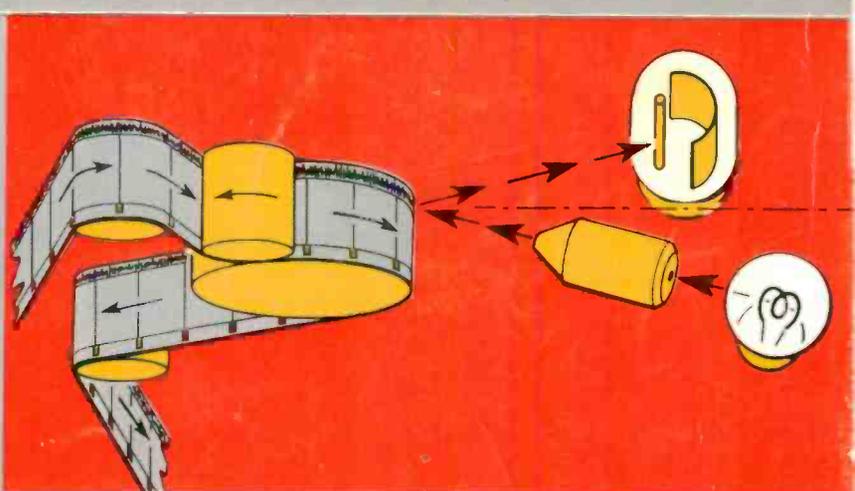
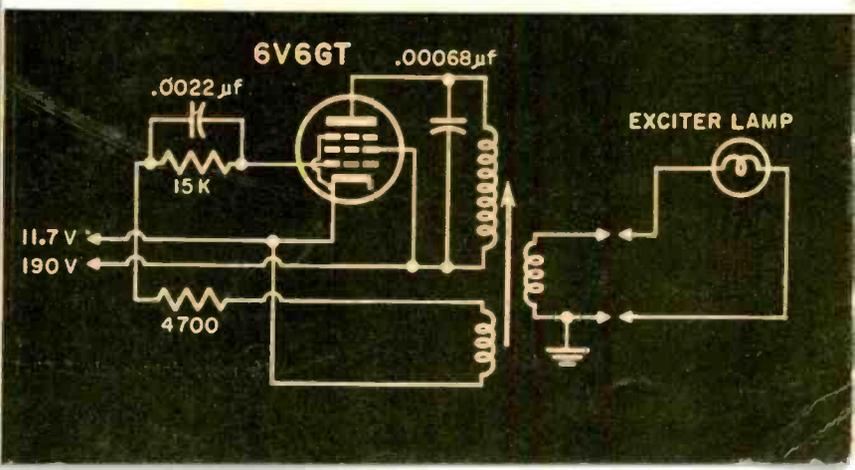


ELECTRONIC TECHNICIAN

Including
SERVICE
Magazine



SERVICING OPTICAL SOUND





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

TUNER REPLACEMENT LISTING IN SAM'S PHOTOFAC

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

NEW TV TUNER REPLACEMENT GUIDE

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

48 HOUR FACTORY GUARANTEED REPAIR SERVICE

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

DEFECTIVE TUNER TRADE-IN ALLOWANCE

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

JUMP ON THE STANDARD COIL PROFIT WAGON TODAY!

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

Standard

Coil Products Co., Inc.

2085 North Hawthorne Avenue, Melrose Park, Illinois

For more data, circle 8-C2-1 on coupon, p. 46

ELECTRONIC TECHNICIAN

Including
SERVICE
Magazine

World's Largest Electronic Trade Circulation

August, 1960

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FRONT COVER If you can repair an audio amplifier, our cover story may uncover a new and profitable service field for you: optical-sound movie projectors. The principles and repair practices concerning sound-on-film equipment are described in the article starting on page 26.



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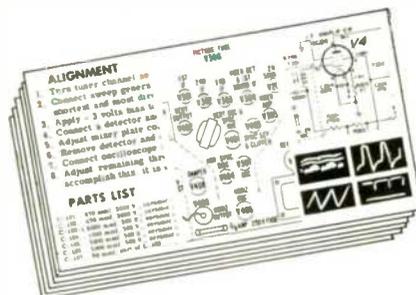
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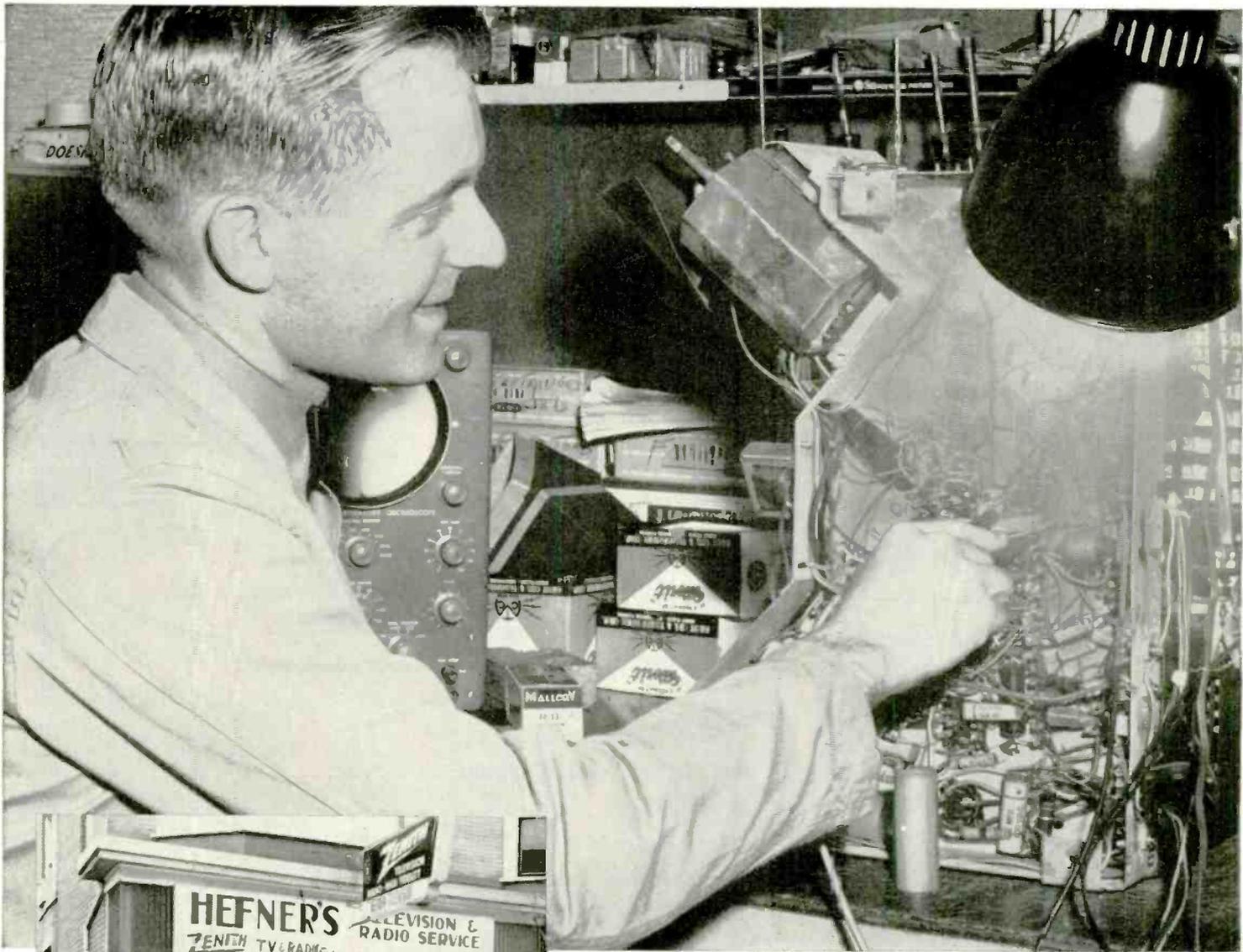
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VOCALINE: Intercom "Vocatron" Model CC-60





Roger Hefner owns and operates Hefner Television & Radio Service in Lima, Ohio. He attended DeVry School in Chicago, then furthered his electronics training by working with a major radio-TV manufacturer. He returned to Lima five years ago to go into business for himself. Roger now has two technicians helping him with sales and service on home and auto radio, TV and hi-fi. He credits his business success to prompt, courteous attention to service calls, careful, thorough workmanship and the use of only quality products.

STOP CALL-BACKS WITH THESE QUALITY MALLORY COMPONENTS



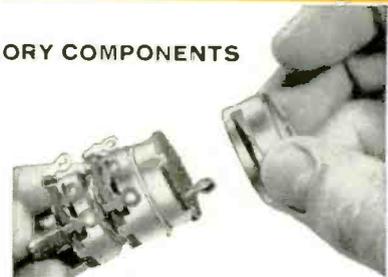
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"Mallory Quality Components

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For replacing ceramic capacitors in TV tuners

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and other precision circuitry, Roger Hefner, like thousands of other technicians, has discovered that Mallory RMC Discaps* are the surest step to customer satisfaction. The quality built into every Discap ends call-backs . . . provides the margin between just *service* and genuine *quality service*. Discaps—for years the standard of quality in original equipment—come packaged for replacement in handy 3 x 5" file card five-packs.

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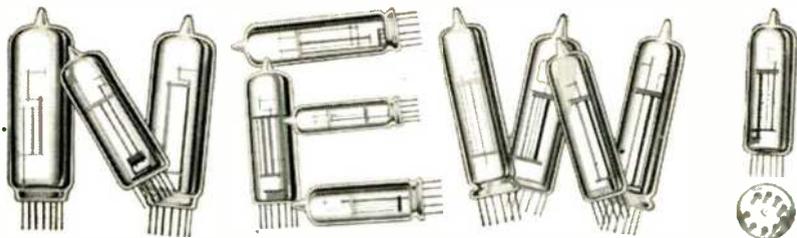
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1AB6	6AJ8	6BY7	6U8	35W4	EABC80/6T8	EF85/6BY7
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1AJ4	6AM6	6CA4	6V6GT	50C5	EBC91/6AV6	EF89/60A6
1B3GT	6AN8	*6CA7	6W4GT	50EH5	EBF80/6N8	EF91/6AM6
1L4	6AQ4	6CB6	6X4	5928-6267	EBF89/6DC8	*EL34/6CA7
1M3	6AQ5	6CD6GA	6X8	60EH5	EC91/6AQ4	*EL84/6BQ5
1S5	6AQB	6CG7	9AQ8	6026	EC92/6AB4	EL90/6AQ5
1T4	6AT6	6DA5	12AT7	7025	ECC81/12AT7	EL95
2AF4A	6AU6	6DA6	12AU7	DAF91/1S5	ECC82/12AU7	EM71
2AF4B	6AV6	6DC8	12AU7A	DAF96/1AH5	ECC83/12AX7	EM80/6BR5
3AF4A	6AX4GT	6DJ8	12AX7	DC90	ECC84	EM81/6DA5
3C4	6BG6GA	6E58	12AX7A	DF91/1T4	ECC85/6AQB	EM84/6FG6
3V4	6BL7GTA	6FG6	12BA6	DF96/1AJ4	ECC88/6DJ8	EZ80/6V4
5AR4	6BL8	6J6	12BE6	DK92/1L4	ECF80/6BL8	EZ81/6CA4
5J6	6BM8	6J6A	12SN7GT	DK96/1AB6	ECF82/6U8	EZ90/6X4
5U4GB	*6BQ5	6K6GT	OZ4	DL94/3V4	ECH81/6AJ8	GZ34/5AR4
5Y3GT	6BQ6GTB/	6L6CC	16A8	DL96/3C4	ECL80/6AB8	PCC85/9AQ8
6AB4	6CU6	6N8	18DZ8	DM70/1M3	ECL82/6BM8	PCL82/16A8
6AB8	6BQ7A	6SN7GTB	35DZ8	EAA-EB91/	EF80/6BX6	UCL82/50BM8
6AF4	6BR5	6S4A	35EH5	6AL5		
6AF4A	6BX6	6T8				

*Available in Matched Pair

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Editor's Memo



An increasing number of service dealers are being asked to join The Club. I'm referring to centralized service clubs which direct calls from consumer members to affiliated repair outlets such as TV technicians, plumbers, masons, painters, etc.

A typical club gets \$5 or \$10 annually from consumer members, and collects 10% of the bill from the service contractor.

There are a number of advantages for the contractor. Where the club acts as factor or collection agency, the immediate payment (less 10%) is most attractive. Satisfied contractors cite the increase in new customers and the prestige of being club approved as benefits.

On the other hand, some contractors complain that the 10% charge cuts much of the profit. Frequently the club makes too much of a thing of "the customer's always right." In addition, fly-by-night clubs have sprung up and disappeared, leaving unpaid bills.

It's up to each service dealer to decide the value of a club contract. However, be sure that the reputability and financial responsibility are in order. United Home Service in Los Angeles was founded in 1954, and claims to be the oldest such club. It is said to have 35,000 members and 800 contractors. Allied Homeowners Assn., Long Island, N.Y., has some 5000 members and 285 contractors. National Home Owners Club of Detroit has about 6000 members and contractors.

Clubs in cities such as Chicago and Phoenix have either folded or are struggling to stay alive. The trouble is that a club can start on a shoestring, but substantial capital (\$25,000 to \$50,000) is usually needed to make it a success.

The important thing for service contractors to consider is the integrity and wisdom of the management.

And that, as the man says, reminds me of the story of the immensely successful TV service shop owner who was introducing his son into the operation.

"Our business is built on integrity and wisdom, son. Integrity means when we promise a customer something, we keep that promise even if we lose money.

"And what is the wisdom we need?" asked the lad.

"Wisdom," replied the father, "means that we don't make such foolish promises!"

Al Forman

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AEROVOX 'BI-ELECTRIC' MYLAR* PAPER BYPASS CAPACITORS

Now...2 famous dielectrics...quality kraft tissue and performance-proved mylar film...are combined to bring you a superior bypass capacitor. Aerovox "BI-ELECTRIC" units feature Aerolene impregnant and unique Polycap plastic case that is the next best thing to a metal can for humidity resistance.

The advanced construction techniques presented in "BI-ELECTRIC" capacitors offer distinct advantages over other radial lead types on the market today. The exclusive Polycap case provides a solid uniform covering that does not depend on dipped coatings that vary in thickness from end-to-end...and from capacitor to capacitor.

Controlled end-fills provide sealed protection where it is needed most. Leads cannot crack end-fill... compare this with conventional dipped units. Standard capacitance tolerance on all "BI-ELECTRIC" units is $\pm 10\%$ making them the precision buy in a bypass capacitor.

Aerovox offers you the widest selection of bypass tubular types in the industry...molded...plastic-cased...ceramic-cased, choose the type that best suits your requirements.

TECHNICAL SPECIFICATIONS

TEMPERATURE RANGE:
-30°C to +100°C

POWER FACTOR AT 25°C:
will not exceed 1%

HUMIDITY TEST: meet all EIA specifications with test duration extended from 100 to 500 hours

LIFE TEST: 150% of rated voltage at 100°C for 250 hours

STANDARD TOLERANCE:
 $\pm 10\%$

*DuPont trademark

AEROVOX CORPORATION

DISTRIBUTOR DIVISION

NEW BEDFORD, MASSACHUSETTS

For more data, circle 8-6-1 on coupon, p. 46

LETTERS

To the Editor

Sears Retorts

Editor, ELECTRONIC TECHNICIAN:

In your May issue you published a letter signed, Ray Cramer, that we, the undersigned, feel privileged to answer. While we at the Tampa Sears Store are more concerned with the quality of our work, we never let our abilities rest on our sinner end. Frankly, most of our work is done with our heads (in spite of the fact that the company does provide stools, some plain and some upholstered). Regarding parts substitution, we sincerely feel that whenever possible exact replacements should be used (since the engineers who designed the set knows best what should be used). However, we do make substitutions when we feel it is practical and will not impair the over-all operation or life expectancy of the set. The last black snake whip (to our knowledge) was buried somewhere out West when large horse-drawn vehicles went out of style. Our "bosses" have developed the idea (some several decades ago) that we are human beings and have treated us that way from the day we hired in. While we confine ourselves exclusively to servicing Sears products, we make no attempt to inhibit anyone from servicing Silvertone sets. Schematics, parts, and all the information we can give are available over our counter. Portions of our trading area are serviced by independent contractors, but these are areas remote to us and Sears feels that rendering proper service is our prime requisite. So to expedite this service, it is "let out" to private firms.

SAM TAGLIARINI
OWEN PARLIN
FRANK PANDOLFE
LLOYD BARTLETT
TONY STEVENS
ALBERT GAUDI
HERVIAN ALVERSON
WILLIAM WEGNER
BENNY DIAZ
R. SHIKENJANSKI

Sears, Roebuck & Co.
Tampa, Fla.

• There are plenty of good men working for Sears, but that doesn't alter the short-sightedness of Sears' policy of refusing to make schematic and service data available nationally to independent service dealers.—Ed.

Transistor Testing

Editor, ELECTRONIC TECHNICIAN:

To comment on your June article, "Repairing Transistor Portables," we do not argue against a harmonic generator for troubleshooting. However, a pencil type does not work, because it (Continued on page 8)

For more data, circle 8-7-1 on coupon, p. 46
ELECTRONIC TECHNICIAN • August, 1960

"BEST OF ALL CONTACT SPRAYS"

AS REPORTED BY INDEPENDENT PRODUCT-TESTING LABORATORY

	Shield	A	B	C	D	E	F	G	H	I
Lubrication After Rubbing For 90 Sec.	GOOD	Fair	Very Poor	Poor	Good	Poor	Very Poor	Good	Poor	Fair
Cleaning After Rubbing For 90 Sec.	GOOD	Good	Good	Good	Good	Fair	Poor	Good	Fair	Poor
Protection After 30 Sec. Exposure to H ₂ S Gas	GOOD	Fair	Fair	Good	Good	Fair	Very Poor	Good	Very Poor	Good
Protection After 2 Hours Exposure to H ₂ S Gas	BEST	—*	—*	2nd Best	5th Best	—*	—*	3rd Best	—*	4th Best
Flash Characteristics	None at 200°F.	—*	—*	Greatest tendency	Boils at 70°F. Tendency to ignite	—*	—*	Tendency to ignite	—*	Slight tendency to ignite
Attack On Plastic Material	NO	—*	—*	Yes**	Yes**	—*	—*	Yes**	—*	Yes**

*Not tested further following sub-standard performance in 30-second exposure test.

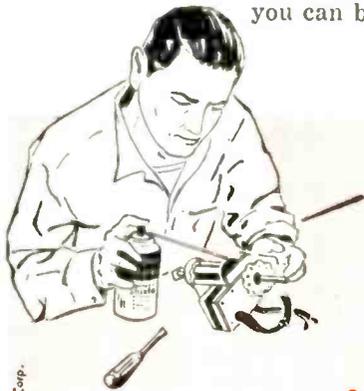
**Presence of solvents and chlorinated hydrocarbons.

Channel Master introduces the first triple-action spray!

Channel Master set out to provide a superior cleaner, lubricant, and protector for electrical contacts. Contact Shield was the result.

To verify our own estimates of the product's effectiveness, Contact Shield was submitted to a nationally known independent testing laboratory.

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Here's why Contact Shield is best:

- provides the most long-lasting protection
- eliminates background and resistance noises
- is safer. Will not ignite, flash, or cause short circuits... propellant is actually a fire extinguisher
- contains no solvents to attack plastics
- performs at temperatures from -95°F. to +320°F.



CHANNEL MASTER works wonders in sight and sound
Ellenville, New York

(Continued from page 6)

has no ground lead, no output control, and not enough output to drive a speaker directly. Nor does it have a second lead to connect to the speaker. Our HG 104 does. Also, the battery eliminator shown will not operate Philco, Sylvania, or Motorola radios with tapped power supplies. Our PS 103 will. Mention is made of checking current drawn as a valuable service aid. I agree. The PS 103 does this by flipping a switch.

R. H. BOWDEN
President

Sencore
Addison, Ill.

Dealers Set Up Distributorship

Editor, ELECTRONIC TECHNICIAN:

Mutual Distributors, Inc., 709 Warrington Ave., Pittsburgh 10, Pa. was instituted by several other dealers and myself. It is definitely not a co-op, but instead a full scale wholesale electronic parts distributor chartered under the Pennsylvania state laws. It is, pure and simple, an investment enterprise, and stockholders are various business men. Only the legitimate tax paying service dealer can purchase from Mutual. This separates the do-it-yourself people or tinkers from undermining the bread and butter of a dealer trying to earn his living and

pay his taxes. The technique involved in setting up Mutual Distributors was simply an attorney, a bank, and some other dealers or businessmen in the field who felt they should form a legitimate parts distributor. In spite of all attempts to block its growth, it is progressing fairly well in the short space of a year. It was branded as the work of an association; it was a buying syndicate; it was a group of men undercutting other distributor prices. Manufacturers were blinded by their reps who actually were being led around by the nose by their established distributors in the area. Manufacturers who investigated over the heads of their reps found the exact opposite. Several reps contacted informed their companies as to the legitimate acceptability of Mutual and actual orders were written. The material never arrived, evidently stopgapped at the last minute by some unfriendly persons' say-so. There was no legal reason for this. The representative was obviously told, stop it or else. Two major tube reps were contacted and all necessary information was given up to and including financial statement. In spite of Mutual's Grade A credit reputation and the potential to compete effectively with a line second to none, the requests were completely ignored. Within a year, we have moved to a main street location with unlimited potential. Mutual will sell only to those people in the business carrying a proper sales tax license number. We are trying to achieve for the service dealer a fair level from which a dealer may have a fighting chance to remain in business.

THOMAS E. SCHOLLER
Mutual Distributors, Inc.
Pittsburgh, Pa.

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For Testing & Rejuvenating

BLACK AND WHITE and COLOR including 110° TUBES

NEW CRT 440

CATHODE REJUVENATOR TESTER

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all black & white and color picture tubes at correct filament voltage from 1 to 12 V.

TESTS AND REJUVENATES
110° tubes with 2.34, 2.68, 6.3 and 8.4 volt filaments.

TESTS AND REJUVENATES
color picture tubes. Checks each color gun separately some as black & white tubes.

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Model CR48 Adapter. For use only with all previous B&K Model 400 and 350 CRT's. Tests and rejuvenates 110° picture tubes with 2.34, 2.68, and 8.4 volt filaments. Net, \$4.95

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or Send now for Bulletin AP15-T



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Export: Empire Exporters, 277 Broadway, New York 7, U.S.A.

Proof of Know-How

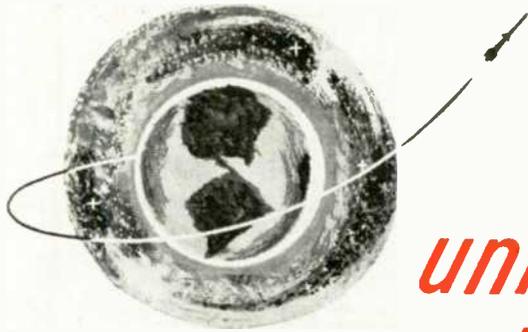
Editor, ELECTRONIC TECHNICIAN:

Next month ends my 41st year in this business. We service TV "dogs" for eight stores—and we service their test instruments too. Concerning your June editorial, "Death of a License Bill," here we have several men who are very good salesmen, with negligible TV know-how—which is okay, because there are dopes who service all TV's for \$5, flat rate—all parts and tubes supplied by outside men. No, we don't work for these outside men. Too bad others do. A licensing bill is very important, to keep out this type, who live on the know-how to men who are technicians, not businessmen. In the old days any idiot could obtain a driver's license, merely by paying a fee. Today, the prospective (hit-and-run) driver has got to prove he knows enough about traffic laws, has a reasonably safe car, before he can buy a license. Same should be the case in TV. Otherwise, the Unions will step in, and no more independent TV techs.

NATE SILVERMAN
Los Angeles, Calif.

(Continued on page 10)

For more data, circle 8-8-1 on coupon, p. 46



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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.

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* DuPont Reg. Trademark

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Capacitors*

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

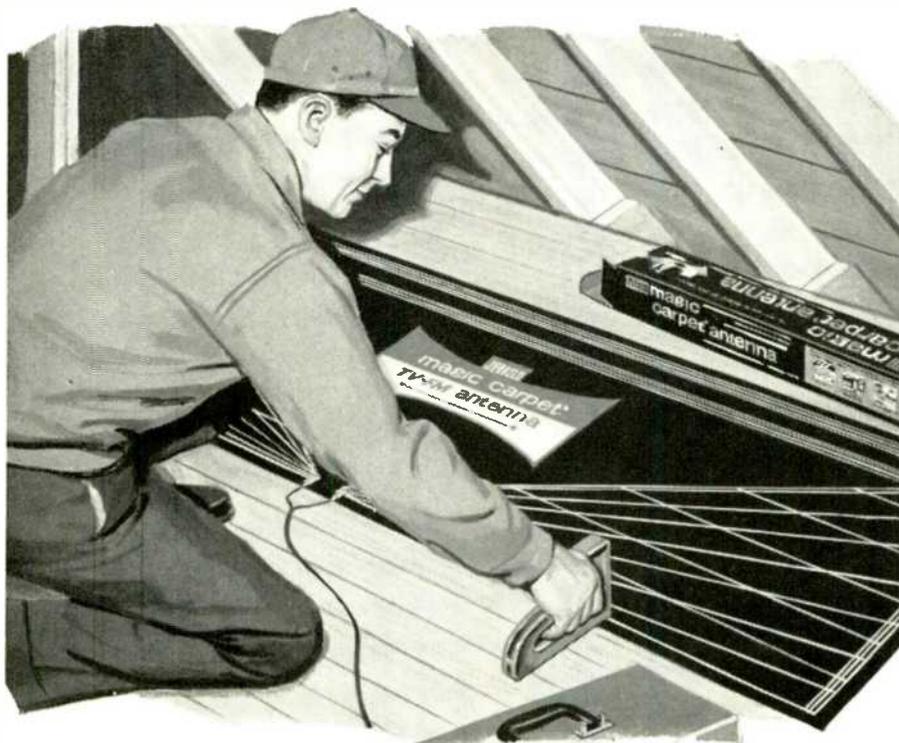
Reliability Elmenco dp Mylar-Paper Capacitors have achieved a reliability that meet missile and computer requirements. They are thoroughly and continually tested during production to insure outstanding performance. For example a 0.1 mfd. dp capacitors operated at full rated voltage and at 105° C will 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

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!



\$9.95 list

For full information and samples of selling promotional material prepared specifically for you see your Jerrold Distributor or write



ELECTRONICS CORPORATION, Distributor Sales Division
 Dept. IDS-53 The Jerrold Building, Philadelphia 32, Pa.
 Jerrold Electronics (Canada) Limited, Toronto
 Export Representative: CBS International, New York 22, N.Y.

*Trademark Patent Pending

For more data, circle 8-10-1 on coupon, p. 46

In the Attic
 Garage or Utility
 Room Ceiling
 In the Closet



Formerly for Licensing

Editor, ELECTRONIC TECHNICIAN:

I believe I have changed my mind regarding licensing of TV shops. I was all for it when the idea was first brought up, but after having read so much pro and con, I have started leaning toward the other side. A license, whether state or city, will bring us closer to being under politicians, either directly or indirectly. It will mean money for a license, adding to our already heavy load for taxes and etc. A city inspector will be hired, and technicians will carry his cost in salary and expenses. I believe licensing will promote some wrangling between shops, accusing each other of malpractice whether justified or not. But it will be in the public eye. Associations could upgrade technicians by providing talks on new products, methods, and business practices and by giving tests and issuing cards for helpers, journeymen, and masters. The important thing is the technician would be keeping his own house, spending his money where it would benefit most.

EDWIN REID

Reid's Television Service
 Palatka, Fla.

Death of a License Bill

Editor, ELECTRONIC TECHNICIAN:

Your June issue editorial, "Death of a License Bill," is an excellent analysis of the situation in New York state. It may be the shot in the arm we all need to knuckle down and do what is necessary to obtain a long sought for goal.

PETER M. FERRARI,
 President

TESA
 Rochester, N.Y.

Hinterland Deliveries

Editor, ELECTRONIC TECHNICIAN:

This community is located in the mountains about 85 miles NE of Atlanta, so direct contact with distributors and reps is quite difficult. Our most certain delivery of specialty service items has been from mail order firms. We get quicker delivery from the established parts concerns in Atlanta, but their stock of supplies is not so broad. Incidentally, the writer had just completed servicing a TV with increased resistance of the ballast resistor in the filament circuit as described by L. C. Kisor in the Tough Dog corner on page 37 of the March issue. This service procedure had been as deceptive to find and it was surprising to read about it soon after encountering the same. As a new subscriber to ELECTRONIC TECHNICIAN, we have nothing but the best of comments on the makeup, and regret not subscribing sooner.

E. L. GEDNEY

Gedney's
 Helen, Ga.

(Continued on page 12)



This service man is installing insurance against costly call-backs...capacitors made with MYLAR®

You can save money by using capacitors insulated with "Mylar"* polyester film... eliminate wasted call-backs for failure of newly installed capacitors. "Mylar" means superior performance for four important reasons.

1. High dielectric strength... "Mylar" averages 4,000 volts per mil breakdown strength.

2. Long life... neither time, temperature nor highest humidities affect 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. Smaller capacitors are ideal for hard-to-get-at jobs... save precious space.

4. Proven value... leading manufacturers make capacitors insulated with "Mylar" for critical military applications, missiles and sensitive electronic computers.

Next time you order, ask your distributor for the extra reliability, long life and economy of trouble-free capacitors made with "Mylar". And for test data that details the basic properties of "Mylar", write for Du Pont's free booklet. E. I. du Pont de Nemours & Co. (Inc.), Film Dept., Room #16, Wilmington 98, Delaware.



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

REG. U.S. PAT. OFF.
BETTER THINGS FOR BETTER LIVING... THROUGH CHEMISTRY

For more data, circle 8-11-1 on coupon, p. 46

DU PONT

MYLAR®
POLYESTER FILM

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



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. Tumbler 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.

Troubles Coming to Roost

Editor, ELECTRONIC TECHNICIAN:

Have been meaning to drop you a note commenting on your very fine May editorial, "Showdown at Distributor Gulch." Our group has always deplored the condition of jobbers selling to the public, and in 1955 we adopted a resolution to that effect. However, at the time things were still too good for the average serviceman and the inroads he feels today were not very painful then. Most servicemen were too busy agitating and being attracted to the mirage of wonderful non-competitive conditions which licensing would create for them to be concerned about the insidious activity of the jobber. The serviceman is now beginning to hurt bad; to try and lock the door after the horse is stolen seems to me a waste of effort. The next best thing is for servicemen to join together and set up their own jobbing enterprises.

HOWARD WOLFSON

Editor of "Common Sense"

Assoc. Radio & TV Servicemen
Chicago, Ill.

Color TV Converter

Editor, ELECTRONIC TECHNICIAN:

For some time I have been looking for replacement parts for the Color Converter (Circuit Digests No. 264 Col-R-Tel color TV converter) designed to convert black and white TV to color. I have found the source, and you may wish to pass it on to anyone else who may need parts. Whitley Electronics, Inc., P.O. Box 349, Huntington, Ind. has taken over the distribution of the converter, and has a lucrative package deal going on these units. They furnished the belt that I needed at no cost, thereby placing themselves on my preferred list of companies for their speedy and interested manner of handling my problem. My own unit has performed admirably and I can vouch for the beautiful color rendition when properly adjusted.

ROBERT J. CISZAK,
Pres.

Bob Ciszak's TV-Radio Service
Buffalo, N.Y.

Retain Freedom

Editor, ELECTRONIC TECHNICIAN:

I agree with your subscribers regarding suggestive advertising; however, I cannot agree with the statement made in the June Letters to the Editor by Mr. J. J. Szomolyai that "It should be against the law for some of the pictures taken and used in advertising." In this day there are too many laws passed restricting our freedoms. It is suggested that one give this phrase "There otta be a law," more thought before advocating legislation that will ultimately cause a further loss of personal freedom.

EUGENE ORRICO

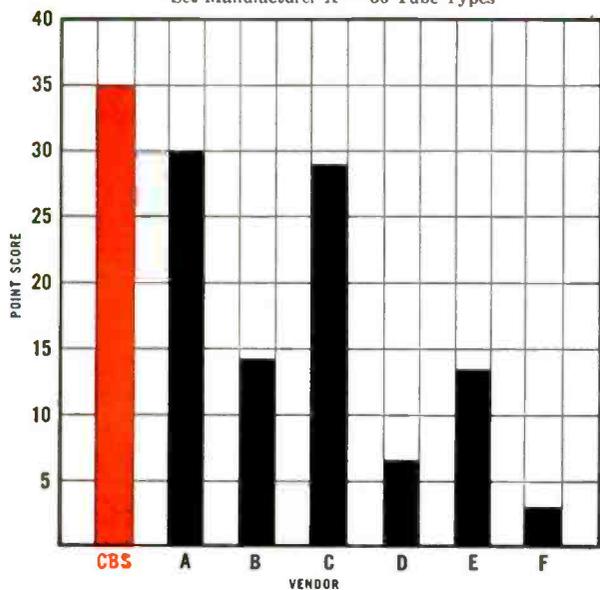
Gene's TV Service
Whittier, Calif.

(Continued on page 14)



Leading set manufacturers RATE CBS RECEIVING TUBES TOPS

... IN VENDOR RATINGS
Set Manufacturer X — 30 Tube Types



... IN LOTS ACCEPTED
Set Manufacturer Z

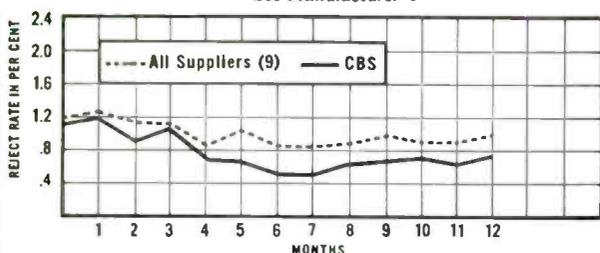
Tube Type	Lots Received	Lots Accepted	Lots Rejected	Rating*
A	5	5	0	Preferred
B	2	2	0	Preferred
C	1	1	0	Preferred
D	10	10	0	Preferred
E	3	3	0	Preferred
F	4	4	0	Preferred
G	1	1	0	Preferred
H	6	5	1	Fair
I	5	5	0	Preferred
J	2	2	0	Preferred
K	1	1	0	Preferred
L	7	7	0	Preferred
M	1	1	0	Preferred
N	4	4	0	Preferred
O	1	1	0	Preferred
P	12	12	0	Preferred
Total	65	64	1	

*Ratings: Preferred, Excellent, Good, Fair, Poor, Unsatisfactory

... IN LOWEST FIELD REJECTS
Set Manufacturer Z

Tube Type	Per Cent Rejects	
	All Vendors	CBS
1	.7	.3
2	.8	0
3	.9	1.0
4	.5	.5
5	.8	.3
6	1.6	1.1
7	.4	.1
8	.8	.8
9	.5	.5
10	1.7	.8

... IN LOWEST LINE REJECTS
Set Manufacturer Y



**TOTAL RELIABILITY . . .
proved in performance**



Yes, CBS receiving tubes are rated tops by leading TV and radio set manufacturers. Any way you want to look at it — vendor ratings . . . lots accepted . . . lowest line rejects . . . lowest field rejects — during 1959 these facts as reported by leading set manufacturers proved CBS tubes superior. This same total reliability . . . continually proved in performance by set manufacturers can be yours for the asking. Just ask for CBS tubes . . . always.

CBS ELECTRONICS

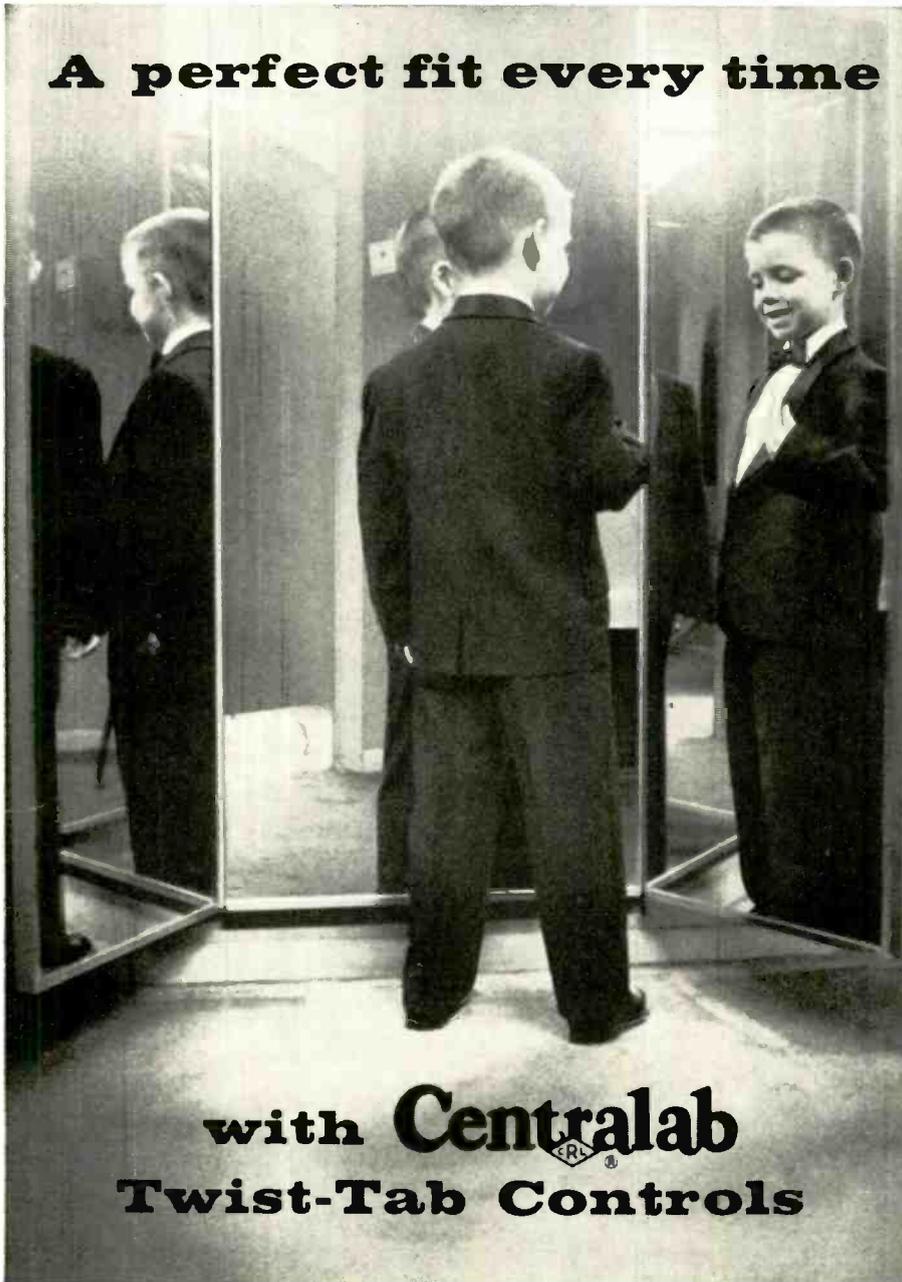
Danvers, Massachusetts

A Division of Columbia Broadcasting System, Inc.

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

For more data, circle 8-13-1 on coupon, p. 46

A perfect fit every time



with **Centralab**
Twist-Tab Controls



These CENTRALAB tab-mounted Radiohm® Controls are sure to suit you—because they're tailored to the minimum shaft length needed for TV set hidden controls. When you need a longer shaft, you simply use the 2" polyethylene extension packed with each unit. Nothing to saw—a snip of the scissors gives you an insulated shaft of the length you need, and the adjustment slot is still there, and still easy to get at.

CENTRALAB Twist-Tabs are available in 25 values from 200 ohms to 7.5 megohms . . . rated at ½ watt, 1 5/16" diameter, 1/16" deep. Ask your distributor for full details about the new fashion in controls—Model TT Radiohms.

Centralab
B-6032

THE ELECTRONICS DIVISION OF GLOBE-UNION INC.
902H EAST KEEFE AVENUE • MILWAUKEE 1, WISCONSIN
CENTRALAB CANADA LIMITED—AJAX, ONTARIO

ELECTRONIC SWITCHES • VARIABLE RESISTORS • CERAMIC CAPACITORS
PACKAGED ELECTRONIC CIRCUITS • ENGINEERED CERAMICS

For more data, circle 8-14-1 on coupon, p. 6

Japanese Parts

Editor, ELECTRONIC TECHNICIAN:

Some members of our profession are purchasing Japanese tubes for use in consumer radio and TV units. The reason is obvious—they are receiving a slightly higher discount than they would for a comparable American brand. This, in my opinion, is unethical in that, in many cases, the consumer is not advised that a Japanese tube has been placed in their units. This is a method of actually forcing the consumer to buy something that he may not want. Technicians buying these important tubes may not realize they are nurturing "a viper in their bosom." By continual purchase of these cheaper and, in many cases inferior goods, they are putting highly skilled American workers out of work. For the extra 10¢ on each tube, we can keep an American worker on the job. All this foolishness is made possible by a stupid agreement our State Dept. has made with the Japanese government that permits them to send almost anything here tariff free, while we may only ship them tariff free four-engine airplanes.

L. CYBULSKA

Lincoln Radio
Brooklyn, N.Y.

Tough Dog Misses the Boat

Editor, ELECTRONIC TECHNICIAN:

In your June issue there appeared a Tough Dog by W. A. Pisciotto, Jr., referring to a Philco 8L41 chassis. Your Editors' note chided Mr. Pisciotto for indiscriminate replacement of ½ watt resistors with those of a 1 watt rating. It now behooves me to take both of you to task for the same reason. Doesn't anyone read production bulletins? The change that your writer sweated so laboriously to effect, could have been accomplished if he had read them. Quite possibly I am being a little rough on both of you in this particular case because I have many, many of this chassis under motel contracts and made it my business to know every quirk involved.

DAN PROWLER

Prowler TV Service
Miami, Fla.

To the Trade Only

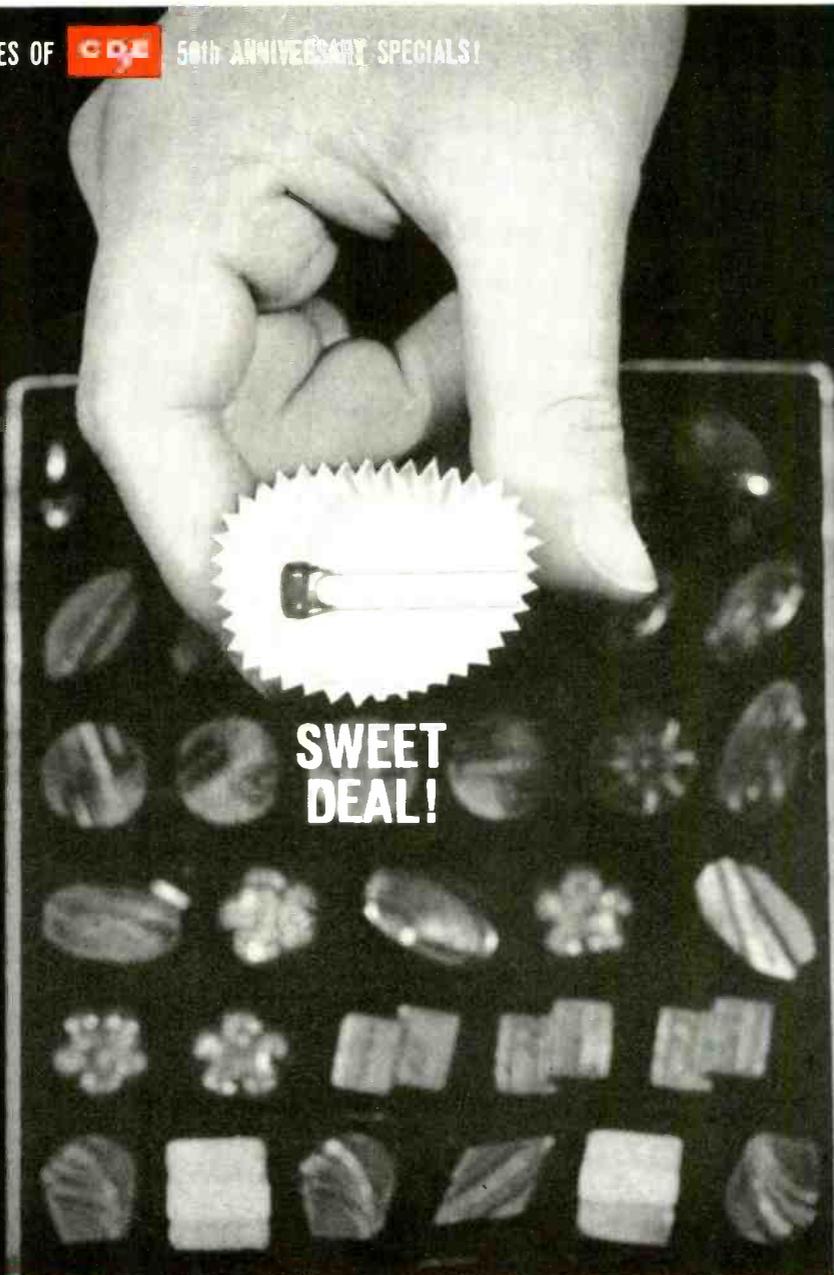
Editor, ELECTRONIC TECHNICIAN:

There are many things I like about your magazine. The articles are to the point, down to earth, where the average technician lives and works. I receive two others which are good, but not up with ET. Also, one thing I would like to point out is that your magazine is not sold on newsstands and therefore, does not get into the hands of every Tom, Dick, and Harry. Keep up the good work you are doing and please keep this magazine for people in the trade.

ADAM W. MILLER

Meadville, Pa.

● We will.—Ed.



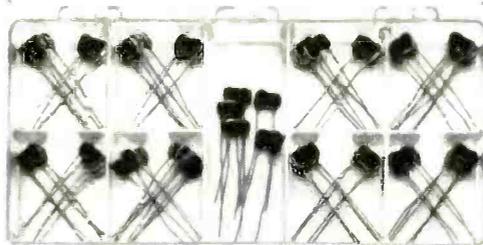
**SWEET
DEAL!**

CDE's NEW MINIATURIZED DIPPED MICAS

YOU GET . . .

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

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



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



CORNELL-DUBILIER ELECTRONICS DIVISION
Federal Pacific Electric Company

For more data, circle 8-15-1 on coupon, p. 46

News of the Industry

CBS ELECTRONICS has named **HOWARD P. MUNDAY** as Training and Communications Coordinator.

INT'L. RESISTANCE Control Components Div. reports the appointment of **HOWARD MORRISON** as Marketing Mgr.

DU MONT LABS. and **FAIRCHILD CAMERA INSTRUMENT CORP.** have set stockholder meetings to vote on a merger agreement.

RCA Electron Tube Div. reports the appointment of **REYNOLD J. GOUV-ERNEUR** as Mgr., Advertising & Sales Prom., Entertainment Market.

SANGAMO ELECTRIC has announced the appointment of **ROGER D. MILLER** to the new position of Sales Mgr., Electronic Components.

CHANNEL MASTER has produced a new 4½ min. film on antenna replacement, for distribution to TV broadcasters throughout the nation. Prints are available through the company's Advertising Dept.

VOCALINE reports that **DONALD GORHAM** is now serving with the Electronics Products Div.

WELLER ELECTRIC has announced a price reduction of their Model #800 Sabre Saw to \$14.95.

CAPITOL RADIO ENGINEERING INST. announces the appointment of **H. E. MC CALLICK** as executive Vice Pres.

RAULAND-BORG announces the appointment of **CARL DORWALDT** as head of a newly established Sales Engineering activity.

UTAH RADIO has announced a lifetime guarantee on all popular replacement speaker sizes and shapes, providing replacement if there is any performance failure at any time during the life of the owner.

PHILCO has announced the following appointments: **LARRY F. HARDY**, Vice Pres.-Public Relations, a newly-created position; **ROBERT M. JONES**, Dir. of Personnel, a newly-created position; **HENRY E. BOWES**, Vice Pres. and Gen. Mgr. of Consumer Products Div.; **ROBERT G. URBAN**, Vice Pres.-Marketing; **RAYFORD E. NUGENT**, Vice Pres.-Asst. to Vice Pres. of Marketing; and **FREDERICK D. OGILBY**, Dir. of Sales.

AEROVOX New Bedford Div. has appointed **EDWARD E. BAUER** as Vice Pres. and Gen. Mgr.

CENTRALAB has named **WALTER E. PEEK** to the new position of Vice Pres., Marketing, and **BRUCE E. VINKEMULDER**, Marketing Mgr.

BLONDER-TONGUE Foundation, non-profit organization, has awarded grants to 18 colleges and educational institutions for the purpose of improving teaching techniques through the use of educational TV.

RAYTHEON has announced election of three new Vice Presidents as follows: **GLENN R. LORD**, Gen. Mgr. of Equipment Div.; **FRITZ A. GROSS**, Asst. Gen. Mgr. of Equipment Div.; and **THOMAS L. PHILLIPS**, Asst. Gen. Mgr. of the Missile Systems Div.

SPRAGUE ELECTRIC and the **TELEGRAPH CONDENSER CO., LTD.** of Great Britain have signed an agreement to exchange research, development, and manufacturing know-how for the next 21 years. Also reported is the appointment of **ALBERT COUMONT** as Sales Mgr. of **SPRAGUE PRODUCTS CO.**, the distributors' supply subsidiary of **SPRAGUE ELECTRIC**.

(Continued on page 18)

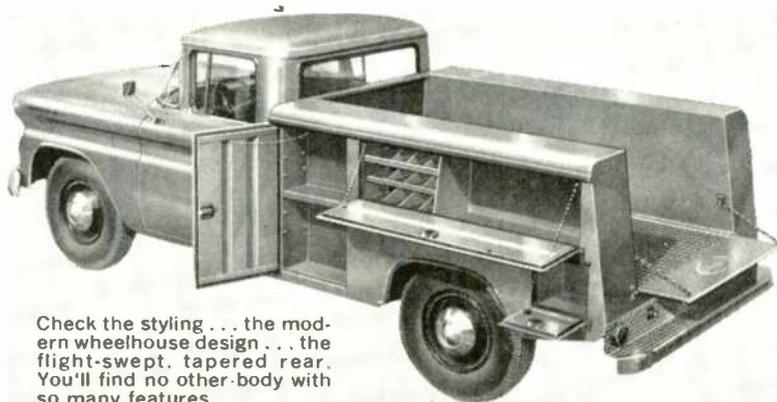
Look beyond the price tag and you'll see why



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 yours... 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.

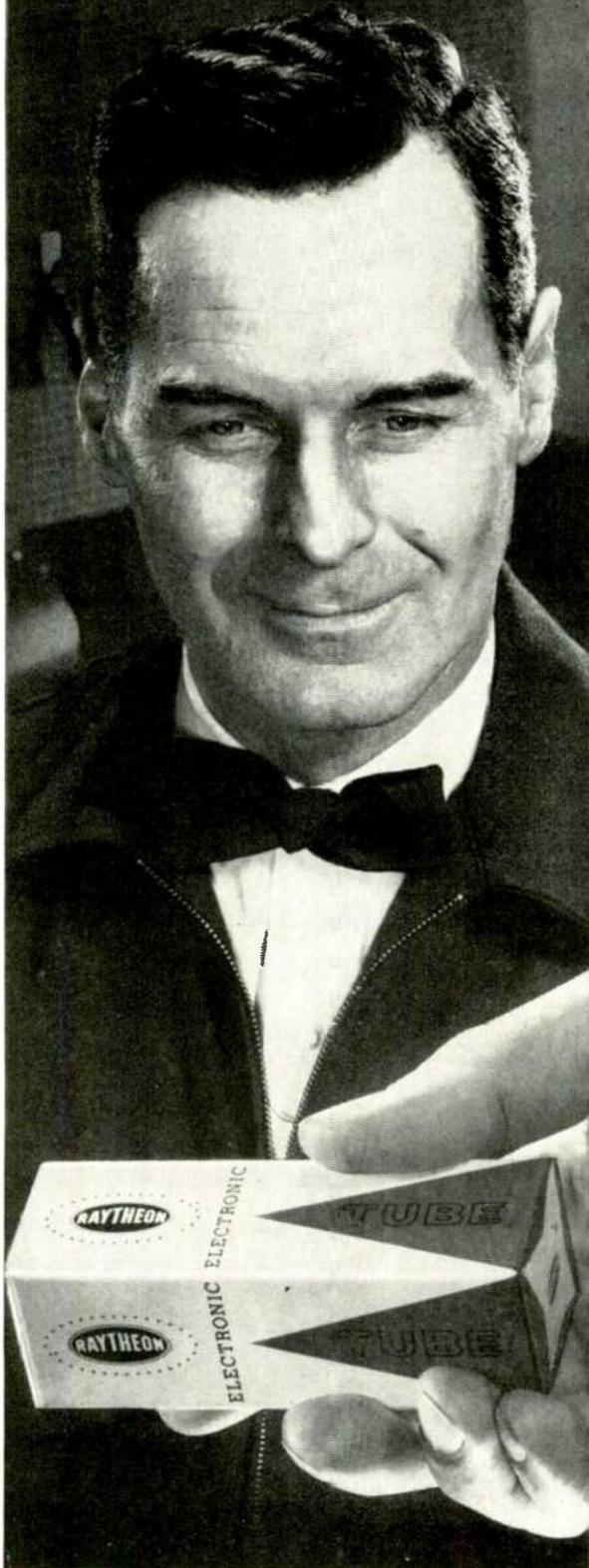
IMMEDIATE DELIVERY! WRITE FOR BULLETIN AND NAME OF DEALER.



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.

*Another bold step in Raytheon's
Crusade Against Call-Backs*



Raytheon Announces

UNILINE

The new standard of receiving tube quality ...
backed by an extraordinary guarantee
against call-back loss.

Now, for the first time, a tube manufacturer offers you a new "tough-type-tested" tube line to protect you against call-backs ... UNILINE ... built to an entirely new standard of quality and covering the ten types you voted the most troublesome in Raytheon's recent nationwide poll.

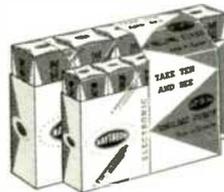
We believe the quality of Raytheon's Uniline tubes is so superior that they will become the most trusted and talked about receiving tubes in the industry.

NOW...

"TAKE TEN AND SEE!"

Your Raytheon Distributor now has in stock specially prepared get-acquainted "Ten-Packs" consisting of one each of the ten Uniline types (1B3GT, 6AU4GTA, 6AX4GT, 6BQ6GTA/B, 6SN7GTB, 1X2A/B, 6CB6A, 6CG7, 6X8, 12AT7). We invite you to "Take Ten and See" if these are not the most trouble-free tubes you have ever used.

To back our complete confidence in Uniline, Raytheon is prepared to make a guarantee never before offered. Your Raytheon Distributor has full details. Prove it to yourself. Start your own Crusade Against Call-Backs today by ordering your Raytheon Uniline "Ten-Pack" in the distinctive new cartons.



RAYTHEON COMPANY

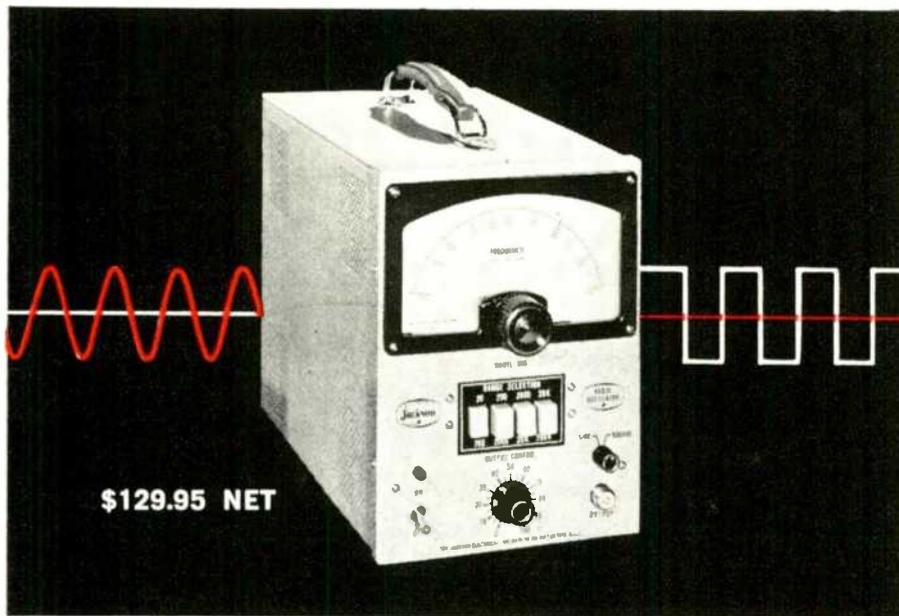
DISTRIBUTOR PRODUCTS DIVISION • WESTWOOD, MASS.

For more data, circle 8-17-1 on coupon, p. 46

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 Till:** 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 8-18-1 on coupon, p. 46

(Continued from page 16)

ZORON, INC., 612 W. Monroe St., Chicago 6, Ill., is a new supplier of electronic components. Complete catalog is available from the company on request.

JACKSON ELECTRICAL INSTR. announces completion of a plant expansion program involving the transfer of office and production facilities of its Commercial Div. into 15,000 sq. ft. of space at 124 McDonough St., Dayton, O.

GENERAL ELECTRIC has completed transfer of the Radio Receiver Dept. headquarters from Bridgeport, Conn. to Utica, N.Y. The Semiconductor Products Dept., Rectifier Component Products Section, has announced the appointment of **ARTHUR S. BAKER** as Mgr. of Marketing Administration.

MOTOROLA service dealers can now obtain a "starter" kit of "Golden M" premium rated tubes being used for the first time in the 1961 TV, stereo, and radio sets, from the Motorola distributors. The Semiconductor Div. has named **JOHN R. WELTY** Product Mgr for diodes & rectifiers.

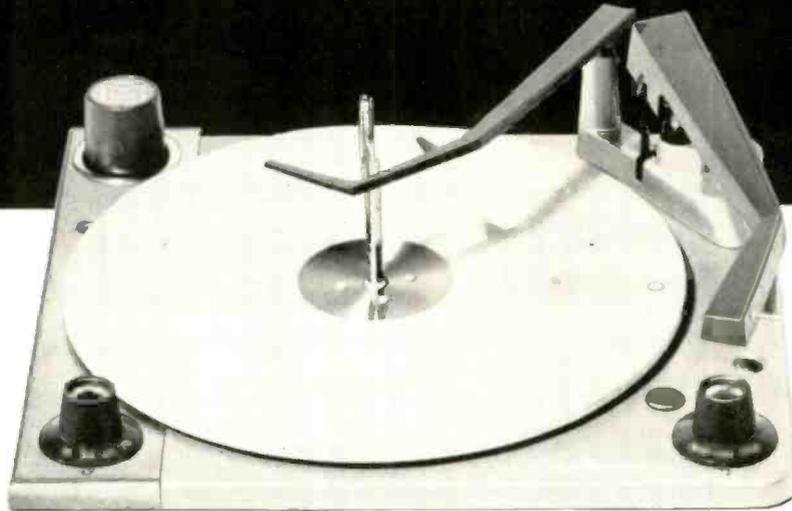
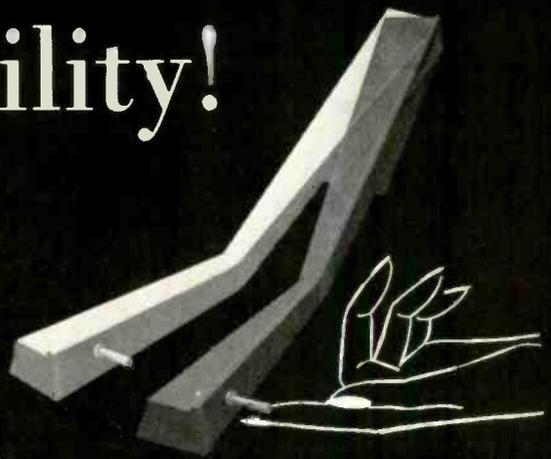
TUNG-SOL announces the following appointments and expansions of duties: **L. EDWARD COTSEN**, Asst. to Vice Pres.-Sales; **RICHARD L. JANDL**, Distributor Sales Mgr.; **JOHN L. MALONE**, Mgr. of Headquarters Account Sales; **JOHN D. VANDERVEER**, Mgr. of Govt. Relations, will supervise sales contacting various government agencies; **HAROLD F. COOK**, Mgr. of Marketing Services, directing advertising, sales promotion, market research, and sales planning departments; **ARTHUR J. KECKEISSEN**, expanded activities in areas of customer services, products, and factory warehousing; **RALPH B. KENNETT**, Coordinator of pricing activities for Sales Div., will represent the Sales Dept. in all pricing procedures.



"You sure that all it needs is a new 6CB6?"

infinite versatility!

*deluxe 'stere-o-matic'®
4-speed automatic
record changer
with stereo cartridge
and diamond needle*



MODEL 1571 SHOWN WITH ACCESSORY "45" RPM SPINDLE IN BASE PLATE SPINDLE WELL

*satisfy all customers for all
custom hi-fi and stereo installations!*

NEW and functionally-perfect are the features of this professional turntable-type record changer: *New "Automatic Manual-Play"* Feature returns tone arm to the rest post *automatically* after single record play! *New Massive Turntable* is a full eleven inches in diameter and has *new* micro-precision bearing system with TEFLON thrust bearings. *New* extra-long, dynamically balanced, non-resonant tone arm reduces the possibility of uneven needle pressure on wall of record groove! *New* accessory "45" rpm spindle adaptor stores in handy well right in changer baseplate. *New* V-M styling plus all the other famous V-M record changer features!

V-M Deluxe 'Stere-O-Matic'® 4-Speed Automatic Record Changer *with Cartridge and DIAMOND NEEDLE—Model 1571*. \$50.00* list. Available with 4-pole motor and plug-in tone arm head for magnetic cartridges as *Model 1572*. \$50.00* list. *Model 1586* is Model 1571 mounted on High Impact Plastic base. \$56.00* list. *Model 1587* is Model 1572 mounted on High Impact Plastic base. \$56.00* list.

V-M RECORD CHANGERS COMBINE TRUE TRANSCRIPTION TURNTABLE FIDELITY WITH AUTOMATIC RECORD CHANGER CONVENIENCE.

the **Voice**  of **Music**®

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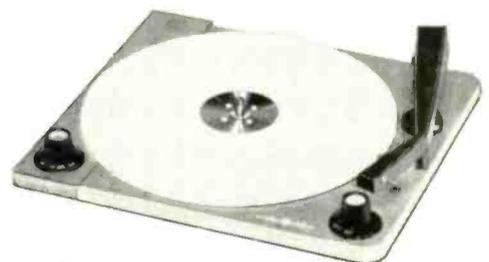
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V-M/High-Fidelity Transcription-Type Turntable—Model 1580

Ideal for Custom Systems

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For more data, circle 8-19-1 on coupon, p. 46

ELECTRONIC TECHNICIAN • August, 1960

Reps & Distributors

VOCALINE has named **W. H. CONNORS CO.** as sales rep for Wyo., Idaho, N.M., Utah, Colo. and Mont.

SHELL ELECTRONICS has announced plans for a free week in Florida to each distributor who purchases a specified quota up to Oct. 31st.

BETTAN SALES, manufacturers' rep firm, announces they are moving to new and larger quarters at 77-15 164th St., Flushing 66, N.Y.

JERROLD ELECTRONICS presented **RAY R. HUTMACHER ASSOCIATES** with the annual "Rep of the Year" Award at the recent annual sales meeting of its Distributor Sales Div.

LOWELL MFG. announces the winner of its "April in Paris" contest as **FRED HARRIS** of the **ATLAS RADIO CORP.**, Toronto, Canada. Second and third place went to **W. B. PRAY SALES** and **H. W. KNAGGS CO.**, respectively.

TACO reports winners in the T-Bird Bolo Drawing as follows: first drawing **BUD EHRLICH**, **BUD ELECTRONIC SUPPLY**; and second drawing, **LEE HARRINGTON**, **WORLD RADIO LABS.**

Catalogs & Bulletins

PARTS: A new 48-page general catalog features replacement parts. Detailed specifications and other data on resistors, diodes, fuse resistors and controls are included. **International Resistance Co.**, Distr. Div., 401 N. Broad St., Philadelphia 8, Pa.

For more data, circle 8-20-2 on coupon, p. 46

CB ANTENNAS: Bulletin 601 covers model HW Heliwhip antennas and beacon fixed station antennas for the 27 mc-11 meter citizens band. Specifications, illustrations, diagrams and prices included. **Mark Mobile, Inc.**, 5441 W. Fargo Ave., Skokie, Ill.

For more data, circle 8-20-3 on coupon, p. 46

ELECTRICAL TAPES: A new 12-page booklet, "Useful Tips For Top Savings & Service," covers 24 specific tape jobs from protecting tools to use of color-coded tapes. **Dutch Brand Div.**, Johns-Manville, 7800 S. Woodlawn Ave., Chicago 19, Ill.

For more data, circle 8-20-4 on coupon, p. 46

ANTENNAS: T-Bird antenna, a new improved broad-band yagi design, for channels 2 through 13, has numerous design innovations. Details and illustrations are provided in current literature. **Technical Appliance Corp.**, Sherburne, N. Y.

For more data, circle 8-20-5 on coupon, p. 46

SOLDERING TOOLS: Catalog #S-60, covering the firm's standard line of soldering tools, features the new improved soldering iron handle, #776. The colorful, 8-page, catalog provides descriptions, illustrations, and prices. **Ungar Electric Tools**, 4101 Redwood Ave., Los Angeles 66, Calif.

For more data, circle 8-20-6 on coupon, p. 46

CAPACITORS: Four-page bulletin, EL-5, covers type ML subminiature electrolytic capacitors, designed for high quality transistor equipment. Specs, dimensions and typical performance characteristics are included. **Pyramid Electric Co.**, Darlington, S. C.

For more data, circle 8-20-7 on coupon, p. 46

MASTER TV SYSTEMS: A new 24-page manual, "Designing and Installing Master TV Systems," covers types of building construction, design of systems and the installation of cables and components. Block diagrams illustrate typical combinations of antennas, amplifiers, cable and distribution components. **Blonder-Tongue Labs.**, 9 Alling St., Newark 2, N. J.

For more data, circle 8-20-8 on coupon, p. 46

TUBES: A handbook of industrial tube interchangeabilities lists some 900 tube types. Included are miniatures, sub-miniatures, voltage regulator-voltage references, radiation counter, pencil, transmitting, magnetron, klystron and many others. From distributors of **Raytheon Co.**, Distr. Products Div., Westwood, Mass.

ELECTRONIC TECHNICIAN • August, 1960

NOW!
one Britener
for ALL
series string
heaters

New **Perma-Power** unit
guards against
picture tube
damage
caused by
excessive power
boost



MODEL C412 VU-BRITE
110° Button Base—Series
ALL Filament Voltages
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110° Button Base—6.3 Volts
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all available from your
Perma-Power Distributor

When you're trying to brighten a 110° button base picture tube, watch those series heaters! Many of the newer sets have controlled warm-up filaments with ratings of 2.34 and 2.68 volts. (Older sets are usually rated at 6.3 volts.)

These new tubes use finer heater wire and closer element spacings—which makes them more efficient, but more fragile. *Too much power boost will "blow" these low voltage filaments!*

On these newer tubes, you can not safely use a Britener made for older sets. But you can use the new Perma-Power Model C412 on these and older style tubes. For the first time, here's one Britener for all 110° button base series string heaters—the only Britener that works properly for 2.34, 2.68, 4.70, 6.3 and 8.4 volt filaments! No switching necessary—no adjustments required.

The Model C412 Vu-Brite is one of four new Perma-Power Briteners, all engineered to fit properly and work properly. Without excessive inventory, Perma-Power—and only Perma-Power—can now assure you of complete coverage—a Britener that's right for every picture tube in general use today.

Perma-Power COMPANY

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King of them all — for price and dependability. Available in all popular values. Ideal for replacement purposes especially where overloading burns out less rugged resistors.



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Pick the one you need — wire-wound or carbon — from the many popular values available. Then choose your shaft — snap it in. Need a switch? Ad-a-Switch attaches to control in seconds — no sweat, no bother...



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For more data, circle 8-21-1 on coupon, p. 46

**The clue that
points to profit!**



All the skilled deductions of a super sleuth will only confirm what servicemen already know — that a caddy full of Tung-Sol tubes is the clue that points to profit. Made to industry's highest standards, Tung-Sol tubes provide original equipment performance for all radio, tv and hi-fi service. Fewer callbacks mean more profit. Tung-Sol tubes mean fewer callbacks — so use more Tung-Sol tubes! Tung-Sol Electric Inc., Newark 4, N. J.

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TUBES • TRANSISTORS • DIODES

For more data, circle 8-22-1 on coupon, p. 46

ELECTRONIC TECHNICIAN

Including
SERVICE
Magazine

The Meaning of the Census

By this time, the census takers have counted all of us, and the preliminary tabulations are being reported.

The nation's population in 1960 is approximately 179,500,000, a healthy 18.6% rise from the 1950 total of 151,325,798. Also heartening is the impressive 60.3% jump in monthly per capita income from \$118.17 a decade ago, to \$189.43 currently.

The growth has not been evenly spread across every town and state. Some cities and states gained, while others lost. An important trend has been the move from the cities to outlying suburbs. As shown below, eight of the top 10 cities in the country lost population, while most of the medium-large cities gained.

1960 Rank	City	1960	Change In Percent
1	New York	7,660,000	- 2.9
2	Chicago	3,516,258	- 2.9
3	Los Angeles	2,448,018	24.2
4	Philadelphia	1,959,966	- 5.4
5	Detroit	1,672,574	- 9.6
6	Houston	932,680	56.4
7	Baltimore	921,363	- 3.0
8	Cleveland	869,867	- 4.9
9	Wash., D.C.	746,958	- 6.9
10	St. Louis	740,424	-13.6
11	Milwaukee	734,788	15.3
12	San Francisco	715,609	- 7.7
13	Boston	677,626	-15.4
14	Dallas	672,117	54.7
15	New Orleans	620,979	8.9
16	Pittsburgh	600,684	-11.2
17	San Antonio	584,471	43.1
18	Seattle	550,525	17.7
19	San Diego	547,294	63.7
20	Buffalo	528,387	- 8.9
21	Memphis	491,691	24.2
22	Denver	489,217	17.7
23	Cincinnati	487,462	- 3.3
24	Atlanta	485,425	46.5
25	Minneapolis	481,026	- 7.8
26	Indianapolis	470,464	10.1
27	Kansas City	468,325	2.6
28	Columbus, O.	465,151	23.7

29	Phoenix	430,459	303.0
30	Newark	396,252	- 9.7

In terms of metropolitan areas, there was fair growth. For example, typical metropolitan areas grew, despite losses in the core cities:

Metropolitan Areas	1960	Gain
New York City	14,586,519	+13.0%
Philadelphia	4,279,961	+16.6%
Detroit	3,761,221	+24.7%
Pittsburgh	2,339,176	+ 5.7%
St. Louis	2,056,623	+19.6%
Washington	1,969,536	+34.5%
Cleveland	1,790,435	+22.2%
Baltimore	1,706,961	+21.5%
Minneapolis	1,477,080	+28.3%
Buffalo	1,304,581	+19.8%

The state-wide trend, for the most part, followed Horace Greeley's advice to go west. The 10 states showing the greatest growth are as follows:

Growth Rank	State	1960	Percent Change
1	Florida	4,893,098	+76.6%
2	Nevada	281,348	+75.8%
3	Alaska	224,383	+74.4%
4	Arizona	1,282,405	+71.1%
5	California	15,537,413	+46.8%
6	Delaware	443,158	+39.3%
7	New Mexico	943,348	+38.5%
8	Maryland	3,072,999	+31.2%
9	Colorado	1,735,807	+31.0%
10	Utah	886,485	+28.7%

These preliminary figures by the Bureau of the Census can serve as a guide to service dealers whose areas have changed or who are thinking of relocating. Traditionally, business prospers in growth areas, particularly for those businesses established early in the growth period. After the peak of the boom, a shakeout period is not uncommon.

Thinking of moving to a warmer climate? Would you like to settle down in hunting and shooting country? Planning to open a branch out in the suburbs? Keep in mind the population shifts, for they vitally affect the potential success or failure of business operations.

Tuning In the

SOFAR (Sound Fixing and Ranging) system for locating aircraft or ships in distress by depth charge generated water sound waves, has set a new record. Depth charges set off south of Australia were recorded in Bermuda. It took the sound 223 minutes to traverse the 12,000 mile distance. The previous record distance recorded was about 3000 miles. There is evidence that the sound waves traveling through water "feel" their way around islands and shallow areas.

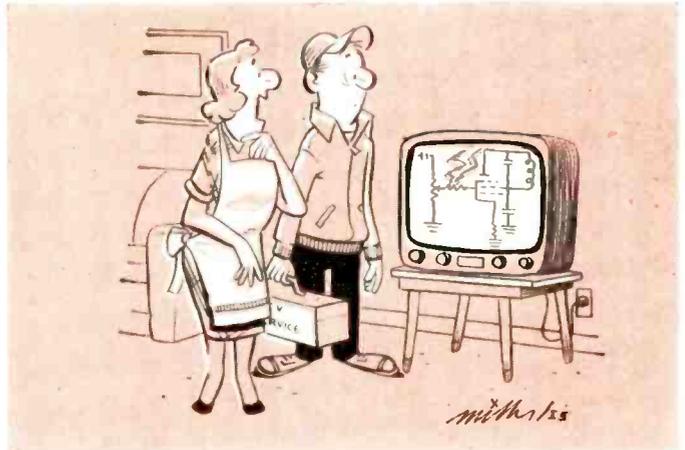
TECHNICIAN EARNINGS according to the U.S. Bureau of Labor Statistics cover a relatively wide range. Although beginning radio and TV servicemen were among the lowest paid technical workers, earnings of journeymen varied from \$80 to \$130 a week in 1958. Generally, servicemen in the larger cities had the highest earnings. Technician employed in companies manufacturing military and commercial electronic equipment generally earned from \$1.75 to over \$3 an hour in 1958. Electronic technicians employed in manufacturing usually work the normal 5-day, 40-hour week, and receive time-and-a-half pay for overtime hours. Radio and TV repair shops, most of which are small establishments, usually have longer working hours. Although some of the largest shops have a 40-hour week, the 6-day, 48-hour week is the more common work schedule.

NEW FLAT SPEAKER invented at Israel's Weizmann Institute under a research program sponsored by Emerson and a French Company has been announced by Emerson. A 16" model shown was only $\frac{3}{8}$ " thick. This electrodynamic pancake design can be made in almost any shape, size, or form.

COMPUTER AIR NAVIGATION



New air navigation system uses a computer to automatically position a map of half the earth in a glass hemisphere. The projection of a 400-mile diameter area (125,000 sq. mi.) on a 7 $\frac{1}{2}$ " screen pin-points the pilot's location. For space navigation, a stellar map would be used. IBM engineers R. W. Kern (l) and J. F. Creedon check out the system.



"I think it's trying to tell us something."

ALL-AMERICAN AWARD program to honor public-spirited TV service technicians has been announced by General Electric's Receiving Tube Dept. The new plan, a revision of the 1957 and 1958 award programs, permits franchised G-E distributors to nominate candidates. The previous program called for the naming of 10 outstanding service technicians, a limitation that left many worthwhile deeds unsung. There is no limit on the number of awards under the new program and no deadline. Nominations by the G-E distributor should be endorsed by a civic leader and two members of the TV service profession, and sent to the Secretary, All-American Awards Comm., General Electric Co., Receiving Tube Dept., Owensboro, Ky.

COMPUTERS are finding interesting—and sometimes humorous—applications in business and industry. In St. Louis, the Lucas Avenue Garage is using a Universal Match device which computes charges for parked cars. The ticket is placed in the slot, and the device automatically determines the length of time and the correct charge, at the proper rate for that particular day or time period. In Kokomo, Ind., for exhibition purposes, Deleo Radio fixed up a computer which tells a man's correct age when 10 questions are answered—but will not reveal the true age of a woman over 21.

TV VIEWER TALKS BACK with a small device called "Key TV" developed by TelePrompter Corp. The control contains two buttons, which a user pushes and which register at a central control point, enabling viewers to take educational television course examinations and participate in opinion polls. The device will be tried out this summer in community TV systems at Liberal, Kan. and Farmington, N.M.

Picture



CREDIT APPRAISAL of electronic parts distributors conducted by National Credit Office shows a 55% gain in dollar volume over the past 5 years, with parts sales in excess of \$815 million. Tubes represent 30% of sales. Classification according to risk showed 7% excellent, 57% satisfactory, 20% fair, and 16% not recommended or no line assigned. A study of 10,000 payments by 1700 firms in the last 6 months revealed 77% were paid on a discount or prompt basis, 10% were 1 to 30 days delinquent, 3% over 90 days late, and 2% were handled on a COD basis.

NEW TV DEVELOPMENTS are coming to the fore. Philco is said to be experimenting with an 18", 122° rectangular picture tube that is less than 9" deep. More commercially speaking, Philco introduced its new 23" line with Mark II Cool Chassis using 20 kv 2nd anode. Air flow chassis design is reported to reduce failures by increased dissipation and elimination of heat traps. From Zenith, we learn of the development of a high voltage transformer used in the company's 22 kv TV chassis. The flame, heat, and moisture resistant alkylid cup is said to be practically impervious to corona discharge.

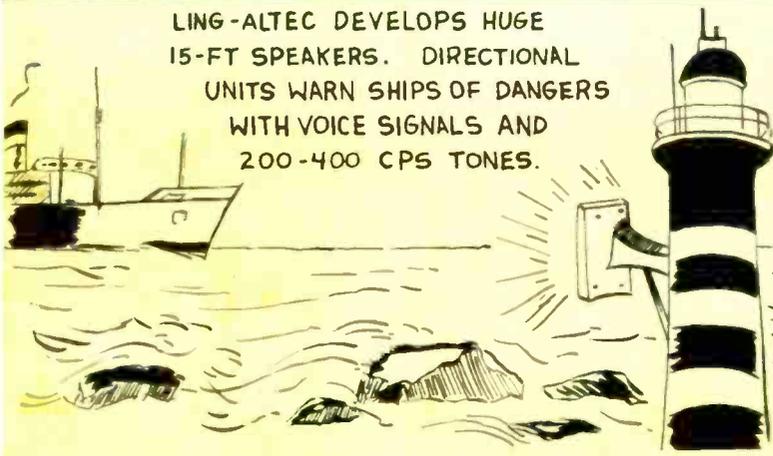
THE SIGNAL CORPS celebrated its 100th anniversary by demonstrating two 24½ lb. transistorized transceivers powered entirely by sunlight. The Hallcrafters, Inc. developed unit, the FPM 200, contains 41 transistors, 30 diodes, 20 quartz crystals and three vacuum tubes, replacing almost 200 lbs. of conventional equipment.

CALENDAR OF COMING EVENTS

- Aug. 19-21: NATESA Annual Convention, Sheraton Towers Hotel, Chicago, Ill.
- Aug. 23-26: Western Electronics Show & Convention (WESCON), Ambassador Hotel, Memorial Sports Arena, Los Angeles, Calif.
- Sept. 6-8: Joint Automatic Control Conference, Mass. Institute of Technology, Cambridge, Mass.
- Sept. 6-11: 1960 New York High Fidelity Music Show, New York Trade Show Bldg., New York, N.Y.
- Sept. 14-15: Fourth Annual Joint Military-Industrial Electronic Test Equipment Symposium, Museum of Science & Industry, Chicago, Ill.
- Sept. 15-16: Eighth Annual Eng'g Management Conference, Morrison Hotel, Chicago, Ill.
- Sept. 15-17: Upper Midwest Electronics Conference and Exhibit, Minneapolis Auditorium, Minneapolis, Minn.
- Sept. 21-22: Industrial Electronics Symposium, Manger Hotel, Cleveland, Ohio
- Sept. 26-29: American Welding Society Fall Meeting, Penn-Sheraton Hotel, Pittsburgh, Pa.
- Sept. 26-30: Instrument Society of America Conference, Exhibit and Fifteenth Annual Meeting, The Coliseum, New York, N.Y.
- Oct. 3-5: Sixth National Communications Symposium, Hotel Utica, Utica, N.Y.
- Oct. 10-12: IRE National Electronic Conference, Hotel Sherman, Chicago, Ill.
- Oct. 24-26: East Coast Aeronautical and Navigational Electronics Conference, Lord Baltimore Hotel, Baltimore, Md.

RANDOM NOISE

LING-ALTEC DEVELOPS HUGE 15-FT SPEAKERS. DIRECTIONAL UNITS WARN SHIPS OF DANGERS WITH VOICE SIGNALS AND 200-400 CPS TONES.



AMERICAN MOTEL MAG SURVEY:

80% OF MOTEL ROOMS HAVE TV. MASTER ANTENNA SYSTEM PREFERRED. SERVICE CONTRACTS USUALLY ONE YR.

ADMIRAL COMPARES VIEWING AREA COST OF THEIR FIRST TV SETS (52 sq") WITH CURRENT MODEL (282 sq").

\$6.73 sq. INCH

71¢ sq. INCH



Optical Sound Servicing

*Movie Projectors Utilize Exciter Lamp & Photoelectric Cell
To Obtain Synchronized Audio*

LUTHER B. HOFFMAN

• The obvious inadequacies of playing a phonograph record while showing motion pictures prompted the development of sound tracks directly on film, permitting accurate synchronization of voice and lip movement.

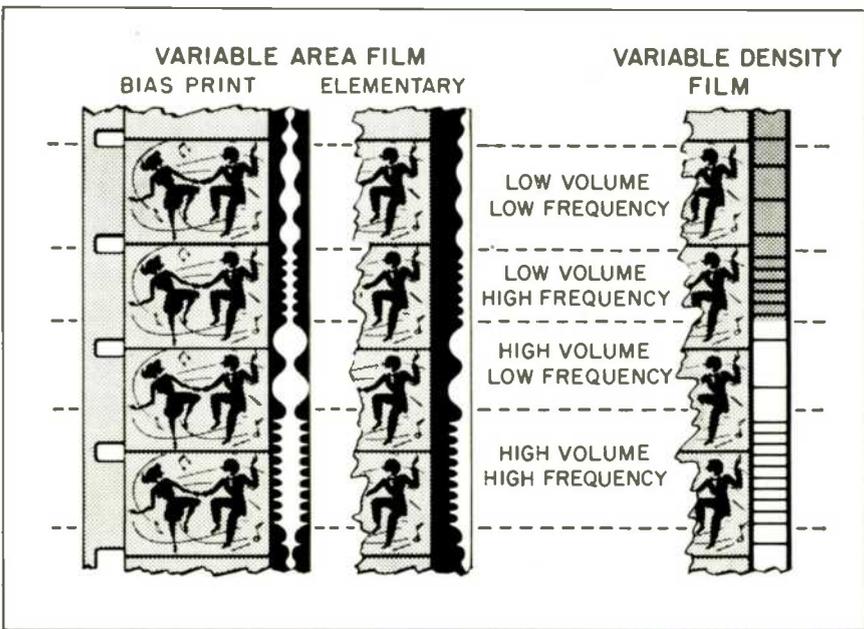
Two types of optical sound systems are used: variable area and variable density. (A different system, the magnetic sound system, is becoming increasingly popular in current sound projectors.)

Both systems use the effect of light passing through film with varying intensity to a photoelectric cell, which converts it into an electrical signal. The amount of light and its variations determine the gain and frequency of the signal. The variable area film operates on the prin-

Sound-On-Film	
Systems	Variable Area Variable Density
Major Components	Exciter Lamp Focusing Lens Reflector Photo Electric Cell Audio Amplifier Speaker
Service Equipment	Audio Signal Generator VTVM Camel Hair Brush Lens Tissue Cleaning Fluid

...ple of constant density with varying area; variable density has con-

Fig. 1—Either a variable area or variable density recording system is used for a movie projector's optical sound track. Variable area film employs constant film density (either "black" or "white"), whose area varies according to sound modulations. The elementary system shown is rarely used due to edge distortion and impaired sound when the film is only slightly misaligned. Variable density film, in contrast to variable area, has constant area with varying film density. The transparency of the film varies with the sound volume.



stant area with varying density. See Fig. 1.

Probably the most popular sound projector in use today, that is, non-professional, is the 16mm film with optical sound track. Schools are using it in audio-visual education. Some state conservation agencies, as well as some of the larger manufacturers, are constantly providing program material gratis, or at a nominal fee, to schools, clubs and institutions. The result is a widespread ownership of movie projectors, and the technicians who can service them properly will find increasing popularity and profit. (In almost every major city, for example, audio-visual service companies have been formed which employ sound projector servicing as the nucleus of their service business.)

The average technician shouldn't

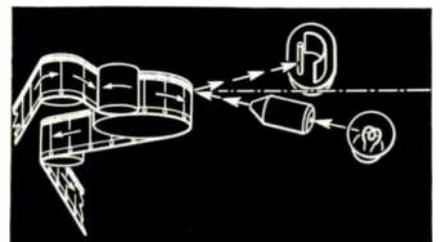


Fig. 2—Basic optical sound operation: light is focused on film's sound track; modulated light passing through film is reflected to a photoelectric cell.

be afraid of this service work. With the exception of two circuits, which the technician can easily understand, the electronic portion of the sound system is essentially the same as found in any well-designed audio amplifier. The two generally unfamiliar circuits are: the ultrasonic oscillator and the photoelectric circuit.

Operation

The basic physical concept of optical sound systems can be seen in

Figs. 2 & 3. A light source, called exciter lamp, is focused through a tiny slot so that it falls on the sound portion of the film. The degree and variations of light passing through the sound track of the film is reflected to a PE (photoelectric) cell. Electronic amplifier circuitry completes the fundamental system.

With this background, let's go back to the exciter lamp. The light source for sound track scanning is usually a coiled filament lamp. The beamed light must not have an appreciable amount of variation, eliminating the possibility of using 60 cycle a-c for the lamp's filament supply. (The PE cell's sensitivity to light variations would pose a serious hum problem if 60 cps was used.)

Although a pure d-c supply would be electronically ideal, a bulky transformer-rectifier addition would hamper portability. A common compromise is an ultrasonic oscillator arrangement, shown in Fig. 4. The separate tube involved is usually an ordinary audio output type, such as a 6V6. This is generally supported by an oscillator-transformer circuit that is practically trouble-free and adds no appreciable weight to the equipment. See Fig. 5. The oscillator frequency operates above human hearing range, usually around 20 kc.

The light is focused through a small, oblong aperture (approximately 3/32" x 1/64") on the film's sound track, which modulates the in-

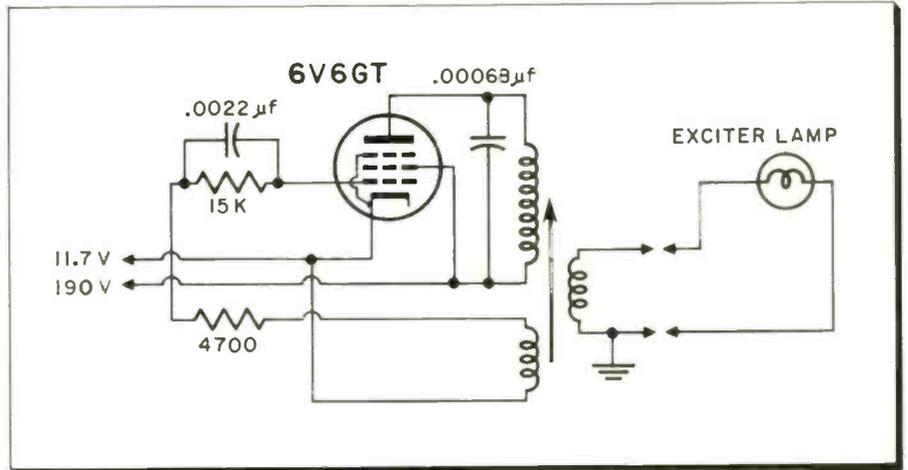


Fig. 4—Oscillator/transformer circuit used to supply exciter lamp filament voltage. Frequency is high enough to avoid hum.

tensity. See Fig. 6. The modulated light strikes a mirror (Fig. 7) and is reflected to the cathode of the PE cell (Fig. 8).

The PE cell is usually a two-element tube with a light-sensitive cathode. The cathode emits electrons in proportion to the volume of light falling on it. The electrons are attracted to the positive anode, converting light to electronic information. The positive potential is supplied to the anode through a load resistor, which is coupled to the grid of the first audio tube through a capacitor.

Aside from its higher impedance, the PE cell behaves very much like a zero-bias voltage amplifier. But, because of its high impedance, the

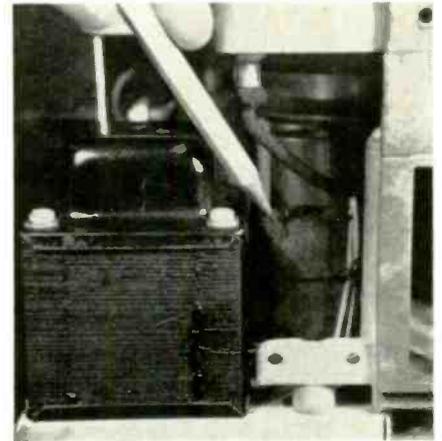


Fig. 5—Compact oscillator/transformer unit.

decoupling must be thorough. Therefore, most circuits employ two bypassed resistors preceding the load resistor, as shown in Fig. 9.

Troubleshooting

Before troubleshooting an optical sound system to locate a defect, it is imperative that the technician know how to operate the unit. Perhaps a friend, relative or the technician
(Continued on page 56)

Fig. 3—A movie projector's optical sound components are illustrated here.

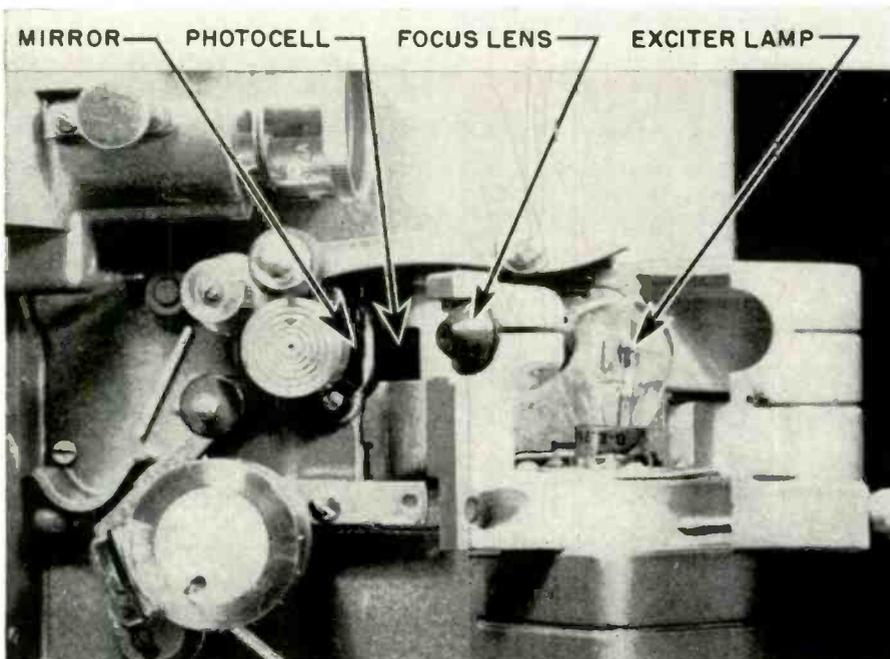
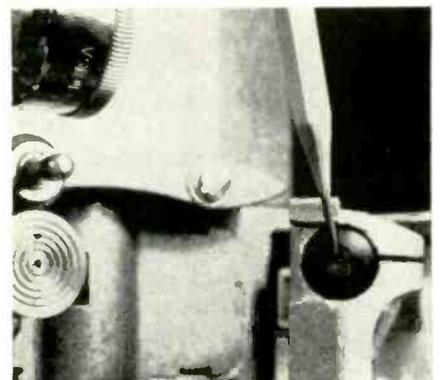


Fig. 6—Light source from focusing device, as it appears to film's sound track.



Benchman's View Of Damper Circuits

Commonly Encountered TV Damper Service Problems Are Explored

HAROLD WEST

• Damping circuits have undergone numerous changes, as evidenced by the different damper tubes that are now used. The early post war TV sets used 5V4, 6W4 and 6AS7 tubes in their circuits. It was common to find a 5V4 and 6AS7 in the same high-voltage chassis. The need for new rugged tubes that could withstand the high positive voltages between filament and cathode of the damper soon became obvious. The old 6W4 would break down under this terrific strain.

Damper History

Within the last few years the 6AX4, 6AU4, 6DA4 and 6DE4 have taken over as popular damper tubes. Present design has eliminated the separate filament transformer or separate power transformer winding for the damper tube. With the turn to series circuit design and pressure of competitive economy-designed sets, tubes in the damper circuit were wired either in series or parallel in the overall filament string.

Series filament string design brought forth the 12 volt damper tube. In some TV sets a 17AX4 or 19AU4 may be found, but usually the 12 volt duplicate of the parallel string six volt tube is found.

Applying theory to pinpoint circuit trouble is naturally a desirable troubleshooting method, rather than using "cut and chop" servicing. This applies to the damper circuit, too. The damper tube, a medium voltage rectifier, has the job of (a) sup-

pressing unwanted damped oscillations, (b) conducting during the last negative portion of the shock-excited flyback pulse until the output tube recovers and (c) providing boost voltage for the plate of the Horizontal Output tube, as well as other circuit sections.

Troubleshooting Tips

Troubleshooting a damper circuit under normal design conditions is very similar to tracing the B+ loss of any low-voltage rectifier.

Damper circuit defects are seen on the picture tube screen in many ways; one symptom is the loss of high voltage, with consequent loss of raster. The "no raster" symptom may be caused by no output of the damper tube or a shorted capacitor in the horizontal linearity or width coil circuit. (Naturally a defective yoke, flyback, oscillator stage, etc., could cause the same effect.) Often the boost supply is fused and technicians are tempted to jump out an open fuse. In circuits with a low voltage transformer, a short in the damper circuit with a jumped fuse has overheated many low voltage transformers. Obviously, its a bad practice to jump a fuse. Locating the cause of the excessive current and correcting it is a much wiser practice.

Equally poor is the allied practice of replacing shorted capacitors with under-rated components. Many of the sets on the market use 600 volt capacitors in the linearity and width circuits. Replacing these parts with 1000 vdc capacitors at repair time reduces damper circuit breakdowns. Do not use 400 vdc capacitors; they will not stand up.

Frequently the damper tube will momentarily arc, causing the horizontal output to collapse into a narrow band; a bright white line with sparking branches. When this happens with older sets, which used a

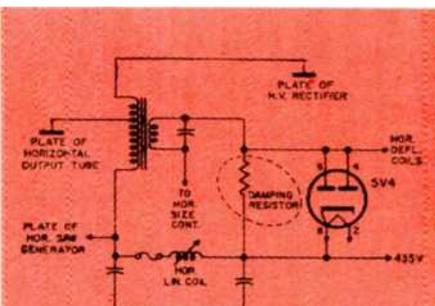
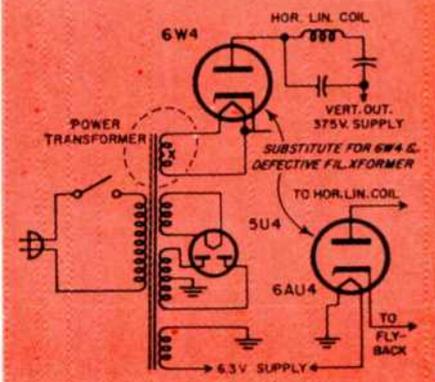


Fig. 1—Damper lines & poor horizontal linearity in the DuMont RA-103, 4, 5, 10 chassis traced to an open damper resistor.

Fig. 2—When the damper heater winding of an RCA KC5 47, 49 series chassis opens, a heater supply can be obtained from another 6.3 v source which is capable of handling the additional current drain. A 6AU4 is substituted for the original 6W4.



standard type $\frac{1}{4}$ or $\frac{3}{8}$ amp fuse, the fuse would generally "pop." Consequently, the service technician may locate only a blown fuse in the customer's home. Replacing this fuse—and nothing else—will only result in a rehash. Let's face it, fuses usually blow due to some defect. An intermittently sparking damper tube is a major cause of blown fuses.

Therefore, the best way to check if the damper tube is apt to arc again is by tapping the side of the tube's glass envelope; perhaps using the plastic handle of a screwdriver or spintite. If the damper tube is defective, it will usually exhibit arcing, giving the picture a Christmas tree effect. If this occurs, the damper tube should be replaced. Additionally, it would be good practice to substitute the later type "slow blow" fuse, eliminating the possibility of a blown fuse at the slightest surge.

Of late, the barber pole or barkhausen effect (black and white rope-like line on the left side of the screen) has been overcome with the inclusion of filter chokes in series with the plate and cathode of the damper tube. In this case, another potential defect is apparent. An open choke could cause no raster due to eliminating the Boost or B+ from the tube. (Older sets got around barkhausen oscillations by placing a magnet, similar to an ion trap, around the horizontal output tube envelope.)

Sometimes the technician has to service a set with distortion at the right side of the picture. This is sometimes caused by the wrong capacitor being used in the linearity circuit. A leaky capacitor replacement with a value *almost* the same as the original is often found as the "defect." Unbalancing this critical filter network will result in picture disfigurement. Consequently, replace that shorted capacitor with the exact value. Don't try to improvise.

Case Histories

In the older *Du Mont* chassis a 7500 ohm 20 watt resistor was used as the damping resistor in the circuit shown in Fig. 1. When this part opens the picture on the screen is overrun with drive lines and the horizontal drive adjustment would not correct this situation. Also, the right side of the picture would

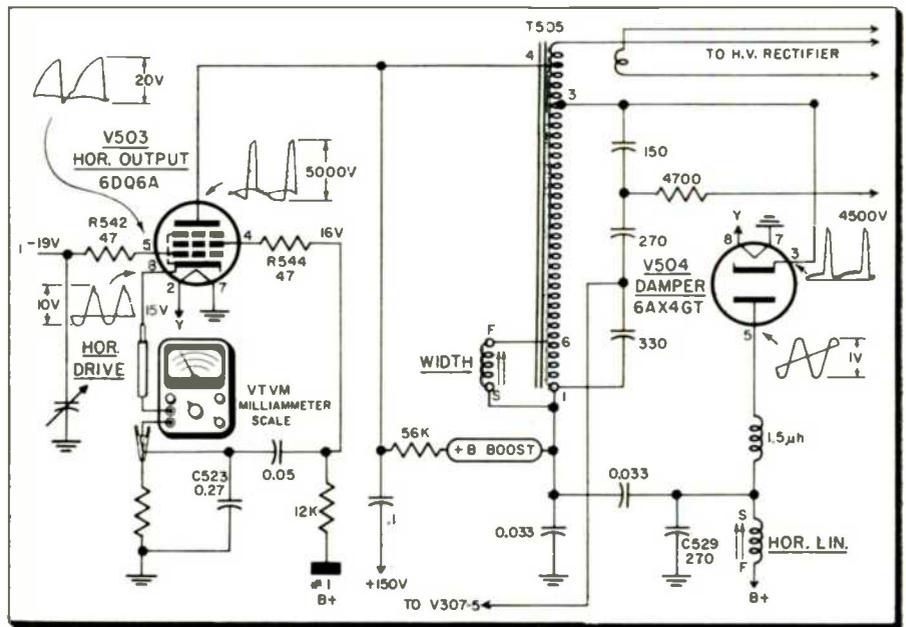


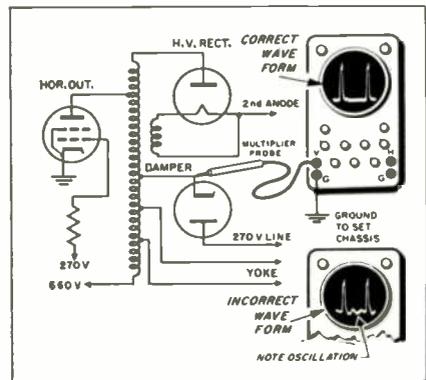
Fig. 3—Minimum millimeter reading is desirable when a horizontal linearity coil is adjusted. Improper adjustment may overheat the flyback transformer due to excessive current.

appear much wider than the left. Replacing the defective part returned the set to normal operation.

It was common to find the old RCA (KCS 47, 49 chassis, having a separate 6W4 winding on the power transformer, with an open damper winding. The technician has three separate choices to make regarding this set repair: change the low voltage transformer at considerable cost to the customer, install a separate filament transformer for the one tube (sometimes space limited use of this method), or change the damper tube to the newer type, namely the 6AU4. This is accomplished by wiring the 6AU4 filament to a suitable 6.3 source, as shown in Fig. 2.

[Space can generally be found on

Fig. 4—Wave-form illustrates the proper shape found at the damper cathode. The irregular scope trace shown indicates trouble in the damper filter circuit.



these chassis to mount a separate 3 amp, 6.3 volt heater transformer to replace the defective unit in the power transformer.—Ed.]

TV sets as recent as five years ago added a horizontal linearity coil in the plate circuit of the damper tube. This pi type filter, with its capacitor, coil and capacitor, filtered the voltage at the plate of the damper tube. By adjusting the horizontal linearity coil the picture changed from a normal deflected picture to one of disfigurement to the left side. It is important to note at this time that defective linearity coils and improperly adjusted coils may cause flyback transformers to burn up due to excess current. A milliammeter inserted in the cathode of the horizontal output tube (Fig. 3) while adjusting the linearity coil for minimum reading will prevent breakdowns of this nature.

Sets that channel the boost voltage to feed the vertical output circuit often cause the "no high-voltage" symptom through a bypass capacitor shorting, thereby creating a B+ short. Replacing the charred resistor and shorted capacitor should restore normal operation.

In the final analysis, the damper circuit should be treated as a medium voltage rectifier. Following normal service procedure by employing a VTVM to check voltages will readily indicate circuit operation. Problems of horizontal line-

(Continued on page 49)

Becoming Acquainted With Your VOM

Tips For Getting The Most From This Versatile Instrument

JOHN HASKELL

• While the volt-ohm-milliammeter is perhaps the most frequently used instrument employed by the electronic technician, field, or plant engineer, few take full advantage of its versatility.

VOM's designed with basic meter movements ranging from 10 to 50 microamperes, with sensitivities

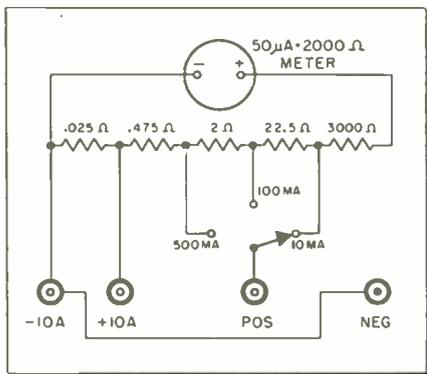
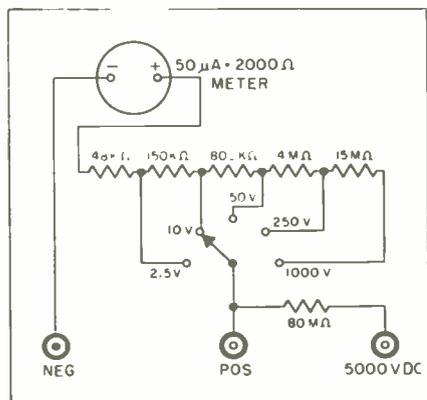


Fig. 1—Basic arrangement of shunt resistors in a VOM for d-c current measurements ranging from 10 ma to 10 amperes.

Fig. 2—Simplified series resistor circuit in a 20,000 ohms-per-volt meter providing d-c voltage ranges covering 2.5 to 5000 v.



from 20 to 100 thousand ohms-per-volt, are inherently capable of wide use. For example, it is often forgotten that these instruments can serve admirably as the basic meter in field strength measurements, null indicators in many bridge applications, grid dip meters, modulation meters, and countless others. In addition, its everyday usefulness as a troubleshooting and measuring device can be greatly expanded by providing the meter with a few necessary probes and other accessories. To get the most out of these instruments, however, it is first necessary to recall a few fundamental facts about the VOM.

How It Works

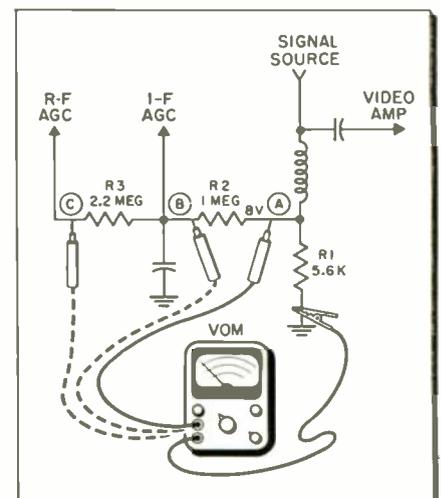
Some users of VOM's can recall with pleasant surprise that it is like a transistor, basically a current-operated device. A 50 µa movement, for example, requires 50 µa of current to deflect it full scale, regardless of the markings and indications on the meter scale. The meter's voltage sensitivity is directly related to this basic full-scale current deflection. This sensitivity is normally specified in ohms-per-volt. For example, 20,000 ohms-per-volt. By using switchable, tapped shunt resistors, as shown in Figs. 1 and 2, and by marking the meter's face in volts, ohms, amperes, milliamperes and microamperes, we have in our hands an essential device adapted to innumerable test and troubleshooting applications.

Another fact which may surprise some is that a 20K ohms/v VOM is just as accurate on its 500 volt scale as a 10 megohm input VTVM. On its 1000 volt d-c scale the VOM has an

input resistance of 20 megs while the VTVM remains at 10 megs. A 100K ohms/v meter has an input resistance of 15 megs on its 150 volt d-c scale. As we all know, the VTVM is essential for accurate low voltage readings in extremely high impedance circuits and also for very high resistance indications.

The input resistance for a VOM on a given d-c voltage scale is, of course, determined by multiplying the full scale indication by the meter's sensitivity. For example, on a 10 volt scale, this would be 10 x 20,000 (with a 20,000 ohms/v meter) or 200,000 ohms. On a 250 volt scale, the meter's input resistance would be 250 x 20,000, or 5 megs, and so on. Remembering this fact can be very important, as we shall now see.

Fig. 3—A significant voltage reading at points B and C in this agc circuit can be obtained only by using the highest readable scale of a VOM. Low input resistance of lower scales will adversely affect VOM/circuit voltage relationships.



How Not To Use It

On occasion a technician will proclaim that a 20,000 ohms/v. VOM is useless on avc and agc measurements and will reach for a VTVM. This is not necessarily true, and can easily be demonstrated by referring to the simplified schematic in Fig. 3, representing a TV agc distribution system or radio avc circuit.

A bias of 8 volts is arbitrarily assumed across R-1, the 5.6 k resistor. The imaginary technician sets the VOM on the 10 volt scale and measures the voltage at point A. The 200,000K meter resistance across the 5.6K ohms will not adversely upset voltage relationships in the circuit. The meter will indicate close to 8 volts. But wait . . .

When the technician moves the meter probe to point B, there will be 200,000 ohms across 1 megohm circuit resistance, giving an average resistance of about 170,000 ohms, which completely upsets meter/circuit voltage distribution relationships. Only about 15% of the voltage, or 1.2 volts, appears across the meter. When the meter probe is moved to point C, the situation grows even worse. The meter needle registers a perceptible flicker at this point, and the technician begins looking for the shop's VTVM.

No one should try to obtain a significant voltage indication in this circuit with the VOM set on its 10 volt scale. Let's try the 250 volt scale.

Input impedance of the meter is 5 megohms on the 250 volt scale. 5 megohms across 1 megohm gives about 630,000 ohms average, and the voltage relationship is now reversed. The meter appears to move only slightly but when we take a closer look we can easily see the needle pointing near 7 volts. Even at point C we can determine close to 4 volts meter deflection. True, it's more difficult to read than a VTVM's scale, in this instance, but a VOM can be employed. Of course, as was pointed out before, in very high resistance circuits with very low voltage, only a VTVM can give the needed information. But what the VOM can do far overshadows the few instances where it fails to adequately perform a task for which it was never intended.

Current Applications

The d-c current scales of the VOM, generally in amperes, milliamperes

and microamperes, are highly valuable to the technician or plant engineer. With the increased use of transistor radios, for example, the low current scales of the VOM provide a convenient, rapid troubleshooting tool for these sets.

A customer walks into the shop with a transistor portable, complaining that "the batteries run down too fast." Maybe he bought the batteries from you, or somewhere else. In any case the first thing you want to know is: How much total current is the radio drawing? Now the average transistor radio draws about 14 milliamperes at normal volume level. Some more, others less. Currents

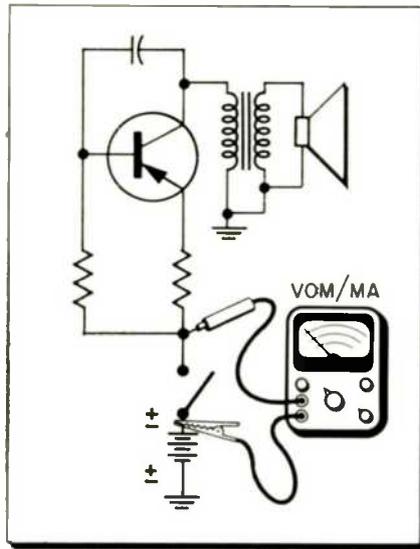


Fig. 4—Current overload in a transistor radio can be detected by inserting a VOM's milliamp scale in series with its load.

Fig. 5—Insert VOM (150 ma or higher scale) in cathode circuit of TV horizontal output tube and adjust linearity coil to give minimum reading. This frequently prevents damaged flybacks and output tubes.

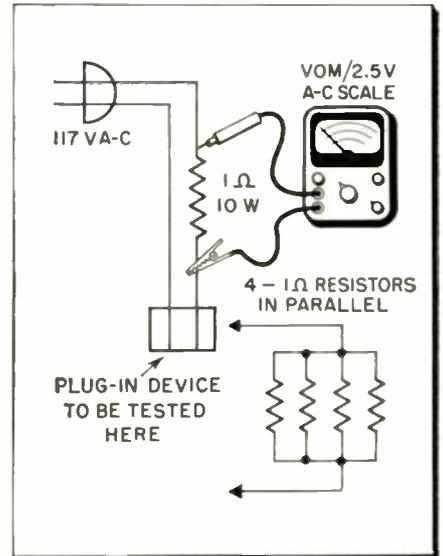
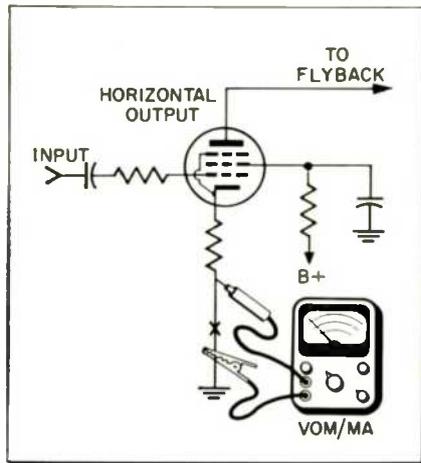


Fig. 6—Extension cord used for measuring power loads by employing a VOM's 2.5 a-c scale. By substituting four 1 ohm resistors, in parallel, currents up to 10 amperes can be measured on this scale.

range from about 8 to 25 ma, depending upon type.

By opening one connection in the radio, or by inserting the VOM/MA probes across the open on/off switch, as shown in Fig. 4, and operating the radio at normal volume, you learn quickly if a bad transistor or a low resistance short in the radio is running the batteries down prematurely.

Many horizontal output and high-voltage problems develop in some critically designed TV's because of a misadjusted linearity coil. The most practical way to check and adjust this coil properly is by inserting your VOM/MA in series with the horizontal output tube cathode and adjusting the linearity coil for *minimum* dip reading on the meter, as shown in Fig. 5. You can now be sure that the fly-back transformer insulation won't melt off or an output tube burn up because of a misadjusted linearity coil.

Power Load Problems

Power load checks on radios, TV's, and any kind of equipment can quickly be made with the milliampere and ampere scales of a VOM. First measure the voltage across the circuit load, then the current in series with the load, and use Ohm's' law, remember?

$$P = E \times I$$

If you know what the normal power
(Continued on page 44)

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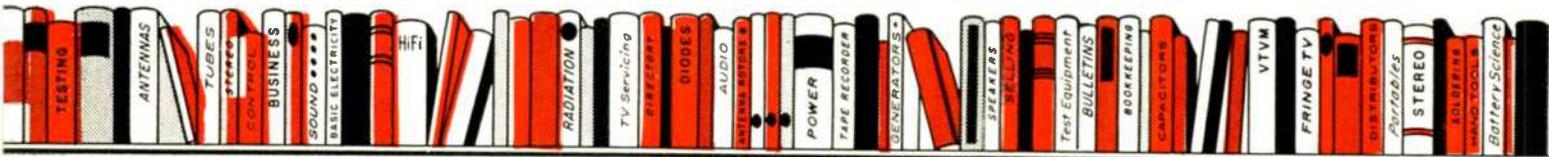
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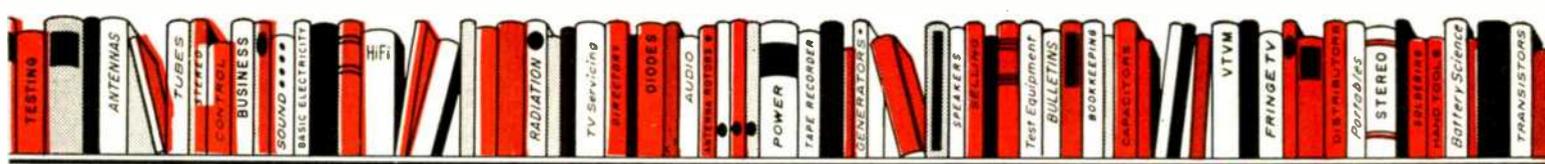
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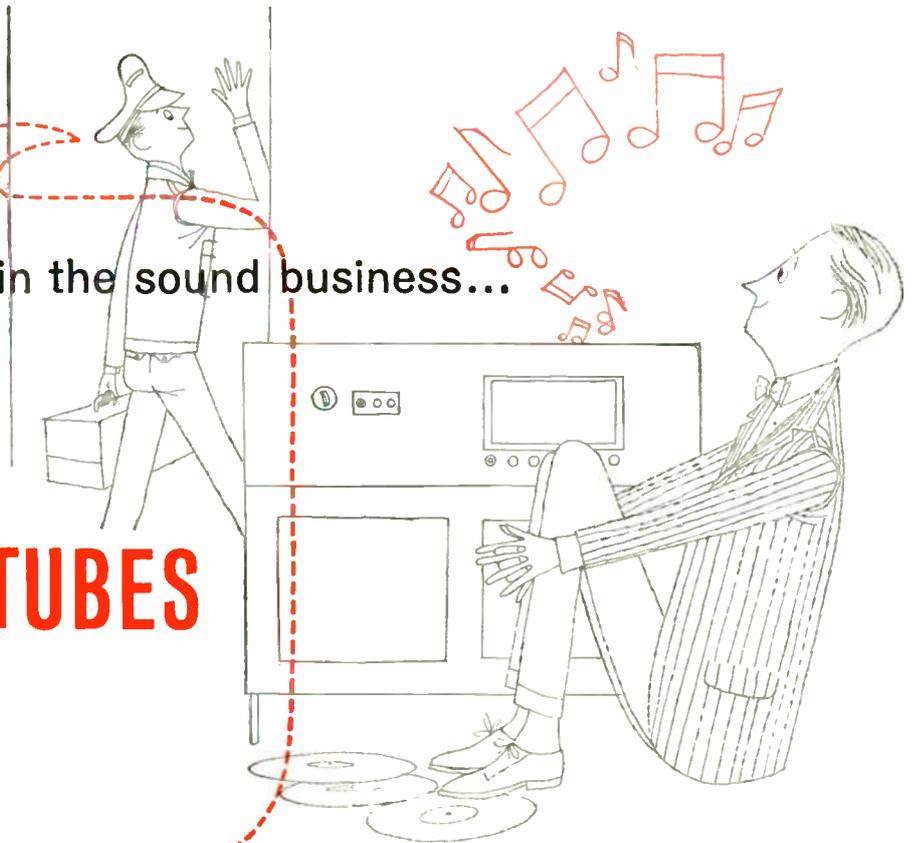
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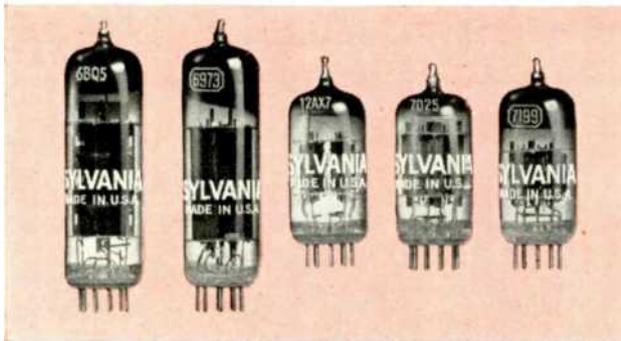
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SHOP HINTS



Tips for Home and Bench Service

Eliminating Vertical Jitter

This hint may save some technicians a few premature gray hairs. I learned the hard way.

There are untold numbers of RCA KCS 47's, 47T's, 47A's, and 47AT's,

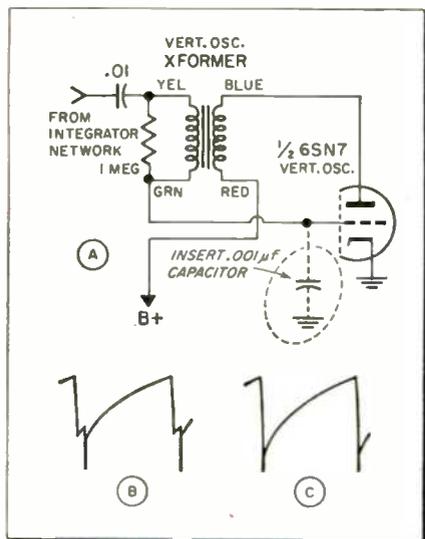


Fig. 1 (A)—Vertical jitter was eliminated by installing a .001 μ f capacitor. (B)—distorted sync in waveform taken at the vertical oscillator plate of Ambassador TV. (C)—Normal waveform after installing capacitor.

with 16GP4 CRT's, still in use; some as 2nd sets. And customers still get them repaired. I have had a number of these in the shop recently.

After years of use many of these sets develop a critical vertical hold control range. With certain settings of the vertical height and linearity controls, vertical jitter takes place. The swing of the jitter is equal to several scanning lines, usually worse at the picture's top. Although most of the sets in for repair did not originally include this fault in the customer's complaint, most will call attention to it after the set is returned. They become accustomed to the fault over a period of years, simply forgetting about it—until the set is returned. Consequently, it is a good policy to include the cost of this fault in the original estimate and remind the cus-

tomers about it before repair.

This fault has shown up even when the vertical oscillator transformer was replaced. All parts may check perfectly and dressing leads to eliminate stray coupling between horizontal and vertical, doesn't help. The only positive solution found was to shunt the vertical oscillator grid circuit to ground through a .001 μ f, 600 v capacitor, as shown in Fig. 1A, slightly readjusting the vertical height and linearity controls.

After discovering this solution, another set, an Ambassador 17" chassis came into the shop for replacement of a vertical oscillator transformer. When replaced, the vertical jitter was very bad. When a .001 μ f capacitor was shunted from the vertical oscillator grid to ground the jitter promptly disappeared. On the RCA receivers no appreciable change appeared on a scope trace of the signal from the oscillator output. On the Ambassador set, however, the trace changed from that shown in Fig. 1B to that illustrated in Fig. 1C.—M. G. Goldberg, St. Paul, Minnesota.

Sync Instability

Poor horizontal sync stability and a soft vertical hold condition in a GE "U4" chassis, can frequently be traced

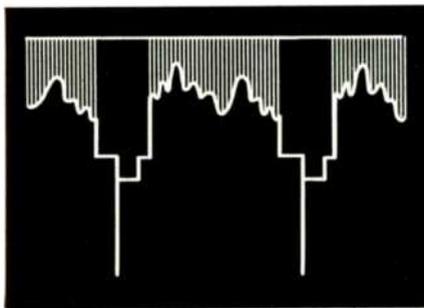


Fig. 2—Composite video waveform taken from the video detector at vertical frequency shows narrow, excessively peaked sync pulse spike, indicating open age filter capacitor.

to an open age filter capacitor, C-252.

When measured with a VTVM, the average voltage may be normal, but

a scope examination of the waveform at test point VII (age bus), shows the keyer pulse present. With the scope set to obtain two waveforms of vertical information (30 cycles), further checking at test point IV, at the video detector, shows an excessively peaked and narrow vertical sync pulse as shown in Fig. 2. This spike results from cancellation of age at pulse time by the keying pulse, producing a greatly exaggerated sync spike which causes the instability.

The cure for this condition is to replace the capacitor. The red durez-dipped type capacitor should be used for replacement instead of the black molded case type.—General Electric Co., Radio & TV Div., Syracuse, N.Y.

Solder Dispenser

A very convenient, easy to use, solder dispenser can be made from a 5" or 6" length of hollow tubing $\frac{3}{8}$ " or $\frac{1}{2}$ " in diameter. I use a hollow

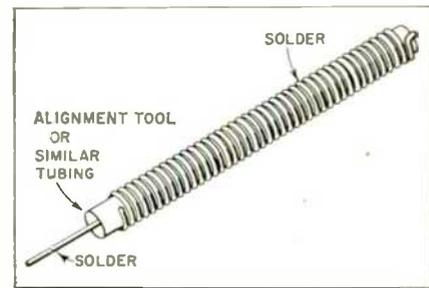
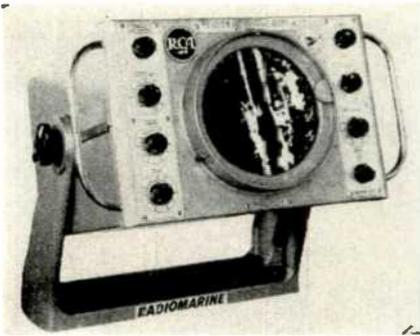


Fig. 3—Made from a length of hollow tubing, this handy solder dispenser is used like a pencil—eliminating a spool or loose coil.

composition type alignment tool.

A length of solder is first fed straight through the tube until it protrudes a few inches from one end. Winding is started at the opposite end and solder is wound around the tube until covered with one layer. It is then cut off. (See Fig. 3).

The holder is used like a pencil, and when more solder is needed at the "feed-end" it is simply pulled out from the tube, easily unwinding from the other end.—G. R. Lince, Stratford, Ontario, Canada.



RCA PPI radar-scope, Model CR-103.

Radar— How It Works

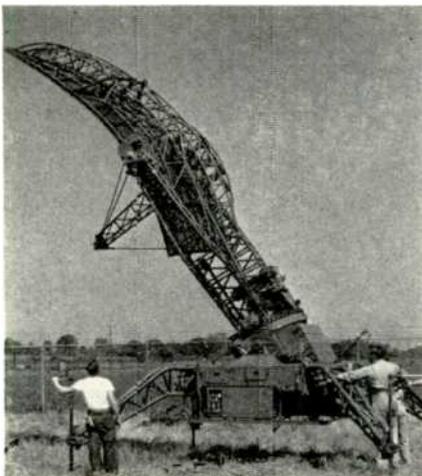
Understanding Typical Radar-Scope Display Systems

ALLAN LYTEL



Fig. 1—84-foot diameter "dish" on its 90 foot tower used to bounce radio signal from the planet Venus back to earth. Signal took about 5 minutes for round trip.

Fig. 2—Field assembly of AN/MP5-16 height finder radar antenna.



• Radar has developed from the early equipment that helped win the battle of Britain during world war II, into an indispensable tool of the hour. It is used to guide aircraft through storms, detect and track missiles, satellites, and provides man with long-seeing eyes through rain, fog, and darkness.

Radar signals, sent into space from M.I.T.'s huge research radar at Westford, Mass., in 1957 (Fig. 1), were bounced off Venus and returned to earth. This was man's first known contact with another planet and extended radar test ranging to 28 million miles.

Signal Corps tests, using a modified SCR-271 radar, sent signals to the moon and back as early as 14 years ago, but M.I.T.'s 84-foot dish is in a real sense man's first radar space-probe. The new MASER (Microwave Amplification by Stimulated Emission of Radiation) sensitive low-temperature amplifier was used by M.I.T. in making the Venus contact.

A 265 kw UHF signal from the M.I.T. radar's 84 foot diameter parabolic antenna made a round-trip of 56 million miles to Venus and return. This was a long journey, consequently only a very small signal returned. Even though amplified by the low-noise maser, the signal was still so weak that special digital computer techniques were necessary to process the pulse data and confirm the Venus contact.

There are many types of radars including the height-finder (Fig. 2), the long-distance search radar (Fig. 3), and the ship-borne set shown in Fig. 4. Basic principle of operation of all types are about the same.

Operating Fundamentals

Arising from the words Radio Detection And Ranging, RADAR was originally developed primarily for detecting and ranging military aircraft targets. The ability of radar to spot unseen objects has proven important for peace-time uses, such as air traffic control and tracking of tropical storms for storm warning purposes.

Radar functions by bouncing back or reflecting a portion of its transmitted r-f energy from the object to be detected, displaying the reflected signals from the object on a CRT screen, as shown in Fig. 5. This is somewhat similar to the sound wave echo. The bat uses this system to avoid collision with objects in his flight path by transmitting an ultrasonic wave with its "voice" and picking up the echo with his ears.

Radar employs electromagnetic waves beamed in a straight line. The frequencies used are in the UHF band or higher. Since the speed of the radio waves is known, it is possible to determine the distance from the point of transmission to the reflecting object. This is done by measuring the time between the transmission of the wave and the return of its echo back to the starting point.

As we already know, radio waves travel at the speed of light, or approximately 186,000 miles per second. Thus, the round-trip for one mile takes about 10.75 μ seconds. By transmitting pulses of r-f energy and timing their return, the distance to a target can be measured. When a pulse or burst of r-f energy is sent out, the receiver starts an "electronic

clock" which is stopped by the return signal. This elapsed time, when converted into distance readings, gives the target range. Direction of the antenna determines the bearing of the received target.

Radar Systems

Fundamentally, a radar system consists of approximately 14 essential units, as shown in the functional diagram in Fig. 6. While the design of some of the individual components may vary widely depending upon the radar's use, the function of each unit in different sets are primarily identical. Briefly, the system consists of a transmitter which sends out radio signals, a receiver which picks up reflected signals, and an indicator which shows the signals returned by a target. This indicator is a visual display on a cathode ray tube. Transmission systems used may be frequency modulation, frequency shift, and pulse modulation.

Unit Functions

A more thorough understanding of the role played by the various units indicated in Fig. 6 can be obtained by a brief functional description of each unit.

(1) The power supply, of course, provides the energy to the radar, including the modulator for feeding the transmitter. Both a-c and d-c is supplied to the set.

(2) Synchronizer components may be located in one integrated unit but in many sets they are distributed throughout other units. This is the "electric clock" system which provides the sync pulse timing requirements for the entire system. It is the

radar's master oscillator. Both trigger pulses for timing the r-f oscillator firing with the rest of the system, and in some sets, a gating pulse to instantly turn the receiver on after transmitter firing are provided by this unit.

(3) The modulator is part of the transmitter and essentially acts as a switch. It stores d-c energy from the power supply and provides the energy for the transmitter in pulses. Pulses generated should be as near rectangular as possible.

(4) The transmitter generally employs a magnetron tube for providing r-f output if the system is operated in the microwave spectrum. A conventional type oscillator may be used on lower frequencies. Extremely high power units usually employ klystrons.

(5) This section of the wave-guide carries the transmitter r-f power to the T-R box (transmit-receive switch).

(6) Acting as an r-f switch or duplexer, the T-R box prevents the transmitter power from reaching and overloading the receiver. It also permits the returning r-f energy to go to the receiver.

(7) This section of the waveguide carries the transmitter's r-f energy to the antenna.

(8) The antenna radiates the r-f energy against the reflector which is facing in the proper direction.

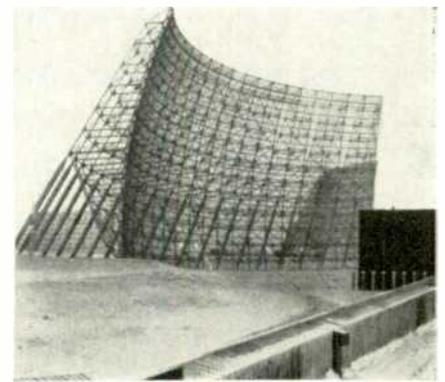


Fig. 3—One of the four giant long-range radar antennas, each 165 feet high and 400 feet long, used in BMEWS missile detection system located at Thule, Greenland.

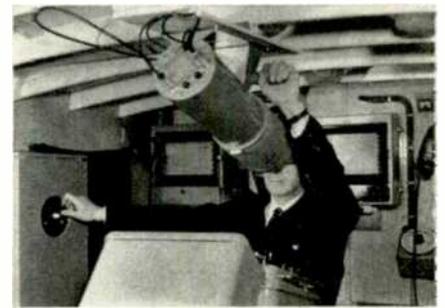


Fig. 4—Small-craft type radar unit shown mounted to bulkhead in the wheel-house.

(9) The reflector beams the r-f waves outward toward the target, generally in a 2 degree beam. The rotation of the radiator sweeps the

Fig. 5—A portion of the signal from the radar transmitter is reflected from the object, picked up by the receiver, and then displayed on the radar's CRT screen.

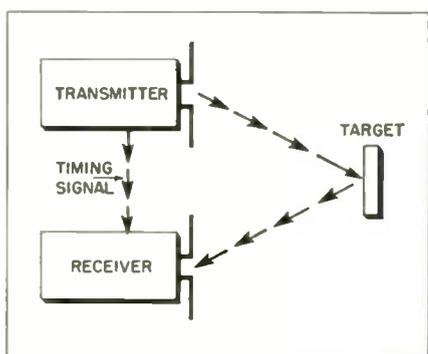
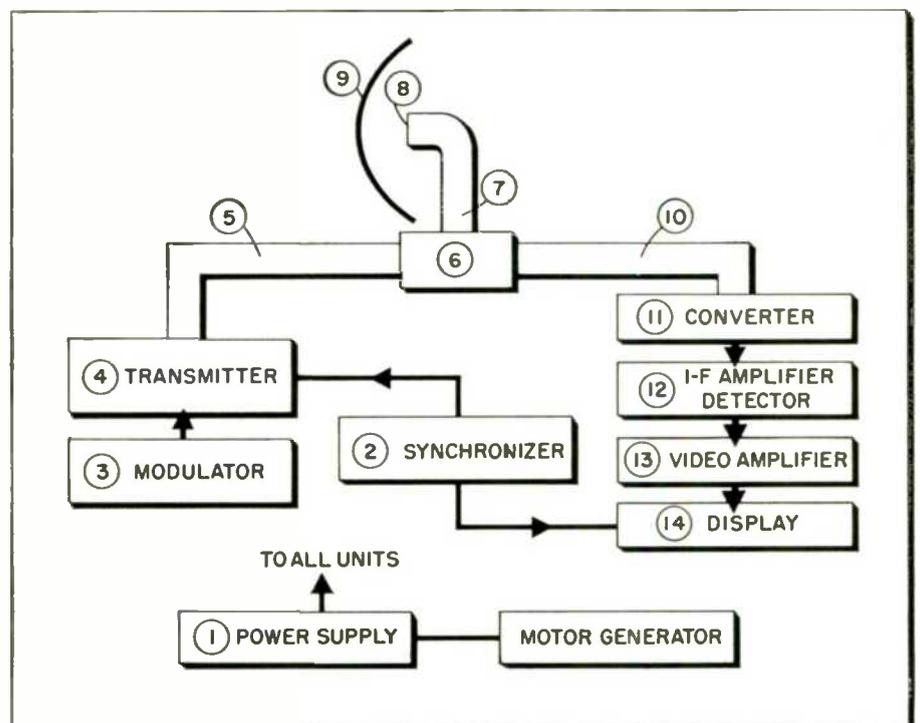


Fig. 6—Functional diagram showing individual units in a complete radar installation.



area under observation in a 360 degree pattern. The waves are reflected in all directions by any object they strike.

(10) Since the same reflector is used for both transmitting and receiving, this section of waveguide is employed for transferring the reflected return waves from the T-R box to the converter.

(11) The converter mixes the r-f return pulses with a local oscillator signal to produce the i-f frequency. These signals then pass to the receiver amplifier.

(12) The i-f signals are amplified here, the video pulses detected and passed on to the video amplifier.

(13) The video signals are properly amplified and fed to the control grid of the indicator CRT.

(14) Visual display takes place at this point. Part of the indicator circuit includes the time-base generator which is controlled by sync pulses.

One system, a form of frequency-shift, employs the Doppler effect. If the source of radio energy or an object from which radio waves are reflected is moving rapidly toward or away from a stationary point, the frequency of the transmitted wave changes. Radar speed meters, employed in highway control, use this principle to determine roughly the speed of automobiles. Briefly, the system performs as follows:

The radar transmitter beams a signal at the object which must be moving directly away from or toward the transmitter/receiver point. The radar receiver picks up the reflected signal

from the moving object, the frequency of which is decreased or increased through the Doppler effect. The frequency of the signal transmitted by the radar is also being picked up by the receiver. The f-m detector in the receiver responds to the change in frequency. The greater the speed of the object the larger the signal detected. The amount of frequency change is proportional to the speed of the object. Of course, if the object is moving crosswise to a radius drawn through it, the returning frequency is the same as the transmitter frequency, in which case the detector output is zero.

CRT Indicators

As we have seen, visual information from targets is presented on the face of a radar's CRT. Fixed surface objects return many echoes to the radar receiver (ground clutter) and these appear on the indicator. In some cases it is difficult to track an aircraft, for example, close in to the radar installation when the radar is near buildings or hilly terrain. The technique of discriminating against fixed targets, and the display of only moving targets, is called moving target indication (MTI). The technique employs the Doppler effect in conjunction with proper pulse timing.

Another display system, known as a plan position indicator, (PPI) is shown in Fig. 7. The electron beam sweeps out from the center of the CRT to its outer edge. The deflection yoke rotates together with the antenna. Thus, the tube sweep which is the time base, indicates the direction of the antenna at any instant. Direction of a target's movement may be determined from the PPI sweep.

When the transmitted r-f energy strikes a target and produces an echo, the intensity of the electron beam and the spot is increased. A bright spot is placed and remains at that point on the screen, even after the scanning spot has passed. With this scan, the CRT can indicate a map of the area near the radar. This system is useful when the radar set is used as an aid to navigation.

Other visual CRT displays can take several forms, as illustrated in Fig. 8. In the scan at 8A the spot has a constant intensity, starting the instant a

Fig. 7—The deflection yoke of the CRT rotates with the antenna on a PPI type radar. A complete map of the area swept by the antenna appears on the CRT screen.

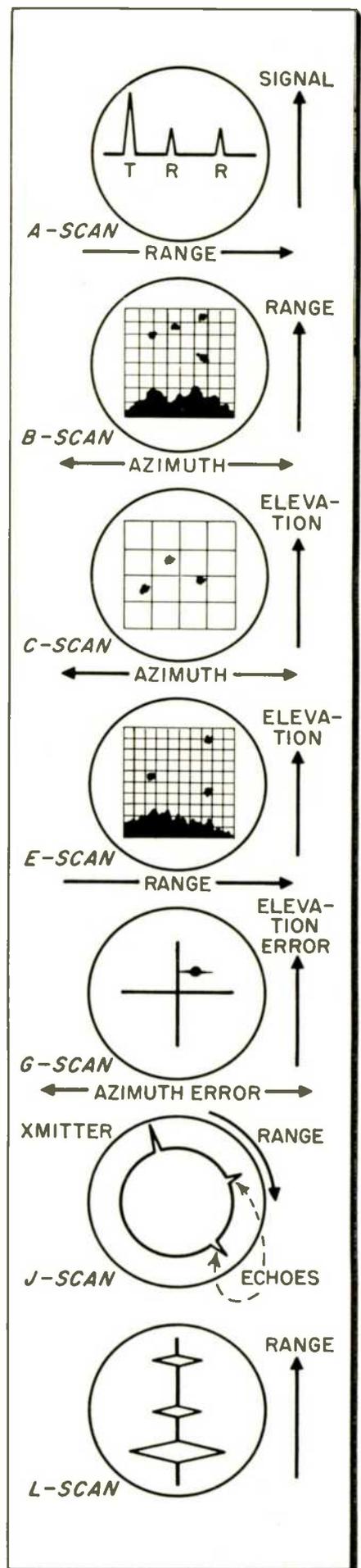
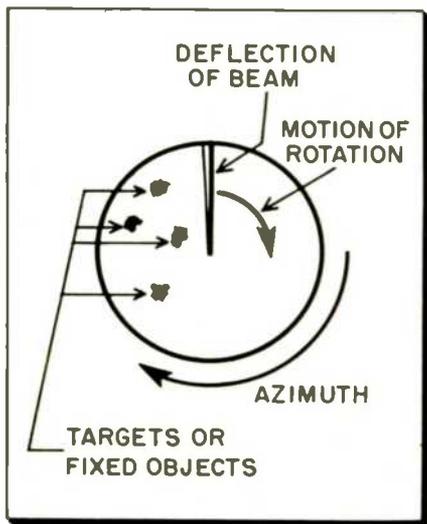
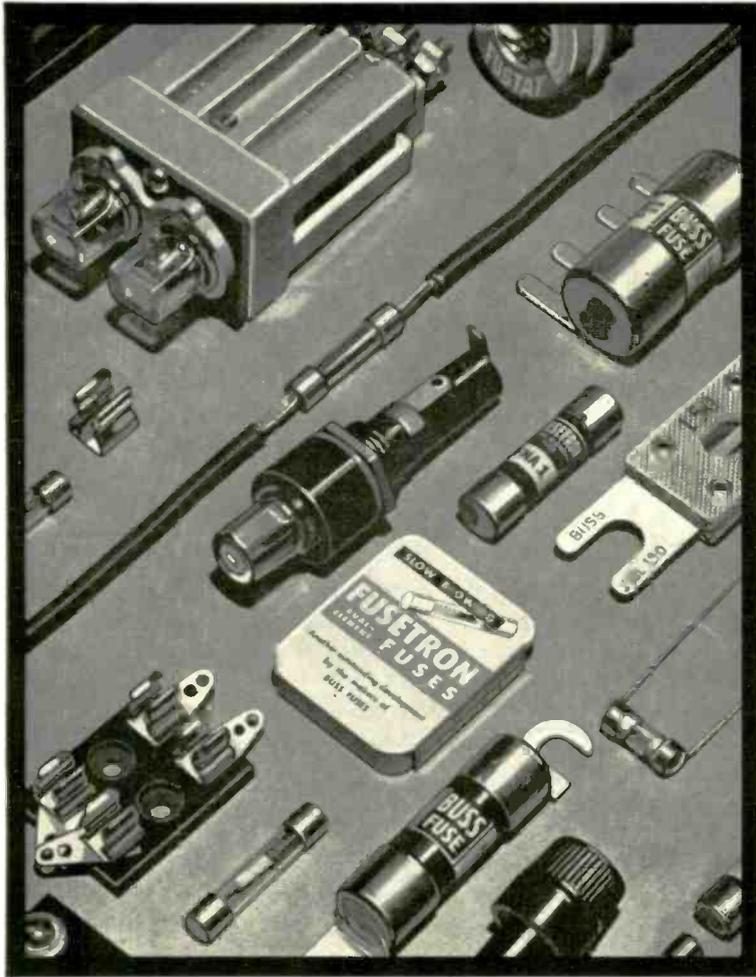


Fig. 8—Different types of scope displays employed in typical radar systems. ▶

(Continued on page 42)



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Radar

(Continued from page 40)

pulse of energy is radiated by the transmitter. The spot moves across the CRT face and received echoes cause a vertical deflection of the spot. The horizontal distance between transmitted pulse (T) and the returned echo (R) represents the distance to the target.

The bearing (azimuth) at 8B as well as the range of reflecting objects are both shown. A directional antenna system is rotated which causes the radiated beam, in this case, to cover a horizontal plane. This motion causes the spot on the CRT screen to have a horizontal motion. The vertical motion from bottom to top of the screen is also given to the scanning spot and every vertical line is synchronized with the transmitter pulse. This vertical sweep is more

rapid than the horizontal sweep and a raster is produced. When an echo or a returned signal is received, the signal is applied to the CRT grid, creating a bright spot. The position of this spot to the right or left of the center line of the screen indicates the azimuth of the target which is its angle to the right or left of the radar. The height of the spot above the base line, as shown, indicates the range or distance of a target.

The returned signal appears as a bright spot at 8C with the azimuth indicated as the horizontal, and the elevation angle as the vertical. This system has been used by night fighter aircraft.

The scan at 8E is somewhat similar to that shown in 8B. The echo appears as a bright spot with the range as the horizontal and the elevation vertical. This is frequently used by planes for blind landing.

Only the echo is presented on the CRT face in the scan illustrated at 8G. It appears as a bright spot on which wings grow as the distance to

the target decreases. The azimuth appears as the horizontal and elevation as the vertical. This type of scan has been used for gun-fire direction.

The scan at 8J is a circular version of that at 8A. Here the spot rotates in a circle near the edge of the CRT face. An echo appears as a deflection from the circle. As the distance changes, the deflection moves around the circle. It is used in radar altimeters.

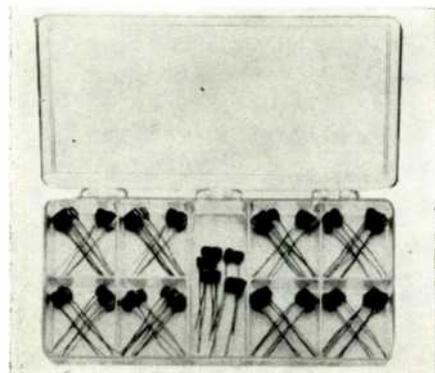
Another version of the scan at 8A is shown at 8L which indicates azimuth by comparing two signals from the left and right antennas. It is used in special radar homing applications.

Present radar systems are being developed and installed which have extreme long-range detecting ability. With these systems it is possible to "see" objects far beyond the horizon, thus providing warning signals for national defense. • *Information credit: D. S. Kennedy & Co., Cohasset, Mass.; Marconi International Marine Communication Co., Ltd., London.*

Latest New Products

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The "Sweet Deal" Kit is made up of 45 popular miniaturized dipped silver-mica capacitors ranging from 56 to 680 μf at 500 v, $\pm 5\%$ tolerance—all housed in a clear plastic compartmented dispenser. The complete package comes to



the dealer for the cost of the capacitors alone, at \$10.20. The free case, provides an orderly dispenser for bench or home service, and, thereafter, can be utilized for small item storage. Cornell-Dubilier Electronics, 1006 Hamilton Blvd., S. Plainfield, N. J.

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Model 605, a wide range oscillator that provides both sine and square wave output for checking hi-fi and audio-amplifier circuits, features push-button range selection and continuously variable output power. Range is 20 to

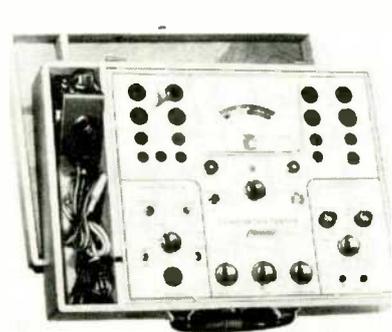


200,000 cps in four ranges. Accuracy is 3% or 1 cycle, whichever is greater. Output voltage: sine wave, 0 to 5.0 rms volts; square wave, 20 mv to 7.0 p-p volts \$129.95. Jackson Electrical Instrument Co., 124 McDonough St., Dayton, Ohio.

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Mercury COMBINATION TESTER

Model 300 combination tester incorporates a versatile multiple-socket tube tester, an advanced design CRT tester-reactivator and a volt ohmmeter (20,000 ohms per volt). The tester checks emission of over 700 types, including



OZ4's, gas regulators, and foreign tubes. The reactivator tests quality of every black and white or color tube, including 110° tubes. VOM tester specifications include: d-c, 20,000 ohms per v; a-c, 5,000 ohms per v. \$99.75. Mercury Electronics Corp., 77 Searing Ave., Mineola, N. Y.

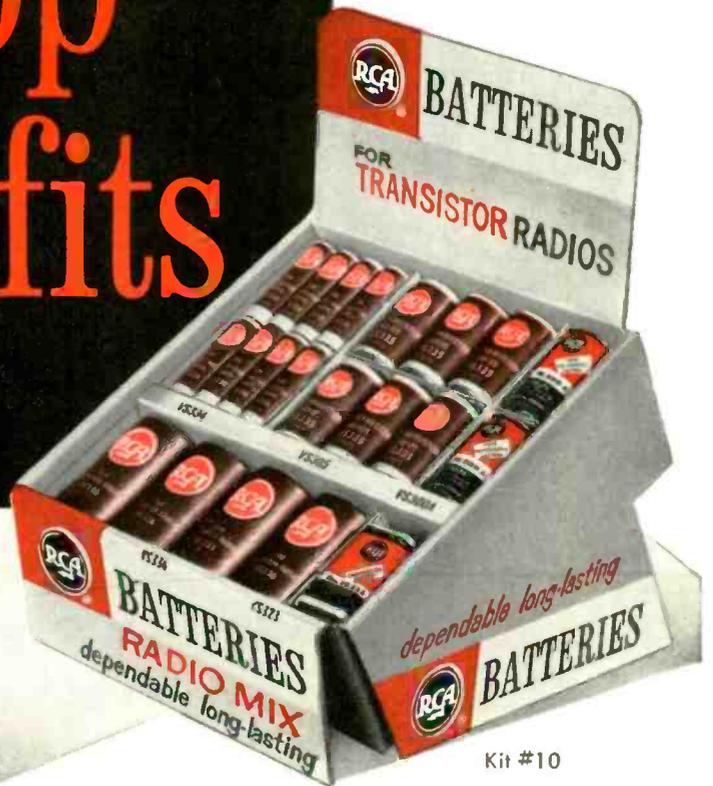
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VOM

(Continued from page 31)

load is for the equipment being checked you now know if trouble exists in the equipment and, if so, the basic reason why. If the meter is designed with a-c current facilities you can make accurate load checks in the a-c supply line to the particular piece of equipment. (The TV nameplate usually lists the power drawn, as 150 watts, 200 watts . . .)

Even if the meter has no a-c current range, it can still be used to measure the power drawn by any device by using the set-up in Fig. 6.

With an accurate 1 ohm, 10 watt resistor in the cord, and using a 2.5 v a-c scale on the meter, current ranges from about 100 milliamperes to 2.5 amperes can be recorded. By using 4 of these 1 ohm resistors in parallel, in place of one, the 2.5 v a-c scale can be extended $\times 4$ to 10 amperes. The current multiplied by the line voltage measured under load, will give relatively accurate wattage. For example, if the line records 118

v, up to 1180 watts can be calculated. If the power factor of the device under test is known, a closer approximation of the wattage can be derived. This is an excellent method for checking a-c motor loads against their normal full-load ratings.

Transmitter Checks

CB, mobile and other type radio transmitters can be tuned to resonance from their oscillator outputs to the final amplifier with a VOM/MA. Check of the transmitter's final amplifier input in watts, a requirement of the FCC, can also be easily made.

To tune the transmitter, insert the meter in series with the plate tank circuit, by-passing the meter with a suitable capacitor ranging from .01 to .005, depending upon frequency of the r-f, as shown in Fig. 7A. Tune C-1 or the slug L-1, depending upon tuning facilities provided in the transmitter's tank coil, to give *minimum* dip on the meter. If the transmitter's oscillator output is untuned, then begin in the next tuned circuit whether plate or grid. Next, as shown in Fig. 7B, insert the VOM/

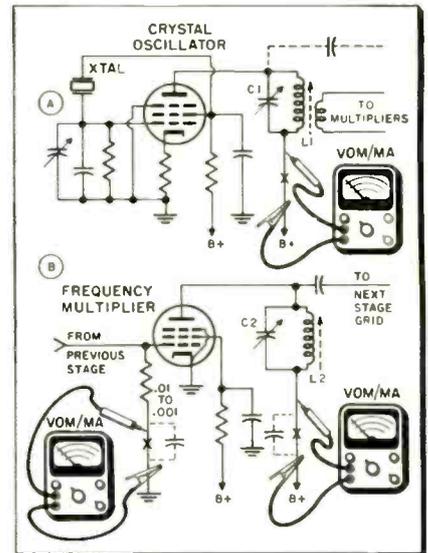


Fig. 7—All r-f stages of a radio transmitter can be accurately tuned to resonance with the oscillator's frequency by adjusting for *maximum* current reading in grid and *minimum* current reading in plate circuits.

MA in the grid of the frequency multiplier. Readjust C-1 or L-1, for *maximum* reading on the meter. Then move the meter to the plate circuit as likewise shown in Fig. 7B, and tune C-2 or L-2 for *minimum* dip.

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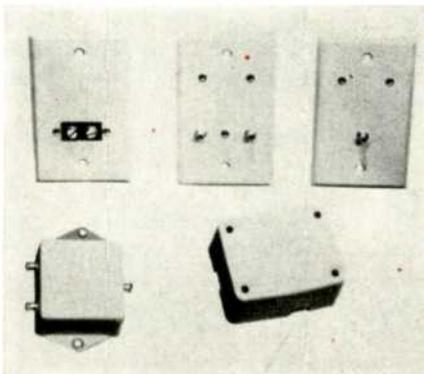
Electro-Voice®

Proceed in a similar manner from stage-to-stage through the transmitter's final amplifier tuned circuits. Each stage is now adjusted to operate efficiently at the crystal oscillator's frequency. Remember: *maximum* current reading in the grids, *minimum* current in the parallel tuned plate circuits. If you want to know the power input to the transmitter's final amplifier, measure its plate voltage, multiply by current.

In addition to a number of commercially available high voltage multiplier and demodulator probes available for extending the usefulness of the VOM, there are also adapters available for converting the meter into a transistor tester, VTVM, thermometer, audio wattmeter, etc. Furthermore, virtually scores of additional pieces of external equipment can be easily designed and constructed by the technician for further increasing application ranges. The number of possible uses for this no-warm-up, completely portable instrument is limited only by the ingenuity of the technician or plant engineer. •

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An advanced series of splitters, baluns and tapoffs, said to satisfy all installation requirements of antenna systems, is available for 75 ohm, 300 ohm, or mixed impedance systems. Flush or wall mounted. Coax may be plugged into a solderless fitting and used with a quick disconnect. Flat 300 ohm line is inserted directly into "no-



strip" connectors. Included are: Model TF-771 75 ohm tapoff, \$2.70 list; TF-771B, \$3.95; TS-771B, \$4.30. Three 75 ohm solderless line splitters are: TF-772B, \$5.85; TS-772, \$5.20; TS-774, \$7.50. Four 300 ohm "No-Strip" tapoffs are TF-331, \$1.75; A-331A, \$2.65; TF-731B, \$3.00; TS-731B, \$4.30. Two 75

ohm to 300 ohm baluns are TF-731, \$4.30; TS-731, \$3.40. Blonder-Tonque Labs., 9-25 Alling St., Newark, N. J. For more data, circle 8-45-2 on coupon, p. 46

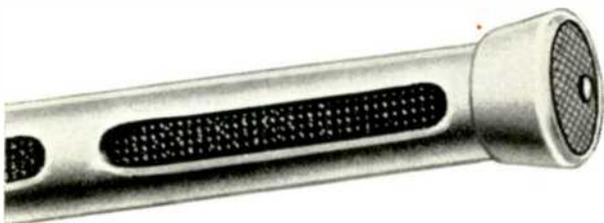
Clear Beam INDOOR ANTENNA

A new slim line indoor antenna designed to blend with new TV set styling offers four section telescoping dipoles which extend to a full 36". Models H6M



and H6B, in both blonde and mahogany finishes feature heavily weighted bases. For added merchandising appeal, Slim Line indoor antennas will be packaged in a new display type, "see-through" plexiglass package. Clear Beam Antenna Corp., Canoga Park, Calif.

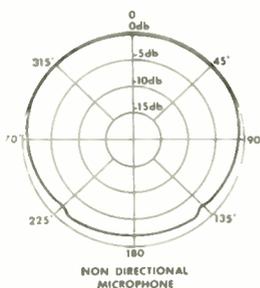
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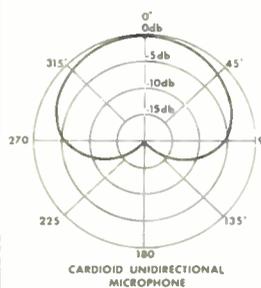
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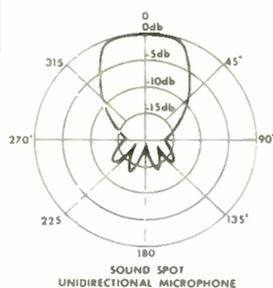
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2 Capacitors: Operating charts, capacitance tables, dimensional drawings, and other information are contained in a new 20-page general purpose catalog, #42-857. Centralab.

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3 Contact Spray: Current literature covers "Contact Shield," a new spray that cleans, lubricates, and protects electrical contacts of all types. Channel Master.

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4 Instruments & Hi-Fi: Test instruments, CB transceivers and radios, and other equipment, in both kit and wired form, are described in a new 28-page 4-color illustrated catalog. Electronic Instrument Co.

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5 Pricing Digest: Literature is available covering Vol. 4, No. 1, all new edition of Dave Rice's Official Pricing Digest. Electronic Publishing Co.

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6 Truck Bodies: A bulletin describes "Service-Master" truck bodies. Features include modern wheelhouse design, flight-swept tapered rear, recessed latches, etc., McCabe-Power Body Co.

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7 Coils: A new 176-page catalog and replacement guide, #61, is printed in four sections: general catalog; TV coil replacement guide; auto radio replacement guide; and home radio guide. J. W. Miller Co.

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8 Tubes: Literature is available covering the new S-5347 silicon rectifier tube. It replaces 12BW4 and 6BW4 vacuum tube rectifiers. Sarkes Tarzian, Inc.

For more data, circle 8-46-8 on coupon

9 Tuners: A tuner replacement and repair program, for better service to your customers at greater profit, is described in current literature. Standard Coil Products Co.

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10 Rectifiers: A new 42-page silicon rectifier handbook and catalog includes technical data, illustrations, specifications, and dimensional drawings. Standard Rectifier Corp.

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11 Tap-Off: "Tap-A-Line," which provides multiple taps from a single power source, is described in current literature. Tap-A-Line Mfg. Co.

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8-12-1	8-20-8	8-46-6	8-49-2	8-57-1	8-62-7
8-13-1	8-21-1	8-46-7	8-49-3	8-57-2	8-63-1
8-14-1	8-22-1	8-46-8	8-51-1	8-58-1	8-63-2
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CITIZENS BAND 2-WAY COMMUNICATIONS TRANSCEIVER
that meets FCC regulations*

*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!

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 - Built-in 3" x 5" oval PM speaker and detachable ceramic-element microphone.
 - 5-W xtal-controlled transmitter—can transmit on any of the 23 Citizen Band channels.
 - Station license available to any citizen over 18 — no exams or special skill required. Application form supplied free.
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- Compare — judge for yourself — at your neighborhood EICO dealer. For dealer's name and catalog of over 70 models of test instruments, hi-fi and ham gear, in easy-to-build kit and wired form, write to Dept. ET-8.

Model 761: 117 VAC & 6 VDC
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Including mounting bracket

\$69.95 **\$99.95**
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For more data, circle 8-48-1 on coupon, p. 46

Seco PORTABLE CB TEST SET

Model 500 combination crystal checker, r-f signal and field strength meter checks citizens band transmitters and receivers, and is ideal for servicing crystal controlled aircraft communications, marine gear, remote controls and fleet radio equipment. It

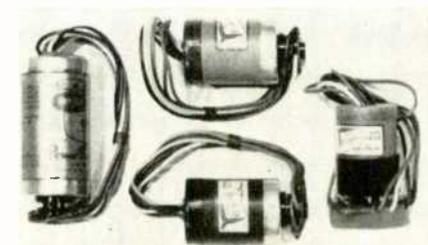


is self-contained, portable, and is powered by a 1.5v "C" battery. 15' remote cable included. The unit supplies low power, minimum interference test signal of unmodulated or modulated r-f signal. \$29.95. Seco Electronics, Inc., 5015 Penn Ave. S., Minneapolis, Minn.

For more data, circle 8-48-3 on coupon, p. 46

Perma-Power TUBE BRITENERS

Four new TV tube briteners are: model C 412, for all series wired sets with 110° button base regardless of filament voltage rating, which requires no switching or adjustments on any



110° series set; companion unit, model C 403, for all duodecal base series wired sets; model C 411 for use in parallel wired sets with 110° button base,

all heater ratings; and model C 311, a new Universal type britener for 110° button base sets. Perma-Power, 3100 N. Elston Ave., Chicago 18, Ill.

For more data, circle 8-48-4 on coupon, p. 46

Philco "TRACE"

A new testing device, for pinpointing faulty circuits and components in transistor radios, is a facsimile of the actual radio circuitry. It aligns with the radio printed circuit chassis panel and diagrams a complete test procedure. Panels contain color-coded cir-



cuit paths and printed locations of major components that match various chassis in the firm's transistor radio line. Visual identification is made of the r-f, i-f, and audio signal paths antenna to speaker. Voltages, and component data are included. Philco Corp., Tioga & "C" Sts., Philadelphia 34, Pa.

For more data, circle 8-48-5 on coupon, p. 46

Scott STEREO AMPLIFIER

A new, improved version of the 299 complete stereo amplifier is announced. Model 299B features such improvements as: tape monitoring provisions for easier tape recording; an extra high level input for connection of an electronic organ and an increase in power to 50 watts measured by stringent IHFM standards. This additional power enables the unit to drive a pair of low efficiency speakers plus extension speakers throughout the house. \$209.95, east of the Rockies. H. H. Scott, Inc., 111 Powdermill Rd., Maynard, Mass.

For more data, circle 8-48-6 on coupon, p. 46

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\$7.50

plus parts,
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Damper Circuits

(Continued from page 29)

arity are often solved by examining the damper pulse on an oscilloscope. Using the manufacturer's schematic as a reference for proper wave-forms, it is simple to cross-check your findings.

Fig. 4 is an example of a proper wave-form coupled from a set to the oscilloscope. Fig. 4 also shows improper wave shape, which indicates poor horizontal linearity. Don't neglect your scope for a visual check as a supplement to meter readings in the damper section. Damper distortion is visually indicated as clipped or irregular wave-forms.

Although damper tube circuitry is essentially simple, that is, comparable to any other rectifier circuit, don't let your guard down. Extensive use of B+ boost to other sections can be deceiving. Therefore, don't neglect checking this allied circuitry. •

Sylvania TUBES

"Ten Pin" miniature electron tube utilizes the regular 9-base pin arrangement of the conventional T-6½ miniature envelope with an additional pin centered in the pin circle. This new design in miniature receiving tubes, which combines multiple circuit functions in a single bulb or envelope, should reduce chassis designing costs by simplifying circuitry and wiring. The first tubes to incorporate the new design are a double tetrode for use as an r-f amplifier and oscillator-mixer in FM tuners and receivers; and a triple triode for use as an r-f amplifier, oscillator-mixer and afc control. Sylvania Electric Products, Inc., 730 Third Ave., New York 17, N. Y.

For more data, circle 8-49-3 on coupon, p. 46

ADDENDUM, JULY 1960

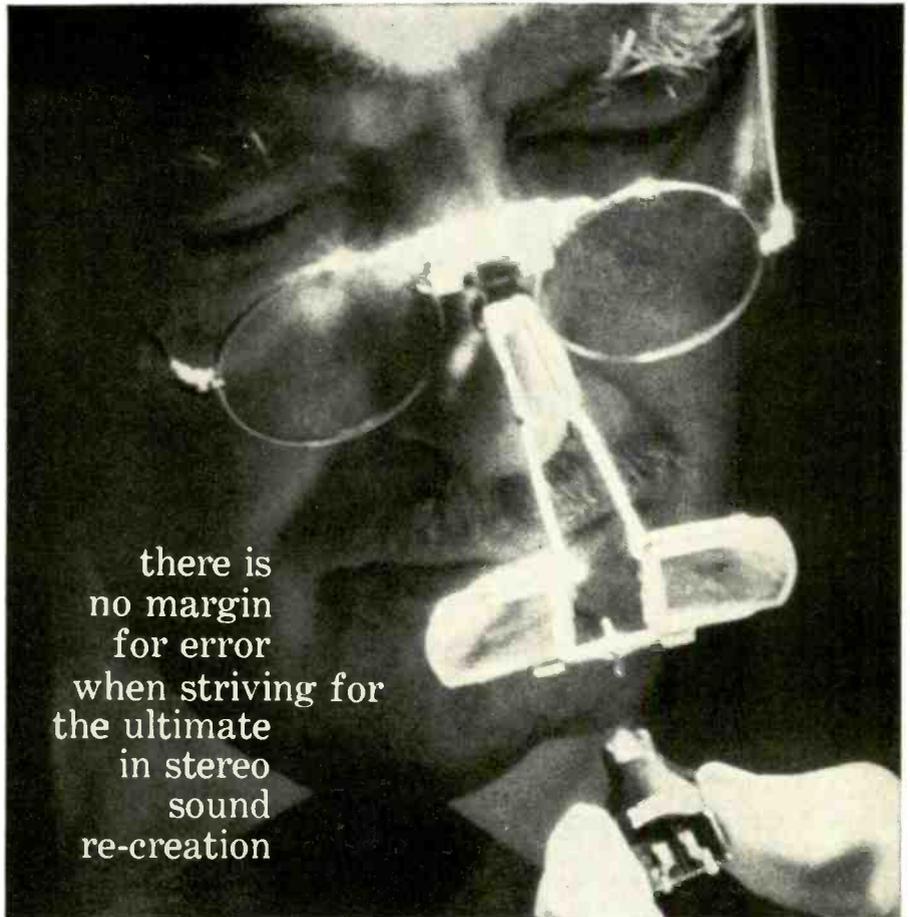
Service Citizens Band Radios

Illustration & information credits: Figs. 6 & 7, Poly-Com Model PC-11D, Polytronics Labs., Clifton, N.J.

ERRATUM, JULY 1960

New Products, page 75

Raytheon Co.'s "Ray-Tel" Citizens Band Radio described. Photograph of Pearce-Simpson Model CBD-1 appeared in error.



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no margin
for error
when striving for
the ultimate
in stereo
sound
re-creation

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Stereo Dynamic

HI-FI PHONO CARTRIDGES

Tiny though it is, the cartridge can make or break a stereo system. For this breathtakingly precise miniaturized electric generator (that's really what it is) carries the full burden of translating the miles-long undulating stereo record groove into usable

electrical impulses... without adding or subtracting a whit from what the recording engineer created. Knowing this keeps Shure quality standards inflexible. Shure Brothers, Inc., 222 Hartrey Avenue, Evanston, Illinois.

CARTRIDGES

Standard M8D. A superb blend of quality and economy.... \$16.50
Custom M7D. Widely acclaimed; moderately priced..... \$24.00
Professional M3D. Overwhelming choice of the critics..... \$45.00
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TONE ARMS

Studio Dynamic. Integrated arm and cartridge. Cannot scratch records. \$89.50
Professional Independent Tone Arm. For any quality cartridge... stereo or mono. \$29.95



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QUIETROLE

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

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

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For more data, circle 8-49-2 on coupon, p. 46

Starting A Sound And Intercom Business

How To Get The Business
How To Make The Sale
How To Estimate Costs

M. S. Sumberg, BOGEN-PRESTO

• The commercial sound and intercom field offers a fertile area for the qualified radio-TV or industrial electronic technician to diversify, expand, and substantially boost his average income. By completely ignoring this potential, many technicians are missing a stable growth opportunity.

Very conservative figures have been accumulated which indicate that the average town with a population of 100,000, for example, has approximately 2,000 prospects who have a need for commercial or packaged sound equipment. This represents important "plus" business, over and above home hi-fi, TV, or radio.

Basic Requirements

What does it take to be successful in the sound field?

First, you must have or obtain the know-how to sell, install, and service this equipment.

Second, if you do not have a flair for salesmanship, you must learn the techniques. We do not mean the flashy, obnoxious sales attitude portrayed in novels; nor the high-pressure type sometimes seen in the movies. This type salesmanship never proved successful. The real salesman is a sincere, friendly, dignified businessman who meets people with a quiet ease, inspiring respect and confidence because he knows precisely what he is talking about in every detail. Knowledge is a prerequisite for the type of self-confidence that

produces notable sales results.

Getting Started

It does not require any great stretch of a technician's imagination to visualize business prospects in the field. Industrial paging and intercommunication systems are being installed in practically every modern business office, factory, and store today. Many installations include background music facilities. Other installations are made in day nurseries, doctors' offices, clinics, and group-practice set-ups. Most schools have one or more systems, with additional facilities being planned. Many new homes are having various systems installed, including sound monitors from children's room to various parts of the house: basement, laundry, garage, etc. Nightclubs, restaurants, motels, and retail stores, are using some form of sound system, including background music. Both manufacturer and sound equipment distributor can usually provide new ideas on additional applications.

The average TV-service dealer or industrial electronic technician is technically equipped to handle this business. All that is required is a little planning—some additional effort. The first move should be in the direction of contacting a manufacturer or distributor who can provide a complete line of equipment.

Although most normal sales leads come from telephone inquiries, direct-mail or other types of advertis-



ing, including knocking on doors, a well-planned effective "business getting" campaign in the sound and intercom field goes much deeper. Every local organization that offers an "in" to business should be contacted. Some of these are as follows:

1. Rotary, Lions, Kiwanis, The Chamber of Commerce service clubs, and country clubs.
2. Trade organizations.
3. State registrar of contractors or contractor's licensing bureau.
4. State or county board of education for school information.
5. State or county board of technical or professional registration for professional architect and engineer contacts.

Sales-lead services can be obtained from a number of professional organizations. Two of these are: Dodge Construction Reports, and the Business Extension Service. Once you have a list of prospects, contact can be direct, by phone or mail.

Answering Inquiries

When your phone rings and you find yourself voice-to-voice with your first inquiring prospect, you should already be thoroughly prepared to follow through to the ultimate sale and installation. To operate successfully, your prospect must have a genuine need for the product, and, if he does not immediately recognize this need, your job is to show him. Most of your inquiring prospects will fall into two main categories:

1. A potential customer who needs

equipment but must be convinced of his need. He must also be convinced that it is to his advantage to spend money to meet the need. You have to sell him 100%.

2. This prospect has a genuine, immediate interest. He acknowledges that he has a sound problem which he wants solved. He is already half sold. The other half calls for efficient, courteous and thorough follow-up.

Your telephone should be handled at all times by a well trained intelligent person. "This is Miss James, Interstate Sound Service, may I help you please?" can be an important step in the proper direction.

Survey And Quotations

Keep your appointments and arrive on time. Your personal appearance is important at this point. No one wants to do business with flashy clothes or with baggy trousers. And you are "beat" at first contact with a 24 hour beard.

A careful survey of a prospective installation is the key to a realistic cost estimate. Consider all variable factors involved. This will convince the customer that your quotation is near the mark and not inflated to cover guessed-at contingencies. Sketch the floor plan of the areas to be served by the system. This should include walls, floor, ceiling, and attic space. Physical problems and length of cable runs should be noted. Agreement on physical appearances, exposed cable runs, etc., should be reached with the customer. Availability of electrical outlets for master stations or amplifiers should be noted.

Prepare an exact equipment list for the job. Enter itemized cost prices, extend them and show total cost of the complete job. Make a step-by-step summary of the installation. Each step is translated into man-hours, in turn, into dollars. Do not forget to add social security, taxes, insurance, transportation, supervision, etc., or any other expense involved in giving the customer one hour of labor. When this is totaled you will come up with a true labor cost. This might mean \$1.50 more per hour than the originally assumed hourly labor charge.

You now must multiply the true labor cost by the estimated number of man-hours required for the job and you will have a realistic estimate

LIFE'S "LITTLE" PROBLEMS

ARE EASILY
SOLVED
WITH

LITTLE SPACE

QUAM has a full line of shallow speakers, covering all popular applications.

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QUAM speakers mount quickly and easily in the most difficult installations because of QUAM's unusual mounting bracket.

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QUAM speakers cost no more — and frequently cost less — than other speakers of the same size and magnet weight.

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THE HANDIEST THING
SINCE
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FROM 6 INCHES
TO 10 FEET LONG

Tap-A-Line — mounted on or behind work benches, in the lab, on test tables, in lamp or appliance stores — provides multiple taps from a single power source. Safe — concealed conductors — tight positive contacts — easy to install in any position.

Sold by Electrical, Electronic and Hardware Jobbers and Dealers

Tap-A-Line Mfg. Co.

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For more data, circle 8-51-2 on coupon, p. 46

This new
BOGEN
GUIDE-BOOK
 tells you how
 to cash in on the
 profitable commercial
 sound market in
PA and INTERCOM



"GETTING STARTED IN SOUND"

16 pages, packed with valuable information, advice, answers to all your questions—discusses qualifications required—how much capital it takes—costs of operation—and, most important, how to get started on a modest investment. This guide book also tells you how to obtain...

VALUABLE FREE SALES KIT TO HELP YOU IN THE FAST GROWING SOUND BUSINESS

FREE sound sales kit contains sales literature—sample solicitation letters—job quotation forms—technical and installation data—product specification sheets—merchandising ideas.

You will also receive additional free material from time to time. And if you are not already dealing with a Bogen Sound Distributor we will also put you in touch with one to serve as your local supply source.

This valuable sales kit will be furnished to you when you send in the special card included in each copy of "Getting Started in Sound."

THIS MAY BE the very opportunity you have been waiting for. Don't miss it! Visit your local Bogen Sound Distributor for your copy of "Getting Started in Sound." It will be the best 25c investment you ever made. If your distributor has not yet received his supply or is sold out, use this convenient coupon. Enclose 25c in coin, and a copy will be mailed to you directly.



BOGEN-PRESTO, PARAMUS, NEW JERSEY ET-8
 Yes, I am interested in earning more money in sound systems, so please send me "Getting Started In Sound" by return mail. I enclose 25c in coin.

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 ADDRESS _____
 CITY _____ ZONE _____ STATE _____

Look to Bogen-Presto
 for the big profit opportunities in sound

BOGEN-PRESTO PARAMUS, NEW JERSEY
 A Division of the Siegler Corporation

of labor costs. When this is added to the cost of material, the complete job cost is fixed. But not quite. It should be multiplied by your previously determined fixed overhead constant. For a profit on your investment, it must be multiplied by your profit constant. You are now ready to present a realistic estimate to your prospective customer. Always add a few cents to your quotation (\$347.75, \$296.50, etc.).

Close The Sale

You have spent a lot of time and effort analyzing the customer's problem, surveying the job and preparing an honest quotation. If you don't close the sale you have wasted your time.

There are no mechanical rules for successful application to closing a sale. But there are fundamental procedures that raise the odds in your favor.

Do not waste your time explaining your quotation to a "flunkie," who has to get an ok from higher up. Determine in advance if the person you are dealing with has authority to sign an order for the job.

Don't be afraid of asking for the order. There are a number of approaches.

"We can begin work tomorrow morning. Just sign here, Mr. Smith."

Or, "We can arrange financing if you like, Mr. Smith. Sign the order here, please."

Or, "Do you prefer natural or mahogany speaker enclosures?"

If you can't think of any of these things, just say: "If you will please sign the order we will start the installation right away."

If you fail to click and the prospect is undecided and says he will "call you later," don't hesitate, answer: "I am out most of the time handling business, let me call you." You are still in control of the situation. If the customer does not sign the order at this point, try to discover why.

Ask the customer: "Is the price in line with your ideas?" Or, "Can we help with our financing plan?" Or, "Do you have a better figure?"

When the installation is made, the customer should be taught how to use and get the most from his equipment. Do not rush off and forget this vital part of an installation. •
 Information Credit: "Getting Started In the Sound and Intercom Field." By Bogen-Presto, Paramus, New Jersey.



J-Tran
top-tuned
miniature
IF
transformer
 by **MILLER**

You can align both tuned circuits from the top of the shield. Unit is designed with tuning cores which have hex holes extending the length of the core. This construction permits aligning tool to pass through one core and engage the other.

The J-Tran comes complete with a new style mounting clip which is part of the shield can.

TOP-TUNED. MINIATURE IF TRANSFORMERS

Cat. No.	Item
14-H1	262 kc Input I.F.
14-H2	262 kc Output I.F.
14-H6	262 kc Output I.F. *
14-C1	455 kc Input I.F.
14-C2	455 kc Output I.F.
14-C6	455 kc Output I.F. *
14-C7	455 kc Input I.F. — battery radios
14-C8	455 kc Output I.F. — battery radios
14-C9	455 kc Input I.F. — AC-DC radios
14-C10	455 kc Output I.F. — AC-DC radios
6270	4.5 Mc Input or Interstage
6271	4.5 Mc Ratio Detector

*with diode filter capacitors

Size: 3/4" square x 2" high

TOP-TUNED PRINTED CIRCUIT IF TRANSFORMERS

Cat. No.	Item
16-PH1	262 kc Input I.F.
16-PH2	262 kc Output I.F.
16-PH6	262 kc Output I.F. *
16-PC1	455 kc Input I.F.
16-PC2	455 kc Output I.F.
16-PC6	455 kc Output I.F. *
16-PC7	455 kc Input — battery radios
16-PC8	455 kc Output I.F. — battery radios
16-PC9	455 kc Input I.F. — AC-DC radios
16-PC10	455 kc Output I.F. — AC-DC radios
6270-PC	4.5 Mc Input or Interstage
6271-PC	4.5 Mc Ratio Detector

*with diode filter capacitors

Size: 3/4" square x 2" high

Write for Miller general catalog, and the TV Replacement Guide, or ask for them at your distributor.



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EXPORT REPRESENTATIVE:
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 Atlas Radio Corp., Ltd., Toronto 19, Ont.

See Us At the Wescon Show Booth #1001
 For more data, circle 8-52-1 on coupon, p. 46
ELECTRONIC TECHNICIAN • August, 1960

Tarzian RECTIFIER

Type S-5347 silicon rectifier tube is announced to replace 12BW4 and 6BW4 vacuum tube rectifiers. Also may be utilized in rectifier applications which require 1,600 PIV at 500 ma d-c. It has a 9-pin miniature base and will replace 12BW4 and 6BW4 in citizens

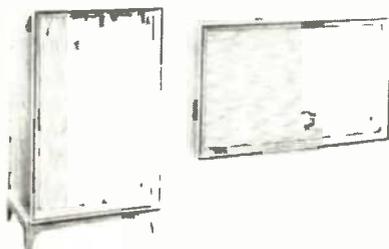


band transceivers. Provides increased d-c output from the rectifier, and better regulation and high reliability. No filament power is required. \$13.00. Sarkes Tarzian, Inc., Semiconductor Div., 415 N. College Ave., Bloomington, Ind.

For more data, circle 8-53-3 on coupon, p. 46

Jensen SPEAKER SYSTEMS

The new "Decorator Group" speaker systems include the TR-30 TRI-ette (shown) a 3-way system utilizing a 12" Flexair woofer for bass response to 25 cycles. Power rating is 30 watts (60 peak) \$159.50 net or unfinished at \$134.50. Also the new GALAXY III consists of three units: a Bass-Center Unit and two satellites. Each satellite contains an elliptical speaker for the 350-



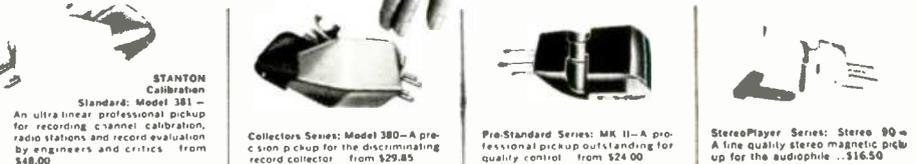
4000 cps range and a compression tweeter for 4000 cps to beyond audibility. \$229.50 net or unfinished at \$195.50. Model F-3 is a 4-speaker 3-way system using a specially designed 10" long travel Flexair woofer. 2 specially designed midrange units take over from 2000 to 10,000 cps. \$79.50 unfinished only. Jensen Mfg. Co., 6601 S. Laramie Ave., Chicago 38, Ill.

For more data, circle 8-53-4 on coupon, p. 46

more

...so much more for everyone...for every application...in the complete line of Stanton Stereo Fluxvalves*.

Here is responsible performance...in four superb models...for all who can hear the difference. From a gentle pianissimo to a resounding crescendo—every movement of the stylus reflects a quality touch possessed only by the Stereo Fluxvalve.



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Standard: Model 381 — An ultra-linear professional pickup for recording channel calibration, radio stations and record evaluation by engineers and critics from \$48.00

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Pre-Standard Series: MK II—A professional pickup outstanding for quality control from \$24.00

Stereo Player Series: Stereo 90—A fine quality stereo magnetic pickup for the audiophile...\$16.50

LISTEN!...and you will agree Pickering has more for the best of everything in record reproduction—mono or stereo. More Output—More Channel Separation—More in Response—More in Record Life!
In short... more to enjoy...because, there's more quality for more listening pleasure.

FOR THOSE WHO CAN HEAR THE DIFFERENCE
Pickering
PICKERING & CO. INC., PLAINVIEW, NEW YORK

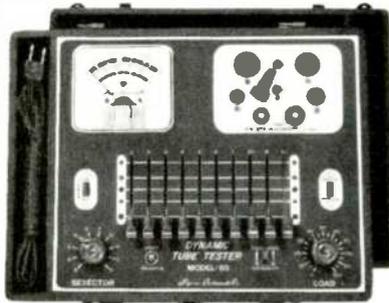
LISTEN!—Ask for a Stereo FLUXVALVE demonstration at your Hi-Fi Dealer today!
Send for Pickering Tech-Specs—a handy guide for planning a stereo high fidelity system...address Dept. M80

* U.S. Patent No. 2,917,590

For more data, circle 8-53-1 on coupon, p. 46

Superior's New Model 85—a DYNAMIC type

TRANS-CONDUCTANCE TUBE TESTER



Employs latest improved TRANS-CONDUCTANCE circuit. Tests tubes under "dynamic" (simulated) operating conditions. An in-phase signal is impressed on the input section of a tube and the resultant plate current change is measured as a function of tube quality. This provides the most suitable method of simulating the manner in which tubes actually operate in radio, TV receivers, amplifiers and other circuits. Amplification factor, plate resistance and cathode emission are all correlated in one meter reading.

● **SYMBOL REFERENCES:** For the first time ever in a trans-conductance tube tester, Model 85 employs time-saving symbols (★, +, ●, ▲, ■, ?) in place of difficult-to-remember letters previously used. Repeated time studies proved to us that use of these scientifically selected symbols speeded up the element switching step. As the tube manufacturers increase the release of new tube types, this time-saving feature becomes more necessary and advantageous.

● **THE "FREE-POINT" LEVER TYPE ELEMENT SWITCH ASSEMBLY** marked according to RETMA basing, permits application of test voltages to any of the elements of a tube.

● **NEW IMPROVED TYPE METER** with sealed air-damping chamber provides accurate, vibration-less readings.

● **FREE FIVE (5) YEAR CHART DATA SERVICE.** The chart provided with Model 85 includes easy-to-read listings for over 1,000 modern tube types. Revised up-to-date subsequent charts will be mailed to all Model 85 purchasers at no charge for a period of five years after date of purchase.

● **SPRING RETURN SAFETY SWITCH** guards Model 85 against burn-out if tube under test is "shorted."

● **AN ULTRA-SENSITIVE CIRCUIT** is used to test for shorts and leakages up to 5 megohms between all tube elements.

Model 85 comes complete, housed in a handsome portable cabinet with slip-on cover. Only...

\$52.50

**SHIPPED ON APPROVAL
NO MONEY WITH ORDER — NO C. O. D.**

Try it for 10 days before you buy. If completely satisfied send \$12.50 and pay balance at rate of \$8.00 per month for 5 months. — **No Interest or Finance Charges Added.** If not completely satisfied, return to us, no explanation necessary.

MOSS ELECTRONIC, INC.
Dept. D-806, 3849 Tenth Ave., New York 34, N. Y.
Please rush one Model 85. I agree to pay \$12.50 within 10 days after receipt and \$8.00 per month thereafter. Otherwise I may return, cancelling all further obligation.

NAME _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____
All prices net. F.O.B., N.Y.C.

For more data, circle 8-53-2 on coupon, p. 46

ASSOCIATION NEWS

California

CSEA, Fresno, has formed a Western Council of Electronic Service Associations to sponsor and direct a major electronic consumer products parts show covering 11 Western states. The show has been proposed

for the summer of 1961, to be held either in Los Angeles or San Francisco. Format will be geared to the interests of the electronic service industry. The state organization elected the following officers: Pres., Robert Whitmore; V.P., Jerry Strauss; Sec., Howard Bogue; Treas., Earl Robbins.

The San Fernando Valley chapter of CSEA, elected the following officers: Pres., Ernest C. Larsen; V.P., Conrad Breil; Sec.-Treas., Ed Stevens.

TSA, San Francisco, members started an initial 20 week advertising

campaign in the top-circulation daily, News Call Bulletin. Theme of the ad, Double Warranty on TV Repairs, points out: (1) "Your repair work is guaranteed by the dealer doing the job. (2) The dealer's work is guaranteed by the San Francisco TSA—a non-profit trade association dedicated to serving the public with honesty, fairness and dependability."

TV Business School

RTA, San Jose, Santa Clara Valley's business school for shop owners and technicians is showing considerable progress. The 10-weeks, one-night a week series, being held in San Jose City College, emphasizes the shop owner's need for maintaining accurate business records as a prime pre-requisite for avoiding business failure. Numerous recordings of interviews with successful shop owners around the country are used as the course take-off. G.E.'s profitable Service Management course is used for the course text. This is supplemented by lectures on accounting, book-keeping, and tax record practices.

Indiana

IESA, Fort Wayne, has elected the following officers: Pres., Jay Schupbach; V.P., Tom Hardy; Treas., Clyde Smeltzer; Rec.-Sec'y., Paul Evans; Corr.-Sec'y., John Crocker.

Massachusetts

ETG, Boston, announced election of the following officers: Pres., Alfred Nickerson; V.P., Patrick LaFauci; Sec'y., Ted de Bryun; Treas., Albert Giddis.

Michigan

NARDA, Kalamazoo, president Carrol McMullin, advised appliance and radio-TV dealers to "hang on to your service privilege." McMullin said NARDA has taken the stand that dealers should have the right to service the merchandise they sell if they can do it satisfactorily.

Missouri

TEAM, St. Louis, reports that the Honorable Tom J. Stubbs, Kansas City, in division 5 of the Circuit Court of Jackson County, Missouri, has recently declared void the Kansas City License Ordinance regulating the service of TV receiving equipment. Judge Stubbs declared that the Council of Kansas City does have charter authority to adopt an ordinance regulating the service of TV equipment, but the definition of TV service in the present ordinance was altogether too broad and unreasonable. The city is said to be planning

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ATLAS HI-FI COAX-PROJECTOR

all-weather construction... install it, forget it!... or take it with you wherever you listen.

True HIGH FIDELITY TWO-WAY system—not just a "compromise" of two horns coupled to a single diaphragm. The WT-6 comprises a weather-proof cone type driver (with 6-inch throat) coupled to its individual woofer horn; a separate pressure-type driver loaded to its separate tweeter horn. The built-in crossover electronic filter supplements the electro-mechanical frequency-limiting characteristics of the 2 individual reproducers—providing for smooth frequency division as each speaker functions within its engineered range of frequencies.

All-weather... high efficiency... compact... for all indoor and outdoor uses... universally adjustable "U"-type rugged steel mounting... finished in high temperature baked modern beige enamel.

POWER RATING 15 watts continuous
FREQ. RESP. 140-15,000 cps
IMPEDANCE 8 ohms. DISPERSION 120°
DIMENSIONS bell opening 15", overall depth 12"

See the WT-6 at your local distributor. Send for catalog ET-8

ATLAS SOUND CORP.

1449 39th St., Brooklyn 18, N. Y.

In Canada: Atlas Radio Corp. Ltd., Toronto 19, Ontario
For more data, circle 8-54-1 on coupon, p. 46



SERVICEMEN KNOW!

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HUSH®

Chemically-Electronically, engineered for Tuners and Switching Mechanisms.

When New HUSH is applied it will wash-away that dirt, leaving clean and positive contacts protected by a lasting lubricant. New HUSH is made from the finest solvents and it contains Electro-Silicone oils.

Also available—2 oz., 8 oz., 32 oz. containers, 6 oz. Spray can \$2.25 net

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VOLUME CONTROL AND CONTACT RESTORER

EVER-QUIET is a free-flowing liquid that leaves no powder residue. Scientifically designed to seep around the shaft and penetrate the control or potentiometer, cleaning the contacts and leaving a safe protecting film. Harmless to metals, wire or carbon.

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2 oz. Bottle & dispenser 79c net



CHEMICAL ELECTRONIC ENGINEERING, INC. Matawan, New Jersey

For more data, circle 8-54-2 on coupon, p. 46

to introduce a completely new ordinance which it hopes will not include objections found in the one voided.

Pennsylvania

LVEA, Allentown, has elected the following officers: Pres., Clarence Eck; V.P., John Griffith; Sec'y., George Beisel; Fin.-Sec'y., Peter Patterson; Treas., Louis Rosati.

Anti Pay-TV Stand

TSA, Delaware Valley, has ratified a petition, sponsored by FRTSA state association of Pennsylvania to the FCC, objecting to licensing pay-TV systems. The state association has taken the stand that pay-TV is a form of captive service. The organization has asked promoters and manufacturers of the systems a number of questions which they have not yet answered. Some of the questions include: Will independent service dealers be allowed to install the coin-operated units? Will the set owner be limited to calling a pay-TV authorized service company for repairs? The following officers were elected: Pres., Louis J. Smith; V.P., Herman Shore; Corr.-Sec'y., Charles Sonnenberg; Rec.-Sec'y., John Hadfield; Treas., John McCloy, Jr.

Washington

TSA, Yakima, announced that representatives from fourteen areas of the state have set up the Washington State Electronic Council and adopted by-laws governing its operation and incorporation. The council will meet periodically to discuss all problems facing the electronic industry, including public relations problems.

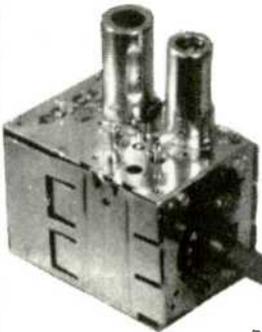
TSA, Seattle, declares that the recently appointed Citizens Evaluation Committee for Local Industrial Training has found that the Radio and Television Service section of the Edison Technical school is not fulfilling its intended purpose of supplying adequately trained and acceptable technicians to the service industry. Important factors contributing to this failure included: Haphazard selection of applicants, mixing of various level students into the same class, obsolete test equipment, shop work not related to class-room instruction, and failure of instructors to keep pace with developments in a rapidly changing industry. Graduates, it was said, are unsuitable for employment, either as advanced apprentices or as technicians. The committee recommended that if the entire program is not immediately revised, it should be terminated entirely. The report stated that present conditions result only in a waste of students' time and tax funds allocated for the purpose.

TV TUNERS OVERHAULED

ALL MAKES AND MODELS **\$9.95** NET **90 DAYS WARRANTY**
UHF/VHF \$19.90

SAME DAY SERVICE

ON POPULAR TYPES—48 HOURS MOST OTHERS



Overhaul charge includes labor and minor parts; tubes and major parts are extra at net prices. Tuner to be overhauled should be shipped complete; include tubes, shield cover and any damaged parts. Quote model and state complaint. Peck well and insure.

WE WILL SHIP C.O.D.—F.O.B. CHICAGO OR TORONTO

Castle TV Tuner Service

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Cut servicing and installation time on all 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!
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- PLATE MILLIAMMETER FOR RF TUNING! • AUDIO FREQUENCY SIGNAL GENERATOR!

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Check output tube cathode current, fast!

Safeguard against horizontal output tube overload! Place in circuit in seconds—no unsoldering. Front panel lists essential information. MODEL HC-6. **\$12.95**



Fast, low-cost tester—complete TV tube coverage! Checks all modern TV tubes and heater type radio tubes. With Seco Grid Circuit Test, Cathode Emission Test. In carrying case. MODEL 78 **\$69.50** NET



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Please send free literature on all Seco Test Equipment.

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EAST CANADA: Daveco Agencies, Ltd., Montreal, Quebec WEST CANADA: Ron Merritt Co., Vancouver 1, B. C.

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THE PRACTICAL APPROACH



Robert Cornell

Coaxial Cable or Flat Transmission Line?

Unfortunately, there is no single answer to this question. But, there are certain rule-of-thumb situations that help the technician arrive at a proper conclusion. Arguments between those who hold out for coax cable and those who champion flat line, have persisted since the early days of TV. As a matter of fact, many early TV receivers called for 75 ohm coaxial cable. This, of course, did not preclude the use of 300 ohm flat line with appropriate matching transformer. The fact that most, if not all, new sets are equipped with 300 ohm antenna terminals does not necessarily mean that the 75 ohm advocates were wrong.

It could have been price, low loss, ease of installation, industry practices, or a host of other practical reasons that caused the adoption of the 300 ohm balanced flat line as standard. . . . At least, we can readily obtain from distributors' stock, 300 ohm antennas, 300 ohm wire, and other 300 ohm accessories to match the 300 ohm input of TV receivers (even if, in many cases, the so-called 300 ohm antenna wire, or set, is actually anything but 300 ohms.)

Conditions that determine characteristic impedance are extremely complex and almost impossible to control for all-channel reception. Fortunately, however, a considerable amount of mismatch can be tolerated, and may often go unnoticed. Of course, mismatch could be responsible for loss of signal, distortion, ghosts, sync problems, and many others.

Impedance match is only one consideration. . . and the chances are that the inconsistencies in rated impedance would show up in either 75 or 300 ohm systems. What about susceptibility to stray noise pick-up and other interference? Here, coaxial cable is desirable; but even 300 ohm line can be given a gentle twist to minimize, if not eliminate stray pick-up.

What about ease of handling? This is a toss up. It depends upon a technician's experience. Much of the problem of preparing lead ends, in both types of lines, has been simplified. Stripless terminals, quick disconnects, and other fittings put both types of transmission on par with each other in this respect.

What then are the factors involved in making a choice? Cost? Perhaps. If the line is going to run inside a metal conduit, or rest against fairly large parts of a building, especially metal parts, then coax is a must. If the run is external and exposed to lots of moisture, losses could run up to 6 db per 100 feet at 100 mc for flat lines, whereas coaxial cable losses for RG-11/U is 2 db, and for RG-59/U is 3.5 db, under most atmospheric conditions. For dry conditions, flat line has the edge; losses are minimal and are approximately 1 db for each hundred feet. However, losses on flat line cannot be predicted as well as on coaxial cable. Each contact, even with stand-offs, or variations in dress of flat line will cause variable and often unpredictable amounts of loss.

One advantage of coaxial cable is that even with its greater losses, attenuation can be more accurately predicted because of its relative immunity to external environment. In larger systems where amplifiers, line splitters, and other accessories may be used, and where signal conditions must be predicted at various receiver sites, coaxial cable is usually installed.

Since all types of equipment and accessories are now available for either type of transmission line, experience and cost will usually dictate the type of line to be used. On small installations, generally you will be safe with flat line.

WHETHER you use 300 ohm line or 75 ohm cable, Blonder-Tongue makes it easy for you to come up with a matched, positive installation in the fastest possible time. Blonder-Tongue TV amplifiers, splitters, tapoffs and other accessories are equipped with stripless terminals for 300 ohm connection. A new solderless coax connector was recently developed for speedy, positive 75 ohm connection. For further information, contact the Sales Engineering Dept., Blonder-Tongue Laboratories Inc., 9 Alling Street, Newark 2, N. J.

Optical Sound

(Continued from page 27)

himself owns one. Operating the unit a few times will familiarize the technician with threading of film, controls and switches that are used. It's as simple as operating a tape recorder.

As far as the mechanical side of projectors are concerned, any technician who can trace and service the mechanical linkage of a record changer shouldn't experience any

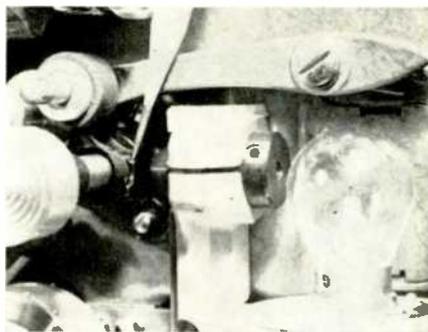
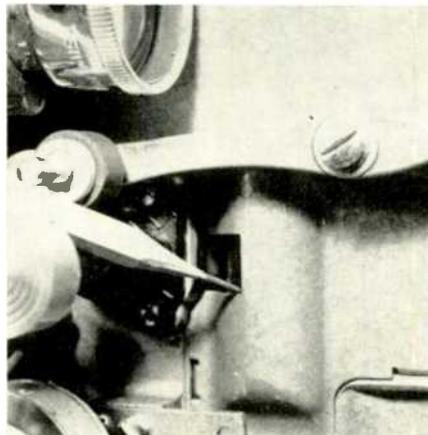


Fig. 7—Optical sound system's mirror.

difficulty with a portable movie projector.

The most common mechanical defects are due to worn belts: motor drive, rewind and take-up. Electrical defects are pretty much standard: line cord, switches, fuses; nothing that the experienced technician can't quickly detect. In addition, the projection or exciter lamps may need replacement, as may the small fan motor. The replacement lamps or fuses should have the exact electrical rating of the original. For example, if the original projection lamp has a rating of 750 watts, the cooling system may not be able to adequately ventilate the heat emitted by a 1,000-

Fig. 8—The photoelectric cell is always well hidden to avoid any stray light.



watt lamp. Film damage may result if heat is excessive.

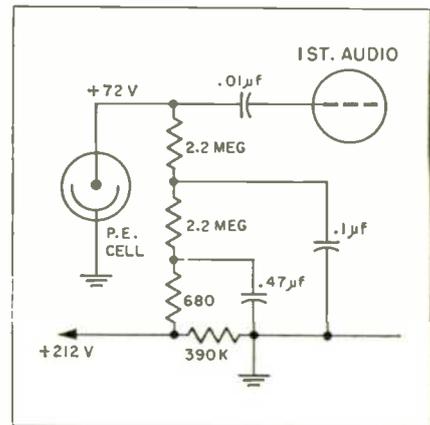


Fig. 9—This photoelectric cell loading circuit shows thorough decoupling of the voltage supply. Slight variations, such as coupling impedance combinations and adjustable resistors to vary the PE potential, are also encountered.

Servicing the sound system of a movie projector for complete absence of sound should begin with checking the exciter lamp. No light is usually the result of an open lamp filament (although a dead oscillator tube or transformer failure is also a possibility).

If the lamp is operating, be certain that the focused light is being reflected into the PE cell. Directing the light of a flashlight at the PE cell and moving it back and forth would result in a "thud" sound in the speaker if the cell and amplifier were normal.

Assuming that the exciter lamp is operating and its light is being focused and reflected correctly, a routine check of the amplifier is the

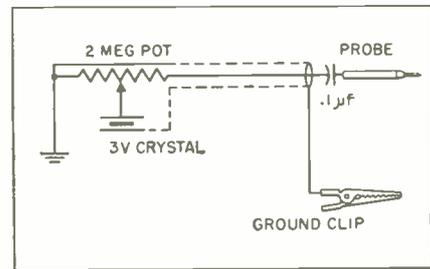


Fig. 10—Audio source for signal injection troubleshooting when audio generator is not available. The 2 meg pot adjusts gain.

next service stop to take. Check the amplifier tubes, after determining that power is being supplied to the unit, of course. The projector lamp and motor switch may be left in the "off" position when checking the sound circuit. If the tubes are good, a signal generator can be used to isolate the defective section while a VOM or VTVM is utilized for resis-

ance voltage checks in the suspected area.

If an audio signal generator is not available, any good audio source may be used for signal injection. In fact, I use a record player with the probe connected directly to the cartridge through a 0.1 μ f capacitor, and across a 2 meg potentiometer, as shown in Fig. 10. The pot in the record player is important as an attenuator to check approximate gain. Injecting the signal from grid-to-grid, as shown in Fig. 11, and working from the speaker toward the input, the volume should increase progressively up to the anode connection of the PE cell.

When the defective component is located and replaced, a final check can be made by interrupting the light beam between the aperture and the film. This can be accomplished with any appropriate object. If operating properly, the audible result is a pronounced click or thud in the speaker.

Weak or otherwise impaired sound could indicate a defect in the amplifier. Normal audio troubleshooting

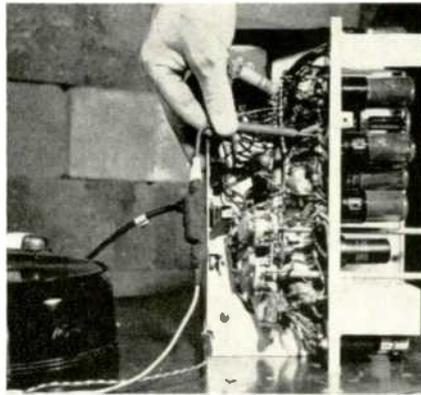


Fig. 11—Audio signal probe used with record player assists author's troubleshooting.

techniques will locate the defect. However, impaired sound can also be due to a weak exciter lamp (it should emit a clear, white light), or, a dirty focusing lens, reflection mirror or PE cell aperture. These parts may be cleaned with a soft #5 camel hair brush, lens tissue and a mixture of pure grain alcohol and water. Some toothpicks will also be handy for cleaning purposes. Wrap lens tissue around the toothpick to get into those tight corners. Avoid scratching any surfaces, though.

Don't forget to clean the exciter lamp, too. (Do not clean a *heated lamp!*) Don't leave any fingerprints or smudges on any surfaces, since this can adversely affect sound. Another important precaution: do not disrupt the lens setting. The light beam must line up precisely in order to obtain proper activation of the PE cell.

Although optical sound projectors differ from make-to-make, a little mechanical talent and experience, coupled with average electronic know-how, makes sound projector servicing fair game for any electronics man. •

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Now you can save hours of testing time with E-Z-HOOK TEST CONNECTORS. And time is money!

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Self-adjusting E-Z-HOOKs make positive connections practically anywhere. The stainless steel hook and the nylon insulator grip firmly, leaving your hands *free*.

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PIGGY-BACK ADAPTER

for tube caddies!

Developed by Seco to save you steps! Free with Seco tube testers or by enclosing 25¢ with coupon.

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Please send free literature on all Seco Test Equipment.

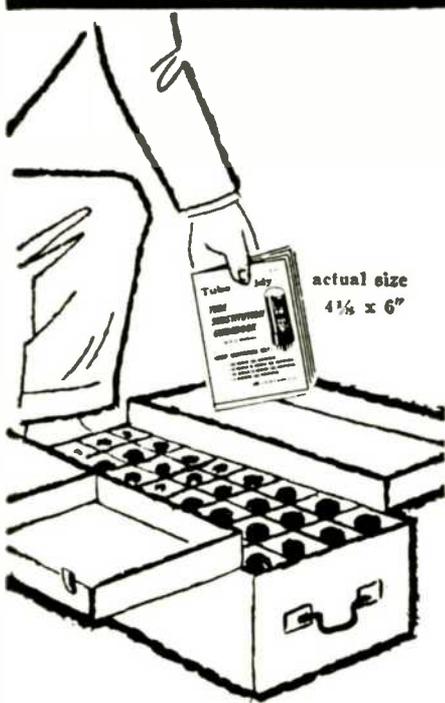
I have enclosed _____ Please send _____ Seco "Piggy-Back" Adapters. (25¢ each.)

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ADDRESS _____

CITY _____ STATE _____

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WEST CANADA: Ron Merrill Co., Vancouver 1, B. C.



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service call...

especially designed
for your tube caddy

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by H. A. MIDDLETON
(direct replacements only)

This guidebook is the answer to the many requests by service-technicians for an efficient direct substitution guide which can be carried in the tube caddy. It contains only direct substitutions which can be made without modification of the wiring. All substitutions listed will yield good or excellent results as indicated in the guidebook.

this guidebook will:

- save you time • eliminate carrying needless tube types • enable you to select the best substitution • minimize sales losses because you don't have the right tube.

It will pay for itself on the first service call!

Contains more than 2,400 substitutions:

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Ruggedized tubes 75
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58

New Books

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

***FUNDAMENTALS OF TRANSISTOR PHYSICS.** By Irving Gottlieb. Published by John F. Rider Publisher, Inc. 152 pages, soft cover. \$3.90.

A thorough theoretical analysis of the action of semiconductors, written in an easy-to-understand language is presented here. Beginning with a clear description of atomic structure of matter, the author moves logically through an adequate review of the nature of electricity and current flow through materials. Reaching the fundamental transistor, the author compares basic functions and circuitry with comparable aspects of the vacuum tube. Related semiconductor devices such as the double base or tetrode transistor, four-layer diode, bilateral transistor, Zener, etc., are covered. The more recent tunnel diode is likewise considered. For those desiring to know more about the fundamental physical aspects of transistor functions, this book offers a condensed, easy-to-absorb source of essential information.

***CLASSIFICATION OF ELECTRON TUBES.** By J. Haantjes and H. Carter. Published by The Macmillan Company. 96 pages, soft cover. \$3.50.

An unusually colorful pictorial-text presentation describes the basic operating principles and applications of a multitude of different type electron tubes in this Netherlands-printed book. Beginning with a brief description of the atom, free electrons, and the theory of thermionic, photo, ionic, field and secondary emission, the authors describe methods of classifying various electron tubes. Rectifiers, high frequency triodes, tetrodes, and secondary-emission type pentodes are covered. Magnetrons, klystrons, travel-

ling wave and X-ray tubes are likewise detailed. Cathode ray, timing indicator, counter, photo-electric, photomultiplier, image orthicon, vidicon, thyratrons, and other special types are described in detail with cut-away color illustrations. The section on applications is well illustrated with black-and-white photographs. Information contained in the book can prove helpful to the student, as well as the advanced technician and engineer.

***TUBE CADDY TUBE SUBSTITUTION GUIDE, BOOK.** By H. A. Middleton. Published by John F. Rider Publisher, Inc. 56 pages, soft cover. \$0.90.

This tube substitution guide, including a list of foreign tube substitutions, is designed for caddy use. The pocket size booklet includes direct substitutions only, and is divided into four sections. Substitutions with a "good" or "excellent" coding is found in Section 1. Section 2 lists some ruggedized tube type substitutions, and Sections 3 & 4 includes European-American and American-European substitutions. It can be a handy addition to the technician's tube caddy or work bench.

***PRACTICAL TRANSISTOR SERVICING.** By William C. Caldwell. Published by Howard W. Sams & Co., Inc. 192 pages, soft cover. \$2.95.

Here's a genuinely practical servicing book, unlike many that incorporate the word "service" in their titles. Beginning with a basic discussion of transistor theory, and circuitry, the remainder of the text commendably illustrates how to isolate troubles in transistor portable radios and auto radios. One chapter each is devoted to Normal Transistor Voltages and Defective Voltages And Their Meanings. Other chapters include: Testing Transistors and Case Histories of Actual Troubles. Test meter connections for ohmmeters and voltmeters are illustrated throughout the book, adding to its practical flavor. This is a decidedly value-packed basic transistor servicing volume and will, no doubt, be enthusiastically received by radio-TV technicians.

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JW ELECTRONICS

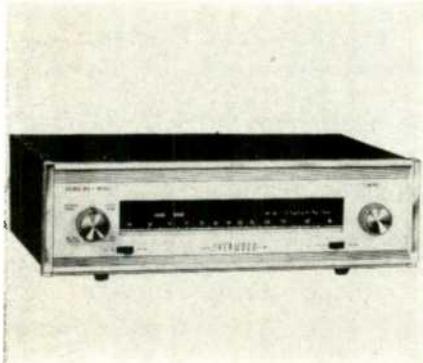
1538 W. Jarvis Ave., Chicago 26, Illinois
Telephone Broadway 4-9757

For more data, circle 8-58-2 on coupon, p. 46

ELECTRONIC TECHNICIAN • August, 1960

Sherwood STEREO TUNER

Models S-3000 III, FM/multiplex stereo tuner incorporates a unique FM "corrective" inverse feedback circuit. 3 db of inverse feedback is applied through a special network from discriminator to afc tube, and the effect is to increase the discriminator equivalent to 1,100 kc and the i-f equivalent

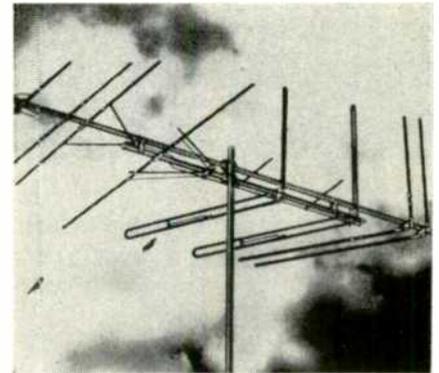


bandwidth to 290 kc, without sacrificing selectivity. Sensitivity, 0.95 μ v for 20 db quieting and 1.8 μ v for the IHFM standard of 30 db. Hum and noise, -60 db. Response, 20-20,000 cps \pm 1/2 db. Chassis, less case, \$110.50. Sherwood Electronic Labs., 4300 N. California Ave., Chicago 18, Ill.

For more data, circle 8-59-2 on coupon, p. 46

TACO ANTENNA

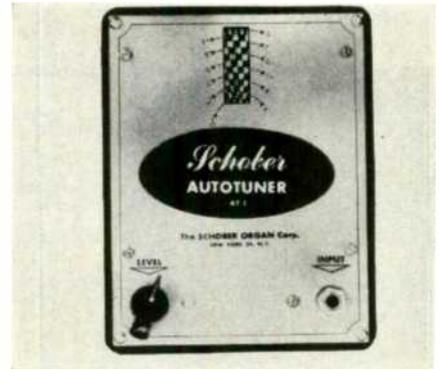
T-Bird improved broad-band yagi antenna for channels 2-13, virtually eliminates side lobes. Features include: t-match coupling for high and low band; new signal injector; new cradle-lok bracket; and power-grip saddle with built-in clips. Three models, available in plain or in gold-anodized aluminum: 707-5 for suburban service, 5 parasitic and 2 driven elements; 707-6 for fringe areas, 6 parasitic and 3 driven elements; and 707-8, which has 6 parasitic elements, 4 driven elements. Technical Appliance Corp., Sherburne, N. Y.



For more data, circle 8-59-3 on coupon, p. 46

Schober ORGAN TUNER

Autotuner, a new pocket-size stroboscopic device, is designed to fine-tune electronic organs in minutes. Its operation requires no technical or musical skill. Simply place the microphone near the speaker, or connect the test cable to the organ's output or speaker coil, and play 13 notes. Each note is tuned until the appropriate pattern in the unit's window stops moving. Accuracy, 1/100 semitone. Complete with microphone and test cable. Assembled \$69.50. Kit, \$49.50. Schober Organ Corp., 43 W. 61 St., New York 23, N. Y.



For more data, circle 8-59-4 on coupon, p. 46

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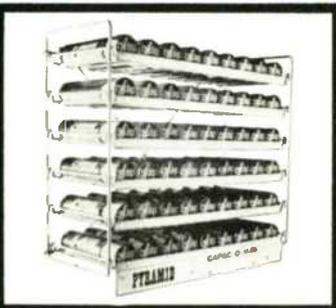
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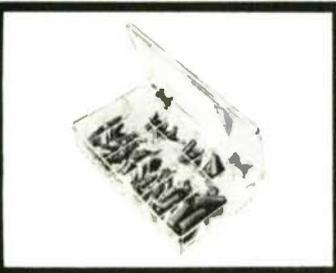
Handsome tan plastic, high impact cabinet with 9 drawers, contains 45 assorted Mylar[®]-paper Gold Dip capacitors, type 151. Practical . . . convenient . . . for storage in your shop, or home. Actual value of the Jewel Box with 45 Gold Dip capacitors—\$19.50, dealer net only \$9.25.



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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 LYTIC-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.



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SHURE has re-issued its reactance slide rule priced @ \$1.

ROBINS announces 3 rigid record changer covers listing @ \$6.95 each.

STROMBERG-CARLSON names Bernard S. (Tommy) Tucker Los Angeles hi-fi dist. mgr., William C. Potter for Minn.

JENSEN INDUSTRIES introduces a line of phono drive wheels, idlers, pulleys, tires and belts in a "Wheel Deal" display rack.

GENERAL INDUSTRIES announces the K-4 "Dial-A-Speed" phonomotor, a knob controlled 4-speed refinement of its earlier lever controlled motors.

BOGEN-PRESTO Pres. Joseph N. Benjamin resigns his position for personal reasons, effective June 30. The new president is Harold A. Goldsmith, former top executive of Magnetic Amplifiers.

V-M introduces 5 portable phonos which range from \$29.95 to \$99.95. A variety of consoles list up to \$1025. The new line of changers incorporate a diamond needle at no price increase.

SHERWOOD adds four authorized service stations to handle local repairs, bringing current total to 23. Included are: Baker's Hi Fi Service, Baton Rouge; Pittman TV Service, Knoxville; Scherrer Instruments, St. Louis; and Audio Service Labs., Irvington, N.J.

ASTATIC publishes a 40-page needle catalog, N-61, covering the company's complete needle line. First part is a replacement guide, and the second a master cross-reference. Director of Sales G. Leonard Werner resigns from the position he has held for the past six years.

1960 N.Y. HIGH FIDELITY SHOW is cooperating with dealers to distribute discount tickets at stores. Upon \$10 worth of purchases at a participating dealer, admission price will be refunded. N.Y. Chapter of ERA will distribute posters and pre-register dealers.

BIRMINGHAM SOUND REPRODUCERS' U.S. outlet changes name from Discus (USA), Inc. to BSR (USA) Limited.

ARMOUR RESEARCH has demonstrated a 3-3/4" diameter tape cartridge using 1/4" tape. Adapters are said to make operation on today's recorders possible.

For more data, circle 8-60-7 on coupon, p. 46

"Compactron"

Multi-Function Tubes

• Transistors have another competitor for the "replace-the-vacuum tube" market, G-E's "Compactron." This development consists of a line of tubes—each one containing the working functions of several vacuum tubes within its glass envelope. Two compactrons, for example, can replace the functions of five tubes (12BE6, 12BA6, 12AV6, 35W4, and 60C5) in a radio, as shown in Fig. 1. Another compactron replaces a TV set's horizontal oscillator and afc tubes (6CG7 and 6AL5).

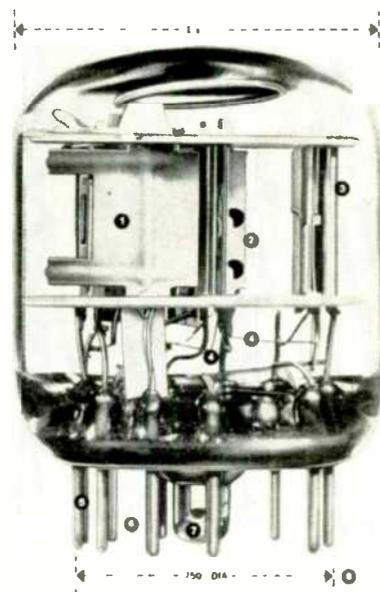
Physically, compactrons are about $1\frac{1}{8}$ " in diameter and vary in seated height from 1 to $2\frac{3}{4}$ ", resembling short, squat, standard miniature vacuum tubes. The compactrons now scheduled for production use 12-pin connections, with the envelope exhausted from the bottom, unlike standard tube exhausts from the top. A cross-section view of a compactron is illustrated in Fig. 2.

The new tube innovation is said to permit adequate isolation of the plate from other electrodes in high-voltage

operation, using two "blank" pins on either side of the plate connection. An arc rating in the order of 10,000 d-c volts is claimed. New metallurgical developments assisted the designers. For example, a new anode material is said to reduce heater power requirements of the cathode by as much as 40%.

Some compactrons replace conventional tubes on only a one-to-one ratio because of maximum power requirements or high voltages. These single-function compactrons are also said to be significantly smaller than the vacuum tubes they replace.

The compactrons' space-saving attribute is emphasized by the working functions they can offer: Two compactrons equal five tubes or seven transistors in a home radio. Seven compactrons and 1 diode equal 15 tubes and three diodes, or 23 transistors and 11 diodes, in black and white TV. Compactrons offer color TV 15 compactrons as against 22 tubes and 2 rectifiers, or 36 transistors, 5 tubes, 1 diode and 1 rectifier.



1. PENTODE SECTION
2. TRIODE SECTION
3. TWO DIODE PLATES
copper base Al clad iron
4. THREE-SECTION INTEGRAL SERIES HEATER
(see time exposure photo below)
5. .040 DIAMETER RIGID OUTER PINS
—no base shell
6. WIDE PIN SPACING
for circuit accessibility
high arc rating, minimized leakage
and glass electrolysis
7. BOTTOM EXHAUST TIP
8. LARGER PIN CIRCLE
for circuit accessibility, improved
mount support, simplified assembly

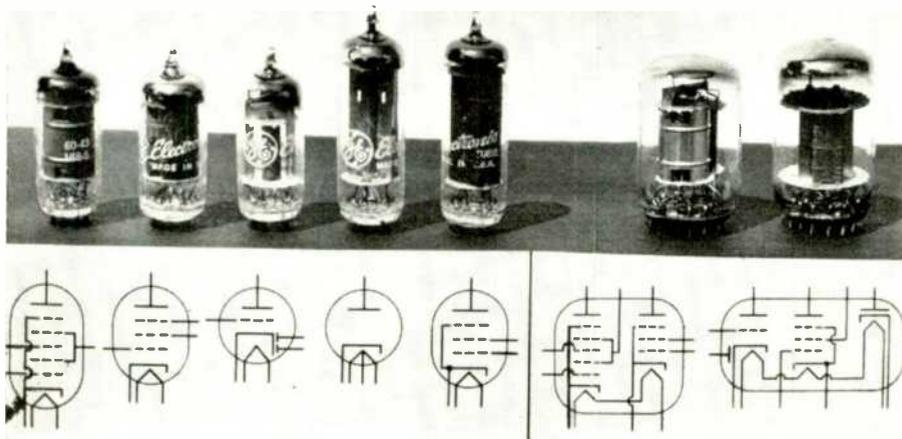
Fig. 2—A single compactron containing the working functions of a pentode, triode, and duo-diode tubes.

A G-E spokesman pointed out that tubes offer greater distortionless power output than transistors; in effect, sounding better at higher volume. In addition, transistors cost 50% more than tubes. Contrasting compactrons with tubes, G-E expects compactrons to reach a cost of up to 20% less per function than tubes. The compactron size is, of course, a desirable feature when compared to the larger space needed for equivalent standard tubes.

The multi-function compactrons could lower manufacturing costs through fewer sockets, smaller cabinets, and lower assembly costs. The radio-TV service dealer may sell more "tubes" in a compactron set, since one defective "tube" means replacement of the several "tubes" contained in a compactron, but service time may be reduced.

G-E plans to introduce approximately nine more compactrons in the next 12 months, in addition to the six units they presently have in development. Long range plans indicate a line having from 75 to 100 types. •

Fig. 1—Two "compactron" tubes, pictured at right, replace the 5 radio tubes at left.



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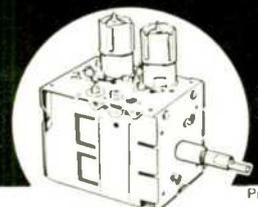


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For more data, circle 8-62-1 on coupon, p. 46

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That's right. Net, \$8.50 per unit and \$15 for UV combinations, including ALL replacement parts. 90-day warranty against defective workmanship and parts failure. Tuners repaired on approved, open accounts. Replacements offered at these prices* on tuners not repairable:

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- VHF 13 or 16 position 23.00
- VHF/UHF combination 25.00
- UHF only 15.50

*Subject to change



Tarzian-made tuners are easily identified by this stamping on the unit. 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. Use this address for fast, 48-hour service:

SARKES TARZIAN, Inc.
 Att.: Service Mgr., Tuner Division
 East Hillside Drive
 Bloomington, Indiana

For more data, circle 8-62-2 on coupon, p. 46

Shure CARTRIDGE

M8D stereo standard dynetic cartridge, designed for use with record changers, is completely compatible. Frequency response, 30-15,000 cps. Channel separation, more than 20 db at 1,000 cps; Tracking force, 5 to 8 grams. Vertical and lateral compliance,



3.0×10^{-6} cm per dyne. Output voltage, 5 mv per channel at 1,000 cps. The cartridge has four terminals, but is adaptable to three-terminal arms. It has standard mounting centers of $1\frac{1}{2}$ " and $\frac{7}{16}$ ". Including a 0.7 mil diamond stylus. \$16.50. Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.

For more data, circle 8-62-3 on coupon, p. 46

20 kc continuously variable in 3 steps; sync, amplified, internal and external; horizontal, 1.5v peak to peak per inch, d-c to 75 kc; and modulation, convertible to modulation monitoring. \$69.95. Waterman Products Co., 2445 Emerald St., Philadelphia, Pa.

For more data, circle 8-62-5 on coupon, p. 46

V-M STEREO RECORD TAPE RECORDER

Model 722, an all-new, portable, tape recorder records stereophonically on 4 tracks. It offers mono and 2 track or 4 track stereo playback. Dual microphones, dual mike input jacks and a dual tuning eye make it possible to

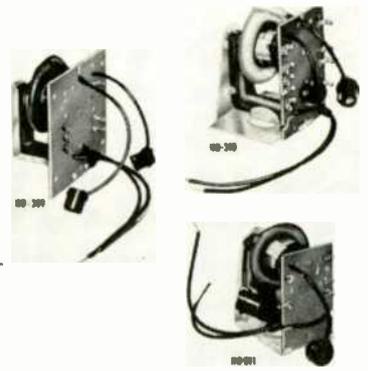


record stereo. It also incorporates the firm's "Add-A-Track" feature which permits recording on one track; re-winding the tape, and recording again on a second track while listening to the first. \$259.95. Matching model 168 auxiliary amplifier speaker, \$75.00 completes system. V-M Corp., 226 Pipestone St., Benton Harbor, Mich.

For more data, circle 8-62-6 on coupon, p. 46

Stancor FLYBACKS

Three new exact replacement flyback transformers are used in Emerson TV sets. Stancor HO-309 replaces Emerson parts 738138 and 738138A; Stancor HO-



310 replaces Emerson 738142 and HO-311 replaces Emerson 738155. These exact replacements are used in 141 Emerson models and chassis without any circuit or chassis alteration. Chicago Standard Transformer Corp., 3501 Addison St., Chicago 18, Ill.

For more data, circle 8-62-7 on coupon, p. 46

Raytheon RECEIVING TUBES

Six new receiving tubes are: 12FR8 and 12FX8, for automobile radios; 6EZ8, 9-pin, miniature triode designed as a one-tube tuner for frequencies as high as the FM band; 6AN8A, class A amplifier, direct replacement for 6AN8; 6EV5, high frequency sharp cutoff for use as the r-f amplifier in VHF tuners; and 12FQ8, 9-pin miniature twin-triode with 4 plates, two for each triode section. Raytheon Co., Distr. Products Div., Westwood, Mass.

For more data, circle 8-62-4 on coupon, p. 46

Waterman OSCILLOSCOPE

Primer Scope Mark I, a new versatile factory wired and tested instrument, measures $3\frac{1}{2}$ " x 7" x 10". Unit ratings: vertical, 1v peak to peak per



inch d-c to 75 kc, 25 millivolts RMS per inch 20 to 75 kc; sweep, 20 cps to

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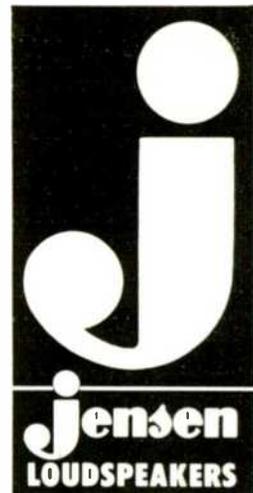
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Here, for the first time, is a precision-made instrument which is specifically designed to *safely* test low-voltage aluminum and tantalum electrolytic capacitors, film and paper capacitors, and ceramic capacitors. *No laboratory or shop working with transistor circuit capacitors can afford to be without one!*

CAPACITANCE BRIDGE: 1 μ f to 2,000 μ f in five overlapping ranges, with laboratory accuracy.

INSULATION RESISTANCE: 50 megohms to 20,000 megohms. Only 25v d-c is applied, permitting measurements on low-voltage ceramic, paper, mica, and film capacitors. For ceramics rated below 25 volts, IR may be calculated from leakage current measurements at exact rated voltage.

POWER FACTOR: Measured by Wien Bridge from 0 to 50%.

LEAKAGE CURRENT: 0.6 μ a to 600 μ a in 7 ranges. Measured directly on meter at exact rated d-c voltage of capacitor. No guessing on eye-width or counting lamp blinks!

A-C BRIDGE VOLTAGE: Only 0.5v is applied to the bridge. The voltage across the capacitor is less than this applied voltage, the amplitude depending upon capacitance being measured. No danger of overheating and ruining even a 1-volt electrolytic or a 3-volt ceramic.

POLARIZING VOLTAGE: Continuously adjustable, 0 to 150v.

STABILITY: Dual regulation of the power supply assures short-time reliability, while specially processed etched circuits and complete encapsulation of the critical meter amplifier insure long-time stability.

MAGIC-EYE TUBE: Simplifies bridge balancing for capacitance and power factor measurements.

HIGH GAIN AMPLIFIER: Sensitivity control for magic-eye null detector permits accurate measurements of small capacitances.

CAPACITANCE DIAL: Latest design jet black dial with brilliant white calibrations for quick, accurate readings from any position.

BINDING POSTS: Shielded for protection against pick-up of strays, assuring greater accuracy during low-capacitance measurements. 5-way connection feature for use with all types of test leads.

SAFETY DEVICES: Automatic discharge of capacitor after testing. Three-wire line cord grounds instrument case.

OPERATING PROCEDURES: Easy-to-follow operating procedures clearly shown on pull-out slide at base of instrument. Always handy for ready reference.

MODERN CASE: Handsome grey Hammerloid finish on heavy-gage steel. Measures 8 $\frac{1}{2}$ " high, 14 $\frac{3}{8}$ " wide, 9 $\frac{1}{2}$ " deep. Weighs only 21 pounds.

See the remarkable new TCA-1 TRANSCAP at your Sprague distributor or write for descriptive folder M-792a to Sprague Products Company, 65 Marshall Street, North Adams, Massachusetts.

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