

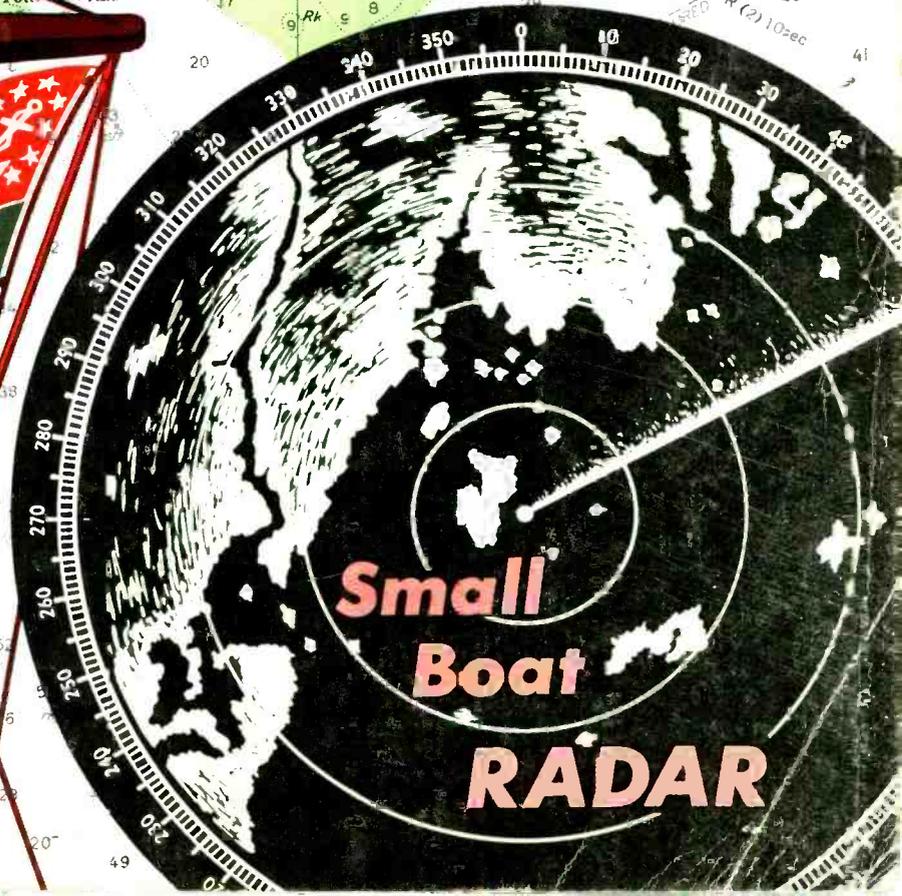
ELECTRONIC TECHNICIAN

Including
SERVICE
Magazine

**INDUSTRIAL
ELECTRONIC
MAINTENANCE**
Edition

Great Captain I
foul

MARKER
MARKER



**Small
Boat
RADAR**

50¢

October 31, 1960





PUZZLED

...no need to be

look to this sign of assurance!

The Distributor displaying this sign will solve your tuner problems at a profit to you.

He has available the New Standard Tuner Replacement Guide, including replacement parts listings. This is the only Guide of its kind in the world. Covers all Standard tuners produced through 1959. Includes replacements for many tuners not produced by Standard.

He handles our 48-hour Factory Guaranteed Repair Service and Trade-In Allowance on unrepairable Standard tuners.

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standard kollman

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ELECTRONIC TECHNICIAN

Including
SERVICE
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World's Largest Electronic Trade Circulation

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October, 1960

FRONT COVER Small boat radar is becoming increasingly popular as a navigation and safety aid for pleasure craft. These simplified, relatively inexpensive units offer interesting work and added income potential for qualified electronic technicians. For detailed information, see article starting on page 32.



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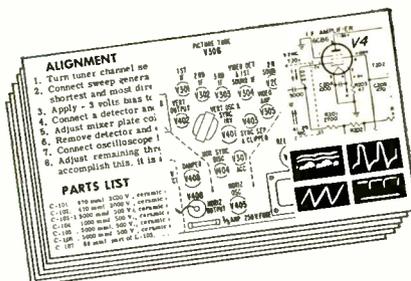
INDUSTRIAL ELECTRONIC MAINTENANCE 89-122

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- ZENITH: TV Chassis 16F25, 16F26, 16F25T, 16F26T, 16F25Q, 16F26Q



The growth of the entire Electronic

in famous

PHILCO Industry Firsts

THIRTY YEARS AGO PHILCO REVOLUTIONIZED THE RADIO INDUSTRY WITH THE FAMOUS "BABY GRAND" . . . the first reliable quality table model to be mass-produced in America. From that day forward, table model radios became big business!

Think back . . . think how much this one Philco development has contributed to the growth of your service business. Yet it's just one example among many, many Philco "Firsts" that have resulted in increased profit opportunities for you. Similarly, the proven reliability of Philco parts, tubes and accessories protects your profits, and builds good will.

For all your servicing needs, look to

PHILCO THE FIRST NAME IN ELECTRONICS
...THE LAST WORD IN **QUALITY**



SEE YOUR PHILCO DISTRIBUTOR

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Service Business is reflected



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**Here's Just One
Example... the Famous Philco
"Baby Grand" Introduced by
Philco in 1930**

With the "Baby Grand", Philco solved the problem of building a quality radio in compact size that could be mass-produced at a price millions could afford. It started a whole new phase of the radio business, and in the same year—1930—Philco also introduced the

FIRST TONE CONTROL
—another famous Philco first!

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PHILCO



Famous for Quality the World Over

Why are more Service-Dealers Switching to **JFD** EXACT REPLACEMENT TV ANTENNAS?



because

50 per cent of all TV sets made in the last 4 years are portables—sending *more* antenna replacement business to service-dealers every day.

because

with the JFD PA500 and PA515 Exact Replacement Kits, dealers are ready and able to service 90% of antenna replacements for portables and tote-ables.

because

as JFD Exact Replacement Specialists, service-dealers can get out of the unprofitable “rabbit-ear” business—earn a *profit* on the antenna *sale* (at full mark-up) *and* on the *installation*.

because

with JFD guides, streamers, and sales helps, service-dealers get the merchandising *know-how* that nets them a bigger slice of the 3,500,000 dollar portable antenna replacement market.

***NOW IS THE TIME TO WRITE JFD OR ASK YOUR JFD DISTRIBUTOR
FOR YOUR EXACT REPLACEMENT PROFIT PLAN PORTFOLIO!***



Only JFD keeps you up-dated with the 1960 Portable TV Antenna Guide covering every portable TV set made since 1956 (compiled and edited by Howard W. Sams & Co., Inc.)
CHECK SAMS PHOTOFACT FOLDERS
For JFD Exact Replacement Antenna Information



THE BRAND THAT PUTS YOU

JFD

JFD ELECTRONICS CORPORATION BROOKLYN 4, NEW YORK

JFD International, 15 Moore Street, New York, New York • JFD Canada, Ltd., 51 McCormack Street, Toronto, Ont., Canada IN COMMAND OF THE MARKET

Why are more Service-Dealers Switching to **JFD HI-FI TV ANTENNAS?**



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 Colorennas to guarantee complete customer satisfaction... guard his reputation.

JFD
IN COMMAND OF THE MARKET

HI-FI HELIX HI-FI BANSHEE HI-FI FIREBALL



because

they know 5 million antennas need replacement—that JFD HI-FI TV antennas assure them a bigger share of this profitable market.

because

JFD all-out advertising sells for them in powerful national mass media—such as Look, TV Guide, Successful Farming, Farm Journal, Progressive Farmer.

because

JFD is the total antenna line with the right model, at the right price for every location—does the most for them in mile-shrinking performance and customer confidence.

because

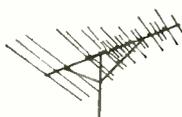
JFD sales stimulators such as cloth patches, decals, mobiles, banners, displays and direct mail give them the complete package to sell new customers.

HOW MUCH INSTALLATION BUSINESS ARE YOU LOSING BY NOT SWITCHING TO JFD? THE TV ANTENNA LINE AMERICA KNOWS BEST!

HI-FI HELIX
Silver or Gold Anodized



HI-FI BANSHEE
Silver or Gold Anodized



HI-FI FIREBALL
Silver or Gold Anodized



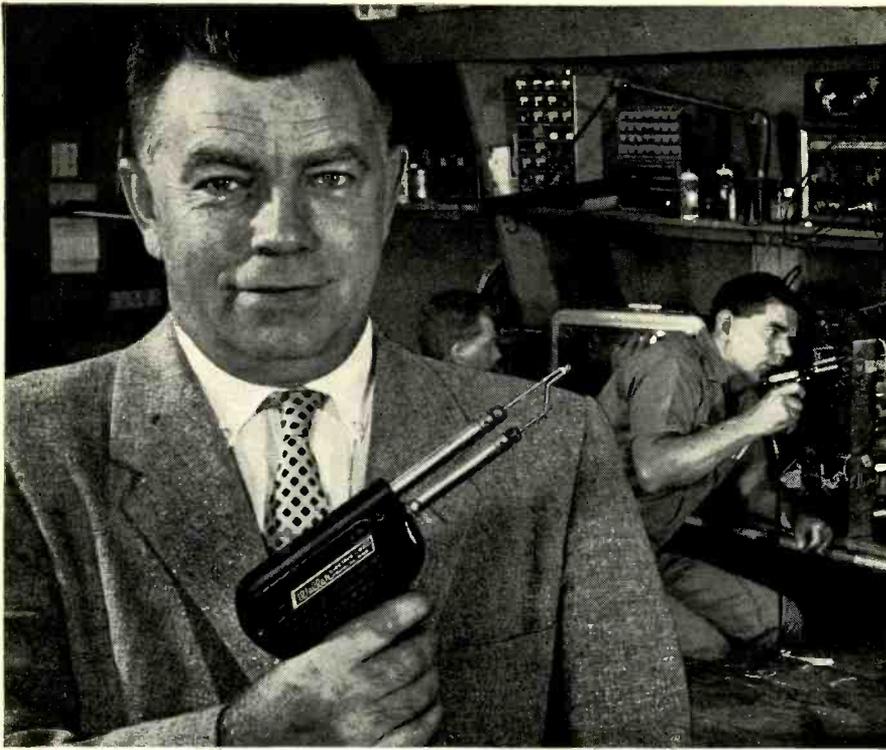
THE BRAND THAT PUTS YOU

JFD

IN COMMAND OF THE MARKET

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JOSEPH WHELAN, VICE PRESIDENT OF GERHARD'S, SAYS:

"Gerhard's averages 70 service jobs a day

... and we do the work faster with

**Weller® DUAL HEAT
SOLDERING
GUNS"**

Brand Name Retailer of the Year in 1959, Gerhard's of Glenside, Pa., is one of the largest TV, radio and hi-fi dealers in the nation. A major reason for this is dependable service. And this service is speeded by 23 service technicians—each with his own Weller Dual Heat Soldering Gun. The combination of instant heat and 2 soldering temperatures saves many man hours and results in more reliable soldered connections. Weller's exclusive Dual Heat feature permits instant switching to high or low heat as the job requires. Get these benefits in *your* service operation.

**WELLER DUAL HEAT
SOLDERING GUN**
model 8200K

90 and 125 watt heat. High efficiency, long-life tip has long reach. Instant heat. Prefocused spotlight.

\$795
list



Weller Single and Dual Heat Soldering Guns from 90 to 275 watts available at Electronic Parts Distributors.

WELLER ELECTRIC CORP. EASTON, PA.

For more data, circle 10-6-1 on coupon, p. 43

6 < For more data, circle 10-5-1 on coupon, p. 43

Editor's Memo



This month I'd like to talk to the bosses. You fellows who work for someone else may want to read on, however, since this concerns you.

I have personnel policy on my mind, specifically, hiring, firing and—most important—keeping employees.

There would be no problem if prospective employees were all skilled hot-shots with delightful personalities. In practice, though, most people have strong and weak points. The object is to make the best use of an asset in a position where the liability will not cause damage. For example, a slightly grouchy bench ace may not hurt anyone if he doesn't handle house calls. When in doubt, don't hire. The inconvenience of waiting for the right man is more than compensated by preventing the costly disruption of turnover.

Which brings us to firing. When an employee is a real sour apple, let him go. And the sooner the better, before he pollutes the good men or insults the customers. Getting fired is a painful blow to the human ego, so have compassion. Besides, the people you kick on the way up the ladder of success may be the very ones you pass on the way down.

Now we come to the problem of keeping good men. Every time an experienced hand quits, it costs you plenty. Oddly enough, few men leave for money alone. Decent working conditions and being appreciated are important. But you can do even more than that.

Do you know that small companies are eligible for low-cost group life and medical insurance for employees?

And did you know that Treasury Department approved profit-sharing programs have great tax saving benefits for boss and employee alike? Check with an accountant. Some of these plans make it unprofitable for a good man to leave you! He loses too much.

So, Mr. Bossman, when you look around the shop today, reflect on the people working there. Resolve to get rid of that troublemaking rascal ("I don't know what I'd do without him—but I'd rather").

And promise yourself to do something especially nice for that stalwart who's been the backbone of your organization for years ("Sam, it's 4 P.M. already. Take the day off, with my compliments").

Al Forman

ADD ARTHUR GODFREY TO YOUR SALES STAFF

WITHOUT ADDING HIM TO YOUR PAYROLL!



Tie in locally with the national Sylvania Silver Screen 85 TV Tube promotion featuring you, the independent service dealer

Arthur Godfrey, America's Number One Salesman, is selling—the Sylvania Silver Screen 85 TV picture tube—and Sylvania quality small tubes—in a dynamic national advertising campaign. Just look where you're being promoted . . . twice each week on 200 CBS Radio Network stations across the country . . . *The Saturday Evening Post* . . . and lots more!



To make the most of this sales-getting promotion, be sure you use all the local tie-in aids Sylvania now offers:

GIANT WINDOW DISPLAY—colorful, 3-dimensional . . . features you and Arthur Godfrey. (Order #1139)

3-PIECE DECAL KIT—Sparkling glassine signs with Arthur Godfrey saying, "Stop Here For Quality TV Service." (Order #1138)

GIANT WINDOW POSTER—Big 20" x 26" poster promotes your service. (Order #2095)

Each and every promotion piece is designed to help you sell Sylvania Silver Screen 85 TV tubes plus Sylvania quality small tubes. For your supply—and helpful hints on how to make the best use of these selling aids—contact your Sylvania distributor. Do it today!

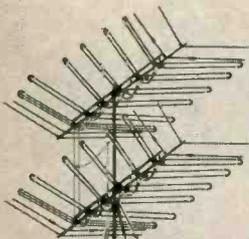
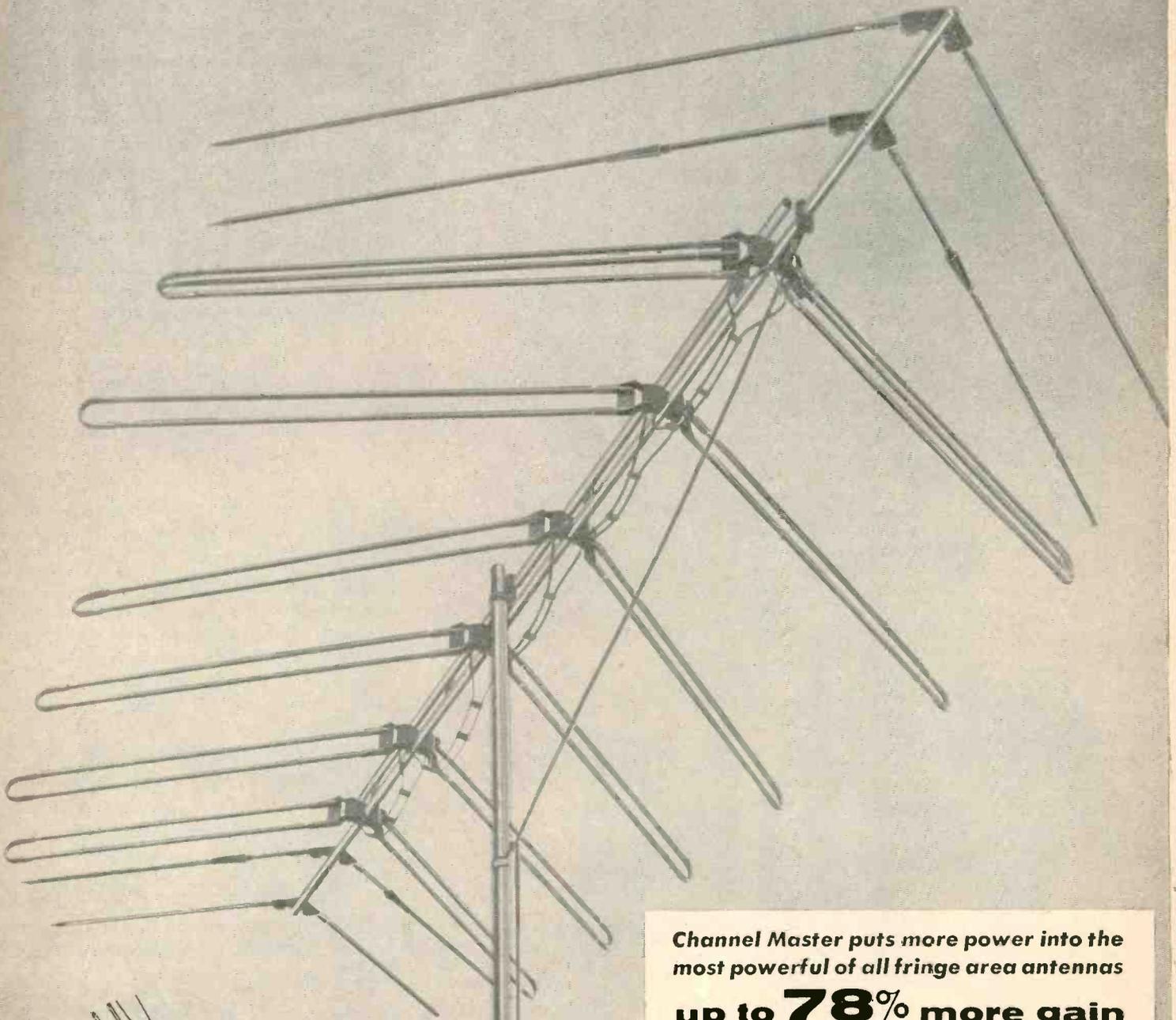
Electronic Tubes Division, Sylvania Electric Products Inc., 1740 Broadway, New York 19, New York

SYLVANIA

Subsidiary of **GENERAL TELEPHONE & ELECTRONICS**



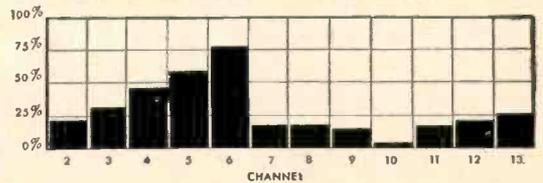
This is the one you've



All T-W's can be stacked for even greater power.

Channel Master puts more power into the most powerful of all fringe area antennas

up to **78%** more gain than the famous 7-Element T-W



Illustrates only the difference between the two antennas on each channel, not their total gain.

CHANNEL MASTER CORP.

ELLENVILLE, NEW YORK

been waiting for!

Out in the super fringes,
where nothing less will
do, step up to the new

CHANNEL MASTER® SUPER 10 T-W

model no. 358

10-Element Traveling Wave Antenna

Channel Master's T-W* is the most thoroughly tried... the most widely used... and the most enthusiastically acclaimed of all the broad band fringe antennas. Its performance has never been equalled.

Now—Channel Master takes another forward step with a bigger and better version of the T-W. This new antenna has more of what you want... more of what you need... in the super fringe areas.

New 10-Element T-W... ingeniously combines Channel Master's famous hairpin dipoles with 4 parasitic low band and co-linear high band elements. Reaches new highs in gain and front-to-back ratios.

New low band director and reflector system... increases gain up to 2½ db more than a 7-Element T-W—a 78% power increase!

New high band co-linear elements... add 20% to the T-W's high band gain. The co-linear reflector and director are each actually 3 half-wave elements placed end to end.

Ruggedized, all-weather construction... Including heavy duty weatherproof harness that won't let rain or salt air impede reception.

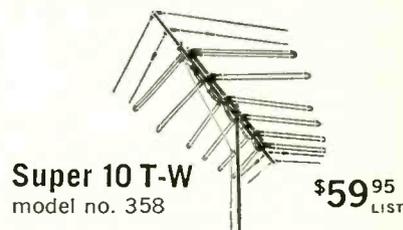
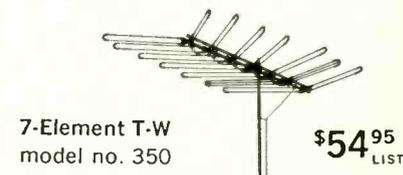
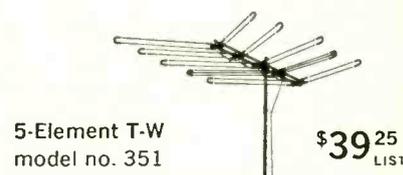
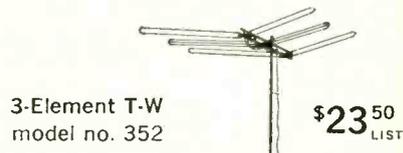
DEALERS: SPECIAL INTRODUCTORY OFFER

Buy **6** Super T-W's—get **1** free

Call your Channel Master Distributor today

NOW...

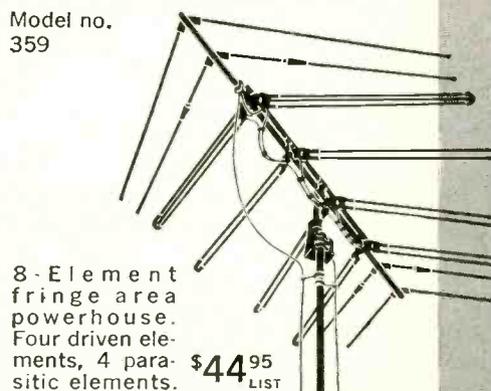
THERE ARE 5
for every problem...
for every area...
pick a T-W



**and introducing
the new**

SUPER 8 T-W

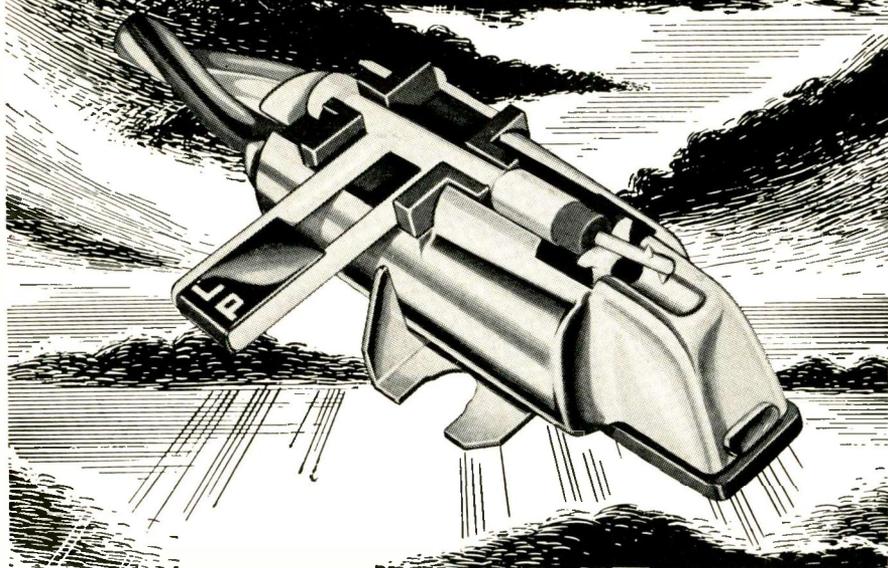
Model no.
359



ALL PRICES SLIGHTLY HIGHER IN CANADA

STEREO QUALITY SOARS TO NEW HEIGHTS...

Presenting the
finest ceramic stereo cartridge
ever perfected by Sonotone



THE "PROFESSIONAL QUALITY" 9T!

Now, the ceramic cartridge proved in independent A-B listening tests to perform as well as the highest-priced "professional" types. It's Sonotone's revolutionary new 9T. So superior, you can expect faithful reproduction from the most robust musical passages to the most subtle overtones. Sonotone's new 9T series stereo cartridge:

GUARANTEES performance equal to cartridges costing up to 3 times as much—as proven in A-B listening tests.

GUARANTEES highest compliance—allows major reduction of tracking force.

GUARANTEES more than adequate channel separation.

GUARANTEES crisp definition.

GUARANTEES superior, more compact mechanical design—including revolu-

tionary new needle design with instant "snap-in, snap-out" replacement needle feature and built-in jewel tip protector.

ELIMINATES distortion—incredibly flat response of ± 1 db from 20 to 17,000 cps—cuts listening fatigue.

ELIMINATES dust pile-up—at recent trade show the 9T ran 4 straight hours, collected no dust.

ELIMINATES most record groove noise or hiss—no "needle talk".

Imagine, the 9T boasts all these "professional" features...yet sells for less than half the price of the least expensive "professional" cartridge. Simplify your inventory...cut call-backs—increase sales and profits—with Sonotone's great new 9T cartridge...unsurpassed for performance—and for value.

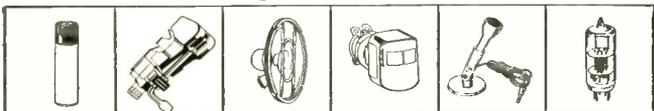
LIST PRICE:	9T-S...\$16.50 (0.7-mil and 3-mil sapphires)	9T-S77...\$16.50 (Two 0.7-mil sapphires)	9T-SD...\$19.50 (Sapphire-Diamond)
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Sonotone[®]

ELECTRONIC APPLICATIONS DIVISION, ELMSFORD, N. Y. DEPT. C9-100

IN CANADA, CONTACT ATLAS RADIO CORP., LTD., TORONTO

LEADING MAKERS OF



BATTERIES • CARTRIDGES • SPEAKERS • TAPE HEADS • MIKES • ELECTRONIC TUBES

For more data, circle 10-10-1 on coupon, p. 43

LETTERS To the Editor

Something in a Name

Editor, *ELECTRONIC TECHNICIAN*:

With but two issues of my subscription digested, I believe you have entitled your magazine incorrectly. The name, "Electronic Technician," can be misleading. Rather, your magazine should be labelled "Service Technician," or "Radio and TV Serviceman," in order to more correctly reflect the text. Your editorials: May—"Show-down at Distributor Gulch," and June—"Death of a License Bill," in my opinion, are narrow minded and directed for the benefit of but one group in the electronic field. Must I remind you that there are electronic technicians interested in more than TV, and still further, those who do not desire to be penalized for not working with TV whatsoever? I, for one, wish to read articles on new developments, new uses of electronics, military uses of the services of the electronic technician, etc. God knows we all have seen at least one TV set.

WILLIAM G. O'MALLEY

Scranton, Pa.

• *Though ELECTRONIC TECHNICIAN provides information for all electronic service people, it caters primarily to TV-radio-audio technicians and service dealers. For specialists in industrial electronic and communications work, we suggest you contact our affiliated publication, designed exclusively for your needs: INDUSTRIAL ELECTRONIC ENGINEERING & Maintenance, 480 Lexington Ave., N.Y. 17, N.Y.—Ed.*

Auto Radio Noise

Editor, *ELECTRONIC TECHNICIAN*:

Having been a subscriber for some time now, and having read your excellent articles, I wonder if you could help me on a couple of problems. I have installed a converter on a car radio, and pick up excessive engine noise or static. I am going to put resistor spark plugs in, but wonder if there is anything else I can do to improve performance and eliminate excessive static.

LAURENCE R. BENTLEY

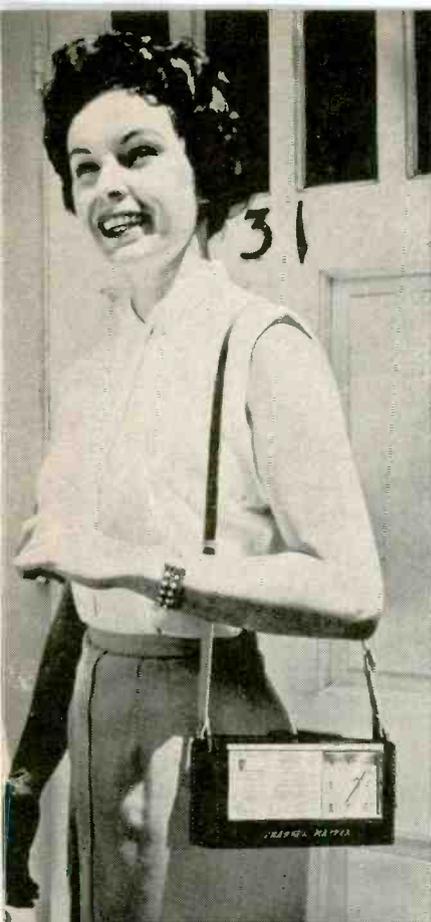
Pittsburg, Calif.

• *Shield leads, use coax bypass capacitors, etc. See Circuit Digest 590 this month.—Ed.*

Correspondence from readers is always welcome. Name and address, which must accompany letters selected by the editor for publication, will be withheld on request. Anonymous letters go right into the wastepaper basket.

(Continued on page 12)

For more data, circle 10-11-1 on coupon, p. 43 →
ELECTRONIC TECHNICIAN • October, 1960



It's a 2-in-1 radio:

- Trim portable in smart "sling" case
- Home table model

where others fizzle...this one
SIZZLES!



model 6515

new **CHANNEL MASTER** 8 transistor "super fringe"

The most sensitive transistor radio ever made!

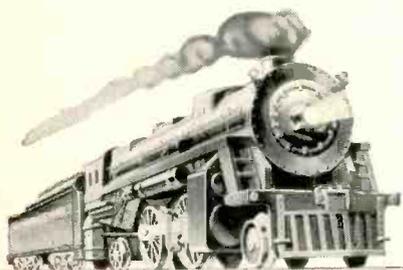
- RF amplification stage • 3-gang tuning condenser
- New fringe area circuit • Extra long built-in ferrite antenna
- Highest signal-to-noise ratio • Easy, precise vernier tuning
- King-size 3½" speaker • Plays for almost one year on a set of ordinary flashlight batteries (Based on average daily use)

The astonishing performance of this new radio is another reason why the dealer who features Channel Master gets ahead—and stays ahead—of his competition.

\$59⁹⁵ List

slightly higher in Canada.

CHANNEL MASTER works wonders in sight and sound 



FREE Lionel Electric Train Set

Dealers:

Get a big 42-piece LIONEL Electric Train Set (worth \$75.00) with your order for only 10 assorted Channel Master radios at regular price. A fabulous pre-Christmas deal. Ask your Channel Master Distributor for full details about the "Main Line" promotion. Limited time only.

from **EICO**... a completely new
CITIZENS BAND TRANSCEIVER

that meets
FCC regulations*



Model 760: 117 VAC
Kit \$59.95 Wired \$89.95
Model 761: 117 VAC & 6 VDC (Kit \$69.95
Model 762: 117 VAC & 12 VDC (Wired \$99.95
incl. mtg. bracket (Pat. Pend.)

*EICO premounts, prewires, pretunes, and seals the ENTIRE transmitter oscillator circuit to conform with FCC regulations (Section 19.71 subdivision d). EICO thus gives you the transceiver in kit form that you can build and put on the air without the supervision of a Commercial Radio-Telephone Licensee!

Highly sensitive, selective SUPERHET (not regenerative) receiver with 5½ dual function tubes and RF stage. Continuous tuning over all 23 bands. Exclusive Super-Hush® noise limiter. AVC. 3" x 5" PM speaker. Detachable ceramic mike. 5-Watt crystal-controlled transmitter. Variable "pi" network matches most popular antennas. 12-position Posi-Lock® mounting bracket. 7 tubes and 1 crystal (extra xtals \$3.95 each). Covers up to 20 miles. License available to any citizen over 18—no exams or special skills required, application form supplied free. Antennas optional.

YOU PROFIT WITH EICO

Everything in top-quality
TEST EQUIPMENT for Shop
and Field—at savings of 50%.



COLOR & Mono DC-SMC
Lab & TV 5" Oscilloscope #466
Kit \$79.95, Wired \$129.50
5" Push-Pull Oscilloscope #429
Kit \$44.95, Wired \$79.95



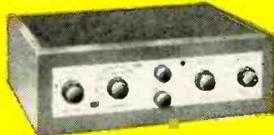
Peak-to-Peak VTVM #232
Kit \$29.95, Wired \$49.95
Vacuum Tube Voltmeter #221
Kit \$25.95, Wired \$39.95

More typical EICO values: Signal Generators from \$19.95, Tube Testers from \$34.95, Sweep Generators from \$34.95, Power Supplies from \$19.95, YDMs from \$12.90.

Everything in CUSTOM HI-FI:
finest quality at ½ the cost.



FM Tuner HFT90
Kit \$39.95, Wired \$49.95
Cover \$3.95. Includes FEY.
AM Tuner HFT84
Kit \$38.95, Wired \$69.95
Includes Metal Cover and FEY.
FM/AM Tuner HFT92
Kit \$58.95, Wired \$94.95
Includes Metal Cover and FEY.



Stereo Dual Amplifier-Preamp NFB8
Kit \$89.95, Wired \$109.95
Includes Metal Cover.
Stereo Dual Amplifier AF4
Kit \$38.95, Wired \$44.95
Includes Metal Cover.

Write for free catalog ET 10 and name of nearest distributor.
Most EICO distributors offer budget terms.



3300 N. Blvd., L.I.C. 1, N. Y.
Add 5% in the West

For more data, circle 10-12-1 on coupon, p. 43

(Continued from page 10)

Japanese Parts

Editor, ELECTRONIC TECHNICIAN:

In reply to the letter by L. Cybulski (Aug. ET) referring to the use of Japanese parts and tubes, it's true there are parts and tubes coming from Japan that are inferior to some of our own. I am a firm believer in exact replacement, even in a case of repairing a foreign component. However, there are many cases where an exact replacement is not possible. That is the time for the technician to say Buy America. Sad as the case may be, the percentage of shops may holler about things like using American parts and at the same time they drive around in every type of foreign made vehicle that they can save a nickel on. If a technician sat down in his front room and looked around, he would more than likely find at least five articles made in Japan; the rest of the house would, in all probability, contain 20 different items made in a foreign country.

L. E. O'NEILL

San Mateo, Calif.

"Come to the Aid . . ."

Editor, ELECTRONIC TECHNICIAN:

I believe that some once famous politician coined the phrase, "It is time for all good men to come to the aid of their party." It's certainly time for all good TV men to come to the aid of their New York State Association to fight for state-wide recognition. There must be sacrifices aplenty, for all of us. We all should realize that the distributors are determined that there be no organized opposition to their indiscriminate selling, i.e., wholesale to retail customers. We all sincerely believe in licensing. We also know that ordinary citizens are desirous and deserve trained and responsible people repairing their equipment. We know that a great majority of the voting public are in favor of a license. Radio and TV are infants no more. No longer can the unwarranted, untrained serviceman prey upon the ignorance and inexperience of Mr. and Mrs. Public without serious consequence to the whole industry.

Therefore, I issue a challenge to all servicemen. If you believe in the society of ourselves, that there must come a determination of qualification, that we must forget our differences, forget our distrust of one another, work together for one common goal, insure our hearth, our family of continued prosperity, render more than lip service to our associates and our beliefs, and realize that all acts good or bad by us reflect upon our brother servicemen as well as ourselves, write, wire, or phone for affidavits to be signed by your customers, returned to your local representative in the State Senate and State Assembly. These are furnished at no cost to you, but completing them can mean a recognized, respected position in the community in which you live.

D. W. COOK

Douglas Electric & Heating Co.
2967 Elmwood Ave.
Kenmore 17, N. Y.



"Hello all of you out there in television land . . ."

For more data, circle 10-13-1 on coupon, p. 43 →
ELECTRONIC TECHNICIAN • October, 1960



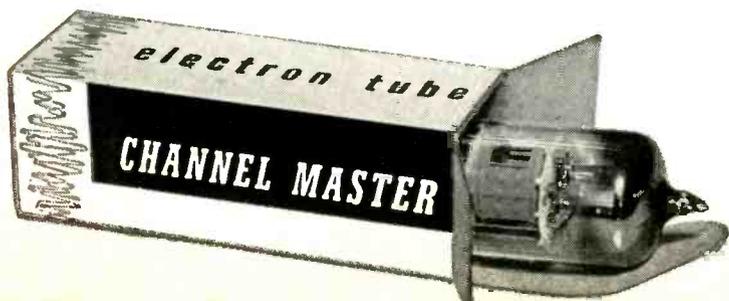
They're so good, we bring them to
you on a **Silver Platter** (a real one!)

Good News:

**Channel Master more than *DOUBLES*
its line of replacement tube types**

How would you best describe Channel Master tubes? Most dealers use the word "dependable". Dependable uniformity, dependable performance, dependable long life.

And now, with the addition of many new tube types, you can make Channel Master your first choice in *over 75% of all service calls!* Find out for yourself why Channel Master Premium Quality tubes have become America's fastest growing line.

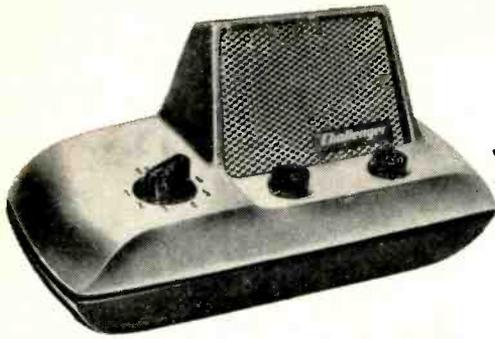


**FREE! Genuine Wm. Rogers
Holloware Service**

Luxurious, beautiful Silverplate...made by International Silver Company.

**Well & Tree Platter • 16" Round Tray
Chip 'N Dip Dish • Double Vegetable Dish**

Get the piece of your choice, free, with each purchase of only \$55.00 in Channel Master tubes, plus one Channel Master transistor radio. Tell your distributor how many holloware sets you'd like before Christmas.



you can
now
provide

**multiple-master
multiple-remote systems
with new, complete**

BOGEN
CHALLENGER SERIES



INTERCOM LINE

New, complete Bogen Challenger intercom line now includes intermix units—fills all essential intercom requirements—expands your market, greatly increases your sales potential and competitive position.

With the addition of the new intermix units to the Bogen Challenger Intercom line, you can now plan any kind of system — single-master/multiple-remote . . . multiple master . . . and multiple-master/multiple remote, the last permitting any required combination of masters and remotes. And you can also use remotes capable of initiating calls to six master stations.

With the new versatility offered by the Bogen Challenger line you can now fill virtually every intercom requirement with proven equipment that is known to provide reliable, trouble-free day-in-and-day-out performance—equipment whose handsome, modern styling and lower cost give you a decided competitive advantage with any intercom prospect.

THE NEW MODEL CHX12 INTERMIX MASTER STATION can be used with up to twelve other stations consisting of masters and remotes in any combination desired. List price \$63.00

THE NEW MODEL CHXR INTERMIX REMOTE STATION designed to receive and respond to calls from CHX12 Masters, is equipped with a six-position station selector switch, and can initiate calls to any one of six masters. List price \$17.50

The Bogen Challenger Intercom Line also permits you to plan low-cost systems where intermix operation is not required. These units are designed for either single-master/multiple-remote or all-master systems.

MODEL CHM6A MASTER STATION can be used in a six-station system with up to five CHR remotes or five other CHM6A masters. List price \$45.95

MODEL CHM12A MASTER STATION is identical to CHM6A, but designed for use in twelve-station systems with up to eleven CHR remotes or eleven other CHM12A masters. List price \$49.95

MODEL CHR REMOTE STATION is designed to receive and respond to calls from CHM6A, CHM12A or CHX12 Masters and to initiate calls to one master. List price \$12.95

all prices slightly higher in West

The new complete Bogen Challenger Series intercom line puts you in number one position to cash in on a bigger share of the big intercom market—a market that is growing by leaps and bounds.

See your Bogen Sound Distributor.

For complete details and specifications, write to Dept. ET-100

BOGEN-PRESTO, PARAMUS, N. J. A DIVISION OF THE SIEGLER CORPORATION

look to Bogen-Presto for the big profit opportunities in sound
For more data, circle 10-14-1 on coupon, p. 43

News of the Industry

AMPEREX announces completion of a new 13,000 sq. ft. wing to the present 123,000 sq. ft. building.

CAPEHART has appointed SEYMOUR MINTZ to the new post of Vice Pres. and Gen. Sales Mgr.

CLAROSTAT reports the appointment of FRANCIS J. CHAMBERLAIN as Vice Pres. of Sales by the Board of Directors.

CORNELL-DUBILIER has named RAYMOND T. LEARY Vice Pres.-Marketing of the Electronics Div., FEDERAL PACIFIC ELECTRIC CO.

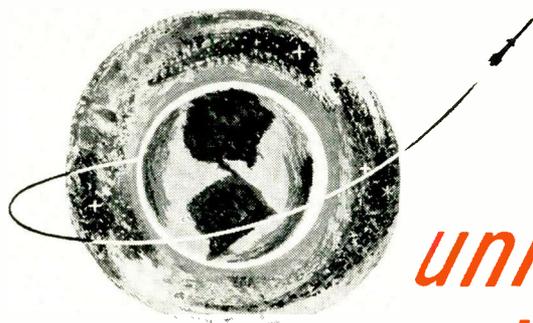
INT'L. RECTIFIER reports two appointments: JOHN A. STALUPPI, Eastern Regional Sales Mgr.; and ELI MITCHELL, Western Regional Sales Mgr.

CBS received First Award for its distributor inventory-control packaging and IBM card system in the annual competition for setup boxes sponsored by the National Paper Box Mfrs. Assoc. JOSEPH G. POPPE has been appointed Dist. Mgr., distributor sales, for the company.

RAYTHEON awarded a master tube case to KACZMARCZYK RADIO & TV SERVICE, Mahanoy City, Pa., for their entry of a 35 year old BA tube in the "Oldest Tube Contest." Second prizes for BH tubes, went to BATES RADIO & TV of Los Angeles, Calif., and AERO RADIO SERVICE LAB. of Detroit, Mich.

GENERAL ELECTRIC has awarded a special citation in the Edison Radio Amateur Award program to RAYMOND E. MEYERS, W6MLZ, San Gabriel, Calif. The Television Receiver Dept. announces the following appointments: CHARLES R. LUNNEY, Mgr., Advertising & Sales Promotion; F. GENE ABRAMS, Dist. Sales Rep., St. Louis, Memphis, & Louisville, Ky.; and HARRY HILL, JR. Dist. Sales Rep., Philadelphia, Washington, & Raleigh, N. C. The Cathode Ray Tube Dept. has appointed ROBERT E. SNARE as National Sales Mgr. for replacement tubes. The Electronics Components Div. distributor sales organization has been expanded by addition of a new East-Central region headquartered in Pittsburgh, with CHARLES A. RICHARDSON as Regional Mgr. Further appointments in the Distributor sales organization are: RICHARD T. BOGH, Dist. Mgr., Detroit; and FRED S. DE WITT, Mgr., Northeastern Region.

(Continued on page 18)



*universal
acceptance!*

miniaturized
ELMENCO

The exclusive Elmenco dip-coated Mylar-Paper capacitors (Arco type dp) represent a double breakthrough in capacitor design. They combine missile and computer quality and compare favorably in price with commercial general purpose units. The "dp" series is designed for universal use, from TV by-pass to critical industrial applications requiring stringent electrical and environmental characteristics. New high levels of ruggedness, stability and reliability have been achieved in a miniaturized body.

**54,745,000 SOLD
IN LESS THAN 2 YEARS**

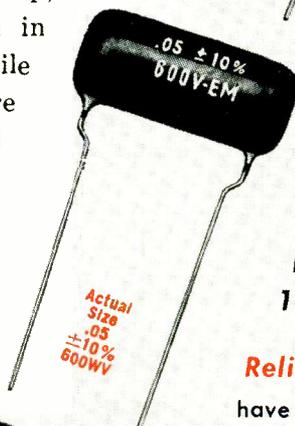
* DuPont Reg. Trademark

Write for catalog dp 110.



ARCO *electronics inc.*

64 White Street, New York 13, N. Y. • Branches: Dallas 19, Los Angeles 35



*Dipped
Mylar* -Paper
Capacitors*

**NOW . . . OPERATING AT
125° C WITHOUT DERATING**

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 capacitors 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.

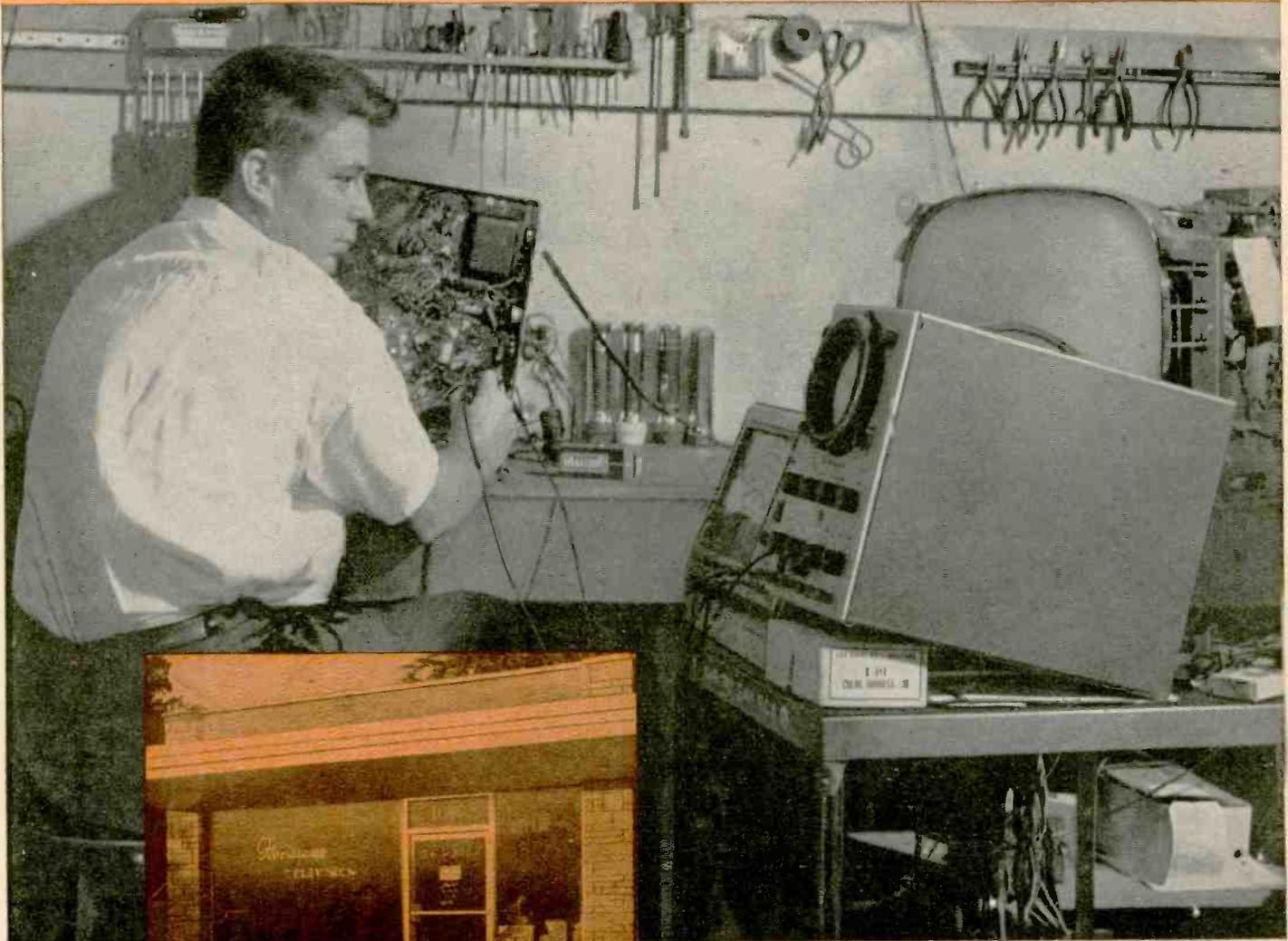
Miniaturized These capacitors are up to 50% smaller than other types and can be used in printed circuit and transistor applications.

±10% Standard Tolerance

For more data, circle 10-15-1 on coupon, p. 43

TV Shop Owners AL GOGEL and TOM WALSH Say:

“Performance and flexibility why we prefer

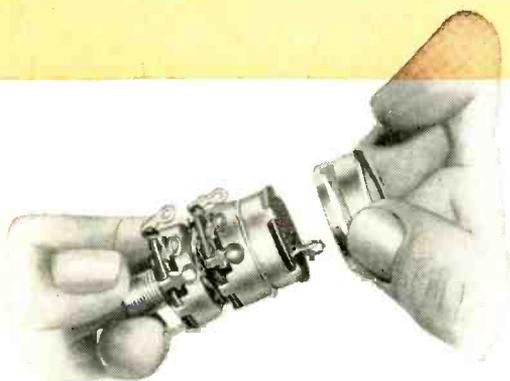


Al Gogel is a co-owner of Ferguson Television Sales and Service Company, Ferguson, Missouri, and Florissant Television, Florissant, Missouri, suburbs of St. Louis. After training at the American Television School, he started his own service shop.

Nine years ago, Al teamed up with Tom Walsh

and opened the store in Ferguson. They recently expanded into a new store in adjoining Florissant, and now employ one bench technician and three servicemen, with three trucks making 25 to 30 calls a day. They handle the warranty work on auto radios for the area's four major new car dealers, plus repair work for other dealers and used car lots.

...two good reasons MALLORY components”



In our business, using quality replacement parts is as important to steady growth as fast, courteous service is. That's why we use Mallory parts whenever we can; we know we can depend on their quality. We particularly like the Gem tubular capacitors and Sta-Loc® controls.

“There are two good reasons why we prefer Sta-Loc: first, naturally, is performance. There's never a call-back on these controls. Second, there's their flexibility. We can get any control we need with Sta-Loc—immediately—without having to check every distributor in town.”

Stop Callbacks with These
Quality Mallory Products . . .

Thousands of technicians have discovered that the flexibility of Mallory Sta-Loc controls spells real convenience. You can get any of over 38,000 types of single or dual controls—even the hard-to-find ones—made to order by your distributor in just 30 seconds. No more shopping, no more waiting. Convenient, too, because you can replace the line switch by itself, without unsoldering the control connections. As for dependability, you can always depend on Sta-Loc controls to work long and quietly.

Whatever your component needs, your best bet is your Mallory distributor. He has the widest line of Mallory quality products at sensible prices.

Distributor Division



FP ELECTROLYTICS

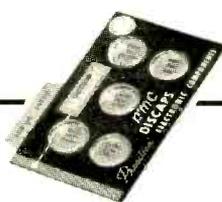
The original 85°C capacitor. Etched cathode construction—standard in FP's at no extra cost—assures hum-free performance. High ripple current ratings.

*Trademark of Radio Materials Company,
A Division of P. R. Mallory & Co. Inc.



GEMS

5 rugged, moisture-proof Mallory “Gem” tubular capacitors in a handy dispenser that keeps your stock fresh, clean, easy to find; prevents kinks in lead wires.



RMC DISCAPS*

Made by the world's largest producer of ceramic disc capacitors. Long the original equipment standard. Supplied in a handy 3x5" file card package.



TC TUBULAR ELECTROLYTICS

Economically priced filter capacitors. Top performance proved in service and backed by years of Mallory experience. Hermetically sealed.



GOLD LABEL® VIBRATORS

The quietest vibrator ever made . . . for the best in radio servicing. Buttonless contact design gives longest life, sure starts for sure customer satisfaction.



MALLORY MERCURY BATTERIES

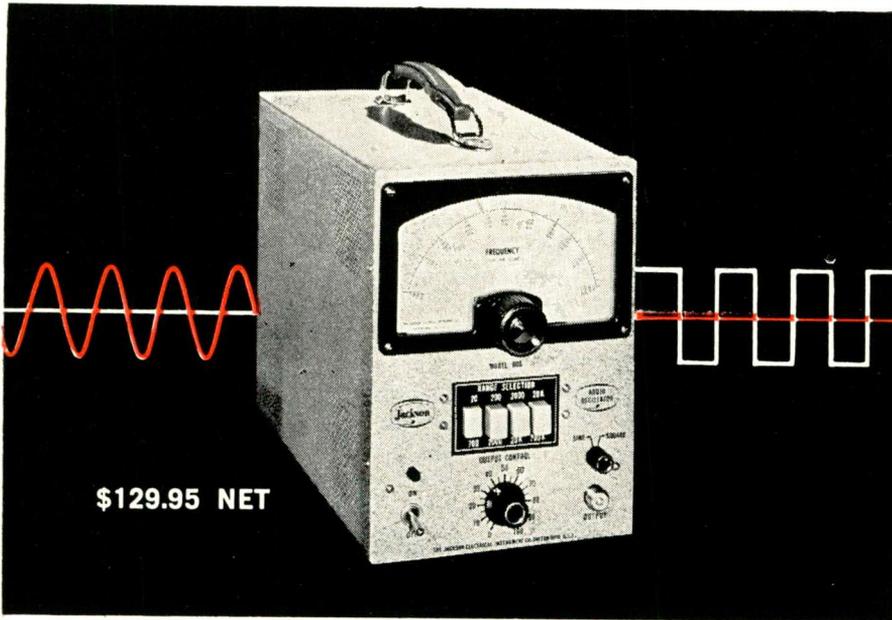
Unequaled for transistor radios . . . last several times longer, give steady power, stay “live” for years when idle. “First in space” in U. S. satellites.

For more data, circle 10-17-1 on coupon, p. 43

NEW

Jackson 605

for accurate Amplifier Circuit Checks



Sine/Square Wave Oscillator

This new, precision generator provides both sine and square wave output for checking distortions, voltage, gain and frequency response of amplifier circuits. The "service-engineered" Jackson 605 is very versatile... ideal for hi-fi, video and stereo testing and equally useful in the laboratory for industrial applications.

Range is wide... 20 to 200,000 cycles, in four push-button selected ranges. Output is continuously variable.

Square wave is not a clipped sine wave. It's generated by a Schmitt circuit triggered by the sine wave. You'll like the professional quality of this new instrument. Ask your distributor to show it to you... or write for literature.

SPECIFICATIONS

- Output Voltage:** Sine wave 0 to 5.0 RMS volts
Square Wave: 20 mv to 7.0 P-P volts
- Accuracy:** 3% or 1 cycle whichever is greater
- Sine Waveform:** Less than 1% distortion
- Square Wave Rise Time:** Less than 0.2 μ sec
- Square Wave Tilt:** 5% at 60 cycles, less than 1% above 200 cycles
- Output Level:** ± 1 db over full range



ELECTRICAL INSTRUMENT COMPANY

124 McDonough St., Dayton, Ohio

In Canada: The Canadian Marconi Co.

For more data, circle 10-18-1 on coupon, p. 43

(Continued from page 14)

INT'L. RESISTANCE has named DARRELL V. JARVIS as Marketing Mgr. of the Burlington, Iowa Div.

WEN PRODUCTS reports the appointment of ED J. KRUG to head the newly formed International Div.

ZENITH announced the promotion of WILLIAM R. CAMPBELL to the position of Mgr., Marketing Services.

IE MANUFACTURING announces acquisition of a new 72,000 sq. ft. building located at 3039 Carroll Ave., Chicago.

WELLER ELECTRIC has named CLIFFORD C. YELTON as Southern Regional Sales Mgr., with headquarters in Atlanta, Ga.

WINEGARD announces CARL LAMM, Allentown, Pa., is the winner of the "My Favorite TV Dealer" contest held in that city.

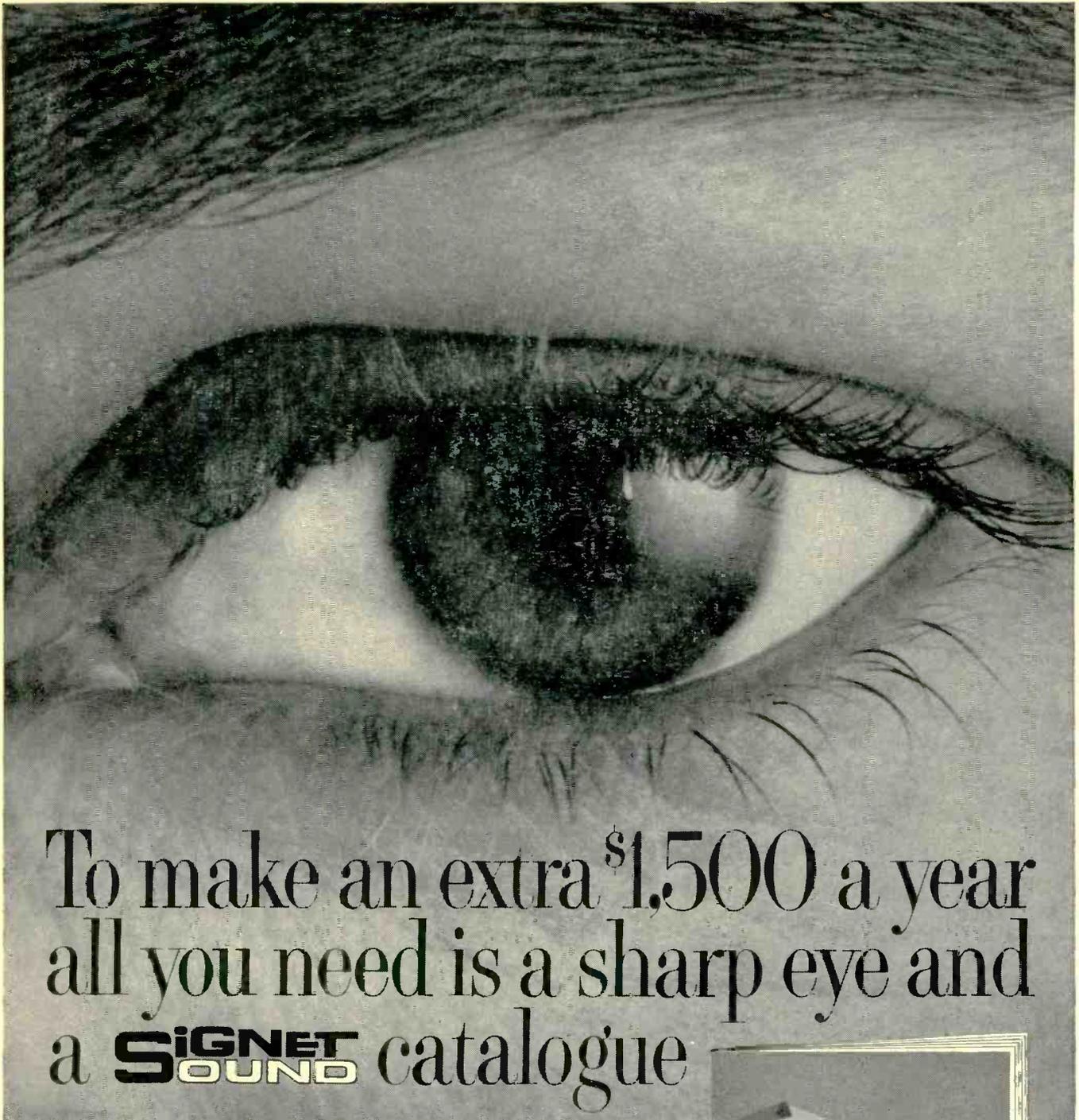
SHERWOOD has announced the appointment of WINSTON ARRINGTON as Project Engineer on a new FM multiplex receiver program.

SENCORE has broken ground for a new addition to the present building which will nearly double plant capacity and enable all phases of manufacture to be conducted under one roof.

SYLVANIA appoints DONALD W. GUNN as a regional Vice Pres. to direct marketing activities in the 12 western states and Hawaii. A general factory price increase ranging from 2 to 5% on all 23-inch models in the 1961 TV line is reported.

RCA has elected W. WALTER WATTS as Chairman of the Board and Pres. of RCA SALES CORP., a post he assumes in addition to his responsibilities as RCA Group Executive Vice Pres. DELBERT L. MILLS becomes Operating Vice Pres. of the Sales Corp. The Electron Tube Div. announces a new advertising and sales promotion campaign has been launched for Silverama TV picture tubes.

GENERAL INSTRUMENT has announced appointment of HERMAN FIALKOV as Pres. of the company's enlarged Semiconductor Div. and MAURICE FRIEDMAN as Executive Vice Pres. of the Div. Complete integration of the research, engineering, production, and marketing operations of GENERAL INSTRUMENT and GENERAL TRANSISTOR will now be conducted under the GENERAL INSTRUMENT Semiconductor Div. name, following the recent merger of the two companies.



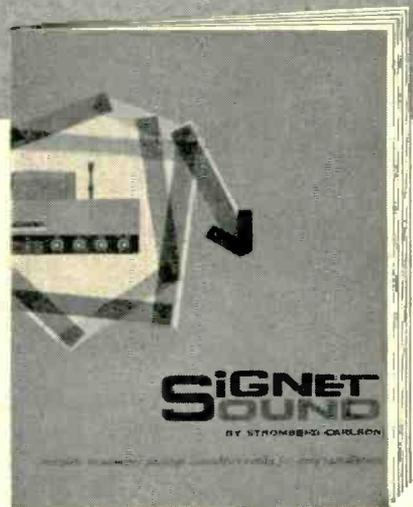
To make an extra \$1,500 a year all you need is a sharp eye and a **SIGNET** **SOUND** catalogue

Look around you. There are hundreds of profit opportunities in your neighborhood... meeting halls, churches, sports and social clubs, fraternities, taverns, restaurants... all ready to be sold on the convenience, effectiveness and comparatively low cost of good sound equipment.

Take along a *Signet Sound* Catalog and you will have all you need to make an easy sale. You can offer professional equipment, expertly engineered by Stromberg-Carlson—the greatest name in sound. You can offer a complete choice... size and price-wise... of pre-planned, ready-to-install *Signet Sound* Packages.

Without any risk or investment you can earn a good profit on the sale. And each installation brings in an extra \$40 to \$200 profit.

"Electronic Technician" magazine revealed that 8,600 electronic servicemen in 1958 made an extra \$1,500 in profits selling this type of sound equipment and service. For detailed information and your copy of the *Signet Sound* Catalog write to: Commercial Products Division, 1461-10 North Goodman St., Rochester 3, N. Y.



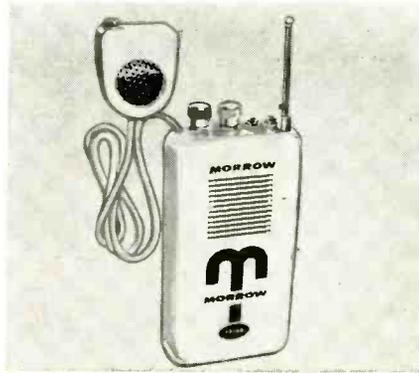
STROMBERG-CARLSON
A DIVISION OF **GENERAL DYNAMICS**

For more data, circle 10-19-1 on coupon, p. 43

Morrow CB Radiophone

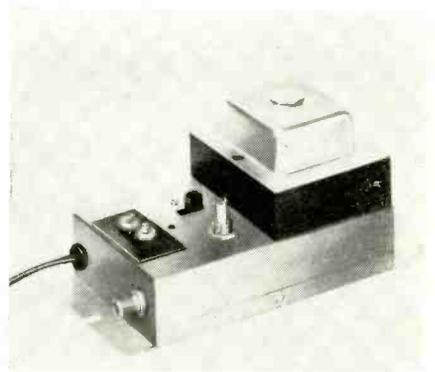
Model VP-100, crystal controlled, transmitting and receiving unit with receiver squelch operates on any one of the 22 channels of the citizens band. Fully transistorized. Self contained, with exception of lapel microphone. 9v 2U6 Burgess or 216 Eveready battery. Circuitry printed on fiber-glass. Case $\frac{1}{16}$ " drawn aluminum, measures 3" W, 1 $\frac{1}{8}$ " D and 6" H. Other features include two external jacks for long wire antenna and earphones. Morrow Radio Mfg. Co., 2794 Market St., Salem, Ore.

For more data, circle 10-20-2 on coupon, p. 43



Jerrold PREAMPLIFIER

Announced is model DSA-202, mast-mounted, preamplifier for TV and FM. It employs only two tubes to provide high (20 db) gain for all UHF TV channels and a minimum of 8 db gain at 108 mcs, the extreme edge of the FM band. An improved noise figure,

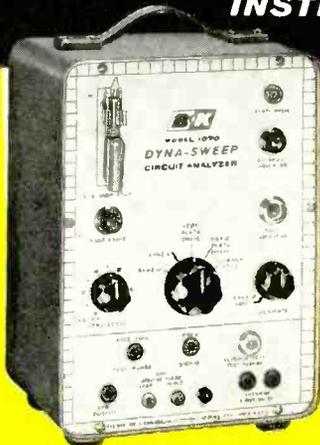


4.5 db maximum for low channels and 6 db maximum for high channels, eliminates snowy pictures in fringe areas. A newly designed power supply incorporates a switch for adjusting the voltage for various cable lengths. \$79.95. Jerrold Electronics Corp., 15th & Lehigh Aves., Philadelphia 32, Pa.

For more data, circle 10-20-3 on coupon, p. 43

Solve Rough Sweep Output Problems

**IN MINUTES
INSTEAD OF HOURS!**



NEW B&K DYNA-SWEEP CIRCUIT ANALYZER

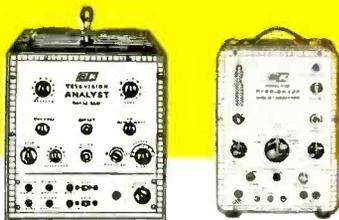
1. Provides composite synchronizing signals (negative or positive) to inject directly in each sync stage.
2. Provides plate drive signal to check complete vertical output circuit, including V.O. transformer.
3. Provides vertical yoke test signal to determine if vertical yoke windings are defective.
4. Provides horizontal plate driving signal to directly drive TV horizontal output transformer circuit.
5. Provides B+ boost indicator.
6. Provides unique high-voltage indicator.
7. Provides sensitive tests for each of the horizontal output components, including H.O. transformer and yoke. Immediately reveals their true condition, good or bad.

Quickly solves tough output servicing problems that have always plagued the TV serviceman. Provides horizontal and vertical sync and driving pulses that make it easy to check out every stage in the sync and sweep sections of a television receiver. Tracks down troubles in the horizontal and vertical output circuit, including defective output transformer and yoke. Checks for shorted turns, leakage, opens, short circuits, and continuity. Gives unique high-voltage indication. Eliminates trial and error replacements. Saves many hours of service work! Pays for itself over and over again.

Model 1070 Dyna-Sweep. Net, \$74⁹⁵

MODEL A107 DYNA-SWEEP CIRCUIT ANALYZER

for use with B&K Model 1075 Television Analyst
Functions like the Model 1070 above, but is designed as a companion unit for use only with B&K Model 1075 Television Analyst for driving source. Makes your Television Analyst more useful and valuable than ever. Net, \$54.95



See your B&K Distributor or Write for Bulletin AP16-T

B & K MANUFACTURING CO.
1801 W. BELLE PLAINE AVE • CHICAGO 13, ILL.

Canada: Atlas Radio Corp., 50 Wingold, Toronto 10, Ont. • Export: Empire Exporters, 277 Broadway, New York 7, U.S.A.



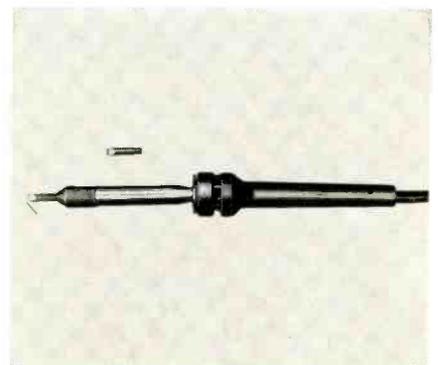
For more data, circle 10-20-1 on coupon, p. 43

Want A Christmas GIFT IDEA?

See page 64

Wall PENCIL SOLDERING IRON

With an overall length of only 8 $\frac{1}{2}$ ", the new 40-watt Radioman #863 pencil soldering iron weighs just 2 oz. A hermetically sealed "Demon Heet" element, bearing a lifetime guarantee, develops an 800°F tip temperature and has an exceptionally fast recovery dur-



ing soldering operations. The handle is kept constantly cool through the use of a silicon spacer. The removable tip is replaceable with various available shapes. Completely UL approved. Packed one to a box. Wall Mfg. Co., Grove City, Pa.

For more data, circle 10-20-4 on coupon, p. 43

**Firefighting is for
firemen –
not servicemen**



Customers really burn when they have to call you back because of a premature failure. And while you're playing fireman, the profit on your next three service calls goes up in smoke. Tung-Sol tube quality is good insurance against callbacks. They're made to the highest specs of leading radio, tv and hi-fi set manufacturers. You'll find it good policy to keep that caddy full of Tung-Sol tubes. Tung-Sol Electric Inc., Newark 4, N. J.

Tell your jobber you'd rather have

ts TUNG-SOL®

Blue Chip Quality

TUBES • TRANSISTORS • DIODES

For more data, circle 10-21-1 on coupon, p. 43

Reps & Distributors

PYRAMID ELECTRIC reports appointment of two reps firms: STANG SALES CORP., New York City area; and KELLY-SCHMITZ-WINKLER ASSOC., Midwest territory.

SWITCHCRAFT announces appointment of TRINKLE SALES for distributor sales in southern N. J., Dela., eastern Pa., Md., Washington D. C., and Arlington, Va.

ATRONIC announces appointment of two rep organizations: WAYNE DINSMORE CO., Southern Calif.; and LANGHAUS-LEVY ASSOC., Ill. & Southern Wis.

ELECTRONIC INDUSTRY Show Corp. has elected SAM PONCHER of NEWARK ELECTRONICS as Pres. Other new officers are: ROBERT D. FERREE, INTERNATIONAL RESISTANCE, Vice Pres.; NORMAN TRIPLETT, THE TRIPLETT ELECTRICAL INSTRUMENT CO., Secy.; and ROBERT E. SVOBODA, AMPHENOL-BORG ELECTRONICS, Treas.

JERSEY SPECIALTY announces appointment of the ROD BUTCHART CO. as Mich. rep.

SAXTON PRODUCTS has named PETERSON-RUDNICK ASSOC. as rep in the N. Y., Long Island, and N. J. area.

SYLVANIA has appointed THE SABINE SUPPLY CO., Houston, Tex., as franchised Sylvania distributor in East Central Tex.

CHICAGO STANDARD TRANSFORMER has appointed ROBERT E. NESBITT CO. as sales rep in Okla. and Tex., except El Paso.

LAND-C-AIR SALES CO. has announced the Philadelphia trading area, covered by the late GIL SEGAL, will now be taken over by JERRY BASH.

ERA, in cooperation with the University of Ill., held the first Business Management Institute directed specifically to the administrative problems of electronic reps, Sept. 18-23rd.

ARMAND-RICHARDS reports the consulting firm of HARRY A. FRIEDMAN has been contracted to handle all electronic distributor and manufacturer rep activities.

NATION WIDE RADIO Pres., JAY E. BASS, has purchased all of the capital stock of WALKER-JIMIESON and its related branches and subsidiaries. WALKER-JIMIESON will be operated as a separate entity.

CBS ELECTRONICS held a recent week-long Management Seminar at Potsdam, N. Y. for members of electronics distributors management to encourage distributors to discuss and evaluate their own businesses in the key areas of organization, purchasing, sales and budgeting.

EASY TO READ . . . The HICKOK Model 209A



HICKOK

- ✓ True VTVM
- ✓ 9" Multi-Colored Meter
- ✓ Low Capacity, High Frequency Probe
- ✓ AC Response to 200MC, RMS or Peak-to-Peak
- ✓ Capacitance Ranges: 1-10,000 μ f in 2 Ranges
1-1,000 μ f in 8 Ranges
- ✓ Resistance Ranges: 0.1 Ohm to 10,000 Megohms
in 8 Ranges
- ✓ Complete with AC and DC Probes and Test Leads

See Your Distributor, Ask for a Demonstration!
\$157.00 net

The Hickok Electrical Instrument Co.

10523 DUPONT AVENUE • CLEVELAND 8, OHIO

For more data, circle 10-22-1 on coupon, p. 43



"Try tuning the oscillator"

Catalogs & Bulletins

MELTING POTS: Detailed specifications and prices covering electric melting pots for solder, lead, glues and compounds are provided in a new 8-page catalog VG-201-P. Vulcan Electric Co., Danvers, Mass.

For more data, circle 10-23-2 on coupon, p. 43

CB RADIO: "Radio Communications For Everyone" is a colorful, well-illustrated, 8-page brochure covering model HE-15A citizens band transceiver. Lafayette Radio 165-08 Liberty Ave., Jamaica 33, N. Y.

For more data, circle 10-23-3 on coupon, p. 43

LANGUAGE TEACHING EQUIPMENT: A new laboratory set-up for teaching languages is covered in a well-illustrated brochure. A new concept offers components that are new, convenient, simplified, portable and low cost. Switchcraft, Inc., 5555 N. Elston Ave., Chicago 30, Ill.

For more data, circle 10-23-4 on coupon, p. 43

SPRAY CLEANERS: A handy reference chart, the Pocket Selector Guide, lists 61 specific applications together with the best cleaner for each, and describes a simple method for determining the best product to use for applications not covered. Colman Electronic Products, Inc., Amarillo, Texas.

For more data, circle 10-23-5 on coupon, p. 43

PLANT & OFFICE EQUIPMENT: Pocket-sized handbooks cover new equipment for increasing plant efficiency, safety equipment, unique materials handling devices, office aids, etc. Offered is a free one year subscription to this handbook service. General Industrial Co., 1760 W. Montrose Ave., Chicago 13, Ill.

For more data, circle 10-23-6 on coupon, p. 43

BATTERIES: A catalog covers eight new batteries for transistor radio and electronic instrument service, and provides a battery replacement guide which lists the proper battery for over 700 radios made by 63 domestic and foreign manufacturers. Bright Star Industries, Clifton, N. J.

For more data, circle 10-23-7 on coupon, p. 43

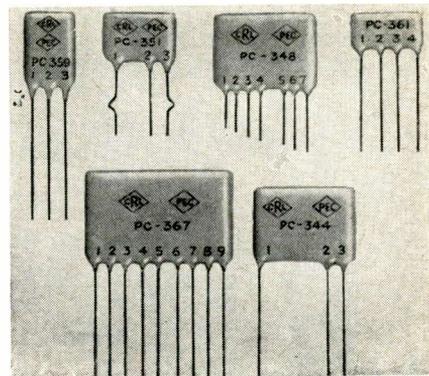
STEREO & HI-FI: An illustrated 4-page booklet, "Stereo and High Fidelity," defines stereophonic sound; discusses stereo sources of live broadcasting, stereo discs and tape; describes and gives diagrams of various combinations of component set-ups; and provides design principles of stereo components, analyzing equipment as illustrations. Electronic Instrument Co., 33-00 Northern Blvd., Long Island City 1, N. Y.

For more data, circle 10-23-8 on coupon, p. 43

Centralab PACKAGED CIRCUITS

Announced are 27 new packaged electronic circuits, designated as part numbers PC-344 to PC-370. In addition to replacements in TV sets, part of this new group is for use in hi-fi components and hi-fi console equipment. Included are loudness contour networks a diode-triode couplate, a balanced dual capacitor, a horizontal oscillator and phase detector and additional units for specialized replacement applications. Centralab Div., Globe-Union, Inc., 900 E. Keefe Ave., Milwaukee 1, Wis.

For more data, circle 10-23-9 on coupon, p. 43



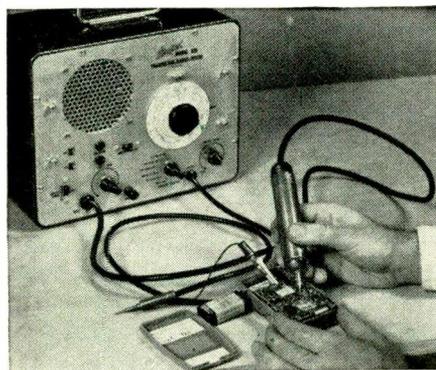
Transistor radio servicing



Problem or Profit?

You are in the transistor-age

Nearly 90% of the radios manufactured today are transistorized. Are you prepared to service this heavy volume of new business? The millions of radios now being sold means that your present customers own them and will expect you to service them . . . And, you must service them *profitably*.



Transistor radios can be service problems

Their compact, miniaturized components and printed circuitry are hard-to-reach for proper test • Transistors, still a little strange to many technicians, make checking difficult • Low price of sets force low servicing costs—troubles have to be spotted quickly and accurately to assure service profit • Conventional servicing techniques take too long and don't always work • Transistors and components can easily be damaged by excessive current from your VOM battery.

Low-cost tester provides the answer

HICKOK'S Model 810, a new Transistor Radio Tester permits high-speed signal tracing whereby elements can be checked right in their circuit—without slow disconnecting and resoldering "Guess-and-Gyosh" servicing.

The 810 is a THREE-IN-ONE Tester

- ★ A signal generator of RF, IF and audio.
- ★ A signal tracer covering RF, IF and audio.
- ★ A transistor tester.

Offers many special features

The signal tracing probe has a cathode follower input . . . No detuning or loading effect. The generator output is a cathode follower . . . Means low impedance to transistor circuits. Special AC line filter . . . Limits leakage current to a safe value in preventing overload damage to transistor circuits. The 810 is ideally designed for servicing 'hard-to-reach' auto radios and small AC-DC portables.

Complete . . . \$138.00 NET

The 810 is everything you need for profitable transistor radio testing. The 810 is Hickok-Quality, easy-to-operate and has repeatedly proven to pay-for-itself quickly through time saved in this 'New Business' of Transistor Radio Servicing for Profit.

See your distributor for a Hickok-810-demonstration today! The Hickok Electrical Instrument Company, 10523 Dupont Avenue, Cleveland 8, Ohio.



For more data, circle 10-23-1 on coupon, p. 43

RECTIFIER PERFORMANCE THAT PLEASES CUSTOMERS

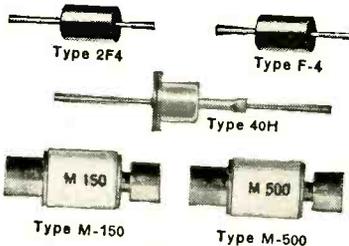
TARZIAN TUBE REPLACEMENT SILICON RECTIFIERS



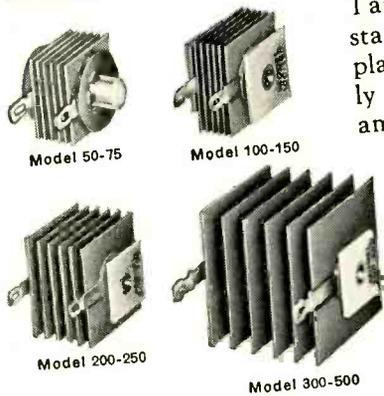
Tarzian's 9 standard models of tube replacement rectifiers are directly interchangeable with over 95% of all popular vacuum tube rectifiers. An added plus is the new Sarkes Tarzian Full Wave Silicon Rectifier (S5347), replacing 6BW4 or 12BW4 in Citizen's Band radios where maximum performance in reception quality and range is desired.

TARZIAN SILICON RECTIFIERS (PLUS CONVERSION KITS)

Sarkes Tarzian silicon rectifiers are made in production quantities by a special Tarzian process that provides optimum forward to reverse ratios, extremely low voltage drop, high reliability and long useful life. Compact conversion kits are available for both the M-150 and M-500 units.



TARZIAN "CONDENSED-STACK" SELENIUM RECTIFIERS



Tarzian's four "condensed-stack" selenium rectifiers—replacing the 20 types that formerly made up the 50 to 500-milliamper line—not only cover your selenium rectifier needs, but their small size eases both your application and inventory problems. Improved production processes have substantially reduced watt losses by as much as 50%.

Tarzian "Distributor Line" Rectifier Catalog

• The new "Distributor Line" Rectifier Catalog is now available on request. It contains complete details on ratings, dimensions, electrical specifications. For additional information write Section 5554A.



SARKES TARZIAN, INC.

World's Leading Manufacturers of TV and FM Tuners • Closed Circuit TV Systems • Broadcast Equipment • Air Trimmers • FM Radios • Magnetic Recording Tape • Semiconductor Devices
SEMICONDUCTOR DIVISION • BLOOMINGTON, INDIANA
 In Canada: 700 Weston Rd., Toronto 9 • Export: Ad Auriema, Inc., New York

For more data, circle 10-24-1 on coupon, p. 43

NEW PRODUCTS

For More Information On
NEW PRODUCTS
 Circle Code Numbers, p. 43

Pyramid CAPACITOR PACKAGE

The Vu-Pak, an entirely new concept in capacitor packaging, are clear plastic tubes packed with electrolytic twistmount capacitors. The plastic tubes are plainly labeled for quick identification; are dustproof and insure that the capacitors they contain

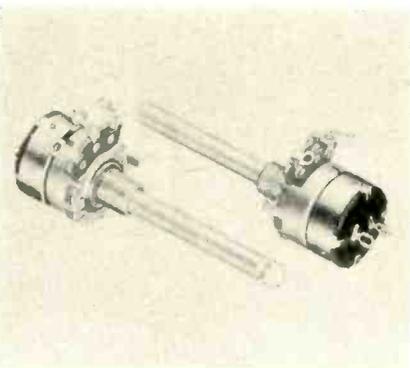


will always be fresh. Moreover, the plastic tubes are reusable as convenient storage units for small parts and tools. The Vu-Paks fit into the firm's new capacitor rack, the Capac-o-mat, 54 Vu-Paks to each Capac-o-mat. Pyramid Electric Co., Darlington, S. C.

For more data, circle 10-24-2 on coupon, p. 43

Stackpole SWITCH

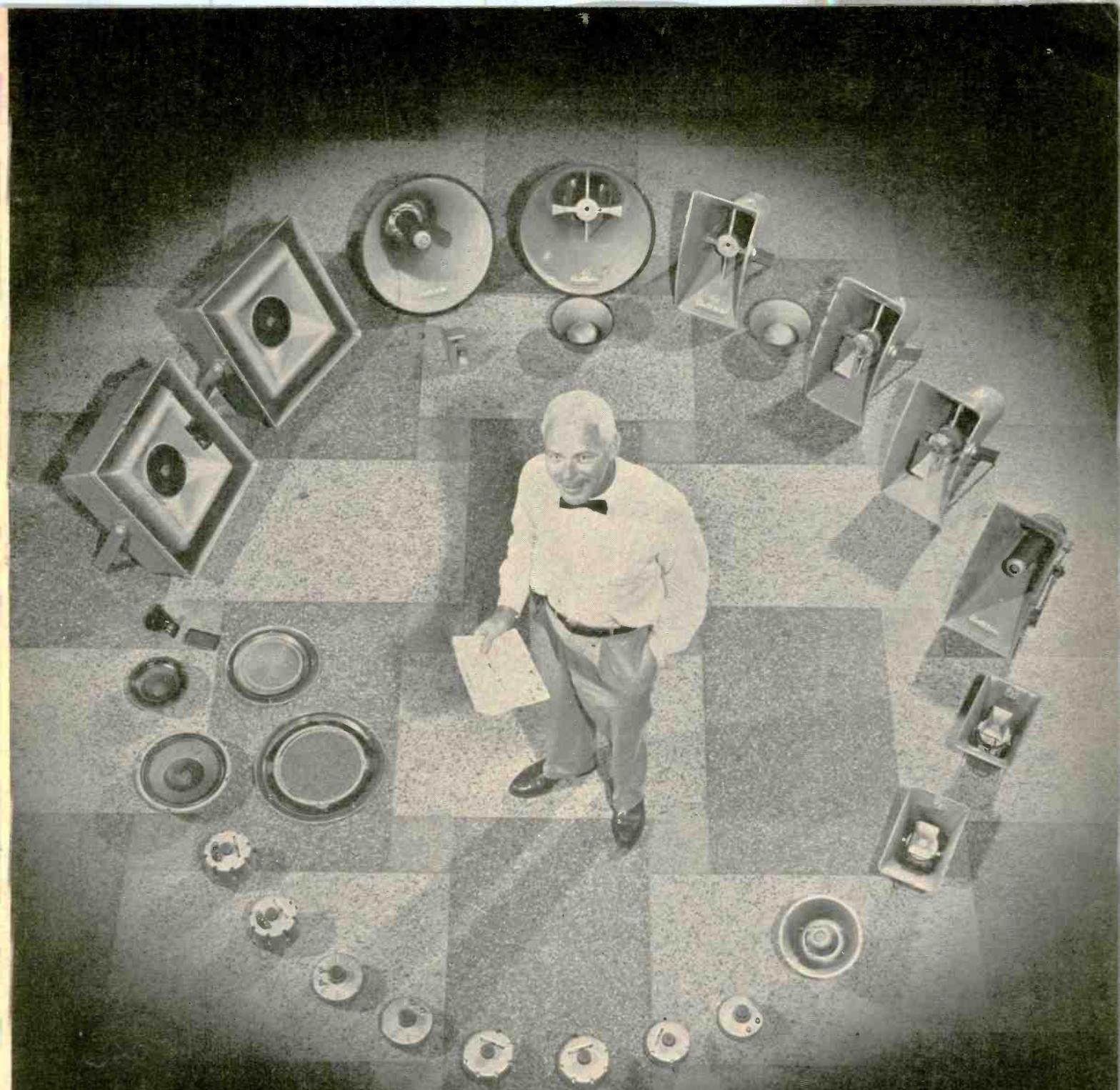
Used in conjunction with variable resistors, type G-16 push-pull switch allows greater operating convenience for radio and TV receivers, hi-fi equipment, instruments, and other electronic assemblies. It can be furnished



on many single-section and dual-section Stackpole variable resistors; and operates from the same shaft that controls the resistor. Single-pole, single-throw contacts are well isolated from solder flux and the entire mechanism is free from lubricants. Rating, 5 amperes at 125v a-c. Stackpole Carbon Co., St. Marys, Pa.

For more data, circle 10-24-3 on coupon, p. 43

For more data, circle 10-25-1 on coupon, p. 43
ELECTRONIC TECHNICIAN • October, 1960



SOLVED

ONLY 22 ELECTRO-VOICE UNITS answer 63 different P.A. speaker problems. Take the short line to profits with Electro-Voice. Preserve working capital by cutting inventory costs, by slicing maintenance expenses to a new low. Save on time and labor . . . and still provide the best possible sound system for specific applications. These twenty-two objects are public address units encompassing varied phases of commercial sound operation—complete projectors for voice and music, compound diffraction horns, reentrant horns, paging and talkback speakers, convertible drivers, weatherproof full-range speakers and accessories. Exclusive Electro-Voice design features in both speakers and drivers offer you unparalleled installation flexibility and the option of choosing from 63 combinations of 22 basic units, the best solution to a given audio problem. For instance, E-V convertible drivers can be used on reentrant horns for maximum economy or in compound horns for lowest distortion. They may be interchanged or shifted from compounds to reentrants. Again, E-V compound diffraction projectors reproduce an exceptionally wide frequency range with uniform efficiency. They are ideal for music as well as speech, and because the *diffraction horns provide wide angle coverage even at high frequencies*, intensity and intelligibility are maintained, thus eliminating the expense of adding more speakers. Consider, too, E-V's new reentrant horn discovery . . . the ring reflector principle. Conventional P.A. horns use smoothly rounded paths at both critical reentrant sections. This method is satisfactory for small radius bends; but only Electro-Voice uses the exclusive ring reflectors to *increase output in the vital presence region by as much as 7 db*. Send for the new Electro-Voice Commercial Sound Catalog No. 132 today.

Electro-Voice®

Commercial Products Division
ELECTRO-VOICE, INC.
Dept. 100T, Buchanan, Michigan



BRIGHT NEW VIEW

for Multi-set TV-FM
Home Operation ...



...and a
Bright Profit Outlook for YOU with

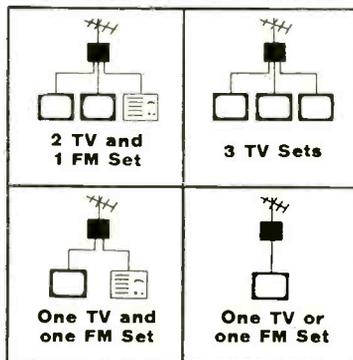
NEW JERROLD HSA-43

Amplified 3 SET COUPLER

Here's a new precision-perfected amplifier that provides 5 DB min. gain across all TV-FM channels on two outputs and no loss in the third output. Housed in a rugged, compact and handsome case. The HSA-43 features single tube operation (6DJ8), A.C. interlock and no-strip twin lead terminals. Its excellent isolation and match prevents set interaction and ghosting. IDEAL FOR FEEDING ONE FM AND TWO TV SETS FROM THE SAME ANTENNA.

\$29.95 list

TYPICAL APPLICATIONS



Write Jerrold today for full details on this new Profit Outlook!

JERROLD ELECTRONICS CORPORATION, Distributor Sales Division
Dept. IDS-85, Philadelphia 32, Pa.
Jerrold Electronics (Canada) Limited, Toronto
Export Representative: CBS International, New York 22, N.Y.

LEADER AND LARGEST MANUFACTURER OF TV DISTRIBUTION SYSTEM EQUIPMENT

For more data, circle 10-26-1 on coupon, p. 43

Electronic Chemical SPRAY

A new chemical formula, EC-44, is reported to lubricate, condition and clean all electrical contacts. Features include: an electrical resistance which lowers as temperature increases; no arcing from surface-to-



surface to cause damage by metal transfer and contact burn; and reduction of radio and TV interference. A 6-ounce spray can is being offered with a 3" plastic extender push button assembly free. Electronic Chemical Corp., 813 Communipaw, Jersey City, N. J.

For more data, circle 10-26-2 on coupon, p. 43

Check the TECHNICAL ADVANTAGES you get in the RCA V-O-M with the Extras



- 20,000 ohms-per-volt meter movement
- Clearly marked db scales; no squinting to read results
- Special 1-volt and 0.25 volt (full-scale) ranges dc
- 3% accuracy on dc
- 5% accuracy on ac

See page 67 for the full story on this superlative value at only \$43.95*
*User Price (Optional)

RCA Electron Tube Division, Harrison, N.J.



The Most Trusted Name
in Electronics

RADIO CORPORATION OF AMERICA

Transmission Line Cables



8225



8226



8230



8285



8235

Microphone and Shielded Power Supply Cables



8410

RUBBER



8411



8413

PLASTIC



8420

Mr. Service Technician:

Ask your Belden jobber about this complete wire and cable line

What types of wire and cable do you need? Ask your Belden electronics jobber for complete specifications on types, sizes, insulations, and convenient spooled lengths. Available from stock.

Hi-Fi, Stereo, and Phonograph Cables



8421



8430



8419

Rubber-Vinyl Multiconductor Portable Cordage



8462

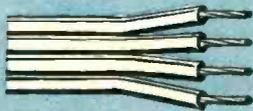
8888

Power Supply Cords



17106

Antenna Rotor Cables



8464



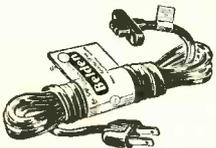
8484

Hook-Up Wire

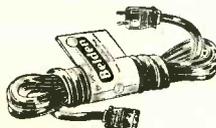


8800

TV and Cheater Cords



8874



8875

Aluminum Ground Wire

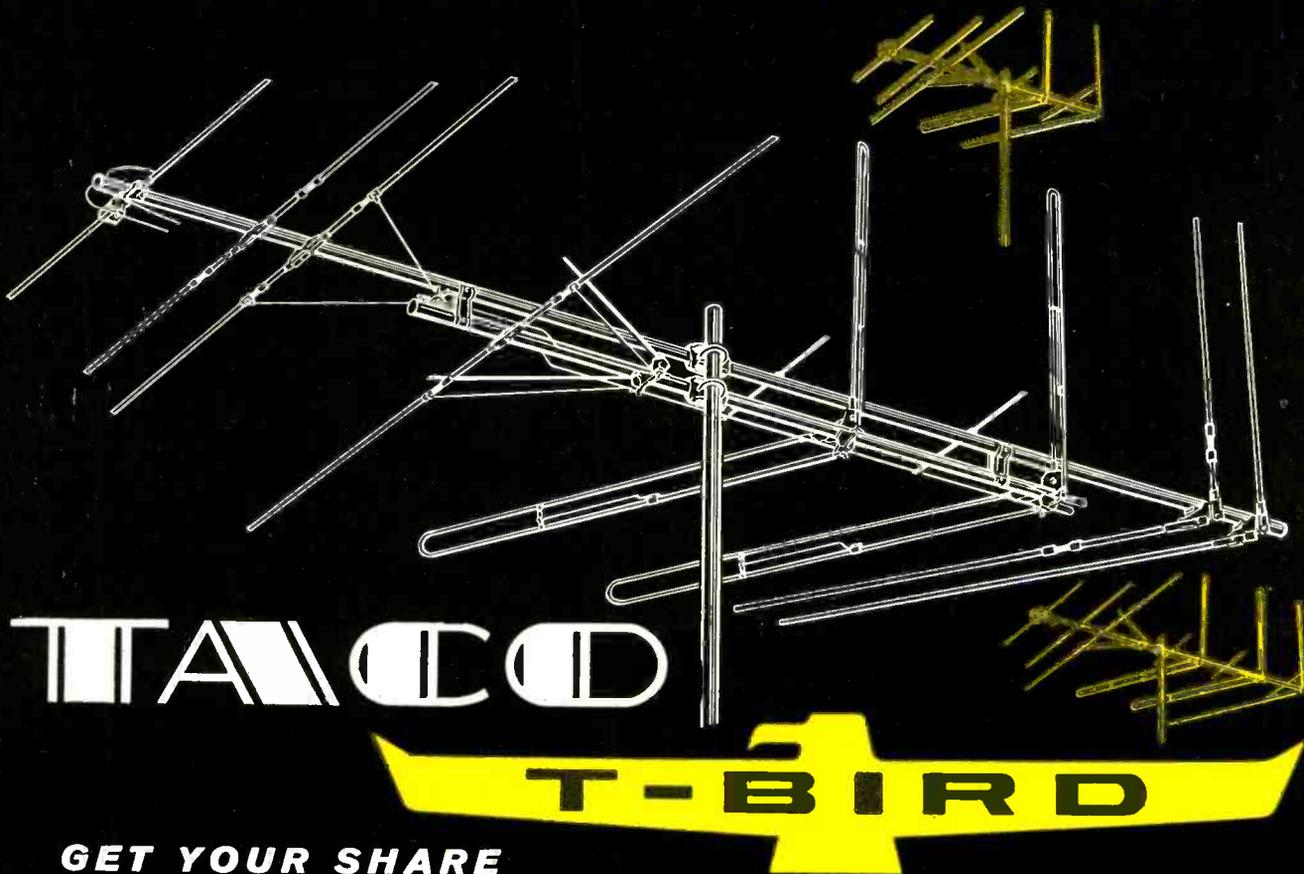


8018



- power supply cords • cord sets and portable cordage • electrical household cords • magnet wire • lead wire • automotive wire and cable • aircraft wires • welding cable

PACKED with **POWER** and **PROMOTION**

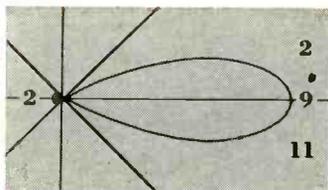


T-A-C-C-O

T-BIRD

**GET YOUR SHARE
OF THE T-BIRD BUSINESS...**

TOP PERFORMANCE



A dramatic breakthrough in TV antenna performance! The T-Bird provides extra-gain on every channel for snow-proof pictures, *plus* a directivity pattern that has no side lobes—clean as a whistle—for the sharpest, clearest pictures ever seen on any TV set...

TOP PROMOTION

An integrated promotion program that's hitting customers from your store on the street, at home—in fact everywhere with the story of the T-Bird Antenna. Featured is Allie Scollon and her Injun Puppets in TV and radio spots telling the world about the T-Bird. This is the antenna people are asking for.



GET YOUR T-BIRD PROFIT PACKAGE NOW! ASK YOUR DISTRIBUTOR OR WRITE...

TECHNICAL APPLIANCE CORPORATION, SHERBURNE, NEW YORK.

ELECTRONIC TECHNICIAN

Including
SERVICE
Magazine

Vote!

National Election

We live in a perilous period, with stockpiles of hydrogen bombs, nerve gas and bacterial weapons hanging over our heads like a Sword of Damocles. Famine and misery stir men's minds to violent revolution. And while we enjoy the fruits of freedom, hundreds of millions of people throughout the world are in the bondage of dictatorships.

The problems and issues of the day are domestic, as well as foreign. Individual rights, labor-management, medical care, taxes, military preparedness, care for the aged, education and government spending are among the topics being heatedly debated.

Certainly, this is no time for smug self-satisfaction, or even mild complacency. We must study the issues, and choose a leader best qualified to lead the nation.

In a few weeks we will be going to the polls to select the next President of the United States. We would not presume to influence readers to vote for one candidate over the other. However, we most emphatically urge everyone to examine the candidates, examine their own consciences, and to cast each precious vote for the man and party of their choice. The essence of democracy is the combined right and duty of citizens to select their leaders. Let us show our appreciation for our good fortune to live in a democracy by carrying out our obligations on election day.

Industry "Election"

Perhaps the most controversial issue in the electronic service industry is the question of licensing. On page 50 of this issue there is a "ballot" for readers to voice their opinions on this vital subject which can affect your livelihood and the public welfare.

This election of sorts, is the first large scale effort, to our knowledge, which is intended to survey the national attitude toward licensing of technicians and service dealers. In order for us to get a fair and democratic picture of the will of the people, we urge each and every reader to complete the entire ballot form, and return it to us immediately.

The results of the votes you cast will be published in a forthcoming issue of ELECTRONIC TECHNICIAN.

Tuning In the

JAPANESE PRODUCTION of electronic products in the first quarter of this year totaled \$282.1 million, up 53% from the same period of 1959, according to the U.S. Department of Commerce, Business and Defense Services Administration. Semiconductors registered the greatest percentage increase in production of any electronic product group for the first quarter 1960 compared with the same period in 1959, up 67% to \$19.1 million, closely followed by electron tubes, up 63% to \$44.5 million. Production of consumer electronic products climbed from \$99 million in the first quarter 1959 to \$158.5 million in the first quarter 1960, a 60% increase.

CLOSED CIRCUIT TV is finding more applications at airports and on the highway. Eight Philco CCTV cameras will be placed in Pittsburgh's newest tunnel, Fort Pitt, so the control officer can view the traffic situation at all times on his monitor. Pye Telecommunications, Ltd., England, are showing a new radio directed TV system for airfield application, which is completely transportable and independent of cables. The system permits control tower staff observation of areas they cannot see and all assembly areas, as well as gives close observation of aircraft take-off and landing performance at test and experimental airfields.

NOISIEST SPOT IN TOWN



This Shure Brothers sound room is where the company is developing special-purpose mikes that can be used in noisy environments. For example, inside the 6 x 6' insulated room, engineers can duplicate the roar of a jet engine at 500 feet, unbearable to the human ear except for a few minutes.



"How's it going?"

HOT STUFF at the GE Wescon booth was a micro-modular electronic circuit operating under temperatures approaching 600° C, heat that would destroy most electronic components. The major advantage of TIMM circuits (thermionic integrated micromodules) is their ability to function in, and even utilize rather than waste, the high heat that is a by-product of extreme miniaturization. GE believes this characteristic makes realistic the possibility of electronic equipment with component densities equivalent to one million parts per cubic foot.

COURTESY CARD PROGRAM for radio-TV service technicians has been set up by Westinghouse to simplify purchase of radio, television and stereo high fidelity parts. The program involves issuance of a card which clears credit in advance to the holder, amount determined by the local Westinghouse credit manager. It enables the distributor to take orders for parts by mail, telephone or over the counter on the initial order without involving credit clearance.

COLOR TV now amounts to a more than \$100,000,000-a-year business, according to RCA Pres., John L. Burns. From overseas we learn that Japanese who have the yen for color TV can purchase same for 400,000 to 500,000 yen (one Yankee dollar equals 360 yen). Japanese 21" color TV should drop to 150,000 yen by 1964.

LANGUAGE LABORATORIES are becoming increasingly popular. They enable students to hear foreign language conversation from tape recorders, and to hear the playback of their own voices.

Picture



CITIZENS BAND centralized marine network in the western Long Island Sound, N. Y., area has been put into operation under the sponsorship of RCA, to link 1500 yachts, six yacht clubs and a marina. Two channels are for ship-to-ship talk, the third will link the yacht clubs and marinas, and the fourth will be something like a floating inter-office communications system among club members, the clubhouse, and the launch.

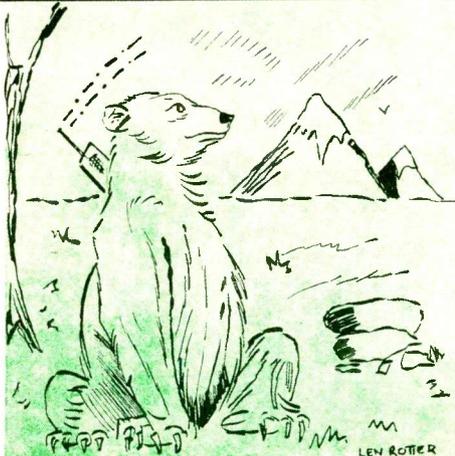
LET PUBLIC PARTICIPATE in UHF tests to take place in New York City, suggests I. S. Blonder, Chairman of the Board of Blonder-Tongue Labs. The proposed FCC test program is limited to 100 receivers of superior quality. The B-T recommendation that the public participate in the program with technical phases limited to advances that can be made in the foreseeable future, was in the belief that it would result in a climate favorable to the conversion of TV broadcasting to all UHF.

MICROPHONES used at the political conventions were made by Electro-Voice, reports the manufacturer. E-V ran a "Count the Mikes" contest among their distributors and revealed a total of 62 mikes at the Democratic convention and 111 microphones at the Republican convention. Is there a political clue in these numbers?

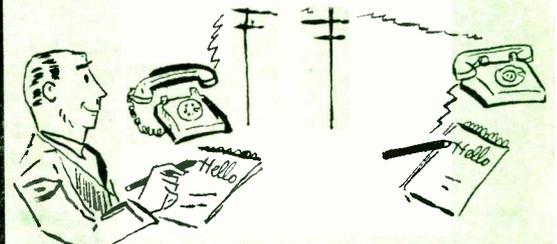
CALENDAR OF COMING EVENTS

- Oct. 10-12: IRE National Electronic Conference, Hotel Sherman, Chicago, Ill.
- Oct. 11-14: Audio Engineering Society 12th Annual Convention and Exhibit, Hotel New Yorker, New York, N. Y.
- Oct. 24-26: East Coast Aeronautical and Navigational Electronics Conference, Lord Baltimore Hotel, Baltimore, Md.
- Oct. 26-27: Armour Research Foundation 1960 Computer Applications Symposium, Morrison Hotel, Chicago, Ill.
- Oct. 27-28: IRE 1960 Electron Devices Meeting, Shoreham Hotel, Washington, D.C.
- Oct. 31-Nov. 2: IRE 13th Annual Conference on Electronic Techniques in Medicine & Biology, Sheraton Park Hotel, Washington, D.C.
- Oct. 31-Nov. 2: IRE Radio Fall Meeting, Syracuse Hotel, Syracuse, N. Y.
- Nov. 14-16: Mid-America Electronics Convention (MAECON), Hotel Muehlebach, Kansas City, Mo.
- Nov. 25-27: Northwest High Fidelity Stereo & Music Show, Audio Div. Paul Bunyan Chapter, Electronic Representatives Assn., Leamington Hotel, Minneapolis, Minn.
- Dec. 5-8: National Conference on the Application of Electrical Insulation, Conrad Hilton Hotel, Chicago, Ill.
- Dec. 12-14: URSI-IRE Fall Meeting, Radio Bldg., Boulder Labs., National Bureau of Standards, Boulder, Colo.

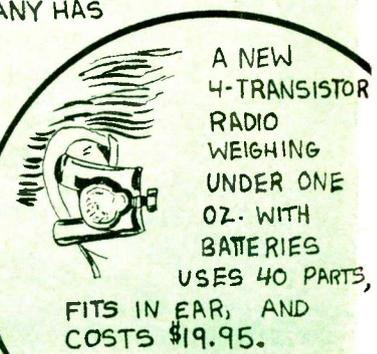
RANDOM NOISE



YELLOWSTONE PARK GRIZZLIES NOW SPORT COLOR MARKERS ON THEIR EARS SO MOVEMENTS MAY BE TRACED. NATURALISTS MAY ATTACH RADIO TRANSMITTERS TOO TO AID TRACKING.



PHONE COMPANY HAS AUTHORIZED TELEWRITER SERVICE WHEREBY HAND WRITTEN MESSAGES ARE SENT OVER REGULAR LINES.



A NEW 4-TRANSISTOR RADIO WEIGHING UNDER ONE OZ. WITH BATTERIES USES 40 PARTS, FITS IN EAR, AND COSTS \$19.95.

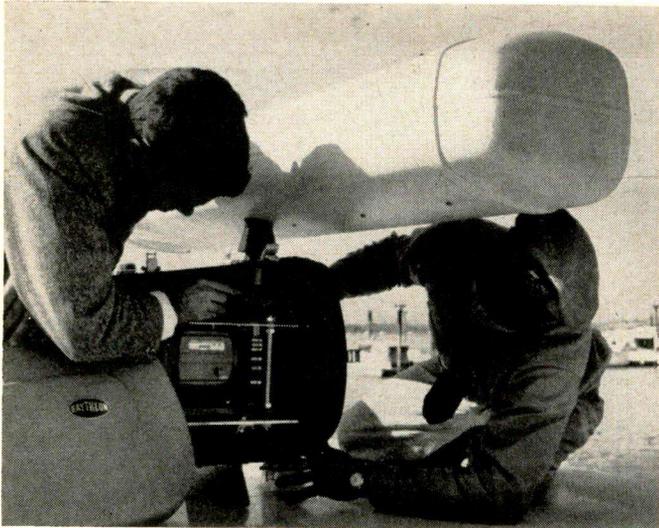
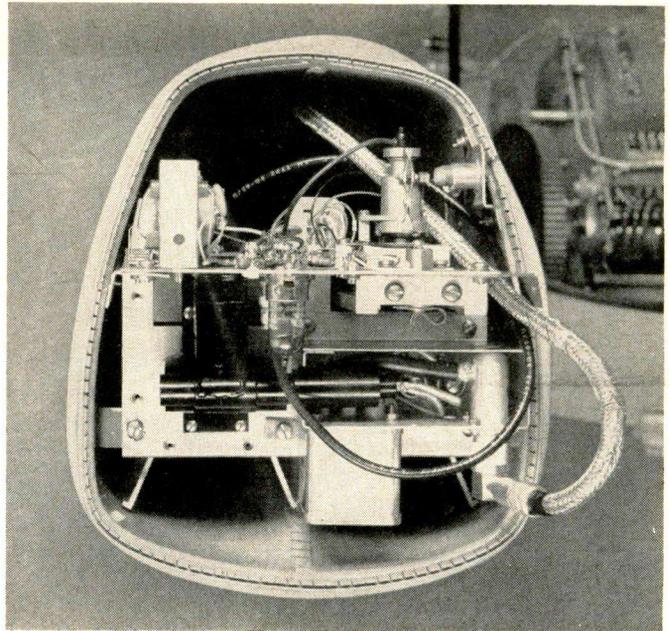


Fig. 1 (l)—Antenna unit mounted on open pedestal houses converter. Fiber gear is removed when tuning klystron.

Fig. 2 (r)—Antenna unit houses klystron (top right), magnetron (lower left-center), and r-f preamplifier (left center).



Radar For Pleasure Boats

Operation, Installation, Adjustment, And Maintenance Procedures For Small-Boat Radar Equipment

ERNEST WILSON
*Marine Products Dept.
Raytheon Company*

- Improved manufacturing techniques and component miniaturization has now made radar a reality to the pleasure boat owner. It has not come too soon.

The number of boats now in use in many localities has created safety problems beyond normal navigation difficulties.

Since radar has contributed so much to the safe navigation of planes and ships, it appears to be a most logical instrument for solving the pleasure boat owner's navigation problems. It can provide definite, instantaneous information on obstructions in a boat's vicinity, including other craft, regardless of visibility.

A recent survey conducted among pleasure boat owners indicated that approximately 70% showed an interest in purchasing low-cost radar equipment. Respond-

ents in the survey indicated a high degree of awareness regarding installation problems and the necessity for periodic maintenance. 67% stated they were willing to pay \$100 or more for a yearly service contract on such equipment.

Several marine electronics manufacturers have introduced small, low-cost radar sets. The sets vary in size, with the smallest consisting of a 60 lb. antenna and a 40 lb. indicator. Prices range from about \$1400 up.

Small-boat radar expands the need for licensed service technicians, since the FCC requires that a second class radiotelephone license with radar endorsement be held by the person making repairs on a radar set.

As we already know, theory and practical functions of radar components approximates that of TV, and should pose few problems for the skilled electronic technician.

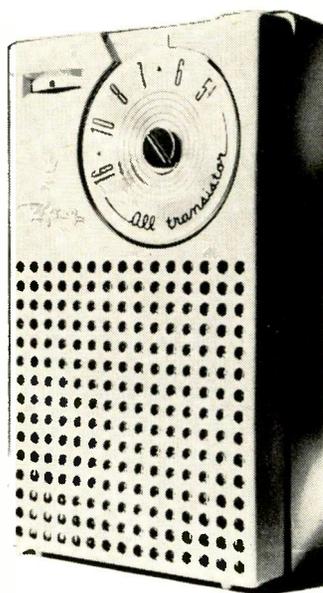
Simply stated, radar functions by radiating extremely short r-f

energy spurts or pulses from the transmitting antenna on a microwave frequency. The antenna is designed to radiate energy in a very narrow beam. When the radiated energy strikes an object a portion of this energy is reflected back to the radar location, where it is intercepted by the receiving antenna and amplified by the receiver. The reflected pulses produce illuminated areas on the radar screen. Range position is determined by time elapsed between pulse transmission and reception of the returning echoes.

Small-Boat Radar

A small boat radar, the Raytheon Model 1700, is constructed in essentially two units. Its antenna housing and pedestal is shown in Fig. 1. The antenna section houses receiving and transmitting antennas, magnetron, klystron, and receiver preamplifier as illustrated in Fig. 2. A mixer crystal is also included.

Servicing Transistor Radio Midgets



Formula For Extra Profits Includes Rapid, Low Cost Repairs

LOUIS E. GARNER, JR.

● With the fall season here, John Q. Public and his family have returned from their vacations. And they brought back hundreds of thousands of transistorized portable receivers, many of them somewhat the worse for wear. Servicing these sets can bring extra profits to the alert Radio-TV technician . . . provided he can complete the repairs quickly, efficiently, and at minimum cost.

You're unlikely to win friends and influence prospects by charging \$15.00 to repair a set costing \$19.95 (new), unless it's obviously in pretty sad shape. To tackle these sets profitably, then, you cannot waste time as a result of having improper tools, using the wrong techniques, or simply being unfamiliar with the sets. Obtain the special tools you need, make sure your test equipment is in good shape and, if necessary, bone up a little on your transistor set servicing techniques.

Since the majority of transistorized receivers are assembled on etched circuit boards, you'll need the usual complement of printed

circuit repair materials and special soldering iron tips.

Adequate service data, of course, is an important "tool," but you may run into a small problem here. A high percentage of the sets you'll encounter will be imported brands (generally from Japan) and the manufacturer's service data, in most cases, *will not* be available for these sets. Here, you can often "make do" by using schematics of domestic (U.S. made) receivers having similar circuit arrangements. As you gain a little experience working with the sets, you'll find less need for referring to a schematic except when you encounter a "dog."

Component Stock

Due to the wide variety of sets on the market, there is little point in attempting to stock major components . . . i-f transformers, audio transformers, loudspeakers, and so on . . . unless a particular brand of set is especially popular in your area. If the latter situation exists, it may prove worthwhile to have a few of these components on hand. Otherwise, purchase the compo-

nents needed through your parts outlets in keeping with your service requirements.

A somewhat similar situation exists with regard to transistors. Today, there are over 2,000 different types offered by domestic and overseas manufacturers. While not all of these types are used in transistorized receivers, an attempt to stock even a majority of "receiver" types could bankrupt all but the largest service shops. Again, purchase your transistor stock as your needs dictate, maintaining a permanent stock only of those types which prove popular in your area.

You should obtain a basic stock of small (1/10 watt) resistors in popular EIA values up to, say, 1 megohm. Relatively few of the higher value resistors are needed, for the majority of those used in transistor circuits are in the *under* 100,000 ohm range.

A basic stock of miniature electrolytics in 6, 12, and 15 volt ratings will prove helpful. The most popular values are 2 μ f, 8 (or 10) μ f, 20 μ f, 50 μ f, and 100 μ f. A similar assortment of low voltage (25 or 50 volt) ceramics will prove valuable . . . typical values here are

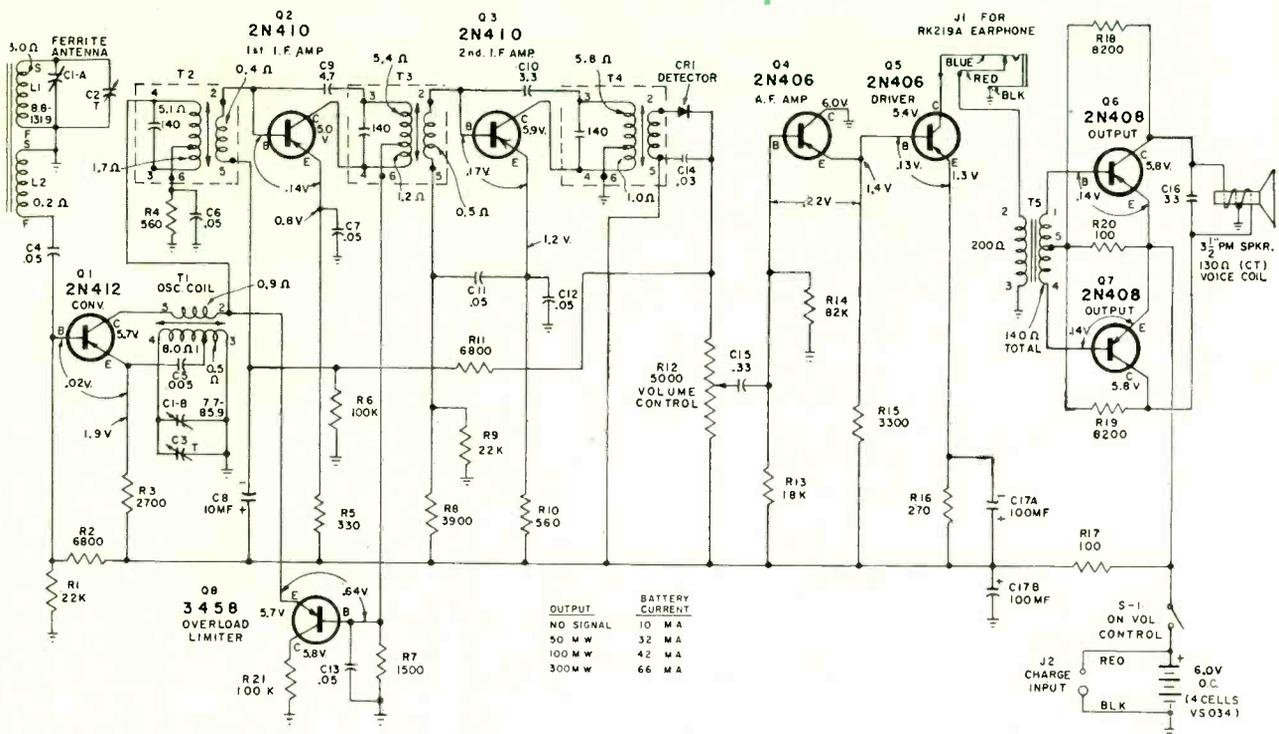


Fig. 1—Schematic of a deluxe-type portable transistor radio. Unit has a 300 mw push-pull output and uses a total of 8 transistors plus one diode as detector. Many transistor radios employ modified versions of the RCA circuitry shown here.

.001, .01, .02, .05, and 0.1 μ f. An adequate stock of replacement batteries is extremely important.

Basic Set Types

If we ignore differences in physical layout and design as well as individual circuit variations, the majority of available transistorized portables can be grouped together into four major classes . . . (a) the "Gimmick" sets, (b) "Minimum" sets, (c) "Standard" receivers, and (d) "Deluxe" sets. These classifications are arbitrary and are chosen for discussion purposes.

As a general rule, the "Gimmick" sets are two or three-transistor receivers intended for the reception of stronger local broadcast stations. They are usually designed for ear-phone operation only and many, quite frankly, are intended as toys. Most use TRF, regenerative, or simple tuned-circuit detector circuit arrangements.

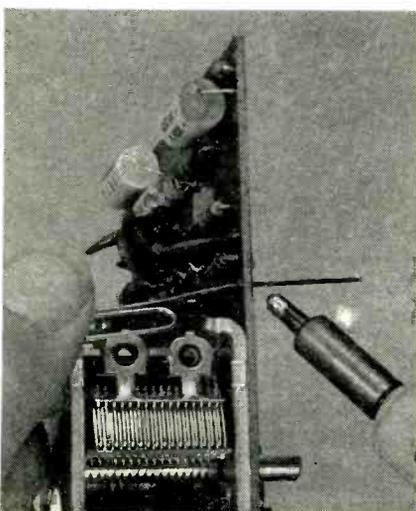
The "Minimum" sets employ three or four transistors in superhet circuits. Designed primarily for the reception of local broadcast stations, they give acceptable performance using a built-in ferrite loop.

The "Standard" receiver is one

employing five or six transistors in a superhet circuit. The overall performance is roughly comparable to that of a five tube receiver, with a smaller-than-usual speaker. A push-pull Class AB (or Class B) audio output circuit delivering about a quarter watt ((250 milliwatts) is typical.

Finally, the "Deluxe" sets are those employing more than six

Fig. 2—A partially opened paper clip is an excellent "tool" for opening a printed circuit mounting hole after heating with an iron.



transistors. Superhet circuitry, of course. Overall performance is quite good, with their sensitivity and selectivity comparing favorably with those of six tube receivers. Included in the general class are multiband sets employing seven or eight transistors. The line-up may include an r-f stage, a converter, two or more i-f stages, a detector, two or more audio "gain" stages, and a push-pull Class AB (or Class B) power stage delivering from one-third to three-quarters of a watt.

Many of the basic circuit features found in the portable shown in Fig. 1 are duplicated in other receivers. This 8-transistor pocket-sized set is operated on four 1.5 volt cells, supplying a total of 6 volts. It uses PNP transistors throughout and is capable of delivering an undistorted power output of 300 milliwatts. Employing a superhet circuit, its i-f is 455 kc. The set can serve as a guide to transistor radio circuitry design.

Diagnosing Defects

Unless there is obvious physical damage or an internal short across the power supply (customer com-

plains, "batteries last only a few minutes"), your first step is to confirm the customer's complaint. John Q. Public is prone to lump every complaint under the general heading, "it doesn't work." To service the set properly, you'll need to know whether the *actual* complaint is . . . weak, distorted, noisy, dead, lacks selectivity, or any of the other basic complaints indicative of a general type of defect. Try out the set yourself, preferably in the customer's presence.

While doing this, try to get a little background history on the set . . . ask the customer a few questions—"Has the set been left in a car on a hot day?" "Has it been dropped?" "Did you install the wrong type of battery at one time?" Excessive heat or incorrect battery polarity, for example, may result in leaky electrolytics or damaged transistors, respectively.

Check the battery, both with the set "off" and under load. An appreciable drop in voltage under load indicates high internal battery resistance or a partial short within the receiver. If in doubt, try a replacement battery known to be in good condition . . . or connect to your bench supply.

A quick, but reasonably thorough, visual check is always a good idea. Watch for broken leads, charred resistors, corrosion and discoloration, or other clues.

From this point on, suit your servicing technique to the type of complaint encountered. Defects causing "weak" or "dead" complaints generally can be isolated rather quickly using Signal Tracing or Signal Injection techniques. If the individual stages all seem "live," but the set is still "dead," suspect the local oscillator in superhets.

Checking the local oscillator in a transistor set can be a sticky job . . . there is relatively little change in bias voltage whether or not the stage is oscillating. The best test here is to try to pick up the local oscillator signal, using either a Tuned Signal Tracer or another receiver (coupled loosely to the set through a 25 or 50 μf capacitor).

"Distortion," a not uncommon complaint, may be caused by a weak battery, a leaky coupling or by-pass capacitor, or by a leaky or partially shorted transistor.

With the trouble isolated to a

specific stage(s), the defective part or connection can be isolated by voltage and/or resistance checks in that stage. Watch those voltage measurements! Checks should be made between appropriate transistor electrodes (base-emitter, collector-emitter) unless specified otherwise in the manufacturer's service data for the set. Measurements to "ground" may be meaningless. Watch, too, for unusually low, nor-

excessive voltage or current.

If we ignore mechanical damage and similar physical defects, the commonest cause of trouble in transistorized portables is a defective battery.

The battery's internal resistance, if high, can have a considerable effect on set performance, causing complaints, ranging from "weak," "distorted," "lacks sensitivity," to "Oscillation," "squeals," and "motorboating." The latter defects are usually caused by common inter-stage coupling through the internal resistance of the power supply. In many sets, a large electrolytic (50 to 200 $\mu\text{fd.}$) will be connected across the battery or in the common "hot" battery circuit to minimize possible coupling through the battery. Capacitor C17B (Fig. 1) serves such a function.

While transistors do not become defective as often as tubes, they can "go bad." A good rule of thumb is . . . to suspect the transistors last, unless the set has been subjected to excessive heat or other abuse. (Hence the importance of obtaining a "history" on the set.) Defects in other components may damage a transistor . . . for example, a leaky coupling capacitor in an audio stage may apply excessive base bias. In time, this may cause the transistor to overheat and become leaky.

Once the defective part has been isolated, a replacement may be made. Familiar techniques may be used here, but special care must be taken to avoid damaging nearby components or wiring. Avoid applying excessive heat near transistors or electrolytic capacitors. Watch that tiny droplets of solder do not fall on printed circuits, shorting closely spaced conductors.

When replacing individual components on circuit boards, a good practice is to cut out the defective part in such a way that its leads are left projecting. These can be used as "tie-points" for installing the new part.

Where a major component is replaced, it may be necessary to unsolder its terminals instead of cutting them. Use an appropriate soldering tip (specially shaped "desoldering" tipleths are available for pencil-type soldering irons), afterwards removing excess solder

(Continued on page 74)

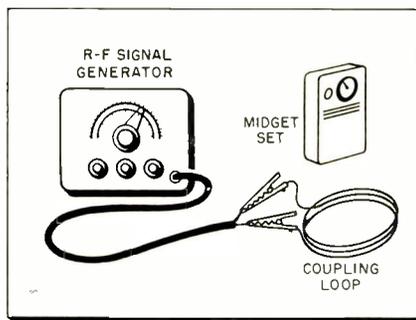


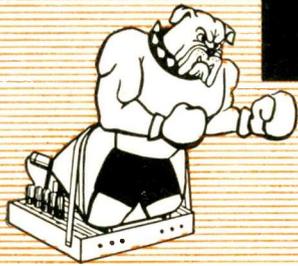
Fig. 3—Aligning a midget transistor radio can be simplified by using a three or four inch scramble-wound loop made of 12 to 18 turns of insulated wire to loosely couple r-f from a signal generator into the radio.

mal voltages . . . note the base-emitter voltage on Q1, Fig. 1.

Testing Transistors

As a general rule, it's a good idea to remove all transistors (if they are plugged into sockets rather than wired in place) *before* making resistance measurements. Otherwise, the internal resistance of the transistors themselves will affect your readings, leading to incorrect conclusions. The exception, of course, is where service data specifies resistance measurements with transistors installed.

If your tests lead you to suspect that a transistor is defective and you don't have a substitute to try in its place, a transistor tester is a welcome instrument to have. If you don't have access to a transistor test instrument, an ohmmeter forward-reverse resistance test may give a rough indication of the transistor's quality. However, it's foolish to depend on "rough checks" when accurate, inexpensive test instruments are commercially available; especially when the rough check can ruin a component through



"Tough Dog" TV

Corner



Difficult Service Jobs Described by Readers

Sound Normal, Intermittent Video

A Zenith 21K20-3 with agc trouble—or so I thought—was brought to the shop for repair. After the set played for a while the picture would occasionally change in contrast and eventually become kinked, turn somewhat negative, go out of sync and disappear. All during the above symptoms the sound remained almost constant.

Naturally the first thing substituted was the agc tube . . . nothing. All tuner i-f and video output tubes were replaced. Still no change. As the keying pulse is taken from the grid of $\frac{1}{2}$ the horizontal oscillator tube (6SN7) this too was replaced. Same trouble.

It was also noticed the agc control acted touchy, so we used a lubricant to clean the control. After cleaning the control the set was rechecked and there was no improvement. The only course left was extensive troubleshooting. A check for grid voltage on the first video i-f revealed that during normal operation of the set the grid voltage was normal (a few volts neg.), but during the abnormal operation this grid checked out slightly positive. I was faced with the problem of determining whether overdriven stages in the video i-f section were causing abnormal agc conditions, or whether abnormal agc conditions were allowing these tubes to be overdriven. I scoped the waveform of the keying pulse to the agc stage on both sides of the coupling condenser and it looked normal but a new condenser was temporarily tried with no results. I

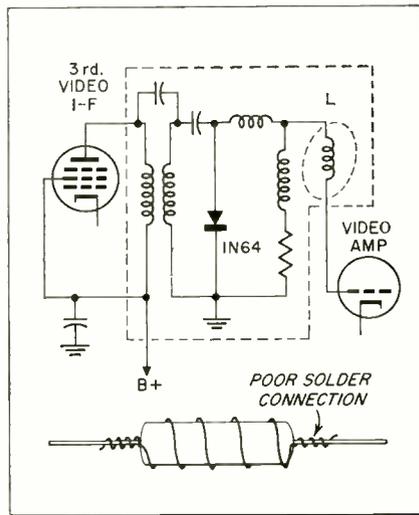


Fig. 1—Cold solder connection on peaking coil caused intermittent video, but, did not disturb 4.5 mc sound output.

checked all the voltages in the i-f strip and studied them very carefully with signal applied and without signal applied; during normal operation and during the abnormal condition. I concluded that the i-f's were 100% OK. The agc stage, given the same treatment, proved to my satisfaction that it also was OK. Components in this stage were individually checked.

By this time I had good reason to believe the tuner was all right so what was left?—The detector and video amplifier. By substitution I

had determined the 1N64 diode was good so I began carefully checking the video amplifier. All voltages were carefully checked and found to be correct with no signal applied. However, study of the schematic reveals that the grid receives a negative voltage due to the rectifying action of the diode when signal is applied. This negative voltage seemed to be absent. In the schematic, all the parts in the dotted line are enclosed in a can, so I proceeded to disconnect the leads and disassemble the components in the detector assembly. A continuity check of the coils involved located one coil that convinced me I finally located the source of the trouble. The series peaking coil shown in Fig. 1 checked open although a visual check couldn't detect the break. This coil is wound on a form shaped like a resistor and the ends of the coil wire are coiled around the pig tail wires a few turns and then soldered. By scraping the coil wire at each end I used an ohmmeter to determine where the break was. It was a poor solder connection to one pig tail. A small drop of hot free-flowing solder put the TV set back in good operating condition.

This poor solder joint was good enough to allow the set to operate most of the time but probably developed into a high resistance connection at times. Nevertheless, it fed enough video to produce a picture part of the time, and there probably was enough capacity in the connection to pass 4.5 mc, allowing sound to get through.—Merton R. Albert, Clintonville, Wisconsin.

TOUGH DOGS WANTED

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

Equipment Specifications And Output Requirements For Various Installations. How To Interpret Different Output Wattage Ratings.

Hi-Fi Power Ratings

FRED BERGMAN

• In setting up a hi-fi stereo installation, the question frequently arises: "How much power is really needed?" The answer depends on program material, type of speaker, room characteristics, noise level, and even what you mean by power. An optimum amount of power is usually desired—high enough to do a good job, low enough to keep costs in hand.

Our purpose here is to present a general guide for the power needed in various circumstances, and to examine briefly the interpretation of amplifier wattage ratings.

Amplifier power output requirements to "fill" a particular room can be approximately determined by referring to Table I. The amount of power needed will vary with the size of a room, speaker efficiency, ambient noise, and musical tastes. Most audio professionals use the rule-of-thumb concept of doubling wattage requirements to compensate for equipment deterioration, extra speakers, unusual music peaks, etc.

Manufacturers generally include "power rating" figures with their equipment. Power output rating should be indicated in watts at a level where harmonic or intermodulation is not objectionable. Typical is the designated rating of a given amplifier having an output of 30 watts, for example.

A close investigation of many such specifications usually uncovers the fact that two channels have an output of 15 watts each. Ratings should include data on percentage of distortion. For example, harmonic distortion 0.3% at full rated power output.

Considerable effort has been ex-

erted by the Electronics Industries Association (EIA), and others, to establish standardized methods of rating amplifiers. The "music power rating" (MPR) which has been adopted is a step in this direction. In a simplified way, MPR means the maximum power output of an amplifier during the initial musical surge—with distortion of not more than 5%. These figures are about 30% higher than equivalent continuous power ratings, and as much as 50% lower than theoretical peak power.

Harmonic distortion % ratings, conforming to IHFM (Institute of High Fidelity Manufacturers) music power output (MPO) standards, are based on a continuous power output system. In effect, total harmonic distortion cannot exceed specifications for 30 seconds at that frequency which gives maximum power output. Power supply voltages must remain constant.

Ratings of amplifiers employing identical output tubes may also vary. Variations are anywhere from five to ten watts, and the uninformed are often perplexed by the different figures.

Some manufacturers specify maximum-signal power with 3% total harmonic distortion, employing the lower figure (receiving tube manual wattage rating) for an amplifier's output. Others specify 4% total harmonic distortion and the maximum wattage rating of an amplifier.

Before the technician selects equipment it would be considered wise to consult a tube manual in order to obtain output tube wattage ratings. Manufacturers' component specifications should also be carefully interpreted. ●

Chart information compiled by Norman Crowhurst.

TABLE I

Amplifier Power Output Requirements (Total—Both Channels)

Room Size →		Small			Medium			Large				
		Live	Medium	Plush	Live	Medium	Plush	Live	Medium	Plush		
Background	Quiet	Jazz	High	30mW	60mW	120mW	60mW	120mW	250mW	120mW	250mW	500mW
			Av.	60mW	120mW	250mW	120mW	250mW	500mW	250mW	500mW	1W
			Low	120mW	250mW	500mW	250mW	500mW	1W	500mW	1W	2W
		Light Concert	High	60mW	120mW	250mW	120mW	250mW	500mW	250mW	500mW	1W
			Av.	120mW	250mW	500mW	250mW	500mW	1W	500mW	1W	2W
			Low	250mW	500mW	1W	500mW	1W	2W	1W	2W	4W
		Classical	High	120mW	250mW	500mW	250mW	500mW	1W	500mW	1W	2W
			Av.	250mW	500mW	1W	500mW	1W	2W	1W	2W	4W
			Low	500mW	1W	2W	1W	2W	4W	2W	4W	8W
		Jazz	High	250mW	500mW	1W	500mW	1W	2W	1W	2W	4W
			Av.	500mW	1W	2W	1W	2W	4W	2W	4W	8W
			Low	1W	2W	4W	2W	4W	8W	4W	8W	15W
	Light Concert	High	500mW	1W	2W	1W	2W	4W	2W	4W	8W	
		Av.	1W	2W	4W	2W	4W	8W	4W	8W	15W	
		Low	2W	4W	8W	4W	8W	15W	8W	15W	30W	
	Classical	High	1W	2W	4W	2W	4W	8W	4W	8W	15W	
		Av.	2W	4W	8W	4W	8W	15W	8W	15W	30W	
		Low	4W	8W	15W	8W	15W	30W	15W	30W	60W	
	Jazz	High	2W	4W	8W	4W	8W	15W	8W	15W	30W	
		Av.	4W	8W	15W	8W	15W	30W	15W	30W	60W	
		Low	8W	15W	30W	15W	30W	60W	30W	60W	100W	
	Light Concert	High	4W	8W	15W	8W	15W	30W	15W	30W	60W	
		Av.	8W	15W	30W	15W	30W	60W	30W	60W	100W	
		Low	15W	30W	60W	30W	60W	100W	60W	100W	not practical	
Classical	High	8W	15W	30W	15W	30W	60W	30W	60W	100W		
	Av.	15W	30W	60W	30W	60W	100W	60W	100W	not practical		
	Low	30W	60W	100W	60W	100W	not practical	100W	not practical	not practical		
Average	Program Choice	Jazz	High	30mW	60mW	120mW	60mW	120mW	250mW	120mW	250mW	500mW
			Av.	60mW	120mW	250mW	120mW	250mW	500mW	250mW	500mW	1W
			Low	120mW	250mW	500mW	250mW	500mW	1W	500mW	1W	2W
		Light Concert	High	60mW	120mW	250mW	120mW	250mW	500mW	250mW	500mW	1W
			Av.	120mW	250mW	500mW	250mW	500mW	1W	500mW	1W	2W
			Low	250mW	500mW	1W	500mW	1W	2W	1W	2W	4W
		Classical	High	120mW	250mW	500mW	250mW	500mW	1W	500mW	1W	2W
			Av.	250mW	500mW	1W	500mW	1W	2W	1W	2W	4W
			Low	500mW	1W	2W	1W	2W	4W	2W	4W	8W
		Jazz	High	250mW	500mW	1W	500mW	1W	2W	1W	2W	4W
			Av.	500mW	1W	2W	1W	2W	4W	2W	4W	8W
			Low	1W	2W	4W	2W	4W	8W	4W	8W	15W
Light Concert	High	500mW	1W	2W	1W	2W	4W	2W	4W	8W		
	Av.	1W	2W	4W	2W	4W	8W	4W	8W	15W		
	Low	2W	4W	8W	4W	8W	15W	8W	15W	30W		
Classical	High	1W	2W	4W	2W	4W	8W	4W	8W	15W		
	Av.	2W	4W	8W	4W	8W	15W	8W	15W	30W		
	Low	4W	8W	15W	8W	15W	30W	15W	30W	60W		
Jazz	High	2W	4W	8W	4W	8W	15W	8W	15W	30W		
	Av.	4W	8W	15W	8W	15W	30W	15W	30W	60W		
	Low	8W	15W	30W	15W	30W	60W	30W	60W	100W		
Light Concert	High	4W	8W	15W	8W	15W	30W	15W	30W	60W		
	Av.	8W	15W	30W	15W	30W	60W	30W	60W	100W		
	Low	15W	30W	60W	30W	60W	100W	60W	100W	not practical		
Classical	High	8W	15W	30W	15W	30W	60W	30W	60W	100W		
	Av.	15W	30W	60W	30W	60W	100W	60W	100W	not practical		
	Low	30W	60W	100W	60W	100W	not practical	100W	not practical	not practical		
Noisy	Program Choice	Jazz	High	30mW	60mW	120mW	60mW	120mW	250mW	120mW	250mW	500mW
			Av.	60mW	120mW	250mW	120mW	250mW	500mW	250mW	500mW	1W
			Low	120mW	250mW	500mW	250mW	500mW	1W	500mW	1W	2W
		Light Concert	High	60mW	120mW	250mW	120mW	250mW	500mW	250mW	500mW	1W
			Av.	120mW	250mW	500mW	250mW	500mW	1W	500mW	1W	2W
			Low	250mW	500mW	1W	500mW	1W	2W	1W	2W	4W
		Classical	High	120mW	250mW	500mW	250mW	500mW	1W	500mW	1W	2W
			Av.	250mW	500mW	1W	500mW	1W	2W	1W	2W	4W
			Low	500mW	1W	2W	1W	2W	4W	2W	4W	8W
		Jazz	High	250mW	500mW	1W	500mW	1W	2W	1W	2W	4W
			Av.	500mW	1W	2W	1W	2W	4W	2W	4W	8W
			Low	1W	2W	4W	2W	4W	8W	4W	8W	15W
Light Concert	High	500mW	1W	2W	1W	2W	4W	2W	4W	8W		
	Av.	1W	2W	4W	2W	4W	8W	4W	8W	15W		
	Low	2W	4W	8W	4W	8W	15W	8W	15W	30W		
Classical	High	1W	2W	4W	2W	4W	8W	4W	8W	15W		
	Av.	2W	4W	8W	4W	8W	15W	8W	15W	30W		
	Low	4W	8W	15W	8W	15W	30W	15W	30W	60W		
Jazz	High	2W	4W	8W	4W	8W	15W	8W	15W	30W		
	Av.	4W	8W	15W	8W	15W	30W	15W	30W	60W		
	Low	8W	15W	30W	15W	30W	60W	30W	60W	100W		
Light Concert	High	4W	8W	15W	8W	15W	30W	15W	30W	60W		
	Av.	8W	15W	30W	15W	30W	60W	30W	60W	100W		
	Low	15W	30W	60W	30W	60W	100W	60W	100W	not practical		
Classical	High	8W	15W	30W	15W	30W	60W	30W	60W	100W		
	Av.	15W	30W	60W	30W	60W	100W	60W	100W	not practical		
	Low	30W	60W	100W	60W	100W	not practical	100W	not practical	not practical		

"Vitamins" For Aging TV's

Component Defects Show Up
When Heat, Cold Or Higher
Voltages Are Applied

HAROLD WEST

• Much of today's service business consists of repairs made on TV receivers which were manufactured from 1950 through 1957. These repairs obviously fall into two categories: complete failures, and partial failures resulting in performance deterioration.

Many technicians repair only the fault for which the customer has called and frequently find a chassis has to be returned to the shop later for additional work (generally for faults the customer "never had until the set was fixed"). Small deviations in picture, sound, or sync which the customer became accustomed to over a long period of time, suddenly become obvious to him again when the set is returned after being absent for a few days.

Common sense prescribes that the technician call attention to these weaknesses before repairing or returning the set. An estimate for a complete overhaul often makes good sense to technician and customer alike.

It is not always easy to determine the exact cause of borderline faults arising from aging sets and deteriorating parts. Consequently, an accurate and realistic estimate for repairs is often difficult to make. Such an estimate can, of course, be arrived at only with the TV set on the work bench. Some helpful aids employed by technicians to make defects show up clearly are as follows:

1. An infra-red or regular type lamp rated from 300 to 500 watts, with an adequate reflector, for concentrating heat on a given point is employed to determine if a compo-

nent's characteristics change with increased temperature.

2. Some modern thought along these lines dictate the use of a

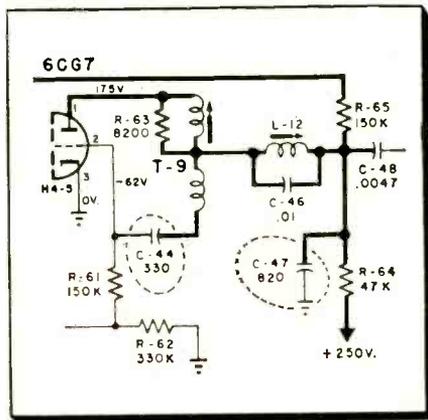


Fig. 1—Horizontal drift is often traced to a defective 330 or 820 μmf capacitor.

freezing agent, available in spray type cans. This method quickly reduces component temperature, frequently causing a change in set performance if the part is defective.

3. Many capacitors, not up to par, will break down when more than normal voltage is applied. A good capacitor is generally rated to withstand 50 to 100% more voltage than specified. Consequently, some technicians use a device to vary the a-c supply voltage above the circuit requirements. This method will often show up defective components, including some intermittent capacitors and resistors.

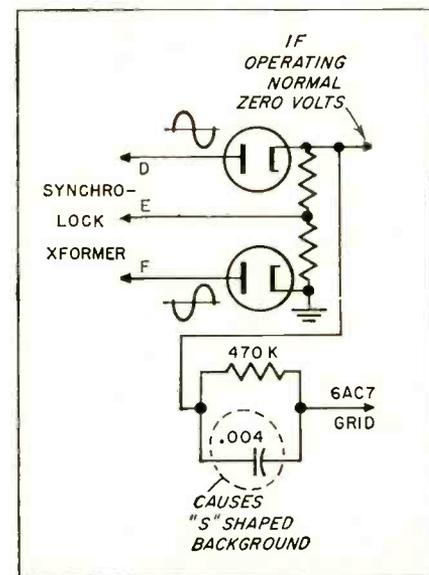
Vertical Problems

When the TV picture barely fills the screen vertically, vertical cir-

cuit's voltages, resistors, and capacitors should be investigated; especially its discharge capacitor. Checking the capacitor on a condenser tester may not show it to be faulty. Use the heat, cold or higher voltage test and it will either break down or indicate its changing characteristics by a quickly elongating or shrinking picture.

Vertical output, blocking oscillator transformers, and deflection yokes are not always easily obtainable for some of the older sets in certain localities. Consequently, parts may have previously been replaced by "nearly identical" components. For example, the current waveform taken from the vertical windings of a deflection yoke driven by an exact replacement output transformer, may be sharper than the waveform obtained from an "al-

Fig. 2—Shorted capacitors in synchro-lock circuit discriminators may cause "S" shaped picture background.



most exact" replacement. A technician making an earlier repair may have juggled the vertical plate load resistors and capacitors to get optimum sweep and linearity. Watch the components in old sets.

Yoke ringing, appearing as a series of bright vertical lines, is often caused by an incorrect damping network in the yoke. This should always be checked against manufacturer's specifications.

Horizontal Faults

Blocking oscillator, multivibrator, and afc circuits (synchro-guide, ringing coil, etc.) generally cause most of the borderline faults in horizontal sweep sections of older TV receivers. One typical condition is horizontal picture slipping, attended by tearing, usually at the picture top. The symptom often appears when reception changes from commercial to program (and vice versa) and represents a brief, partial loss of horizontal sync. In one version of the well known synchro-guide circuit, partly shown in Fig. 1, either of two components are frequently suspect. The 820 and 330 μf capacitors shown in the schematic are highly critical and should always be replaced with 5% tolerance types.

Many older original and custom made sets are still in operation which use the highly stable sine-wave (synchro-lock) horizontal oscillator. On occasion a defective capacitor in the network from one sync phasing diode to the reactance tube grid, as shown in Fig. 2, will cause an "S" shaped picture background. Its capacity is usually 4000 to 5000 μf , and replacement with a good mica capacitor rated at not less than 600 v d-c is recommended. Replacement will generally restore straight lines to the picture background.

Multivibrator circuits using ringing coils are known to deteriorate with age. A partial diagram of a cathode-coupled multivibrator circuit is shown in Fig. 3. Note the resistor in series with the ringing coil network. If the specified value of this resistor changes, either permanently or temporarily through heat variations, the ringing coil's range will be adversely affected. Differently designed circuits use different values but the resistor

should be replaced with one having a 5% tolerance.

Horizontal instability may result from a defective output tube or breakdown of a screen grid resistor (changing value when it gets hot). Obvious failures include the horizontal tube that suddenly pops in after being operative for a certain period of time—usually up to a half hour. This one is easy. Just replace the tube and sit around and wait.

But what about the horizontal output screen resistor that changes value or arcs internally in an intermittent manner? At the expense of blowing a fuse in the damper circuit, it may be advisable to arc the resistor to ground momentarily (overloading it for an instant) in which case it will usually open per-

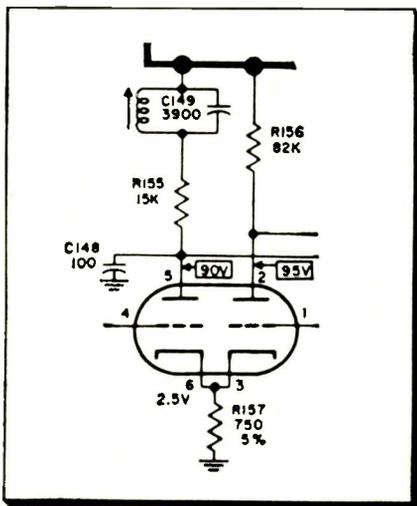


Fig. 3—Resistors changing value in multivibrator cathode coupled sync circuits play havoc with hold range.

Fig. 4—Defective current limiting resistors in high voltage rectifier circuits frequently cause picture blooming.

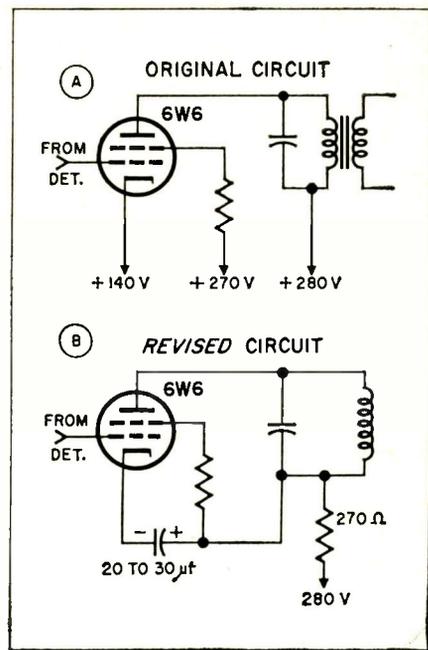
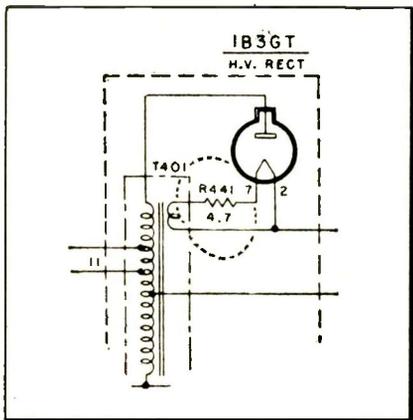


Fig. 5—(A) Hum and buzz in this audio output circuit could not be reduced. (B) When circuit shown above was modified as shown here, hum and buzz were reduced.

manently if defective.

Age problems in the horizontal section of older TV's are generally revealed by "drift" or "bending" symptoms.

Power Failures

High voltage arcing may result from "drying out" of the rectifier filament winding on the flyback, or failure of the 500 μf filter capacitor. The symptom is either a visible violet corona seen in the dark, or odor of ozone when the brightness control is turned up. Replacing the old heater winding with new 20 kv wire is the normal solution.

Defective high voltage filter capacitors can cause slight picture tearing. This condition may become very annoying at times and generally appears only on damp or humid days. Filter replacement is the only practical cure and should be made with 20 kv rated components. These may be tubular oil filled, mica "door-knob" or "cart-wheel" types.

Picture blooming is frequently an age problem and this may only happen after the receiver has been on for a considerable length of time. The current limiting resistor under the rectifier socket (often 4.7 ohms or less) may change value or be-

(Continued on page 75)

SHOP HINTS



Tips for Home and Bench Service

Life Saver

A great many TV receivers, especially portables, have been sold which are enclosed in metal cabinets. All service technicians realize the potential shock hazard this poses, but few check to see if the cabinet is "hot" upon completing a repair. Receivers that utilize a power transformer are not as dangerous as the ac/dc variety, but even a transformer type chassis bypasses the line to chassis with capacitors which may short. The chassis in portable receivers is mounted on insulators, but a splash of solder or a chassis bolt which is too long may easily defeat their purpose. A common sight is to see portable receivers going out of repair shops in good operating condition, but missing a few knobs. These exposed shafts may be 115 volt electrodes, depending upon how the line plug is inserted.

Fig. 1 shows an inexpensive tester I constructed which will quickly locate a "hot" cabinet. The circuit is relatively simple and needs no explanation. To use the tester with toggle switch in position #1, the test probe is simply brought into contact with the metal cabinet and the pushbutton pressed. This is repeated with the toggle switch thrown to position #2. If the indicator lights in either position it indicates a "hot" cabinet. The set's line plug does not have to be reversed as this is, in effect, accomplished by the tester switch. I suggest using a 3 watt 115 volt bulb as an indicator rather than an a-c voltmeter not just because it's cheaper, but because a voltmeter sometimes gives an ambiguous indication on sets which have the chassis connected to the cabinet through an R/C network.

This tester can be built in a three inch square housing and permanently attached to the test bench. For safety the press-to-close push-

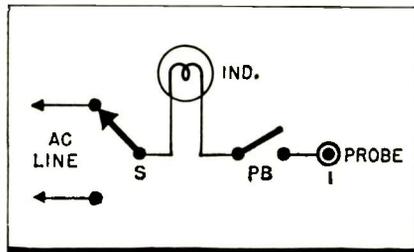


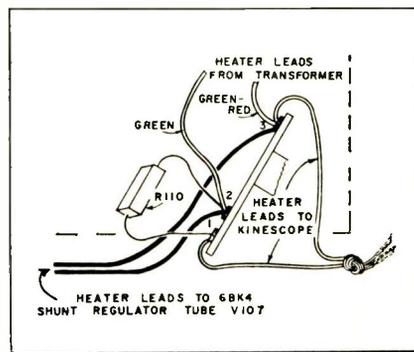
Fig. 1—"Hot chassis" checker helps unmask those 115 volt electrodes. Parts list: Ind.—3-watt, 115v bulb; J—probe jack; S—SPDT toggle; PB—normally open, press-to-close switch.

button switch in series with the probe allows a-c on the probe only when in use. This tester can also be used with radios and appliances where there is a possible shock hazard. The tester can be constructed for less than \$2, but if you find just one "hot" cabinet with this tester it may become the most priceless piece of equipment in your shop.—*Albert J. Krukowski, West Springfield, Mass.*

CRT Heater Resistor

All future production of RCA 210-CK-855 series color TV receivers, using a 21CP22 type CRT, will include a 0.56 ohm resistor in series with one of the heater leads, as shown in Fig. 2. The resistor is used to reduce heater voltage, thus low-

Fig. 2—Resistor R-110 is added to the heater circuit in all 21CP22 CRT's. This is used to reduce cathode temperature.



ering the cathode temperature of the CRT. The resistor is only effective if placed in the circuit simultaneously with the replacement 21CP22 CRT.

In the event the 21CP22 CRT is later replaced with a new CRT type, 21CP22A, this resistor must be shorted out. This may be conveniently done by twisting the resistor leads together and soldering the junction securely.

Caution should be observed that the resistor, terminal strip and heater leads are properly secured and isolated to prevent the heater circuit from shorting to the chassis.—*RCA Service Co., Camden, N. J.*

PM Tape Eraser

Here is a method of erasing tape with the aid of a permanent magnet speaker. (See Fig. 3.)

Take the roll of tape to be erased

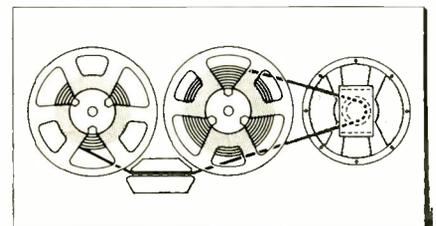


Fig. 3—Using the permanent magnet in a PM speaker to erase tape information.

and place it on either side of the tape recorder on a box or tape boxes so that the magnet will be in line with the tape travel. Thread the tape around the permanent magnet of a speaker (the magnet has to be one that is exposed and smooth) and back to the take up spool. Set the tape recorder to fast forward or fast rewind, as the case may be, and your tape will be erased.—*Paul S. Segars, Jr., St. Petersburg, Florida.*

• This is not recommended for precise applications where retained magnetism on tape may have an undesired d-c bias effect.—Ed.

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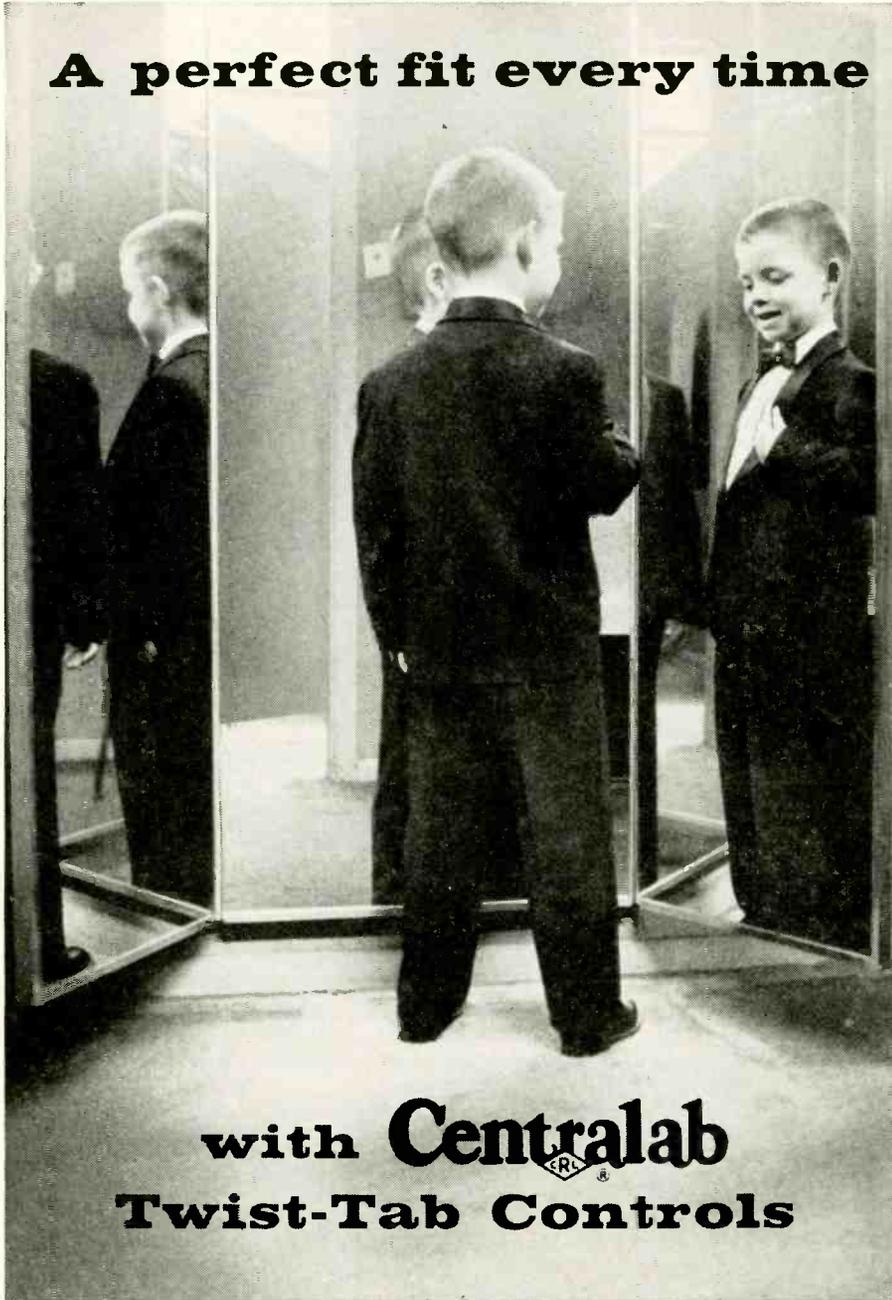
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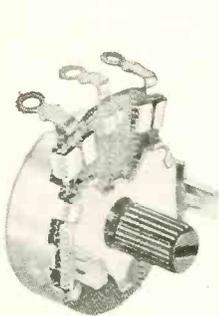
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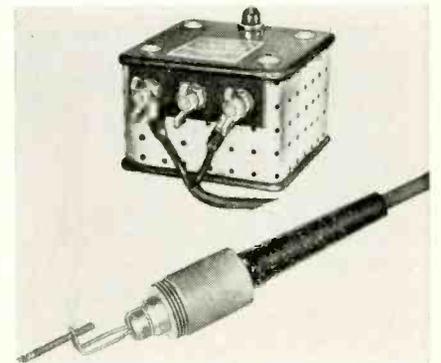


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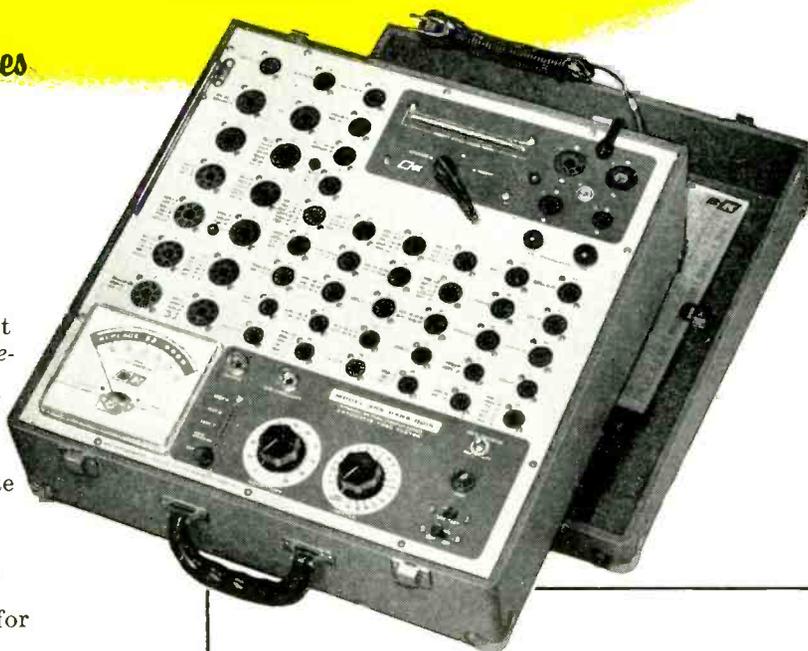
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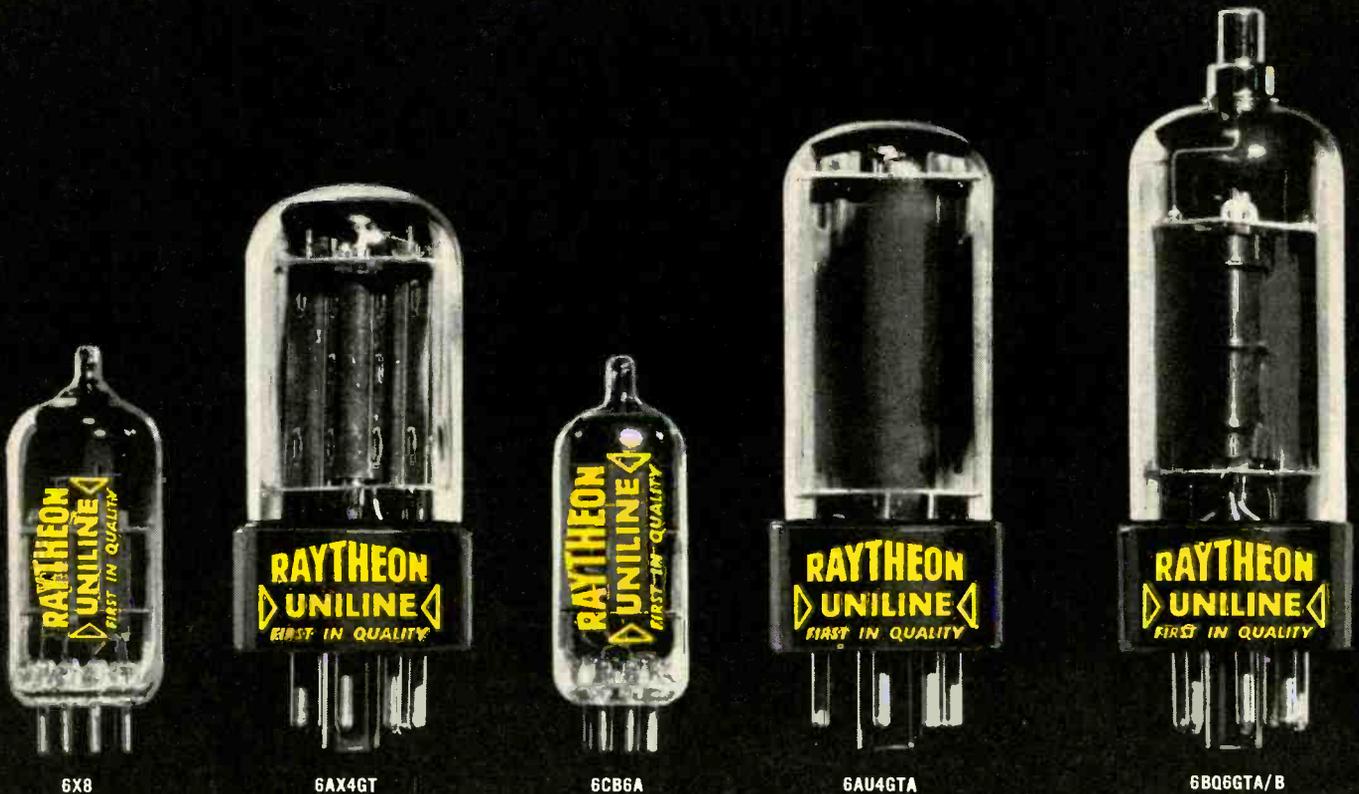
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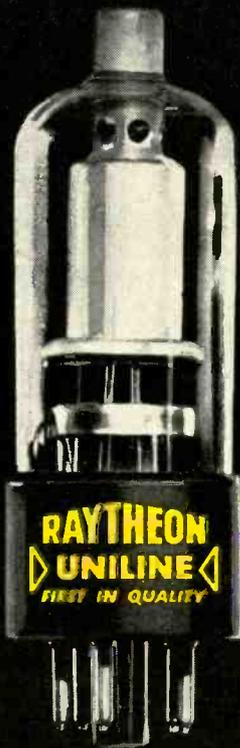
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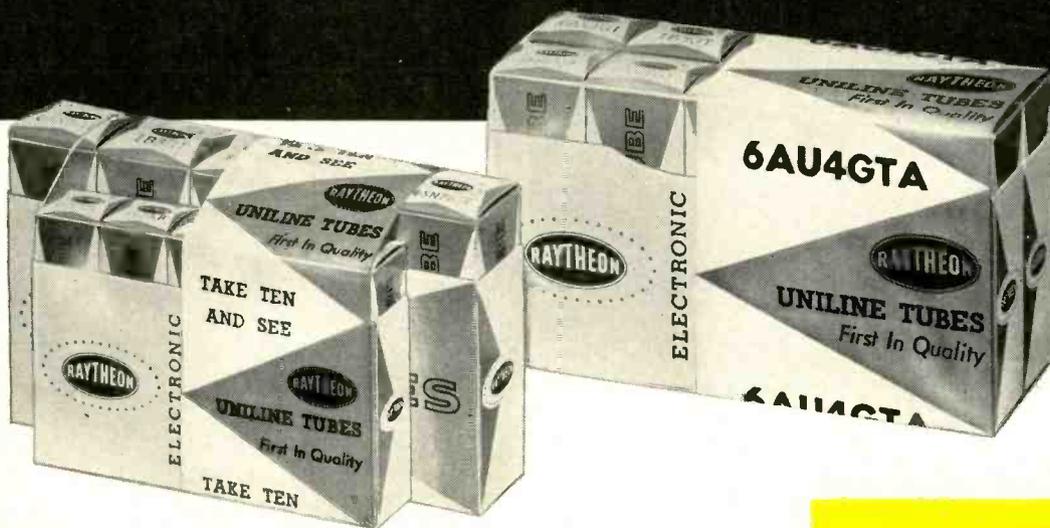


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2. I am a (SHOP OWNER) (EMPLOYED TECHNICIAN).
3. I (AM) (AM NOT) a service association member.
4. Hours/week I work in TV-radio servicing: (UNDER 30) (30 to 45) (OVER 45)
5. My weekly earnings from TV-radio work are: (UNDER \$75) (\$75 to \$100) (OVER \$100)
6. Years I've been in TV-radio work: (UNDER 3) (3 to 10) (OVER 10)
7. Pop. of town I work in: (UNDER 100,000) (100,000 to 1,000,000) (OVER 1,000,000)

Note: If licensing is now in effect in your area, comment on how it is working out.

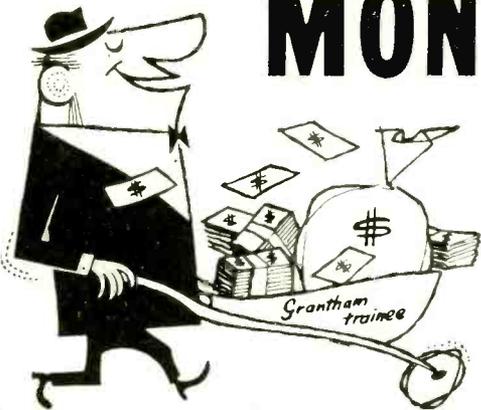
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This free booklet gives details of our training and explains what an F. C. C. license can do for your future. Send for your copy today.



for **FREE** Booklet **CLIP COUPON** and mail in envelope or paste on postal card.

for **FREE** Booklet **CLIP COUPON** and mail in envelope or paste on postal card.



To: **GRANTHAM SCHOOL OF ELECTRONICS**
1505 N. Western Ave., Hollywood 27, Calif.

Please send me your free booklet telling how I can get my commercial F. C. C. license quickly. I understand there is no obligation and no salesman will call.

Name _____ Age _____

Address _____

City _____ State _____

I am interested in: Home Study, Kansas City classes, Hollywood classes, Seattle classes, Washington classes

For more data, circle 10-51-1 on coupon, p. 43

GIVE YOUR STORE THE WITH NEW EYE-



PROSPECTS WILL STOP...LOOK...ENTER YOUR STORE when they see this attractive full-color window exhibit.

PUT YOUR WINDOWS, COUNTERS, CORNER AREAS TO WORK SELLING TV SERVICE! LET PROFESSIONAL-DECORATOR SKILL INCREASE YOUR CUSTOMER LIST!

THIRTY-FOUR display pieces are included in this year-round General Electric program to build customer traffic for your store or shop. All displays are handsomely processed in full colors. Many are reversible, with a different message and color treatment on either side. The range of decorative combinations that can be made up for window, counter, wall, or corner is almost unlimited. You can have a new display treatment every week in the year, if desired!

Easy-to-follow instructions show you how to create a number of attractive effects. Every grouping will be modern, lively, interesting—sure to draw attention, packed with “sell” that pays off in more service, tube, and parts business. Now—at low, low cost—step out ahead of other shops that don’t advertise! See your G-E tube distributor! Or use the coupon to order direct! *Distributor Sales, Electronic Components Division, General Electric Co., Owensboro, Ky.*

PROFIT BY SERVICING PORTABLES!

Use this kit of full-color stand-up displays—one large, three small—to draw customers who want good service fast!

SELL MORE TUBES AND MORE SERVICE!

Four colorful die-cut cards feature the importance of tubes and tube testing... with you as the expert to consult.

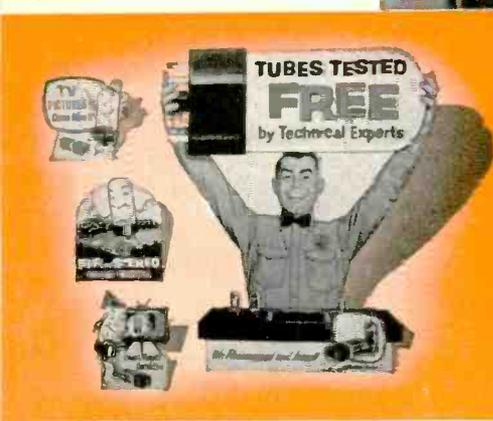
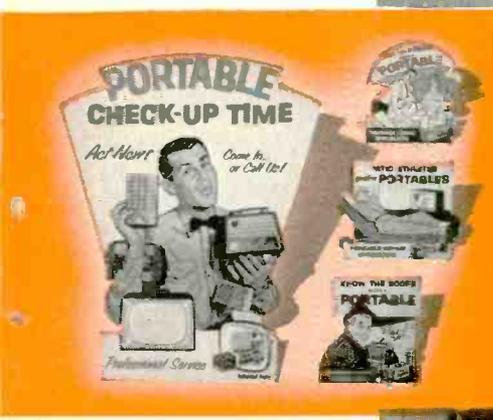
THERE'S MONEY IN HI-FI SERVICE!

You want your share, and these full-color displays will help you get it. All are keyed to music and your audio facilities.

GET THOSE AUTO-RADIO DOLLARS!

Keep them from rolling on by! Motorists will pull up at your shop when they see these effective service reminders.

LOOK OF TOMORROW CATCHING G-E DISPLAYS!



THAT "DRESS-UP" LOOK INSIDE! Mount a full-color interior display to tell your service story!

\$8.00 DECORATES YOUR STORE FOR A WHOLE YEAR!

That's the bargain combination offer on both packages below! Mail coupon at right to the Chicago warehouse address given. Individual display-package costs are:

ETR-2244. "Dress-up" decorator package for store window and interior, 18 pieces in all, as shown in two large pictures across top. \$5.00

ETR-2313. "Self-Merchandiser" package of service-specialty kits, each with four stand-up cards, as shown in vertical illustrations at left. 16 pieces in all. \$5.00

General Electric Company, Dept. B
3800 N. Milwaukee Ave.
Chicago 41, Illinois

Kindly ship me prepaid:

ETR-2244 at price of \$5.00 each.

ETR-2313 at price of \$5.00 each.

Combinations (both the above) at \$8.00 per pair.

My check money order is enclosed for the required amount plus any sales or use tax applicable in my area.

MY NAME

STREET ADDRESS

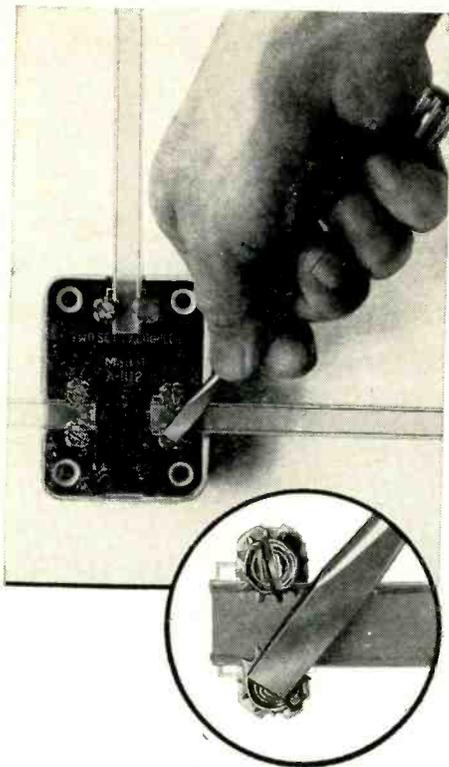
CITY AND STATE

Progress Is Our Most Important Product

GENERAL  ELECTRIC

311-404

For more data, circle 10-53-1 on coupon, p. 43



**MAXIMUM INTER-SET
ISOLATION WITH
MINIMUM SIGNAL LOSS
BLONDER-TONGUE
COUPLERS**

In just a matter of seconds, new quality engineered B-T couplers featuring 'striplless' terminals provide a low loss, matched installation for superior multi-set performance.

2-SET COUPLER — maximum inter-set isolation — minimum signal loss

Model A-102 Two-Set Coupler delivers more signal to each TV or FM set, with greater inter-set isolation than other couplers. A new original B-T circuit with phase cancellation feature automatically defeats interfering signals. No ghosts, no smears, ideal for color TV and FM.

List 3.50.

NEW B-T COUPLERS—4-SET, HI-LO & UHF-VHF A-104 FOUR SET COUPLER. Low loss 300 ohm directional coupler only 7 db insertion loss and 12-20 db inter-set isolation. Flat response 50 to 220 mc.

List 4.95

A-105 HI-LO ANTENNA COUPLER. Combines low band and high band VHF antennas or provides separate low and high outputs from a common line or antenna.

List 3.95

A-107 UHF-VHF ANTENNA COUPLER. Combines VHF and UHF antennas, or provides separate VHF and UHF outputs from a common line or antenna.

List 3.95

A-100 OUTDOOR MOUNTING KIT. Bracket and strap assembly for fast, easy mast mounting of models A-102, A-104, A-105, A-107.

List 1.10

**SMARTLY STYLED
WEATHERPROOF • NON-BREAKABLE CASE**

Available at parts distributors.
For further information write Dept. ET-10

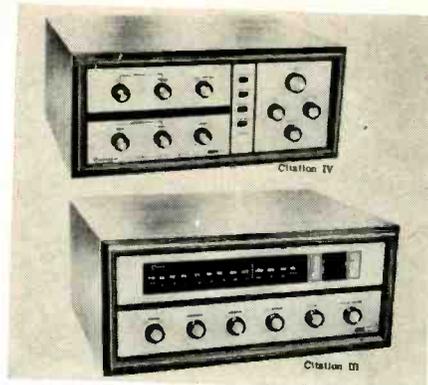
**B-T
LABS** **BLONDER-TONGUE LABS., INC.**
9 Alling Street, Newark 2, N. J.

For more data, circle 10-54-1 on coupon, p. 43

Harman-Kardon STEREO KITS

Citation III FM tuner employs Nu-vister tube and two-stage audio circuit. Kit, \$149.95. Wired, \$229.95. Citation IV compact stereophonic pre-amplifier. Separate bass and treble controls for each channel. D-c on all heaters. Low noise resistors reduce thermal agitation and hum. Zero to infinity balance control. Kit, \$119.95. Wired, \$189.95. Also available, Citation V, compact amplifier rated @ 40 watts rms per channel. Kit, \$119.95. Wired, \$179.95. Metal enclosure, ACV, \$7.95. Harman-Kardon, 520 Main St., Westbury, N. Y.

For more data, circle 10-54-2 on coupon, p. 43



Shell Hi-Fi COMPONENTS

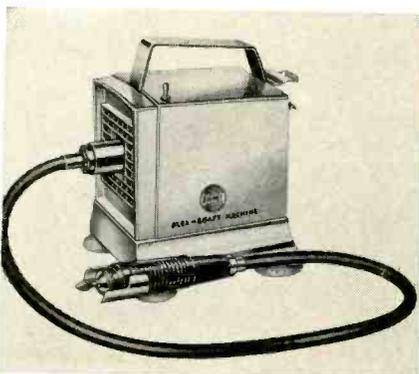
Announced are: the "Hampton" model 800 FM tuner. Sensitivity, 1.5 μ v for 20 db quieting; 2.5 μ v for 30 db quieting. Frequency response, 20-20,000 cycles \pm 1 db. Distortion, less than 1%. \$79.95; "Huntington" AM-FM stereo tuner. Sensitivity, FM, 1.2 μ v for 20 db quieting. Frequency response, FM, 20-20,000 cycles \pm 1 db. Distortion, FM-AM, less than 1%. \$159.95; and the "Meadowbrook" dual 30 watt stereo amplifier. Power output, 60 watts. Frequency response, \pm 1 db 30-20,000 cps at rated output. \$159.95. Shell Electronics Mfg. Corp., 112 State St., Westbury, N. Y.

For more data, circle 10-54-3 on coupon, p. 43



Dremel SERVICE TOOL

Flex-O-Tool, for radio and TV service work, is a lightweight flexible shaft instrument that grinds off rivet heads for easy removal of tube sockets, condensers, transformers, etc. Faster and more effective than drilling. Eliminates



spinning of loose rivets. Particularly useful for repairing printing circuit boards. Equipped with a 40" flexible shaft for difficult-to-reach places. Lightweight plastic handpiece will chuck any accessories having up to 1/8" shank. \$34.50. Dremel Mfg. Co., 2300 18th St., Racine, Wis.

For more data, circle 10-54-4 on coupon, p. 43

**Check the
EXTRA CONVENIENCE
you get in the RCA
V-O-M with the Extras**



- Rugged, scuff-proof, stain-resistant laminated vinyl carrying case: only \$4.95 extra. Special receptacle for test leads!
- Spring clips on handle hold leads when instrument is not in carrying case.
- Red test probe supplied with slip-on alligator clip for added versatility.

See page 67 for the full story on this superlative value at only \$43.95*
*User Price (Optional)



RCA Electron Tube Division, Harrison, N.J.

**The Most Trusted Name
in Electronics**
RADIO CORPORATION OF AMERICA

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[®]



For extremely small
size and exact
original replacement

SPRAGUE DIFILM[®] ORANGE DROP[®]



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 found in the plastic film.**
- **Difilm capacitors have high insulation resistance, low power factor, and excellent capacitance stability and retrace under temperature cycling!**

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 Klear-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 10-55-1 on coupon, p. 43

BUY PYRAMID! GET MORE!



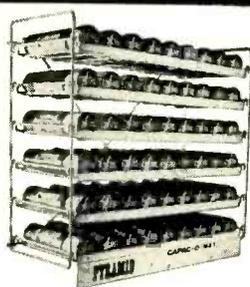
Only Pyramid offers you so much! Only Pyramid gives you highest quality capacitors plus so many "all new" extras.

THE VU-PAK

An entirely new way to package capacitors . . . clear plastic tubes, plainly labeled and packed with the highest quality electrolytic twist-mount capacitors. Each re-usable Vu-Pak comes with a blank label, ideal for storing small parts and tools on your bench or in your tool kit.

EXTRA OFFER!

Save 50 Vu-Pak labels and get the fabulous new Pyramid storage rack the Capac-o-mat, at tremendous savings from your authorized Pyramid distributor. The Capac-o-mat fits right on your shelf, is dust-free and holds 54 Vu-Paks.



JEWEL BOX

Handsome tan plastic, high impact cabinet with 9 drawers, contains 45 assorted Mylar*-paper Gold Dip capacitors, type 151. Practical . . . convenient . . . for storage in your shop, or home. Actual value of the Jewel Box with 45 Gold Dip capacitors—\$19.50, dealer net only \$9.25.



Gold Dip capacitors are also available in Clear-Vu paks . . . 5 to a package. Find them on Pyramid's new Whirl-o-mat on your favorite parts distributor counter.

"GOLD STANDARD" 111 KIT

Clear lucite hinged box containing 75 Pyramid's popular assorted Gold Standard Mylar* capacitors. You'll find so many uses for the Gold Standard 111 Kit. Actual value is \$26.00, dealer net only \$13.00.



515 LYTIK-KIT

Hinged cover, clear lucite box with 15 assorted miniature low voltage electrolytic capacitors for transistorized circuit replacements, type MLV. This Kit is a constant companion to any busy serviceman. Actual value, \$20.60, dealer net only \$10.30.



PYRAMID ELECTRIC COMPANY

DISTRIBUTOR DIVISION: UNION CITY, NEW JERSEY

Factories: Gastonia, North Carolina • Darlington, South Carolina
In Canada: Wm. Cohen, Limited, 8900 Tanguay Street, Montreal
Export: Morhan Exporting Co., 485 Broadway, New York 13, N. Y.



OXFORD names Edwin A. Schulz Co. as rep in Ind. and Ky.

STROMBERG-CARLSON appoints Howard W. Hibshman sales mgr., consumer prod.

ATLAS SOUND appoints Harry Paston and Neal Hunter as reps for upstate N. Y.

SHURE issues a 20-page booklet called "The Art of Selecting, Playing & Preserving Recordings," available at 25¢ each.

HARMAN-KARDON announces the Festival II, Model TA260 AM-FM stereo receiver @ \$299.95 less enclosure. Rating is 30 watts/channel.

GARRARD introduces the SPG3 stylus pressure gauge @ \$2.95. This swivel balance type scale comes with 5 gram brass standard weight.

UTAH names Fred Neubauer, ex-Majestic & Warwick, as asst. to pres. Al Altenhof, ex-Allied, has been named product manager for distributor sales.

PICKERING publishes "Tech-Specs," a pocket guide to aid audiophiles plan the space and selection requirements for a stereo hi-fi system.

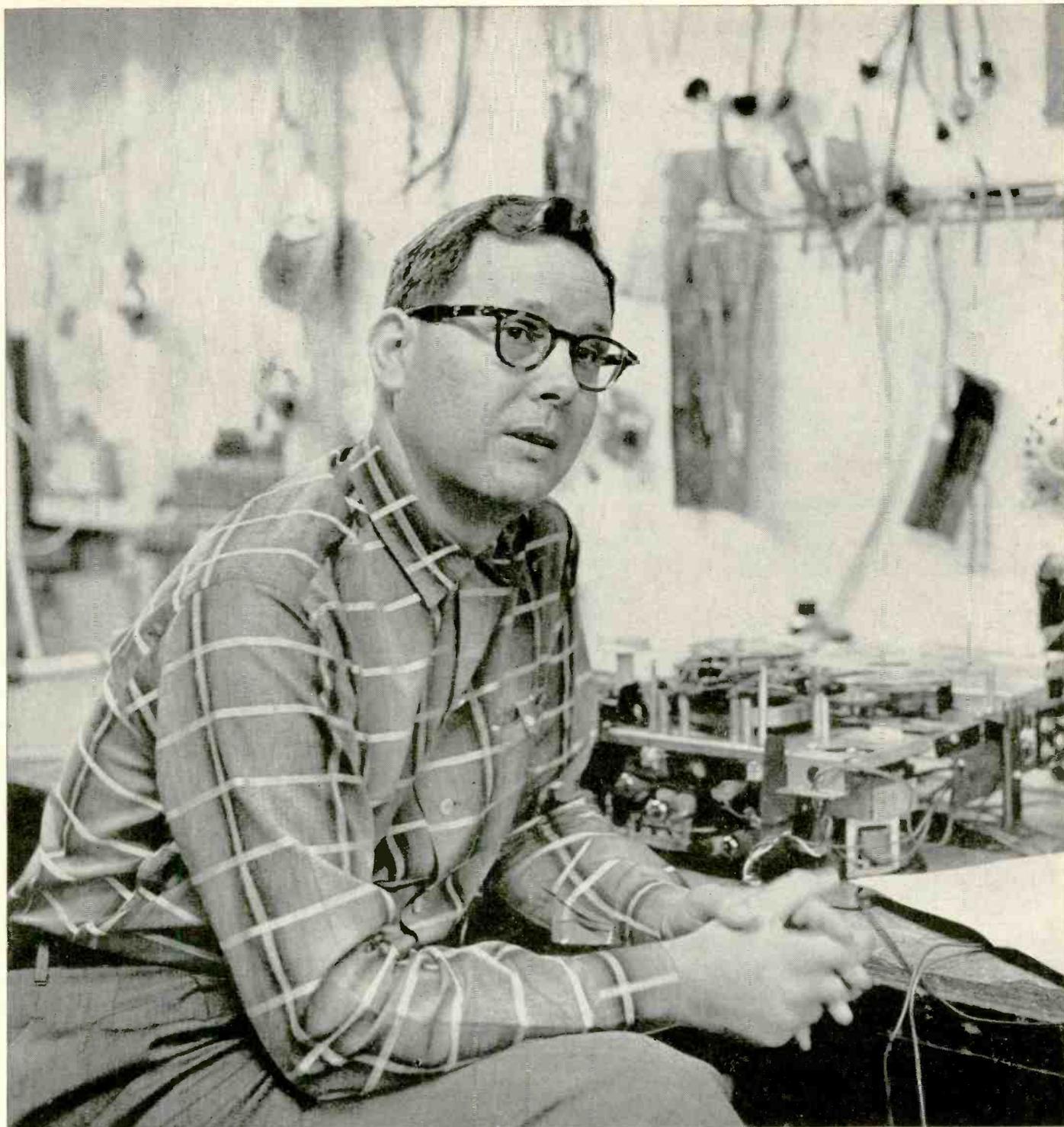
ELECTRO-VOICE production facilities for Featheride Cartridges, formerly made by Webster Electric, have been readied at the Eureka, Ill. plant.

WESTINGHOUSE unveils its TV & stereo products at New York's National Design Center. Accent is on furniture styling. Units are shown in 20 imaginative settings by seven leading interior designers.

SHELL announces new products. Hampton Model 800 FM tuner features sensitivity of 1.5 μ v for 20 db quieting, distortion of less than 1%, \$79.95. Manhasset Dual 20 Watt Stereo Amplifier, 30-20,000 cps \pm 1 db, \$129.95.

H. H. SCOTT announces the LT-10 FM tuner kit with front end preassembled. Kit features arrangement whereby the builder can align the unit accurately without test instruments. \$89.95 complete. Other new products announced are: Model 310D wide-band tuner, \$184.95; Model 290 stereo power amplifier 50 w/channel, \$239.95; Model 272 stereo amplifier 44 w/channel; \$269.95; and Model 399 stereo amplifier/tuner combination 20 w/channel, \$389.95. Prices east of Rockies.

For more data, circle 10-56-1 on coupon, p. 43



“Over half my business comes in through the Yellow Pages!” says Jimmy Huett, owner, Buck’s TV and Record Shop, Dallas, Texas. “Some time ago, I checked to see how new customers were finding me. Again and again, people told me, ‘your ad in the Yellow Pages.’ That’s why I have 21 advertising messages in the Yellow Pages, covering all phases of my business. Eight of these are listings under brand name trademarks. Nothing pays off like Yellow Pages advertising!” ■ Display ad (shown reduced at right) runs under TELEVISION SERVICE. Call the Yellow Pages man at your Bell Telephone office to plan a sales-building program for your business.



Display this emblem. It builds your business!

For more data, circle 10-57-1 on coupon, p. 43

BUCK'S
TV & Record Shop

Jimmy Huett, Owner

<p>HO 1 13115 Buckner Blvd. HO 1425 2000 DA EX 1-3887 OR EX 8-9861</p>	<p>NO 2 10918 Garland Rd. Near Lockwood Ship Center DA 7-4975</p>
---	---

LABOR & PARTS GUARANTEED 90 DAYS
TV ANTENNA INSTALLATION & MOVING
RECORDS - PHONOGRAPHS - HI-FI

Home Video Center
Phono Air Conditioner

AUTHORIZED SALE - SERVICE
RCA - PHILCO - METROLA

Check the MODERN STYLING you get in the RCA V-O-M with the Extras



- Big attractive 5¼" meter for better readability and visibility.
- Non-breakable plastic case and meter faceplate; no glass to crack or shatter.
- Orderly location of jacks below the switches keeps test leads out of the way.

See page 67 for the full story on this superlative value at only \$43.95* *User Price (Optional)

RCA Electron Tube Division, Harrison, N.J.

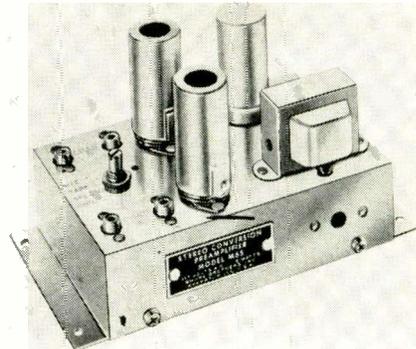


The Most Trusted Name
in Electronics
RADIO CORPORATION OF AMERICA

Shure PREAMP

Preamplifier M65 plus installing a magnetic cartridge converts ceramic system to magnetic. Single rotary switch on preamp enables selection of: (1) phono, (2) special, for converting from ceramic cartridges to magnetic cartridges, (3) tape, and (4) microphone. Operates @ 117v 60 cycle power, self contained power supply. Has dual input and output jacks which accept standard phono plugs. Two stages of amplification are provided in each channel. Audio net price, \$24.00. Shure Brothers, Inc. 222 Hartrey Ave., Evanston, Ill.

For more data, circle 10-58-2 on coupon, p. 43



Scott PREAMPLIFIER

Model 122 dynaural stereo control center accommodates 5 separate stereo inputs, each with its own level control. One input channel provides special high-gain performance for direct input from tape heads. Each stereo channel has its own bass, treble and loudness controls as well as four switch-selected record equalizations for the phono controls. Specifications, IHFM standards: frequency response, 19-35,000 cps; harmonic distortion, 0.15%; phono channel sensitivity, 3 millivolts for 1.5v output; tape channel sensitivity, 1.5 mv for 1.5 v output. H. H. Scott, Inc., 111 Powdermill Rd., Maynard, Mass.

For more data, circle 10-58-3 on coupon, p. 43



Look beyond the price tag and you'll see why



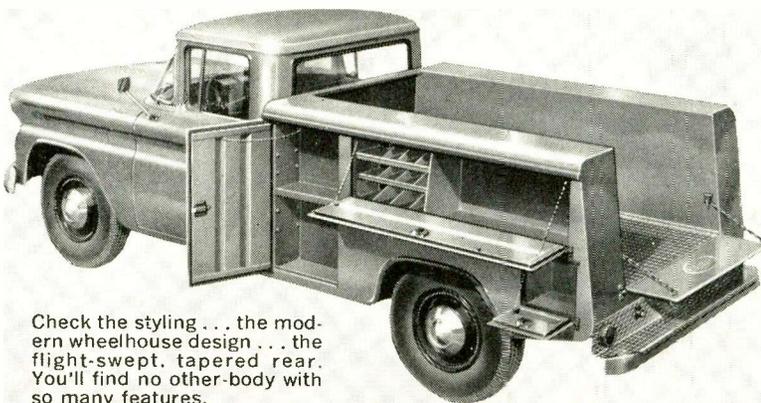
POWERS

Service-Master®

OUTSELLS ALL
OTHER MAKES OF
SERVICE BODIES
COMBINED

Precision-crafted by expert workmen who grind welds marble-smooth and finish off all dangerously sharp tray and shelf edges.

Compare doors! Open and slam ours... then competitors'. Note our "solid" sound, balanced "feel", superior construction, and "can't-bind", nylon bushings.



Check the styling... the modern wheelhouse design... the flight-swept, tapered rear. You'll find no other-body with so many features.

Finest recessed latches on the market. Fool-proof, safety catches make it impossible for doors to fly open in travel.

Concealed fenders with built-in "lastability" assure at least 10 years of rugged service... truly your best body buy.

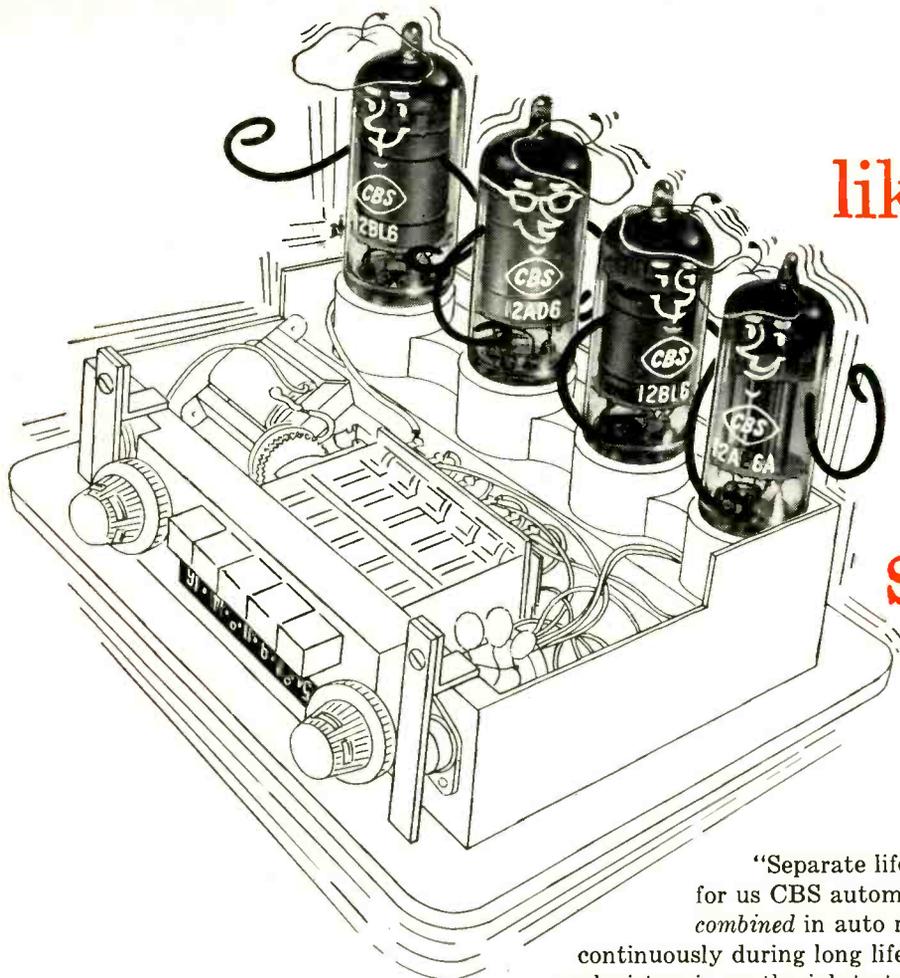
IMMEDIATE DELIVERY! WRITE FOR BULLETIN AND NAME OF DEALER.



Optional Canopy Top, at left, has 53" floor-to-roof height. Body is also available with compartment-high telescopic roof.

McCABE-POWERS BODY COMPANY
5900 N. BROADWAY • ST. LOUIS 15, MO.

For more data, circle 10-58-1 on coupon, p. 43



like in autos . . .
only more so,
we get
real
shook-up!

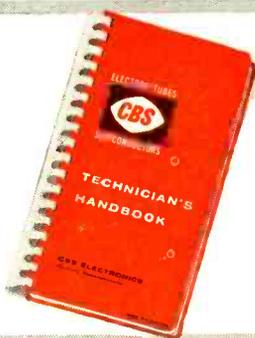
**(AND YOU GET NO
BURN-OUTS, SHORTS,
OPENS OR NOISE)**

“Separate life and vibration tests aren’t tough enough for us CBS automobile radio tubes. We have to take ’em *combined* in auto radio chassis that are vibrated continuously during long life tests. You can imagine what happens to weak sisters in on-the-job tests like this. The causes of annoying burn-outs . . . shorts . . . opens . . . and noise just get shaken out and eliminated. And no ride is too rough for us.”

Yes, all CBS auto radio tubes offer you total reliability . . . *proved in performance* by leading radio set manufacturers. You, too, can profit from the total reliability of CBS tubes. Just make it a habit always to replace with CBS.

NEW REVISED EDITION

Compact, handy and up-to-date, the new revised CBS Technician's Handbook is designed especially for the technician. Its 480 pages include, in addition to a wealth of reference material, data he needs on over 1000 receiving, picture, industrial, and European hi-fi tubes . . . transistors and diodes. Only \$1.95 now at your distributor's.



TOTAL RELIABILITY...proved in performance



CBS ELECTRONICS

Danvers, Massachusetts

A Division of Columbia Broadcasting System, Inc.

Receiving, industrial and picture tubes • transistors and diodes • audio components • and phonographs

For more data, circle 10-59-1 on coupon, p. 43

A Profitable New Field!

INDUSTRIAL ELECTRONIC SERVICING

with
OHMITE®
QUALITY
Components

Industrial electronic servicing is profitable new business for you. Especially when you stock and replace with dependable Ohmite components . . . the line your industrial customers know and prefer. Service such industrial equipment as mobile radio, aircraft and marine radar and radio, electronic controls for factory processes and automation, industrial P.A. and intercom systems, and—medical and dental electronics.

AXIAL-LEAD RESISTORS

Vitreous-enamelled, power-type units designed to withstand high temperatures. In 3, 5, and 10-watt sizes.

BROWN DEVIL® RESISTORS

Vitreous-enamelled. In 5, 10, and 20-watt sizes.

LITTLE DEVIL® COMPOSITION RESISTORS

Meet all MIL-R-11A requirements. Available in 1/10, 1/4, 1/2, 1, and 2-watt sizes in all standard EIA values.

MOLDED COMPOSITION POTENTI- METERS TYPE AB

Resistance material is solid-molded, noise-free. Rated at 2 watts.

Write for Stock Catalog

OHMITE®

DEPENDABLE
RESISTANCE
UNITS

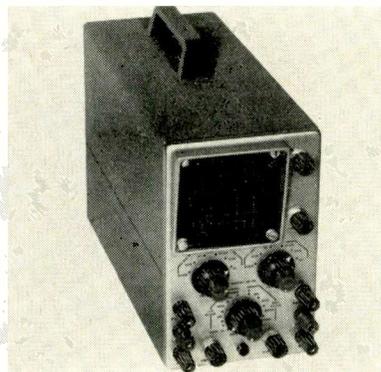
OHMITE MANUFACTURING COMPANY
3687 Howard Street, Skokie, Illinois

For more data, circle 10-60-1 on coupon, p. 43

60

Heathkit 3" OSCILLOSCOPE

Model 10-10 "Space-Saver" 3" d-c oscilloscope may be used as a "read-out" for computers, for waveform observation and for voltage, frequency and phase shift measurement. Featured are: identical vertical and hori-



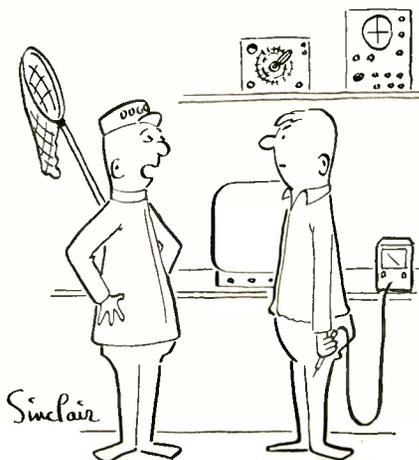
zontal d-c-coupled amplifiers with low relative phase shift characteristics; external sync. binding posts; external capacity binding post for sweep frequencies lower than 5 cps; transformer-operated power supply; voltage regulated B+ and bias. \$79.95. Heath Co., Benton Harbor, Mich.

For more data, circle 10-60-3 on coupon, p. 43

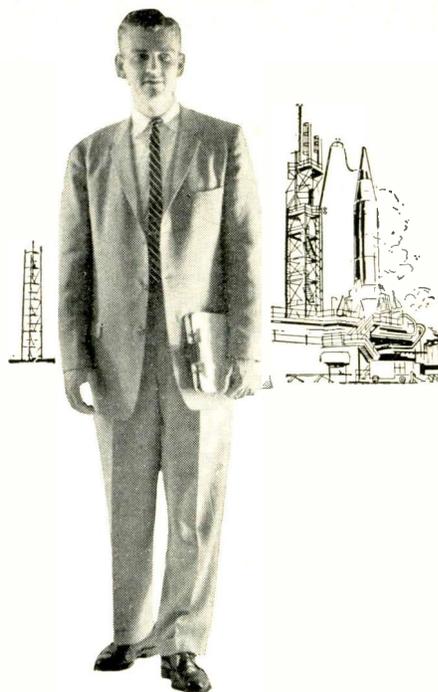
Raytheon TUBES

Announced are two subminiature pentode r-f amplifier tubes, featuring unusually high transconductance with low heater power. Providing high gain in any r-f application, with greatly reduced wattages, the CK6611 has a mutual conductance of 1000 micro-mhos at a filament power of only 25 milliwatts (20 ma @ 1.25v). The CK6612 has a mutual conductance of 3000 micro-mhos at a filament power of only 100 milliwatts (80 ma @ 1.25v). Both have a maximum d-c plate voltage of 30. Operating life time, more than 5,000 hours. Measurements, 1.5" x 0.285". Raytheon Co., Industrial Components Div., 55 Chapel St., Newton, Mass.

For more data, circle 10-60-4 on coupon, p. 43



"I was told that all dogs come here."



Field Engineers

For Univac Missile- Guidance Computers! (Overseas & Domestic Assignments)

Field engineers are now being selected for maintenance assignments on ultra-reliable Univac missile-guidance computers and other military electronic data processing systems.

Openings involve maintenance of the Univac ICBM guidance computer, first of its size to be completely transistorized.

Applicants must have at least 2 years formal education in Electronics with 3 or more years in maintenance or maintenance-instruction. Experience should be associated with complex electronic equipment such as TV, radar, sonar or digital computing systems.

Before assignment, you will receive 2 to 6 months training at full pay in our St. Paul, Minnesota, laboratories. Benefits include company paid life insurance, hospitalization, medical and surgical benefits, relocation expenses and living allowances at field sites.

Openings also for qualified instructors with backgrounds similar to above.

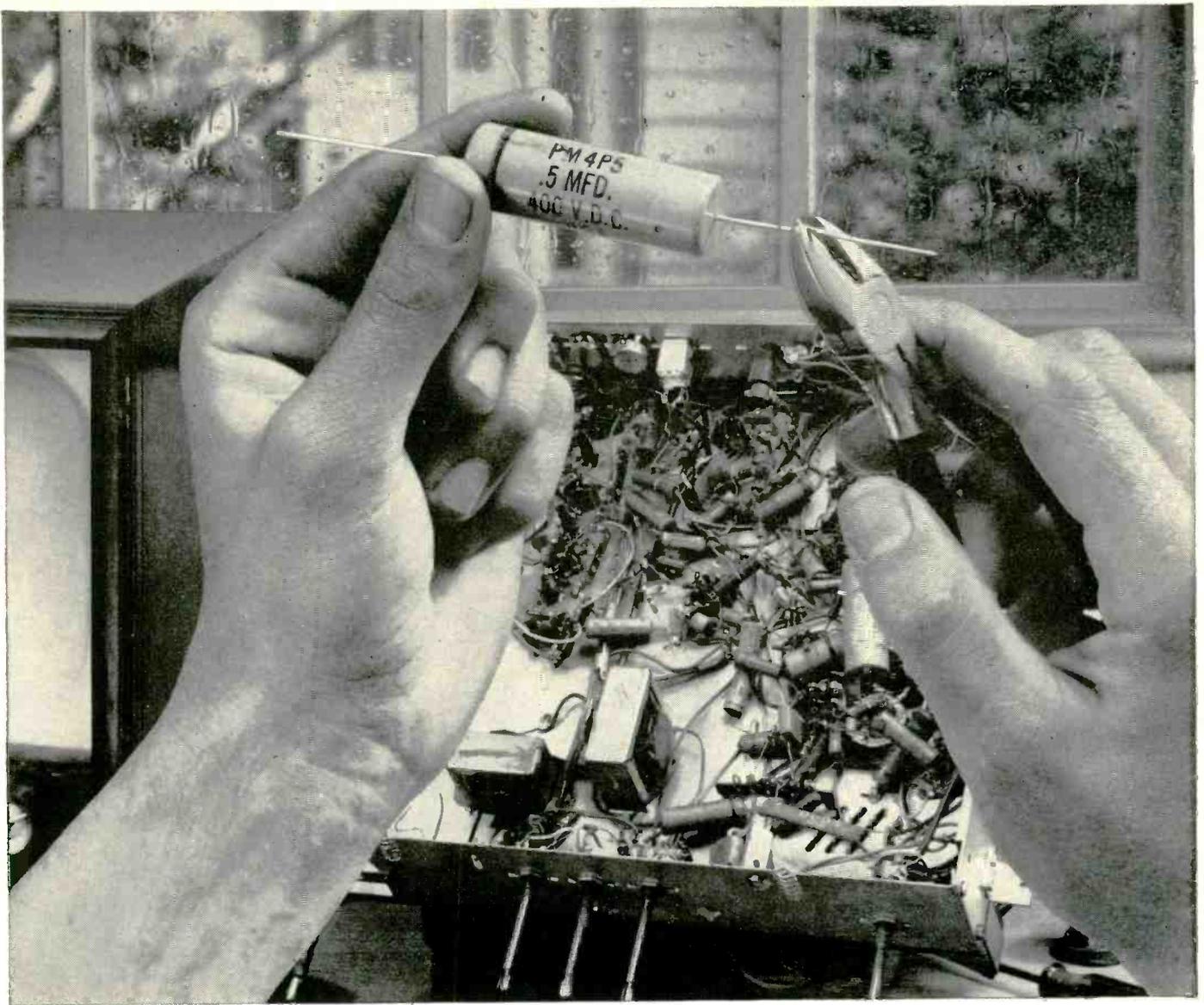
Send complete resume of education and experience to:

R. K. PATTERSON, Dept. J-10

**Remington Rand
Univac**

DIVISION OF SPERRY RAND CORPORATION
2750 W. Seventh St., St. Paul 16, Minn.

For more data, circle 10-60-2 on coupon, p. 43
ELECTRONIC TECHNICIAN • October, 1960



This service man is installing

Protection against call-backs . . . moisture-resistant capacitors made with "Mylar"

Rainy weather or long periods of high humidity can cause failure of ordinary capacitors. But they won't affect units made with "Mylar"* polyester film because "Mylar" won't absorb moisture. Insulation of "Mylar" can save you money by eliminating costly call-backs to replace newly installed capacitors. "Mylar" means superior performance for four important reasons:

1. **High breakdown strength...** "Mylar" averages 4,000 volts per mil dielectric strength.
2. **Long life . . .** neither time, temperature, nor highest humidity af-

fects the stability of "Mylar".

3. **Size reduction . . .** the high dielectric strength of "Mylar", coupled with its great physical strength, permits its use in thinnest gauges. Small capacitors save precious space . . . are ideal for hard-to-get-at jobs.
4. **Proven value . . .** leading manufacturers make high-reliability capacitors insulated with "Mylar" for critical military applications, mis-

siles and sensitive computers.

Ask your distributor for capacitors made with "Mylar". You'll get a bonus of extra reliability and long life at no extra cost. And for test data that detail the basic properties of "Mylar", write for Du Pont's free booklet. E. I. du Pont de Nemours & Co. (Inc.), Film Department, Room No. 16, Wilmington 98, Delaware.



*"Mylar" is Du Pont's registered trademark for its polyester film.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY
For more data, circle 10-61-1 on coupon, p. 43





TWO-WAY RADIO

communications equipment

VHF-FM FOR: MOBILE, AIRCRAFT, MARINE, MOTORCYCLE, PORTABLE, BASE

VHF-AM FOR: AIRPORT VEHICLES, GROUND STATIONS, POINT-TO-POINT

VHF: ANTENNAS, REMOTE CONTROLS, ACCESSORIES



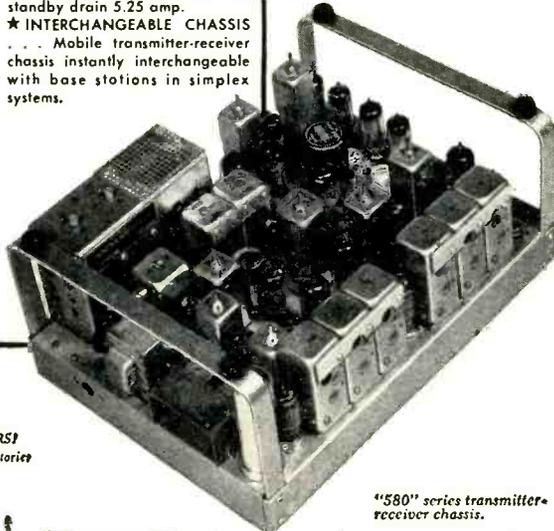

COMCO'S ALL NEW "580" FLEETCOM VHF-FM MOBILE RADIO

The new "580" is compact, light weight, has high performance, and features an original concept in Mobile equipment packaging by combining the control head, speaker, and transistorized power supply in one small easily mounted case assembly.

FEATURES

- ★ HIGH PERFORMANCE... meets "split channel" technical requirements, all FCC and FCDA requirements.
- ★ FULL POWER OUTPUT... 35 Watts in 25-50 Mcs. 25 Watts in 144-174 Mcs.
- ★ BUILT-IN RELIABILITY... Preproduction Models field tested in 5 states and 3 foreign countries before starting production.
- ★ SMALL AND LIGHT WEIGHT... Chassis in case 13"x9 3/4"x5 1/2". Control-power Supply-Speaker case 5"x5"x3 3/4". Complete Mobile installations 24 lbs.
- ★ EASY TO INSTALL... "Two-unit" package so small most installations are under dash.
- ★ LOW COST... Complete mobile package

\$398 f.o.b. factory



"580" series transmitter-receiver chassis.

ATTENTION DEALERS!
Write for available territories

DESIGNERS AND MANUFACTURERS OF RADIO COMMUNICATIONS EQUIPMENT

COMMUNICATIONS COMPANY, Inc.

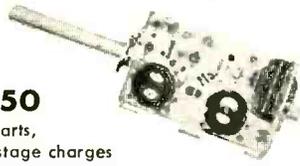
FOUNDED 1938 CORAL GABLES, MIAMI 34, FLORIDA

For more data, circle 10-62-1 on coupon, p. 43

PHONE ED 9-9653

90 DAY WARRANTY

\$7.50
plus parts,
C.O.D. and postage charges



Precision Tuner Service

ALL TYPES T.V. TUNERS REPAIRED AND ALIGNED TO FACTORY SPECIFICATIONS ON CRYSTAL-CONTROLLED SWEEP GENERATORS

24-HOUR SERVICE ON MOST TUNERS

UHF - VHF COMBINATIONS — \$13.50

See your local distributor or send to:
P.O. Box 272, 601 N. College
BLOOMINGTON, INDIANA

State make and model. Send all parts, tubes and shields.

For more data, circle 10-62-2 on coupon, p. 43

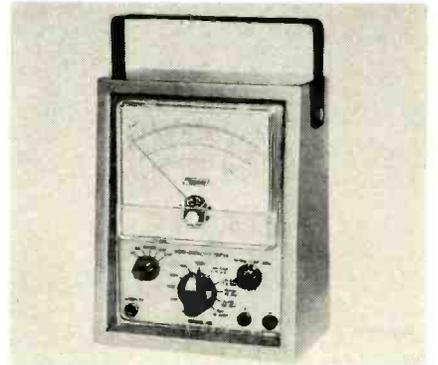
G-E RADIO

Claimed to be the smallest six transistor radio made in the U. S., model P8501 features: a four volt mercury cell of standard type; class B push-pull audio output; and vernier tuning and on-off volume controlled by thumb-wheels. It can be carried or hung up by a metal ring secured in the top. The "camera-type" case is die-cast in black and chrome. It measures 3 5/8" high, 2 3/8" wide and 1" thin. Weight, with battery, 10 1/2 ounces. With carrying case, earphone and battery, packed in leatherette box, \$39.95. General Electric Co., Radio & Television Div., Syracuse, N. Y.

For more data, circle 10-62-3 on coupon, p. 43

Mercury VOM-CAPACITY TESTER

Model 400 VOM-capacity tester serves as a versatile 20,000 ohms per volt VOM as well as an efficient capacity meter. The sturdy steel case has been designed with a slope front that projects the meter forward, and the carrying handle folds back to serve as



a rest when the instrument is used in a tilted position. The unit's specifications allow for a wide range of operation, and it is designed with only 3 knobs and 3 jacks to speed up operation. The 4 1/2" meter has easy-to-read scales. \$39.95. Mercury Electronics Corp., 77 Searing Ave., Mineola, N. Y.

For more data, circle 10-62-4 on coupon, p. 43

TV SALES SERVICE

TRY IT

COLOR TV

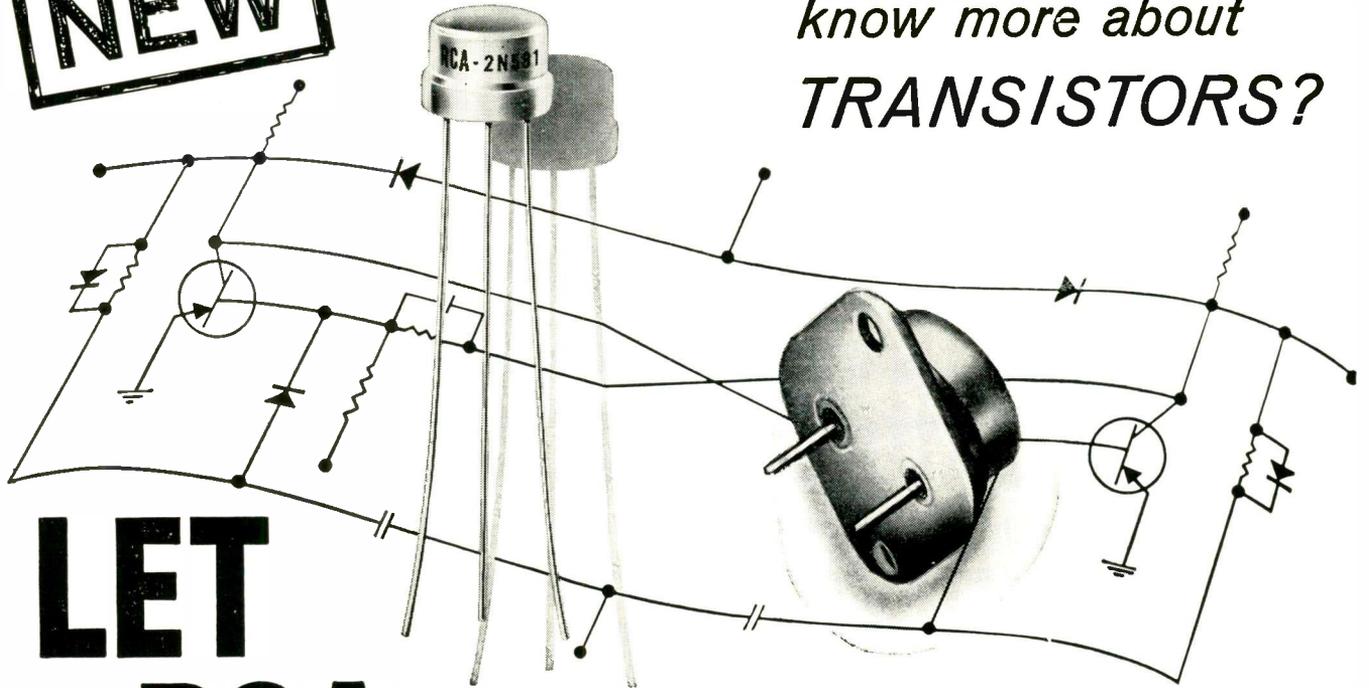
TV

W. S. W.

"Well, I'll take one but aren't they kind of small."

NEW

Need to
know more about
TRANSISTORS?



LET RCA TRAIN YOU AT HOME

in semiconductor physics and transistor applications

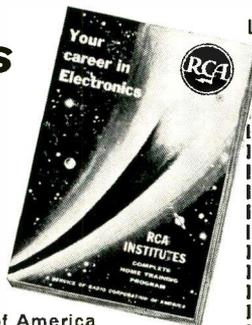
RCA Institutes Home Study School now has a new course created for men and women in the field of electronics who realize the growing importance of semiconductor technology. The new course covers transistor characteristics and testing methods... prepares you to move up in your job as you increase your knowledge and skills.

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most economical possible home study method *because you never pay for lessons that you do not receive!* You pay for your next study group only when you order it! Should you drop out at any time, you do not owe RCA Institutes one penny.

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Please rush me your FREE illustrated 64-page book "Your Career in Electronics", describing your home training programs, including complete information on the new Transistor course. No obligation. No salesman will call.

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SAVE \$ BY RENEWING NOW

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 Dec. 1, 1960, 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).

DEADLINE

December 1, 1960

ELECTRONIC TECHNICIAN

World's Largest Circulation Electronic Trade Publication
480 Lexington Avenue, New York 17, N. Y.

CHRISTMAS GIFT IDEA!

You can buy a subscription for your friend or co-worker if he is engaged in electronic work. Or your wife can buy it for you. It's a practical gift that is "given" 12 times each year.

Just fill in the envelope here, enclose payment, and mark "XMAS GIFT" boldly next to his name at the top. We will send the recipient an attractive Christmas card in your name telling him of your gift. Be sure to print your own name at the bottom of the envelope.

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.

HI-FI WARRANTY AND SERVICE PRACTICES

• The Publicity and Public Relations Committee of the Institute of High Fidelity Manufacturers conducted a survey of hi-fi component manufacturers to determine their warranty and service policies. A total of 48 companies replied.

Presented below are some of the key questions and the replies received.

1. What period of time is covered by the warranty?

Total Replies	Period
1	10 days
21	90 days
22	1 year
1	5 years
1	Indefinite

Amplifier-Tuner Manufacturers Only

19 Replies*	Period
11	90 days
7	1 year
1	5 years

*In all cases, tubes are guaranteed for only 90 days.

Tape Recorders Manufacturers Only

4 Replies	Period
4	90 days

Speaker Manufacturers Only

11 Replies	Period
8	1 year
2	2 years
1	Indefinite

Accessories, FM Antenna, etc. Manufacturers Only

6 Replies	Period
1	90 days
4	1 year
1	10 days implied to one year

Record Changers and Arms Manufacturers Only

6 Replies	Period
4	90 days
2	1 year

Cartridge, Microphone Manufacturers Only

2 Replies	Period
1	90 days
1	1 year

2. Are labor costs on units in warranty paid by the factory? 42 yes. The consumer? 3 yes. If shared, please state percentages: 1 indefinite statement, 1 cost is shared by consumer and factory, 1 has no policy.

3. Are service facilities available to the consumer at the factory?

	Replies	Yes	No
Amplifiers-Tuners	19	19	—
Tape Recorders	4	4	—
Speakers	11	9	1*
Accessories, FM Antennas, etc.	6	5	1**
Record Changers & Arms	6	6	—
Cartridges, Microphones	2	2	—
Total	46	46	2

* 1 only if returned by the dealer

** none required

4. Are service stations available where warranty work is of the same caliber as that available at the factory?

	Replies	Yes	No
Amplifiers-Tuners	19	13	4*
Tape Recorders	4	4	—
Speakers	11	2	9
Accessories, FM Antennas, etc.	6	—	5**
Record Changers & Arms	6	4	2
Cartridges, Microphones	2	—	2
Total	25	23	2

* 2 according to area

** 1 not required

5. Are freight charges to the service station or factory paid by the consumer? 25 yes; or the factory? 6 yes. If shared, please state percentages: 12 shared 50/50, 5 indefinite.

6. If a unit in warranty is serviced at a service station, are the parts and labor paid for in total by the factory? 26 yes. If not, please state policy: 4 parts are paid by factory, labor by consumer. 18 not applicable, no service stations.

7. Do all units of your manufacture carry the same warranty?

	Replies	Yes	No
Amplifiers-Tuners	19	16	3
Tape Recorders	4	4	—
Speakers	11	8	3
Accessories, FM Antennas, etc.	6	3	3
Record Changers & Arms	6	6	—
Cartridges, Microphones	2	2	—
Total	39	39	9

8. Are schematic diagrams included with your units? 41 yes 7 no. If not, are they available? 48 yes. (If a nominal charge is made, please state amount): 35¢ to \$3.00. •

Audio-Empire TURNTABLE

Empire 208 transcription turntable features include hysteresis synchronous motor, belt coupling, three speeds (33-1/3, 45 and 78 rpm), variable speed adjustment, illuminated push-button power control, heavy (6 lbs.) individu-



ally dynamically balanced turntable with unique double rim fly wheel design, cushioned vertical thrust support, acoustically isolated motor suspension, massive precision ground and milled, Swiss finish base plate. Satin chrome Swiss finish, \$87.50 audiophile net. Matching base available in walnut, mahogany or fruitwood @ \$12.50 audiophile net. Dyna-Empire, Inc., 1075 Stewart Ave. Garden City, N. Y.

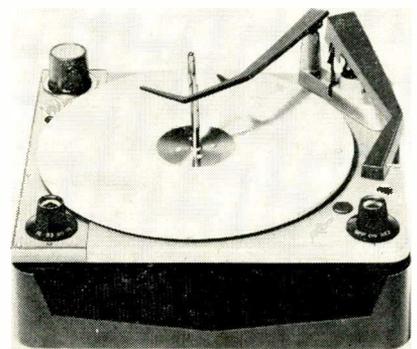
For more data, circle 10-65-1 on coupon, p. 43

V-M RECORD CHANGERS

Announced is a new line of deluxe record changers which incorporate a diamond needle and stereo cartridge with no increase in price. Equipped with an 11" turntable with micro-precision bearing system and extra long, dynamically balanced tone arm. Model 1572 has 4-pole motor and plug-

in tone arm head for magnetic cartridge, \$50.00. 1586, shown, mounted on base with 45 rpm spindle storage well, \$56.00. Available also, model 1551 4-speed automatic changer, \$35.00. V-M Corp., Benton Harbor, Mich.

For more data, circle 10-65-2 on coupon, p. 43



SPEND ONE HOUR A DAY WITH THESE RIDER BOOKS INCREASE YOUR INCOME

TV SERVICING

MASTER RECEIVING — PICTURE TUBE SUBSTITUTION GUIDEBOOK, H. A. Middleton, \$7.45
RECEIVING TUBE SUBSTITUTION GUIDEBOOK 4th suppl., H. A. Middleton, \$1.35
TUBE CADDY-TUBE SUBSTITUTION GUIDEBOOK, H. A. Middleton, 90c
HOW TO TROUBLESHOOT TV SYNC CIRCUITS, I. Remer, \$2.90
REPAIRING TELEVISION RECEIVERS, C. Glickstein, \$4.40
PICTURE BOOK OF TV TROUBLES, Rider Lab Staff. Fabulous series of definitive practical books that teach recognition of faults in TV receivers.
VOL. 1: HORIZONTAL AFC-OSCILLATOR CIRCUITS, \$1.35
VOL. 2: VERTICAL SWEEP-DEFLECTION CIRCUITS, \$1.80
VOL. 3: VIDEO I-F & VIDEO AMPLIFIER CIRCUITS, \$1.80
VOL. 4: AUTOMATIC GAIN CONTROL CIRCUITS, \$2.25
VOL. 5: HORIZONTAL OUTPUT & H-V CIRCUITS, \$2.40
VOL. 6: HORIZONTAL & VERTICAL SYNC CIRCUITS, \$2.50
VOL. 7: SOUND CIRCUITS & L-V POWER SUPPLIES, \$1.50
TV PICTURE TUBE-CHASSIS GUIDE, Rider Lab Staff, \$1.35
TV TROUBLESHOOTING & REPAIR GUIDEBOOK, R. G. Middleton, VOL. 1: \$3.90; VOL. 2: \$3.30
TECHNICIAN'S GUIDE TO TV PICTURE TUBES, I. Remer, \$2.40
TV TUBE LOCATION & TROUBLE GUIDE (RCA), Rider Lab Staff, \$1.25
TV SWEEP ALIGNMENT TECHNIQUES, A. Liebscher, \$2.10
HOW TO TROUBLESHOOT A TV RECEIVER, J. Richard Johnson (2nd ed.), \$2.90
SERVICING TV VERTICAL & HORIZONTAL OUTPUT SYSTEMS, H. Thomas, \$2.90
HANDBOOK OF 630-TYPE TV RECEIVERS, Miller & Bierman, \$3.50
ADVANCED TELEVISION SERVICING TECHNIQUES, Zbar & Schildkraut, Main Text, \$3.60; Lab. Workbook, 95c

COLOR TELEVISION

INTRODUCTION TO COLOR TV (2nd ed.), Kaufman & Thomas, \$2.70
HIGHLIGHTS OF COLOR TELEVISION, John R. Locke, Jr., 99c
COLOR TELEVISION RECEIVER PRACTICES, Hazeltine Corp. Lab. Staff, soft cover, \$4.50; cloth, \$6.00
COLOR TV DICTIONARY, J. Richard Johnson, \$1.25

AUDIO & HIGH-FIDELITY SERVICING

RIDER'S SPECIALIZED HI-FI AM-FM TUNER MANUAL, \$3.50
HOW TO INSTALL & SERVICE INTERCOMMUNICATION SYSTEMS, J. Darr, \$3.60
HOW TO SERVICE TAPE RECORDERS, C. A. Tuttle, \$2.90
RIDER'S SPECIALIZED TAPE RECORDER MANUAL, VOL. 1, \$4.50

TEST EQUIPMENT

HOW TO USE METERS (2nd ed.), J. F. Rider & S. Prensky, \$3.50
HOW TO USE TEST PROBES, A. Ghirardi & R. Middleton, \$2.90
OBTAINING INTERPRETING TEST SCOPE TRACES, J. F. Rider, \$3.00
HOW TO USE SIGNAL & SWEEP GENERATORS, J. Richard Johnson, \$2.40
HOW TO USE GRID-DIP OSCILLATORS, R. P. Turner P. E., K6AI, \$2.50

RADIO SERVICING

RADIO RECEIVER LABORATORY MANUAL, A. W. Levey, M. S., \$2.00
RADIO TROUBLESHOOTING GUIDEBOOK, VOL. 1, Rider & Johnson, \$2.40
HOW TO INSTALL & SERVICE AUTO RADIOS (2nd ed.), J. Darr, \$3.25
REPAIRING PORTABLE & CLOCK RADIOS, B. Crissee & D. Gnessin, \$2.75



JOHN F. RIDER, PUBLISHER, INC.
 116 West 14th Street, New York 11, N.Y.
 Canada: Chas. W. Pointon, Ltd.,
 66 Racine Rd., Rexdale, Ont.

For more data, circle 10-66-1 on coupon, p. 43
 66

New Books

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

RECEIVING TUBE MANUAL. Prepared and published by Electronic Tube Div., Radio Corp. of America, Harrison, N. J. 434 pages, soft cover. \$1.00.

The new edition RC-20 of a long established reference contains technical data for more than 760 receiving tubes and 173 picture tubes, including color. Informative sections are also contained explaining TV circuits, hi-fi, and radio.

This popular manual is a handy and important addition for the tube caddy or shop library.

* **VIDEO TAPE RECORDING.** By Julian Bernstein. Published by John F. Rider Publisher, Inc. 272 pages, hard cover. \$8.95.

Time delay programming in TV broadcasting created the need for video tape recording. This book is a thorough treatment of the system that is used to rebroadcast live programs at a later time. It is written at a level understandable to all interested in video recording, with mathematical formulas absent. The text outlines the methods used and the circuitry employed.

Subjects covered include: waveforms and signals, electronic photography, mechanics of recording, electronics of tape recording, video recording, servo systems, video and servo circuits.

Abundant with photographs and drawings, this volume is an interesting and authoritative reference.

* **GETTING THE MOST OUT OF VACUUM TUBES.** By Robert B. Tomer. Published by Howard W. Sams and Co., 160 pages, hard cover. \$3.50.

Using a reverse approach, the author presents the rhyme and reason for catastrophic, degenerative and subjective tube failures. Information contained reveals the author's feelings about selected and premium tubes, predicting tube performance, tube testers, special purpose tubes and methods to lengthen the life of tubes.

Absent is the usual mathematical formula and graphic explanation for tube failures. This text makes interesting, informative reading for all who want to know the reasons both old and new tubes break down . . . and that should certainly include every man who makes his living in electronic service.

TRANSISTORS CIRCUITS AND SERVICING. By B.R.A. Bettridge, M.Brit. I.R.E. Published by Trader Publishing Co., Ltd., Dorset House, Stamford St., London, S.E.1, England. 28 pages, soft cover. \$1.90.

This pamphlet, written in England, is a descriptive presentation of transistor theory and servicing with mathematics left out. American readers will find vacuum tubes referred to as valves, but other than the touch of unfamiliar terminology, the small yet informative manual contains useful information.

Jammed into 28 pages is information about transistor theory, common base operation, common emitter operation, low frequency amplifier circuits, complete transistor receivers, and general servicing notes.

* **USING AND UNDERSTANDING PROBES.** By Rudolf F. Graf. Published by Howard W. Sams & Co., Inc. 192 pages, soft cover. \$3.95.

Here is a practical and informative book on many different types of test probes and their uses. Chapters include: Direct & Isolation Probes, High-Voltage Probes, Low-Capacitance Probes, Rectifier Probes, Signal-Tracer Probes. In addition, chapters on special purpose probes are thoroughly discussed from a technician viewpoint, such as: Medical Probes, Radiation Detector Probes, Industrial Probes (leak detector, vibration pickup, proximity pickup, etc.). Over 200 illustrations assist the reader in understanding how to use test probes advantageously, thereby advancing his test capabilities. The important subject and excellent presentation should meet with technician approval.

* **INSTALLING HI FI SYSTEMS.** By Jeff Markell and Jay Stanton. Published by Gernsback Library. 224 pages, soft cover. \$3.20.

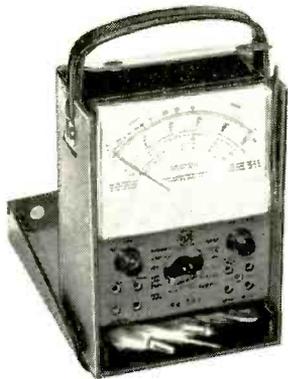
The authors present the stereo story in 14 informative chapters. Topics include client needs and preferences, legal and insurance considerations, hi-fi components, electrical and electronic interconnection, noise and interference, acoustic factors and problems, and esthetic appeal and effect.

The text offers material for the audiophile and professional hi-fi technician. Written in non-technical terms, with numerous photographs and drawings, this text should have substantial appeal.

RCA ELECTRONIC INSTRUMENTS

"PREFERRED BY PROFESSIONALS"

METERS and TUBE TESTERS



WV-38A VOLT-OHM-MILLIAMMETER THE V-O-M WITH THE EXTRAS!

Compare this superlative RCA V-O-M against the model you may have been thinking of buying. See if it doesn't check out better in these extra features:

- EXTRA! 1.0 volt and 0.25 volt ranges DC!
- EXTRA! Big easy-to-read 5 1/4" meter!
- EXTRA! Non-breakable plastic case; no glass to crack or shatter!
- EXTRA! Smart attractive modern styling—the V-O-M of the future!
- EXTRA! Red test lead has probe and slip-on alligator clip for added versatility!
- EXTRA! Orderly location of jacks below switches keeps leads out of the way!
- EXTRA! Spring clips on handle to hold test leads!

- EXTRA! DB scales clearly marked: no squinting!
- EXTRA! Rugged, scuff-proof, stain-resistant laminated vinyl carrying case, only \$4.95* extra!

Only \$43.95* complete with batteries, instruction book and all probes, clips and cables. (RCA V-O-M Kit only \$29.95*.)



NEW! WV-77E VOLTOHMYST®

Measures AC and DC voltages to 1500 volts; resistance from 0.2 ohm to 1,000 megohms. Separate scales, 1 1/2 volts rms and 4 volts peak-to-peak for low AC measurements.

Only \$43.95* complete with probes, leads, instructions. (RCA VoltOhmyst Kit only \$29.95*.)



NEW! WV-98B SENIOR VOLTOHMYST®

Measures AC and DC voltages (3% accuracy); resistance from 0 to 1,000 megohms. Measures peak-to-peak values of complex waveforms. Rugged cast aluminum case, field-tested printed circuits. Big 6 1/2" meter.

Only \$79.50* with leads, clips, instructions.



WT-110A AUTOMATIC ELECTRON TUBE TESTER

Especially designed for TV and general service testing of electron tubes. Uses automatic punched-card selection of correct test conditions on wide variety of tubes. Checks vacuum-tube rectifiers under high-current conditions.

\$199.50* complete with 263 punched cards, 24 blank cards, card punch; instruction book.

SCOPES



W0-91A 5-INCH COLOR-TV OSCILLOSCOPE

High-performance, wide-band oscilloscope ideally suited for color-TV, black-and-white TV, and other electronic applications. Dual bandwidth (4.5 Mc, 0.053 volts rms/in. and 1.5 Mc, 0.018 volts rms/in.). Internal calibrating voltage and calibrated graph screen. Includes special direct/low-cap shielded probe and cable.

Only \$239.50* complete with ground cable, insulated clip, instruction book.



NEW! W0-33A SUPER-PORTABLE OSCILLOSCOPE

A low-cost all-purpose scope you can carry anywhere—only 14 pounds—ideal for in-the-home servicing of black-and-white and color-TV, audio and ultrasonic equipment. High gain and wide bandwidth to handle the tough jobs! Rugged and compact—scaled 3" graph screen.

Only \$129.95* complete with low-cap direct input probe, cable, power cord, cord-carrying brackets, instructions. (RCA Super-Portable Oscilloscope Kit, only \$79.95*.)

GENERATORS



NEW! WA-44C AUDIO GENERATOR

Generates sine and square wave signals for testing audio systems. Frequency range: 20 cps to 200 Kc. Used to measure intermodulation distortion, frequency response, input and output impedances, speaker resonance, speed of recording and playback mechanisms, transient response and phase shift.

Only \$98.50* with cable and instructions.



WR-49B SIGNAL GENERATOR

For alignment and signal tracing of AM/FM receivers, low-frequency signal tracing and alignment of TV vf/lf amplifiers. Six ranges—85 Kc to 30 Mc. Internal 400 cps modulation. Low rf signal leakage!

Only \$79.50* complete with shielded cable for rf and af output, instruction book.



WR-69A TELEVISION/FM SWEEP GENERATOR

For visual alignment and troubleshooting of TV rf/lf/vf circuits and other electronic equipment IF/video frequency ranges 50 Kc to 50 Mc, TV channels 2 to 13, plus FM range—88-108 Mc. Sweep width continuously adjustable to 12 Mc or more.

Only \$295.00* with cables, instruction book.



WR-70A RF/IF/VF MARKER ADDER

To be used with WR-69A or similar electronic equipment. Eliminates waveform distortion due to receiver overloading during visual alignment by adding markers after the rf signal is demodulated.

Only \$74.50* with cables, instruction book.



WR-99A CRYSTAL- CALIBRATED MARKER GENERATOR

To supply a fundamental frequency rf carrier of crystal accuracy for aligning and troubleshooting color-TV, black-and-white TV, FM receivers and other electronic equipment operating in 19 Mc to 260 Mc range.

Only \$242.50* complete with output cable, two phone tips, instruction book.

There's an RCA test instrument to help you do every job better, and easier—and to save you valuable time. A comprehensive line of test accessories: video multi-markers, TV isotaps and bias supplies, probes and cables. See your Authorized RCA Electronic Instrument Distributor for complete information.

RCA Electron Tube Division, Harrison, N.J.

*User Price (Optional)



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RADIO CORPORATION OF AMERICA

5 GOOD REASONS WHY Shell OUTSELLS THEM ALL!

TEST-O-MATIC

- DEPENDABLE
- ACCURATE
- TIME SAVING
- PROFIT MAKING
- TOP QUALITY

A
TUBE TESTER
TO FIT EVERY NEED

ASSOCIATION NEWS

Arizona

Code of Ethics Adopted

BEST, Phoenix, reported a code of ethics has been adopted by members of the television service industry. The nine point platform pledges each member to "uphold integrity in advertising and business conduct." The pledge requests employers to use only qualified personnel, approved business methods, adequate service equipment, and advertise in a manner fair to both customer and competitors. Other provisions included: itemized service charge, prompt and proficient service, advanced estimates, perform only authorized repairs, install parts of similar or better quality, issue an itemized bill, give valid specific guarantees and warranties, and provide adequate protection of customer property in the process of service.

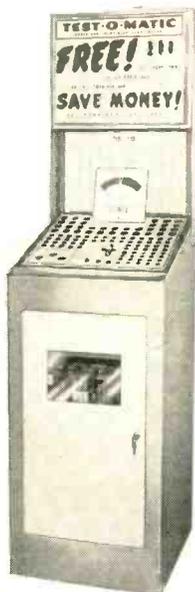
Repair Costs

ACTRA, San Jose, reported results of a survey illustrating TV business operating costs in California. A California state official quoted the New York average dealer cost of making a house call as \$5.62, in comparison to the California rate of approximately \$6.32. Facts and figures were based on information compiled after interviewing small shops (one or two men). Average monthly costs reported by the California firms were as follows:

Rent	\$120.00
Utilities	30.00
Phone	29.00
Employee	350.00
Truck	43.00
Insurance	27.50
Federal Taxes	14.00
Licenses, etc.	14.50
Bookkeeper	17.50

The New York breakdown was not reported. In addition, costs represented in these figures are the extra burdens of interest on loans, depreciation, advertising, and association dues. The figures do not include owner's salary, nor his wife's time, but they represent an accurate accounting of the bare costs of maintaining the door open for business. Naturally the per call cost varies with the number of calls made.

(Continued on page 70)



DELUXE 102 SELF-SERVICE VOLUME TUBE SALES

Profit from list price sales of tubes at remote locations. The Test-O-Matic display is a permanent ad for your professional services. Units sell your tubes and services for you. The 102 lists and checks more tubes than any other self-service tube tester.

- Checks 6 and 12 volt vibrators
- one knob control
- complete emission tester
- checks each section of multi-purpose tubes

\$199.95 dealer net price

S-18 SELF-SERVICE CREATES REPEAT SALES

The most consistent, dependable tester on the market. Suitable for placement in any high traffic location. Takes only 19" x 15" floor space. Storage capacity of up to 400 tubes. Turnbuckle lock steel cabinet allows easy stock control from compartmentized sliding shelves.

- tests each side of multi-purpose tubes
- Emission tests all tubes
- New sockets conform to MIL spec
- Tests more than 800 tube types

dealer net price **\$149.95**



TM-18 TABLE MODEL SERVICE SHOP MONEY MAKER

Designed especially for the Service Shop the TM-18 is also available with legs. Same panel and performing qualities as the S-18 and attractively priced.

\$91.95 dealer net price



V-18 PORTABLE HANDY PORTABLE

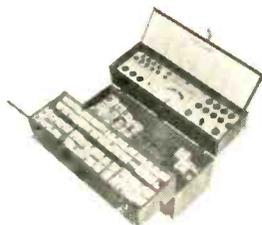
Compact, yet tests more than 800 tube types. Ruggedly constructed, increases "on-the-job" tube sales. Panel and specs same as the S-18.

dealer net price **\$59.60**



TC-18 TUBE CADI-TESTER TUBE TESTER AND AMPLE STORAGE

The Tube Cadi-Tester is a complete service outfit. A handy, convenient serviceman's dream with its accurate, dependable, built-in Test-O-Matic tube tester. "On-the-job" tube sales soar. Will stand up under constant use. Covering is black vinyl with reinforced outside trim. Uses just 18 sockets to test all tube types. Easy-to-use controls and fool-proof test meter.



dealer net price **\$69.95**

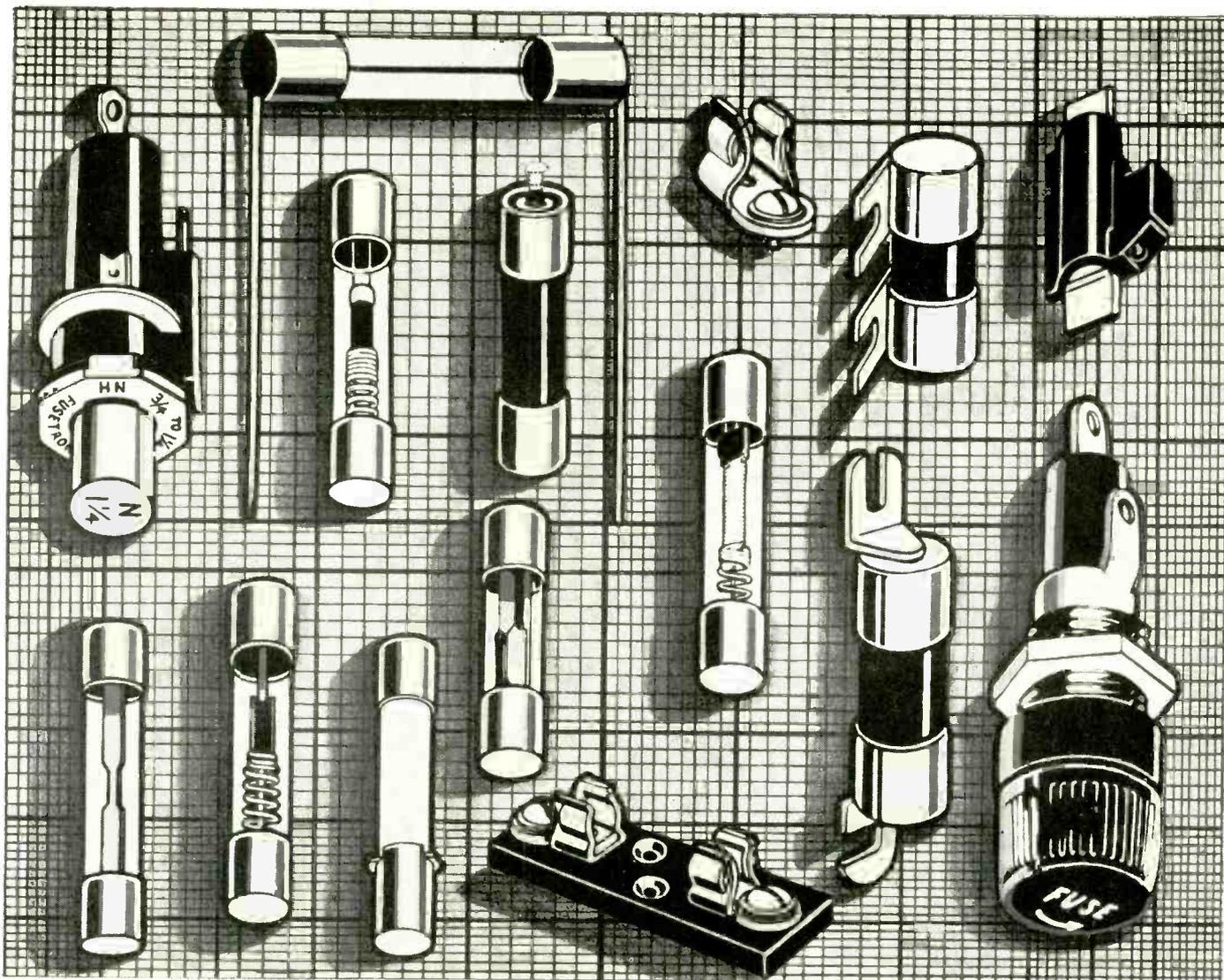
and our NEW BATTERY TESTER at \$14.95

Shell

ELECTRONICS MFG. CORP.

112 STATE ST.
WESTBURY, N. Y.

For more data, circle 10-68-1 on coupon, p. 43



BUSS fuses can help protect *your profits and your reputation for service*

You get double protection when you install BUSS fuses.

First, BUSS fuses are designed and manufactured to give maximum electrical protection.

But it doesn't stop there.

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

This is your assurance that BUSS fuses will operate as intended.

Second, BUSS fuses help protect your reputation for quality service. A fuse that opens prematurely causes a needless shutdown. Likewise, one that doesn't function properly may cause other components to burn out or be damaged. In either case, it's an annoying headache for your customer and it may cost you his confidence. More often than not, he will blame you for his trouble.

With dependable BUSS fuses, you need have no worries that faulty fuses will threaten your profits or your reputation. That's why it makes good sense to install BUSS fuses.

For more information on BUSS and FUSETRON small dimension fuses and fuseholders . . . Write for bulletin SFB.

BUSSMANN MFG. DIVISION
McGraw-Edison Co.

University at Jefferson, St. Louis 7, Mo.

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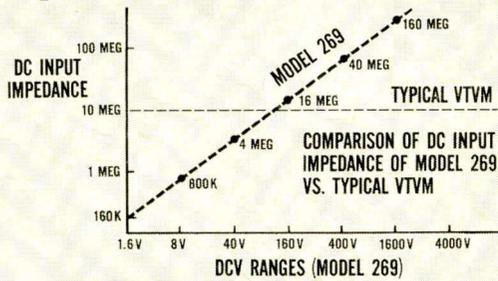
**BUSS FUSES ARE MADE TO PROTECT -
NOT TO BLOW NEEDLESSLY**



BUSS MAKES A COMPLETE LINE OF FUSES FOR HOME, FARM, COMMERCIAL, ELECTRONIC, ELECTRICAL, AUTOMOTIVE AND INDUSTRIAL USE.

For more data, circle 10-69-1 on coupon, p. 43

The only VOM with 100,000 OHMS / VOLT SENSITIVITY



RUGGED
SPRINGBACK
JEWEL MOVEMENT

Simpson 269

AC-DC VOLT-OHM-MICROAMMETER

Here's a VOM with so much capability, you'll find yourself using it more than any tester in the lab or shop. The 10 microampere movement handles tests other VOMs can't touch . . . even outdoes a VTVM on some checks. And, because the movement in the 269 is built with springbacked jewels, you don't have to baby it. Through the toughest service, it's always accurate and sensitive. The 269 is handy, too. Being self-powered, there's no plug-in required. You can make tests anywhere. A big, w-i-d-e 7-inch scale makes the 33 ranges easy to read and you select them merely by turning a knob. Your Electronic Parts Distributor will be glad to demonstrate these and other features like the Adjust-A-Vue handle and explain the *self-shielding* of its rugged core-type movement. Call him up about this super-sensitive VOM today.

DC Volts: 1.6, 8, 40, 160, 400, 1600, 4000 . . . 100,000 ohms per volt.

AC Volts: 3, 8, 40, 160, 800 . . . 5000 ohms per volt.

AF Output Voltage: 3, 8, 40, 160 volts.

Volume Level in Decibels: -12 to +45.5 DB in 4 ranges.

DC Resistance: 0-2K ohms (18 ohms

center); 0-20K ohms (180 ohms center); 0-200K ohms (1800 ohms center); 0-2 megohms (18K ohms center); 0-20 megohms (180K ohms center); 0-200 megohms (1.8 megohms center).

DC Current: 0-16, 0-160 μ a; 0-1.6, 0-16, 0-160 ma; 0-1.6, 0-16a.

Model 269 with Leads and Operator's Manual \$89.95

Simpson Electric Company

5208 W. Kinzie St., Chicago 44, Illinois
Phone: EStebrook 9-1121

In Canada: Bach-Simpson Ltd.
London, Ontario

VOMs and VTVMs

A complete line for every job. Shown here is the world-famous 260.



For more data, circle 10-70-1 on coupon, p. 43

(Continued from page 68)

APA, Los Angeles, announced completion of appliance technician testing in Northern California. Also reported was a shift of testing operations to Southern California with base headquarters at the Phineas Banning High School. Technicians from the Long Beach, Southeast cities, and South Bay Cities chapters of APA, are being urged to take the aforementioned tests.

Georgia

SETA, Savannah, announced the following officers have been elected: Pres., Frank Semken; V. P., Curtis Hoffman; Sec'y, Leo K. Thomas; Treas., M. Boyette.

Illinois

NATESA, Chicago, reports election of the following: Pres., Alphonse Benoit Jr.; Sec'y-General, W. O. Hirshberg; Treas., Nelson Burns. Association also announced recipients of the 1960 annual "Friend of Service" awards will be ELECTRONIC TECHNICIAN Magazine and the Finney Antenna Company.

Louisiana

TESA, New Orleans, reports bill HB 761 licensing all technicians in the state has been signed.

Missouri

TESA, Southwestern section, reports election of the following officers: Pres., J. J. Gulliford; V.P., Lee Hopkins; Sec'y, Earnest Moudy; Treas., Ed Muhleman.

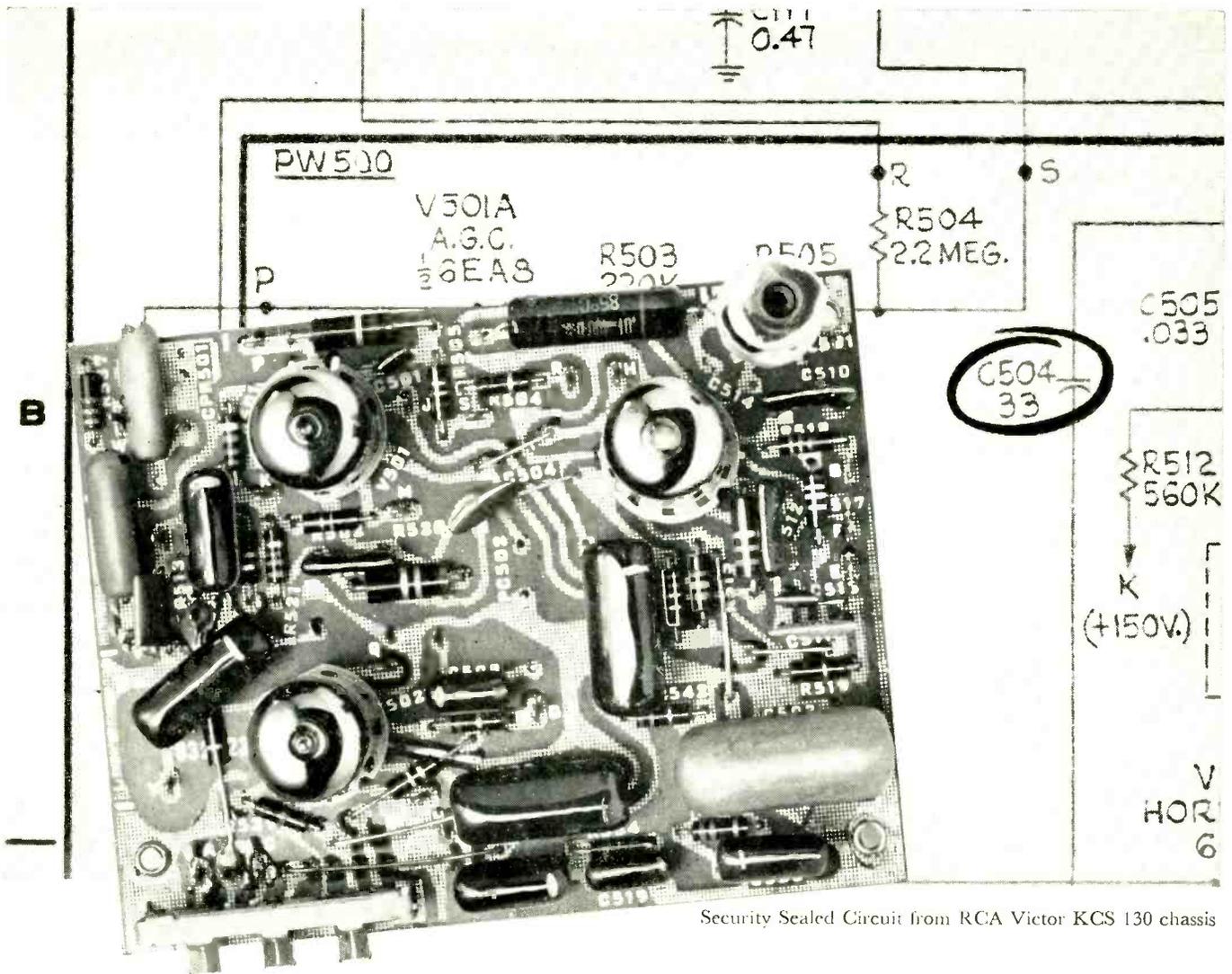
North Carolina

RTSA, Durham, has elected the following officers: Pres., Norman Schultz; V. P., Walter Cobb; Sec'y, J. J. Bralley; Treas., Willie Hester. Catawba Valley, has elected the following officers: Pres., Bob Patton; V. P., Walt Stewart; Sec'y-Treas., Gene Pittman.

TV REPAIR



"You mean how much for that antenna and a picture tube."



Security Sealed Circuit from RCA Victor KCS 130 chassis

How fast can you find C 504? (Average time—10 seconds)

You know how valuable minutes are in TV servicing! Every one you save means money in your pocket.

With this all-important fact in mind, take a good look at the RCA Security Sealed Circuit in the picture above. All components are plainly marked. So are meter and scope take-off points and signal injection points. RCA Security Sealed Circuits take the *guesswork* out of servicing. That's for sure!

Now compare the RCA Security Sealed Circuit with any old-fashioned point-to-point wired chassis you have on your bench. Which do you vote for as a timesaver and error eliminator? If you vote for the printed circuit, you

are voting along with the nation's top missile, satellite and computer engineers! *Long ago, they chose printed circuits because printed circuits alone offer the maximum dependability.*

But, you may be thinking, how about parts replacement? Do printed circuits make this easier or tougher? The answer is—*easier!* All you need is a light, low wattage iron or gun, which is a good thing to have around the shop anyway. No special techniques are needed . . . just plain common-sense methods.

Next time a customer asks, explain that printed circuitry is the mark of modern, dependable, easy-to-service home entertainment equipment—such as RCA Victor!

TMR'S®



The Most Trusted Name in Television

RADIO CORPORATION OF AMERICA

Just because 2 speakers LOOK alike

doesn't
mean
they'll
SOUND
alike...

or that
they'll
give the
same
trouble-free
performance.

ask for

QUAM

The NO CALL-BACK speaker with the exclusive Adjust-a-Cone Suspension
Completely manufactured in the United States of America

QUAM-NICHOLS COMPANY

226 East Marquette Road • Chicago 37, Illinois

For more data, circle 10-72-1 on coupon, p. 43

ANOTHER
Mercury
SERVICE AID

The versatile **MULTI-PROBE** Patent Pending
DOES THE WORK OF 4 PROBES!

DC Probe

AC/Ohms Probe



RF Probe

Lo-Cap Probe

Model MP-1 **\$975** Net

Now for the first time — exclusive with MERCURY — a MULTI-PROBE that does all the work of 4 different probes. Functions: DC position . . . matches VTVM input impedance • AC/Ohms position . . . for all low frequency, low impedance, voltages and wave forms • RF position . . . a demodulator for checking RF voltages, wave forms and signals and TV/radio RF and IF stages • Lo-Capacity position . . . a must for high impedance, TV sync and radio circuits where regular probes overload the circuit.

Can be used with your VTVM, SCOPE or SIGNAL TRACER

Save the cost of 4 separate probes!

A quarter turn of the head selects either DC, AC/Ohms, Lo-Cap or RF probe positions

See your electronics parts distributor

MERCURY ELECTRONICS CORP., 77 SEARING AVENUE, MINEOLA, NEW YORK
West Coast Office: 4306 W. Victory Blvd., Burbank, Calif.

For more data, circle 10-72-2 on coupon, p. 43

Chemtronics AIDS

The manufacturer is offering technicians a tool choice, free with each 8oz. spray can of Trol Aid or Tun O Lube. These new premiums, consist of a screwdriver with safety pocket clip, or printed circuit solder in pocket self



dispenser. Choice is given with each 8 oz. can of Tun O Lube tuner cleaner, or Trol Aid volume control and contact cleaner. Dealer net, including "Spray Aid" and choice of premium, is \$1.98. Chemtronics Inc., 870 E. 52nd St., Bklyn, N. Y.

For more data, circle 10-72-3 on coupon, p. 43

Want A Christmas
GIFT IDEA?

See page 64

Ray-O-Vac BATTERY TESTING STATION

RB-4 radio battery test station contains a balanced assortment of 13 of the fastest selling types of radio batteries covering 95% of the replacement market. The tester goes to the dealer

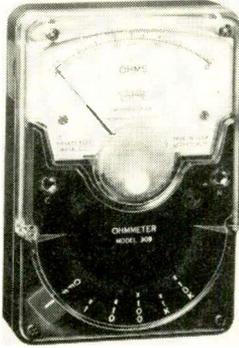


for \$30.00 and the firm gives free batteries with a retail value of \$39.50 to offset the cost of the tester. The unit, complete with batteries, is dealer priced at \$49.20 and is said to bring back \$66.85. Ray-O-Vatic Co., 212 E. Washington St., Madison 10, Wis.

For more data, circle 10-72-4 on coupon, p. 43

Triplet OHMMETER

Model 309 general purpose ohmmeter, designed for industrial, laboratory and general servicing use, has ranges to 20 megohms. A handy selector switch speeds the selection of five ranges: 0-2000 ohms; 0-20,000 ohms;

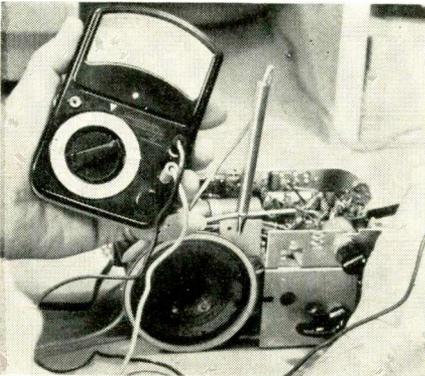


0-2 megohms; 0-20 megohms (20 ohm center scale on 0-2000 range). Tester, 2 3/4" x 4 1/4" x 1 3/16" fits into the palm of the hand and has back mounted elastic strap and control knob. Triplet Electrical Instrument Co., Bluffton, Ohio.

For more data, circle 10-73-2 on coupon, p. 43

Audiotex POCKET METER

A new test meter that combines versatility and small size, "Pocket Meter" (Catalog No. 30-240), is reported to serve as a d-c voltmeter, a-c rms voltmeter, ohmmeter, decibel meter and



d-c micro-milliammeter. In addition, the meter reads inductance, capacitance and relative signal output. Size, 6" x 4". Complete with a pair of test prods and full instructions, \$24.95. Audiotex Mfg. Co., 400 S. Wyman St., Rockford, Ill.

For more data, circle 10-73-3 on coupon, p. 43

Pearce-Simpson CB TWO-WAY RADIO

The new citizens band two-way radio, model CBD-1 is compact in size, has a 5-watt power input; and offers a dual power supply for 12v d-c or 115v a-c current. It has high level modulation and comes complete with a press-to-talk microphone and crystals. \$159.50. Pearce-Simpson, Inc., 2295 N.W. 14th St., Miami, Fla.

For more data, circle 10-73-4 on coupon, p. 43

Designed with the Serviceman in Mind!



JERROLD magic carpet* antenna

NEW TV-FM indoor antenna with outdoor performance . . .
NEW profitable business for you . . .

Servicemen everywhere are discovering a whole new market with this revolutionary new indoor TV-FM antenna. Now for the first time you can obtain signal gain across all frequencies, within 30 miles of the transmitter, that is comparable to that of a standard conical antenna.

In addition to strong gain characteristics, the Magic Carpet Antenna has an exceptionally low V.S.W.R. (Impedance Match) that assures maximum transfer of signal to the viewer without ghosting or smearing. Your customer avoids the expense and unsightliness of a rooftop antenna and the nuisance of ugly "rabbit ears"—you save time, trouble, and eliminate rooftop hazards with the quality-engineered, and profitable Jerrold "Magic Carpet" antenna. Get the details today!



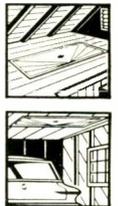
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For more data, circle 10-73-1 on coupon, p. 43

*Trademark Patent Pending

Transistor Radio Midgets

(Continued from page 36)

by brushing with a small wire brush. The mounting hole(s) may be re-opened by using a piece of stiff wire . . . a straightened paper clip is an excellent "tool" for this job. See Fig. 2.

A small receiver may have to be realigned if r-f or i-f transistors or frequency determining components

(coils, i-f transformers, neutralizing capacitors, etc.) are replaced, or if the set has been subjected to tampering or to unusual vibration and shock.

The basic alignment procedure used with transistorized receivers is essentially the same as that applied to more familiar sets. The i-f transformers are adjusted for peak output at their i-f value (usually 455 KC, although auto sets use 262 KC), the local oscillator trimmer for dial tracking at the upper end of the Broadcast Band (1500 to 1600 KC), the r-f trimmer for peak

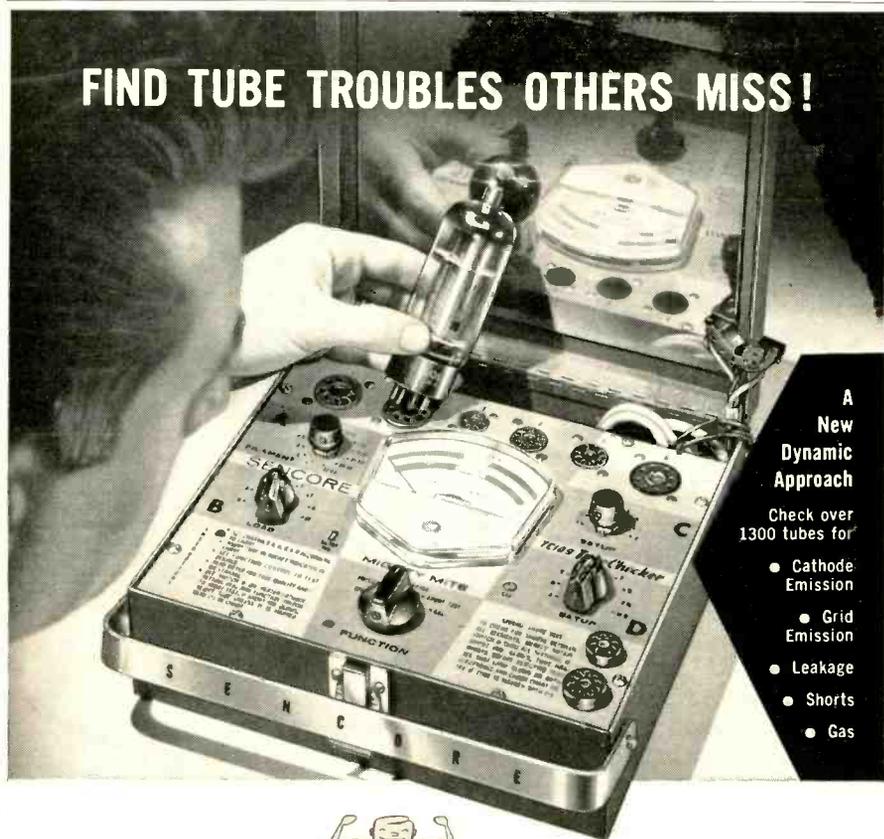
response at about 1300 or 1400 KC, and the padder (or oscillator coil slug) for peak response near the low frequency end of the band (about 550 to 600 KC) while "rocking" the tuning capacitor.

There are a few modifications of the basic technique which may be employed, however. First, it is not always necessary to "kill" the set's local oscillator before aligning the i-f stages. Second, the modulated i-f signal, as a rule, is coupled through the set's regular "loop" antenna coil rather than applied directly to the input of the converter stage. Third, since the avc circuits of most transistorized receivers are not as effective as their tube-operated counterparts, common practice is to use the audio signal heard through the loudspeaker as an indication of output level rather than attempting to measure avc voltage. For best results using this last technique, turn the set's volume control to its maximum volume position and use the lowest level r-f signal which will give a useable output tone.

A coupling loop for applying a signal generator's r-f (or i-f) signal to the receiver may be made up by coiling 12 to 18 turns of common hook-up wire in a scramble-wound loop about 3 to 4 inches in diameter. See Fig. 3. This coupling loop may be placed relatively close to the receiver's antenna coil during initial alignment steps, but should be moved back as far as possible (while maintaining an acceptable output level) as alignment progresses.

With all repairs completed, the set should be given a quick performance check before being reinstalled in its case. Check relative output level, see if distortion levels are acceptable, note sensitivity, selectivity, and dial tracking. Make sure, too, that the control is not noisy.

One useful final check is to measure the set's d-c requirements, comparing the current drawn to that specified in the manufacturer's service data. In the case of receivers having Class AB (or Class B) output stages, the battery current drawn *should* vary with loudspeaker volume level. As a check on this, try adjusting the set's volume control, watching for changes in current requirements. •



FIND TUBE TROUBLES OTHERS MISS!

A New Dynamic Approach

Check over 1300 tubes for

- Cathode Emission
- Grid Emission
- Leakage
- Shorts
- Gas

SENCORE "MIGHTY MITE" TUBE CHECKER

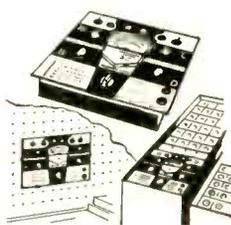
Answers the needs of the fast moving, profit minded serviceman who hates time consuming call backs. A "mite" to carry but a whale of a performer that spots bad tubes missed by large mutual conductance testers.

New unique "stethoscope" approach tests for grid emission and leakage as high as 100 megohms, yet checks cathode current at operating levels. Special short test checks for shorts between all elements. The MIGHTY MITE will test every radio and TV tube that you encounter (over 1300!) plus picture tubes, foreign, five star and auto radio tubes (without damage). As easy to set up as a "speedy tester" from easy to follow tube booklet. New tube charts free of charge.

AND check these added Sencore servicing features: • Meter glows in dark for easy reading behind TV set • Stainless steel mirror in cover for TV adjustments • Rugged, all steel carrying case and easy grip handle • Smallest complete tester made.

Model TC109.....DEALER NET **59⁵⁰**

• Ask your distributor for the "MIGHTY MITE" with the mirror in the cover



Use it everyday in every way. Especially designed so you can transfer inner chassis to your tube caddy, bench or counter. Only 9" x 8" x 2 1/2".

ALL PARTS

MADE IN AMERICA

SENCORE

ADDISON 2, ILLINOIS

For more data, circle 10-74-1 on coupon, p. 43

Aging TV's

(Continued from page 41)

come intermittent. This component may arc internally and cause unstable raster or blooming picture. Position of this resistor in the circuit is shown in Fig. 4.

In sets using a high voltage doubler circuit with two rectifiers, a voltage regulator resistor defect often causes arcing or blooming after the set has been operating for two or three hours. Many manufacturers used high resistance low wattage components, and others used 1 or 2 watt 470 k resistors in series. Replacement should be made with a single heavy duty precision type, mounted with the shortest possible leads, and dressed away from all uninsulated points.

Under normal circumstances damper circuit faults are usually of a definite nature. Here again, however, annoying troubles do arise as a direct result of a previous "patch-up" repair job where an "almost correct" component was used. Incorrect damper boost capacitors, linearity coils, etc. are the usual offenders. Boost capacitors in most damper circuits should be replaced with exact values rated at 1000 v d-c. Exact value linearity coils, properly tuned to resonance, is a must in many TV designs—otherwise short lived horizontal output tubes and overheating flybacks will result.

Most low voltage fault symptoms are obvious either on the CRT screen or by the smells arising from B+ shorts. But some unusual and misleading symptoms do appear for various reasons. For example, a set with full horizontal sweep shows insufficient vertical sweep. No fault can be found in the vertical section. Overall B+ is slightly low, but does not affect horizontal sweep or any other section of the set. In this case, the selenium rectifiers may prove to be slightly weak. When replaced with two new units, the problem is often solved.

One particularly troublesome problem which arises in all types of low voltage power supplies should be mentioned here. It is well known that the original voltage rating of electrolytic filter capacitors can fall

below normal, or "reform," when operated over an extended period at lower than normal rating, as when a set operates for some time with a weak rectifier. In a high percentage of cases when the rectifier is replaced one or more of the filter capacitors will break down shortly thereafter.

Video Problems

Picture clarity and CRT control latitude varies as a TV ages. Most

often the technician is faced with no video, or a very weak, washed out picture. Partial video detector, i-f, and output failures may change picture quality slightly, and the defective component is seldom replaced. Examples are small value capacitors opening or developing high resistance shorts.

An open capacitor or peaking coil in the crystal detector circuit can cause deterioration of picture quality—but in a strong signal area
(Continued on page 80)

SENCORE SS105 SWEEP CIRCUIT TROUBLE SHOOTER

IT'S A... UNIVERSAL HORIZONTAL OSCILLATOR. For direct substitution. No wires to disconnect in most cases. Traces trouble right down to the defective component. Variable output from 0-200 volts, peak-to-peak. Oscillator will sync to TV sync signal giving check on sync circuits.

HORIZONTAL OUTPUT CATHODE CURRENT CHECKER. A proven method that quickly checks the condition of the horizontal output tube and associated components. Adaptor socket prevents breaking wires. Easily replaceable Roll Chart gives all necessary pin, current and voltage data. New Roll Charts are Free.

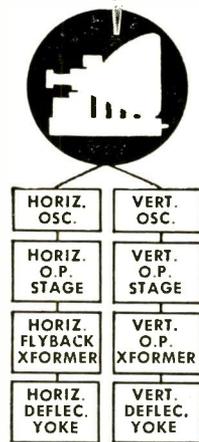
UNIVERSAL DEFLECTION YOKE. A new, simple way to determine yoke failure accurately—without removing yoke from picture tube. Merely disconnect one yoke lead and substitute. If high voltage (also bright vertical line) is restored, TV yoke is defective.

DYNAMIC FLYBACK TRANSFORMER CHECKER. Merely flip switch to "Flyback Check" and meter will indicate condition of flyback transformer, in degrees of horizontal deflection. Extremely sensitive and accurate; even shows up one shorted turn on flyback.

VOLTMETER. For testing bootstrap, screen and other voltages. Direct-reading voltmeter, 0-1000 volts.

UNIVERSAL VERTICAL OSCILLATOR. Checks oscillator, output transformer and yoke. Merely touch lead to component and check picture on screen.

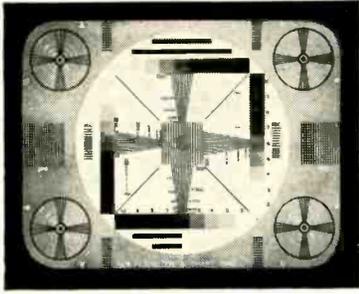
SS105 is completely self-contained, nothing else is needed. New Improved Circuit... DEALER NET 42⁹⁵



ALL PARTS
SENCORE
MADE IN AMERICA

SENCORE
ADDISON 2, ILLINOIS

For more data, circle 10-75-1 on coupon, p. 43



TV TIPS FROM TRIAD

NO. 9 IN A SERIES

"It's this kind of job that makes me envy the box boy's career at a supermarket," said Joe, the Junior PTM, as he gloomily eyed the job on the bench.

"You should be an expert on them, since that's the second one in three days," said Bill.

"Same set, same trouble, but not same cure," said Joe. "The first set came in with a short between the yoke windings. I went down and picked up the replacement, compared terminal numbers, connected it, and it worked fine. This set came in, same type of short, so I bought the same yoke as before, compared numbers, connected it, and got a fine picture, but it was upside down and backwards. When I reversed the leads to make it read right I had the worst case of 'ring ripple' I have ever had."

"Did you, by any chance," asked Bill, "buy a replacement with all the parts wired in?"

"The counterman said it was an 'exact' replacement," answered Joe defensively. "But why was it perfect in one case, and like this in the second?"

"Hm," said Bill, as he looked, "did you notice where the leads came out of the first yoke when you had it mounted?"

"Out the bottom," said Joe promptly.

"Well, they come out the top the way this one is mounted," said Bill. "If I remember correctly they used different mountings in different runs. When you installed this yoke you had exactly the right anti-ring network on exactly the wrong terminals, because you had to reverse polarity to make the picture read 'right.' If you follow my system, use new parts to duplicate the wiring (and mounting) of the original, you would never know about this kind of trouble."

MORAL: It is probably impossible to "exactly" replace over four thousand yokes from a line of less than a hundred. If you use the correct basic unit (proper deflection and inductance) plus a Network Kit to duplicate the original installation, you will find that nearly all jobs can be done quickly and easily. Review your yoke fundamentals as outlined in PTM #3, a copy of which is available from your Triad Distributor or from Triad in Venice. **Triad Transformer Corporation**, 4055 Redwood Avenue, Venice, California.

For more data, circle 10-76-1 on coupon, p. 43



QUIETROLE

LUBRI-CLEANER

The first of its kind and still best for silencing noisy controls and switches in TV, Radio & all Electronic Equipment.

Spray it or Drop it

Just Press and whoosh aerosol QUIETROLE quickly and easily cleans as it lubricates.

Or, if you prefer, use this handy eye-dropper and just a drop or two of quality QUIETROLE does the job perfectly.

Either way, make sure it's QUIETROLE

QUIETROLE

Company, Inc.

Spartanburg, South Carolina



In Canada:
CROSS CANADA ELECTRONICS
67 Ontario St., S., Kitchener, Ont.

For more data, circle 10-76-2 on coupon, p. 43

Radar

(Continued from page 39)

Primary Power

Most boats provide power in either 12, 24, 32 or 110 v d-c, or 110 v a-c. The Model 1700 is normally furnished with a rotary converter in the antenna pedestal, as previously mentioned. The converter changes d-c to a-c and also rotates the antenna. When a boat uses 110 v a-c, an a-c motor is used to drive the antenna.

Installation Considerations

Installation of small boat radars should be performed by reliable and thoroughly experienced marine communications and electronic contractors. Installation and initial "fire-up" of the equipment should be supervised by a licensed radar technician.

Selection of an adequate location for the radar's antenna is highly important. Large super-structure masses should not appear in a horizontal plane with the antenna. Otherwise blind areas and false targets will result. On larger boats, installation near the top of a stack must be avoided to prevent damage by stack gases, soot and possibly by excessive heat. Sufficient space should be allowed for antenna servicing.

To eliminate possible confusion in radar presentation, the indicator unit should be mounted so that the operator is facing the boat's bow when observing the screen.

The indicator and antenna units are connected by coax, multiconductor, and power cables. Since most boat owners are generally meticulous about their boat's appearance, care should be taken to make cable runs as neat and shipshape as possible.

Synchronizing Antenna

A plan position indicator type radar (PPI) requires the picture tube's deflection yoke to be rotated in sync with the antenna. This system provides a "map" on the radar screen of all objects within a

360 degree radius of the boat—within a given range. Information appearing on the screen is related to the bow of the vessel, with the top of the radar screen representing the bow. In the model 1700, a synchronous motor rotates the yoke, obtaining its a-c power from the converter.

To ensure synchronization between antenna and sweep, a relay circuit is provided. A manually operated switch in the indicator and a normally closed sensing switch in the antenna are in series with this relay. The sensing switch is actuated at a point when the antenna is in line with the boat's bow. If the antenna and sweep are out of step, the manual switch in the indicator is operated. This completes the relay circuit, thus energizing the relay. The relay will stop and hold the deflection yoke when the sweep reaches the top of the radar screen. As the antenna passes the bow line, the antenna sensing switch operates, breaking the circuit and allowing the sweep to rotate in synchronism with the antenna.

Klystron Tuning

The tunable velocity modulated klystron local oscillator supplies a 9420 mc signal to the crystal mixer circuit. It employs a resonant cavity which functions as follows:

The tube's electron beam is directed through the built-in cavity and then is reflected back "in phase" to sustain oscillations. The integral cavity is tuned mechanically by adjusting the bowed struts. This adjustment tilts the tube's top, flexes a portion of the upper cavity wall, and changes the spacing between the cavity grids. Output power is taken through a small diameter coaxial line. The line is loop coupled to the cavity and terminates in the antenna.

Tuning the klystron can be accomplished with a 20,000 ohm/volt VOM. To facilitate tuning, a jack and a potentiometer are located on top of the antenna pedestal. A jack and a tuning adapter is also located beneath one end of the antenna housing. The jack on the pedestal provides a monitor point for voltage produced by returned echoes, and the pot provides a coarse adjustment for the klystron repeller



to be equipped
for every call . . .

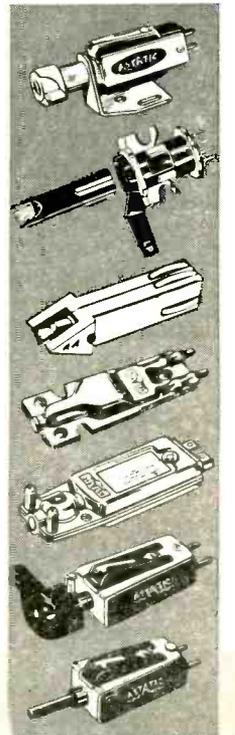
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BUSINESS YOU HAVE TO HAVE

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WORLD'S MOST FAMOUS NAME IN PHONO
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For more data, circle 10-77-1 on coupon, p. 43

ANOTHER
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The MULTI-HEAD incorporates:

- 12-pin socket—for all standard base black and white tubes
- 8-pin socket—for all 110 degree narrow-neck RCA type tubes
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- 14-pin socket—for all color TV tubes in use today
- Color gun switch—for checking the red, green and blue color guns separately

See your electronics parts distributor

CONVERT YOUR TUBE TESTER INTO A HIGHLY
EFFICIENT PICTURE TUBE TESTER . . .

No other CRT Adapter does
as much as the MULTI-HEAD!

✓ TEST **ALL**
BLACK AND
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✓ TEST **ALL**
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Model MH-1 **\$1245**
MULTI-HEAD Net

MERCURY ELECTRONICS CORP., 77 SEARING AVENUE, MINEOLA, NEW YORK
 West Coast Office: 4306 W. Victory Blvd., Burbank, Calif.

For more data, circle 10-77-2 on coupon, p. 43

voltage. This pot is in series with another (for fine tuning) which is mounted on the indicator unit front panel. The jack on the antenna housing bottom is used for monitoring mixer crystal current. The tuning adapter under the antenna housing allows mechanical tuning of the klystron with a screwdriver.

Tuning procedure is as follows:

1. Set the fine "tune control" pot on the indicator front panel to its mid-position.

2. Turn antenna motor power off.

3. Remove the fiber gear that mates with the bull gear in the antenna pedestal (See Fig. 1). This allows power to be applied to the antenna without its rotating.

4. Turn radar power on.

5. With an extension plug attached to the VOM, plug meter into mixer current jack at bottom of antenna housing. Set meter to the 10 ma or lower scale.

6. Rotate the klystron cavity tuning screw clockwise for maximum mixer crystal current. Two points of maximum current should be noted on the meter. Adjust to the most counter-clockwise peak, since this peak occurs when the local oscillator is 45 mc above the transmitter frequency.

7. Plug the VOM into the jack atop the antenna pedestal. Set on volt scale and adjust the local oscillator pot for maximum voltage indication.

8. Turn off power and replace the fiber gear.

9. Turn on equipment and test for satisfactory operation. It may be necessary to readjust klystron cavity tuning (mixer current) and coarse potentiometer (klystron repeller voltage) so that each is at maximum at the same point on the potentiometer.

The top and bottom cover of the indicator unit are easily removed by unsnapping the hinges. The signal-mixer assembly, which includes the local oscillator tube and preamplifier, is completely removable from the end of the antenna housing. To facilitate troubleshooting refer to Chart I. General service

procedures are similar in many ways to those of regular TV equipment.

In addition to the normal high voltage employed in the radar set, considerable r-f is generated. Every precaution should be observed by the technician when testing, adjusting, and servicing radar equipment. An r-f burn can be very painful and even fatal.

Radar is a wonderful aid to boat navigation and safety. More technicians qualified to handle radar gear will be increasingly in demand. •

NEW FROM H. H. SCOTT

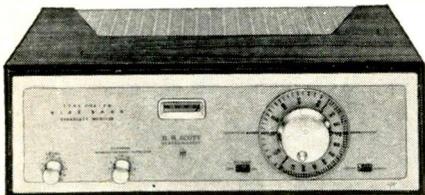
Leader in Audio Design and Engineering

6 SUPERB STEREO COMPONENTS PLUS A RADICALLY DIFFERENT FM TUNER KIT

3 NEW WIDE-BAND TUNERS! The new 310D Broadcast Monitor Tuner at \$184.95*, the 314 FM Tuner at \$114.95, and the 330D AM-FM Stereo tuner at \$209.95. All have H. H. Scott's unique silver-plated front end, all are multiplex adaptable.

3 NEW AMPLIFIERS! H. H. Scott now has an amplifier in every important price range. The new 222B (30 Watts) is only \$114.95*, the 299B (50 Watts) is \$209.95, and the 272 (88 Watts) is \$269.95.

NEW WIDE-BAND FM TUNER KIT! A laboratory tuner kit that meets high H. H. Scott standards! The pre-aligned silver-plated front end is the same used in all H. H. Scott tuners. All wires are cut, stripped and tinned . . . all parts mounted on special Kit-Pack® cover to facilitate assembly. **TUNER IS ALIGNED BY USING THE METER ON THE KIT ITSELF!** Using this procedure, tuner will work as well as factory aligned units. Only \$89.95*



310D Broadcast Monitor FM Wide-Band Tuner

H. H. SCOTT
H. H. Scott Inc., Dept. ET-10,
111 Powdermill Rd., Maynard, Mass.

Rush me complete information on your new line. Be sure to include complete details on your new Wide-Band FM Tuner Kit.

Name _____

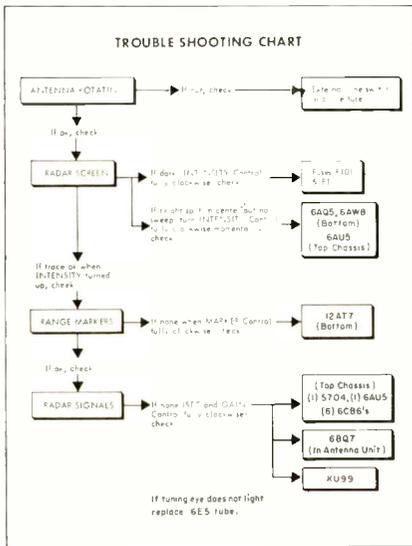
Address _____

City _____ State _____

Export: Telesco International, 36 W. 40th St., NYC

*All prices slightly higher west of Rockies. Subject to change without notice. Accessory cases extra.

For more data, circle 10-78-1 on coupon, p. 43



The Modern "PUSH BUTTON" way to protect ELECTRONIC PARTS!



- Prevents corona in high voltage section
- Keeps lead-in connections tight
- Prevents rusting and pitting of antenna
- Goes on in seconds—DRIES IN MINUTES



CRYSTAL CLEAR ACRYLIC SPRAY

Protect radio, TV and hi-fi equipment indefinitely against humidity and dust with Krylon Crystal-Clear, the modern "push button" acrylic spray. High dielectric strength, excellent weatherproof qualities. Available at your favorite radio-TV repair shop.

KRYLON, INC., Norristown, Pa.

Paint touch-up work easily, expertly, with Krylon Spray Paints—choice of 24 colors

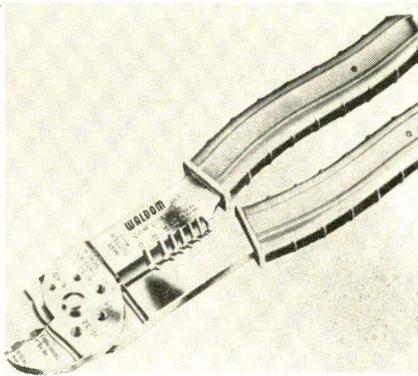
IF YOU PRIZE IT...KRYLON-IZE IT!

For more data, circle 10-78-2 on coupon, p. 43

ELECTRONIC TECHNICIAN • October, 1960

Waldom CRIMPING TOOL

Announced as four tools in one, Universal crimping tool CT-3050 provides a perfect crimp for both non-insulated terminals and connectors. It crimps all terminals in wire ranges 22

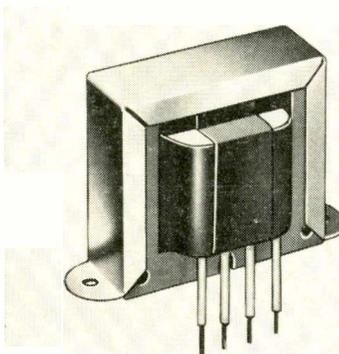


through 10; cuts wire; strips wire; and shears bolts and screws in sizes 4-40, 6-32, 8-32, 10-24 and 10-32. The tool cuts screws clean and ready for use without deburring. \$4.25. Waldom Electronics, Inc., 4625 W. 53rd St., Chicago 32, Ill.

For more data, circle 10-79-3 on coupon, p. 43

Stancor TRANSFORMERS

Four new replacement vertical output transformers are: VO-110, VO-111 and VO-112 isolation type. Turns ratios, 16:1, 18:1 and 8:1 respectively. Primary impedances, 18,000, 20,000

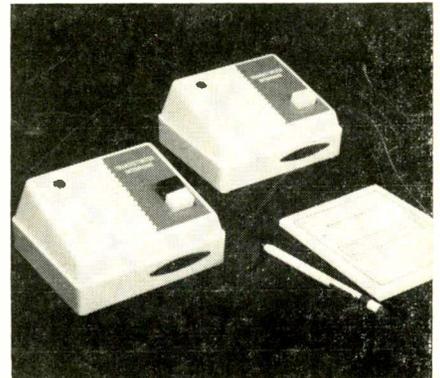


and 7,000 ohms respectively. The fourth unit is OV-113 autoformer type. Turns ratio, 15:1; primary impedance, 13,000 ohms. All are of the open frame channel type mount mounting. Chicago Standard Transformer Corp., 3501 Addison, Chicago 18, Ill.

For more data, circle 10-79-4 on coupon, p. 43

Capkit INTERCOM

A transistorized intercom system, with range up to 1 mile, is powered by four penlight batteries. "Telecall" offers communication for home, business or outdoor use. One model is for door



answering. Any combination of "master" and "remote" stations are available. Model TP-KS comes ready to operate, in a set of 1 "master" and 1 "remote" station with 60 feet of wire. Capkit International, 816 W. Olympic Blvd., Los Angeles 15, Calif

For more data, circle 10-79-5 on coupon, p. 43

TRUST YOUR TV TUNER REPAIR and ALIGN to **JW**

24 HR SERVICE

VHF or UHF—ALL MAKES

VHF Tuners.....	\$950
UHF Tuners.....	net
UHF Converters.....	
UHF-VHF Combinations.....	\$17.95



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

10 STEPS IN OUR GUARANTEED SERVICE

1. All tuners mechanically and electronically inspected.
2. All necessary parts replaced.
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4. First test run for intermittents and drift indication.
5. Fine tuning range checked on all channels.
6. Local osc aligned to correct frequency all channels—XTAL controlled.
7. RF alignment—all channels—XTAL controlled.
8. AGC check, all channels—cut off of RF amp checked.
9. Overall response all channels, shield covers in position.
10. Quality control FINAL CHECK ALL UNITS, UHF-VHF.

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

JW ELECTRONICS 1540 W. Jarvis Avenue
CHICAGO 26, ILLINOIS Broadway 4-9757

For more data, circle 10-79-1 on coupon, p. 43

ELECTRONIC TECHNICIAN • October, 1960

NEW!

Only
Grid Circuit
Tube Tester
with Full TV
tube coverage!

SECO GRID CIRCUIT TUBE TESTER

Introducing the new Seco GCT-9—the first and only Grid Circuit Tester that offers you complete coverage of all TV tube types—including voltage amplifiers, power output and heater-type diodes, hundreds of Foreign and Industrial types as well as types with Grid, Plate or Cathode caps. Quickly lets you test for Grid Emission, Leakage, Shorts and Gas in one operation—indicates results instantly, visually on a 6AF6 "Eye" Indicator. In addition to conventional tests, the GCT-9 also offers two exclusive new testing features not found on any other tester: 1. Cathode Continuity Check; and 2. Complete Inter-Element Short Test, with shorts identified to pin numbers.

The new Seco GCT-9 is available in a sturdy metal case with exposed panel (GCT-9S); or mounted in a compact, portable carrying case (GCT-9W)—complete with easy to read tube set-up data. Equipped with new "Piggy-Back" adapter so you can mount either unit right to your tube caddy—unit may be removed for use in seconds! Wired and factory tested.

MODEL GCT-9S **\$3295** NET MODEL GCT-9W **\$3495** NET

WRITE TODAY! New literature available on all Seco test equipment.

SECO ELECTRONICS, INC.
5015 Penn Ave. So. • Minneapolis 19, Minn.

EAST CANADA: Daveco Agencies, Ltd., Montreal, Quebec
WEST CANADA: Ron Merritt Co., Vancouver 1, B.C.

For more data, circle 10-79-2 on coupon, p. 43

NOTICE

The **Billboard** confirms Fidelitone's growing lead at 41.7% over nearest needle competitor

BILLBOARD'S MUSIC MERCHANTS' 1960 ACCESSORIES SURVEY REPORTED ON PHONOGRAPH NEEDLES:

"Relative standing of brands according to percentage of all dealers who reported one or more sales:"

FIDELITONE	34%	BRAND X	20%
BRAND V	24%	BRAND Y	20%
BRAND W	21%	BRAND Z	16%

All others reported were 8% or less.

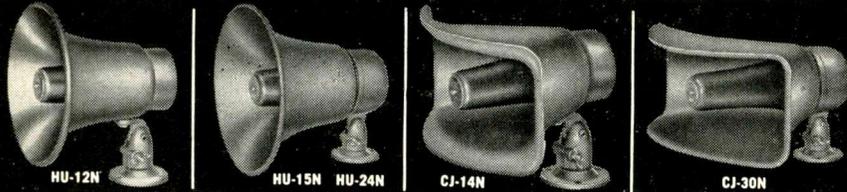
These figures reflect the strong consumer preference for the Fidelitone Phonograph Needle line . . . a growing preference that will increase even more as a result of Fidelitone's powerful new ad campaign. A preference that will make more sales for you . . . faster than ever before. Do you handle the Fidelitone line? Order Fidelitone now.

Fidelitone

"Newest shape on records"
Chicago 26, Illinois

For more data, circle 10-80-1 on coupon, p. 43

ATLAS "Job Rated" P. A. SPEAKERS



There is an Atlas Speaker Ideally Suited for Every Job

All Atlas P. A. speakers are highly efficient, especially in the voice frequency range, providing the extra "punch" needed to override high level background noise. Most are 100% weatherproof; aluminum and diecast parts are treated with corrosion inhibitors, then finished in "stone hard" baked enamel. The CJ Cobra-Jector horns are constructed of nonresonant, indestructible fiberglass, and HU and TP speaker horns of aluminum, finished in gun-metal grey. The HU and TP speakers are particularly designed for efficient talkback operations. The peaked characteristics within the voice frequencies increase the sensitivity of these speakers as pickup devices.

All HU and CJ speakers are equipped with versatile "Versalock" . . . This rugged, reliable mounting bracket, completely adjustable both horizontally and vertically, provides positive locking in any position.

The DU-12 and DC-5, Atlas' renowned DeCor projectors, are styled to harmonize with any decor, modern or traditional.

Send for free catalog to Dept. "T-10"

Model	HU-12N	HU-15N	HU-24N	CJ-14N	CJ-30N	CJ-44	TP-15N	TP-24N	DU-12	DC-5
POWER*	7.5 w	25 w	25 w	7.5 w	25 w	60 w	25 w	25 w	7.5 w	6 w
IMPEDANCE**	8 ohm	8 ohm	8 ohm	8 ohm	8 ohm	16 ohms	8 ohm	8 ohm	8 ohm	8 ohm
FREQUENCY C.P.S.	350-10,000	250-10,000	200-10,000	400-10,000	250-10,000	150-9000	250-10,000	200-10,000	400-10,000	120-7000
LENGTH OVERALL	7 1/4 in.	8 3/4 in.	12 in.	8 in.	1 1/4 in.	23" x 13"	16 1/2 in.	23 in.	14 in.	14 in.
BELL DIAMETER	7 1/2 in.	9 3/4 in.	11 1/4 in.	9 1/2" x 5 1/2"	14" x 6"	19 in.	9 3/4 in.	11 1/4 in.	7 in.	7 in.
NET PRICE	\$16.20	\$20.10	\$22.35	\$18.00	\$24.60	\$43.50	\$31.20	\$34.50	\$19.80	\$13.20

*Input range limited to frequencies above horn cutoff **All models available in 45 ohms at slightly higher prices



ATLAS SOUND CORP.
1449 39th Street
Brooklyn 18, N. Y.
In Canada:
Atlas Radio Corp., Ltd.,
Toronto, Ontario

For more data, circle 10-80-2 on coupon, p. 43

Aging TV's

(Continued from page 75)

the failure may never be noticed by the customer. The coupling capacitor feeding to the output tube grid may leak and cause a critical condition in contrast control adjustment. Unless completely shorted, the circuit is seldom thoroughly checked and the partially shorted capacitor goes unnoticed.

An open resistor in the 1st video i-f control grid may go undetected in high signal areas. Stage gain may not be reduced sufficiently to require circuit troubleshooting, and the only visible change is a different setting of the contrast and brightness controls to suppress vertical retrace lines.

Leakage in the video output circuit can change the CRT brightness and contrast levels. Plate circuit resistor value changes and leaky video coupling capacitors can cause unbalance in picture contrast and brightness values.

Some years ago the writer discovered an original resistor of incorrect value in the CRT circuit of a TV chassis which had not previously been removed from the cabinet. The set was in the shop for high voltage repairs. The customer had operated the set for two years in this condition. After high voltage repairs were made, the picture appeared dull with little contrast, although the CRT was an aluminumized type. A careful check of the CRT circuitry against manufacturer's specifications revealed the assembly-line faux pas. It was difficult to convince the customer that we had returned the same set. He wanted to know if the picture tube had been replaced.

Sound Defects

Hum and "buzz" constitute most of the causes for audio complaints in older TV's. Poor filtering, quadrature coil and ratio detector defects are general. In one group of sets with a typical circuit as shown in Fig. 5A, hum could not be reduced until the audio output circuit was revised as shown in Fig. 5B.

Many older sets (as well as new) employ gated-beam FM detector

type circuits with a quadrature coil. Intermittent distortion in the sound is usually caused by a defective screen bypass capacitor.

Tuner Weaknesses

Snowy pictures and blank rasters are often caused by bad tubes or a definite breakdown in the tuner. But normal aging can create annoying "drift" problems that require constant re-tracking of the signal with the fine tuner adjustment, usually after the set has been on a few hours.

A tuner may drift because of a defective 10 or 12 $\mu\mu\text{f}$ capacitor in the oscillator section. Many tuner complaints, however, are of a different nature—usually requiring only a thorough cleaning to eliminate the complaint. Cleaning should be done with commercially available cleaning agents designed for this purpose. Under no circumstances should carbon tetrachloride (carbon tet) be used. Chemical research tests have proven carbon tet to be dangerous to health and

an inadequate electronic contact cleaner. It leaves a film deposit which promotes oxidation and may do more harm than good.

The Standard Coil type tuner at times develops intermittent faults caused by a poor ground connection at the center spring contact. With the drum removed, the center contact spring can be carefully reshaped outward to restore normal operation.

The technician cannot guarantee life or death to a customer's old TV. He can, however, augment his reputation in the community and serve his customers well by selling a thorough job—rather than a series of "patch-up" deals that cost the customer more in the long run. •

Want a Christmas

GIFT IDEA

See page 64

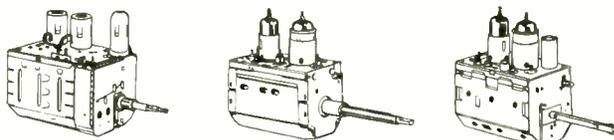
TACO PACKAGED FM ANTENNA

Packaged in a colorful carton, designed to spur impulse and traffic sales, "Lark" gold anodized FM antenna is available as an individual antenna and also as a complete kit. The "Lark" is an 'S' type all-direction de-



sign providing high gain over the entire FM range. It may be mounted to an existing mast or installed in attics or other out-of-the-way locations. The "Karry Karton" has knock-out carrying handle for easy pick-up and carry. Technical Appliance Corp., Sherburne, N. Y.

For more data, circle 10-81-3 on coupon, p. 43



TUNERS REPAIRED \$8.50
24-Hour Service 6-Month Warranty
Repair Charge includes
ALL Replacement Parts

SARKES TARZIAN, INC., pioneer in the Tuner Manufacturing business, offers fast, dependable, factory repair service on all makes and models. Cost—\$8.50 per unit. \$15 for UV combinations. Now offering 6-month warranty against defective workmanship and parts failure due to normal usage. Tuners repaired on approved, open accounts. Replacements available at low cost on tuners beyond practical repair.

Ⓢ Tarzian-made tuners easily identified by this stamping. When inquiring about service or replacements for other than Tarzian-made tuners, always give tube complement . . . shaft length . . . filament voltage . . . series or shunt heater . . . IF frequency, chassis identification. And, allow a little more time for service on these tuners. Use this address for fast, factory repair service:

SERVICE MANAGER • TUNER DIVISION
 Dept. B

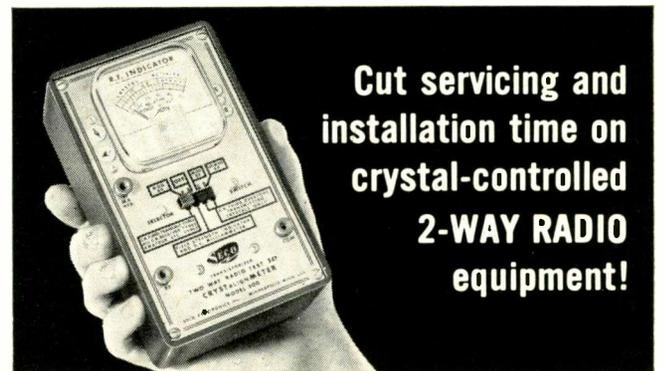
SARKES TARZIAN INC

east hillside drive • bloomington, indiana
 edison 2-7251

Mfgs. of Tuners, Semiconductors, Air Trimmers, FM Radios, Audio Tape, and Broadcast Equipment

For more data, circle 10-81-1 on coupon, p. 43

ELECTRONIC TECHNICIAN • October, 1960



Cut servicing and installation time on crystal-controlled 2-WAY RADIO equipment!

SECO 2-WAY RADIO TEST SET

Compact, portable, use it anywhere. Designed to assist you in the following applications:

- CHECKS WIDE RANGE OF CRYSTAL TYPES! Checks fundamental types at fundamental frequency—5th and 7th overtone types at fundamental frequency—3rd overtone types in 25-30 mc range in special overtone circuit.
- RF POWER INDICATOR FOR DIRECT OR REMOTE METERING! Simply place next to antenna or use 15 ft. remote metering cable furnished with unit.
- MODULATED RF CRYSTAL-CONTROLLED SIGNAL GENERATOR!
- MODULATION CHECKER! • BEAT FREQUENCY DEMODULATOR!
- PLATE MILLIAMMETER FOR RF TUNING! • AUDIO FREQUENCY SIGNAL GENERATOR!

MODEL 500—Fully transistorized—the perfect "assist" instrument even for the fully equipped shop. **\$29.95 NET**

NEW! T-6

PIGGY-BACK ADAPTER

for tube caddies!

Developed by Seco to save you steps! Free with Seco tube testers or by enclosing 25¢ with coupon.

SECO ELECTRONICS, INC.
 5015 Penn Ave. So.—Minneapolis 19, Minn.

Please send free literature on all Seco Test Equipment.

I have enclosed _____ Please send _____ Seco "Piggy-Back" Adapters. (25¢ each.)

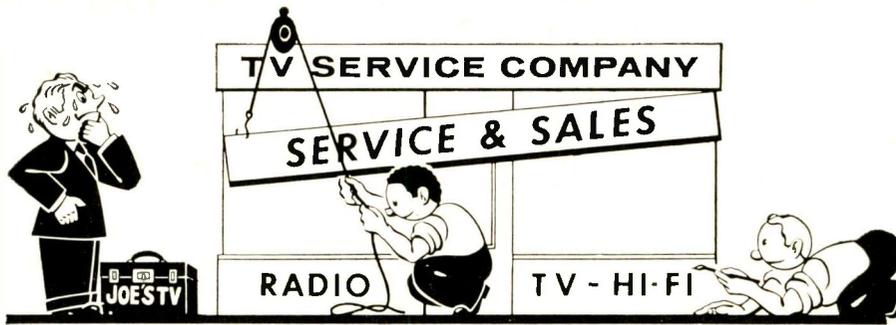
NAME _____

ADDRESS _____

CITY _____ STATE _____

EAST CANADA: Daveco Agencies, Ltd., Montreal, Quebec
WEST CANADA: Ron Merritt Co., Vancouver 1, B. C.

For more data, circle 10-81-2 on coupon, p. 43



What To Do When A New Competitor Appears

Counter New Competition With A Planned Program

ERNEST W. FAIR

• In some businesses the problem of a new competitor appearing is remote. However, we are in a line of business that may find a new electronic service shop opening up in the immediate area we serve.

Far too many TV shop owners are caught flat-footed when this happens and, if the new competitor turns out to be an aggressive business man, may suffer to a great extent.

There is no need for such a situation with even the average shop operation. With proper preparatory steps any shop owner can meet new competition without serious damage to his business. Based on a study of the men who have done just that, here are suggestions on what to do when that new competition appears.

Begin planning as quickly as you can—preferably the very day you first learn of the new shop (usually one can have a month or more in which to carefully work out a business plan).

Where action is taken after the opening of a new competitor, we are apt to do things in haste. Advance planning enables us to intelligently plan our actions.

Put your own house in order. Whatever competition looms it's a good time to self-examine your own business methods.

You can lose business permanently to new competition when we fail to satisfy the needs of our present customers. On the other hand, the shop owner offering his customers every courtesy and service they would obtain anywhere else is giving them very little reason to take their business elsewhere.

Spruce up, clean up, paint up—for in all probability you are going to have to do business against a brand new spic-and-span shop, trucks, etc. This, in itself, will attract some customers. If your own shop is clean, freshly painted and as modern in appearance as it can be made—then the new one will have far less effect on your customers.

Remind employees to take stock of the manner in which they treat customers. Courtesy, consideration and a policy of always showing customers how much their business is appreciated is important. It is very easy to become complacent and particularly so when local competition doesn't exist. Neat clothing and clean shaves are imperative.

What sort of a shop will the new one be? Will it handle services, accessories, etc., that you are not making available to your customers? Why not beat him to the punch and make these new services and sales available right now? Do it weeks before he can open up.

Find out in advance what premium offers the new competitor will make as part of his grand opening. Make your own plans to match his offers.

As soon as you learn of such nearby competition carefully study your customer lists and pick out those very good customers who keep you in business. Concentrate on giving these particular customers the maximum possible service they could obtain from any shop anywhere. You've worked too hard and long to lose them. They are the nucleus of your business; retain them and nothing the competitor does can affect your business to any great extent.

Be prepared to lose some business during the first few months. No matter what steps you take some business will go to the new shop simply because it is new and many people are curious. Most such customers, if they have been treated properly, will return to you.

Have you had to tell your customers during the last few weeks that you could not fulfill some requested service? These are the things you may wish to handle right now to make your own shop a more complete operation and become a better adversary in the competitive battle ahead. When you take this step be sure you do some advertising to tell

your present customers what you have done.

Don't get panicky about the new competition. It is very difficult to do any constructive competitive planning in such a frame of mind. No matter how big or elaborate the new competitor or how he will dwarf your own enterprise remember, you have been in business for a long time while he has yet to start. It is also a proven fact that an additional shop will often attract more business to the area than exists at present. It could very well be that if you match his services your own business will be increased by the presence of this shop; it has happened many times.

Make some promotional efforts, either house-to-house within your immediate location area or by mail. This can be done through house-to-house circular distribution or by a simple post card.

Such promotional efforts, in advance of the new competitor's opening, will take the edge off any publicized methods he uses. Remember also, that he cannot afford to start such promotional efforts two or three weeks in advance of his opening since he cannot take immediate advantage of the interest it will arouse. You can.

Finally, spare no effort in improving window display space you may have with attractive signs calling attention to your services and premiums. Neglect these steps and this competitor will have easy sailing in establishing his business. Give them big emphasis and his chances of hurting your own business enterprise become additionally remote. ●

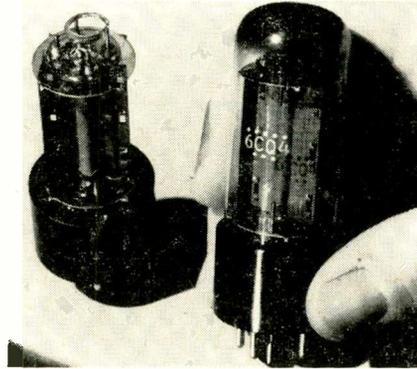
Sylvania TUBES

A variety of "Bonded Shield" 23" TV picture tubes, added to the firm's distributor tube line are: Type 23ZP4, an aluminized model with 90° deflection, a non-ion trap construction, and low $E_{G2} = 50v$; 23ANP4, 92° deflection, non-ion trap, aluminized, 6.3v, .600 amp. heater, and low $E_{G2} = 50v$; AR23ANP4/23ATP4, a 23ANP4 whose safety panel is treated with special anti-reflection materials; 23CP4, 110° aluminized, non-ion trap model with Sylvania's standard 110° electron gun; 23UP4, 110° aluminized, non-ion trap model with a 6.3v, .450 amp heater; and 23YP4, 92° deflection, non-ion trap, aluminized, 6.3v, .600 amp heater. Sylvania Electric Products Inc., 730 3rd Ave., New York 17, N. Y.

For more data, circle 10-83-3 on coupon, p. 43

Westinghouse DIODE

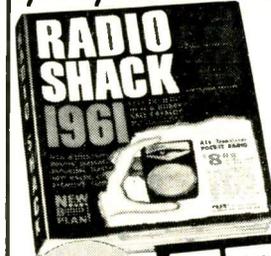
A new damping diode, tube type 6CQ4, for use in horizontal deflection circuits of TV receivers, bears the highest breakdown voltage rating of any single-ended octal-based damper. Rated at 5500v peak and 190 ma average plate current. Plate dissipation,



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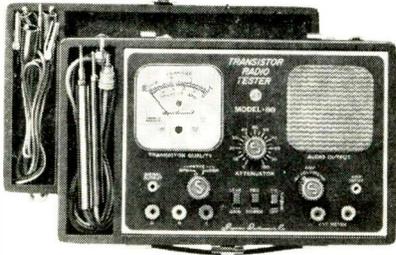
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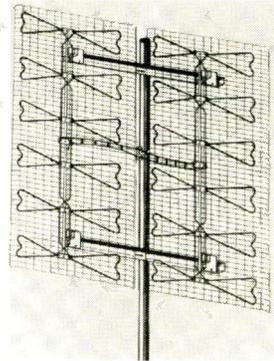
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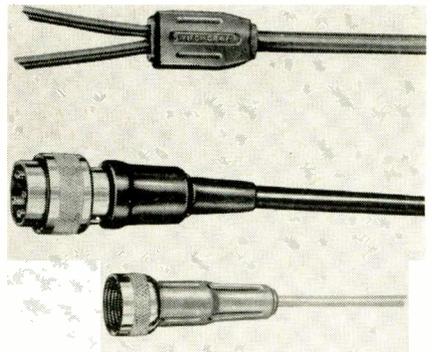
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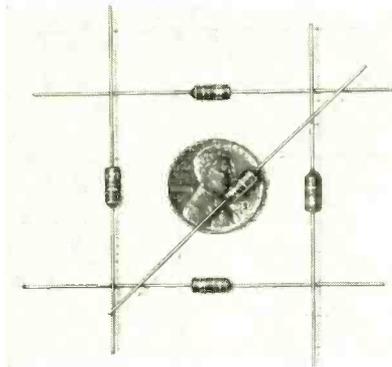


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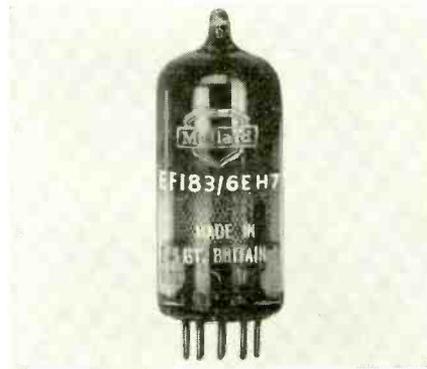


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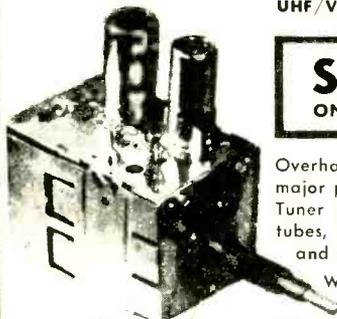
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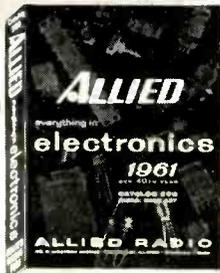
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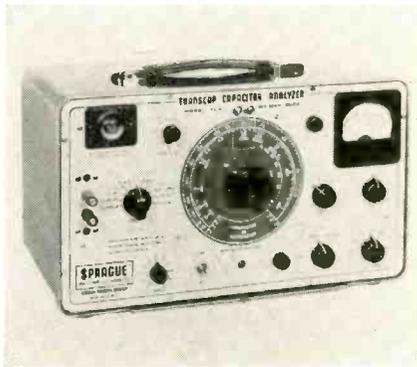
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86

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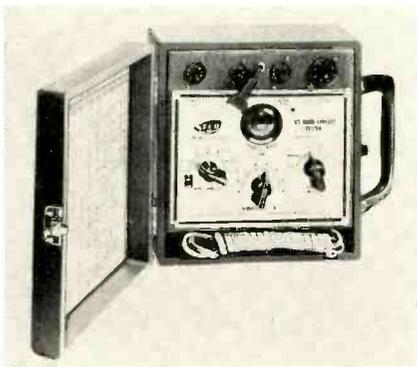


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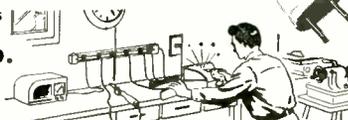
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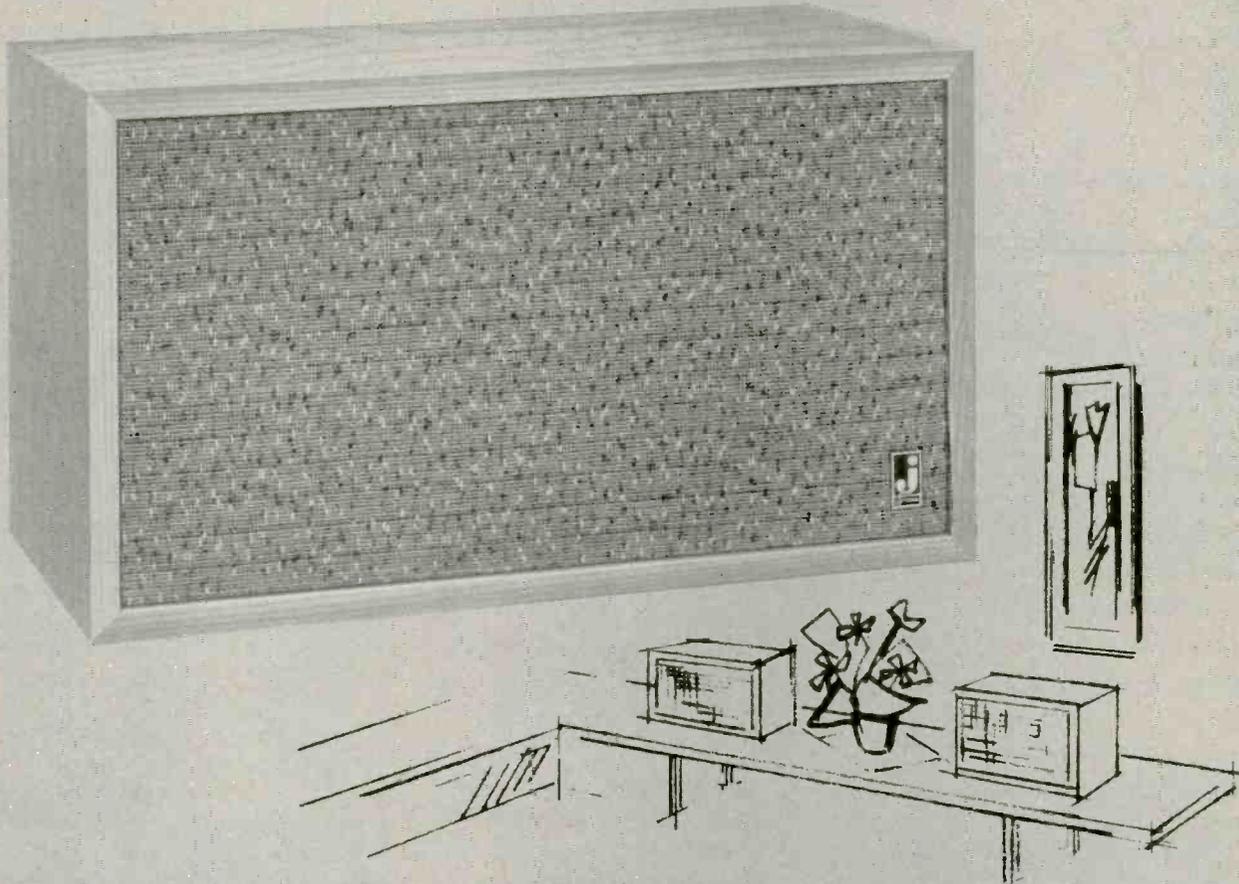
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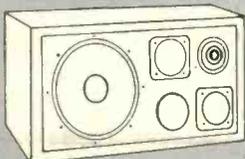
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10-111-1. RAYTHEON CO.

Complete guide to industrial electronic applications, "Industrial Market Master Customer Index," available at 50¢ a copy.

10-95-1. SYLVANIA

Booklet, "Sylvania Industrial Tubes," available free of charge.

10-122-1. TUNG-SOL ELECTRIC

"Tung-Sol Tips" is a series of publications on electronic subjects. Current one is on dc power supplies.

10-94-1. VOCALINE CO. OF AMERICA

4-channel Commaire ED-27M citizens band radio. Adapts for wireless paging.

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 November 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 10-92-1 means Oct. issue, page 92, 1st item on page.

TEAR OUT

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

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

- | | | | | | |
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| 10-94-1 | 10-114-3 | 10-114-13 | 10-115-2 | 10-116-4 | 10-120-7 |
| 10-95-1 | 10-114-4 | 10-114-14 | 10-115-3 | 10-116-5 | 10-121-1 |
| 10-96-1 | 10-114-5 | 10-114-15 | 10-115-4 | 10-116-6 | 10-121-2 |
| 10-111-1 | 10-114-6 | 10-114-16 | 10-115-5 | 10-119-1 | 10-121-3 |
| 10-111-2 | 10-114-7 | 10-114-17 | 10-115-6 | 10-120-1 | 10-122-1 |
| 10-111-3 | 10-114-8 | 10-114-18 | 10-115-7 | 10-120-2 | |
| 10-111-4 | 10-114-9 | 10-114-19 | 10-115-8 | 10-120-3 | |
| 10-111-5 | 10-114-10 | 10-114-20 | 10-116-1 | 10-120-4 | |
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Company Name Position

Street City & State

Please check one: I am supervisor of industrial electronic installation, maintenance or operation . . .

I personally maintain, operate, or install industrial electronic equipment . . .

Neither of above

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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.

The reason IEM readers are also authors is that they are best equipped to tell about the techniques used to install, operate and maintain electronic equipment from actual on-the-job experience. You can let others learn from your own specialized knowledge, contribute to the body of technical literature in the field—and profit from your writing efforts.

Reader-authors need not be literary giants. The editors work closely with authors, and help them prepare manuscripts to make them suitable for publication.

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:

Editor:

INDUSTRIAL ELECTRONIC MAINTENANCE

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WHAT'S AHEAD IN IEM

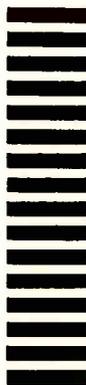
Forthcoming issues of

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:

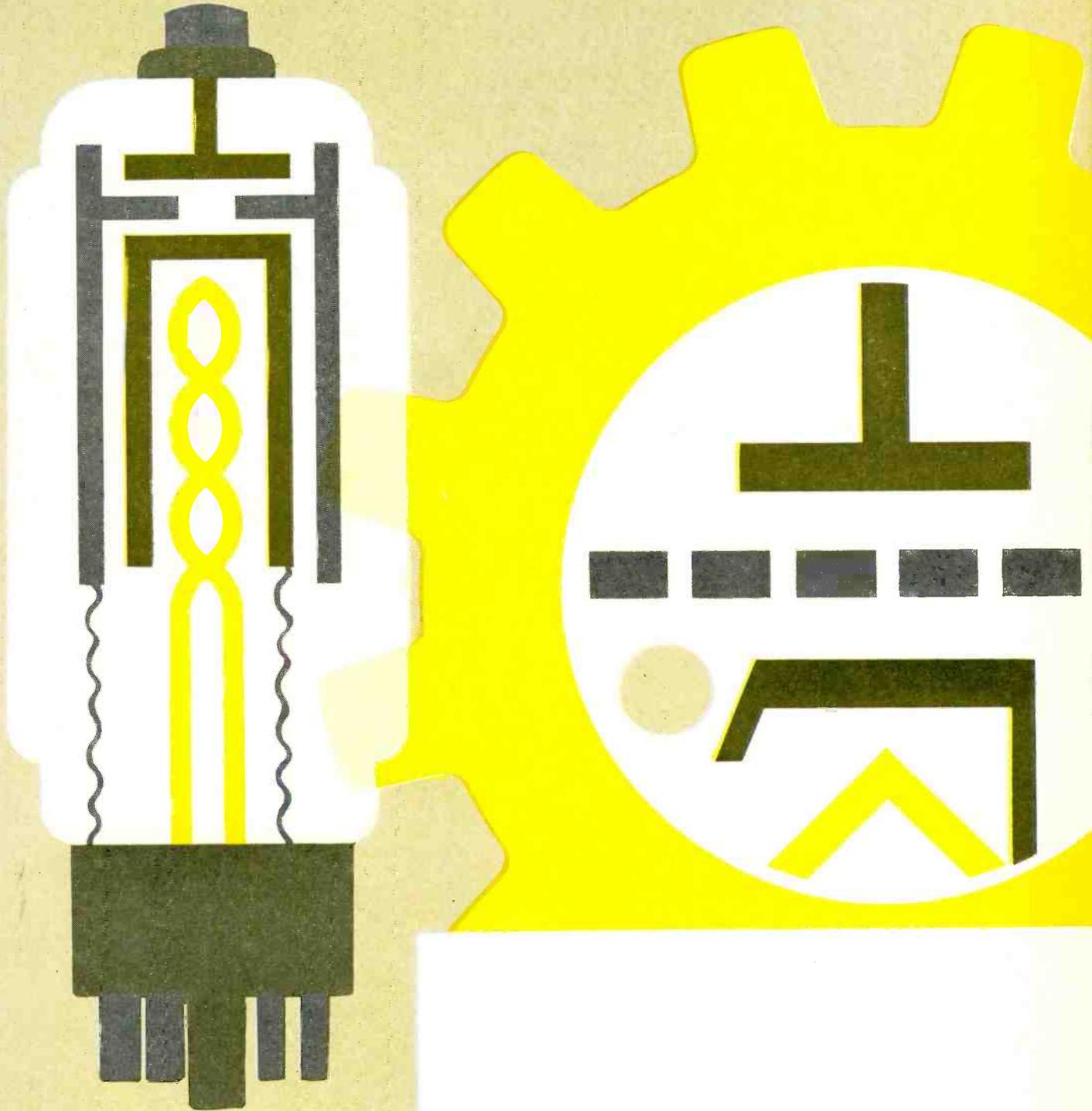
Plant Engineering Techniques
Controls for Automation
Laboratory Measurements
Maintaining Closed-Circuit TV
Troubleshooting Visual Indicators
Setting Up A Plant Intercom System
Digital Recording Techniques
Installing & Servicing Control Timers
Adjusting 2-Way Radios
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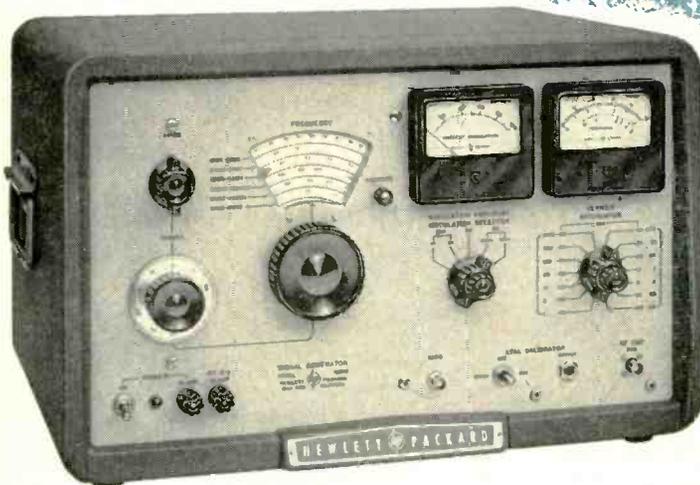
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NOW!

Constant output level
Constant modulation level
3 volt output into 50 ohms
Low envelope distortion

50kc
TO
65MC



New -hp- 606A HF Signal Generator

Here at last is a compact, convenient, moderately-priced signal generator providing constant output and constant modulation level plus high output from 50 kc to 65 MC. Tedious, error-producing resetting of output level and percent modulation are eliminated.

Covering the high frequency spectrum, (which includes the 30 and 60 MC radar IF bands) the new

hp 606A is exceptionally useful in driving bridges, antennas and filters, and measuring gain, selectivity and image rejection of receivers and IF circuits.

Output is constant within ± 1 db over the full frequency range, and is adjustable from +20 dbm (3 volts rms) to -110 dbm (0.1 μ v rms). No level adjustments are required during operation.

SPECIFICATIONS

Frequency Range: 50 kc to 65 MC in 6 bands.

Frequency Accuracy: Within $\pm 1\%$.

Frequency Calibrator: Crystal oscillator provides check points at 100 kc and 1 MC intervals accurate within 0.01% from 0° to 50° C.

RF Output Level: Continuously adjustable from 0.1 μ v to 3 volts into a 50 ohm resistive load. Calibration is in volts and dbm (0 dbm is 1 milliwatt).

Output Accuracy: Within ± 1 db into 50 ohm resistive load.

Frequency Response: Within ± 1 db into 50 ohm resistive load over entire frequency range at any output level setting.

Output Impedance: 50 ohms, SWR less than 1.1:1 at 0.3 v and below.

Spurious Harmonic Output: Less than 8%.

Leakage: Negligible; permits sensitivity measurements to 0.1 μ v

Amplitude Modulation: Continuously adjustable from 0 to 100%.

Internal Modulation: 0 to 100% sinusoidal modulation at 400 cps $\pm 5\%$ or 1000 cps $\pm 5\%$.

Modulation Bandwidth: Dc to 20 kc maximum.

External Modulation: 0 to 100% sinusoidal modulation dc to 20 kc.

Envelope Distortion: Less than 3% envelope distortion from 0 to 70% modulation at output levels of 1 volt or less.

Spurious FM: Less than 0.0001% or 20 cps, whichever greater.

Spurious AM: Hum and noise sidebands are 70 db below carrier.

Frequency Drift: Less than 0.005% or 5 cps, whichever greater.

Price: (cabinet) \$1,200.00. (rack mount) \$1,185.00.

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

HEWLETT-PACKARD COMPANY 5023T Page Mill Road, Palo Alto, California, U.S.A.

Cable "HEWPACK" • Davenport 6-7000 • Field Representative in all Principal Areas.



world's most complete line of signal generators

For more data, circle 10-92-1 on card, p. 89

ELECTRONIC TECHNICIAN (IEM Section) • October, 1960



INDUSTRIAL ELECTRONIC[®] MAINTENANCE

The Publication of Plant Engineering, Application & Repair

October, 1960

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ALBERT J. FORMAN
Editor

HOWARD A. REED
Publisher

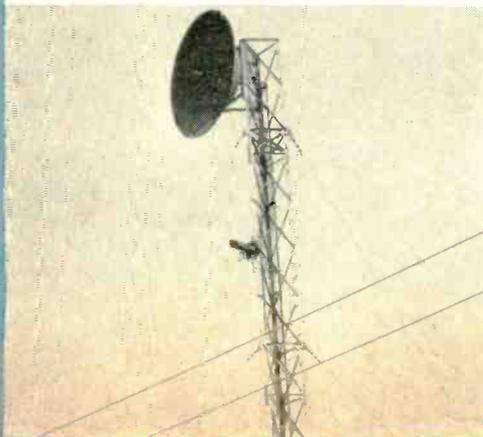
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Vol. 2, No. 4

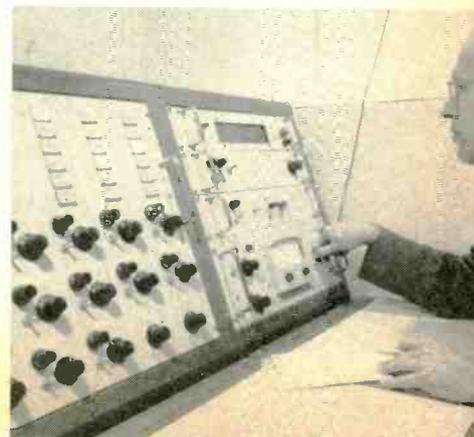
MICROWAVE MULTIPLEXING systems provide economical radio telephone, teleprinter, and data processing channels for industry and business—see p. 104.



STRAIN GAGES weigh giant aircraft, and perform a multitude of other industrial weighing, measuring and automated control operations—see p. 100.



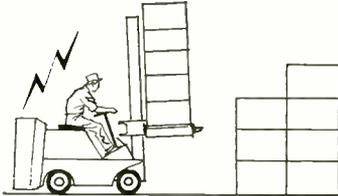
ANALOG COMPUTER converts ice cream recipe to digital formula and produces uniform product at H. P. Hood and Sons ice cream plant—see p. 108.





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ED-27M CITIZENS BAND RADIO



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The industrial
communication system
that's easiest to
install and service!

Practical, dependable, economical, an ideal method of industrial communications. The Commaire ED-27 citizens band radio affords complete versatility as it adapts for wireless paging, too. With Commaire, you are assured of transmission and reception unmatched by any other unit in its class — clear, trouble-free communications over a 15 mile radius under normal conditions. No tests to pass to obtain FCC license. The entire unit measures a mere 5¼ x 9¼ x 8¼. For full details in this proven, advanced means of communication, write:

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For more data, circle 10-94-1 on card, p. 89

94



LETTERS To the Editor

Uncooperative Manufacturers

EDITOR, IEM:

First, let me state my personal appreciation of INDUSTRIAL ELECTRONIC MAINTENANCE. As a company primarily engaged in service of medical and industrial, and less in radio and television, this fills a particular need that has never before been published. Information for industrial electronic maintenance had to come (before your magazine) by empirical guess, since rarely did one even have a diagram to go by. This brings us to a highly delicate question, that of cooperation by the manufacturer. While there are many factories which gladly give you information and parts to service their instruments, there are still many who seem to think that their service men alone (at the factory level) are capable of servicing their instruments. This often leads to bad taste on the part of the owner of the equipment, who must get the instrument in operation as quickly as possible, and cannot afford the delays involved in shipping and waiting for overloaded service facilities of the factories to decide to make necessary repairs. Oftentimes the repair involved is a simple replacement of a special power transformer, which, unfortunately, cannot be obtained from the usual electronic supply centers.

Factories which make electronic products and appoint service centers, either their own, or independent service companies, and keep these people supplied with information concerning the servicing of their products, usually end up with the bulk of the business. Factories which crawl into their shell and do not allow the individual to maintain his apparatus, usually end up having their equipment shoved in a corner by the owner, who purchases from a competitor when the time is ripe for him to replace the instrument. Especially is this true in the deep South, where "factory service" is sometimes 300 miles away, involving the slow and expensive expedient of shipping, with the necessary dangers of improper packaging for shipping, and subsequent shipping damage, delays due to damage claims, and etc. Isn't it easier to airmail a set of points or a power transformer, and get the instrument back in the hands of the customer immediately, leaving a train of good will, than to insist that only they and God can repair the equipment, with the permission of the shipping companies?

It is high time that factories realize their prime responsibility is to build proper and adequate equipment, and to maintain an adequate supply of

parts to keep this equipment working, and to leave the job of servicing to their logical representatives in the entire country, the man who makes his living on servicing. These people are not his competitors, but rather are his repair department, leaving him (the manufacturer) with adequate repair facilities but without the expense of maintaining a repair department in every little city and town in the country. If the manufacturer wants to insure himself of having the best man for the job, all he has to do is send a representative around the different cities and towns and appoint maintenance centers for his apparatus. Those who have done this are very happy with the results, and make more sales than do their competitors who insist that only the factory can provide service.

CHARLES R. MADUELL, JR.
Electronic Physicist

Delta Electronics, Inc.
New Orleans, La.

Tunnel Diodes Symbol

EDITOR, IEM:

I have been reading articles on tunnel diodes. The tunnel diode is as different from a conventional diode as a transistor is. Therefore, I find that a separate schematic symbol would be helpful to avoid confusion with conventional diodes. I enclose a sugges-



tion for the consideration of those interested. The conventional symbol for a diode is shown unchanged on the left. The suggested symbol for tunnel diode is shown on the right.

J. THOMAS MCCRARY
Brooklyn, N. Y.

Ultrasonic Welder Source

EDITOR, IEM:

On page 75 of your August issue, there is a brief article on the International Ultrasonic Spot Welder. Our Engineering Department is interested in this machine and would appreciate receiving more information on it. Would you please forward any literature you may have or indicate where I may write in regards to this welder. Thank you.

B. F. TANNER, Buyer
Sigma Instruments, Inc.
Boston, Mass.

• You may contact the company at the following address: Mr. Thomas Scarpa, Pres., International Ultrasonics, Inc., 1697 Elizabeth Ave., Rahway, N.J.

News of the Industry

FAIRCHILD has named Dr. ALLEN B. DU MONT as Group Gen. Mgr. of the ALLEN B. DU MONT LABS. Divs.

BECKMAN INSTRUMENTS announces the appointment of ROBERT J. BAUMANN as Mgr. of the Systems Div.

TEXAS INSTRUMENTS Semiconductor Components Div. has named RICHARD J. HANSCHEN as Mgr. of Marketing.

RAYTHEON has appointed HAROLD T. ASHWORTH as Dir. of Manufacturing. Price reductions up to 58% in 24 silicon transistors were announced.

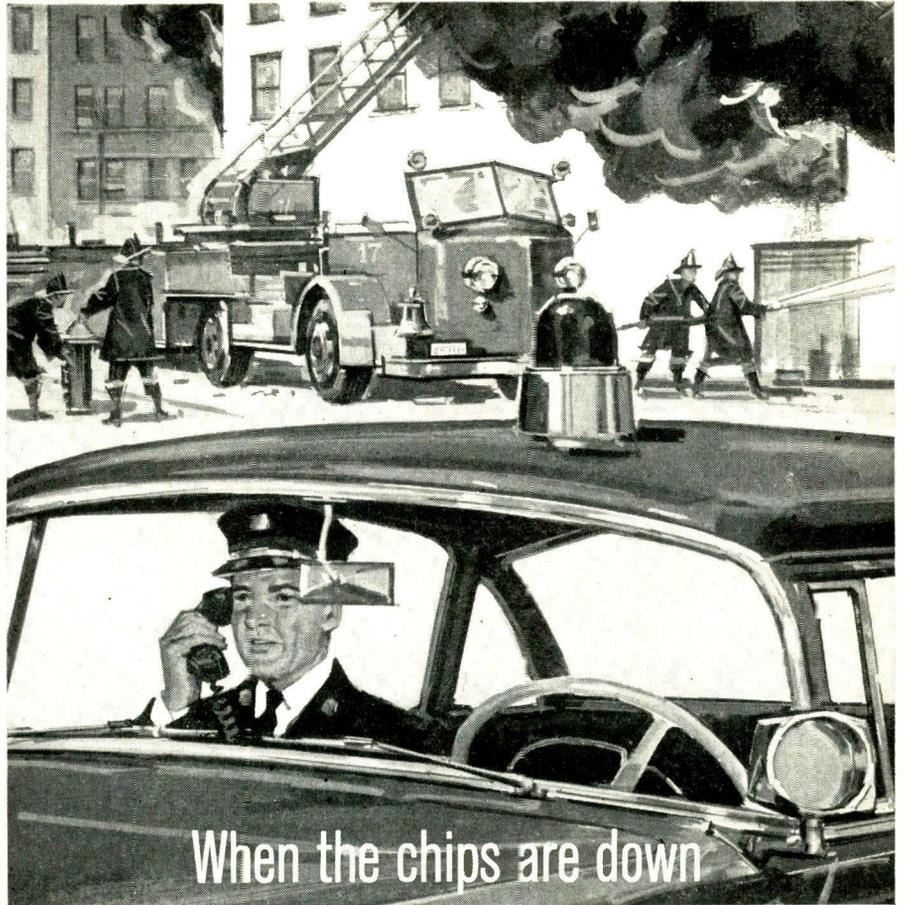
MEASUREMENT CONTROL DEVICES, wholly-owned subsidiary of SCHAEVITZ ENGINEERING, reports the election of PAUL CHERKAS as Pres.

EITEL-McCULLOUGH reports the appointment of EARL J. SHELTON as Mgr. of the newly-formed high-power tube div. Also announced is establishment of a regional sales office in Belleville, N. J. with BILL RATE as Regional Sales Mgr. of the N.Y.-N.J. metropolitan area.

JOHN F. RIDER has announced an agreement with BERNARD T. LEWIS and WILLIAM W. PEARSON to co-author 11 titles in the field of Industrial Management. The Industrial Management Guide Books will carry a list price to permit mass distribution and will deal with subject matter in a practical manner.

GENERAL ELECTRIC Power Tube Dept. has formed two new product sales planning operations for microwave tubes and devices as follows: Palo Alto, Calif. subsection is based at the Microwave Lab. under BERNARD L. PFEFER; and the other is at department headquarters in Schenectady, N. Y. under A. C. ROWE.

RCA Industrial Semiconductor Products Dept. announces entry into the medium power rectifier market with the immediate commercial availability of seven new 20-ampere stud-mounted diffused junction silicon rectifiers. Also reported is the appointment of C. WESLEY MICHAELS to the newly-created post of Mgr., Planning and Market Research for Industrial Electronic Products.



When the chips are down

reliability is up with

SYLVANIA POWER TUBES

Rugged Sylvania Power Tubes like the 6146, beam power tube, pay off with dependable performance—when you need it most. Conservatively rated, they are built to take demanding operation and still offer extended useful service.

Keep your mobile units on the road—replace with Sylvania Power Tubes. For prompt service, just phone your Sylvania Industrial Tube Distributor. Ask him for the "Sylvania Industrial Tubes" booklet. Or write Electronic Tubes Division, Sylvania Electric Products Inc., Dept. 26101100 Main Street, Buffalo, N. Y.



Guide to Popular Sylvania Power Tubes

TYPE	MAX. PLATE DISSIPATION (Watts) (ICAS)	MAX. FREQ. (Mc)
2E24	13.5	125
2E26	13.5	125
2E30	10	160
4X150-A	150	500
807	30	60
812A	65	60
815	25	125
829B	45	200
832A	20	200
5763	13.5	50
5933	30	60
6146	25	60

SYLVANIA

Subsidiary of GENERAL TELEPHONE & ELECTRONICS

For more data, circle 10-95-1 on card, p. 89



ALNOR INSTRUMENT CO., Div. of Illinois Testing Labs., Inc., will be the new name of **ILLINOIS TESTING LABS., INC.**

HUGHES AIRCRAFT Semiconductor Div. has announced a price reduction of 10-55% on its complete line of diodes, transistors, and rectifiers.

CANNON ELECTRIC announces opening of a new Central Service Store at 107 Gateway Rd., Bensenville (Chicago area), Ill., under the supervision of **EDWIN E. LOGAN.**

MOTOROLA has named **DONALD R. SMITH** Mgr. of Distributor Sales for Motorola Semiconductor Products, Inc., Phoenix, Ariz.

DAYSTROM announces the appointment of **HARRY CHADWICK** as Mgr., Repair Service, of the new Weston Instrument Div.'s. repair station in Red Wood City, Calif.

MINNEAPOLIS-HONEYWELL announces appointment of new general mgrs. for two of its Industrial Products Group divs.; **KENNETH BRIERLEY**, Fall River, Mass.; and **JOHN H. HAGEN**, Rubicon Div.

SYLVANIA announces the election of **ARTHUR L. B. RICHARDSON** as a Senior Vice Pres.; **WILLIAM R. RUEGER** has been elected Secy. of the company. The Electronic Tubes Div. has named **HENRY K. KINDIG** as General Manufacturing Mgr. for Picture Tube Operations.

Reps & Distributors

SYNTRON Semiconductor Div. has named **P. J. ENGINEERING SALES CO.** as New England area sales rep.

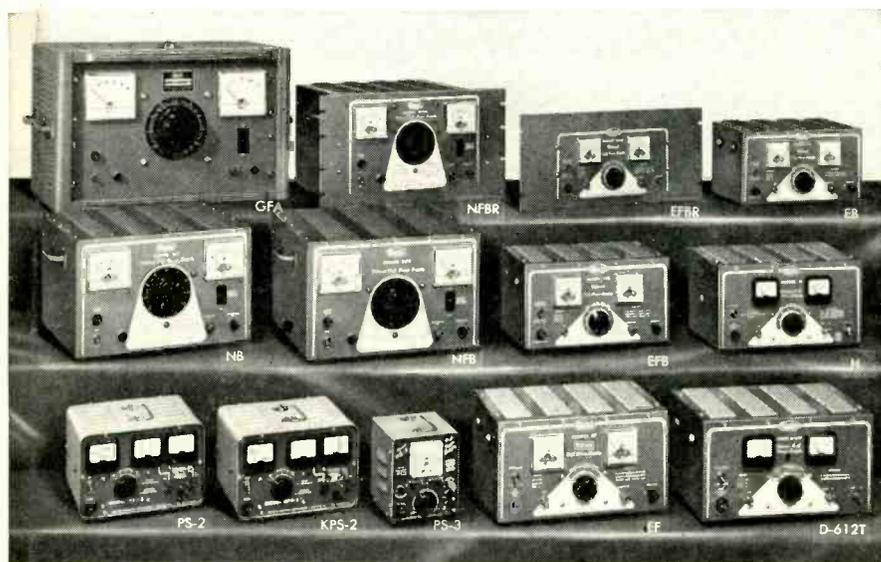
STANDARD RECTIFIER announces the appointment of **HUDSON RADIO & TV CORP.** as industrial distributor.

SCHWEBER ELECTRONICS has announced relocation of its Eastern Sales office to Perpetual Bldg., 8710 Georgia Ave., Silver Spring, Md.

WESCON'S sixth annual Distributor-Representative Conference attracted an anticipated crowd of more than 600 persons at the Los Angeles show.

WARD LEONARD Electronic Distributor Div. has announced the following two industrial distributor appointments: **EAST COAST RADIO OF ORLANDO, INC.** and **INDUSTRIAL ELECTRONIC SUPPLY** of Grand Rapids, Mich.

OSBORNE ELECTRIC CORP. reports appointment of the following four new reps: **MYRON SMITH**, Wash. and Ore.; **CARLSON SALES CO., Ill.**, Wis. and northern Ind.; **WAYNE B. PALIOCA CO.**, New England; and **ROBERT FINLAY** for metropolitan N. Y., N. J., Pa., Dela., Md., Washington, D. C., and Va.



HERE'S EVERYTHING YOU WANT IN A DC POWER SUPPLY

- Economical price and operation
- Low ripple
- Efficient performance
- Continuously variable output
- Thermal cooling
- Reliability unsurpassed
- Overload protection

ELECTRO'S COMPLETE LINE . . . proved in 1000's of applications

Model	Voltage Output	Amperage Output	V/Amp. Meter Scales	Ripple %	Net Price
GFA	0-125	0-10	0-150, 0-20	1	\$550.00
NB	0-32	0-15	0-50, 0-25	5	210.00
NFB	0-32	0-15	0-50, 0-25	1	235.00
NFB	0-32	0-15	0-50, 0-25	1	265.00
EB	0-32, 0-16	0-4, 0-8	0-40/20, 0-10	5	95.00
EFB	0-32, 0-16	0-4, 0-8	0-40/20, 0-10	0.1	120.00
EFBR	0-32, 0-16	0-4, 0-8	0-40/20, 0-10	0.1	145.00
EF	0-28, 0-14	0-5, 0-5	0-50, 0-6	1	86.50
PS-3	0-25, 0-15	0-100 ma; 0-200 ma	0-25, 0-100/200 ma	1 mv	69.50
PS-2	0-20, 0-16	0-75 ma, 0-5	0-20, 0-10, 0-75 ma	0.15, 0.5	49.95
KPS-2	0-20, 0-16	0-75 ma, 0-5	0-20, 0-10, 0-75 ma	0.15, 0.5	43.50
D-612T	0-16, 0-8	0-10, 0-10	0-20, 0-10	0.5	56.00
H	12, 6	0-10, 0-20	0-20, 0-30	5	79.50

See Your Distributor or Write for Literature

ELECTRO PRODUCTS LABORATORIES, 4501-G Ravenswood, Chicago 40

Canada: Atlas Radio Corp., Ltd., Toronto, Ontario

0621

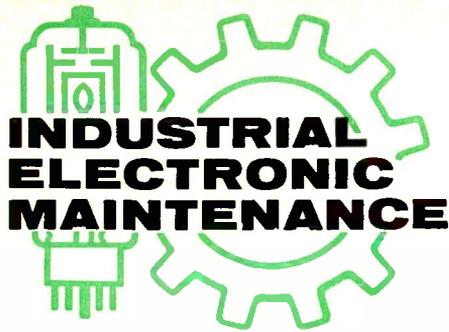


"I take it you've located and fixed the trouble in the transmitter that our own men couldn't find."

For more data, circle 10-96-1 on card, p. 89

ELECTRONIC TECHNICIAN (IEM Section) • October, 1960





COMMENTARY

Computer Field Servicing by Remote Control

Here's an interesting approach aimed at eliminating some of the expensive field servicing of electronic computer control and data logging equipment.

Under a program called Systems Service, users of Daystrom equipment throughout the country can put their installations under the hand of an expert, and have him aid in programming or troubleshooting simply by a telephone call. Once connected to the central console in La Jolla, Calif., the plant operator could cut his system into the telephone line and run his program off the console.

If the system were doing square root and the operator noted, for example, that it was dropping digits, he would report this trouble, and the expert at La Jolla would observe the functioning of various parts of the system. When the trouble point was located, he would direct the plant operator by voice phone to put in an oscilloscope at that point in the system and how to proceed with repairs.

This plan should prove helpful, but no doubt it has the same limitations as a doctor would have in diagnosing a patient from afar.

Ready for Numerical Control?

Like the delicate little lady who steals the show from the big muscle men, electronics proved to be the most fascinating attraction at the recent Machine Tool Exhibition in Chicago.

In particular, the pros and cons of numerical machine control were debated. At the Production Engineering Show in the same city, William C. Moog, President of Moog Servocontrols, Inc., came up with the following questions which fac-

tory management should ask itself when deciding whether numerical control is worth it or not:

1. In terms of sales and plant efficiency, is it vital that lead time be cut to a minimum?
2. Are the operations of your machine tool section complex and varied?
3. Are there several operations involved in your machine set-up?
4. Is the running time of your machines out of proportion to machine set-up time?
5. Are your products so diverse, in type and dimension, that it is impractical to maintain a large inventory of finished parts?
6. Is there excessive wear on your machine tools?
7. Are you frequently required to produce highly complicated parts in short production runs?
8. Is the hazard of possible human error or gaging error a continual threat, due to high precision requirements of complex parts?

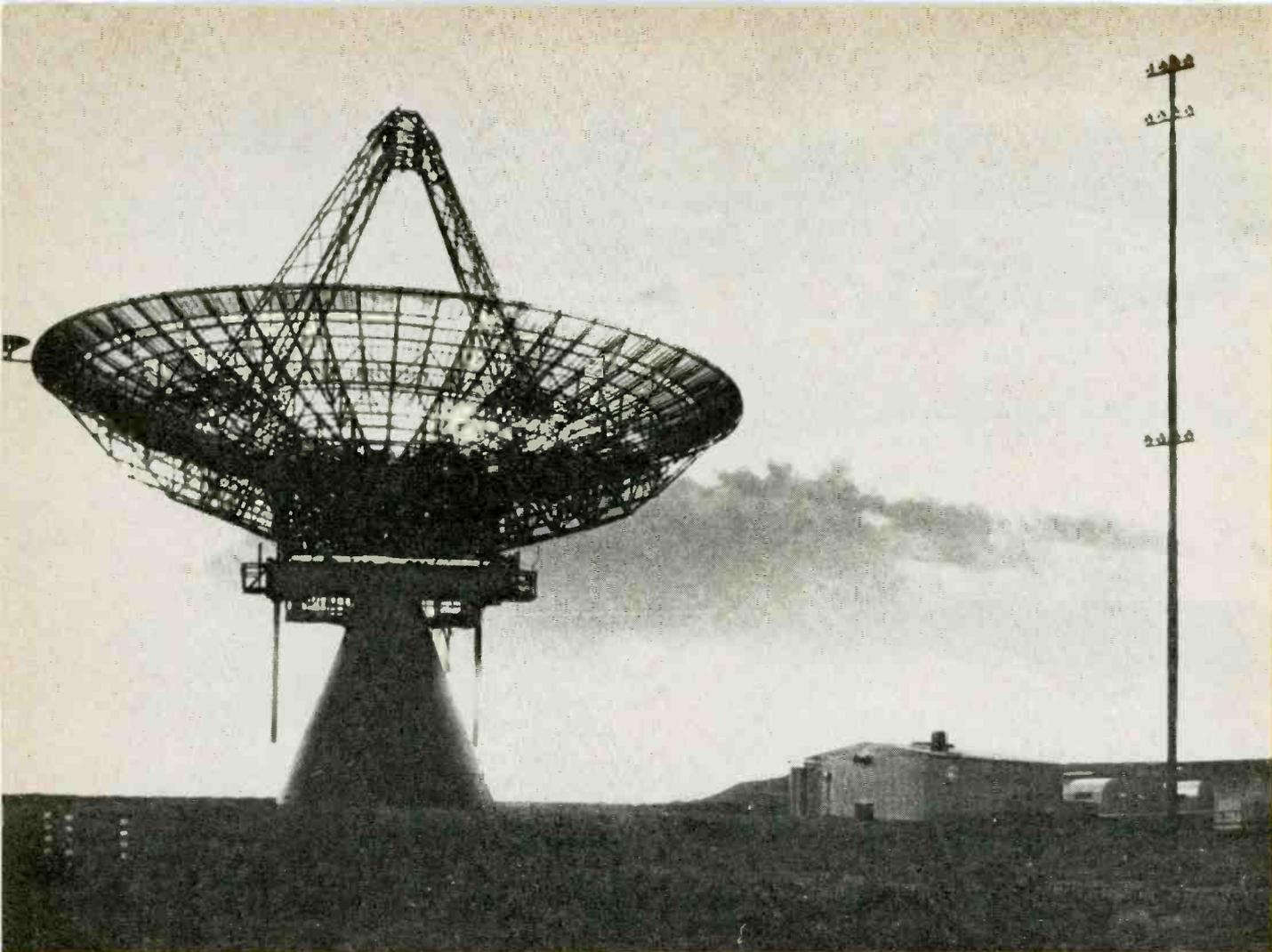
If your answer is "yes" to several or all of these questions, it may be a wise step to investigate any of more than 40 different types of numerical control systems that can automate machine tools from programmed tape, says Moog.

Nuclear Instrumentation

The Atomic Industrial Forum, the association of the nuclear industry, has issued an interesting report, "Business Statistics on the Atomic Industry, 1954-1958." It is available for \$3.50 from the Forum at 3 E. 54th St., New York 22, N. Y.

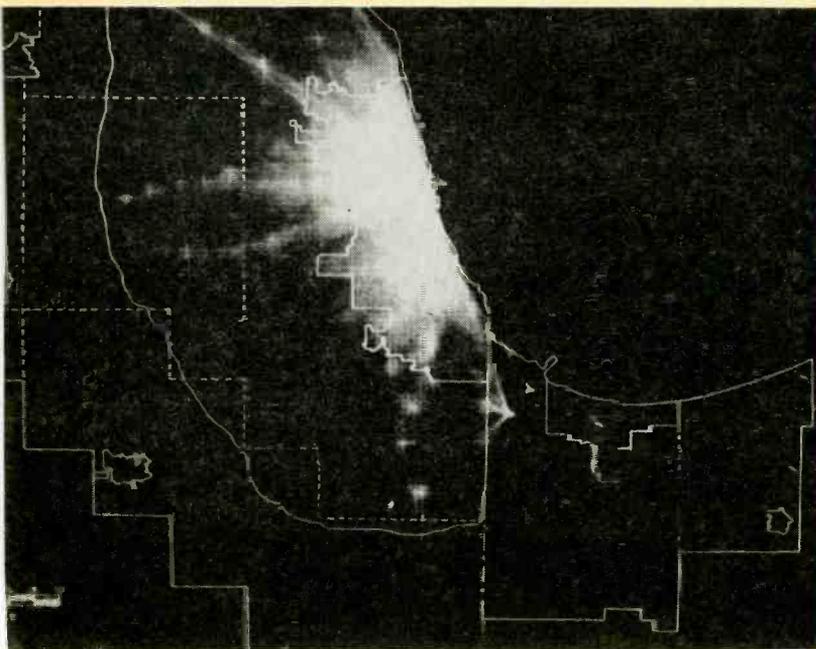
This 36-page report points out that nuclear instrumentation and related electronic equipment sales in 1959 reached \$47.1 million. This was about 7% of total industrial nuclear sales of \$659 million.





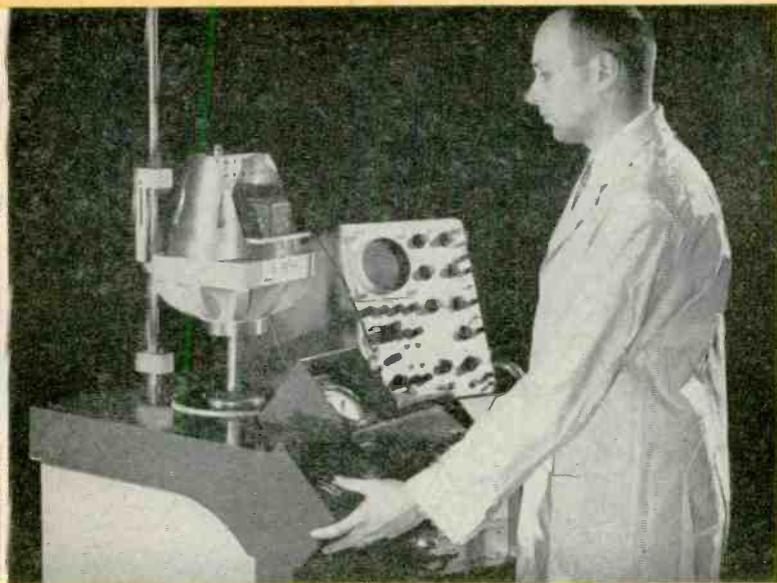
This 200 ton, 110 ft. high equatorially mounted antenna built by Blaw-Knox, and located at Goldstone Tracking Station, Calif., was used in the "Project Echo" experiment. Signals were bounced off an orbiting balloon satellite. This antenna was used to transmit the 2392 mc west-east signal, and to pick up the 960 mc east-west signal. Cal Tech, Bell Labs, NASA, Collins Radio, and IBM were among the participants. Ultimately, a chain of tracking stations around the world is expected to make single-hop microwave communications possible over thousands of miles.

This sample map made on a Cartographatron shows the pattern for automobile trips in the Chicago area. The electronic device, designed by Armour Research, processes thousands of trip cards, and plots "trip desire lines" between origin and destination. Data is stored on magnetic tape. Trip records are read and displayed at a rate of 48/second, as aid to traffic study.

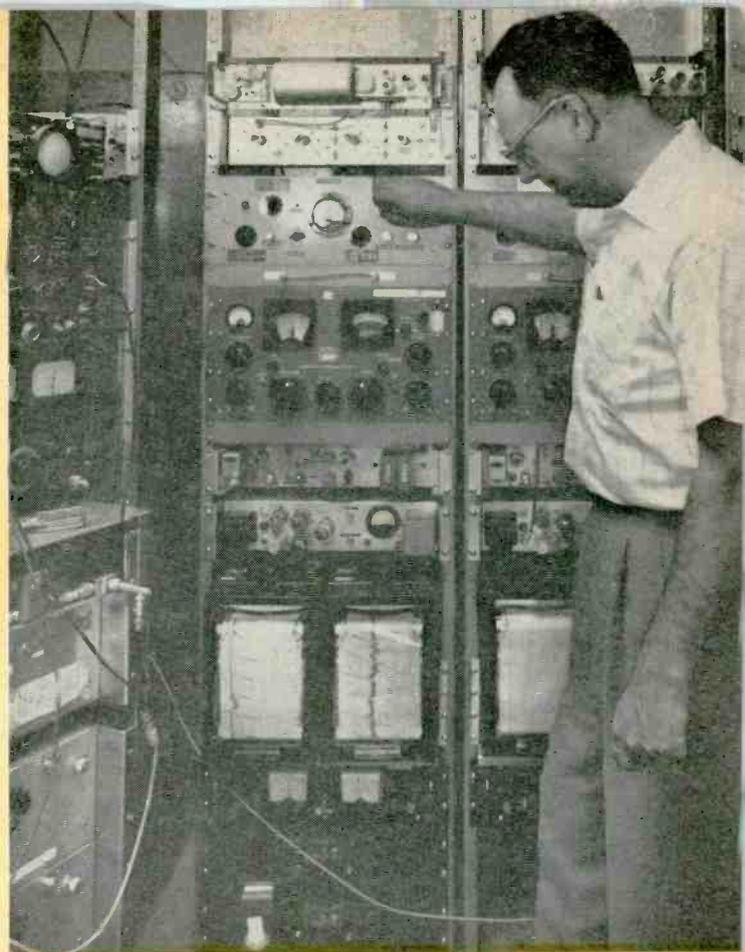


Computers communicate in machine-to-machine telephone calls. This IBM 1009 data transmission unit allows 150 numbers per second to flow from a Model 1401 computer over dial or leased telephone or telegraph lines. The operator is calling a similar computer at a distant office to establish direct connection from the computers' memory.





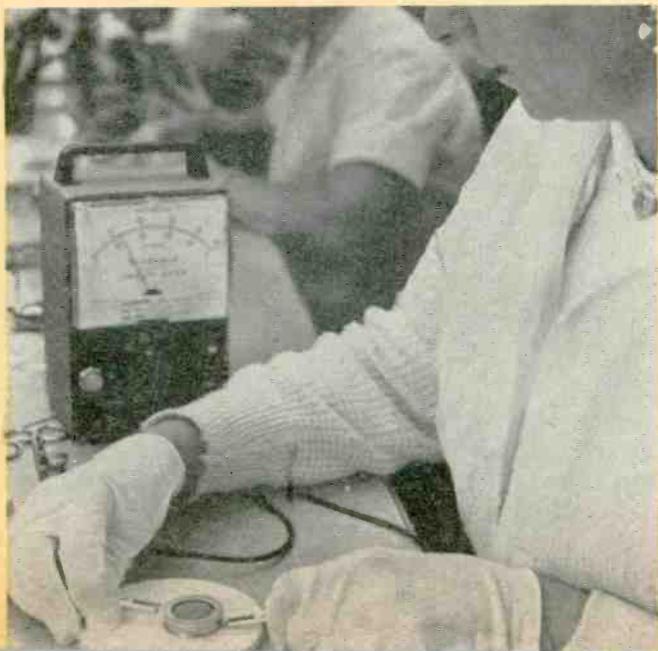
Avco shock test machine for electronic components tests a relay with a 30 g, 11 millisecond half-sine shock. It can test up to 3000 g. There is no superstructure, and the machine relies on air pressure to propel it down during test.



Modulation systems engineer, Harry Patrie, adjusts fading rate recorder developed at National Bureau of Standards. A strip chart records received radio signal fade-rate, the number of times per second that a signal envelope crosses the average level with a positive slope.

VIEWS in the NEWS

Production worker at General Electric tests vacuum thermionic converter, which can produce 1 watt of electrical power from an 1100° C. heat source. Cesium vapor overcomes space charge effect between cathode and anode. Thermal efficiency of 2.5% is increased to 8-12% when cathode temperature rises to 1300° C.



The attractive young lady is comparing a smaller resistor with what is claimed to be the largest precision resistor voltage divider built, according to the manufacturer, Resistance Products Co. The giant 30 meg, 100 to 1 divider operates at 30 kv with 0.05 accuracy. Ratio division was maintained within 0.01%.



Industrial Control With Strain Gages

Voltage And Resistance Checks With VOM Usually Reveal Faults In Temperature Compensated Bridge And Associated Circuitry

HENRY A. SCHWARTZ

● Industrial processes usually involve the determination and proportioning of several variables to aid or control the process. Though the techniques employed are new, the theory of industrial control can be related to our everyday lives.

Measurement and control by

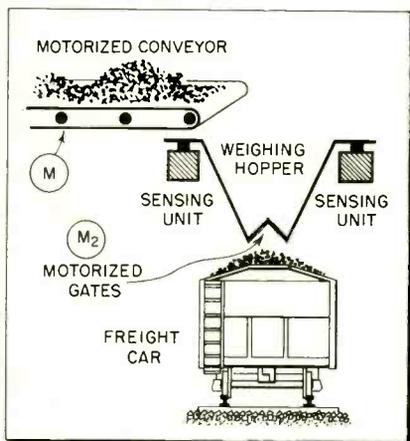


Fig. 1—Strain gages under ore hopper stops conveyor belt when proper ore weight is reached. Hopper discharges ore automatically and loading cycle is repeated.

weight is a common occurrence in both our daily experiences and in industry. The local vegetable vendor who selects and weighs a few pounds of tomatoes is performing a function of measurement and control by weight. The measuring instrument in this instance is a mechanical scale which indicates total weight of the tomatoes on the scale face. The price is determined, or controlled, by the weight of the tomatoes and computed (usually without the aid of pencil and paper) by the vendor.

This simple process is repeated in some degree with additional com-

plexities, in commercial weighing. In the industrial variety of weight measurement we may have to deal with heavy, bulky quantities. In addition, the material to be measured may not be easily removed from an assembly, chemical, or food processing line. To make our problems even more difficult, the measurement may have to be accomplished without disrupting the process while the material to be weighed is "flowing" or moving in the process line.

Applications

New techniques have been developed for solving the problems of measurement and control. A weight control application example is shown in Fig. 1. A freight car is loaded with the proper amount of ore for transportation to the second phase of an ore refining process. Since the entire operation depends upon the right amount of ore being delivered by the freight car, the ore loaded into the freight car must be accurately measured. Since the weight of the ore is proportional to the quantity of the ore, proper control by weight will provide required results.

The ore is moved to the loading hopper with a motorized conveyor belt. The hopper is mounted on top of several sensing elements which provide an output voltage directly proportional to the weight of the hopper plus its contents. The ore is dropped into the hopper and when a predetermined weight is reached the sensing elements initiate operations causing the conveyor motor to stop. Thus, the flow of ore into the hopper ceases. After a short time delay the hopper gate motor is automatically energized, allow-

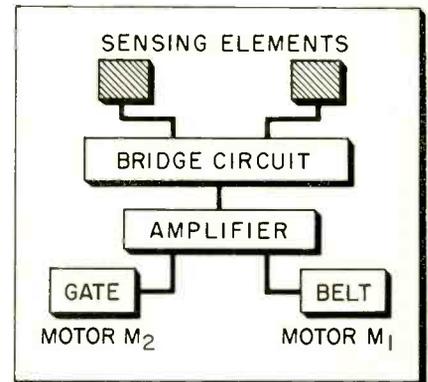
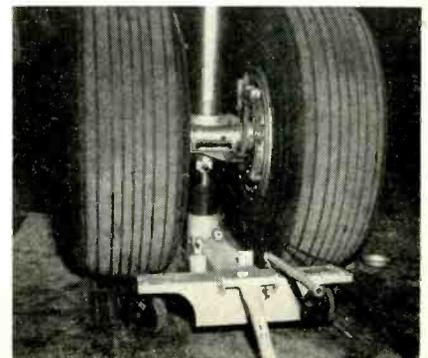


Fig. 2—Functional diagram of components involved in ore loading operations.

ing the hopper to discharge its contents into the waiting freight car. A block diagram of the basic control elements involved in this process is shown in Fig. 2. As shown in Figs. 3 and 4, electronic weighing of an entire aircraft is easily performed by mounting load cells on three jack rams and lifting the plane off the ground. An aircraft's center-of-gravity can also be determined by this method. Cables leading from each load cell feeds readings to a digital indicator. Readings are generally accurate to 0.1 of 1%, plus or minus.

Fig. 3—Close-up of strain gage mounted on ram jack under aircraft wheel.



Load Cells

The sensing transducer elements are essentially a group of strain gages mounted within a supporting body (see Fig. 5). The completely encased strain gage and supporting body is commonly referred to as a load cell, one of the many strain gage forms which are used for measurement (see Fig. 6). Essentially, a strain gage is a special wire bonded to a solid material. When force (either weight or pull) is applied to the solid carrier material, it changes shape. The strain gage wire attached to the solid material will also change its shape. The strain gage wire is selected and physically coiled on the carrier material in a manner that provides a measurable change in its resistance with a small change of weight or pressure on the carrier material. Resistance changes in strain gage wire is very nearly linear with weight change on the carrier material.

Specifically, strain gages are composed of wire from 1 to $1\frac{1}{2}$ mils in diameter. Sufficient wire is used in the gage so that overall resistance is from 100 to several hundred ohms. Resistance of the strain gage is large compared to that in the external control circuit so that little or no error is introduced by external wiring.

The Carrier

The carrier material of a strain gage, usually a high quality steel, is divided into two sections which provides distortion of the strain gage wire in both the horizontal and vertical planes. The wires are securely tied to a terminal strip within the load cell and the incoming control wires are firmly connected to the reverse side of the terminal block (see Fig. 6).

Bridge Circuits

A bridge circuit is commonly used in several industrial measurement and control processes for accurate resistance measurement. Ideally, a bridge can be used to develop an unbalanced voltage or current in the strain gage application. The bridge shown in Fig. 7 consists of four arms, one of which is the strain gage. The other three arms



Fig. 4—Heavy aircraft is weighed by mounting strain gages on ram jacks under each wheel. Aircraft's center-of-gravity can also be determined in a similar manner.

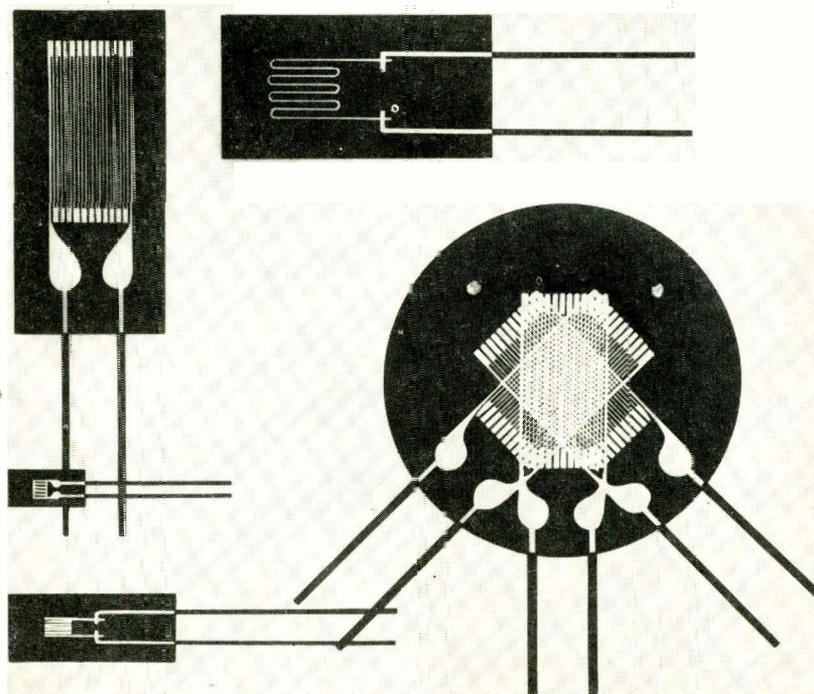
are selected and adjusted so that the bridge is "balanced" when in a quiescent state—a condition of zero weight. In this condition no voltage appears at the bridge's output terminals. When weight is applied and increased at the strain gage arm of the bridge, the bridge becomes unbalanced and an output voltage proportional to the weight appears at the output terminals. By selection of the proper driving voltage for the bridge (either a-c or d-c), the bridge output may be used for direct reading on a millivoltmeter or milliammeter. Output voltage may also be amplified and used to correct or control the weight by means of solenoids, gear drives, and valves. Selection of bridge driving

voltage, as well as selection of a strain gage type, is determined by a particular type of application or control function needed in a process.

Unfortunately, strain gage wire changes dimensions when there is a change in ambient operating temperatures. This change in dimension is reflected in a change of strain gage resistance, indicating an apparent strain or weight under static or zero weight condition. Therefore temperature compensation is required to prevent erroneous readings.

By substituting an additional strain gage for one of the bridge arms, as indicated in Fig. 8, any change of the strain gage in the

Fig. 5—Cross sectional views of strain gage configurations mounted in supporting body.



bridge's measurement arm due to temperature variations will cancel an equal change in resistance occurring in the strain gage in the second arm of the bridge. When the load bearing strain gage, and the "dummy" strain gage are exposed to the same temperature variations, the bridge will remain balanced even though the measuring strain gage may develop apparent strain because of ambient temperature variations. Thus, bridge output will be a true reflection of

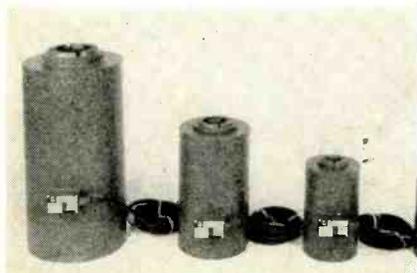


Fig. 6—Three sizes of strain gage load cells with terminal blocks and cables attached.

the load applied to the measuring strain gage.

Gage Factor

Of course, as previously mentioned, consideration must be given to the specific application before selecting a strain gage. Every strain gage has a "gage factor" which is the fractional change of resistance of the element divided by the fractional change of its element length. Average gage factors fall between 1.7 and 3.2, and their millivolt output range varies between 2.5 and 80 millivolts.

Servicing

Strain gage systems can be serviced by normal application of a good VOM. Since all specification data is furnished with each gage, a point by point analysis of the strain gage and associated bridge circuitry will determine whether or not the gage and its associated circuitry is defective. The schematic in Fig. 8 indicates points for making resistance measurements. The functional strain gage and the "dummy" should be physically disconnected from the bridge circuit before attempting resistance measurements. Voltage measurements

across A and B will determine if source voltage is being applied to the bridge. Failure of the source voltage would, of course, result in a zero output as will an internal failure in the strain gage. From a practical servicing standpoint therefore, source voltage should be measured before disconnecting the strain gage elements, and before making point to point resistance measurements. If the source voltage is normal, the strain gages should be disconnected from the bridge circuit and measured for continuity and proper resistance based upon manufacturers specifications. A similar procedure should be used with the "dummy" strain gage.

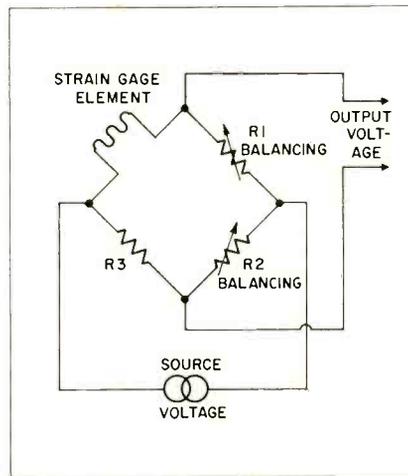


Fig. 7—When weight is applied to the strain gage (as one bridge arm), the bridge becomes unbalanced and its output can be employed for measurements or for initiating a variety of control operations.

After completing a resistance analysis of the strain gage elements, connecting leads to the strain gage terminals should be replaced. The service engineers attention should now be directed to the opposite end of the lead wires—namely, that point where the lead wires enter the bridge circuit. This terminal point is usually at a control panel. By disconnecting the lead wires at the bridge circuit, an ohmmeter measurement can be accomplished through the lead wires and through the previously measured strain gages. Since the strain gage has a magnitude of resistance much greater than the lead wire resistances, the ohmmeter should read essentially the same resistance as previously measured at the strain

gage terminals. An open circuit (infinite reading) or a vastly different reading than that previously obtained, would be indicative of a lead wire defect.

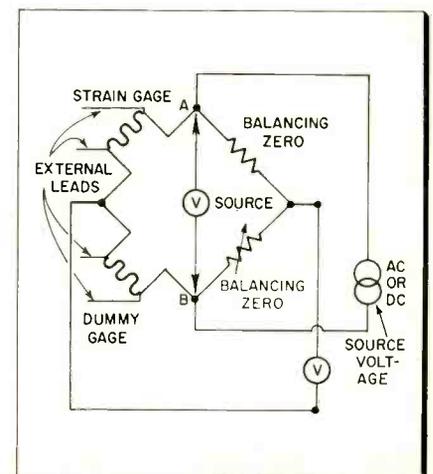
Resistance analysis can indicate proper electrical functioning of a strain gage network. Each strain gage should have its gage factor checked periodically. This can only be done by applying a known calibrated load to the strain gage or load cell. This is usually accomplished in a plant's standards laboratory or at an outside standards laboratory.

In addition to load and force applications, including torque, pressure, displacement and acceleration measurements, strain gages are finding increased applications in industry. Their stability and low cost is a distinct advantage. Their continuously variable characteristics, with no practical resolution limitations, permit versatile and easy application.

The plant or service engineer will find strain gages being employed more and more in industry and should quickly become familiar with their general classifications and possible specific equipment applications which he may shortly be called upon to maintain. ●

Information and Illustration Credit: Baldwin-Lima-Hamilton Corp., Waltham, Mass.

Fig. 8—An additional "dummy" strain gage can be inserted in the bridge to compensate for temperature errors. Proper source voltage is measured across A and B with a regular VOM after disconnecting gages.



Self-Tuned Ultrasonic Cleaner Requires Minimum Operator Attention

• An ultrasonic cleaner which employs a piezo-electric type feedback transducer for automatically maintaining maximum cavitation, under varying conditions, has been developed by Powertron Ultrasonics Corp. of Garden City, N. Y. The unit, shown in Fig. 1, was designed primarily to eliminate some objectionable features of conventional ultrasonic cleaning systems.

The transducer employed in the Autosonic unit measures the tank's ultrasonic energy level, and feeds this information back to the generator to tune it electronically. Thus, it is claimed, maximum cleaning action is constantly maintained regardless of load changes, liquid level, solution temperature, or any other factor. Automatic tuning of the generator eliminates the

Fig. 2—Schematic diagram of Autosonic generator, including test voltage and current data.

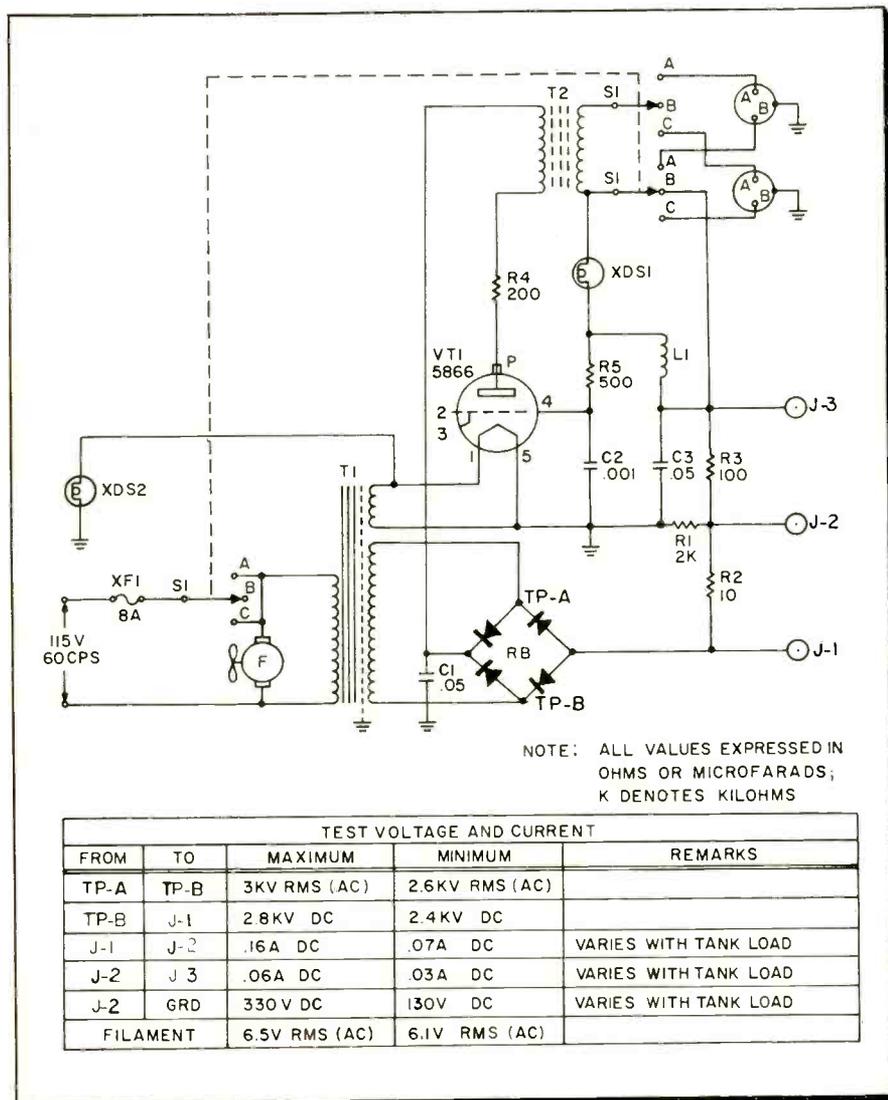


Fig. 1—Components of self-tuning ultrasonic cleaner which has single switch control.

necessity for panel meters; tuning, load, and other controls, and reduces operator attention and training to a minimum. The self-tuning feature also makes it possible to locate the generator at a considerable distance from the tank.

A schematic diagram of the unit's oscillator section appears in Fig. 2. Drive and feedback transducer units, mounted in the tank's bottom, are not shown. The oscillator operates on 105 to 120 volts, 60 cycles, single phase a-c power, and generates 300 watts average output at 28 kc. Heavy duty industrial components are used throughout the unit. •

Microwave Communications

Growing Microwave Terminal & Repeater Stations Include Multi-Hop Systems, Multiplex, Telegraph and Service Channels

LEO G. SANDS

• Now that anyone eligible for a mobile radio system license is also eligible for a license to operate a point-to-point microwave radio relay system, new microwave systems will be popping up all over. As of February 12, 1959, there were already 2,428 privately-operated fixed microwave stations (see Table I) authorized by the FCC.

All of these microwave stations require servicing, as will the thousands of new microwave stations that will be installed soon. Most of the existing microwave stations are being serviced by salaried employees of the owners. The equipment manufacturers do not have enough field personnel to install all the new microwave systems they hope to sell. Because most of the prospective users do not have electronics experts in their employ, there will be a demand for outside maintenance and installation service.

The biggest potential opportunities for the independent service man looking for industrial business lie in mobile radio, data processing, closed circuit television and microwave.

Circuit-wise, a microwave repeater or terminal is not as compli-

cated as a TV set. Almost anyone who can master TV circuits can easily become expert in microwave equipment circuits.

When approached broadside as a whole, a microwave system appears complex. But, if we examine it step-by-step, it appears much less complex.

Hop Systems

Ignoring actual transmitting frequency for the moment, let's examine Fig. 1. Considering TR1, 2 and RE1, 2 only, we have two one-way radio links side by side for a single-hop system. Let us assume that transmitter TR1 transmits on 30 mc and its signal is picked up by the receiver RE2; and that TR2 transmits on 40 mc to RE1.

If we connect the receiver end of a telephone handset to RE1 and the microphone end to TR1, and we also connect a handset in the same manner to TR2 and RE2, we have a full duplex telephone circuit. Both stations can transmit and receive at the same time over the radio link which is equivalent to a four-wire telephone circuit.

If we want to extend the radio link to enable communicating over a greater distance, we can interpose a repeater station between

two terminal stations. RE3 and TR3 would then be a terminal station. The repeater station consists of two transmitters and two receivers for a two-hop system. For each direction of transmission, a transmitter and receiver are connected back-to-back; the demodulated signal from the receiver output is fed to the modulator input of the associated transmitter.

Now, we need four radio frequencies. TR1 transmits to RE2A on 30 mc. The information picked up by RE2A is retransmitted by TR2A to RE3 on 40 mc. In the other direction TR3 transmits to RE2B on 45 mc, and TR2B relays the information to RE1 on 35 mc.

To extend the system further, more relay stations are needed. However, the number of frequencies need not be increased. They can be reused as shown in Fig. 1. Terminal station D is beyond the range of terminal station A so the A frequency can be used by C. In the opposite direction, B can transmit on the same frequency as D since A is out of the range of D.

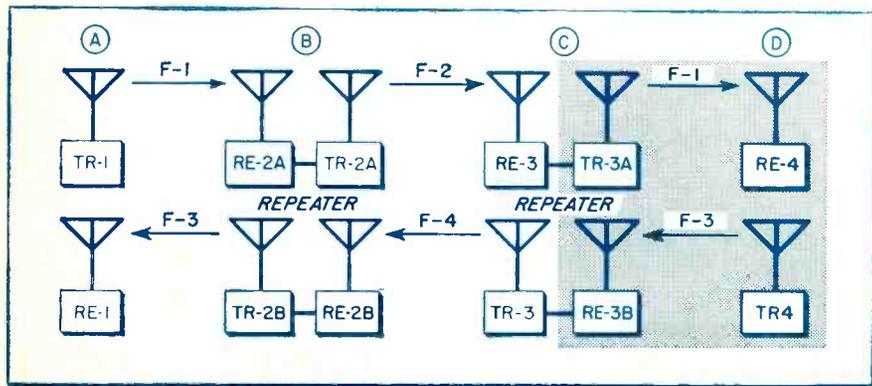
Regardless of the number of repeaters, the system looks like a four-wire circuit over which information may be transmitted simultaneously in both directions.

If the modulation bandpass of the transmitters and receivers is only 3 kc wide, the circuit may be used for transmission of one two-way telephone conversation.

To allow transmission of more than one telephone conversation at the same time, the system bandpass must be wider. The bandpass of typical so-called *thin-route* microwave systems is around 100 kc to 150 kc. The bandpass of *heavy density* microwave systems sometimes is several megacycles wide.

A microwave system may carry from one to as many as 720 simultaneous telephone conversations.

Fig. 1—Two-hop microwave system, allows simultaneous transmission in both directions, and is equivalent to a four-wire telephone circuit.



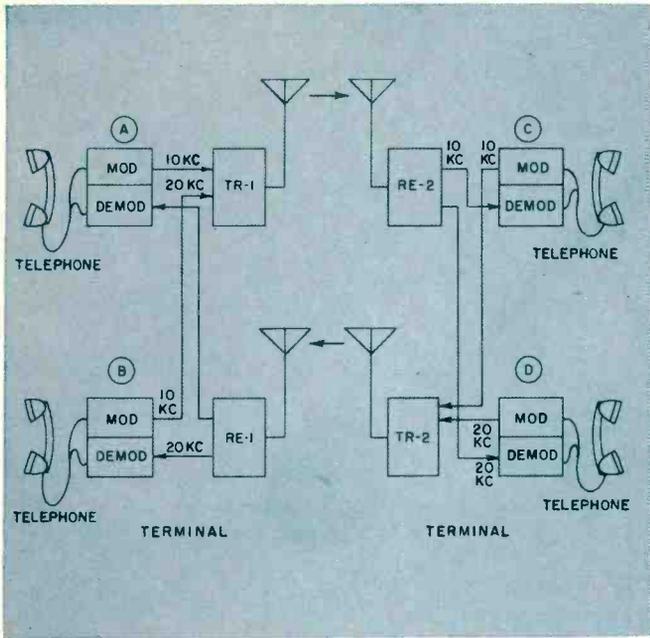


Fig. 2—In a frequency-division multiplier system, voice channels are applied as subcarriers via transmitter-receive combinations.

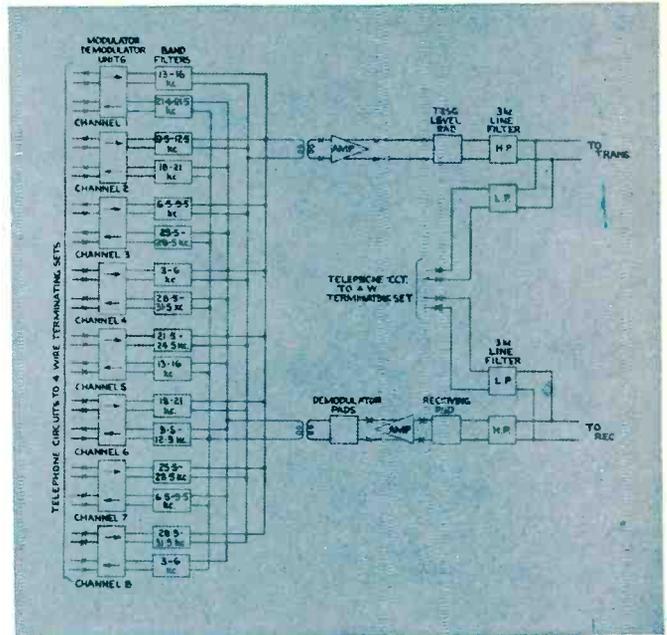


Fig. 3—Functional diagram of a typical eight channel frequency division carrier type terminal.

Most industrial and business microwave systems, however, will fall into the thin-route category, carrying from 3 or 4 up to 24 voice channels.

Multiplex Equipment

There are two basic systems for dividing a microwave system into individual voice channels, *time division* and *frequency division*.

There are various kinds of time division systems, PTM, PAM, PWM and PCM. Of these, PTM (pulse time modulation) and PWM (pulse width modulation) are most widely used in privately-operated systems.

In PTM a train of pulses is transmitted, each pulse representing a voice channel, and each separated from the other by a variable time interval. As each pulse is modulat-

ed by a voice signal, the pulse moves back and forth in relation to time. At the distant microwave receiver, each pulse is looked at sequentially and any variation in its time of occurrence in relation to a sync pulse is detected. In PWM systems, the width of each channel pulse is changed with modulation and this change in width is detected at the distant receiver.

The individual voice channels of a frequency-division multiplexing system are applied to the radio circuit as subcarriers by means of transmitter-receiver combinations called carrier terminals. As shown in Fig. 2, the output of carrier terminal A is fed to the radio transmitter as a 10-kc amplitude modulated signal. The output of carrier terminal B is fed in as a 20-kc AM signal. Both signals are transmitted

over the radio link to the distant terminal where carrier terminal C demodulates the signal from A, and D demodulates the signal from B.

To provide two-way voice communication, the reply is transmitted as a 10-kc AM signal from C to A, and from D to B as a 20-kc AM signal. Additional channels may be derived by adding carrier terminals operating at frequencies other than those used by carriers already in service. An 8-channel terminal is shown in Fig. 3.

A typical carrier terminal consists of a transmitter and a receiver, which may operate on the same or different frequencies between 3 kc and 140 kc or higher. The carrier terminal often has a self-contained a-c power supply and typically consumes about 25 watts of power.

The carrier transmitter is often

Fig. 4—One voice carrier microwave channel can handle 18 keyed tones simultaneously, with speeds up to 100 words per minute.

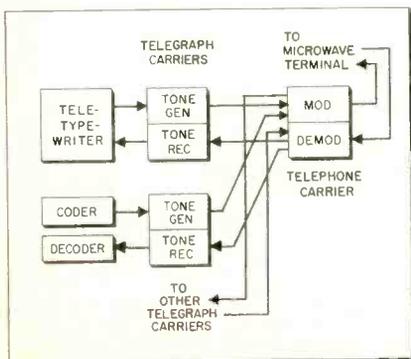


Fig. 5—Moore Associates fault alarm device system interrogates each station in the microwave system automatically.

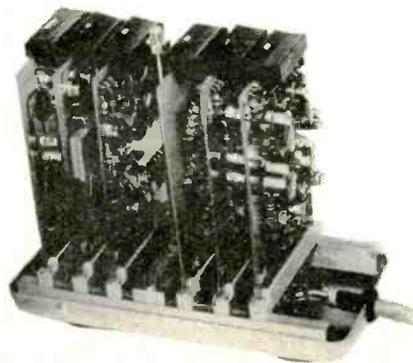
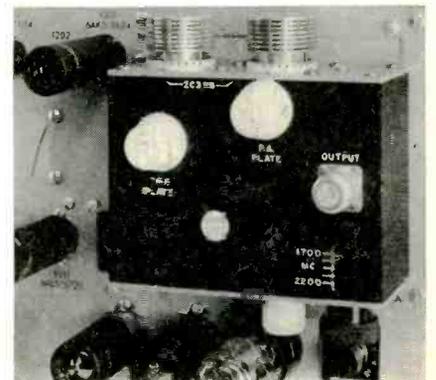


Fig. 6—Budelman mono-bloc used in 2000 mc microwave transmitter, provides a stable, broadband, and high Q output circuit.



called a *modem*, and the receiver a *demod*.

Carrier terminals are produced in various types including those that transmit and receive AM signal sideband, AM double sideband or narrow band FM signals.

In addition to transmission of voice or coded signals from one end of a microwave system to another, the individual channels may be dropped out at various repeater stations. New channels can also be inserted at repeater stations for transmission to another repeater or terminal station in either or both directions.

Telegraph Channels

In addition to voice, microwave systems may also be used to convey tones which are keyed on and off, or shifted abruptly from one frequency to another, for transmission of digital Morse telegraph, telegraph printer, data, control or telemetering signals. For some telemetering applications the tone is varied continuously in amplitude to enable transmission of analog signals.

The tones are generated by an audio oscillator and the coded intelligence is demodulated at the distant end of the circuit by a tone receiver.

The tone signals may be applied directly to the radio transmitter as a subcarrier at any frequency within the system pass band, or to a voice carrier or PTM or PWM voice channel as a sub-subcarrier, when the tones are within the 300-3000 cps voice band. As many as 18 tone channels may be conveyed by one voice carrier channel when keyed at speeds of up to 100 words per minute. When keyed at higher speeds, the number of tones that a single voice channel can carry is reduced. See Fig. 4.

Service Channels

In the case of a typical thin-route microwave system with a bandpass of 300 cps to 100 kc, the region from 300 to 3000 cps is usually reserved for what is known as the *service channel* or *order wire*. The through voice channel carriers operate at the frequencies between 3000 cps and 100 kc.

The service channel is used for intercommunication between microwave terminal and repeater sta-

tions. It is in this band that the *fault alarm* system operates. (See *Analyzing The Microwave Service Channel*, Industrial Electronic Maintenance, March 1960.)

A fault alarm system provides automatic indication to the main control point that all is well or that something is wrong at each of the stations.

The fault alarm device shown in Fig. 5 automatically interrogates

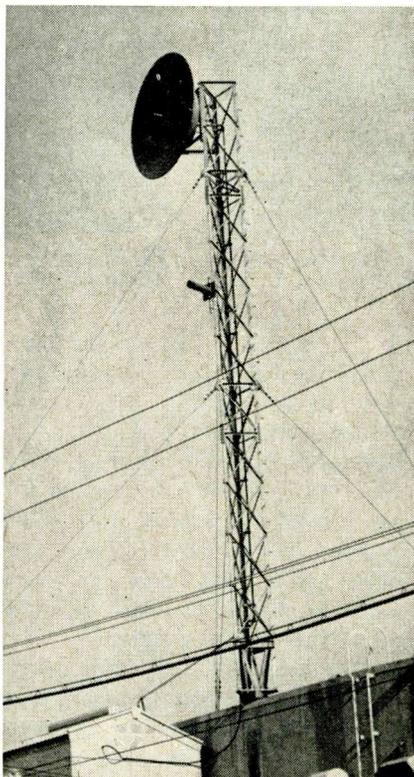


Fig. 7—450 mc helical and 6000 mc parabolic antennas mounted on the same mast.

each station in a microwave system. A Monitron encoder at each station repeatedly transmits a train of 8 pulses. When all is well, the pulses are of the same width. But, if something goes wrong, such as a power failure, the pulse associated with that particular monitoring function becomes wider. This causes a lamp to light on the panel of the decoder at the main control point. The lamp identifies the fault and the station.

Up to 8 functions (transmitter failure, receiver failure, tower lights out, unlawful entry, power failure, etc.) can be monitored at each station. The encoder steps sequentially from one monitoring function to another, repeating the sampling cycle repeatedly. Instead

of a stepping relay, the encoder utilizes an all-transistor pulse generator and a diode matrix.

The main control point is equipped with a decoder for each station so that all stations can be monitored simultaneously. A different audio tone is required for transmitting fault alarm pulses from each station.

Alternatively, stations can be monitored sequentially, one after the other, in which case only one tone and one master decoder are required.

Transmitters/Receivers

Microwave systems are operated in the so-called 450, 960, 2000, 6000 and 1300 mc bands, not in the 30-50 mc band as indicated in the example discussions earlier.

Techniques, similar to those used in mobile radio equipment, are used in 450, 960 and 2000 mc band transmitters. A transmitter could typically employ, for example, a crystal controlled oscillator, followed by a phase modulator (to produce an FM signal), several frequency multiplier stages and a 5-watt r-f power amplifier. When required, a booster r-f amplifier may be added to enable transmission over a longer distance.

Since the crystal controlled carrier frequency is multiplied up to 216 times, depending upon output frequency, the small deviation of frequency, at the crystal frequency, is also multiplied. In a 2000-mc band model, the output frequency is deviated ± 200 kc; the output frequency of a typical FM mobile unit is deviated only ± 5 kc.

While conventional coils and condensers are used in most HF and VHF transmitters, cavity resonators are used in the UHF band. The Mono-Bloc shown in Fig. 6 is used in a 2000 mc transmitter to achieve great stability and a high-Q, broadband tuned output circuit.

Microwave equipment for the 6 000 and 13.000 mc bands employ klystron tubes for generating the r-f signal at the output frequency, and do not require frequency multiplier stages. Frequency stability is obtained by carefully regulating klystron voltages and keeping the klystrons at a constant temperature.

The subcarrier modulating signals are fed directly to the klystron



tubes to obtain an FM signal. Power output of 6000-mc transmitters runs from 100 milliwatts to one watt.

Receivers for the 450, 960 and 2000 mc bands are similar to mobile radio receivers, except for their much wider i-f bandwidth. A receiver may employ a double-conversion superheterodyne circuit. The two local oscillators are frequently fixed-tuned and crystal controlled. Receivers for the 6000 and 12,000 mc band also use superheterodyne circuits, but must employ klystron tubes as local oscillators.

Antennas

Directional antennas are used at microwave stations to obtain power gain and to beam the signals in the desired direction.

Helical antennas are often used when operating in the 450-mc band, while parabolic antennas are most widely used when operating in the 2000, 6000 and 13000 mc bands. Fig. 7 shows a 450-mc band helical antenna and a 6000-mc parabolic antenna on the same tower. The helical antenna is used with a single-hop *thin-route* system; the paraboloid is used with a *heavy density* system.

A parabolic antenna focuses the microwaves into a narrow beam in the same manner that light is concentrated in a spotlight. The larger the reflector dish, the higher the antenna power gain, and the narrower the beam. An antenna with 20 db. gain, for example, increases the effective radiated power of a 5-watt transmitter to 500 watts. At the same time, the strength of incoming signals is made 100 times stronger at the receiver input.

While Fig. 1 shows separate transmitting and receiving antennas, it is customary to employ only one antenna for simultaneous transmission and reception. A terminal station requires only one antenna, whereas a repeater requires two antennas.

An antenna multiplexer, like the one shown in Fig. 8, is used for simultaneous transmission and reception on a single antenna. The multiplexer is a directional filter which blocks entry of the transmitter's signal into the receiver, but allows the transmitter's signal to feed into the antenna transmission

line, and incoming signals into the receiver.

Ordinary solid dielectric coaxial cable (RG-8/U or RG-17/U) or hollow transmission line is used for interconnecting 450, 960 and 2000 mc equipment to the antenna. The type of cable used depends upon the length of cable required.

Waveguide is required for interconnecting 6000 and 13,000 mc equipment with the antenna. Since

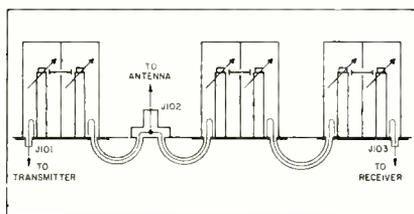


Fig. 8—Antenna multiplexer enables simultaneous transmission and reception on one microwave antenna.

TABLE I

Microwave Score Board

Band (mc)	Microwave Score Board				Total
	Industrial	Public Safety	Land Transportation	Other	
952-960	179	241	19	15	454
1850-1990	780	130	4	5	919
2110-2200	3	0	0	0	3
2500-2700	38	39	0	0	77
6575-6875	788	144	29	14	975
Total	1,788	554	52	34	2,428

waveguide is expensive and requires careful handling, many systems employ passive reflectors.

The antenna is connected to the microwave equipment through a short length of waveguide. The antenna is mounted horizontally, pointed upwards toward a passive reflector at the top of the tower.

The passive reflector is a flat piece of metal, metallized fiberglass or metallic mesh, which acts like a mirror. The signal is radiated vertically to the passive reflector which reflects it in a horizontal direction.

Larger passive reflectors are also used in lieu of an *active* repeater station. The Southern Pacific Railway, for example, has installed a passive reflector on the side of Mount Shasta to provide a signal path from Dunsmuir to Black Butte (both in California).

It is necessary to have line-of-sight conditions between the an-

tennas of adjacent microwave stations since microwaves, like light, travel in a straight line. Therefore, it is often necessary to install a tall tower to get the antenna up high enough. The tower must be rigid so that the beam will not be deflected by twisting of the tower in a high wind.

Microwave terminals are generally installed at the locations where the services of the system are to be utilized. But, the repeater stations must often be installed on high ground, and the owner must therefore acquire the property at these locations.

Often there is no electrical power at a desirable repeater site. A power line must be run in, or an electrical power plant must be installed.

Sometimes the microwave equipment is installed in weatherproof outdoor-type equipment cabinets. More often, a shelter is constructed for housing the microwave equipment and stand-by power generator. In such cases, a workbench is often provided for use by the field engineer.

A remote repeater station is often provided with standby microwave equipment to assure continuity of service. When the main microwave equipment fails the standby equipment is automatically turned on, and the fault alarm system informs personnel at the main control point of the fact.

Like any other kind of electronic equipment, a microwave system must be serviced. Terminal stations are usually easily accessible. But, repeater stations may be at hard-to-get-to locations, such as mountain tops.

It should be more economical to have a technician living near the location of a repeater station available to service such a station than to have the system owners send out a man from a distant operating center. A technician interested in this kind of business should make it known to owners of nearby microwave stations.

Servicing microwave equipment is not difficult once the principles are understood. It is also necessary to become somewhat familiar with telephony. Studying the service instruction manual for various makes of microwave equipment is also helpful preparation for this type of work. •



Computer Blends Ice Cream Electronically

Automated Control System At H. P. Hood & Sons Provides Uniform Products, Increased Capacity, And Minimum Production Costs

IEM FIELD STAFF

• Electronic computer and control equipment which employ advanced application design concepts have been installed to direct blending and mixing operations of the Boston ice cream plant of H. P. Hood & Sons. The entire automated system, shown in Fig. 1, and engineered by Brown Instruments Division of Minneapolis-Honeywell Regulator Co., provides uniform quality products, attains maximum plant productivity, and eliminates much of the heavy manual labor normally involved in large scale ice cream production. The electronic system was designed to complement the automatic methods used by the ice cream company.

Uniform mix proportioning of ice cream's dairy and other necessary ingredients is a highly complex process, primarily because of unpredictable daily and seasonal variations occurring in dairy raw materials. The computer, shown in Figs. 2 and 3, simplifies this task by automatically selecting proper amounts of various raw ingredients for a specific mix 20,000 times faster than it takes a human to do the same job—and with a much higher degree of accuracy.

The system also incorporates a pushbutton programmed automatic sequential washing and rinsing system (CIP) which simplifies

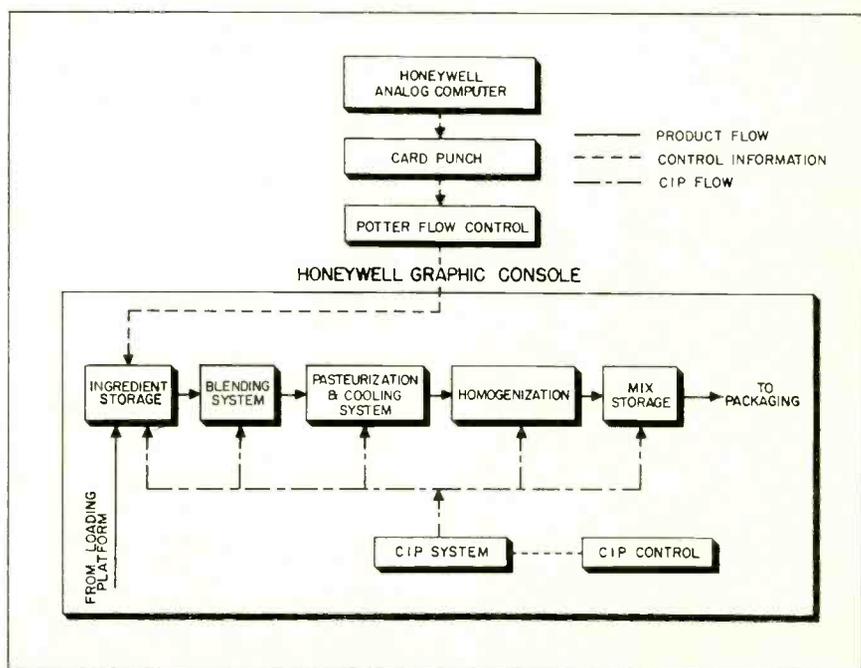
cleaning of pipelines, pasteurization lines, raw product and mix storage tanks. One feature of this process is an automatic cycling system which employs the final rinse of one tank for the pre-rinse of the next tank to be cleaned.

The automated process is begun by manual programming of the analog computer, inserting percentage information of ingredients involved: (butter-fat and non-fat solids) previously derived from laboratory analysis. The computer

automatically selects the proper amounts of other ingredients—sugar, flavorings, etc. Proportional amounts of all mix ingredients are obtained by electronic solution of algebraic simultaneous linear equations which are performed by the computer in less than a second. A group of chopper stabilized d-c amplifiers and associated switching circuitry are employed to control and monitor these operations.

A digital voltmeter translates the analog solution and settings to

Fig. 1—Complete functional diagram of Hood's electronically automated ice cream plant.



digital form for ease of readout. This readout is then scanned by a card punch control module which operates the card punch equipment, recording all information on a punch card. The card is then placed in a slot on the control board, as shown in Fig. 4, after which the mixing process is ready to begin.

Control System

Heart of electronic control is the Potter flow control console which regulates the flow of ice cream mix ingredients from raw material storage tanks to blending tanks. This system was manufactured by Pottermeter Aeronautical Corporation of Union, N. J.

Turbine flow-meters generate electric pulses for actuating electronic control equipment in the console, including identifying lights, such as "normal," "supplement," "step 1," "step 2," etc., which is remotely displayed to keep the operator informed of blending operation progress. Totals of each ingredient being delivered (in pounds) plus accumulated totals for accounting purposes, are automatically displayed and recorded. After completion of a batch the system allows time for pipe drainage, after which the "ready" button can be pressed for delivery of an identical batch, or a new card can be inserted for a different formula.

A recessed service control panel with switching circuitry allows amplifier outputs and calibration test points to be conveniently

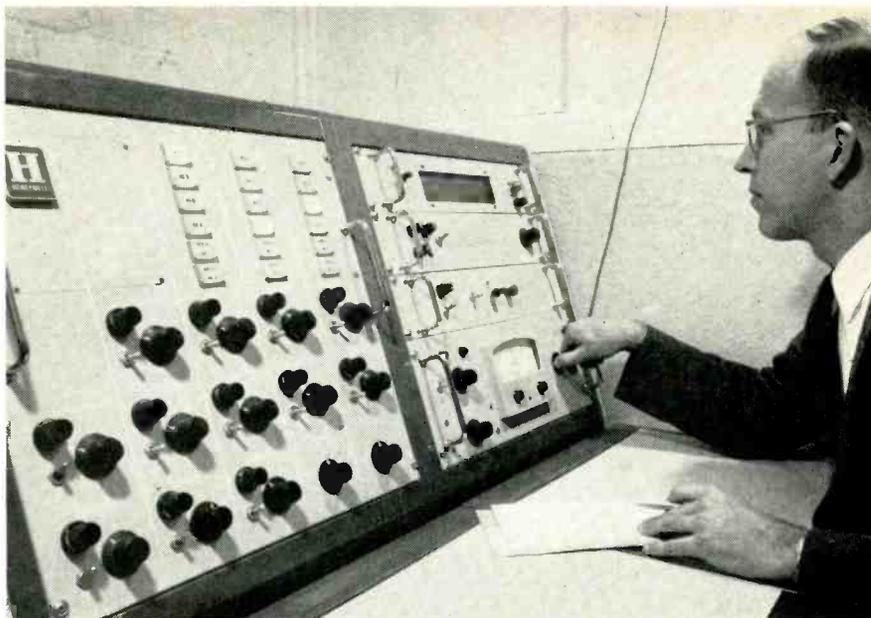


Fig. 2—Analog computer rapidly selects ice cream raw materials in correct proportions.

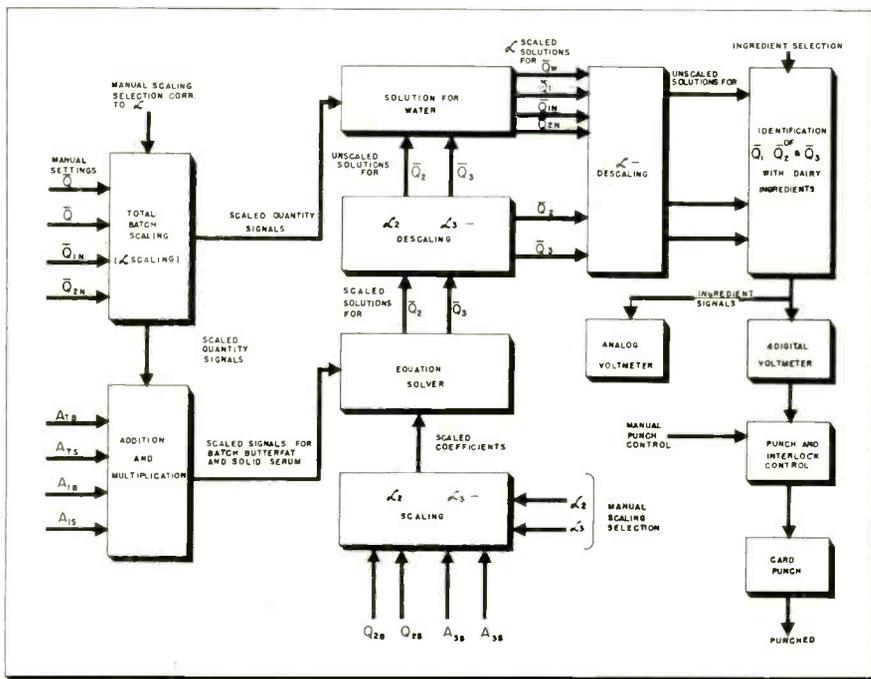
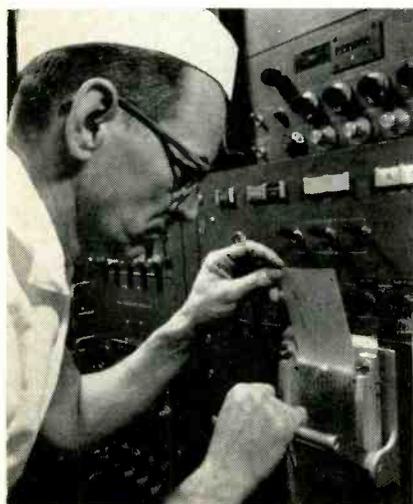


Fig. 3—Functional diagram of computer, including digital card punch control section.

Fig. 4—Punched card ice cream recipe is inserted to begin automated operations.



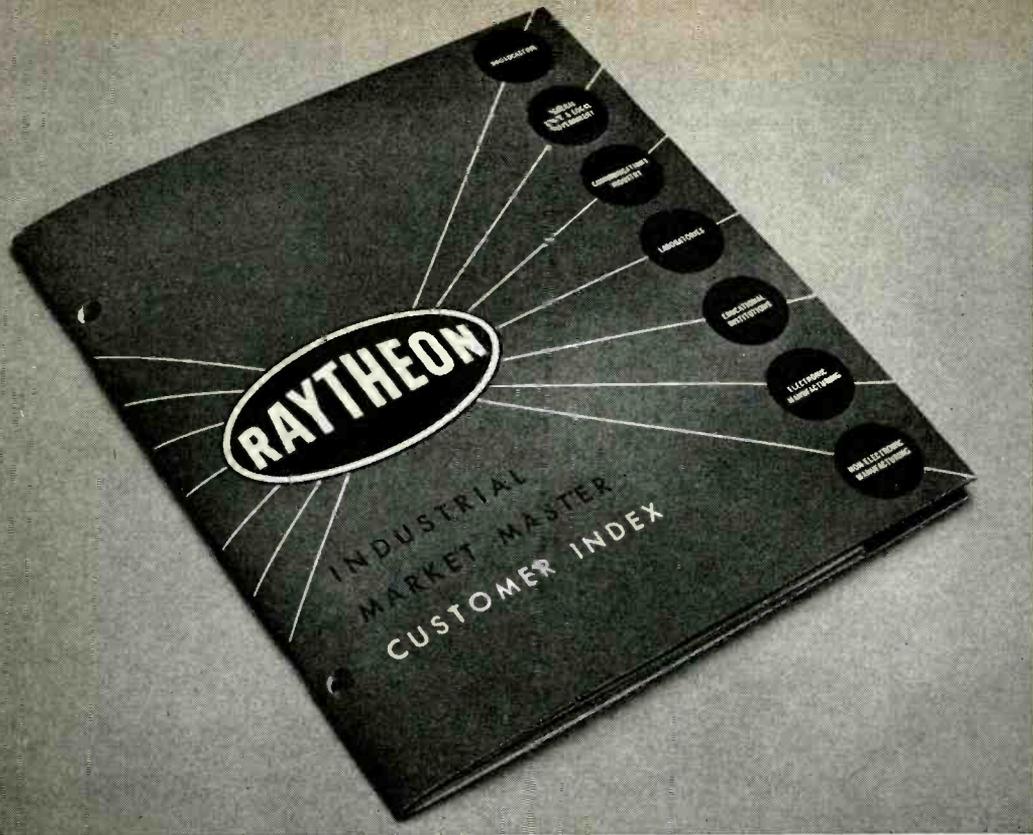
scanned. The panel contains eight calibration adjustments.

The computer is modular in design and all amplifiers and individual networks are plug-in units. Networks are sealed to avoid the effects of temperature change and atmospheric conditions.

The control system is also modular in design and employs 3,000 semiconductor diodes and 2,000 transistors.

The Hood company says that hours once spent in moving heavy cans, manual weighing, and tedious cleaning operations, have been converted into increased volume and higher quality. Savings in steam, electrical power, water, and cleaning detergents have resulted. In addition, unidentified losses have grown less through precise measuring, handling, and automatic recording. •





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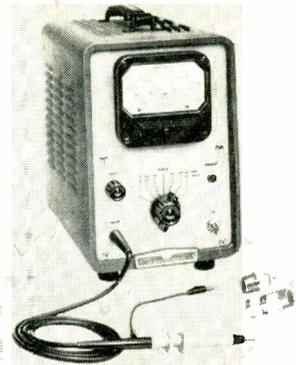
For more data, circle 10-111-1 on card, p. 89

ELECTRONIC TECHNICIAN (IEM Section) • October, 1960

HP MILLIVOLTMETER

RF millivoltmeter, model 411A, measures r-f voltages from 1 mv to 10 volts at frequencies up to 1,000 mc. Db scale readings from -42 to +33 db. Accuracy from 1 mc to 50 mc is $\pm 3\%$ of full scale; 50 mc to 150 mc, $\pm 6\%$ of full scale, and 500 kc to 1,000 mc, ± 1 db. Temperature stability, 10° – 40° C. Voltage range, 10 millivolts rms full scale to 10 volts rms full scale in seven ranges. Full scale readings of 0.01, 0.03, 0.1, 0.3, 1, 3 and 10 volts rms. Equipped with a pen type probe tip, 500 kc to 50 mc. Priced at \$450.00. Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.

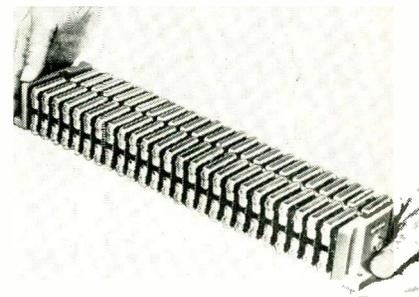
For more data, circle 10-111-2 on card, p. 89



International Rectifier SUPERPOWER SILICON

Modular silicon high voltage rectifier columns rated @ 1000 watts of power per cubic inch of volume have been announced. Voltages range from 10,000 to 120,000 volts, current capacity ranges from 1 to 50 amperes. Basic rectifier column module is a polyester glass board containing two rectifier cells, voltage dividing circuitry, connectors and heat dissipating shield. Standard type 1HV column made up of 50 basic modules mounted on an 18" central beam. International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif.

For more data, circle 10-111-3 on card, p. 89



Motorola PERSONAL PAGE

Operates on standard mobile radio VHF frequency bands (25-54 mc and 144-174 mc), enables one-way communications between a central base station and individuals carrying compact "Handie-Talkie" radio paging receivers. Tone sounds alert individual. Fully transistorized FM "Handie-Talkie" receiver, audio output, 500 milliwatts. Operates from either a rechargeable battery or mercury cells. Weight, 14 ounces. Motorola Inc., Communications & Industrial Electronics Div., 4501 W. Augusta Blvd., Chicago 51, Ill.

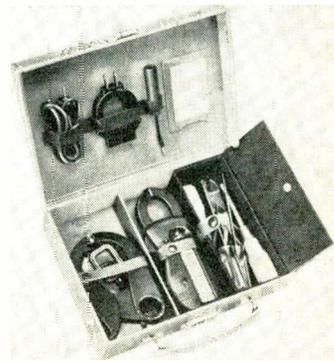
For more data, circle 10-111-4 on card, p. 89



Pyramid TECH-MASTER KIT

Kit to hold Pyramid's amprobe test equipment in one compact case. Constructed of rugged, good looking, genuine cowhide, $7\frac{1}{2}'' \times 10'' \times 2\frac{1}{2}''$. Available in two models. TM-33 contains amprobe RS-3 snap-around volt-ammeter-ohmmeter with five current ranges and three volt ranges. \$84.50. RM-11 contains amprobe RS-1, economy snap-around volt-ammeter plus an amprobe deca-tran and an energizer. \$71.75. Pyramid Instrument Corp., 630 Merrick Rd., Lynbrook, L. I., N. Y.

For more data, circle 10-111-5 on card, p. 89



Installing A Signal-Controlled Tape Clutch

Device Can Cut Operating Costs

And Reduce Recording Errors

RONALD L. IVES

• Use of magnetic tape to record observational data telephoned to a central station from field stations has become common practice. Results indicate a considerable saving in time, money, and reduction in errors. When field observations are received at widely-spaced intervals, tape consumption becomes excessive, as does the cost of tape editing, transcription, and data reduction.

A special tape drive will eliminate these problems. This drive must function only when a signal is being received and must automatically stop the tape transport during "dead" intervals. Since drive motors are not

instant starting, the best drive control mechanism is an electro-magnetic clutch. This clutch couples the drive motor to the tape transport when energized. Suitable clutches are standard servo components, readily available in a variety of arrangements, voltages and current ratings. Installing a clutch in a transport mechanism is a relatively simple mechanical job.

Circuitry for controlling this tape transport clutch is shown in Fig. 1. The tape runs when a signal is being received, and remains stationary during no-signal intervals. A signal, coming from the phone line or a radio receiver, is passed through an impulse noise limiter into a suitable amplifier and filter. These two com-

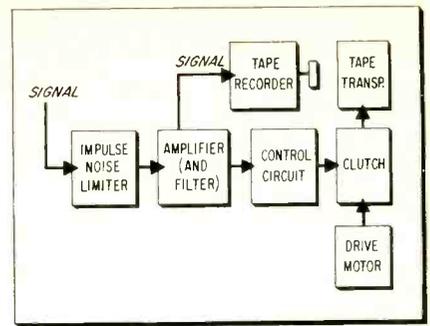


Fig. 1—Block diagram of signal-operated clutch drive circuitry.

ponents, specifications of which depend upon conditions at a given installation, remove impulse noises and undesired frequencies from the incoming signal. They deliver a "clean" signal of suitable amplitude to the tape recorder input. Another "clean" signal, having an average peak-to-peak amplitude of 200 or more volts, is delivered to the clutch control circuit. A push-pull amplifier output simplifies control.

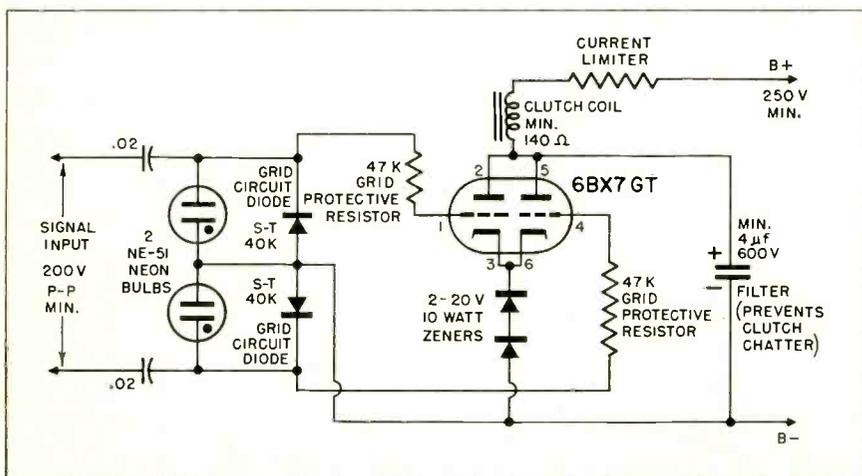
Control circuitry is shown in Fig. 2, and the constants shown are for operation of a 140-ohm 170 milliamperere direct current clutch (IBM 435 M1).

When no signal is incoming to this circuit, the cathodes of the dual triode are held to +40 volts by the Zener diodes. Grids of the tube are substantially at ground potential. In consequence, the tube is cut off, no plate current flows, and the clutch coil is deenergized. The plate capacitor attains a charge equal to the plate supply voltage.

When a signal arrives, positive half waves are clipped to about 55 volts by the neon tubes, and this voltage is applied to the tube grids through protective resistors (47k ohms). This drives the grids positive with respect to the cathodes, heavy plate conduction takes place, and the clutch coil is energized. The transport starts immediately since the drive motor runs continually.

Negative half waves of the signal are blocked by the grid circuit diodes, and have no important effect on tube operation.

Fig. 2—Clutch drive circuit using 6BL7 duo-triode. Filter capacitor prevents clutch chatter and supplies carry-over voltage during intersyllabic pauses.



The current limiting resistor in the plate circuit is so chosen that the current rating of the clutch coil is not exceeded when a normal signal is incoming. The plate capacitor filters the pulsating signal in the plate circuit, preventing clutch chatter. It also supplies a short "carryover" period, so that the clutch will not release during intersyllabic pauses in the signal. If the operators talk very slowly, this capacitance should be increased, a value of about 20 μf being found optimum.

A slight modification of the grid circuit, shown in Fig. 3 for one tube, permits release delays of up to several minutes if desired. Here, the positive half cycles charge the capacitor

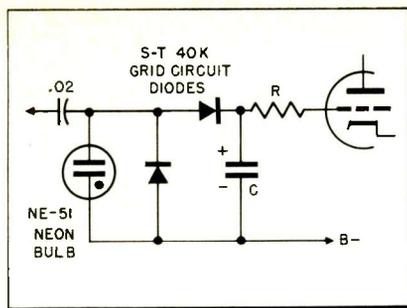


Fig. 3—Grid circuit modification for release delay. If "C" is very large with respect to the input capacitor, a start delay will produce a loss of part of the incoming signal.

C, which now discharges slowly through the resistors R, to the tube grids. If the capacitor C is very large

with respect to the input isolating capacitor, a start delay will be produced, causing the loss of the first few syllables of an incoming signal.

Experimentation with clutch coils showed that if the coil in this clutch is rewound with finer wire (so that its resistance is 1,000 ohms) it would then operate on about 30 milliamperes. This would permit a 12AU7 tube to be used, a single 27-volt 3.5 watt Zener diode, and a much higher value of current limiting resistor. Because this change reduces the plate and filament power needs, as well as reducing parts costs and heat production, use of a high-resistance clutch coil is recommended whenever possible. •

NBS Develops Scanning Photometer

• The National Bureau of Standards has developed an improved scanning photometer to aid in measuring accurately and rapidly the wavelengths of lines appearing on a spectrograph plate. The image of the lines in a 0.5 mm scanning area is electronically converted and display on an oscilloscope as a density versus wavelength curve.

Devised by M. L. Kuder, of the Bureau's electronic instrumentation laboratory, the instrument replaces the tedious conventional method of reading spectrographic plates by microscopic examination of the spectral lines.

Operation

A spectrographic plate is mounted on an optical bench and scanned by manually shifting the position of the moving carriage. The plate is illuminated on one side; on the other side a 10-power microscope is trained on a limited area of the spectrum. Immediately behind the microscope is a dichroic mirror that splits the image into two components: one, red-yellow and the other, blue-green.

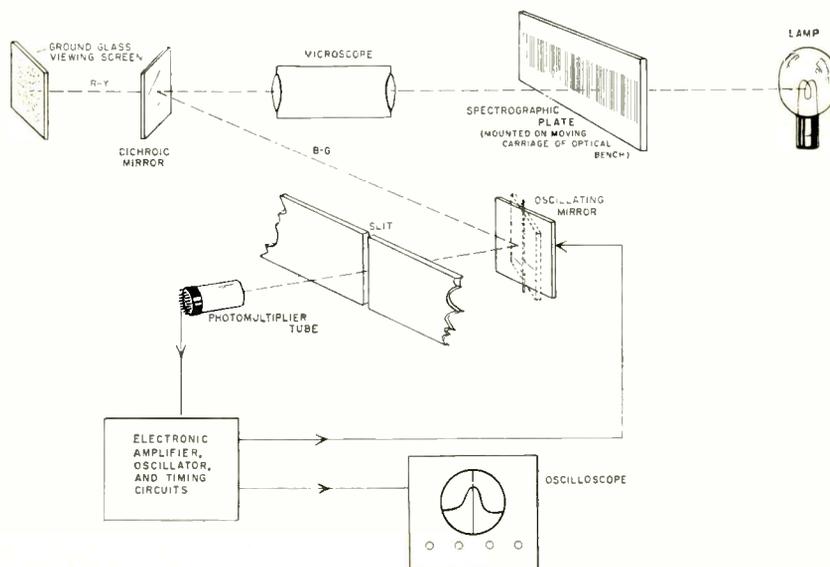
The red-yellow image is reflected to a ground glass viewing screen, providing the operator with a visual check of that portion of the spectrum being scanned. The blue-green image is transmitted to a vibrating mirror,

which reflects an oscillating image through a narrow slit to an end-on photomultiplier tube. The vibrating mirror provides the scanning action of the system, and the phototube "sees" only a 13-micron width of the spectrum at any given time.

Output of the tube is fed to amplifying, timing, and positioning circuits. The resulting density-versus-wavelength curve is presented together with a reference line on the oscillo-

scope. The horizontal sweep of the oscilloscope, the vibrating mirror, and the reference line generator are all driven by the same oscillator. Phase relation between the three is constant, therefore, the display holds steady and is completely free from drift. The only time this curve moves is when the carriage carrying the plate is manually shifted on the optical bench to examine another portion of the spectrum. •

Functional set-up of components employed in the integrated electronic photometer.



FREE LITERATURE

To receive these bulletins circle numbers on card, p. 89

OSCILLOSCOPE: Current literature covers type 561 oscilloscope. Basically an indicator unit, it powers any two of the five presently available modules which drive the crt deflection plates directly. Tektronix, Inc., P. O. Box 500, Beaverton, Ore.

For more data, circle 10-114-1 on card, p. 89

MINIATURE RECTIFIERS: Bulletin SR-353 covers seven new miniature "Thyrode" silicon controlled rectifiers weighing as little as $\frac{1}{40}$ of an ounce. International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif.

For more data, circle 10-114-2 on card, p. 89

SILICON CARTRIDGE RECTIFIERS: Technical data is available covering a standard line of high voltage silicon cartridge rectifiers, designed for applications including missile, radar, X-ray and other power supplies. General Instrument Corp., Semiconductor Div., 65 Gouverneur St., Newark 4, N. J.

For more data, circle 10-114-3 on card, p. 89

CIRCUIT BREAKER: Application Note HV-603 describes an electronic "crowbar," which functions as a circuit breaker or thyatron, yet does not use vacuum tubes, heated cathodes or moving parts. Sorensen & Co., Richards Ave., South Norwalk, Conn.

For more data, circle 10-114-4 on card, p. 89

ELECTRONIC EQUIPMENT: New 452-page industrial electronics catalog, 1961 No. 71, lists more than 60,000 parts and components, representing over 500 manufacturers. Illustrated. Indexed. Newark Electronics Corp., 223 W. Madison St., Chicago 6, Ill.

For more data, circle 10-114-5 on card, p. 89

TOWER ERECTION SERVICE: Current literature describes a new tower erection service for complete towers and tower systems for communication and industrial purposes. Rohn Systems, Inc., 6718 W. Plank Rd., Peoria, Ill.

For more data, circle 10-114-6 on card, p. 89

MEASUREMENT CONTROL DEVICES: Product brochure, designated as catalog No. G-100, is a 4-page, 3-color, illustrated brochure describing systems and components for the continuous indicating and monitoring of minute changes in dimensions for control usages. Measurement Control Devices, P. O. Box 505, Camden, N. J.

For more data, circle 10-114-7 on card, p. 89

BRIDGES: Two current data sheets cover model 868B direct reading universal bridge and model 1342 lo-capacity bridge, respectively. Specifications, illustrations and diagrams included. Marconi Instruments, 111 Cedar Lane, Englewood, N. J.

For more data, circle 10-114-8 on card, p. 89

DC RELAYS: Specification sheet for new RSH relay provide operating conditions, type designation and coil data, and mounting variations. Diagrams included. Allied Control Co., 2 East End Ave., New York 21, N. Y.

For more data, circle 10-114-9 on card, p. 89

ELECTRON TUBES: A colorful, 16-page booklet covers "vacuum tube" equipments required in induction heating. Lists names of equipment manufacturers, oscillator tube and rectifier tube types used in the equipment, as well as other data. Machlett Laboratories, Springdale, Conn.

For more data, circle 10-114-10 on card, p. 89

CERAMIC CAPACITORS: A new Special Purpose Capacitor catalog complements the firm's general purpose capacitor catalog. Feed-thru, trimmer, transmitting and flat plate are some of those covered. Centralab, 900 E. Keefe Ave., Milwaukee 1, Wis.

For more data, circle 10-114-11 on card, p. 89

ELECTRONIC EQUIPMENT: With special emphasis on electronic equipment for industry, the firm's 1961 catalog lists over 48,000 items in its 576 pages. Allied Radio Corp. 100 N. Western Ave., Chicago 80, Ill.

For more data, circle 10-114-12 on card, p. 89

RESISTORS: Catalog sheet CE-2.04 covers high power resistors that have low inductance at high frequencies, designed for circuit loading, damping and terminating. Corning Glass Works, P. O. Box 544, Corning, N. Y.

For more data, circle 10-114-13 on card, p. 89

ELECTRONIC COUNTERS: Five-page application note (No. 2) presents detailed methods of frequency measurement by using high speed electronic counters and various accessories. Charts and diagrams summarize equipment applicable to various frequency ranges. Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.

For more data, circle 10-114-14 on card, p. 89

METER RELAYS: Catalog sheet covers a new line of front adjustable meter relays, model 29XA. Stock ranges, suggested circuits using slave meter relay, power supply and suggested components included. Simpson Electric Co., 5200 W. Kinzie St., Chicago 44, Ill.

For more data, circle 10-114-15 on card, p. 89

WIRE WOUND RESISTORS: Literature covers a new power wire wound resistor line including 2, 3, 5, 7, and 10 watt units rated at 125° C ambient. International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa.

For more data, circle 10-114-16 on card, p. 89

FREQUENCY CONVERTER: Two-color data sheet offers detailed technical data on a fully transistorized frequency converter. Includes specifications, block diagram and a complete circuitry description. Gertsch Products, Inc., 3211 S. La Cienega Blvd., Los Angeles 16, Calif.

For more data, circle 10-114-17 on card, p. 89

VOLTMETERS: A colorful, illustrated 8-page folder covers the firm's precision electronic voltmeters. Specifications and prices included. Ballantine Labs., Boonton, N. J.

For more data, circle 10-114-18 on card, p. 89

ELECTRONIC PRODUCTS: More than 250 electronic product lines, which the company stocks for industrial customers, are listed in a ready-reference directory. Arrow Electronics, Inc., 525 Jericho Turnpike, Mineola, L. I., N. Y.

For more data, circle 10-114-19 on card, p. 89

TRANSISTORS: An "Application Note" suggests methods and circuits to protect regulator transistors against overloads caused by transients and load malfunctions. Protection by current limiting and protection by load switching are covered. Includes circuit diagrams. Texas Instruments, Inc., Semiconductor Components Div., P. O. Box 312, Dallas, Texas.

For more data, circle 10-114-20 on card, p. 89

TRANSISTOR TEST INSTRUMENTS: A colorful, 4-page brochure covers model 870 dynamic beta transistor tester and 850P portable transistor analyzer. Specifications and schematic diagrams included. Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland 8, Ohio.

For more data, circle 10-114-21 on card, p. 89



CAPACITORS: Literature is available covering four new high reliability capacitors, types MLE, CQM, TAK-H, and TAD. Pyramid Electric Co., Darlington, S. C.

For more data, circle 10-115-1 on card, p. 89

PUSH-BUTTON TIMER: Model 309 Atcotrol timer, available in 16 standard dial ranges, is covered in current literature. Automatic Timing & Controls, Inc., King of Prussia, Pa.

For more data, circle 10-115-2 on card, p. 89

POWER SUPPLY: A compact battery substitute, "Batt-Sub," replaces short-life dry cell in potentiometers. Covered in a technical data sheet. Dynage, Inc., 75 Laurel St., Hartford, Conn.

For more data, circle 10-115-3 on card, p. 89

INSULATION TESTING EQUIPMENT: Manual G-65, a new manual on methods and equipment for testing insulating materials is available. Associated Research, Inc., 3777 W. Belmont Ave., Chicago 18, Ill.

For more data, circle 10-115-4 on card, p. 89

TUBE: Technical information, illustration, diagrams and graphs covering the NL-6989/C6J/KL thyatron tube are furnished on a current catalog sheet. National Electronics, Inc., Geneva, Ill.

For more data, circle 10-115-5 on card, p. 89

AC TO DC CONVERSION: Technical data sheet, "Applications Notes on AC to DC Conversion," describes a new conversion method. Diagrams included. Adage Inc., 292 Main St., Cambridge 42, Mass.

For more data, circle 10-115-6 on card, p. 89

TELEPHONE RELAYS: A 4-page, full color folder covers the firm's full line of telephone relays. Enclosures with the folder are: a chart showing all the electrical and mechanical characteristics of the seven basic types of relays; and data on coils. Potter & Brumfield, Princeton, Ind.

For more data, circle 10-115-7 on card, p. 89

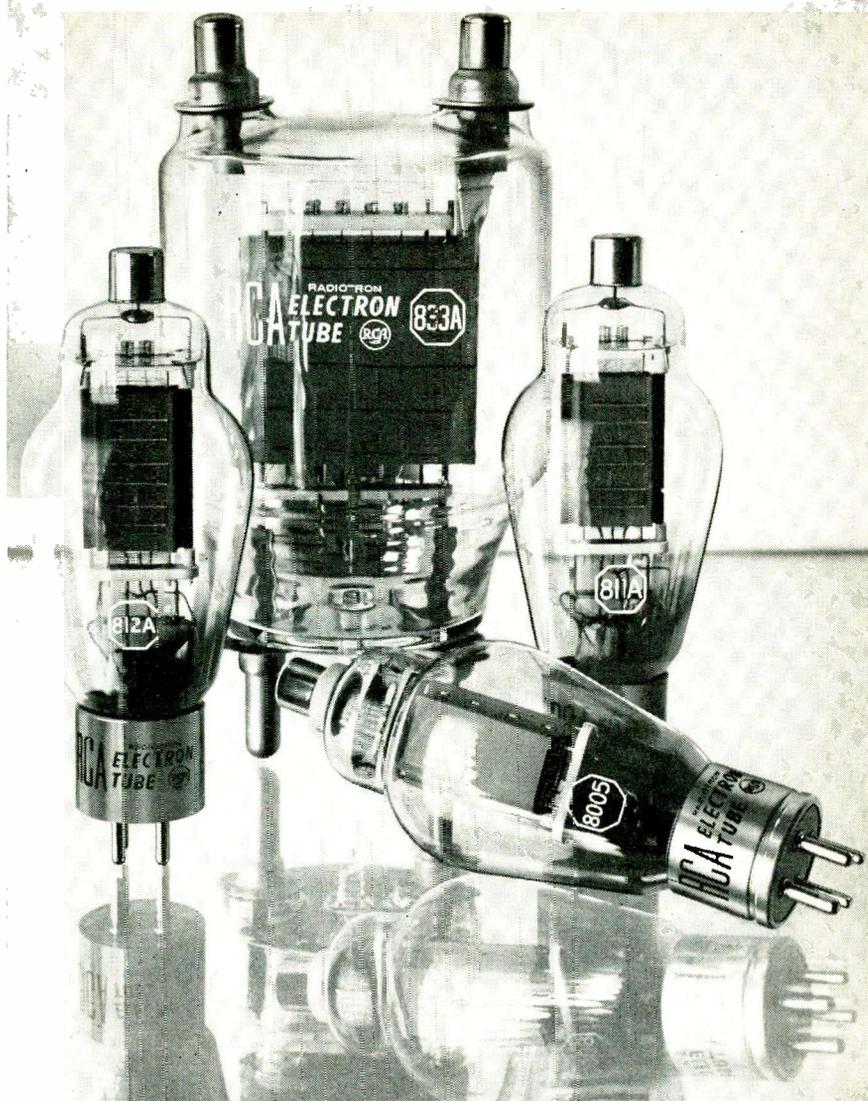
CIRCUIT BREAKERS: A new 8-page catalog gives information necessary for the proper selection of circuit breakers for large aircraft and industrial electronic systems. Standard and miniature thermal units are covered as well as push-pull and toggle types. Wood Electric Corp., 244 Broad St., Lynn, Mass.

For more data, circle 10-115-8 on card, p. 89

COMING SOON

A New Publication

See page 117



replace with **RCA** **POWER TRIODES**

for long life in industrial RF power applications

For reliability, high efficiency and long life in electronic heating and other industrial radio frequency power applications, make it a point to replace with RCA RF Power Triodes available from your local RCA Industrial Tube Distributor.

RCA Power Triodes are conservatively designed to provide efficient operation and long life under industrial conditions. This means less downtime as well as lower tube cost per hour of operation.

Your RCA Industrial Tube Distributor carries a complete line of RCA Power Tubes in a wide range of power and frequency ratings. Call him for immediate service on all your industrial tube needs.



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

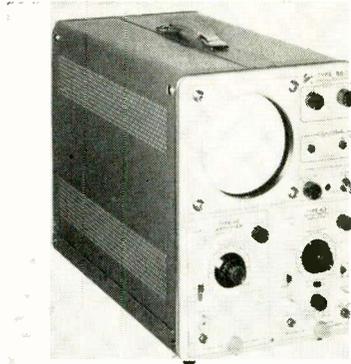


Industrial Electronic Products

Tektronix OSCILLOSCOPE

Operating with low-cost signal-amplifier and time-base plug-in units, type 560 is basically an indicator. Contains a 5" crt with 3.5 kv accelerating potential, 8 x 10 cm viewing area, amplitude and sweep-time calibrator, and a regulated d-c supply providing 30 watts of power. Dimensions, 13½" high, 9¾" wide, 21½" deep. Weight, less than 27 lbs. Type 560 oscilloscope, \$325.00. Plug-in units: type 59, \$50.00, type 60, \$115.00, type 63, \$125.00, type 67, \$150.00. Tektronix Inc., P. O. Box 500, Beaverton, Ore.

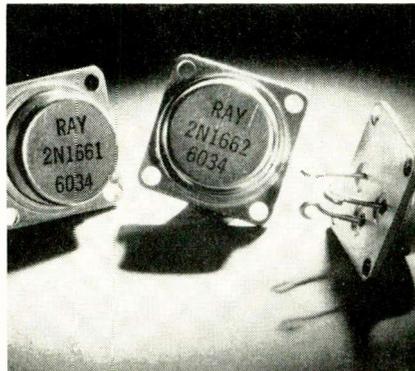
For more data, circle 10-116-1 on card, p. 89



Raytheon HI-GAIN TRANSISTORS

Two new high-voltage, high-gain transistors have been added to the Raytheon line of NPN diffused, silicon power transistors . . . 2N1661 and 2N1662. Collector-to-emitter voltages, 80 and 100 volts. Maximum collector current, 2 amps, a minimum Beta frequency, 25 mc. Power output, 85 watts. Suited for use in regulated power supplies, power switching, power amplifiers, power oscillators, core drivers, servo amplifiers and other high-frequency power applications. Raytheon Co., Semiconductor Div., 215 First Ave., Needham, Mass.

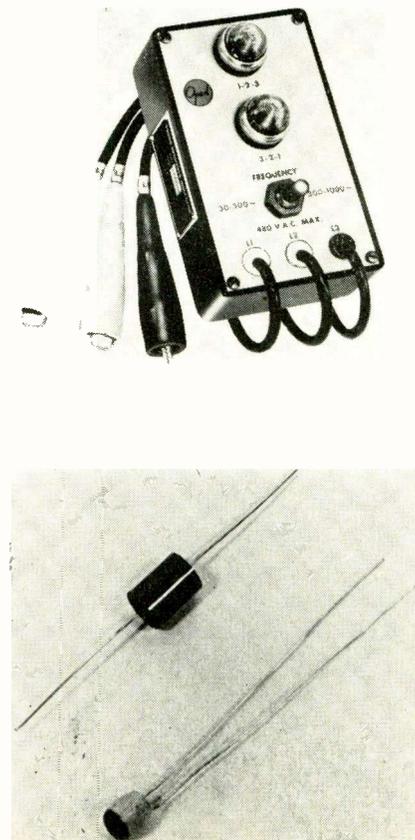
For more data, circle 10-116-2 on card, p. 89



Opad INDICATOR

Model VA2 phase sequence indicator featuring a two-color melamine panel with markings beneath the surface and highly resistant to scratching, marring, heat, oil and even common acids has been developed. Process conforms to MIL-P-78A. Frequency range, 30-1000 cycles. Includes three 36" oil resistant rubber covered test leads. Self contained in a high resistance case 6¼ x 3¾ x 3¼. Weight, 24 ounces. Opad Electric Co., 43 Walker St., New York 13, N. Y.

For more data, circle 10-116-3 on card, p. 89



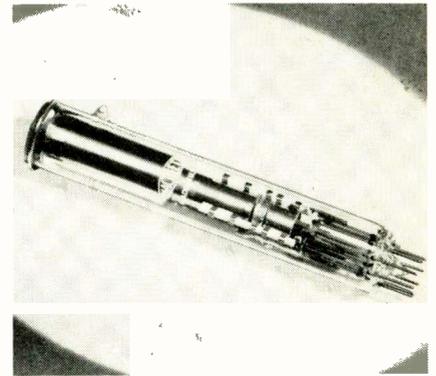
Radio Receptor CONTACT PROTECTION DEVICES

Designed to solve the problem of destructive arcing due to inductive voltage surges at contact points, new contact protection units are available in encapsulated or tubular construction. Claimed to extend the life of a contact up to 100 times that of an unprotected contact, these new devices will serve all relays operating up to 40 times per second; and which draw up to 200 ma operation current at 130v a-c or 250 ma at 154v d-c. Ratings based on operation in an ambient temperature of 35°C. Radio Receptor Co., Selenium Div., Subsidiary of General Instrument Corp., 240 Wythe Ave., Brooklyn 11, N. Y.

For more data, circle 10-116-4 on card, p. 89

Machlett VIDICON TUBE

A vidicon tube, ML-S522B, sensitive in the near ultra-violet region has been developed. Peak response about 0.4 microampere per microwatt. Resolution capability is 600 lines. Meas-



ures 6¼" long by 1.125" in diameter and is mechanically, as well as electrically, interchangeable with standard vidicon tubes. Magnetic focus and deflection. Machlett Labs., 1063 Hope St., Springdale, Conn.

For more data, circle 10-116-5 on card, p. 89

Seiscor TELEPATH AMPLIFIER

A new industrial wired communications system utilizes transistorized amplifiers and a variety of earphone/microphone headsets. Two amplifiers are available in the system. One for



low to medium background noise conditions, the other for medium to high background noise conditions. Lightweight, belt-clip units. Self-contained batteries and controls. Communications Section, Seiscor Div., Box 1590, Tulsa, Okla.

For more data, circle 10-116-6 on card, p. 89



ANNOUNCING

A New Publication

Starting January 1961, the **Industrial Electronic Maintenance** section of **Electronic Technician's** IEM edition will become a separate monthly publication. It will be called—

INDUSTRIAL ELECTRONIC ENGINEERING & Maintenance

The new publication will enlarge its present technical editorial service to electronic users, to personnel in plant and field engineering (not design engineering), application, operation and maintenance functions of industrial electronics. The new name, **INDUSTRIAL ELECTRONIC ENGINEERING & Maintenance**, will reflect that service.

Present subscribers to **Electronic Technician's** IEM edition will automatically receive both **Electronic Technician** and **INDUSTRIAL ELECTRONIC ENGINEERING & Maintenance** for the duration of their current subscriptions. When current subscriptions are about to expire, readers may renew for either or both publications.

The first two sets of comments received by the FCC supporting the agency's proposed rulemaking to split public safety radio channels between 150.995 and 151.475 mc and assign the 16 channels derived to the local government radio service were submitted by Oakland County, Mich., Department of Public Works and Drain Office and Communications Engineer Robert E. Brooking of the City of Burbank, Calif.

The large number of comments previously received by the Commission were either from forestry conservation radio interests asking that the new split channels between 151.145 and 151.475 mc be allocated to the forestry conservation service, or from highway interests asking that the new split channels between 150.995 and 151.115 mc be assigned to the highway maintenance radio service.

The FCC invited comments to a notice of proposed rulemaking which would amend the manufacturers radio service rules to permit base stations in the service operating on 152-162 megacycle frequencies to be located beyond the boundaries of the plant, factory, shipyard, mill or other manufacturing area, and to allow such stations to operate with power in excess of 60 watts.

The rule proposal follows FCC action of July 8, 1959, when the Commission partially granted the request of the National Association of Manufacturers Committee on Manufacturers Radio Use, to permit base stations on frequencies above 450 mc to be located outside the boundaries of the licensee's plant or other manufacturing area. At that time, last year, the agency said it would give additional study to questions involved in extending the same relaxation to 152-162 mc manufacturers stations, and to the power question.

The FCC approved a total of 8717 new "authorized stations" in the industrial, public safety, citizens, and land transportation radio services during the month of August, according to statistics compiled by the agency's Safety & Special Radio Services Bureau. Of the total, 6449 were in the citizens radio category.

The American Hospital Association, outlining its efforts over the past three years to get the FCC "to adopt specific rules to accommodate the important radio communication needs of hospitals and to reserve frequencies for hospital use," asked the Commission to "proceed expeditiously" with whatever "additional consideration" is necessary "to establish a medical emergency radio service" meeting the needs of hospitals.

The "request for expeditious action" follows the FCC's recent report and order allocating 25 new frequencies for police radio use and 17 new frequencies for fire radio use, but describing the medical emergency service proposal as requiring "additional consideration before a proper determination may be reached."

The general subject of the coming shortage of frequencies for the land mobile radio services, as the field continues its rapid growth, was discussed at length by the Land Mobile Section of the Electronic Industries Association during EIA's quarterly meeting at French Lick, Ind.

The EIA ad hoc committee which has been considering the problem during the past several months reported a number of recommendations which the full EIA section now has under active consideration, it is understood. Among the recommendations are suggestions as to further channel splitting in some of the land mobile radio bands.

Four of the public safety radio licensees who had been granted extensions of time to comply with the FCC's requirements that the frequency deviation of their transmitters must be reduced to plus or minus 5 kilocycles were advised by the Commission that "administrative sanctions" may be invoked by the agency unless the terms of the rule waivers are met quickly by the licensees.

The 12th annual convention of the National Mobile Radio System started Sept. 16, at the Sir Francis Drake Hotel in San Francisco. Miscellaneous common carriers began registering for the meeting Sept. 15, in numbers indicating the possibility of a record turn-out for the conference.

Subjects of discussion during the conference included interconnection of MCC facilities with those of the telephone industry; MCC regulation by state public utilities commission; MCC frequency prospects; methods for improving sales and profits for the industry; and FCC rulemaking activity, including the finalization of rules establishing a new category of "dispatch station" to permit an MCC customer to dispatch his vehicles via a radio link between his offices and the MCC's control point.

The Federal Aviation Agency has proposed the adoption of a new regulation which it said "for the first time, would establish within a single regulatory document" the FAA requirements applying the construction or alteration "of all structures affecting the safety of aircraft in flight"—including radio towers.

FAA invited interested persons to submit their comments on the proposed regulation (Airspace Docket No. 60-WA-159) within 45 days after publication of the proposal in the Federal Register. Final date for comments is Oct. 31.



New Books

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

CONTROLLED RECTIFIER MANUAL. Published by General Electric's Semiconductor Products Department, Charles Bldg., Liverpool, N. Y. 255 pages, soft cover. \$1.00.

This manual contains 224 circuit diagrams, charts, nomographs and oscilloscope traces. The text illustrates and explains many rectifier circuits.

After two chapters outlining theory and definitions, the text proceeds to examine many types of silicon rectifiers, firing characteristics and firing circuits, turn-off methods, series and parallel operation of silicones, circuits operating from a-c or d-c power, protecting silicones from overloading, heatsinks, test circuits and G.E. rectifier specifications.

This controlled rectifier manual is crammed with data of special value to the engineer who builds, modifies or designs electronic equipment.

***MAGNETIC AMPLIFIERS—Principles and Applications.** By Paul Mali. Published by John F. Rider Publisher. 261 pages, soft cover. \$2.45.

Written in an easily read style, aided by numerous photographs and drawings, the text most capably presents the how and why of magnetic amplifiers. Approaching the subject on an intermediate technical level, the book covers magnetism, electromagnetism, saturable reactors, core, compensating and polarized magnetic amplifiers with the aid of the tried and proven picture/text style of presentation. Considering how increasingly important magamps have become in control and related industrial electronic applications, this excellent volume should receive a rousing reception.

SURPLUS RADIO CONVERSION MANUAL. Published and distributed to the electronic parts distributing trade by Editors and Engineers, Summerland, California. 88 pages, soft cover. \$2.50.

31 types of surplus electronic equipment is featured in this manual dealing in how to convert military transmitters and receivers to citizens band and similar service. Among the equipment featured are the SCR-274N command sets, 375 Transmitters, AN/APN Altimeter, plus other standard pieces used by most electronic technicians in military service.

This manual should bring valuable information to anyone interested in converting that "white elephant" he bought at the surplus store.



BUILT UNDER GLASS IN LINT-FREE FACTORY! No dust, lint, moisture get in 5-Star Tubes to affect performance. Rubber finger cots keep workers' hands from touching mounts. Pre-cleaned parts are delivered to the assembly area in sealed containers.

Finest tubes you can install are G-E FIVE-STAR TUBES!

Be safe, be sure, by using 5-Star receiving tubes when you service electronic equipment! High reliability is built into these tubes—by extra-clean, extra-careful G-E manufacture that omits no step to assure optimum quality.

Airlines use them in communications, navigation, radar. Five-Star Tubes help guard our country against surprise attack, help assure the efficient striking power of our armed forces.

There are 5-Star Tube replacements for most sockets in communications and industry where you and your customers need to be safe, sure . . . see list at right! Phone your G-E tube distributor! Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Ky.

REGULAR	5-STAR
2C51	5670*
2D21	5727
5Y3-GT	6087
6AK5	5654
6AL5	5726
6AQ5	6005
6AS6	5725
6BA6	5749
6AS7-G	6080
6BE6	5750
6BH6	6265*
6C4	6100
6X4	6202
12A7	6201
12AU7	5814-A*
12AX7	5751*
12AY7	6072*

* Heater current approximately 17% higher. Check heater circuit before substituting.

Progress Is Our Most Important Product

GENERAL ELECTRIC

For more data, circle 10-119-1 on card, p. 89

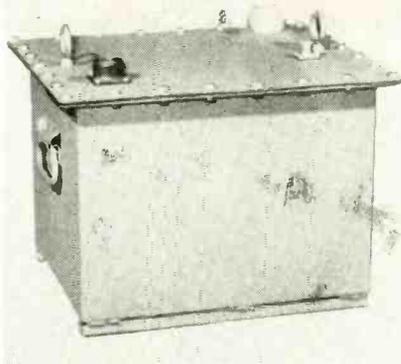


New Products

Peschel HV TEST SET

Featuring small size, lightweight and maximum ruggedness with low cost, model S50-5DC produces 5 ma continuously at 50 kv. Oil fill high voltage tank weighs 90 lbs with oil, measures less than 1 cubic foot in volume. Contains all HV components including metering facilities, automatic output shorting switch, and a gravity type solenoid. Input, 115v a-c, 60 cycle, single phase. Peschel Electronics, Inc., Patterson, N. Y.

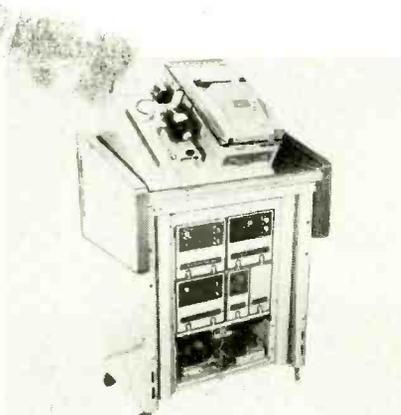
For more data, circle 10-120-1 on card, p. 89



Alden RECORDING SYSTEM

Complete modular helix-type recording system, Alden model 305 GPL graphic presentation lab. Speed range, 60 rpm to 1800 rpm, helix sweep rate range of 1 second to 1/30 second, paper feed rate range of 0.6" a minute to 18.0" a minute, for standard 100 lines to the inch resolution. Other plug-in modules include synchronizing trigger assembly, tone shade signal amplifier, scale line amplifier, marking amplifier and high voltage power supply. Alden Electronic & Impulse Recording Equipment Co., Inc., Westboro, Mass.

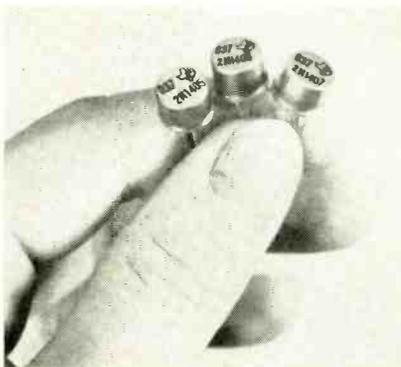
For more data, circle 10-120-2 on card, p. 89



TI MESA TRANSISTORS

Features low noise figures with f (max) in excess of 1000 mc. Engineered to provide rugged and reliable device for applications as r-f amplifiers, oscillators or intermediate frequency amplifiers in transceivers and communications equipment. 2N1405, 2N1406 and 2N1407 feature exceptional gain characteristics for transistors which operate in the VHF/UHF range. Each of these devices are production tested to assure maximum noise figures of 6 db, 8 db and 10 db respectively at 200 mc. Texas Instruments, Inc., P. O. Box 312, Dallas 21, Texas.

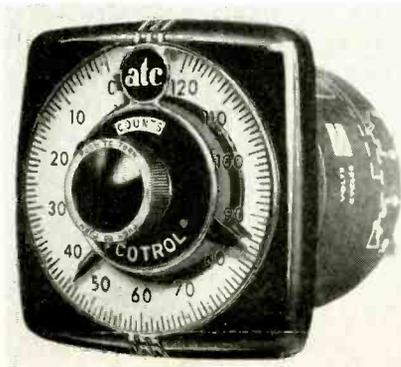
For more data, circle 10-120-3 on card, p. 89



ATC COUNT CONTROL

Miniaturized count control type 310, with automatic reset has been introduced. Counter provides range of 1-120 impulse counts @ rate of 500 per minute. Minimum pulse duration, 50 milliseconds, reset time full scale count range, 1/10 second, with minimum pointer rebound. Available for 115v, 50 or 60 cycle current, has two sets of single pole, double throw contacts rated at 10 amperes. Automatic Timing & Controls, Inc., King of Prussia, Pa.

For more data, circle 10-120-4 on card, p. 89



RCA UHF BEAM POWER TUBE

A new, forced-air-cooled, UHF beam power "Cermolox" tube was introduced. RCA-7649 can deliver about 4500 watts of useful power at peak of pulse with a driver power output of about 450 watts at peak of pulse. Can withstand shock and vibration tests as follows: 500 g, nominal 3/4-millisecond shock; 50 g, 11-millisecond shock; 5-55 cycles per second, 0.5-inch double amplitude, mechanical resonance vibration; 2.5 g, 25 cps, 96-hour fatigue vibrations; and 5-2000 cps variable frequency and cycling vibration. RCA Electron Tube Div., Harrison, N. J.

For more data, circle 10-120-5 on card, p. 89

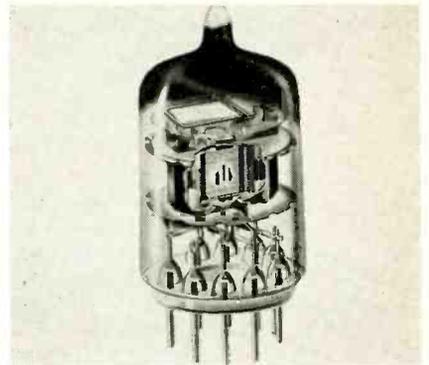
G-E CC TV CAMERA

A self-contained, single-unit transistorized camera model TE-9-A is designed for closed circuit military, industrial and educational applications. The Vidicon unit is cylindrical in design, 11 3/4" by 5 1/2" and weighs nine pounds. Uses any standard 16mm lens and is equipped with a remote turret for mounting four lenses at one time. Remote optical focus, turret, and other accessories available. Has maximum sensitivity and can be used down to 1.0-footcandle scene illumination. General Electric, Lynchburg, Va.

For more data, circle 10-120-6 on card, p. 89

Amperex "AMRLIFRAME" TUBES

Two new "PQ" (Premium Quantity) 10,000 hour frame grid "Ampliframes," type 7737 and the type 7308 have been announced. Type 7737 is a broadband amplifier pentode, similar to type 6688. Transconductance, 16,500 micromhos. Vibrational noise output, 500 mv @ 10 g peak over sweep fre-



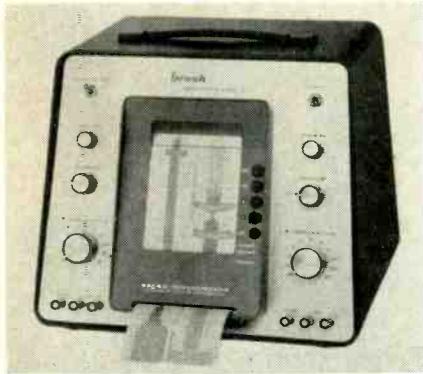
quency range 50-2,000 cps. Type 7308 is a high gain, twin triode, similar to the 6922, designed for use in radar, oscilloscopes, computers, broadband amplifiers and critical airborne applications. Transconductance, 12,500 micromhos. Amperex Electronic Corp., Semiconductor and Special Purpose Tube Dept., 230 Duffy Ave., Hicksville, L. I., N. Y.

For more data, circle 10-120-7 on card, p. 89



Brush RECORDER

Mark II model 2522 portable electric writing recorder is available. Chart speeds are 0.4, 2, 10 and 50 mm/sec. At 0.4 mm/sec, up to 31½ hours of continuous recording can be made. Factory-calibrated, self-contained d-c amplifiers are matched to



each analog channel. Sensitivities down to 10 mv per millimeter of pen excursion. Power source, 12v internal. Full scale deflection from center ± 200 mv. Measurement range, from 0.010 to 400v. Frequency response, from d-c to 100 cps. Price \$1450.00. Brush Instruments Div., Clevite Corp., 37th & Perkins, Cleveland 14, Ohio.

For more data, circle 10-121-2 on card, p. 89

Hoover POWER COUNTER

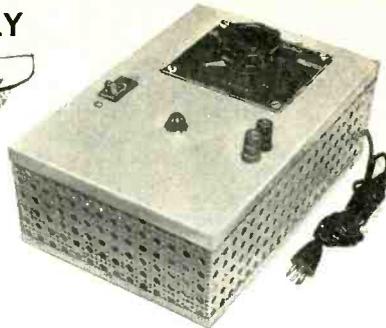
Operates 12 volt electronic equipment in vehicles with 6 volt electrical systems. Input voltage, 6.3v. Output currents from 2 to 25 amperes at 12.6 to 14.0v. Two outputs are supplied—one filtered and one unfiltered. Operates over temperature range from -30° C to $+65^{\circ}$ C. Size 5½" wide, 8" long and 4" deep and weighs approximately 6 pounds. Made of fabricated steel finished in blue-gray semi-gloss machine enamel. Hoover Electronics Co., 110 W. Timonium Rd., Timonium, Md.

For more data, circle 10-121-3 on card, p. 89



"Due to the high temperature saturated switching circuits at frequencies up to 5 mc which represents beta ranges of 6-18 . . . you need a new tube!"

A.C. to D.C. POWER SUPPLY



. . . just what you need FOR TESTING TRANSISTORS

Plug this instrument into any 60 cps, 95/130 volt circuit and get a stabilized source of direct current, adjustable over a range from 0 to 45 volts DC, with current output 0/2.5 amperes.

Filtered direct current output range 0/45 volts, 0/2.5 amperes is continuously adjustable and stabilized $\pm 1\%$ at any setting regardless of alternating current fluctuation. Voltage regulation is approximately 5% between full load and no load at full voltage setting.

This DC Power Supply instrument is ideal for use in transistor testing, circuit testing, to provide regulated voltage for light testing, eliminates the need of batteries by supplying exact DC voltage required.

Write for Bulletin 17-BLO1 which gives full details and models available. SAA 3402-1850

ACME ELECTRIC CORPORATION

1810 WATER STREET

CUBA, N. Y.



For more data, circle 10-121-1 on card, p. 89

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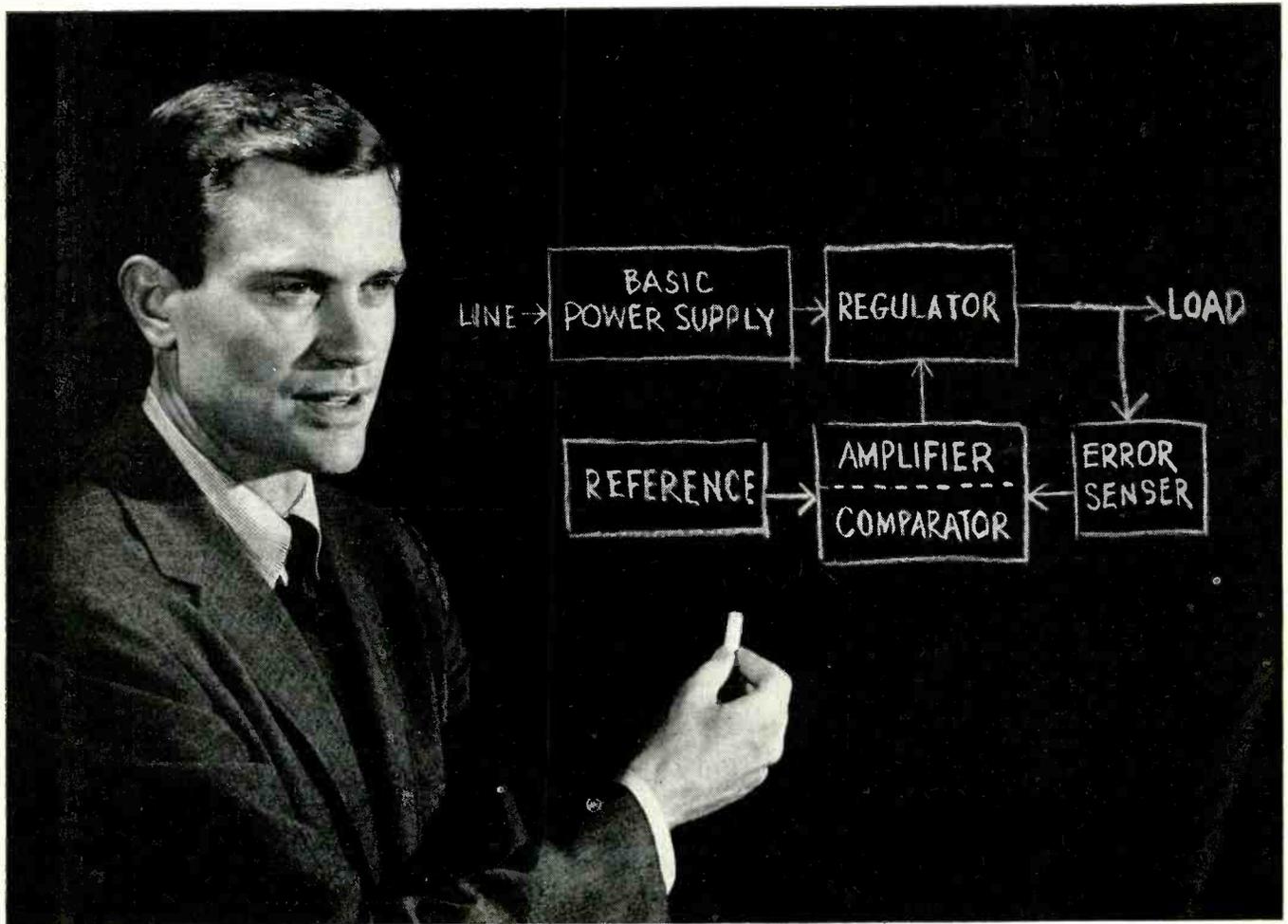
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Latest issue of TUNG-SOL TIPS

tells you what you should know about
DC POWER SUPPLIES



PICTURED above is a block diagram of an electronically regulated power supply. It's the subject of the latest issue of Tung-Sol's monthly series for the industrial serviceman, *Tung-Sol Tips*. And it's must reading if you're going to deliver fast and efficient trouble shooting service to your customers. Or if you work with dc supplies in your laboratory. That's because Issue #11 of *Tips* delivers quickly and clearly the ins and outs of modern dc power supply equipment.

You get a big, broad analysis of how each of these elements contribute to the overall performance of these power supplies. There's a thorough discussion of one of the most critical elements in the power supply, namely the regulator . . . with lucid illustra-

tions and explanations of several common (and not so common) regulating devices in use today . . . PLUS a ready-to-use, problem-solving series regulator trouble shooting guide that will prove a big help to you in your work.

Then, to top things off: a lengthy description of how designers design regulated power supplies. Right in this issue, the author takes you through a step-by-step analysis of designing procedures. You actually design a power supply with him. He shows you how circuit elements are selected through graphical means. He explains why particular tubes are suited for the design. And finally, to cap it all, you get a complete circuit diagram of the finished design . . . a tried and tested

regulated dc power supply that delivers a 250 volt output at 50 to 250 mA.

So, don't miss out on this really important issue. It's yours merely for the asking. Just drop in to see your Tung-Sol distributor. He'll be glad to place your name on the mailing list. Or else write directly to us and start getting your issues of *Tips* immediately. Tung-Sol Electric Inc., Newark 4, New Jersey.

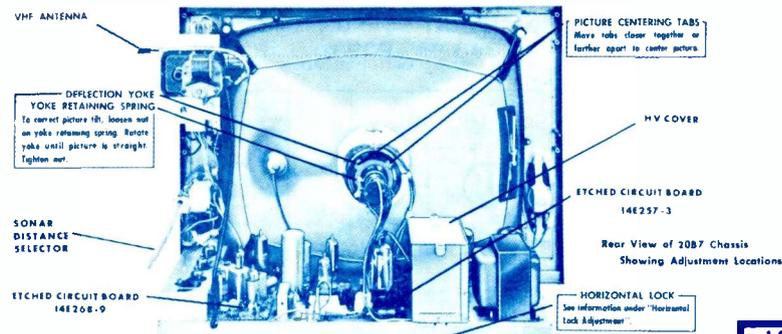
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For more data, circle 10-122-1 on card, p. 89

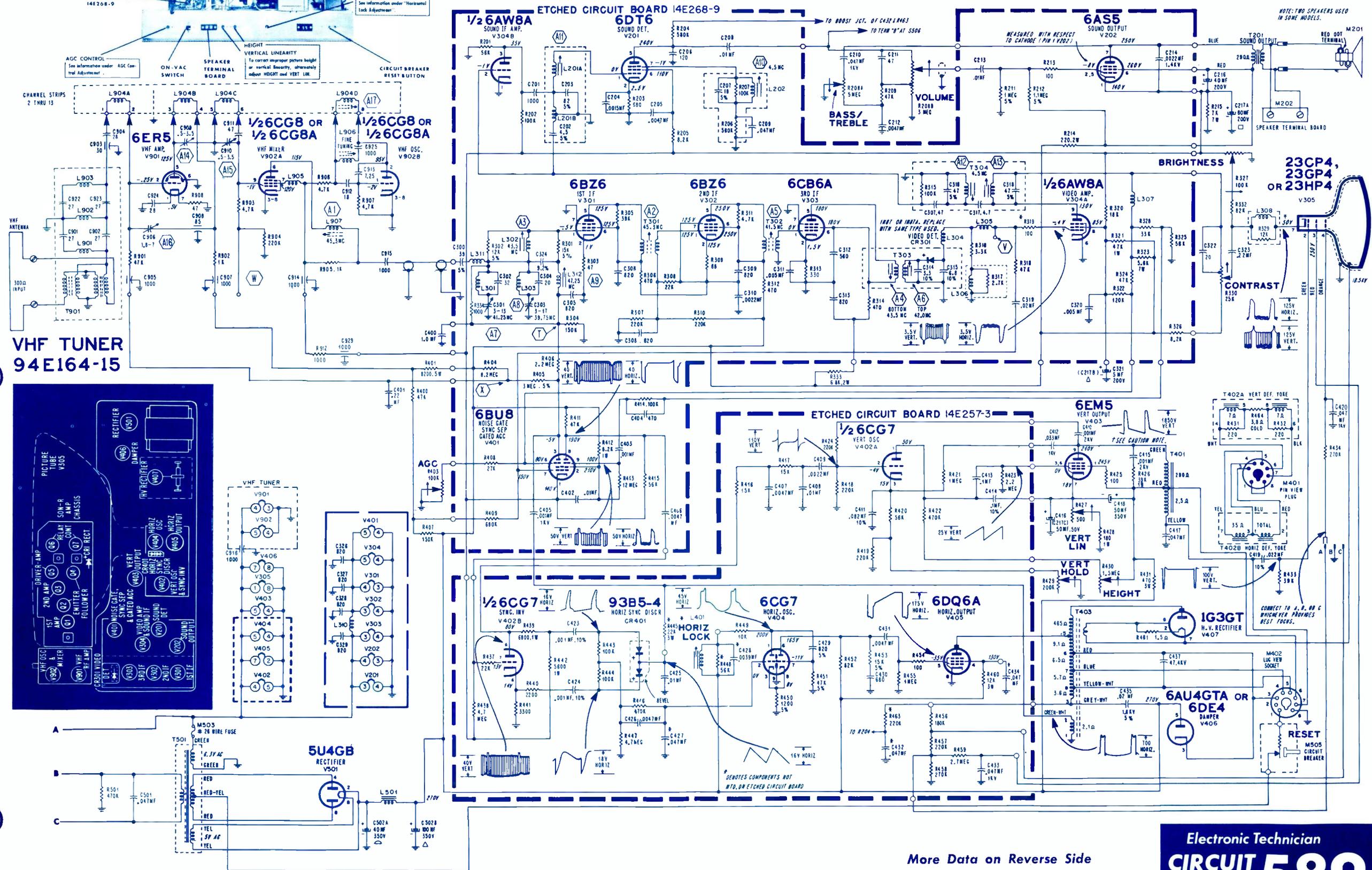


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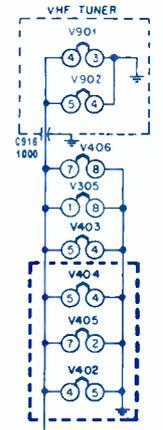
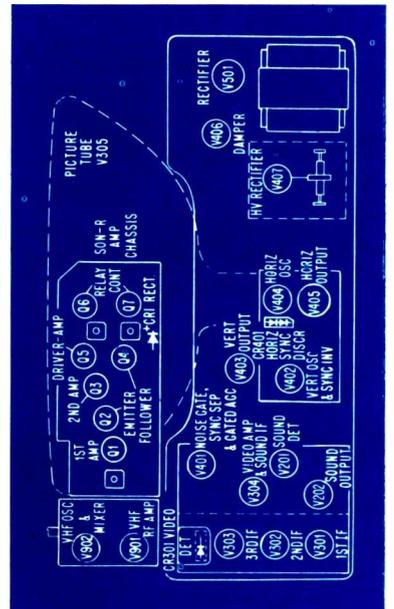


Rear View of 20B7 Chassis Showing Adjustment Locations.

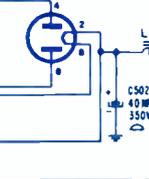
Special Full-Width Spring Binder Holds 24 Groups of Electronic Technician's Circuit Digests Available @ \$2.95



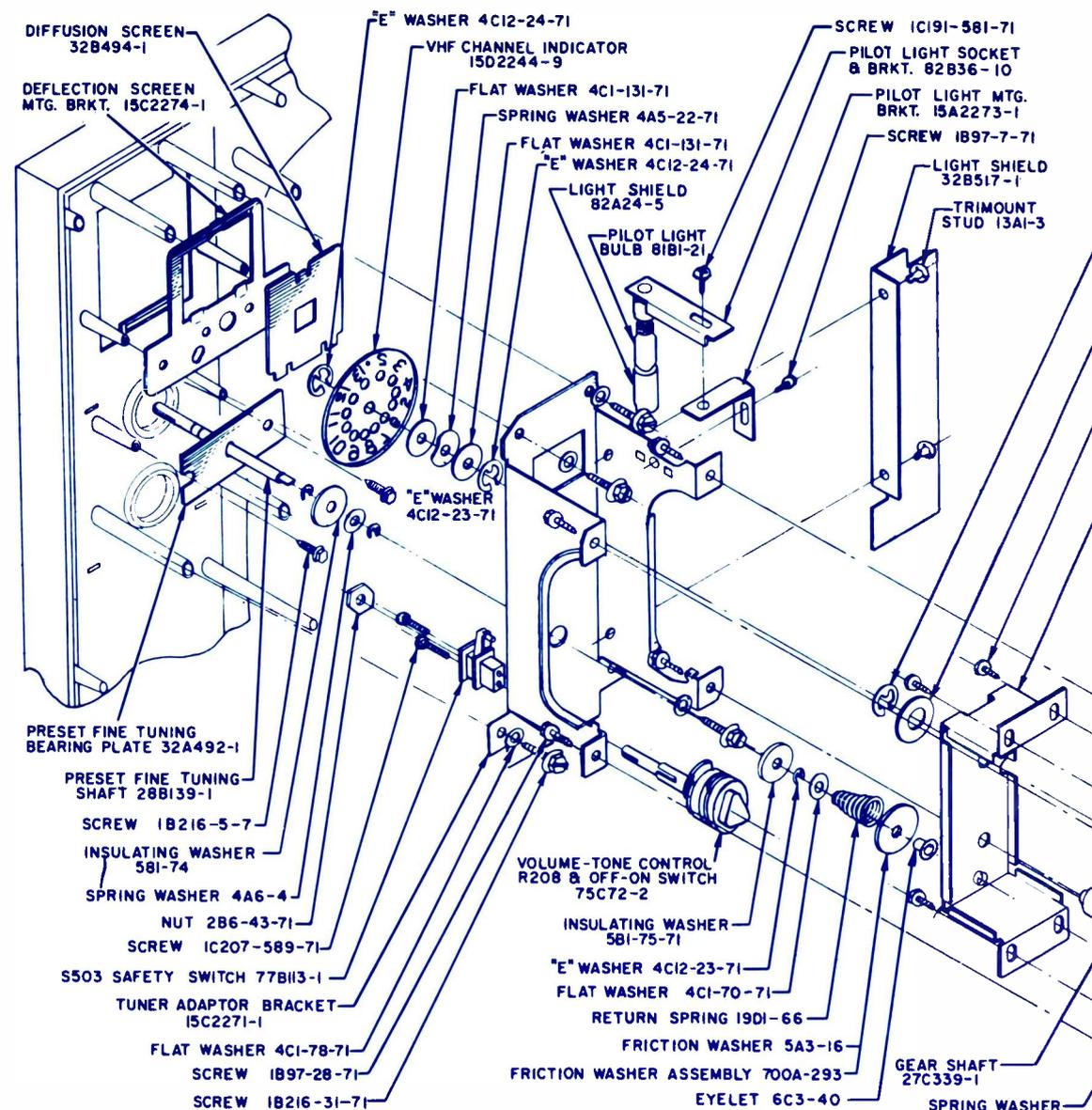
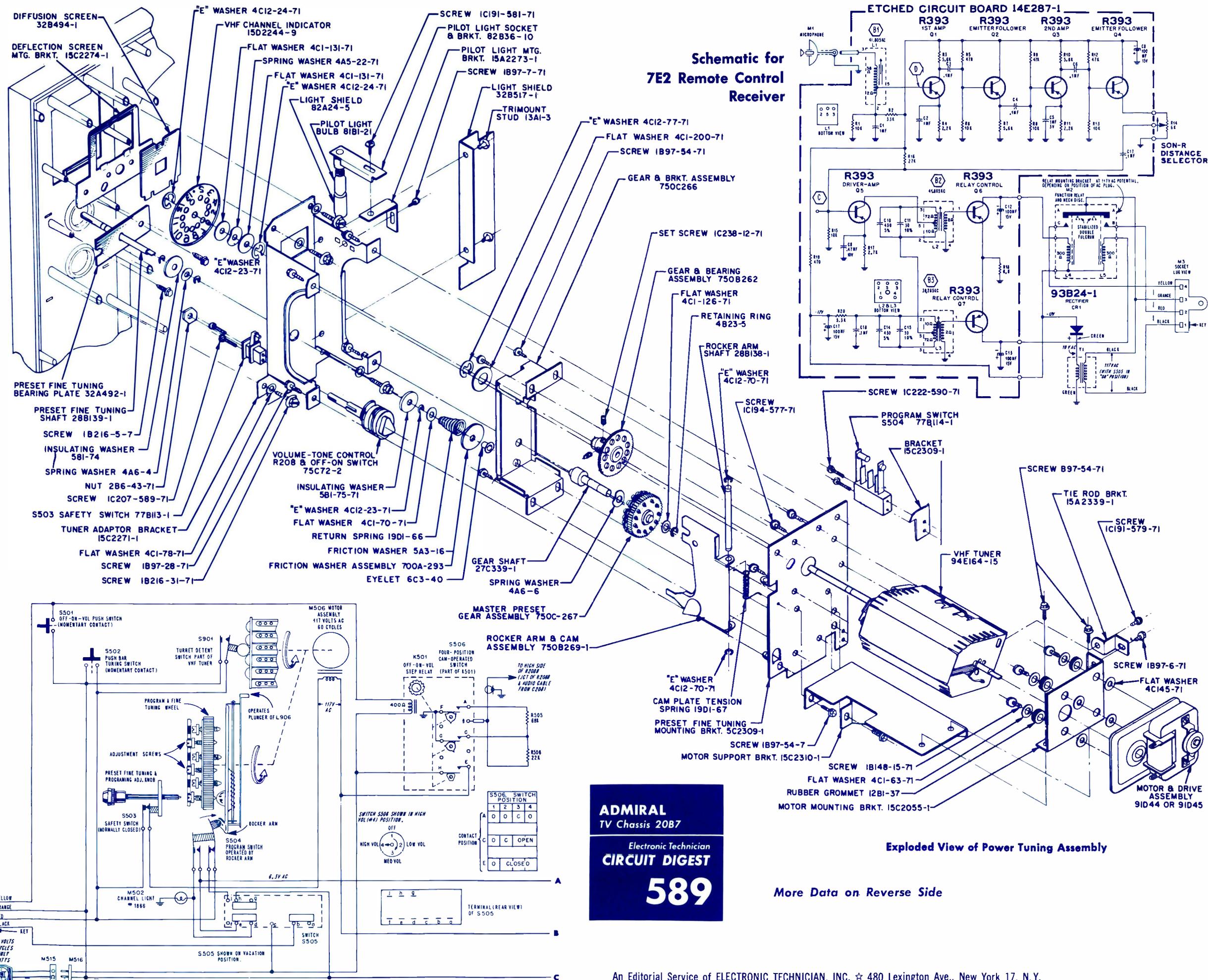
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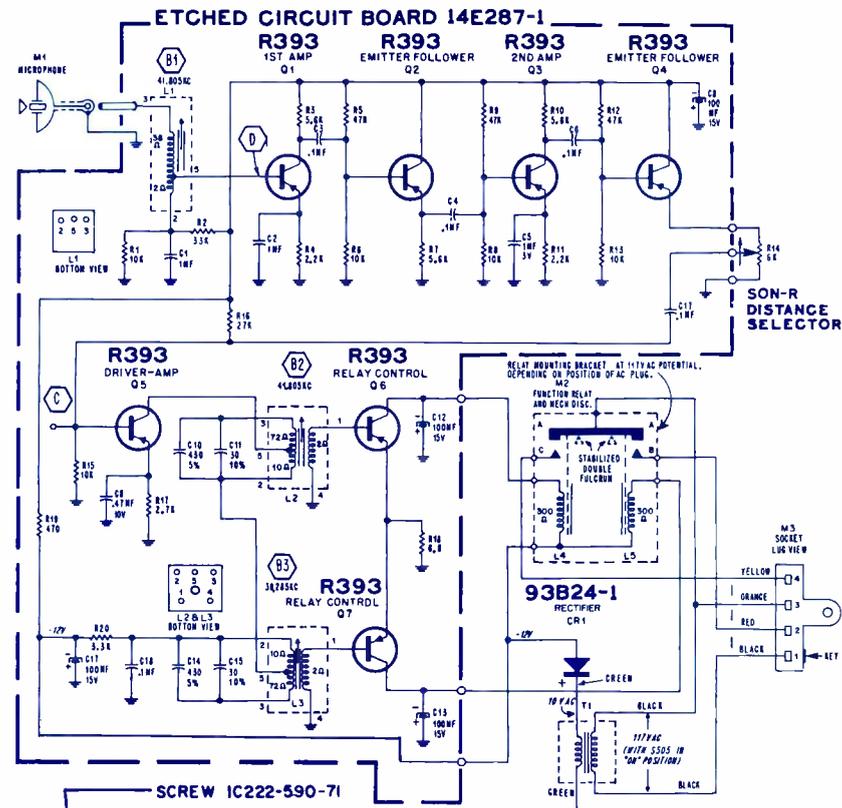
5U4GB RECTIFIER V501



More Data on Reverse Side



Schematic for 7E2 Remote Control Receiver



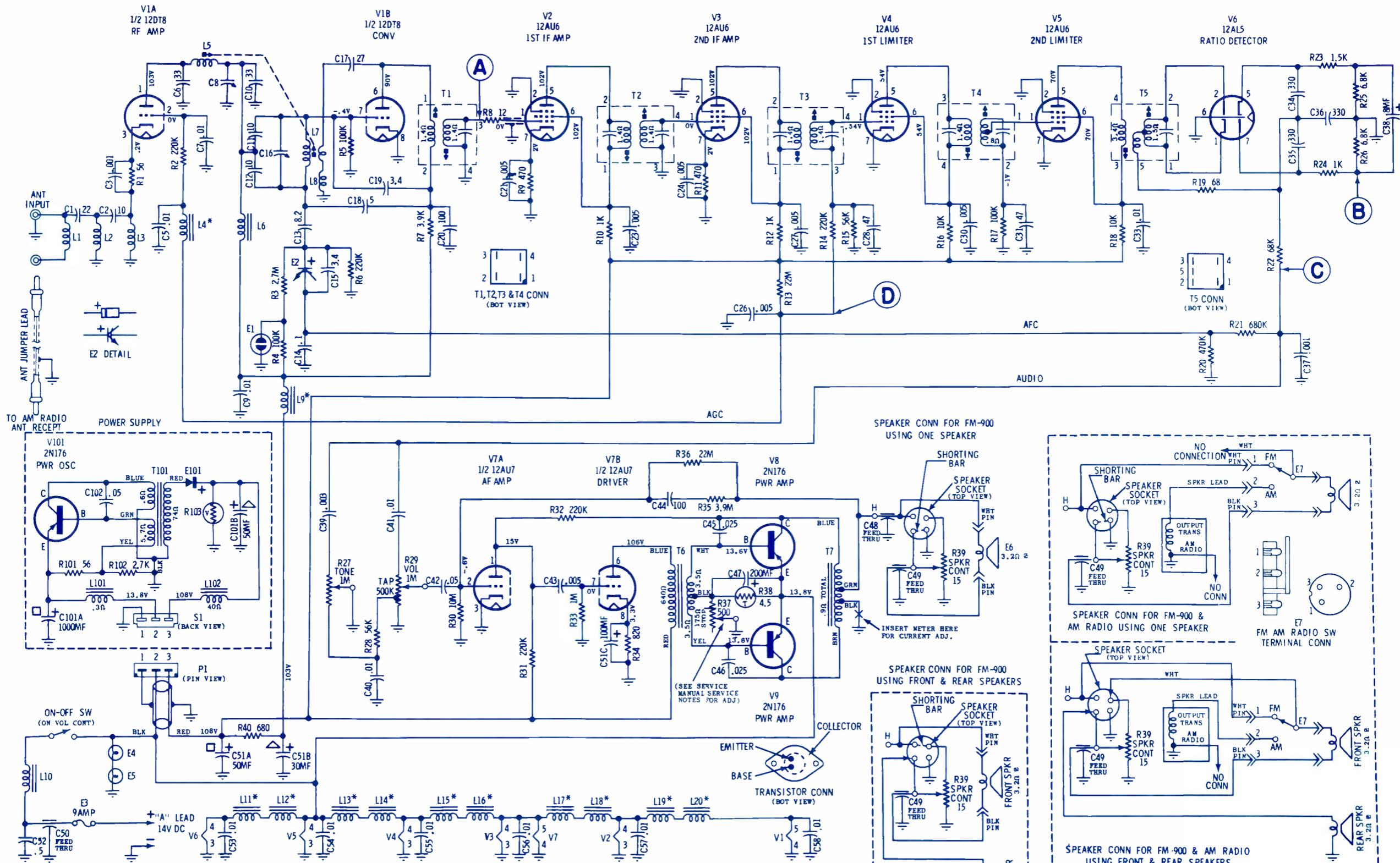
Exploded View of Power Tuning Assembly

ADMIRAL
 TV Chassis 20B7

Electronic Technician
CIRCUIT DIGEST

589

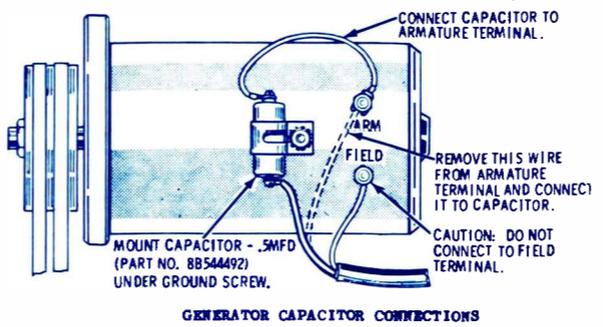
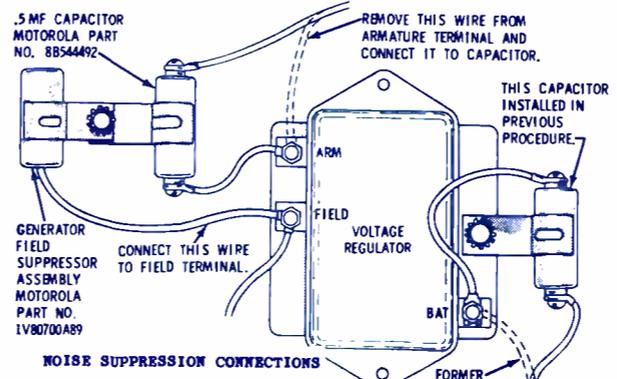
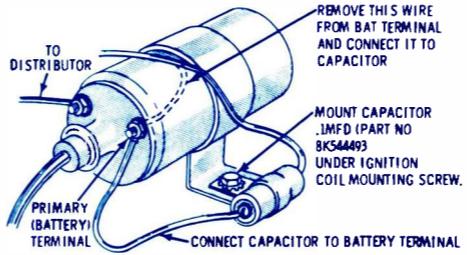
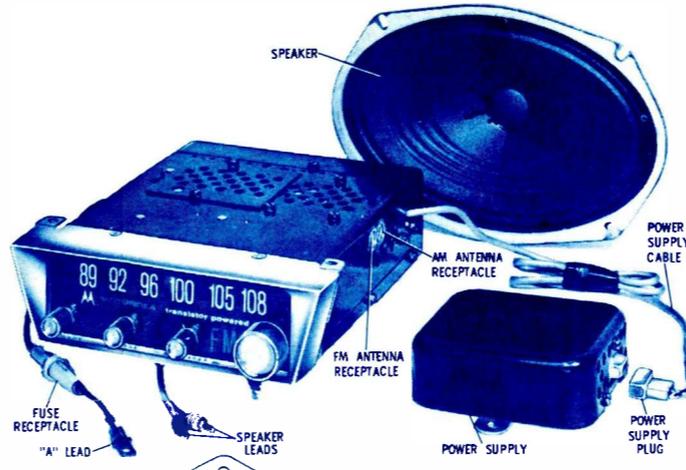
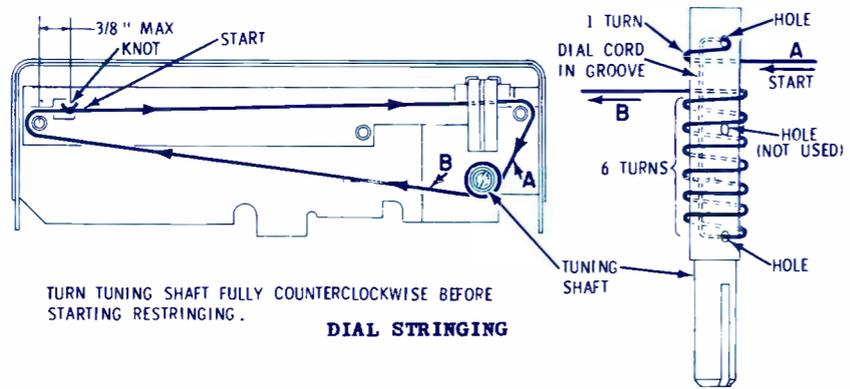
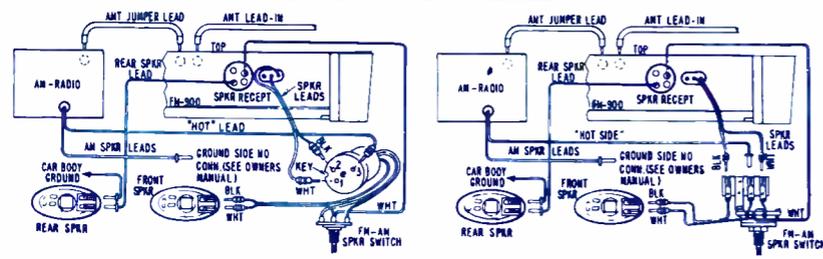
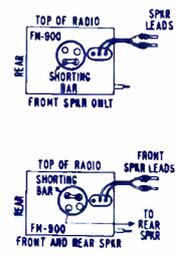
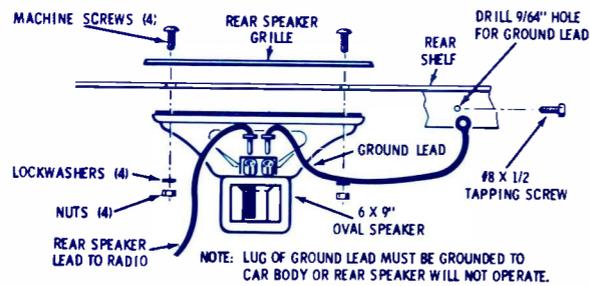
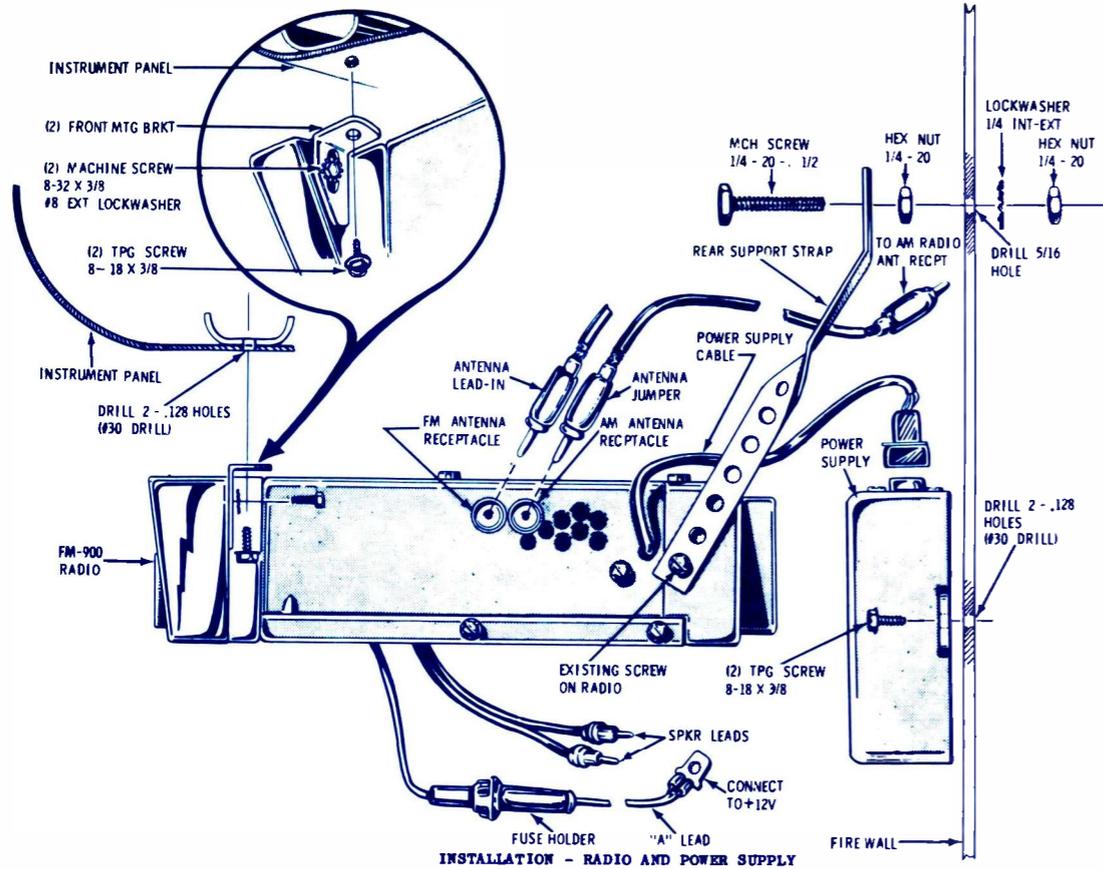
More Data on Reverse Side



CAUTION
"A" LEAD MUST BE CONNECTED TO POSITIVE (+) SIDE OF POWER SUPPLY. RADIO WILL NOT OPERATE AND DAMAGE TO COMPONENTS WILL RESULT IF CONNECTED OTHERWISE.

NOTES:
CAPACITORS - Unless otherwise specified, decimal values in MF, all others in MMF.
VOLTAGES - Measured from point indicated to chassis with a VTVM. No signal in. Tolerance $\pm 10\%$.

INPUT VOLTAGE - 14V DC.
TUNING RANGE - 88 MC to 108 MC.
IF FREQUENCY - 10.7 MC.
* Denotes ferrite bead.

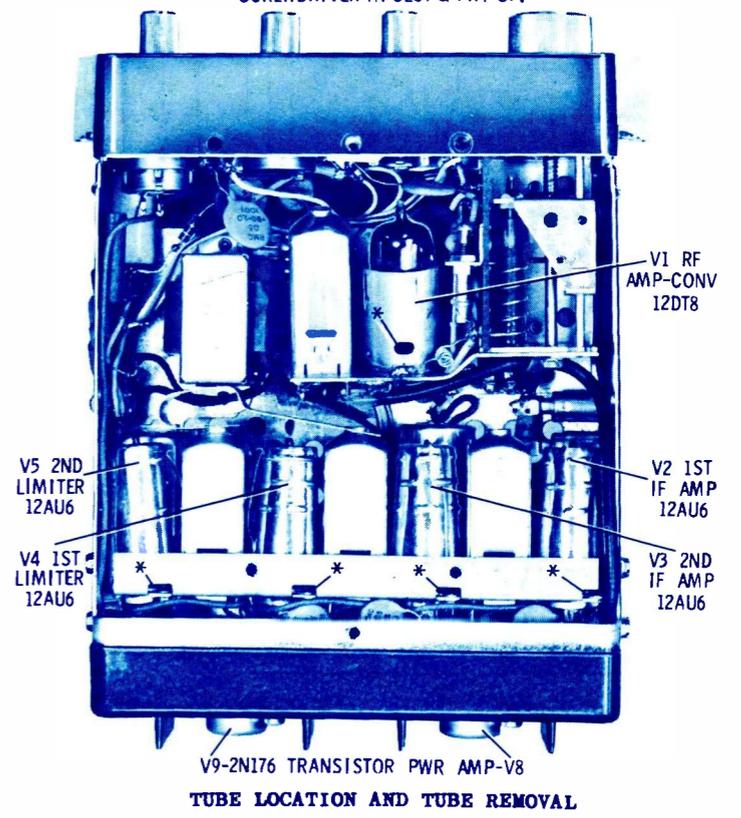
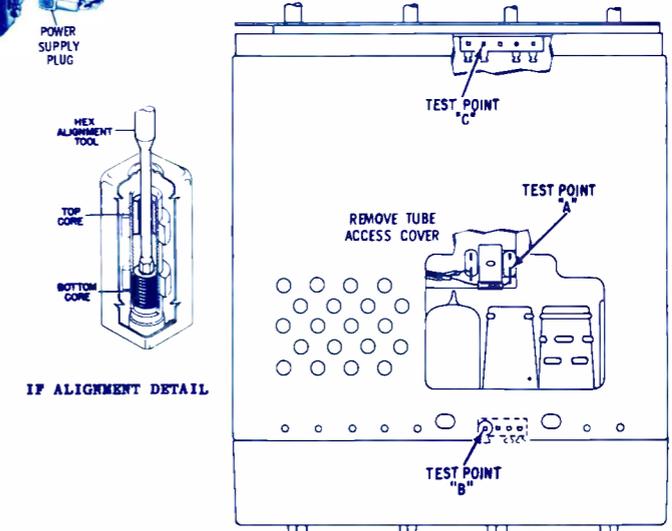


INTERFERENCE ELIMINATION

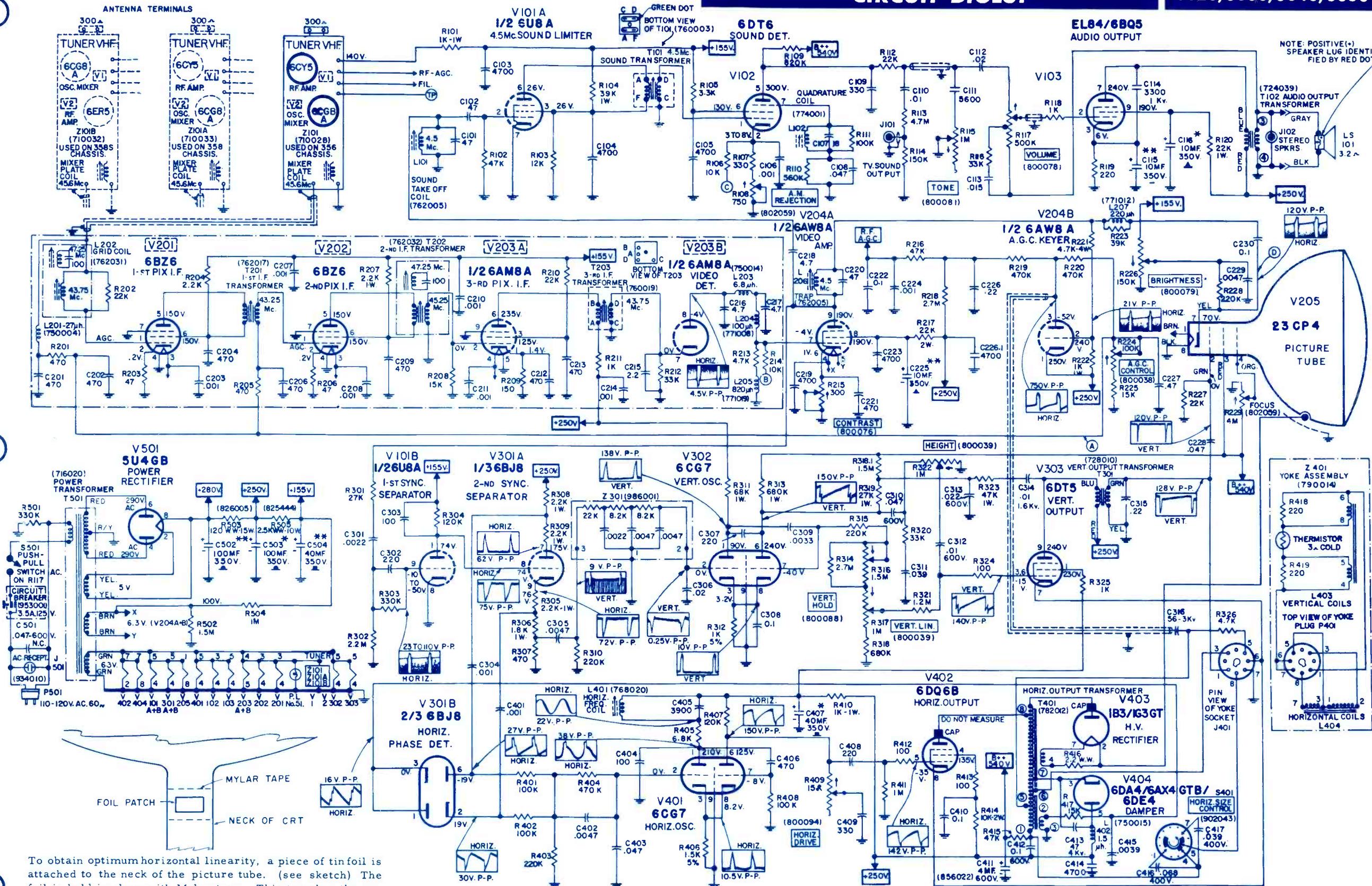
The ignition noise suppression capacitors supplied with the FM-900 must be installed, even though the car may have existing suppression equipment for an AM radio.

POWER SUPPLY REQUIREMENTS - It is preferable to use a storage battery (without a battery charger) in place of a battery eliminator. If a battery eliminator is used, it must be well regulated and filtered.

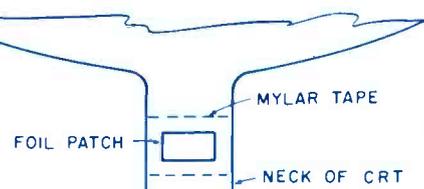
TRANSISTOR REPLACEMENT - When replacing a transistor, be sure transistor insulator is in place and well greased and that the mounting screws are securely and evenly tightened.

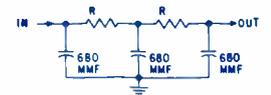
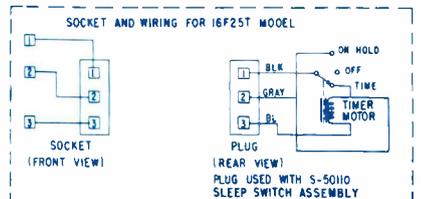
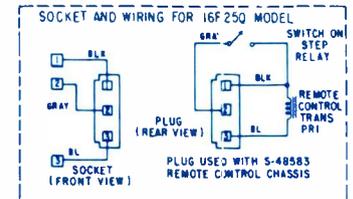
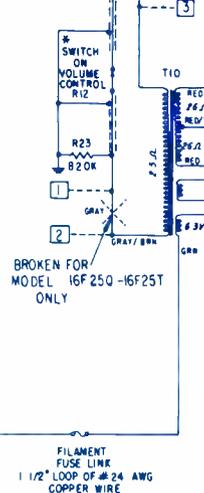
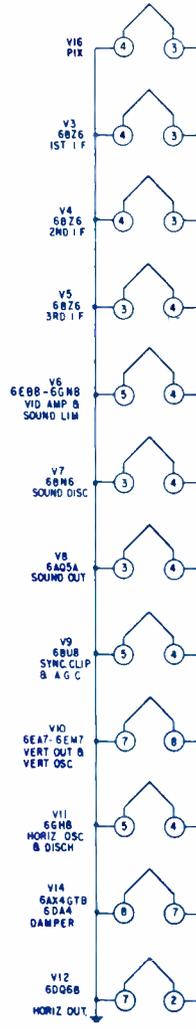
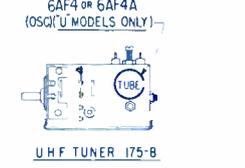
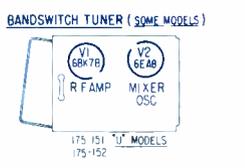
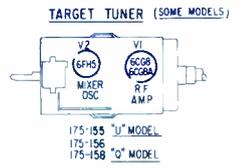
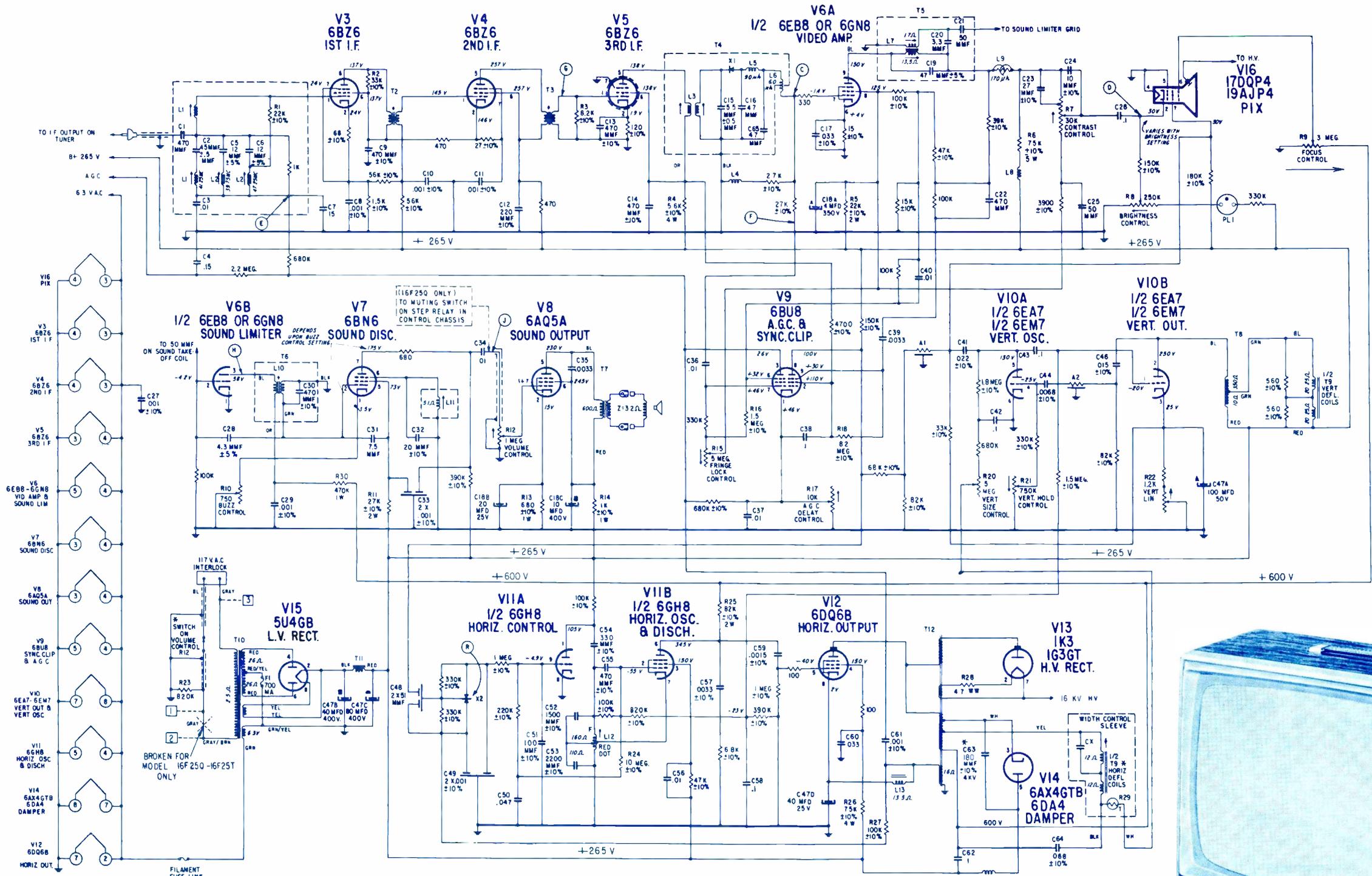


MOTOROLA
 Auto Radio, FM
 Model FM-900
 Electronic Technician
CIRCUIT DIGEST
590

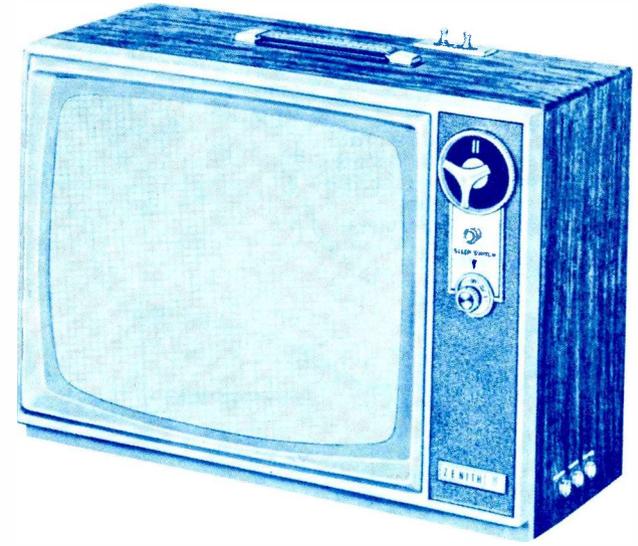


To obtain optimum horizontal linearity, a piece of tinfoil is attached to the neck of the picture tube. (see sketch) The foil is held in place with Mylar tape. This tape has the required high voltage breakdown potential. The foil should be removed from the old picture tube and placed on the neck of the new replacement picture tube, before the replacement tube is installed.





EQUIVALENT CIRCUIT
A-1 and A-2 INTEGRATORS
87-7 R is 68K
87-8 R is 82K

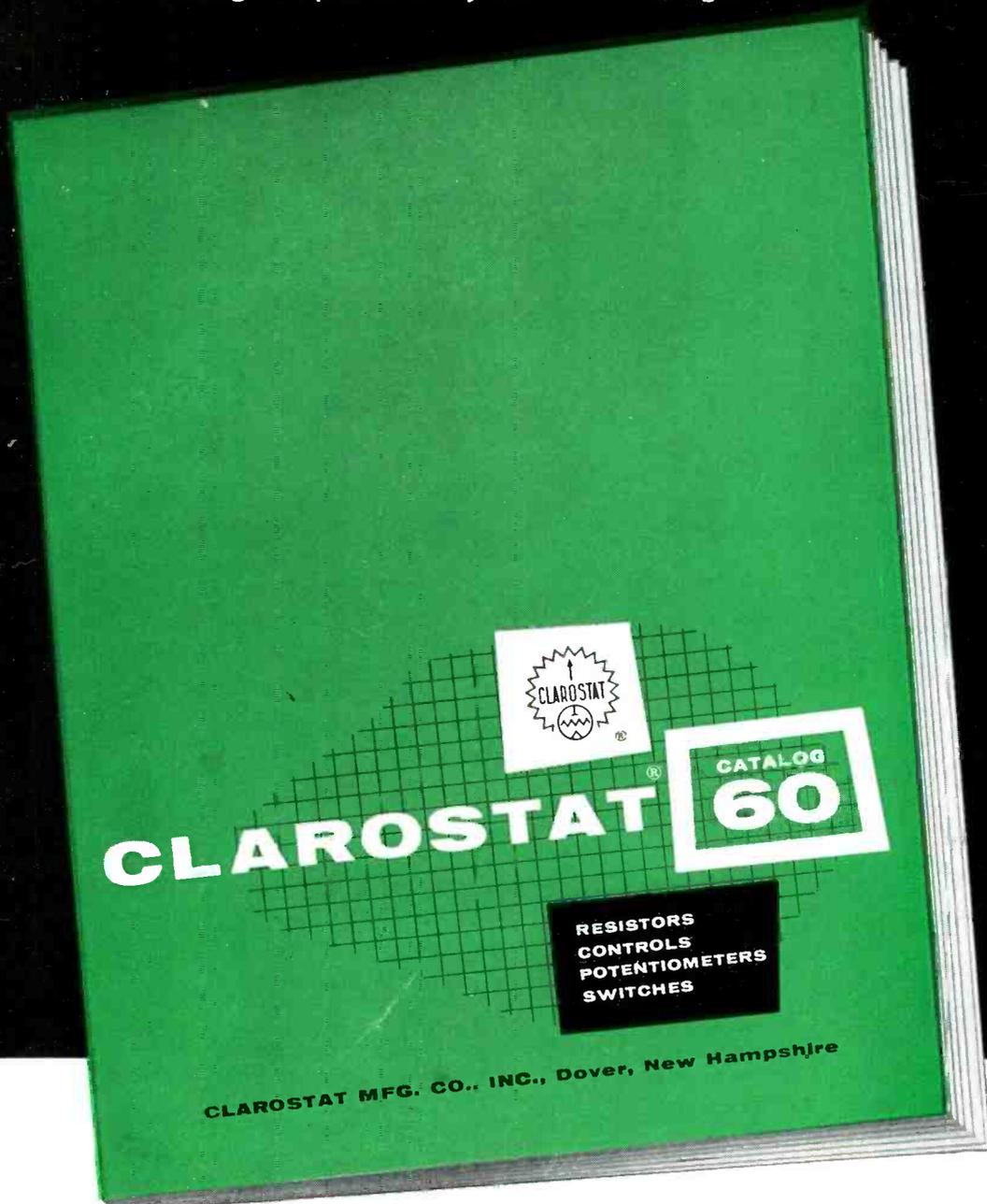


* 16F26 CHASSIS
C63 22-3185 CAPACITOR (200 MMFD, 4KV)
T9 95-1796 YOKE

ALIGNMENT POINTS
CIRCLED LETTERS INDICATE ALIGNMENT AND TEST POINTS
TEST POINTS:
C - DETECTOR OUTPUT
D - VIDEO OUTPUT
E - I.F. A.G.C.
F - GROUND DURING I.F. ALIGNMENT
G - 3RD I.F. GRID
H - SOUND LIMITER PLATE
J - SOUND OUTPUT
K - PLATE OF A.F.C. DIODE

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For more data, circle 10-C3-1 on coupon, p. 43





WHEN YOU REPLACE A TUBE . . .

You have a lot at stake each time you replace a receiving tube in a customer's set. Your professional reputation, your customer's confidence, your day's profits—even future business—all depend on the quality of that replacement tube.

It is RCA's constant aim to provide receiving tubes you can install with confidence. To this end, RCA carefully controls every step of the tube making process from initial design to final test.

QUALITY BY DESIGN—Some of the foremost tube experts in the industry collaborate on each new RCA tube design. Engineers, chemists, physicists, metallurgists, production specialists, field representatives, all contribute their own skills and knowledge before a new RCA tube design ever leaves the drafting board.

IMPROVED QUALITY FROM NEW AND IMPROVED MATERIALS—All parts and materials in RCA tubes are either *produced* or *processed* by RCA under strictest quality control. Moreover, RCA scientists search constantly for new and better materials which will still further improve performance of RCA tubes. Many tube types you install today benefit from new cathode and plate materials developed in RCA labs.

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QUALITY BY TESTING AND CONTROL—Before shipment, *every single RCA receiving tube* is factory-tested for every significant characteristic. *A tube that fails one single test is rejected and destroyed. So there is no such thing as a "second" when you buy RCA.* In addition, thorough aging of tubes and rating-lab tests assure strict adherence to performance specifications.

This is why YOU CAN REPLACE WITH CONFIDENCE with RCA tubes . . . and why RCA tubes give you an extra advantage on every service job. Electron Tube Division, Harrison, N. J.



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