbyist, the technical data is watered down so the layman can grasp electronic principles.

***SERVICING TV VIDEO SYSTEMS.** *By Jesse E. Dines. Published by Howard W. Sams & Co., Inc. 224 pages, soft cover. $3.95.*

The video section of a TV receiver—from the i-f stage to the CRT—is thoroughly explored by the author. Video fundamentals, circuit variations and alignment is covered in the first half of the book. The latter half examines video stages from a servicing viewpoint. Typical topics include: Test-Pattern Analysis, Troubleshooting Methods, Isolating Trouble To Video Or Sync Section. These topics are followed by inspecting various trouble symptoms common to specific video stages, including CRT defects. The last chapter covers often-needed service hints. Numerous illustrations enhance this worthwhile book.

***TRANSISTOR PROJECTS.** *Compiled and published by Gernsback Library, Inc. 160 pages. soft cover. $2.90.*

This book is a compilation of magazine articles illustrating how to build various transistorized equipment. Prefaced by a discussion of transistor theory, 3 sections of transistor applications follow. Sections are assembled by project applications, as follows: Transistor Radios, Instruments and Accessories, Miscellaneous Transistor Projects. Parts lists accompany each project, as do pertinent illustrations. Recommended if you intend to put together your own gear.

THE PHYSICS OF TELEVISION. *By Donald G. Fink and David M. Lutyens. Published by Doubleday & Co. 160 pages, soft cover. $0.95.*

This volume, Series 8 of a science study series, concerns itself with the application of physics principles to light, electricity, TV transmission, reception and color TV. The book is written in a clear, simple manner, obviously intending to appeal to a large cross-section of the general public, rather than to the electronically-sophisticated individual. Nonetheless, the book does present a fresh account of how electrons are controlled to produce a TV picture and is sufficiently interesting to appeal to technicians.

ROBINS INDUSTRIES appoints I. R. Stern as S. Calif. rep.

CBS ELECTRONICS names Ira Molay product manager for audio components.

DUOTONE publishes a booklet on how to buy a diamond needle.

JENSEN INDUSTRIES appoints Edward Crowley asst. to the president.

FIDELITONE'S April-July needle promotion offers a booklet of prizes with various assortments. Prizes are given before the promotion.

AUDIO EMPIRE announces Model 108 moving magnet stereo cartridge @$34.50 with 0.7 mil diamond. Specs are 15-20,000 cps ±2 db, output 8 mv/channel, separation 25 db, V & H compliance 6, tracking 1.5-5 grams.

FEDERATED INDUSTRIES, Chicago producer of electronic games, is entering the replacement speaker business. VP Russ Gawne states the line will include the Crescent replacement series and Falcon hi-fi speakers.

STROMBERG-CARLSON names William W. Hessler as hi-fi district sales manager in Northern Calif. and Western Nev. Frederick W. Reynolds has been appointed NYC district manager for hi-fi. Also, advanced Richard W. Jones to asst. sales manager for consumer products.

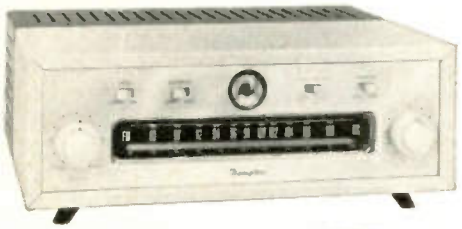
ELECTRO-VOICE announces battery-operated underwater voice communication system, the "Scubacom," @$210.00. Range up to 150 ft., response 500-2500 cps, weight 10 lbs. and appoints Brothers and Conneen Associates as eastern reps. Dave Brothers will cover Md., Va. & D.C. George Conneen will serve the area of Del., southern N.J. & E. Penna.

INDEX TO ADVERTISERS
June, 1960

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

For more data, circle 6-81-1 on coupon, p. 49

Shell *keeps on growing!*



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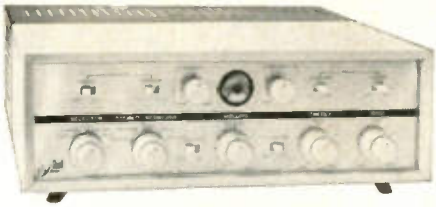

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5

(1) HAMPTON FM TUNER

Sensitivity: 1.5 microvolts for 20 db quieting, Freq. Resp: 20 to 20,000 cycles ±1db, Distortion: less than 1%, IF Bandwidth: 270kc at 6db down, Hum Level: 70db below 1 volt output, Outputs: dual (2) cathode follower (1) FM multiplex, AFC Pull In: 200kc ±15kc, 1 volt at detector, Drift: zero with AFC on.

audiophile net $79.95

(2) CB-12 CITIZEN BAND

Power input 5 watts to class C RF amplifier, Ocillator: plug in 3Rd. overtone crystal .005% accuracy, AM plate modulation with automatic limiting for less than 100% mod. High impedance input microphone, Super regen receiver with RF amplifier, Sensitivity: 1 microvolt useable signal, Tuning range 26.965MC to 27.255MC, Audio output 2 watts.

dealer net $79.95

(3) DUAL 20 WATT AMPLIFIER

Power output 40 watts (20 watts each), Peak 80 watts, Binaural 2 volts rms, 4 volts combined, Tape (recorder outputs) 2 volts each, Distortion less than 2%, Freq. Resp. ±1db 30 to 20,000 cps @ rated output, Inputs: tape head, mag., phono, ceramic phono, tuner, auxiliary, Tone balance signal.

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(4) DUAL 30 WATT AMPLIFIER

Power output 60 watts (30 watts each), Peak 120 watts, Binaural 2 volts rms, 4 volts combined, Tape (recorder outputs) 2 volts each, Distortion less than 2%, Freq. Resp. ±1db 30 to 20,000 cps @ rated output, Inputs: tape head, mag. phono, ceramic phono, tuner, auxiliary, Tone balance signal.

(5) AM-FM STEREO TUNER

Sensitivity: FM 1.2 microvolts for 20db quieting, AM 3 microvolts for 20db S/N Ratio, Freq. Resp. FM 20 to 20,000 cycles ±1db, AM 20 to 5.kc ±1db, Hum Level: FM-AM —70db below 1 volt output, 7 Outputs: FM 2 dual cathode followers, 1 Multiplex, AM 2 dual cathode followers, AM FM 2 monaural, Automatic frequency control, Drift: FM zero with AFC on, AM negligible.

(6) 102 TUBE TESTER

Vibrator tester-checks 6 and 12 volt vibrators, Engineered to accommodate new tube types, Lists and checks more tubes than any other self-service tube tester, 102 sockets, Easy-to-operate 1 knob control. Tumble lock compartment stores over 400 tubes, Complete emission tester, Checks each section of multi-purpose tubes.

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(7) S-18 TUBE TESTER

Tests each side of multi-purpose tubes, Tests 6 and 12 volt vibrators, Emission tests all tubes, Uses just 18 sockets, New sockets conform to MIL spec. assures positive contacts and longer wear. Tests more than 800 tube types, Foolproof test meter, Holds 400 tubes in sliding shelves, 110-120 volt AC.

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(8) TM-18 TUBE TESTER

Same panel and performing qualities as the S-18. Perfect for counter use in service shop. Available with legs as L-18. dealer net $91.85

(9) V-18 PORTABLE

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(10) TC-18 CADI-TESTER

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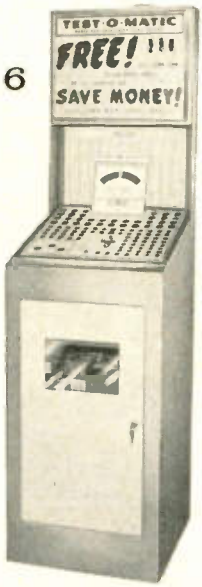
6



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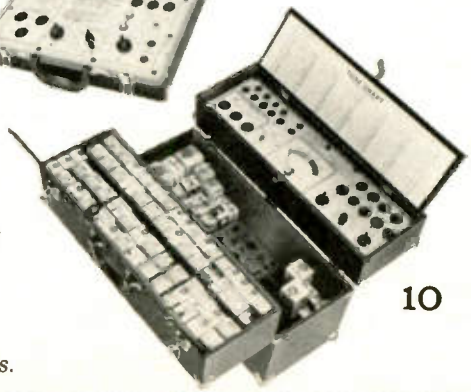
the most diversified line of tube testing equipment on the market.

write for complete information on these and other units.

9



10

For more data, circle 6-82-1 on coupon, p. 49

FREE LITERATURE SERVICE

ADVERTISERS IN THIS ISSUE

6-119-1. ACME ELECTRIC CORP.—
DC Power Supply Instrument for transistor and circuit testing. Bulletin 17-BL01 available.

6-113-1. AEROVOX CORP.—
Carbofilm Resistors and Carbomold Resistors encapsulated in moisture and heat resistant plastic.

6-115-1. BARRY ELECTRONICS CORP.—
Laboratory Test Equipment.

6-117-1. DUMONT LABORATORIES INC., ALLEN B.—
Cathode-ray Tubes and Multiplier Phototubes and accessories. List of distributors available.

6-88-1. ELECTRO PRODUCTS LABORATORIES—
New transistorized regulated DC Power Supply, Model PS-3.

6-90-1. ERIE RESISTOR CORP.—
Erie, Corning and Grigsby electronic components and listing of distributors.

6-86-1. HEWLETT-PACKARD CO.—
Precision 200 KC Oscilloscope with dual trace presentation, new model 122A.

6-120-1. TUNG-SOL ELECTRIC INC.—
"Tung-Sol Tips"—free publication for industrial servicemen.

In order to make it easier for our subscribers to get more information on advertisements and new product items, Industrial Electronic Maintenance offers this free reader inquiry service. Manufacturers are eager to provide interested readers with informative literature on their products. You may inquire for any electronic items discussed in Industrial Electronic Maintenance this month merely by using the postage-free postal card below. Each item in IEM has been assigned an inquiry number. Merely circle the number on the card and return it to us no later than July 20, 1960. We will process your inquiry promptly, and the manufacturer will send you his literature shortly after receiving your name from us.

Note: Code 6-122-7 means June issue, page 122, 7th item on page.

TEAR OUT

THIS CARD MUST BE MAILED NO LATER THAN JULY 20, 1960

Please send me literature of companies whose code number I have circled below (includes editorial and advertised items):

6-86-1	6-112-6	6-112-16	6-113-8	6-115-3	6-118-2
6-88-1	6-112-7	6-112-17	6-113-9	6-116-1	6-118-3
6-90-1	6-112-8	6-112-18	6-113-10	6-116-2	6-118-4
6-106-1	6-112-9	6-113-1	6-113-11	6-116-3	6-118-5
6-109-1	6-112-10	6-113-2	6-113-12	6-116-4	6-118-6
6-112-1	6-112-11	6-113-3	6-113-13	6-116-5	6-119-1
6-112-2	6-112-12	6-113-4	6-113-14	6-116-6	6-119-2
6-112-3	6-112-13	6-113-5	6-113-15	6-116-7	6-120-1
6-112-4	6-112-14	6-113-6	6-115-1	6-117-1	
6-112-5	6-112-15	6-113-7	6-115-2	6-118-1	

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I personally maintain, operate, or install industrial electronic equipment . . .
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In addition to publishing articles by professional technical writers, INDUSTRIAL ELECTRONIC MAINTENANCE will continue to carry many articles written by practicing technicians, service managers, engineers and other electronic specialists in industry.

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If you are well acquainted with the practical technical details of operating and maintaining electronic gear, and can clearly state the test techniques and maintenance procedures required for any electronic equipment used in the industry, tell the editor of IEM about it. He'll guide you in the preparation of the article. Write to:

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WHAT'S AHEAD IN IEM

•

Forthcoming issues of

INDUSTRIAL ELECTRONIC MAINTENANCE

will cover a wide variety of electronic products and informative subjects. In addition to case history Field Reports on how different factories are using and maintaining electronic equipment, articles such as the following will appear in IEM during the next few months:

Plant Engineering Techniques
Controls for Automation
Laboratory Measurements
Maintaining Closed-Circuit TV
Troubleshooting Visual Indicators
Setting Up A Plant Intercom System
Digital Recording Techniques
Installing & Servicing Control Timers
Adjusting 2-Way Radios
Setting Up An Industrial Lab
Magnetic Amplifier Applications
Get More Practical Use Out of Your Meters
Maintaining Marine Electronic Devices
Working with Metallic Rectifiers
Q-Meter Test Techniques
Servicing Motor Controls
Tackling Electronic Switches
Industrial Electronic Case Histories
. . . and many, many more

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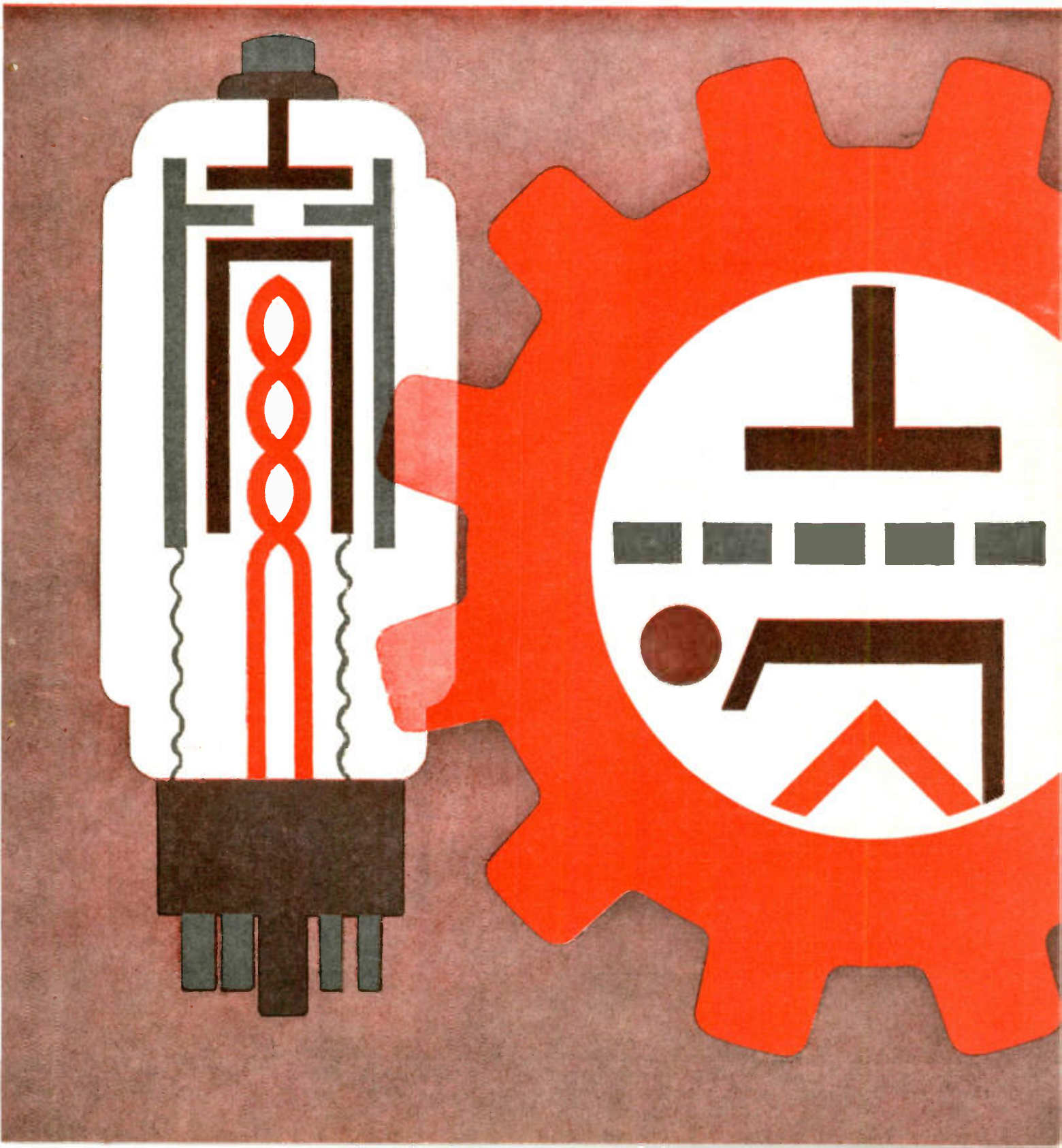
The Technical Publication of Installation, Operation & Repair



AT LAST!
A Precision 200 KC Scope with Dual Trace Presentation!

NEW MODEL 122A

Here at last is a 200 KC oscilloscope—priced at just $625—giving you "big-scope" versatility and the time-saving convenience of simultaneous two-phenomena presentation.

Engineered to speed industrial, mechanical, medical and geophysical measurements in the 200 KC range, the new hp 122A has two identical vertical amplifiers and a vertical function selector.

The amplifiers may be operated independently, differentially on all ranges, alternately on successive sweeps, or chopped at a 40 KC rate.

Other significant features include universal optimum automatic triggering, high maximum sensitivity of 10 mv/cm, 15 calibrated sweeps with vernier, sweep accuracy of ±5% and a "times-5" expansion giving maximum speed of 1 μsec/cm on the 5 μsec/cm range. Trace normally runs free, syncing automatically on 0.5 cm vertical deflection, but a knob adjustment eliminates free-run and sets trigger level as desired between −10 and +10 volts. Rack or cabinet mount; *rack mount model only 7" high.*

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BRIEF SPECIFICATIONS hp 122A

Sweep: 15 calibrated sweeps, 1-2-5 sequence, 5 μsec/cm to 0.2 sec/cm, accuracy ±5%. "Times-5" expander, all ranges. Vernier extends 0.2 sec/cm range to 0.5 sec/cm.

Trigger selector: Internal + or −, external or line. Triggers automatically on 0.5 cm internal or 2.5 v peak external. Displays base line in absence of signal. Trigger level selection −10 to +10 v available when automatic trigger defeated.

Vertical Amplifiers: Identical A and B amplifiers, 4 calibrated sensitivities of 10 mv/cm, 100 mv/cm, 1 v/cm and 10 v/cm; ±5% accuracy. Vernier 10 to 1. Balanced (differential) input available on all input ranges. With dual trace, balanced input on 10 mv/cm range. Input impedance 1 megahm with less than 60 μμf shunt. Bandwidth DC to 200 KC or 2 cps to 200 KC when AC coupled. Internal amplitude calibrator provided.

Function Selector: A only, B only, B-A, Alternate and Chopped (at approx. 40 KC).

Horizontal Amplifier: 3 calibrated sensitivities, 0.1 v/cm, 1 v/cm, 10 v/cm. Accuracy ±5%. Vernier 10 to 1.

Bandwidth DC to 200 KC or 2 cps to 200 KC, AC coupled.

General: 5AQP1 CRT, intensity madulatian terminals at rear, power input approximately 150 watts, all DC power supplies regulated.

Price: (Cabinet or rack mount) $625.00.

Data subject to change without notice. Prices f.o.b. factory.

hp now offers 8 different precision scopes

For more data, circle 6-86-1 on card, p. 83

INDUSTRIAL ELECTRONIC® MAINTENANCE

The Technical Publication of Installation, Operation & Repair

June, 1960

FEATURES and ARTICLES

DEPARTMENTS

ALBERT J. FORMAN
Editor

HOWARD A. REED
Publisher

480 Lexington Ave.
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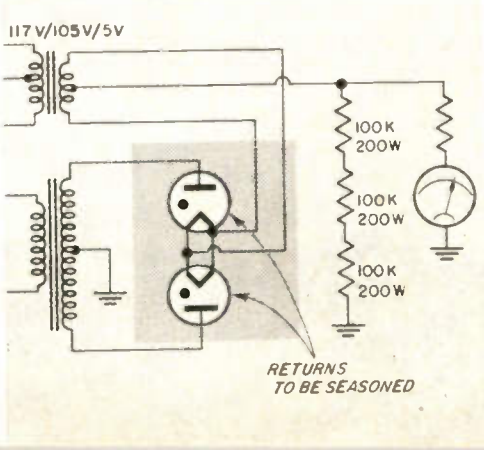
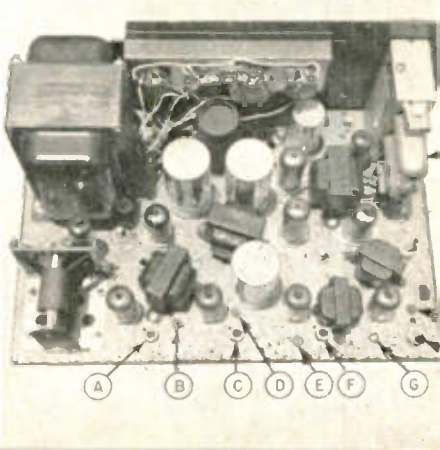
Vol. 1, No. 6

TEST INSTRUMENTS, primarily scopes, VTVM's & generators, help Baird-Atomic manufacture & repair their own transistor test equipment—see p. 110.

POWER RECTIFIER life can be extended, and equipment failure avoided, by observing seven simple operating precautions—see p. 104.



CLOSED-CIRCUIT TV sync multiplier and divider circuits can be kept accurately aligned with proper pot adjustments—see p. 98.



LETTERS
To the Editor

Radio-TV to Industrial

EDITOR, IEM:

Your INDUSTRIAL ELECTRONIC MAINTENANCE section in ELECTRONIC TECHNICIAN shows a realistic understanding of present day needs. Since last August, I have been in charge of maintenance of five large Reliance variable speed driven units and ILS electronic counters, among other duties. Previously, all my work and training had been on radio and TV repair and interpreting the related schematic diagrams. I had to learn to read and interpret straight line drawings and symbols in order to trouble-shoot the systems. If you could cover the above material pertaining to theory, operation, and adjustment as well as troubleshooting techniques in future editions, it would be very much appreciated. I am dropping my subscriptions to other electronic magazines in favor of yours, as it more thoroughly meets my present requirements.

ALVAN O. WHITEHEAD
Miami, Fla.

Attention Manufacturers

EDITOR, IEM:

In years past I have subscribed to many different electronic periodicals only to become dissatisfied with them after a few months have gone by. So far, I am very pleased with the INDUSTRIAL ELECTRONIC MAINTENANCE Edition of ELECTRONIC TECHNICIAN. The Reader Service is rather skimpy in regard to inquiries being answered, but that may be for reasons not apparent to me. The information I have received has been very useful and appreciated. Thanks again for a fine magazine, and keep up the good work.

STAN R. KOLMAN
Aviation Electronic Technician
United Air Lines
Los Angeles, Calif.

• All reader inquiries for manufacturers' literature and new product data are routed through us to the respective companies—most of whom fill requests promptly. The few laggards with "skimpy" response are missing the boat. —Ed.

Many Instruments

EDITOR, IEM:

Our company does research and development on missiles such as the "Titan." My specialty is in communications, microwave, and noise field intensity. We have many signal generators and frequency counters. As a matter of fact, I couldn't begin to list the large number of units we have, but every piece of equipment for industrial use is serviced and calibrated by my department.

WALTER A. SKOWRON,
Electronic Calibration Lab. Tech.
Martin-Denver
Denver, Colorado

Engineering Decline

EDITOR, IEM:

The article in your March "Commentary" on the report of the Engineering Manpower Commission shows the decline in enrollment in engineering courses. While not a new warning, it deserves serious consideration. Your suggestion for the use of the "near engineer" to free the pure engineer for research work is one of the solutions. It could also be tried by many other professions. Along this line, I want to add that classification of technicians and aides in different steps and through Government examinations and licensing, leading to a full Engineer's License, would be a very great incentive to these technicians in their studies and work. Requirements, instruction, and experience should be commensurable with or equivalent to professional standards.

Many good prospective students have to dismiss their aspirations of a college education in their need to go out to

make a living. If some practical way of continuing their studies without having to wait four or more years before starting to earn money were available, I believe there would be more people taking advantage of all educational opportunities.

JORGE L. GONZALEZ
Federal Aviation Agency
Tampa, Fla.

News of the Industry

CLAROSTAT announces a complete-line stocking program of the Greenohm V power resistors through their distributors.

ACTON LABS. has announced the promotion of DONALD W. WEBBER to Western Sales Mgr. and STANLEY C. SWANSON to Eastern Sales Mgr.

CHICAGO STANDARD has received an award for four years of "consistent production of high quality electronic products for the Armed Forces," from the U.S. Army Signal Supply Agency.

ALPHA WIRE announces the election of the following three corporate officers: HOWARD B. SALTZMAN, Executive Vice Pres.; JACK KIRSCHBAUM, Vice Pres.-Sales; and PHILIP FREIDIN, Treas.

DAYSTROM Weston Instrument Div. has announced the following appointments: ARTHUR J. L'HOMMEDIEU, Aircraft Instrument Sales Mgr.; JOHN G. MOREY, Sales Research & Development Coordinator; RICHARD L. CRAIG, Aircraft Section Mgr., Sales Engineering Dept.; JOSEPH C. FIEGE, Mgr. of Albany, N.Y. District Office; and A. R. WALTHERS, Buffalo District Mgr.

RAYTHEON Board of Directors has elected four new vice presidents as follows: STUART D. COWAN, Commercial Marketing and International Services; JOHN E. GAGNON, Industrial Relations; ROBERT L. MC CORMACK, Gen. Mgr. Industrial Components Div.; and DR. MARTIN SCHILLING, Government Programs & Planning. Machlett Labs. Div. will build an expandable 120,000 sq.ft. plant on a 100-acre site in Winsted, Conn. Commercial Marine Operation has named ROBERT E. ANSLOW Product Planning Mgr. The Distributor Products Div. has announced two first prizes of $500 U.S. Savings Bonds awarded in the "Treasure Hunt" contests to the following: WEIR KYLE of ZACK RADIO SUPPLY, and OSCAR MACKLES of RADIO ELECTRIC SERVICE CO.

(*Continued on page 117*)

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- ( ) Feed-Thru Ceramicons
- ( ) Ceramicon Trimmers
- ( ) Tubular Trimmers

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- ( ) *Strip Packages*
- ( ) *Suppressors*

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Capacitors
- ( ) CY Fixed Glass
- ( ) CYF Fixed Glass
- ( ) W-WL Fixed Glass
- ( ) Direct Traverse Trimmers
- ( ) Midget Rotary Trimmers

Resistors
- ( ) LPI Low Power
- ( ) C-42
- ( ) N-Type (non-insulated)
- ( ) N-Type (insulated)
- ( ) NF-Type
- ( ) S-Type
- ( ) ST-Type
- ( ) R-Type
- ( ) H-Type
- ( ) HP-Type

Inductors
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INDUSTRIAL ELECTRONIC MAINTENANCE

COMMENTARY

Installers Are Designers

We recall the old army story about the officer candidates who were asked how they would have a 50 foot pole erected. The uninitiated speculated on all forms of levers, winches, and block and tackle arrangements. The shrewdest lieutenant-to-be offered the solution by stating: "I would say, 'Sergeant, get that pole up!' "

All too often, the industrial electronic specialist in the factory receives the "get that pole up" order to fix up an arrangement to control, measure or protect a manufacturing function.

All it takes to polish this job off is some installation experience—and a goodly amount of information on the products available to perform the operation.

For example, suppose the division production manager wants an automatic count of all units coming off the assembly line. The responsibility falls on the industrial electronic/electrical specialist to figure out whether a mechanical, switch actuated, or photo-electric counter should be used.

So in effect, not only is the installer of the equipment putting the device into use physically—he is also designing the plant operating system in the process.

And it's a good thing this can be done, since it is impossible to mass produce conveyer systems, for example, which will answer the specific control and measuring needs of every individual company in every industry.

Radioactivity Department: Big Brother Is Monitoring

Industry is using an increasing amount of radio isotopes as tracers and function analyzers. At times, the instrument specialist becomes involved in this.

So be advised that cars and trucks crossing New York's George Washington Bridge are silently being checked to test a method for the control of illegal transport of radioactive materials.

The source of this information, Tracerlab, also notes that the A.E.C. will transfer the control of radio isotopes to the states when suitable legislation has been adopted. So far, California and New York are said to be the most advanced states in the enactment of such legislation.

Down On The Farm

Sprawling industrial complexes are not the only users of industrial electronic equipment. One of the nation's largest industries—agriculture—looks forward to more electronic applications.

According to Frederic C. Jacob of the University of California's agricultural engineering department, one commercial milking machine controller automatically registers the quantity of milk given by each cow, feeds the cows in proportion to milk delivered, and signals the operator when the milking is over. Other uses are color sorting of fruit, rapid egg inspection, computer directed planting and harvesting management, and soil condition instrumentation.

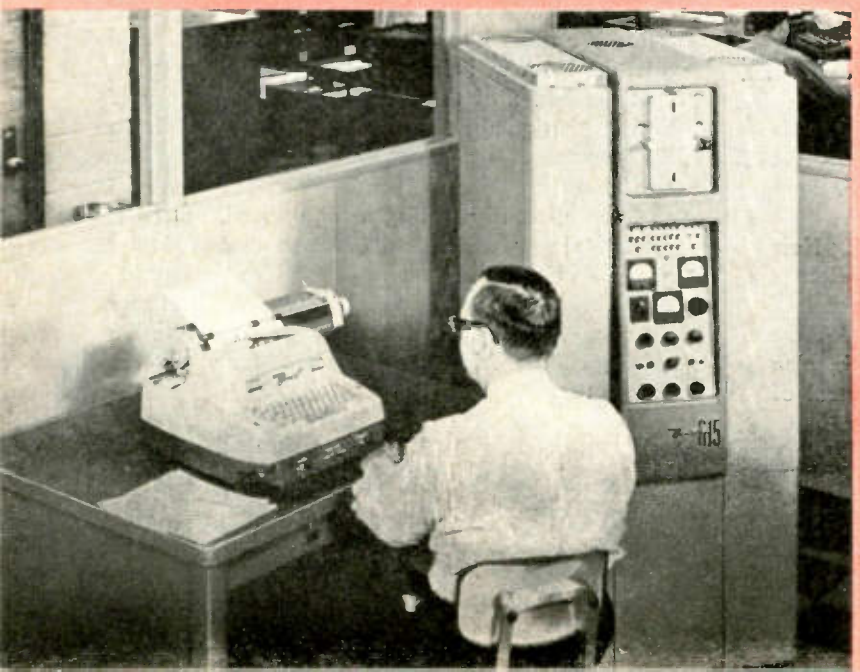
Avionics Report

The following statement by Federal Aviation Agency Administrator, E. R. Quesada, should be of interest to all readers who are interested in aviation:

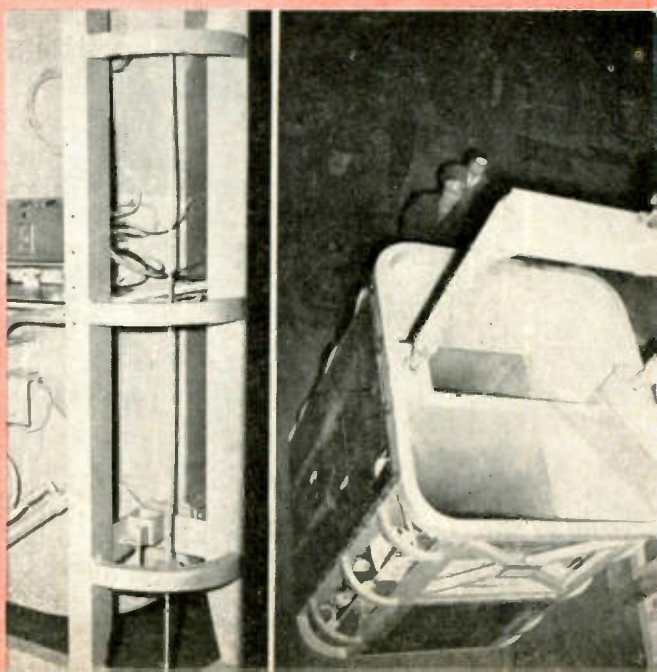
"As more and more aircraft are introduced into the system, the overcrowded air traffic control and air navigation frequency bands will reach saturation in high density areas. We do not foresee any significant increase in aviation's share of the spectrum. We must live with what we have and to do this, the FAA will do everything possible to insure that the bands of the spectrum allocated to aviation are assigned and used effectively . . . We are well aware of the fact that the communications bottleneck must be overcome. We have developed and are currently testing a high-speed, automatic ground-air-ground communication system known as AGACS. Within a two-minute roll call cycle, AGACS handles up to 500 two-way messages. These messages are contained within a single-frequency channel, as is presently used for voice communications."

Sealing technique adapted from optical manufacturing is said to increase electron tube reliability and life. Ward Watrous of the Chatham Electronics div. of Tung-Sol observes polyoptic tube being sealed in the bake oven. The tube is evacuated to 2 x 10^{-8} mm. and baked at 400° C. Then a graphite ring on the tube is heated to 950° C. for 15 seconds by induction heating from the r-f coil which crowns the tube.

A Bendix digital computer has been installed at National Broach and Machine Co. to aid in the design of gear shaving cutters, master gears, and broaching tools. The computer will substantially reduce the extended period of time which gear analysis usually requires.

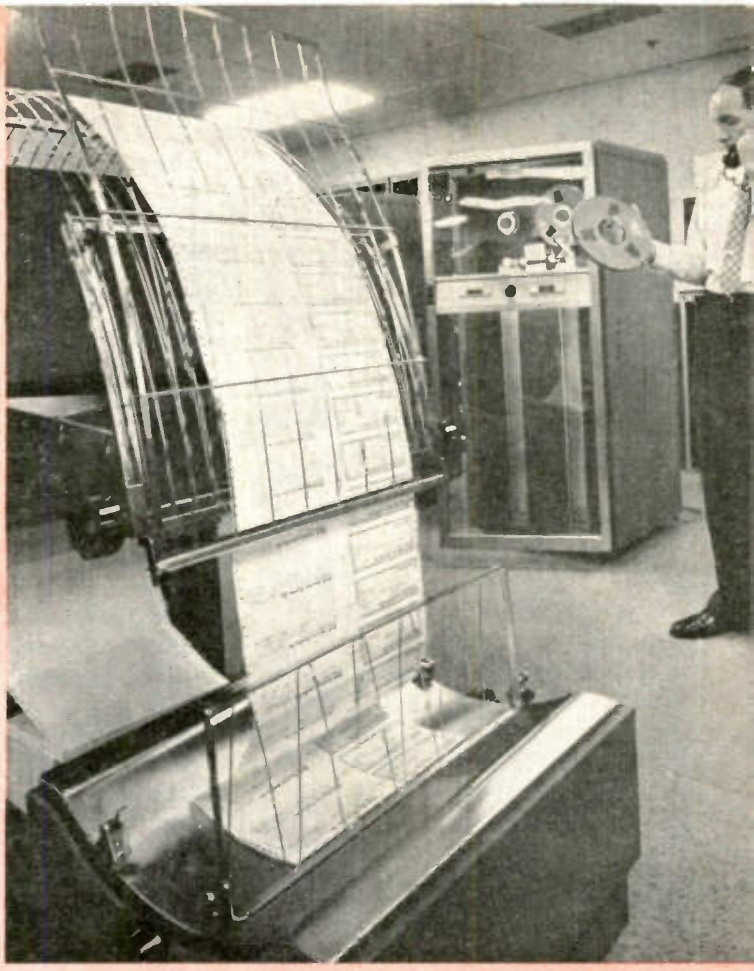


The 8 cu. yd. concrete bucket designed by Blaw-Knox to be used at the Greers Ferry Dam in Arkansas is said to be the first radio controlled unit, shown at left, scheduled for construction operations.



In Providence Hospital, Washington D.C., a research project for the identification of pathological conditions through serum protein analysis employs an American Instrument photronreflectemeter. The instrument passes light through the sample, scanning and recording the density. Routinely, the device aids multiple sclerosis diagnosis through gamma globulin analysis.

VIEWS in the NEWS



Payroll via microwave. Some 400 checks per minute came off the IBM printer at North American Aviation's Los Angeles division. Employee information is received by microwave from Rocketdyne plant in Canoga Park, 30 miles away. This tele-processing data system allows six computers to "talk" to each other at the rate of 75,000 words per minute.

Pioneer V earth satellite replica shows 150 watt transmitter which is sending radio signals back to earth from a distance of 8,001,000 miles, the greatest distance from which man has ever received a radio broadcast. Held aloft is one of the RCA ceramic-metal tubes.

Graphite core black body ultraviolet radiation standard, packed in boron nitride powder, is inserted into an inert atmosphere induction heater by R. G. Johnston of the National Bureau of Standards. This unit may be closer to the ideal radiator than the more common tungsten ribbon lamp.

Servos

For Industrial Control

Electro-Mechanical Feedback Systems Provide Automatic Correction Operations

ALAN ANDREWS

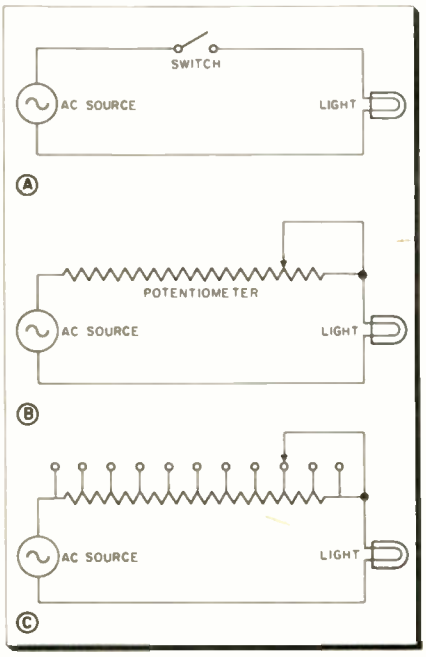
• Automation has become a deified word in industrial and business circles. The ability of machines to automatically control themselves is based on synchros and servo-mechanisms.

Examples are numerous: machines automatically set material, drill holes, remove the finished product from the machine. Automatic milling machines shape intricate metal parts without the aid of human hands, guns are positioned, radar antennas revolve, etc.

Control Systems

Many devices can be classed as control systems. For example, an ordinary light and switch, shown in Fig. 1-a. The switch controls the "on" and "off" condition of the light. There are only two possible situations—the light is either on or off. This may be called a discontinuous control system. Contrast this with the arrangement shown in Fig. 1-b. The circuit is essentially similar, except that now the light's brightness can be controlled. Fig. 1-b provides continuous control.

Fig. 1—Open cycle systems. (A)—Simple on/off discontinuous control system. (B)—Continuous control system allows the light to be varied. (C)—Variable control.



Some systems have step control, as illustrated in Fig. 1-c. This arrangement provides zero to maximum control, just as in 1-b, but within limited steps. These systems are *not* automatic, and must be controlled by an operator. They are open-loop or open-cycle systems.

There is another system which controls itself. We are all familiar with a home heating system, for example. When the interior of the house cools, a thermostat closes a switch placing the furnace into operation. This switch remains closed until the temperature rises and the switch again opens. This system is automatic since the temperature acts to control itself. This is a closed-loop or closed-cycle control system.

Servomechanisms

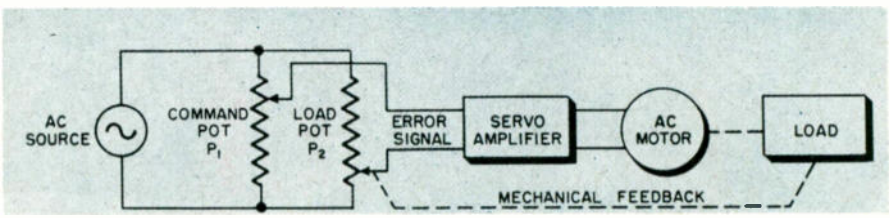
A basic servo system is shown in Fig. 2. It can be defined as "a feedback system used in controlling physical position." Assume the load is an antenna and the arrangement is designed to position the antenna.

Control is effected through two potentiometers, the command pot P1, and the load pot P2. P1 is calibrated in degrees and the antenna direction is manually set by turning its shaft. P2 is a similar unit but mechanically coupled (through shafts and gears) to the antenna being controlled. It always indicates the angular position of the load. A-c voltage is applied across both pots and the potential on each arm depends upon its angular rotation. When both are at similar angles, both terminals are at the same potential. The potential difference between them is zero.

The a-c error signal is equivalent, in amplitude and phase, to the difference between the two settings. When both are similar, the amplitude of the error signal is zero, and the amplifier output is also zero. The motor does not turn, and the antenna, connected to the motor, is stationary. For example, suppose the command pot is moved upward, as shown in Fig. 2. When this occurs, an error signal with a definite amplitude and phase is applied to the servo amplifier input. An amplified signal is applied to the motor, causing rotation of the antenna.

As the antenna rotates, the feedback coupling moves the arm of P2 upward. The amplitude of the error

Fig. 2—A basic servo system with mechanical feedback, a closed-cycle system, automatically controls the physical position of the load.



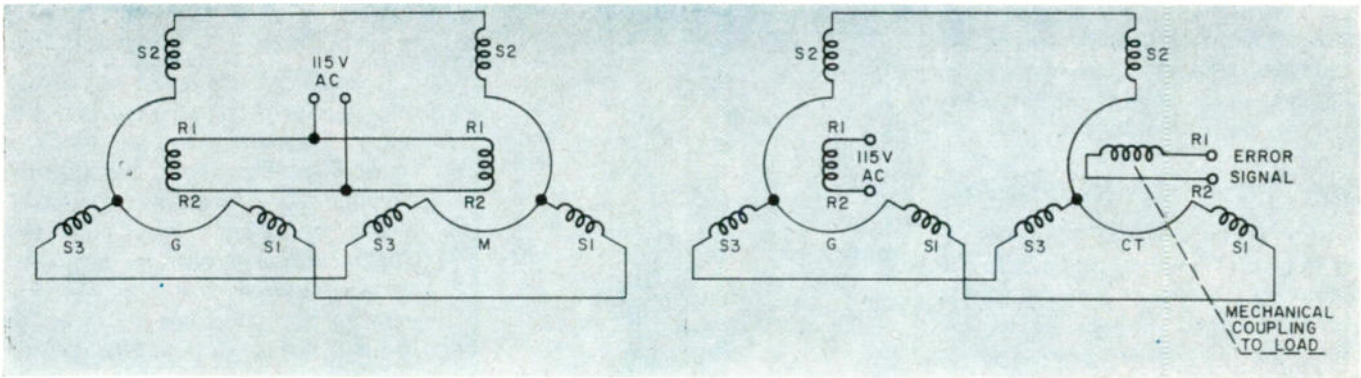


Fig. 3—Schematic of a simple servo control system utilizing master (G) and slave (M) synchro units.

Fig. 4—A simple servo control system using a synchro control transformer for heavier loads.

signal is now decreased, followed by a decrease in motor speed. As the antenna approaches the command setting, the error signal reaches zero and rotation stops. If the command pot is moved in the opposite direction, then polarity of the error signal is reversed and the motor turns in the opposite direction.

Frequently a two-phase motor is used in servo applications. One input phase is supplied by the a-c line —with constant phase and amplitude. This is the reference phase. The servo amplifier supplies the control phase, either leading or lagging the reference phase 90°. The amplifier output phase then determines direction of rotation. Although an a-c system is used here, a d-c input could be amplified and used to drive a d-c motor.

Synchros

Many servo systems employ synchros, resembling small electric motors, and consist of a single-coil rotor and stator with three groups of coils spaced 120° around the unit. Some trade names for these units are: Selsyn, Autosyn, Diehlsyn, and Synchrotie. Fig. 3 shows the circuitry of a simple servo system including two synchro units.

Line voltage, usually 115 volts, 60 or 400 cps, is applied in parallel to both rotors. A voltage is induced into each stator coil, the exact voltage depending upon the relative angle between rotor and stator coil. Maximum voltage is induced when the rotor and stator coils are in line, for example S2 in the diagram. Minimum voltage is induced into a stator coil when it is perpendicular to the rotor. A combination of the three stator voltages produces a resultant stator flux in a certain direction.

In operation one unit functions as the command or master, and the other the slave, or the following unit. The master unit is usually called a synchro generator (G), transmitter or tachometer, and the slave, a motor (M) or receiver. If the rotor of the generator is turned, say 45° clockwise, the voltage distribution in the generator stator coils is altered. When voltages in the motor stator coils change from those in the generator, currents are set up between the units. These currents create torque which turns the rotor of the synchro motor until it is lined up at 45° clockwise. When this position is reached, the stator voltage distribution is equal in both units and no current remains in the system.

In this manner the synchro motor follows the generator movements. This system is used for positioning light loads. For heavier loads, a larger motor must be used with a synchro control transformer (CT), for the error signal.

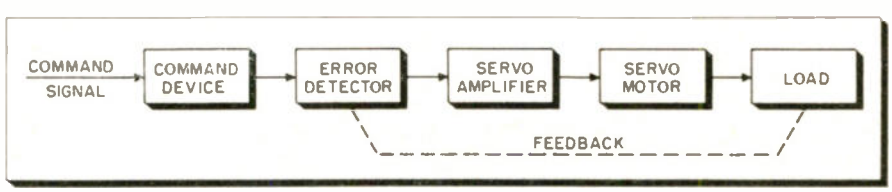
Control transformers are similar to the generator motor except that line voltage is not applied to its rotor, and torque created by stator currents cannot turn it. The control transformer produces an error voltage, the amplitude and phase depending upon the angular rotation of the generator and control transformer rotors. This arrangement is shown in Fig. 4. Essentially, these units replace the two pots shown in Fig. 2.

Command settings are made by rotation of the synchro generator rotor. As the distribution of the stator coil voltages change, the voltage induced into the CT rotor is changed accordingly. This rotor is mechanically coupled to the load and as the load reaches the command position the CT rotor is turned in a direction reducing the error signal to zero. In the relative position shown there is zero voltage induced into the CT rotor. Amplitude of the error signal depends upon the relative difference between the generator and control transformer rotor positions. Phase of the output depends upon the directions in which they are moved with respect to each other.

In general a servomechanism contains a command device, an error detector, amplifier, motor, the load, and some sort of feedback between the load and error detector as shown in the block diagram of Fig. 5. Although an all-electric system is shown, hydraulic and pneumatic elements are also used.

Normally, the command device is an input transducer, which converts various phenomena into electrical signals. In a pressure control system, for example, the command de-

Fig. 5—Functional diagram illustrates basic elements necessary for an integrated servo-mechanism control system.



vice should convert pressure into some proportional electrical quantity. Other systems would require comparable input transducers.

Error Detector

Any device capable of producing an output which is equivalent to the difference between two inputs is called an error detector. They are also known by other general terms such as comparator, summer, or sensing element. In Fig. 2 the two potentiometers served as an error detector, with P1 also serving a dual purpose as the command device. In Fig. 4 the control transformer is the error detector. For the CT, the command angle is applied through the three stator voltages. Load angle is applied through physical rotation of the rotor. The error signal is proportional to the difference between these two input angles, as previously explained.

Differential gears produce a mechanical output angle equivalent to the difference between two mechanical inputs, as illustrated in Fig. 6-a. Here shaft 1 is connected to gear B, shaft 2 to gear D. Gear A is not in any way connected to shaft 1 but is attached to the frame which is free to rotate around shaft 2. Consider that shaft 1 is rotated 45° counterclockwise (indicated by arrow). This turns gear B by 45°, also rotating gear C. Gear D is held so that it cannot move, thus, the movement of gear C rotates the frame, gear A, then gear E, which turns 45°.

Another error detector is the differential transformer (a cross-sectional view is shown in Fig. 6-b). A constant voltage a-c input is applied to the primary winding, and the two secondaries are connected so that their outputs are series opposing. The armature, made of magnetic material, can be moved up and down inside the windings.

As shown in the diagram, more of the armature is located inside secondary 1 than in secondary 2. This gives a certain phase of a-c output. If the armature were lowered, the secondary 2 voltage would increase while the voltage of secondary 1 would decrease. Then, at an even lower setting the secondary 2 voltage would be larger, again providing output voltage. In this second case, however, the output would have reversed phase as compared to the previous case.

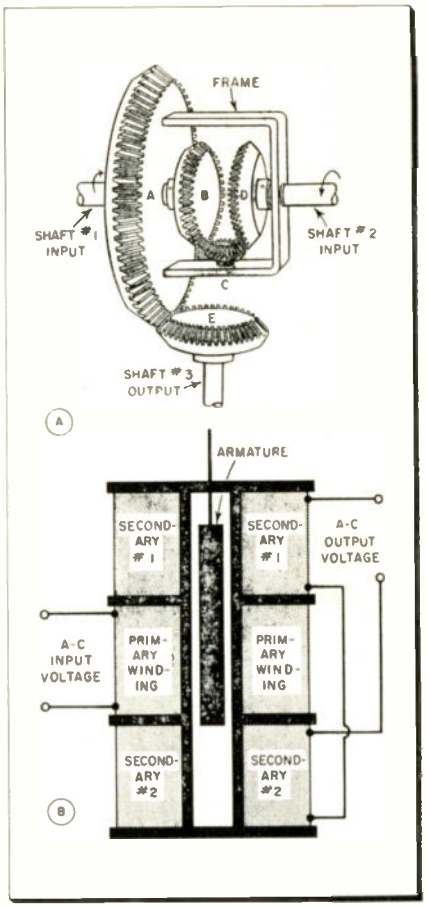


Fig. 6 (A)—As an error detector, shaft #3 of a differential gear produces a mechanical output angle equal to the difference between shaft #1 and #2. (B)—Example of basic synchro transformer. Its output varies in magnitude and phase as armature moves.

Servo Amplifier

In electrical servos the amplifier is often a conventional electronic amplifier, frequently similar to audio types. For either a-c or d-c systems, vacuum-tube, transistor or magnetic amplifiers are employed. Thyratrons may also be employed. In some servos an a-c error signal may be used to drive a d-c motor, the a-c being converted to d-c before the signal is applied to a d-c amplifier.

The very large systems use either a magnetic or rotary amplifier, in some cases preceded by a vacuum tube or thyratron unit. Magnetic and rotary amplifiers operate on the basic idea of controlling large amounts of power with relatively small input power. This can be termed amplification in the sense that the controlling action is amplified.

Magamps

Magnetic amplifiers use saturable reactors as the basic part of their circuitry. A simplified version is shown in Fig. 7. In this case a lamp is representing the load. Inductance depends upon the degree of saturation of the core, which in turn depends upon the current through the control winding. If this current is increased (by varying the control pot) the inductance is decreased because the core is then operating nearer saturation. Decreased inductance offers less opposition to the flow of load current so the lamp burns brighter. Decreased control current has the opposite effect. In a practical servo amplifier various circuit refinements would be used but Fig. 7 illustrates the basic idea.

A rotary amplifier includes a d-c generator whose output is controlled by the field current. This idea, used in a servo, is shown in Fig. 8. The push-pull servo amplifier feeds the

Fig. 7—Simplified circuit of a magnetic amplifier used as error detector and amplifying device in servo control applications.

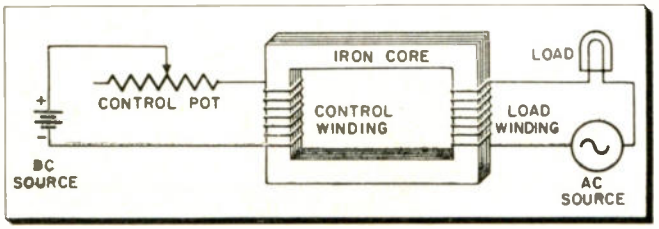
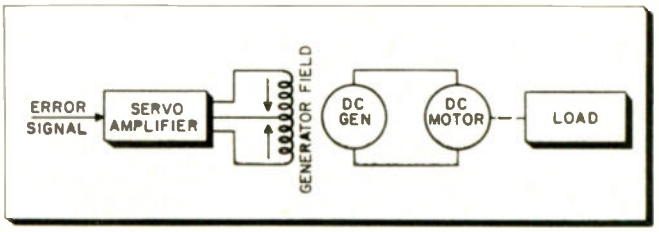


Fig. 8—A push-pull rotary type amplifier and error correcting unit employing a constant speed d-c generator for servo control.



field windings of the d-c generator which is turned at a constant speed by a motor (not shown).

If there is no error signal the field currents are equal (but in opposite directions) to give an effective field of zero. Generator output would then also be zero and the motor and load would not turn. An error signal increases one field current and decreases the other, allowing the generator to produce an output which in turn drives the motor and the load. Generator polarity, and thus load direction, is determined by error signal polarity. Output voltage, and thus load speed, depends upon the amplitude of the error signal.

Servo Motor

Either d-c shunt-wound or two-phase a-c motors are usually used in servo units. Damping is usually provided to prevent the load from hunting or oscillating about the load position. The damping may be either mechanical, electrical or both. Feedback is provided either from the motor shaft or the load shaft to make the system automatic.

Maintenance

Industrial servo controls are generally integrated electro-mechanical and electronic systems. Precise gear alignments and other mechanical factors are involved in addition to the normal electric and electronic considerations.

Care and maintenance of both a-c and d-c servo motors and generators is essentially the same as that for types used in other applications. Preventive maintenance is by far the best approach to the problem of keeping down-time at a minimum. Frequency of check-ups will depend largely upon type of operation, length of daily operating time and environmental conditions.

All motors must be kept free of grease, oil, dust, water and be given protection from a high temperature and humidity environment. This means periodic motor cleaning and other precautions.

The condition of a motor's bearings should be investigated at each periodic check-up. Specific attention will depend upon the type of bearings: grease lubricated roller or ball types and oil lubricated sleeve bearings.

Brush type motors require their brushes to be checked thoroughly. Brushes should fit properly in holders, with correct pressure, and seat correctly against the commutator.

Electronic type servo amplifiers not only amplify the systems feedback error signal, they are likewise phase sensitive devices that must be kept in top condition to prevent inefficient and incorrect operation. Tubes and other components should be checked periodically and the over-all response characteristics require periodic investigation. Heater voltages in d-c type amplifiers, especially in the first stage, require a high degree of stability, and particular attention should also be given to the input-output zero adjustment setting. If unstable heater voltage is encountered, cathode-compensating tube or associated components should be checked.

Helpful test equipment for maintaining servo control systems include VTVM, oscilloscope and a combination signal generator providing sine wave modulated carrier, low frequency sine and square waves. •

Nuclear Tests Affect Radio Noise

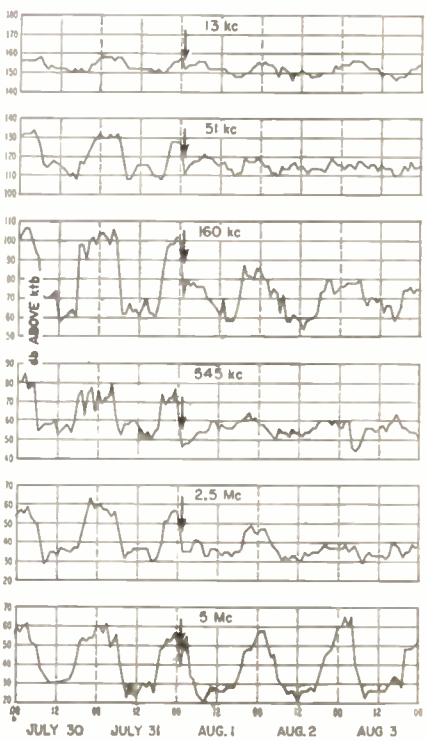
• The National Bureau of Standards recorded the changes in radio noise that occurred when two high-altitude atomic explosions were set off over Johnston Island in the Pacific Ocean in August 1958. The explosions appear to have had a pronounced effect on the radio noise as recorded at Kekaha, Hawaii, 700 miles northeast of Johnston Island.

Two bomb bursts occurred shortly after midnight on August 1 and August 12 at elevations estimated to be from 25 to 100 miles. Recordings were made of the received atmospheric radio noise power for a period before and after the first explosion. The usual diurnal pattern is evident on the graphs during the three days prior to the blast, with the highest noise levels recorded at night, and a rapid decrease in level between 0400 and 0800 local time. In the hour following the blast, however, the noise decreased by as much as 32 db (at some frequencies) at a time of day when it would normally be rising or holding steady. Recovery apparently occurred in a matter of hours at 13 kc and 5 mc, but from 51 kc through 2.5 mc a changed pattern is evident for several days.

Because of the very low incidence of thunderstorms in Hawaii, most of the received radio noise is believed to be propagated from storms at a considerable distance. Thus, changes in propagation conditions are reflected more clearly on the Kekaha noise records than at stations situated on large land masses, where local and short-distance storm effects tend to mask changes in propagation.

It would appear likely that a highly ionized region was formed by the bomb explosions over Johnston Island and that this ionized region persisted for a period of at least several days after each test, causing greatly increased ionospheric absorption. •

(Time of explosion indicated by arrows)



Radio Noise Power Recorded At Kekaha, Hawaii

Maintaining Closed-Circuit TV Sync Systems

Scope & Chassis Test-Points Simplify Generator-Counting Circuit Adjustments

HENRY A. SCHWARTZ

• A simple block diagram of a typical closed circuit TV camera and monitor location is illustrated in Fig. 1. The scene to be televised is picked up by the vidicon tube at the camera location and reproduced by the CRT at the monitor location. Since it would be technically unfeasible to reproduce the entire scene at one instant of time, the televised picture must be broken up into small segments and transmitted to the monitor. At the monitor, it is reconstructed in the same manner that it was previously broken up at the camera location.

A method of dissecting, so the picture information, or "picture scanning," can be easily transmitted over coaxial cables, is shown in Fig. 2. The beam or thin pencil stream of electrons of the vidicon start painting a picture at the top lefthand corner of the vidicon, and continues to paint this picture in a series of lines to the bottom of the tube. In actual practice, the odd lines are first scanned, followed by scanning of the even lines. A complete scanning cycle takes 1/30th of a second (the scanning of both odd and even lines). It is essential that the picture be reassembled at the CRT in exactly the same scanning sequence as it was disassembled at the vidicon.

A block diagram of a closed circuit TV camera and generator, is shown in Fig. 3. The "synchronizing circuit" of the camera-generator system provides the signal information so that the picture scanned at the vidicon tube is reassembled at the CRT as previously described. Without the sync circuit, we could not reassemble the picture and, therefore, would have no usable image on the CRT.

Sync Systems

Three basic types of synchronizing signals are used in television systems today. Television stations use a complex sync signal commonly called RETMA sync. The RETMA sync was established by the FCC at the time TV broadcasting was first introduced. Increased receiver circuit stability, however, has decreased its need.

Industrial and educational television applications generally employ EIA sync. The system requires less equipment at the camera-generator location. EIA sync, like RETMA sync, produces an interlaced picture. The odd lines scanned are kept at a very tight time relationship to the even lines. Interlaced scanning provides maximum video resolution with high picture stability.

The third type of synchronizing system used in industry is called "Random Interlace." The essential difference between Random and EIA sync is: no relationship exists between the horizontal and vertical sync pulses. The odd field scanned

Fig. 1—Functional relationship of major units in closed circuit TV installation.

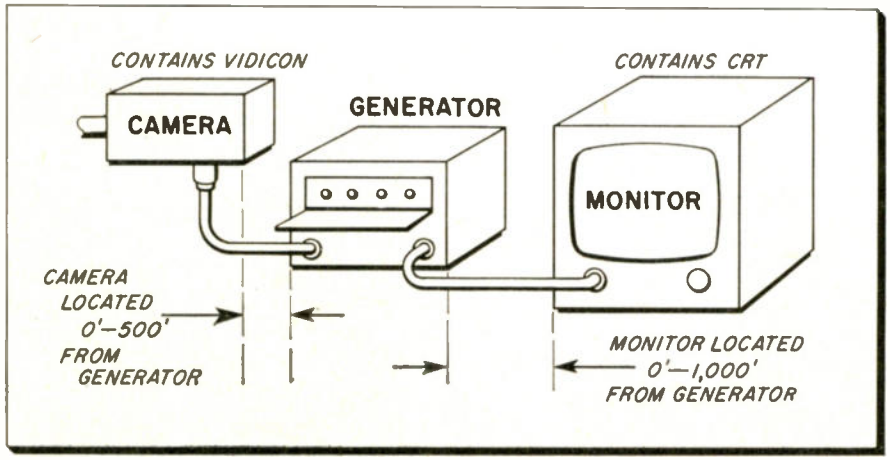
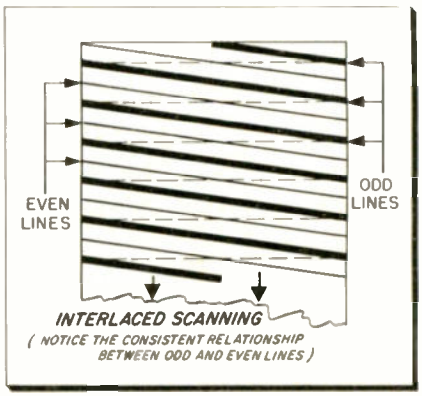


Fig. 2—A simplified illustration of TV interlaced scanning system. Sweep begins with odd lines, terminating with even lines.



during the first sweep may appear on top of the even field because of this absence of time relationship. There is a constant movement of one field as opposed to the other and the picture viewed has a slight drift commonly referred to as "line crawl." This method of synchronization provides a less stable picture with less detail. Equipment required to produce Random interlaced sync is quite inexpensive and used in non-critical work.

Frequency Dividers

A simple block diagram of a typical 2-to-1 interlaced synchronizing generator system is illustrated in Fig. 4. The horizontal oscillator block is the master oscillator for all frequencies produced in the synchronizing generator reactance tube block. It compares the final frequency of the generator, 60 cps, with the line frequency of 60 cps, and corrects the oscillator for any frequency drift. Output of the horizontal oscillator is first multiplied by two and then divided by three, five, seven, and finally by five again. The system provides a stabilized vertical output sync pulse which has a very tight time relationship with the horizontal sync pulse. This method gives stable and properly interlaced pictures over long operating periods. Each of the frequency dividers contain a blocking oscillator circuit employing ½ of a 6U8 tube, and a cathode-coupled blocking oscillator transformer.

A blocking oscillator in some respects performs in the same way as a multivibrator. Frequency of the blocking oscillator is essentially controlled by the coil (L-1, Fig. 5). The signal to be divided is injected into the grid of the blocking oscillator through capacitor C-1. When the blocking oscillator is operating close to its design frequency, the injected signal will trigger it at proper intervals. For example, if a blocking oscillator is designed for operation at 300 cps and the injected signal is 2,100 cps, every 7th pulse of the 2,100 cps signal will trigger the blocking oscillator at 300 cps. The 300 cps oscillator therefore acts as a frequency divider, dividing the 2,100 cps input. Though the 300 cps blocking oscillator can independently provide a 300 cps pulse frequency stability would not be maintained. This system applies to each of the divider and multiplier stages in the sync generator.

A photo of an oscilloscope pattern from the 5-to-1 divider stage is shown in Fig. 6. The input pulse is 10,500 cps, and the output pulse is 2,100 cps. Note that the input pulse is directly on top of the output pulse.

Adjustments

Adjustment of the synchronizing generator is highly important for proper interlacing in the camera equipment. Actual location of the sync circuits in a typical generator, is shown in Fig. 7. Proper scope probe connections to test points for observing both oscillator and injected signal frequency is likewise shown. A complete loss of either the horizontal or vertical sync pulse will provide an out-of-sync image on the CRT. Partial loss of either horizontal or vertical sync pulses at the generator will frequently provide unusual effects at the monitor screen. If the generator falls out of count, the picture would "breath," first falling out of horizontal sync and then producing a normal picture. In the event of partial loss of vertical sync, the pic-

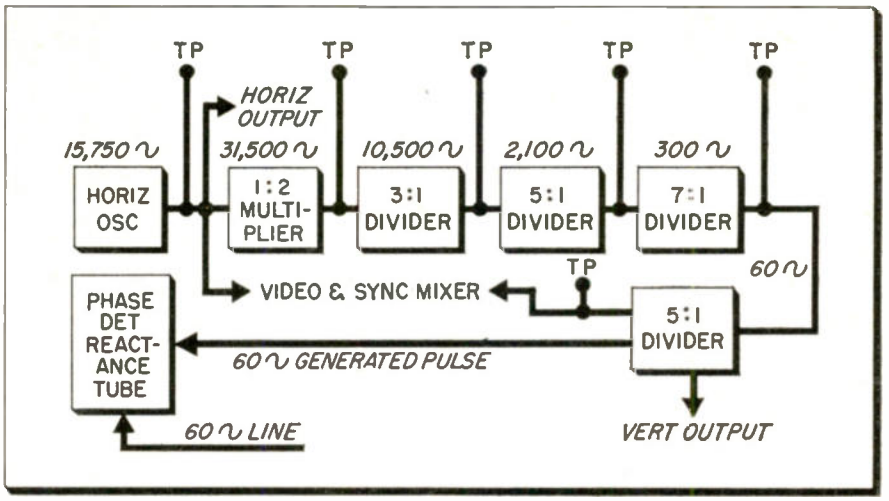


Fig. 4—Block diagram showing horizontal oscillator, multiplier and divider units of a 60 cycle a-c line reference sync system with reactance tube phase detector.

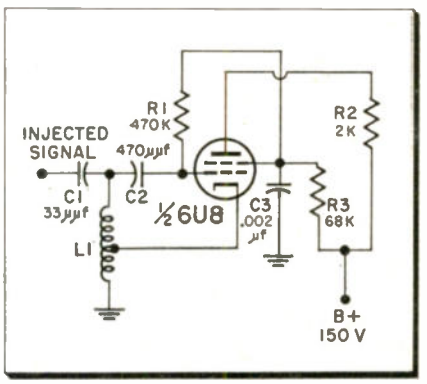


Fig. 5—Circuit of a free running cathode-coupled blocking oscillator which performs as a counter or frequency divider.

Fig. 3—Block diagram of video amplifier, sync and deflection generators.

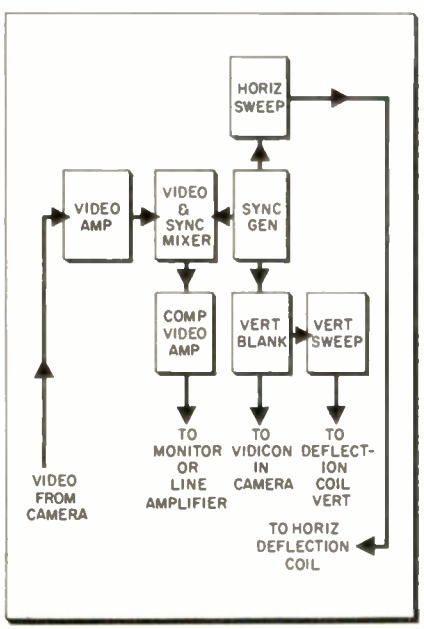
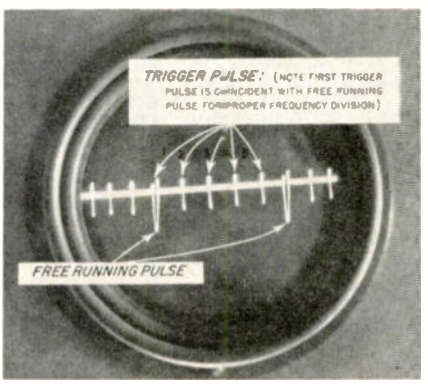


Fig. 6—Every fifth pulse of the input signal triggers the free running oscillator, thus generating an output frequency 1/5 that of the input. Adjustments require the 2nd, 3rd, 4th, and 5th input pulses be centered between the two free running pulses as shown.



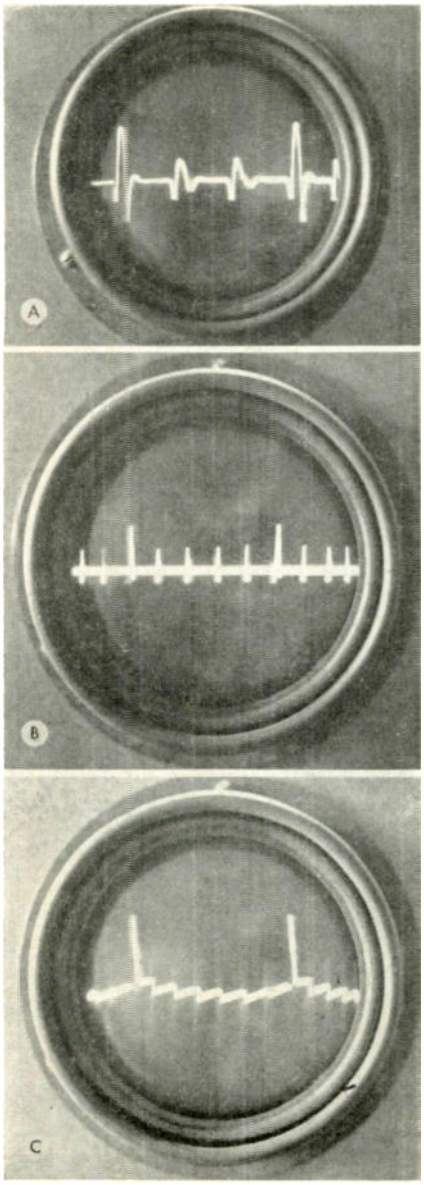


Fig. 8 (A) Scope waveform of 3-1 divider showing blocking oscillator firing on first and fourth pulse of the grid input signal. (B)—5-1 divider fires on 1st and 6th pulse (C)—7-1 divider firing on 1st and 8th pulse.

ture may tend to skip, hold, and then skip again. The counting circuits of the generator may be adjusted in the field, by using a high quality scope with low capacity probe. It is essential to remove the phase comparison 60 cps line signal from the reactance tube circuit. This can be accomplished by shorting the generator terminals as indicated in Fig. 7. The entire counting system is now disconnected from line frequency control, and can be accurately adjusted by applying the scope probe to various test points and adjusting the divider frequency for proper countdown. It is important that the injected pulses observed on the scope are physically centered between the pulses provided

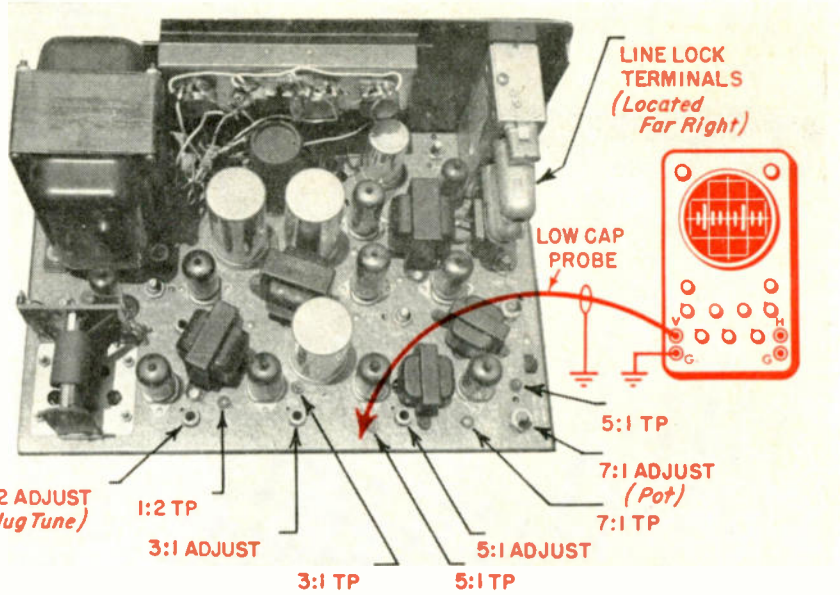


Fig. 7—Chassis of typical closed circuit TV sync generator showing multiplier, divider test and adjustment points.

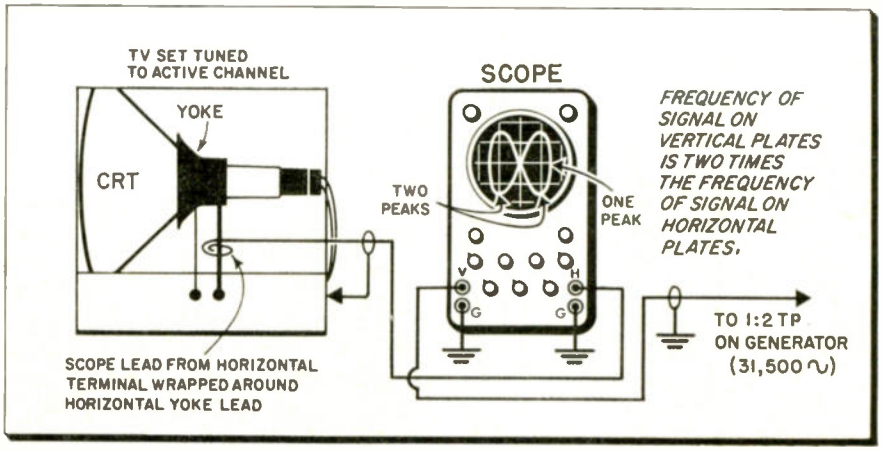
by the oscillator output. Fig. 8 indicates the various oscilloscope countdown patterns for the 3-to-1, 5-to-1, and 7-to-1 dividers.

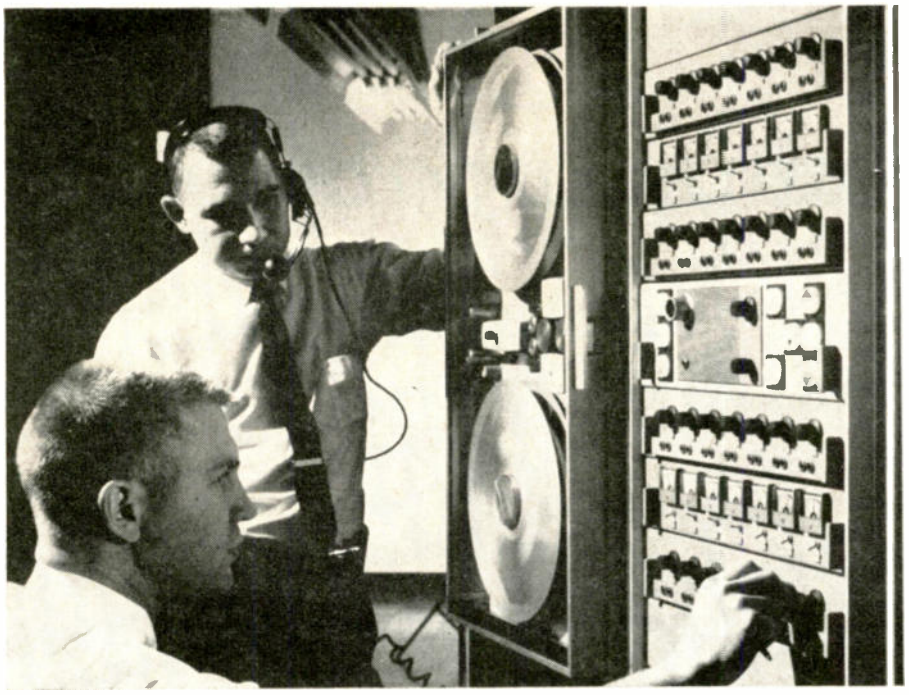
The generator's horizontal oscillator may be adjusted by using a Lissajous figure. The horizontal oscillator frequency is fed to the scope's vertical input, and an accurate 15,750 cps signal is fed to the horizontal input. The Lissajous figure obtained on the scope is indicated in Fig. 9. In the absence of a 15,750 cps crystal controlled signal, an acceptable signal may be obtained from the horizontal yoke lead of a standard TV receiver. This signal is obtained by simply wrapping a wire from the scope around the horizontal yoke lead, as illustrated in Fig. 9. When the TV receiver is tuned to a station and the picture is "locked" horizontally, the horizontal output pulse is accurately set at 15,750 cps.

When the countdown is completed, beginning with the horizontal oscillator and continuing from the 1-to-2 multiplier through the 5-to-1 divider, the shorting bar which was placed in the reactance tube circuit should now be removed. If the generator remains in count, and the picture is stable on the monitor screen, adjustments have been accurately completed. If the picture falls out of sync, the counting adjustment process should be repeated.

Most closed circuit TV systems are made up of functionally divided plug-in sub assemblies which are easily removed for repair and replacement of components. As in home TV equipment, most failures are caused by tubes. With a VTVM, scope, and manufacturer's service data, the technician will find servicing and repair similar to other comparable equipment. •

Fig. 9—Sync generator frequency is checked by injection to scope's vertical plates, and by feeding a horizontal pulse from a TV set to the horizontal scope plates. Lissajous figure obtained indicates generator frequency is 31,500 cycles.





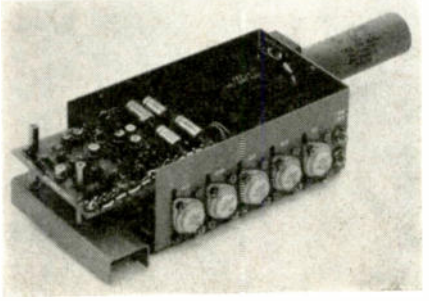
Engineers monitor tape recorder data output levels for missile testing.

Tape Recorder Aids Missile Testing

• An all solid-state modular analog recorder has been developed by Ampex Corp., Instrumentation Div., 934 Charter Street, Redwood City, California for Boeing Aircraft Co. ground station use in testing the new ICBM Minuteman missile.

Providing the primary information source to a tape "format converter," the recorder is a part of a fully integrated missile telemetry programming system.

Transistorized power supply for the solid-state ground analog tape recorder.



The first production model of the new analog recorder, which will be used to provide a permanent record of the large volume of data that will be involved in Minuteman testing, can record telemetry data from ICBM's at up to 350,000 bits per second on ½" wide Mylar tape.

Received information will be recorded on 7-tracks, composed of pulse-code-modulated (PCM) and frequency-modulated (FM) signals, including coded range timing, signal strength and tape servo speed control at a tape speed of 60 ips. A .005" wide voice track is also included at the edge of the tape.

A 14 inch tape reel records for 24 minutes at a frequency response from 300 cps to 250 kc. An "end sensing" device automatically switches to a second transport for continued recording.

Since high reliability and minimum down-time were specified for the recorder, design goal was 750 hours of recording time without failure—and failure was defined not as loss of information, but any departure from specified performance in terms of accuracy during the life of the recorder.

The recorded telemetry signals can be reproduced in visual form by a bank of cathode-ray-tube oscilloscopes which are part of the control panel. There is a monitor for each track of recorded data.

Since tape damage can be an expensive event in missile data recording, tape damage is minimized by "air-lubricated" guides. An air film lifts the tape from guide surfaces, centers the tape and prevents it from touching either edge of a guide.

Modular packaging permits quick service replacement of individual electronic units, and solid-state design eliminates the warm-up time necessary for high reliability. All electronic units are mounted on slide-out trays and all components are accessible from the front of the recorder so they can be adjusted or replaced within a matter of seconds.

Tape search, in either direction, is possible at speeds from 60 to 200 inches per second.

The company announced other machines now being engineered will provide telemeter recording bandwidths to 500 kc at 120 ips with up to 14 tracks on a 1-inch wide tape. •

SAC Communications

Strategic Air Command Utilizes Backup System of Communication Networks to Assure Instant Contact

IEM Field Staff

• The Strategic Air Command motto is "Peace is our Profession."

In order to maintain the peace, SAC believes it must be constantly poised as a deterrent force to an aggressor. SAC's nuclear-armed jet bombers and missiles around the world are on ready alert. Some bombers are in the air, and one-third of the force can be sent to targets within 15 minutes.

Since response to an aggressive action must be immediate, an efficient, dependable communications system must be in readiness 24 hours a day to direct aircraft, receive reports from distant bases, and transmit commands between air and ground units and air-to-air units.

If the main Command Post at Offutt Air Force Base in Omaha, Nebraska is destroyed, or if any other base is put out of action, multiple communication circuits would be vital to connecting alternate headquarters to remote bases.

Primary Communications

The heart of the international communications network consists of 750,000 circuit miles of cables and microwave relays, most of it leased from common carriers and commercial communications companies. There are some 12,000 people in the SAC Communications and Electronics Division. There are over 170 radio stations and about 70 bases on alert throughout the world.

By picking up the famous red telephone in the SAC headquarters underground command post, the controller can be placed in instantaneous voice contact with every SAC command post throughout the world.

The underground command post, in addition to having the red telephone, utilizes four live color TV cameras and a complete closed circuit color television system to provide instantaneous briefings for key staff officers who are required to make immediate decisions. Since the charts and maps on floor to ceiling panels are plotted in color, the color TV system is vital. See Fig. 1.

In addition, a vidicon camera is used in SAC's Weather Central to display conditions.

An industrial type camera is used to supplement security guards at the command post access point.

Still another closed circuit television system connects the SAC command post in Offutt AFB to the combat operations center of the North American Air Defense Command in Colorado Springs, Colorado. An enemy plane approaching would be indicated to SAC for retaliatory action while NORAD acts to intercept the enemy.

Fig. 1—Buried far below the earth is the Strategic Air Command's single most important building at Offutt AFB near Omaha—the three-story command post containing this 140-foot-long operations control room. Floor-to-ceiling panels contain maps, charts, and other data.

Ground-Air Control

Called the "short order system," SAC has three ground-to-air radio

stations in the U.S., and a fourth will go into operation shortly. These high frequency stations operate at 12 and 45 KW to direct SAC pilots on their missions.

Of particular interest is the high gain (22 db at 18 mc) Wullenweber antenna which can operate in the 2-35 mc range. It consists of three giant antennas phased in a manner which can direct the high power beam in 20 degree increments. The antenna is 135 feet high and 260 feet across the outside. See Fig. 2.

A third communications network —SAC believes in backup systems in case one network fails—consists of the single side band (SSB) Commanders network for point-to-point communications. There are approximately 100 such stations, some 28 of them on the ground and the rest in aircraft. They operate on approximately 11, 15, and 20 mc, depending on propagation conditions. Using only 500 and 1000 watt transmitters, and a system of station relays around the world, the frequencies are constantly monitored by SAC personnel to provide instantaneous communications between commanders.

In addition to the communications networks, SAC operates an IBM computer room which can calculate in moments the most effective plans for bomber flights, the percent of any enemy industry that has been destroyed, in-air refueling schedules, etc. Even the computer has a backup —though a humorous one. A glass covered panel with a hammer has written on it, "In case of emergency, break glass." Inside the glass is an abacus.

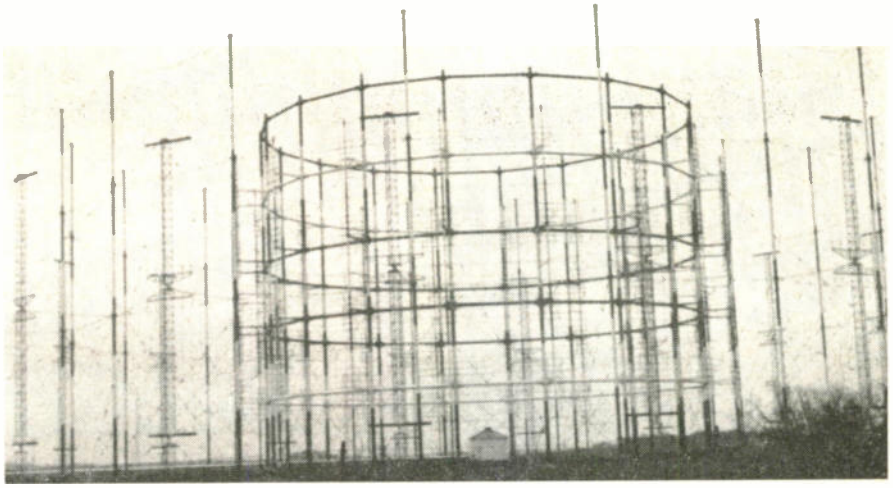


Fig. 2—SAC's giant Wullenweber antenna silhouetted against an overcast Iowa sky. It is 260' across. A key element in the "short order system," this 22 db gain antenna transmits HF signals from a 45 kw station to pilots in H-bomb loaded planes.

Maintenance

The critical necessity of minimum down time is obvious. According to Lt. Colonel Joseph Beler, Chief of the Operations Branch of SAC Communications and Electronics, the functioning of each network is checked very frequently. For example, the main telephone lines have a pulse sent into them every three seconds. If three return pulses are missed, the line is considered out. Therefore, if a line fails or is cut, headquarters knows about it in nine seconds. The Commander's SSB net is checked at least each hour. A geographical outage, one in which all communications to a specific base fail, happens only rarely—but SAC is immediately alerted to a possibly serious situation.

Collins equipment is used extensively in the Commander's SSB, and in the high power short order radio system. The manufacturer's field technicians take care of most repairs, though SAC personnel are also involved in maintenance work.

Panel boards are replaced when a failure occurs. Much of the maintenance is routine, such as burnishing the contacts on binary count relays.

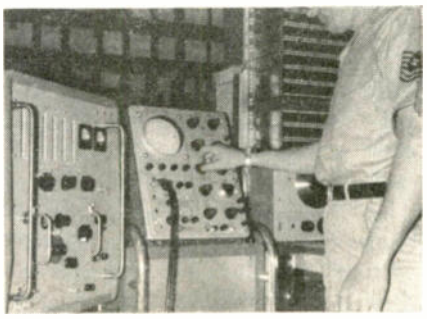
Where more detailed servicing is required, a variety of test instruments are brought into use. At the receiver site, there is a Collins test cart which includes an Advanced Electronics oscilloscope. A Daven transmission set 12B checks lines with input and output pulses. A Hewlett-Packard 200 CDR audio oscillator is used, as well as the company's 521A for checking oscillator and i-f frequencies. The H-P 524B frequency counter checks the tones in the modulators and demodulators. A H-P 410B VTVM provides a fast check on line resistance and audio output. A Measurements Corp. 65-B signal generator is also used to check output, as well as making other tests. A Tektronix 535 scope is employed in testing output, modulation wave shape, d-c ripple, and other factors which can affect communications quality.

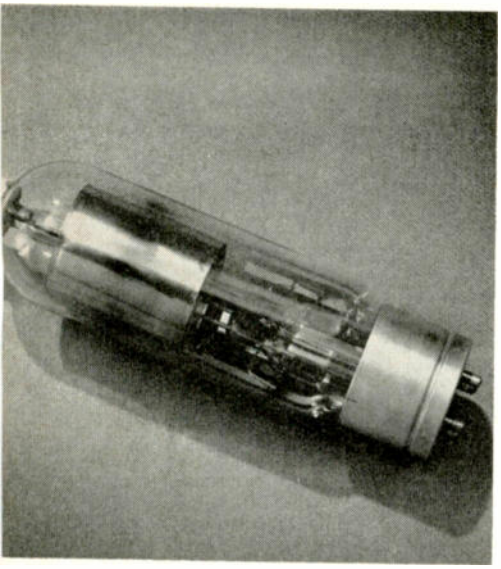
The frequency counter plays an important role in SSB testing systems. Voice garble indicates off frequency, and the counter gives instantaneous readout. It can tell whether the station is on or off frequency, and check transmitter stability. See Fig. 3.

At the transmitter site, in addition to the foregoing instruments noted at the receiver site, the following test instruments were observed. Alpha SWR meter 868; BJ Electronics signal generator; General Radio 1330-A bridge oscillator; 219-M decade condenser; Triplett 630 voltmeter; Hewlett-Packard 400A voltmeter, and 2001 audio oscillator; Forway Industries TV-7A/V and 7B/V tube testers; and Hickok AN-USM-34 multimeter. There are also certain specialized military instruments such as a plug-in module tester TS 1220 (XA-1)/ARM41.

The quality of personnel responsible for SAC communications operations and maintenance are of notably high caliber. The system functioning —instantaneous contact at any time throughout the world—is notably reassuring. •

Fig. 3—SSB supervisor T. Sgt. Alan Campbel examines frequency counter, scope and oscillator used in troubleshooting gear at "short order" transmitter site.





Long-Life Rx For Mercury Rectifiers

Pre-Operating Precautions For Mercury Phanotrons & Thyratrons Lower Replacement Costs

BERT GREEN
Application Engineer
Amperex Electronic Corp.

• After investigating field reports of short life in high-voltage mercury rectifiers and thyratrons for quite some time, it has been found that, almost without exception, the tube was being used improperly. By this statement I do not mean that the voltage or current ratings were exceeded, but rather that certain basic rules for long life were not being followed. In most cases the engineers and plant maintenance personnel were not acquainted with these rules. When properly instructed, the average life of the tubes increased radically.

All of the following rules (with the exception of the last one) apply both to the rectifiers and thyratrons, since the thyratrons are essentially rectifiers with a control grid added. Rule #7 applies to thyratrons only.
1. New high-voltage mercury rectifiers and thyratrons should be preseasoned before being used at full plate voltage and/or full plate current.

Unless this pre-seasoning is observed it is more than likely that the tube will arc when full power is first applied. This will destroy part of the cathode, causing the remaining area of the cathode to be operating beyond its normal capabilities and result in low emission after relatively few hours of use.

The typical occurrence in the field would be a maintenance man placing a new rectifier into a high voltage supply, waiting a few minutes for the filament to heat, and then applying full plate voltage. In a number of instances, the tube will arc a few times before kicking out a fuse or circuit breaker. Closing the circuit again, the tube will seem to "clean up" and the maintenance man leaves. Since the arc-over occured at full voltage with nothing in the circuit to limit power, the cathode coating is usually disintegrated. Within the next few hundred hours the tube is acting up again and the maintenance man is back to repeat the same steps with a new rectifier, all the while muttering under his breath that the tubes are faulty. This same man, however, would never think of jumping into his car on a cold morning and speeding off at top speed without first warming up his engine, because he knows to do so would shorten the life of his engine.

The correct method of seasoning a high-voltage mercury rectifier or thyratron when first received is to operate the filament at the correct filament voltage for about an hour to permit any mercury adhering to the filament, grid anode or supporting structure to vaporize. This is necessary to, first, reduce the possibility of a high voltage arc from a drop of mercury on one element to another element and, second, to insure that the correct gas pressure is reached within the tube.

After running the filament for 1 hour the next step consists of applying plate voltage. The voltage should not exceed a value which will cause a *peak inverse voltage* of 6,000 volts to appear across a tube with a 10,000

CHART I

Type of Power Supply	Peak Inv.	*RMS Trans. Volts	*DC Volts
Single-Phase Full Wave 2 Tubes	6000	Peak Inv x .707 4250 C.T.	Peak Inv ÷ 3.14 1920
Single-Phase Full Wave Bridge 4 Tubes	6000 6000	Peak Inv x .707 4250	Peak Inv ÷ 1.57 3820
Three-Phase Full Wave 6 Tubes	6000	Peak Inv x .41 2460/phase	Peak Inv ÷ 1.045 5750

*All values approximate

PIV rating. Chart I shows the approximate relationship between transformer voltage, peak inverse voltage and d-c output voltage.

The tubes should be operated in this manner for 5 minutes and then the voltage gradually increased over a period of 15 minutes until the normal operating *peak inverse voltage* is reached, say, 6 kv for 10 kv PIV rating.

During this seasoning period, the current through the tube during arcs should be limited to a value that will not cause damage to the cathode. Since most transmitters and induction heaters do not have provision for this type of seasoning, and since the equipment can't usually be taken out of operation for this period of time, it is wise to construct an inexpensive seasoning set as a separate unit. This is especially true where many rectifiers are in use or where "down time" is important and the spare tubes must be on stand-by for immediate use in the transmitter or induction heater.

Fig. 1 shows the schematic for a simple seasoning rack on which spare rectifiers or thyratrons may be left for weeks at a time while on stand-by.

Using the seasoning unit shown in Fig. 1, the neon transformer will limit arc currents to a safe value because of its high reactance. The load resistance of 270K insures that only 25 milliamperes will be drawn if the tubes are left on in the unit for stand-by duty. The meter is calibrated both for d-c output voltage and peak inverse voltage. If the tubes are to be left on this rack for longer than 24 hours, the filament switch should be adjusted to the tap on the filament transformer to give 4.5 to 4.75 volts (rather than the normal value of 5 volts) at the filament terminals of the rectifier.

Mercury thyratrons may be seasoned in this rack in the same manner as rectifiers, if the grid is tied to one side of its filament through a 10K 2 watt resistor shunted by a .002 µf mica capacitor with a 2500 volt rating.

To review the operation of the seasoning rack:

A. Turn on filament for 1 hour.

B. After 1 hour, turn on plate voltage and adjust variac for 6,000 *peak inverse volts* and leave for 5 minutes.

C. Slowly increase plate voltage with variac over a period of 15 minutes until the *normal operating* value of *peak inverse voltage* is reached when working in the final equipment.

D. If tubes are to be left on rack with filament and plate voltage applied (for stand-by service), reduce the filament voltage.

NOTE: When transporting tubes from the seasoning rack to the final equipment it's imperative that the mercury tubes be carried in an upright position and not laid on their side. If these precautions are not followed mercury will splatter and the tube will have to be seasoned once again.

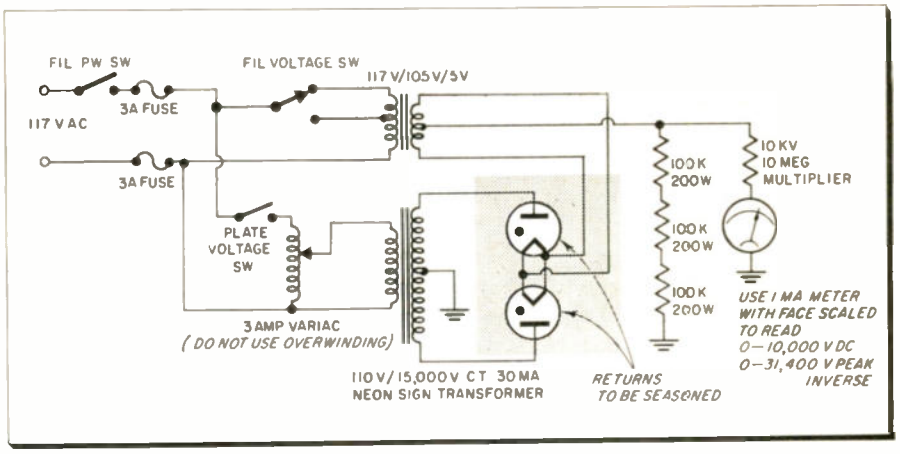


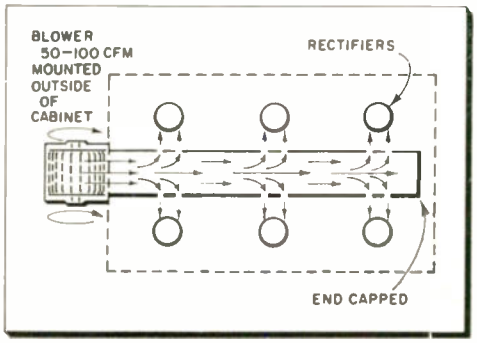
Fig. 1—A "seasoning rack" is a valuable adjunct to a plant's maintenance equipment. Frequently, tubes are needed on a stand-by basis for transmitters or major production equipment, like induction or dielectric heaters. The "rack" provides almost immediate mercury tube service should a major equipment's rectifier become defective.

2. The temperature of the glass just above the base of the tube should never exceed 40 degrees centigrade.

While it is true that tubes will continue to operate at a higher temperature than 40°C., the peak inverse voltage rating decreases rapidly with any increase of temperature. This is also a major cause of arcs.

Probably the simplest method to insure that the temperature remains below 40 degrees centigrade is to run a 3 inch tubular bakelite rod in line near the base of the tubes. At each tube position, one or two ½ inch holes should be drilled in the tubing so that the escaping air plays on the glass of the rectifiers just above the base. The bakelite tubing should have the far end capped and the other end fed with a small 50 to 100 cfm blower, which should draw in cool air from outside of the cabinet. The blower should commence operation when the filaments are turned on. Fig. 2 roughly shows the layout described.

Fig. 2—The simple cool-air device shown, reduces mercury tube breakdown by lowering the operating temperature of the rectifier. Lower temperature minimizes arcing.



3. Always allow sufficient filament pre-heating before applying plate voltage.

The filaments of most rectifiers require a full minute pre-heating before application of plate voltage. Most thyratrons require 5 minutes of filament pre-heating, provided the tubes have been used within the past few days. When the tubes have not been used for a week or more, 30 minutes should be allowed for the rectifier and thyratron filaments to pre-heat.

On tube data sheets, the time indicated as heating time is that necessary to bring the filament up to operating temperature. However, it is important to note that this does not necessarily mean that the mercury temperature is up to operating range. Usually, a curve is included in the data sheet which indicates the additional time necessary to operate the filament in order to bring the mercury to operating temperature. The additional time may be as long as 50 minutes. Failure to conform to this mercury temperature will prob-

ably result in arc back, low emission, poor grid control and very short tube life.

4. On the larger types of tubes the filament in-rush current must be limited to 200% of the normal operating value on cold starts.

The larger type of mercury rectifiers and thyratrons require either automatic or manual filament starting which should limit the initial in-rush current to the cold filament to a value not exceeding 200% of the rated filament current. High in-rush currents (which may reach values of 5 times the rated value because the resistance of the cold filament is much lower than that of a hot filament) cause the filaments to flex excessively on starting and result in premature failure.

5. Filament voltage should be held to ±5% of the correct nominal value.

Over-voltage on the filament will cause short life due to burn outs, while under-voltage results in low emission. In addition, incorrect filament voltage will allow the tube to operate at the incorrect temperature and consequently operate at the incorrect gas pressure. Result? Erratic operation and damage to the tube.

Where the line voltage regulation exceeds ±5% voltage, stabilizers should be inserted in the primary of the filament transformers.

6. Protect rectifiers with fast-acting circuit breakers.

A fast-acting circuit breaker should be used in the primary of the plate transformer to minimize the probability of arcing permanently damaging the rectifiers or associated equipment. Should an arc occur during normal operation a fast-acting circuit breaker will remove power after a few cycles, thus keeping the damage to a minimum.

7. When heat shields are supplied with thyratrons, they must be used.

On some types of thyratrons a heat shield is placed on the upper part of the tube, insuring this portion of the tube is warm enough to fully vaporize any condensed mercury. Operation without this heat shield results in short life due to the fact that arcing may occur because of droplets of mercury clinging to the structure and also due to incorrect gas pressure within the tube.

While it may be granted that it requires some small expense in time and money to comply with these operating/maintenance suggestions, the consequent savings on tube replacements and down-time of equipment will soon more than pay for this effort. •

For more data, circle 6-106-1 on card, p. 83

Ultrasonics Measures Liquid Flow

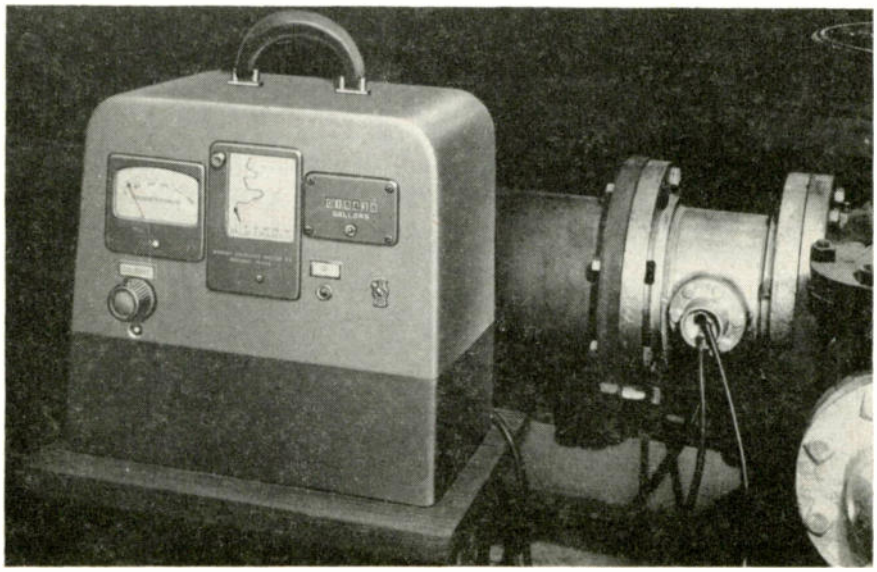
• An ultrasonic flowmeter measures the flow of liquid through a pipeline from outside the pipe. It employs high-intensity sound waves, transmitted through the walls of the pipe to the flowing liquid, in order to measure quantity and rate of flow. Development of the unit for water and sewage uses was co-sponsored by the Hersey-Sparling Meter Co. of Dedham, Mass. and Gulton Industries. It is expected to resolve problems of field-testing existing large water meters and checking flow in pipeline and fire protection systems already in service. There are numerous applications in oil and chemical industries.

Conventional flowmeters use mechanical devices inside the pipe through which the liquid flows. These tend to wear out under the impact of the liquid or corrode if used to measure such fluids as acids.

Most attempts to produce ultrasonic flowmeters have been based on measuring the time required for a sound wave of a given frequency to travel a known distance in the stream of liquid.

The principle used here, instead sends an ultrasonic beam across the stream and measures the shift of the beam under the influence of the flowing liquid. The sound from the transmitting ceramic transducer echoes back and forth inside the pipe. Because of the shift of the beam, only a fraction of it is picked up by a sonic detector in the opposite wall of the pipe. The detector produces a small voltage which can be amplified and read on the voltmeter and which varies with the velocity of flow in the pipeline. The circuits are designed to modify this voltage according to the density of the liquid so that the output to a recorder measures rate of volumetric mass flow. The flowmeter is hooked up to remote control readout devices that show both rate of flow and total flow at any given moment. •

Direct writing recorder flowmeter at Hersey-Sparling measures flow from outside pipe.



R-F Power Measurements

Practical Methods For Low, Medium, And High Power R-F Measurements

JOHN HASKELL

• Total power input and output measurements are important basic requirements for all r-f amplifiers, including radio transmitters.

Necessity for such measurements fall within two general categories: (A) To meet FCC regulations regarding maximum power inputs to final r-f amplifiers in radio transmitters and other equipment, and (B) to determine d-c power conversion efficiency and/or r-f load transfer efficiency.

Three general specific measurements are usually involved: 1. Determination of d-c or pulsating d-c power input. 2. Total r-f power output. 3. Impedance measurements of r-f output circuits with respect to their loads, and standing-wave ratio (SWR) measurements of transmission lines.

In most applications power measurements are indicated in units varying from megawatts to microwatts.

Power Input Measurements

Input power to any r-f power generator can easily be determined by measuring either the cathode or the plate current of the final output tube, and the voltage applied to the plate circuit, as illustrated in Fig. 1. The power input is the current in amperes times the voltage (ExI). If the meter used is not internally protected from r-f, then a capacitor having the proper voltage rating from 0.01 to 0.001 μf, depending upon frequency of the r-f power, should be shunted across it. A similar bypass to ground should be used to protect the meter when making voltage measurements.

For d-c input power measurements, a VOM or multimeter having a resistance of 20,000 ohms per

Fig. 1—Power input is determined by measuring the current, under normal load conditions, in either the cathode or plate/screen circuit, and the voltage applied to the plate.

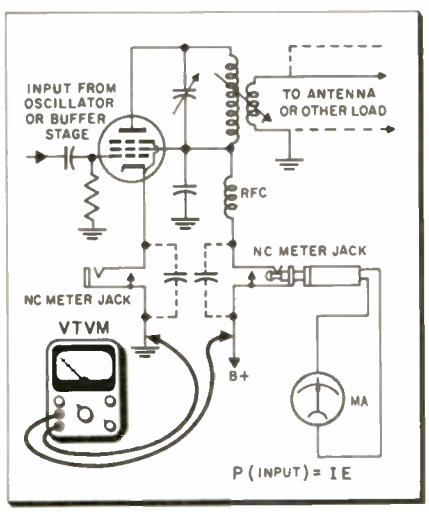


Fig. 2—Power output may be calculated by using an r-f thermocouple ammeter, or milliammeter, and a non inductive resistor.

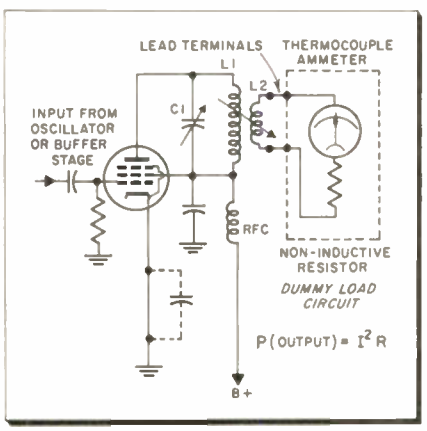
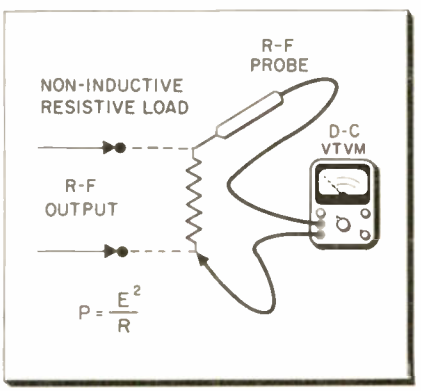


Fig. 3—Power output is determined by using a non inductive resistive load and a d-c VTVM with r-f probe.



volt is sufficiently accurate for all practical purposes. The basic active element of this d'Arsonval moving coil type instrument varies from 10 to 500 μa with current measuring facilities ranging from 50 to 500 milliamperes or higher. For power inputs beyond one KW, an amperemeter and higher range d-c volt meter are usually required. Most r-f generating equipment is provided with closed circuit jacks in either the cathode or plate circuit for current measurements and tuning purposes.

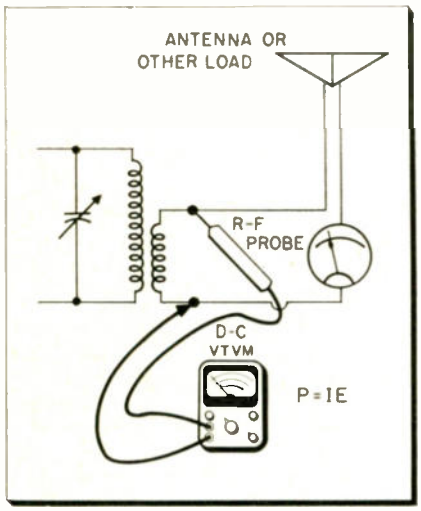


Fig. 4—Approximate power output with normal load device can be determined by using an r-f thermocouple ammeter and a d-c VTVM with r-f probe.

Power Output Measurements

Numerous methods are available for measuring r-f power output over wide power ranges, depending upon the frequency generated.

A thermocouple type r-f ammeter or milliammeter with a non-inductive resistive load is practical for power output measurements of relatively high frequencies if frequency correction figures, normally furnished by the meter manufacturer, are applied. This is necessary because of internal resistance changes caused by skin effect.

The meter and dummy load is connected to the transmitter antenna terminals, as indicated in Fig. 2. The load resistor should have a wattage rating twice that of the power being measured and a resistance equal to the normal load. Steps for measurement are as follows:

1. Disconnect antenna or other normal load from the r-f generator output.
2. Reduce plate power input to one half of normal or, if this is not possible, attach dummy load and decouple L-2 slightly from L-1 if variable coupling exists.
3. Plug milliammeter or ammeter into J-2 and tune C-1 for *minimum* "dip" reading on this meter.
4. Vary the coupling of L-2 for maximum reading of the thermocouple r-f meter.
5. Retouch C-1 to re-peak thermocouple meter reading.
6. Increase power to normal, if previously reduced.
7. Retouch L-2 for final peak reading of the thermocouple meter.

Output in watts is now determined by ohms law: current squared multiplied by the dummy load resistance:

$$P = I^2R$$

Another method of measuring r-f power output is shown in Fig. 3. A dummy resistive load is connected across the r-f generator's output and the voltage across the load is measured with a d-c VTVM using an r-f (demodulator) probe. Power output is then determined by the voltage squared divided by the resistance of the dummy load, or

$$P = \frac{E^2}{R}$$

A third method, illustrated in Fig. 4, utilizes a thermocouple r-f meter in series with one lead to the normal load. For example, using one side of the antenna feed-line, a voltage reading is obtained across the load with a VTVM and demodulator probe. Power output is now the voltage times the current, or

$$P = EI$$

Because more than the normal amount of reactance may exist in this hook-up, power indicated may be slightly higher than actual output.

In all measurements, a thermocouple type r-f meter should be selected having a full scale reading approximating the current to be measured. Since this meter has a square law scale, its lower scale markings are crowded and cannot be read accurately. Calibrated dummy loads with direct reading wattmeters are commercially available. R-f power measurements are feasible from 25 to 1,000 mc to 500 watts with these instruments, depending upon frequency. A somewhat higher degree of accuracy is possible because direct reading wattmeters normally include power factor corrections.

Combination portable test sets include field strength meter, calibrated dummy load and meter for power output measurements are also obtainable for medium power measurements.

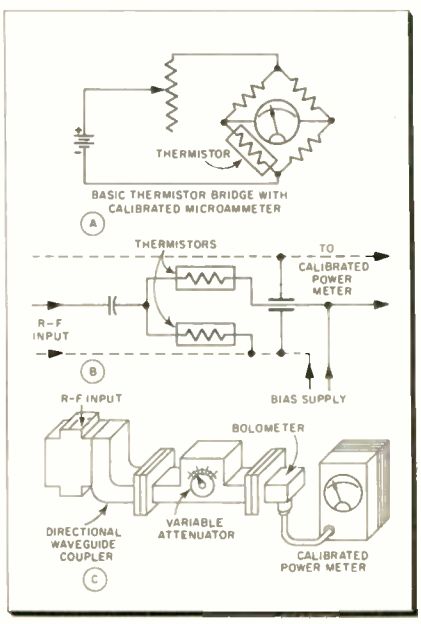
Thermistor type bridge circuits, in both coaxial and waveguide types, are extremely accurate for low power measurements but require relatively complicated methods for "sampling" portions of r-f power for higher power measurements. These circuits employ a bridge network with one or two thermistors. Some basic circuits are shown in Fig. 5.

The arrangement shown in Fig. 5C, employing a directional wave guide coupler, calibrated attenuator, bolometer and calibrated power meter is useful for microwave power measurements up to 100 watts from 2,000 to 20,000 mc.

High Power Measurements

Various calorimetric methods can be used for accurate power measurements over wide power and frequency ranges. One typical arrangement is shown in Fig. 6. Measurements are made by dissipating the transmitter or other r-f generator's output through a non-inductive resistive load within a closed circuit

Fig. 5 (A)—A basic thermistor bridge type watt meter using a calibrated microammeter. (B)—Thermistors employed in a coaxial type connector for power output measurements with a calibrated power meter. (C)—Directional waveguide coupler, variable attenuator, bolometer and calibrated power meter for microwave power output determination.



liquid coolant flow—in this case, water. Power output is determined by the rate of water flow and its rise in temperature by the following formula:

$$P = 264Q\Delta T$$

where P is power in watts; 264 is a specific heat/gravity constant applying to water, Q is the water flow in gallons per minute, and T is the difference between the coolant's temperature at input and at its output.

Although two accurate thermometers can be used in this arrangement, a thermopile (thermel) is generally employed. A thermopile is a special device having two banks of thermocouples connected in series that converts heat into a small linear voltage. One half of the device is placed in the cold input liquid flow and the other half in the hot output flow. The thermopile's output can be connected direct to a sensitive meter or through a d-c amplifier, to read difference of temperature directly.

Impedance Measurements

The amount of power transferred from any r-f generator to its load, in a given arrangement, is primarily dependent upon the impedance match existing between the generator's output circuit and the load. The characteristic impedance of the feed system from generator output to the load is part of this consideration.

Although impedance matching is the prime concern of the design engineer and manufacturer, it often becomes necessary for the maintenance technician to investigate this factor in attempting to locate the cause of insufficient r-f conversion or transfer to load. In the case of radio transmitters, defects in feed systems and antennas can often be located and isolated by impedance measurements.

R-f generator output impedance, feed-line and load impedances can be accurately measured in a number of ways. The most usual basic method is illustrated in Fig. 7.

The r-f bridge should have individual balance controls for reading both resistive and reactive components directly in ohms. The output meter performs as a null indicator for initial equipment balance and for actual load measurement indications. The signal generator should be amplitude modulated. All connections between instruments should be as short as possible and thoroughly shielded. Average accuracies, depending upon inherent accuracy of individual instruments employed, is approximately ±2%. More accurate set-ups can be employed, depending upon frequency and available equipment. •

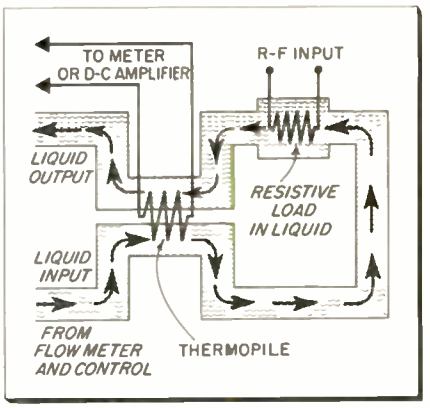
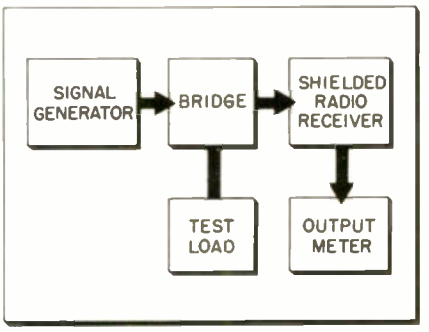


Fig. 6—A difference temperature registering thermopile is the basic unit employed in a calorimetric system for measuring high power r-f outputs.

Fig. 7—Functional set-up for making direct r-f impedance measurements using a calibrated bridge and null indicator.



Industrial Lamp Annunciator System

• Flexible, modular industrial lamp annunciator systems with plug-in circuits and snap-in indication plates, have been announced by Edwards Co., Inc., of Norwalk, Conn.

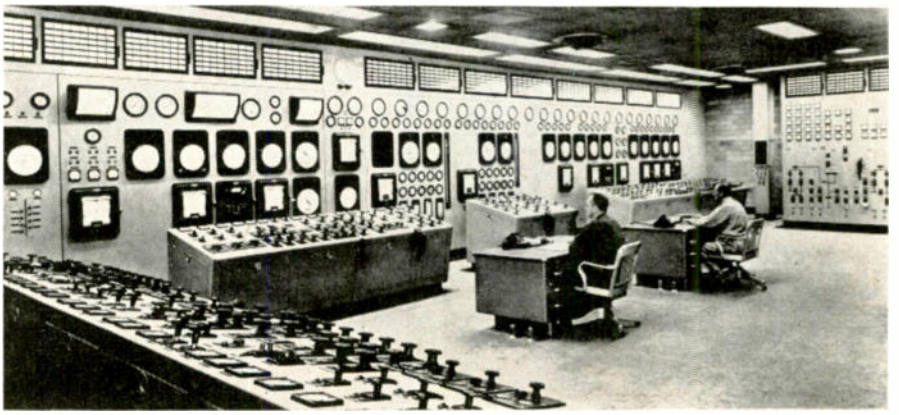
Industrial lamp annunciators are designed to indicate visually and audibly any abnormal condition or change in status of pressure, temperature, opening of circuit breakers, high or low level, power or equipment failure or any break in an electrical circuit. Typical applications are for maintenance monitoring and supervision of generators, turbines, compressors, pump supervision, switchboards, oil refineries, control centers and all types of industrial processes or equipment supervision.

Circuits may be switched from one operational sequence to another without altering terminal or external connections, or installing or removing jumpers. Simply plugging in a specific circuit changes operation from open to closed circuit.

Other features include relamping from the front, no dropping resistors used, and extra terminals on indicating circuits for data-logging or other control functions. •

For more data, circle 6-109-1 on card, p. 83

Annunciators in utility installation are mounted above control panels.



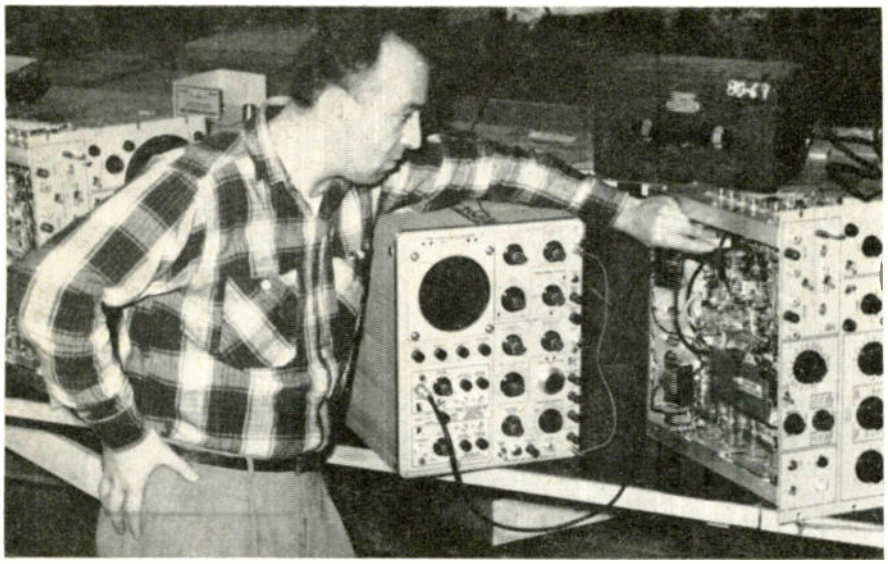


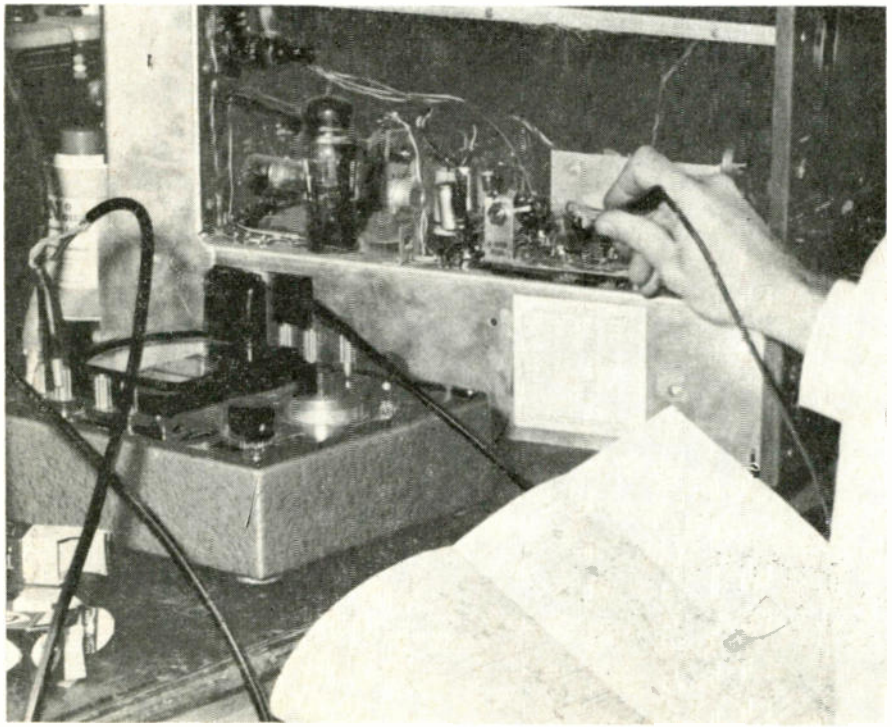
Fig. 1—Instruments on Baird-Atomic production line are used to observe waveforms, check voltages and calibrate the transistor test equipment manufactured by the company.

Field Interview

Electronics At Baird Atomic

Precision Instrument Manufacturer Employs Varied Test Equipment For Quality Control & Maintenance

Fig. 2—An oscilloscope is being checked against manufacturer's service data by a technician in the service shop section of Baird-Atomic plant.



IEM FIELD STAFF

• Space age demands of transistor, nuclear, and spectro-chemical research, requires accurate electronic test instruments having a high degree of reliability. To develop instruments of this caliber, Baird Atomic of Cambridge, Mass., finds it necessary to employ other equally accurate and reliable instruments in their research, design and manufacturing processes.

Oscilloscopes are only one of the test instruments employed in the laboratory and on the production line by quality control engineers. (See Fig. 1.) Other important instruments used in laboratory and production are illustrated in Figs. 3 to 5.

Directors of the plant, employing approximately 575 people, have long recognized the need for a progressive

instrument maintenance program. Two electronic specialists actually maintain Baird's electronic equipment. The technicians keep an array of oscilloscopes, VTVM's, and waveform generators in tip-top condition.

Maintenance Program

Irving Levitan, Supervisor of Instrument Maintenance and Calibration, is responsible for supervision of electronic component quality control and reliability operations. Mr. Levitan, who has a BSEE degree from Northeastern University, explained Baird's well-organized maintenance system, as follows:

"All test equipment is periodically returned to the calibration laboratory where its accuracy is checked against standards which are referenced to the National Bureau of Standards. Equipment that needs repair is given to the equipment and maintenance department. After repair they are sent to our calibration laboratory.

Of course, good records form an important part of the system. Each instrument has a calibration and maintenance record. Each instrument also has a calibration certificate attached, showing its accuracy, date of calibration, next scheduled calibration date, and name of the technician performing the calibration."

Numerous test instruments are employed to meet quality and performance specifications of the transistor test equipment manufactured by Baird Atomic. A representative list of some of the test equipment used by Baird's electronic department is as follows:

Oscilloscopes
- Dumont—303A, 304A, 350, 401A, 401AR
- Tektronix — 315D, 513D, 514, 515A, 531, 532, 535, 543, 545, RM15
- Hewlett-Packard—122A, 130A

VTVM's
- Acton Labs—810
- Ballantine—300, 302B, 310, 310A, 314
- Hewlett-Packard — 400D 400H, 410B
- RCA—WV97A, WV98A
- Waveform—861

Oscillators
- Hewlett-Packard—200C, 200CD, 650A
- Waveform—401, 401A, 401C

In addition, Baird-Atomic naturally takes advantage of their own precision test equipment. For example, a curve tracer manufactured by the company provides a visual display of transistor characteristic curves.

Servicing

Test measurements made in the maintenance section (Fig. 2) are carefully collated with instrument manufacturer's service data. Service techniques are somewhat similar to those employed with other modestly complex electronic equipment.

Aside from the standard trouble-shooting procedures to locate a defective part, past service experiences are recorded and used extensively. For instance, if a calibrated wave on a Dumont scope is lost, technicians invariably check one tube first, a 6AL5.

If all tubes check normal, the next step followed is an investigation of low frequency and sweep drive adjustments. These two controls can frequently become misadjusted because of interacting tendencies.

When an instrument component breakdown occurs, for example, a capacitor, point-to-point checks are made with either a VTVM or scope. Frequently both are used. Point-to-point checks are followed until the technician finds a defective component, usually a burned or overheating resistor and shorted or leaky capacitor. To isolate a defective component in this manner it is frequently necessary to separate interconnecting resistive components, which is a tedious process.

Occasionally a spot occurs on a scope screen, indicating loss of sweep. Normal procedure calls for a check of all tubes with a tube tester, besides direct replacements. Standard precautions for such work requires reduction of spot intensity to avoid a permanent burn on the scope's CRT face.

In addition to periodic readjustment of balancing controls, caused by slow changes in tube conditions, most instruments require recalibration after certain tube changes and component replacements.

Meter repair and maintenance includes electrical balance checks, tube and battery replacements, d-c and a-c voltage calibration, and a-c compensation adjustments. •

Fig. 3—Popular RCA VoltOhmyst WV-98A.

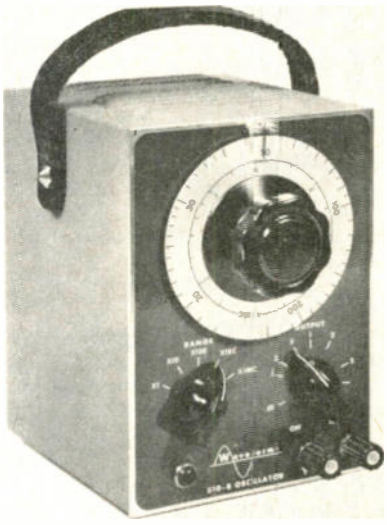
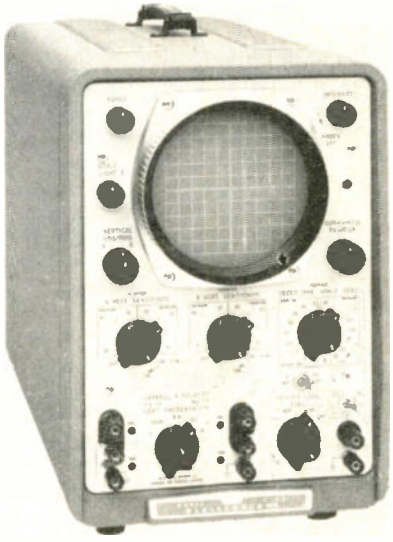


Fig. 4—Waveform wide-range audio oscillator Model 510B uses an R-C tuned oscillator with a frequency range of 18 cycles to 1.1 mc.

Fig. 5—Hewlett-Packard's Model 122A dual-trace scope with separate, twin vertical amplifiers employed by production-line personnel.



FREE LITERATURE

To receive these bulletins circle numbers on card, p. 83

MOUNTS: Bulletin 60-04 illustrates and describes the Barrymount line. These mounts isolate shock and vibration; reduce cost of maintenance, moving and installation; improve quality and keep production lines flexible. Barry Controls Inc., 700 Pleasant St., Watertown 72, Mass.
For more data, circle 6-112-1 on card, p. 83

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SHIELDING: Sixteen-page revised bulletin F-1 gives design and performance efficiency data of magnetic alloy shields for high gain input transformers and electron beam tubes. Shield thickness requirements are specified and charts show shielded efficiency. Magnetic Metals Co., Hayes Ave. at 21st St., Camden 1, N. J.
For more data, circle 6-112-2 on card, p. 83

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RESISTORS: A new type of glass-enclosed resistor that defies moisture is described, with characteristics, in data sheet CE-2.02. Illustrated are the ⅛-watt and the ¼-watt NF-60 and NF-65 resistors. Corning Electronic Components, Corning Glass Works, Bradford, Pa.
For more data, circle 6-112-3 on card, p. 83

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TETRODES: "AGC of Silicon Tetrodes" is the subject of a recent copy of Application Notes. This 12-page publication gives technical descriptions, curve diagrams, circuit diagrams and tables of circuit performance. Texas Instruments Inc., Semiconductor-Components Div., P. O. Box 312, Dallas, Texas.
For more data, circle 6-112-4 on card, p. 83

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POWER SUPPLIES: Catalog B-601 provides 24 pages of information on voltage regulated power supplies. Features, specifications, illustrations, schematics, index according to design and index according to output voltage included. Kepco Inc., 131-38 Sanford Ave., Flushing 55, N. Y.
For more data, circle 6-112-5 on card, p. 83

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SWEEP GENERATOR: Literature describes models SG-1 and SG-1R sweep frequency generator . . . one instrument for both audio and ultrasonic frequency response curve tracing. Panoramic Radio Products, Inc., 10 S. 2nd Ave., Mount Vernon, N. Y.
For more data, circle 6-112-6 on card, p. 83

TRANSFORMERS: Four-page, 2-color, brochure gives technical data on subminiature, coaxial ratio transformers. Diameter size, 2½" and 3½". Specifications, dimensions and photographs are provided for six models. Gertsch Products, Inc., 3211 S. La Cienega Blvd., Los Angeles 16, Calif.
For more data, circle 6-112-7 on card, p. 83

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PHASE METERS: Three catalog sheets cover the following: type 320-AB phase meter; type 328-A transistorized phase meter and type 335-A ultra-low frequency phase meter. Illustrations, features, descriptions and principle of operation are included. Acton Labs., 533 Main St., Acton, Mass.
For more data, circle 6-112-8 on card, p. 83

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TOROIDS & FILTERS: A colorful 4-page catalog lists various toroid types and shows typical performance curves. A new standard line of encapsulated toroids is described and illustrated. Included is a section on the ordering of filters with a listing of requirements. Barker & Williamson, Inc., Bristol, Pa.
For more data, circle 6-112-9 on card, p. 83

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POWER SUPPLIES: Equipment specification sheet covers low voltage transistor regulated power supplies. Features include the firm's exclusive regulator circuit, complete semiconductor circuitry and new advanced-design cooling system. Power Sources, Inc., Burlington, Mass.
For more data, circle 6-112-10 on card, p. 83

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SLIDES: Industrial slides which provide instant access for maintenance and servicing are described in new literature. Applications, features, illustrations included. Grant Pulley & Hardware Corp., High St., West Nyack, N. Y.
For more data, circle 6-112-11 on card, p. 83

▼

TIMERS: A series of technical data sheets provide engineering specifications on time delay relays. Features, applications and ordering information included. Voi-Shan Electronics, 13259 Sherman Way, North Hollywood, Calif.
For more data, circle 6-112-12 on card, p. 83

SEMICONDUCTORS: Five complete lines of industrial semiconductors are covered in a new 12-page brochure, "Dependable Quality in Quantity." Breakdown voltages, current capacity and operating temperature range included. Motorola Inc., Semiconductor Products Div., 5005 E. McDowell Rd., Phoenix, Ariz.
For more data, circle 6-112-13 on card, p. 83

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RESISTORS & COIL FORMS: Products covered in a new catalog include a complete line of ½, 1 and 2-watt fixed composition resistors that meet, or exceed, all requirements specified by MIL-R-11 and RS 172. Dimensions, derating curve, color code and table of standard resistance values and tolerances included. Phenolic coil forms and special resistors are described in separate sections. Speer Resistor Div., Speer Carbon Co., Bradford, Pa.
For more data, circle 6-112-14 on card, p. 83

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POTENTIOMETERS: Miniature single-turn wire-wound potentiometers that save up to 25% space behind the panel are covered in a circular. Both are capable of dissipating 2 watts continuously. Waters Mfg. Co., Wayland, Mass.
For more data, circle 6-112-15 on card, p. 83

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VOLTAGE REGULATOR: Bulletin 3300 provides 14 pages of information on the Fincor model F-33 series voltage regulator-exciter. Detailed description of operation with schematic wiring diagram, connection diagrams, and dimension diagrams are included. Fidelity Instrument Corp., 100 E. Boundary Ave., York, Pa.
For more data, circle 6-112-16 on card, p. 83

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PROCESS CONTROL SYSTEM: The firm's Beta Gauge Process Control Systems are covered in a 32-page catalog. Information on components and applications is included. Tracerlab-Keleket, 1601 Trapelo Rd., Waltham 54, Mass.
For more data, circle 6-112-17 on card, p. 83

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TUBING: Two new tubing products, teflon extruded tubing and silicon rubber extruded tubing, are included in a new 2-color, 8-page, catalog which covers the complete Alphlex tubing line. Alpha Wire Corp., 200 Varick St., New York 14, N. Y.
For more data, circle 6-112-18 on card, p. 83

OSCILLOSCOPES: Application Note #36 entitled "Sampling Oscillography" traces the history of the sampling technique and its recent application to oscilloscopes. It also discusses general sampling considerations and describes the new model 185A sampling oscilloscope. Hewlett-Packard Co., 275 Page Mill Rd., Palo Alto, Calif.

For more data, circle 6-113-2 on card, p. 83

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MARKERS & SIGNS: Speedy Marx pipe markers, electrical markers, numerals, letters, safety signs and identification signs are described in a multi-colored, 24-page, catalog. North Shore Nameplate, 214-27 Northern Blvd., Bayside 61, N. Y.

For more data, circle 6-113-3 on card, p. 83

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MINIATURE LAMPS: A pocket-size booklet lists approximately 400 standard miniature lamps with specifications, lamp nomenclature, drawings, descriptions and sources of supply. Chicago Miniature Lamp Works, 1500 N. Ogden Ave., Chicago 10, Ill.

For more data, circle 6-113-4 on card, p. 83

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BATTERY CHARGERS: Automatic battery chargers, designed to automatically control the charging of starting batteries, are described in bulletin 237. Non automatic battery charger literature covers: trickle chargers, bulletin 236; battery chargers, bulletin 203. Automatic Switch Co., Florham Park, N. J.

For more data, circle 6-113-5 on card, p. 83

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SOLID-STATE: State-of-the-Art advancements on new systems and components are graphically presented in a new brochure, "Solid-State Conversions." Concise information is given, particularly in size reduction and extended environmental range. Cook Electric Co., Diaphlex Div., 2700 Southport Ave., Chicago 14, Ill.

For more data, circle 6-113-6 on card, p. 83

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SOLENOIDS: Bulletin A-1259, an illustrated application guide contains specific physical, performance and environmental data on more than 250 different models of solenoids, selectors and stepping motors. Included are charts, circuit diagrams and an explanation on how to use the data. Ledex, Inc., 123 Webster Ave., Dayton 2, Ohio.

For more data, circle 6-113-7 on card, p. 83

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INDUCTION HEATING TURNTABLE: Continuously moving, variable speed turntable, Vari-Matic, is covered in a 4-page folder. For use in conjunction with induction heating, chief applications are silver brazing and soft soldering electronic components, making glass-to-glass seals, and heat treating or annealing mechanical parts. McDowell Electronics, Inc., 105 Forrest St., Metuchen, N. J.

For more data, circle 6-113-8 on card, p. 83

ROTARY SWITCH: A small-size, lightweight, rotary switch which completes up to 100,000 contacts per minute with no bounce is covered in a 2-color, 4-page, brochure. Specifications, environmental characteristics and an exploded view of complete parts breakdown are included. Circuit Controls Co., 1500 E. Colorado St., Glendale 5, Calif.

For more data, circle 6-113-9 on card, p. 83

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RELAYS: A 2-color, 4-page, brochure on Advance Elgin relays is fully illustrated and includes details of application, performance, specifications, etc. Schweber Electronics, 60 Herricks Rd., Mineola, L. I., N. Y.

For more data, circle 6-113-10 on card, p. 83

▼

ELECTRIC MOTORS: Technical data and illustrations of fractional and sub-fractional hp electric motors are contained in the new, 4-page, Thor SpeedMotor catalog. Speedway Mfg. Div., Thor Power Tool Co., 1421 Barnsdale Rd., LaGrange Park, Ill.

For more data, circle 6-113-11 on card, p. 83

▼

DELAY LINES: Bulletin #192, "Delay Lines—Basic Design Considerations," supplies information needed to calculate the circuit parameters and size of the delay line to meet specific requirements. The firm is now custom-building lumped constant delay lines. Cornell-Dubilier Electric Corp., 4144 Glencoe Ave., Venice, Calif.

For more data, circle 6-113-12 on card, p. 83

▼

TAPE SEARCHWRITER: The Univac Tape Searchwriter, an integrated system which provides an economical method for searching a magnetic tape file for a desired item, is described in a new 8-page booklet, U-1729. Remington Rand Div., Sperry Rand Corp., 315 Park Ave. South, New York 10, N. Y.

For more data, circle 6-113-13 on card, p. 83

▼

PRINTED COMMUNICATIONS: "Teletype 28 Stunt Box" is the title of a new 20-page, illustrated, 4-color brochure. Its purpose is to explain how model 28 page printers and automatic send-receive sets can be utilized to their maximum capabilities. The basic information of Teletype equipment, together with explanation of its operation and application, are provided. Teletype Corp., 4100 Fullerton Ave., Chicago 39, Ill.

For more data, circle 6-113-14 on card, p. 83

▼

CAPACITORS: Four-page bulletin, K-1, describes a line of subminiature ceramic capacitors now made from any one of thirteen different ceramics. Properties and range of capacitance values are shown for these materials. Terminal arrangements are illustrated. Stock high-capacitance units for transistor circuit applications are shown. Mucon Corp., 9 St. Francis St., Newark 5, N. J.

For more data, circle 6-113-15 on card, p. 83

INDUSTRIAL COMMUNICATIONS Report

ROBERT E. TALL
Editor, *Industrial Communications*
Washington, D. C.

A plea to all organizations "concerned in any way with the sale, maintenance or use of business or citizens radio stations" to help the FCC bring about the "prompt cessation" of unlicensed operation of radio stations was distributed to hundreds of organizations which the agency feels may be of help.

▼

The FCC made final, with several changes from the original proposal, new common carrier radio rules restoring provision for the assignment of 450-460 megacycle frequencies for control stations operating in the domestic public land mobile and point-to-point microwave radio services.

▼

Orders may be placed with the "Secretary General, International Telecommunication Union, Geneva, Switzerland" for copies of the International Telecommunication Convention, Geneva, 1959, and Radio Regulations annexed to that document, which resulted from the international radio conference last year. English versions of both the Convention and the radio regulations will cost $1.15, which is to be transmitted by international money order.

▼

An amendment to the Communications Act to authorize the FCC to suspend radio licenses for a period of 90 days, in addition to other sanctions which the Commission can invoke, has been recommended in correspondence sent to Congress by the agency.

The Commission explained that the only sanctions presently available to it, except in certain cases involving common carrier matters and licenses of ship radio stations, is actual revocation of the station license, and this is too "drastic" in many cases. The requested authority, as far as mobile radio services are concerned, would be in addition to the previously requested authority to impose "small forfeitures" on licensees for willful and repeated violations.

Officials of communications companies, and the communications chiefs of a number of large industrial and service companies, addressed the annual convention of the Industrial Communications Association on May 25-27 at the Seville Hotel in Miami Beach, Fla.

▼

The Army Signal Corps reported development of a stabilization device for quartz crystals that makes possible more precise control of radio frequencies.

The new device uses temperature-sensitive bimetal strips pressing against certain spots on the edge of the crystal. Acting like thermostats, the strips apply the right amount of press to keep the crystal operating on frequency as temperature fluctuates.

▼

A new rundown on FCC policy and procedures on requests for waivers of transmitter deviation reduction requirements in the land transportation radio services—which permit the use of "wide-band" transmitters after Jan. 31, 1959, provided the transmitters do not cause interference to narrow-band units—has been compiled by the FCC Safety & Special Radio Services Bureau, and is available from that bureau on request.

The FCC this week denied a request for waiver of the eligibility requirements of the special industrial radio service which had been submitted by Boudreaux Marine Service, Inc., Berwick, La. The company had asked a base station and 30 mobile radio units in the special industrial service operating on the frequencies 2292 and 2398 KC.

▼

A number of presentations on communications and telecontrol of gas pipeline systems were scheduled during the Combined Distribution-Transmission Conference of the American Gas Association's Operating Section May 9-13 at the Jung Hotel in New Orleans.

▼

▼

A. E. Lowe, Electronic Engineer for the US Forest Service told a meeting of the Washington Chapter of the Institute of Radio Engineer's Professional Group on Vehicular Communications that while efficiency and standard production of solar power equipment has progressed in the past three years, the cost of such equipment in relation to power obtained is far too costly for normal commercial use.

▼

The FCC has affirmed its Feb. 12 report and order which—effective March 15—amended the agency's citizens radio rules to clearly prohibit "random contacts with unknown stations, seeing how far a citizens station transmission can go, monopolizing the citizens frequencies with prolonged conversation, and other operations which are more appropriate in the amateur radio service."

▼

The fact that skip interference, particularly to and from low-band mobile radio operations, will be tapering off somewhat in the next several years was verified in a technical report by the National Bureau of Standards. NBS pointed out that since "magnetic disturbances seem to lag from one to three years behind the peak of solar activity," the increasing number of "disturbed periods in the late summer of 1959 was an indication that the solar activity cycle was definitely past its peak."

▼

Subscribers to burglar alarm services who lease connecting lines or channels directly from telephone companies, obtaining terminal services from the burglar alarm company, must pay the usual 8% wire and equipment service excise tax to the burglar alarm firm for the services obtained from it, the Internal Revenue Service stated.

▼

New Books

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

***INTRODUCTORY ELECTRIC CIRCUITS.** *By John B. Walsh & Kenneth S. Miller. Published by McGraw-Hill Book Co. 372 pages, hard cover. $8.50.*

The subject matter of this book presents the phenomena of electronic circuits using mathematics as a basis for discussion. Commencing with an introductory explanation of simple d-c circuits, the text becomes ever more difficult as each succeeding chapter analyzes increasingly complex circuitry. A proper background in mathematics is essential for those endeavoring to undertake the complex study of electronic fundamentals. The text may serve as a reference study for the advanced electronic technician or student. Phasors, Fourier series, Laplace transform, matrix analysis, and logarithmic equations, form the greater portion of this electronic engineering text.

OFFICIAL REGISTRY OF INDUSTRIAL RADIO SYSTEMS. *Published by Communication Engineering Book Co., Monterey, Mass. 229 pages, soft cover. $5.00.*

This catalog is broken into two main sections. Part I lists licensees in the special fields of industrial, power utility, petroleum and gas, etc. Part II lists assigned frequencies and call letters. A coding key accompanies each section.

***2-WAY MOBILE RADIO HANDBOOK.** *By Jack Helmi. Published by Howard W. Sams & Co., Inc. 208 pages, soft cover. $3.95.*

The fast growing mobile radio field is expertly covered for technicians and equipment owners in this well written volume. Ten well illustrated chapters explore mobile radios, including: basic systems, receivers, transmitters, antennas, and control systems. One chapter each is devoted to servicing and setting up the shop. A good comprehensive treatment.

ZENER DIODE HANDBOOK. *Prepared and published by International Rectifier Corp. El Segundo, Calif. 96 pages, soft cover. $2.00.*

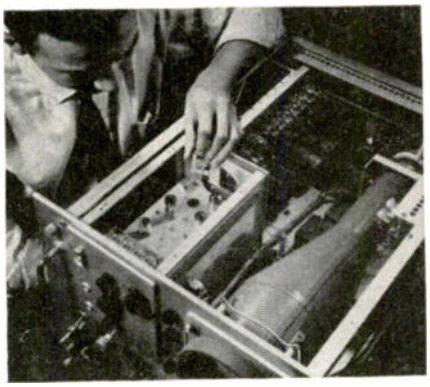
This handbook offers a concentrated discussion of the theoretical and practical aspects of Zener diodes. Semiconductor theory and reverse breakdown theory is analyzed, as are characteristics of Zener diodes in various applications. Chapters on applications are particularly interesting, such as: D-C Applications, Audio & R-F Applications, Computer & Instrumentation Applications. A number of specification charts is included in the latter portion of the manual. Recommended as one of the more complete guides available for understanding Zener diodes.

NEW PRODUCTS

For more information on these products, CIRCLE CODE NUMBERS on inquiry card, page 83.

CBS INSTRUMENT TUBES:

A line of instrument tubes, claimed to be the first of their kind, feature: coil heaters throughout; 48-hour stabilization of electrical characteristics; 100-hour early life assurance test; special 1,000-hour life test and 5,000-hour in-

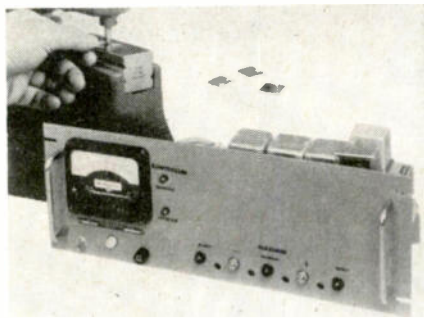


formational life test. Instrument versions of popular standard types are the 7728, 7729, 7730, 7731, 7732, and 7733. The first five types replace the 12AT7, 12AX7, 12AU7, 6U8A and 6CB6 respectively. The 7733 is the instrument counterpart of a 6v version of type 12BY7A. CBS Electronics, Danvers, Mass.

For more data, circle 6-115-2 on card, p. 83

Regohm METER RELAY

Claimed to offer a radical increase in operating range over the conventional contact meter, a new meter relay provides continuous operation without the need for re-set circuitry. Prime application is in the field of process control. Driven from low-level electrical



signals, or the output of differential transformers, strain gages, gas analyzers, bridges, temperature-sensitive elements or photocells. Can perceive a 0.00005" thickness change on the basis of less than a 2μw signal change from the gaging head. Electric Regulator Corp., Pearl St., Norwalk, Conn.

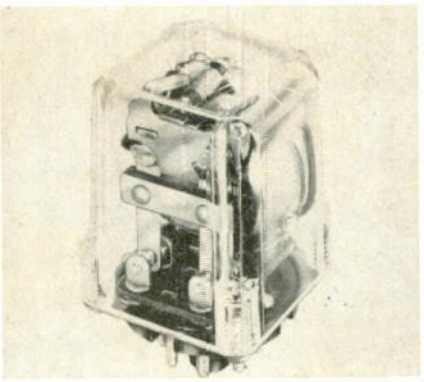
For more data, circle 6-115-3 on card, p. 83

Latest New Products

P&B RELAYS

Type KRP-N general purpose relay, with built-in neon indicator lamp, is available for 6 to 110v d-c and 6 to 230v a-c operation. Silver cadmium contacts rated at 10 amperes are standard for both a-c and d-c models and silver contacts are rated at 5 amperes. Contact arrangements are available up to 3 PDT. Overall dimensions, not including plug are 2" high x $1\frac{13}{32}$" square. Octal plug terminals are standard. This model is one in the new KRT series. Potter & Brumfield, Princeton, Ind.

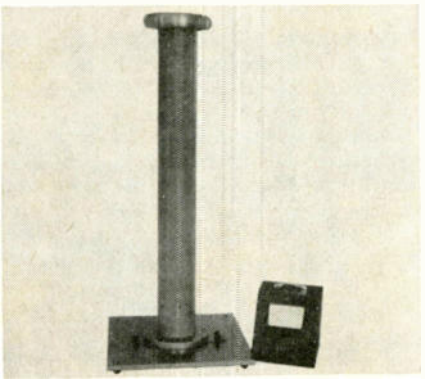
For more data, circle 6-118-1 on card, p. 83



Peschel VOLTMETER

Model M200DC kilovoltmeter features two piece construction for remote metering, direct reading linear scale, rugged construction, conservatively rated components, safe operation, low drain and reversible polarity. Composed of a high-voltage multiplier resistor in a tall bakelite tube and an indicating instrument in a small metal cabinet at ground potential, it has an input resistance of 2,000 megohms, a 4½" square indicating instrument and will take care of an overload of 150%. Peschel Electronics, Inc., Towners, Patterson, N.Y.

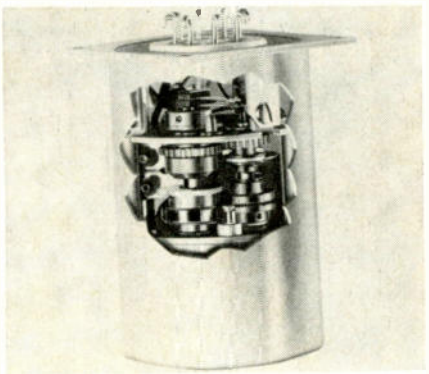
For more data, circle 6-118-2 on card, p. 83



ITC TIMERS

Series "D" hermetically sealed automatic reset time delay timer, for applications requiring extreme accuracy and dependable service under extreme ambient conditions, feature: time cycles, factory set, 1 second to 60 hours; switch rating, 5 amps at 115/60; switch contacts, SPDT; voltages, 6-230v. 25, 50, 60, or 400 cycles, 6, 12, 24, 28, 115v d-c. Also available with additional load switches. All switches timed to customers specifications. $53.50 for a 1 switch model, 115/60, quantity one. Price subject to standard quantity discount. Industrial Timer Corp., 1407 McCarter Highway, Newark 4, N. J.

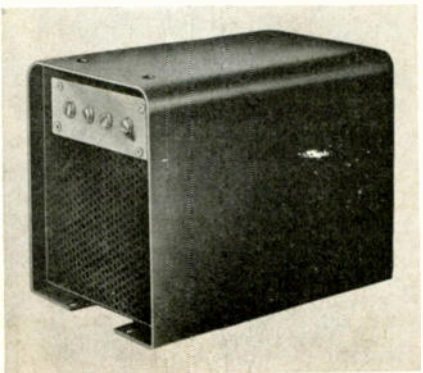
For more data, circle 6-118-3 on card, p. 83



Freed TRANSFORMER

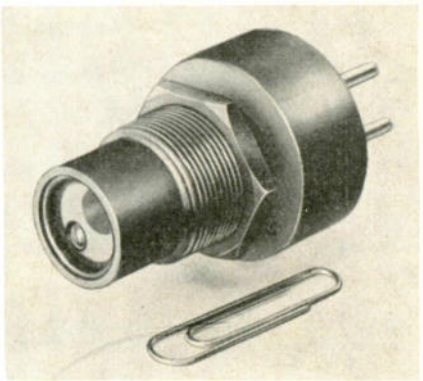
A new Sine Wave (7% distortion) constant voltage transformer in 60 and 400 cycle units has a current-limiting feature which prevents excessive fault currents. With a line variation of 95v to 130v, output will remain constant to within ± 1.50%. It can replace non-regulating transformers in step-up or step-down service. Replacement of parts and service are eliminated because the new tubeless constant voltage transformer has no renewable parts. Can be hermetically sealed for military applications at elevated temperatures. Freed Transformer Co., 1718 Weirfield St., Brooklyn 27, N.Y.

For more data, circle 6-118-4 on card, p. 83



Farmer SCANNER

Type SA-IR infrared photoelectric scanned, or proximity sensor, combines light-source and photocell in a single unit and operates on reflected light. Size, 2¼" long, 1⅛" in diameter. Responds to metallic and non-metallic objects and will sense objects or control-areas at distances up to two

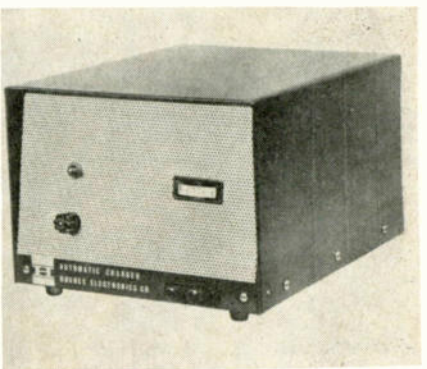


inches. Infrared source rated at 60,000 hours life when operated at 5v a-c. Solid-state detector is sturdy, sensitive, and sealed for protection against moisture, dust or corrosive atmospheres. Infrared filter minimizes effects of ambient light. $29.00. Farmer Electric Products Co., 2300 Washington St., Newton Lower Falls, Mass.

For more data, circle 6-118-5 on card, p. 83

Hughes BATTERY CHARGERS

Silicon battery chargers, with automatic stepless control for lead-acid and nickel-cadmium batteries, operate from single phase power. Standard models are available in capacities of 1 and 3 amperes for battery systems from 6-120v d-c. Claimed as a new concept in modular design whereby the



charging current and voltage are automatically controlled through a stepless transition from beginning to end. End voltage regulation obtained, less than ±1%, reduces the end charging current in the order of 20/1 of the rated charger capacity. Hughes Electronics Co., 5343 Crenshaw Blvd., Los Angeles 43, Calif.

For more data, circle 6-118-6 on card, p. 83

Reps & Distributors

SCHWEBER ELECTRONICS has announced the appointment of ERNEST V. SMITH as Field Representative.

LEDEX has named THE RUSSELL F. CLARK CO., INC. as rep for West Pa., West Va., and bordering counties of adjacent states.

HAMILTON ELECTRO SALES announces an expansion move to new quarters at 12308 Wilshire Blvd., Los Angeles 25, Calif.

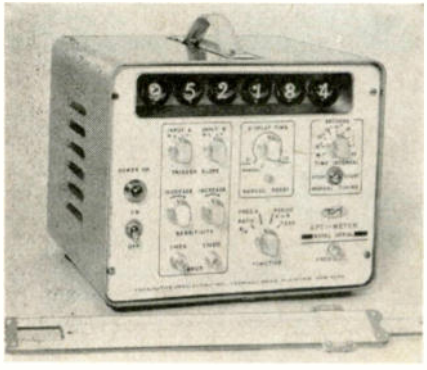
HOFFMAN ELECTRONICS Semiconductor Div. reports the appointment of AEROMOTIVE ENGINEERING PRODUCTS, LTD. as its franchised Canadian distributor and sales rep.

ATOHM ELECTRONICS has announced the following three rep appointments: THE DAN GREENE ORGANIZATION, New England; FLOYD FAUSETT & CO., Dixie; and THE NORWEST CO., Pacific Northwest.

SPARTON CORP. Electronics Div. announces the following technical service rep appointments: LON LADD & ASSOC., Southwest including Ariz., N.M., Colo., and Texas; and R. HUGH LEE & ASSOC., Michigan.

TSI COUNTER-TIMER

A 1 mc counter-timer, model 361, featuring all solid state circuitry and in-line Nixie readout, is designed for laboratory and industrial applications. The counter serves for calibration, timing and control, frequency meter, time-interval meter, secondary fre-



quency standard, period counter and ratiometer. Counting accuracy is achieved through a transistorized, crystal controlled clock, with or without temperature oven. Accuracy is specified as ±1 count ±3 parts in 10^7 per week. Size, 8"x10"x8". Weight, 11 lbs. Transistor Specialties, Inc., Terminal Drive, Plainview, L. I., N. Y.

For more data, circle 6-119-2 on card, p. 83

INDEX TO ADVERTISERS

June, 1960

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

IT TAKES TWO TO SELL THEM ALL

There are wide differences in what customers want in price, performance, and quality of a replacement picture tube. Now RCA offers you this two-line sales team to help you capture EVERY sale.

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Sell the premium RCA Silverama—the ultimate in picture tubes. Silverama premium-quality offers top profit per unit. And remember: Every RCA Silverama is pre-sold for you—through heavy TV network and consumer magazine advertising.

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Sell the popular-priced RCA TV Picture Tube—second to none among competitive standard brands. Make the most of the powerful sales potential in the RCA name—the brand your customers want and trust.

Check with your authorized RCA distributor now! Get the inside story on this two-way opportunity for greater profits. *RCA Electron Tube Division, Harrison, N. J.*

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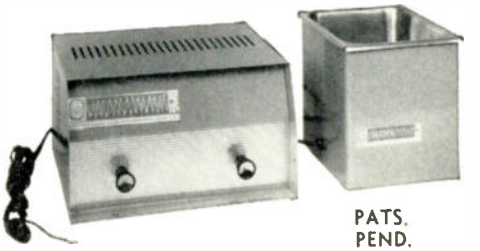
My name is Paul M. Platzman,

I pioneered the ultrasonic industry. Two well known ultrasonic companies were founded by me. Now, I have created a new organization, Ultrasonic Industries, Inc., based on a revolutionary approach to mass producing and selling ultrasonic equipment. No middleman's profit in this factory — direct-to-you deal.

Tremendous savings are passed on to you the customer bringing formerly high-priced ultrasonic cleaners within the range of everybody's budget. My products stand out because of their distinctive appearance, unbelievably low money-back-guaranteed prices—free five year service contract, and consistent trouble free performance under the most gruelling conditions. This is possible because my DiSONtegrator generators and transducers incorporate the latest advances in ultrasonic technology.



PATS. PEND.

Not Pint Size . . . But Full ½ Gal. Cap.
Extra Tanks: $40 each; Junction Box: $12.95

$99.95

Including tank, connecting cable and instruction manual (export model: 220V — 50 cycles $7.50 extra)

DiSONTEGRATOR® SYSTEM FORTY ULTRASONIC CLEANER

The lowest priced ultrasonic cleaner ever sold! **Buy ONE or 100 and Save!**

The diSONtegrator System Forty ULTRASONIC CLEANER is attractively styled, ruggedly-built, and work-tested to give a lifetime of trouble-free service.

The diSONtegrator Features:

Simplified one knob control for easy operation. High Frequency sound waves disintegrate harmful soils and contaminants in seconds. Saves time and labor, boosts production rate, improves product. You can replace hazardous chemicals with safe solvents and even water.

The diSONtegrator works FAST

In SECONDS you can disintegrate soils on: radioactive lab apparatus; glassware; medical instruments; test tubes, syringes, hypodermic needles; dental instruments, drills, burrs, false teeth, bridges; fossils and fossil foraminifera; electronic components, semi-conductors, crystals, switches, precision potentiometers; optical parts, lenses, plastic contact lenses, eyeglasses; timing mechanisms; small gear trains; miniature printed circuit boards; and hundreds of other items.

In seconds you can remove:

rust, oxides, shop dirt, dust, lint, preservatives, finger prints, machining chips, extrusion lubricants, paraffin, wax, paint, varnish, lacquer, plastic residue, resists, silicones, greases, cooked food residue, blood, plaster of paris, lapping compounds, carbon, radioactive particles, polishing compounds, shale, diatomite, volcanic tuffs, clay and sand, graphite, starches, cutting oils, heat treat scale, color stains, foundry sand, abrasives, quenching oil, salts, pitch, asphalt, tar, inks, adhesives, jewelers rouge, tripoli, resin flux, acid flux, many others.

Ultrasonic cleaners are widely used

in production lines, maintenance departments and laboratories. You should have at least one diSONtegrator if your field is Electronic, Optical, Glass, Clinical, Biological, Textile, Oil, Food, Paper, Dental, Plastic, Drug, Rubber, Wood, Chemical, Isotope, Geological, Agronomical, Metallurgical, Anthropological, Paleontological, Petrochemical, Ceramics, Dairy, Brewery, Beverage, Confectionery, Laboratories, Photographic, Paint, Bottling, Cosmetic, Pharmaceutical, Metal Working, Metal Finishing, Die-Casting, Foundry, Plating, Metal Treating, Automotive, Aircraft, Horological, Jewelry, Medical, Marine, Mining, Utilities, Power Plants, Instrumentation.

LOW PRICES ON LARGER MODELS!

System No.	Power Output (Watts)	Tank Capacity Gallons	Tank Dimensions Length x Width x Depth (inches)	Price
80	80	1½	12 x 6 x 6	$ 199.95
320	320	5	14 x 10 x 9	349.95
520	520	10	20 x 10 x 10	999.95
1040	1040	30	24 x 18 x 16	1,999.95
3000	3000	75	31 x 31 x 18	3,999.95

INTRODUCTORY OFFER

Money Refunded (less shipping charges) if not completely satisfied.

Guarantee

The DiSONtegrator you have just received is the finest ultrasonic machine made. It has passed a rigid inspection and found to be in perfect condition. Read your instruction manual carefully. Properly handled, this equipment will exceed your expectations and render long service.
A free 5 year service policy is included with this purchase. No charge for replacement parts first two years. Tubes carry 90 day guarantee. Service and parts required after the expiration of the guarantee will be furnished at prevailing factory prices.

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We will pay all shipping charges to any point within the continental limits of the United States (not including Alaska and Hawaii), if you enclose check with order.

UNPRECEDENTED FREE 5 YEAR SERVICE CONTRACT

The DiSONtegrator — System Forty is available from stock for immediate delivery in unlimited quantities.

SPECIFICATIONS

GENERATOR INPUT: 117 V, 60 cycle — GENERATOR OUTPUT: 40 W, 90 KC
DIMENSIONS: GENERATOR: 10" L x 7" W x 5¾" H
TANK (OVERALL): 6½" L x 7" W x 6½" H
TANK (INSIDE): 5¼" L x 5¾" W x 4" D
TANK (CAPACITY): 0.5 Gal.

FOR THE FIRST TIME — you have a choice of 7 beautiful decorator colors to harmonize with your office or laboratory decor: Ivory, Wheat yellow, Turquoise, Desert sand, Pale green, Coral pink and Soft gray. Please specify color when ordering.

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Unit(s) @ $99.95 ea.: ☐ Ivory ☐ Wheat yellow ☐ Turquoise ☐ Desert sand ☐ Pale green ☐ Soft gray ☐ Coral pink

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I understand that my money will be refunded if not completely satisfied after 5 day trial.

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For more data, circle 6-C3-1 on coupon, p. 49