

ELECTRONIC TECHNICIAN

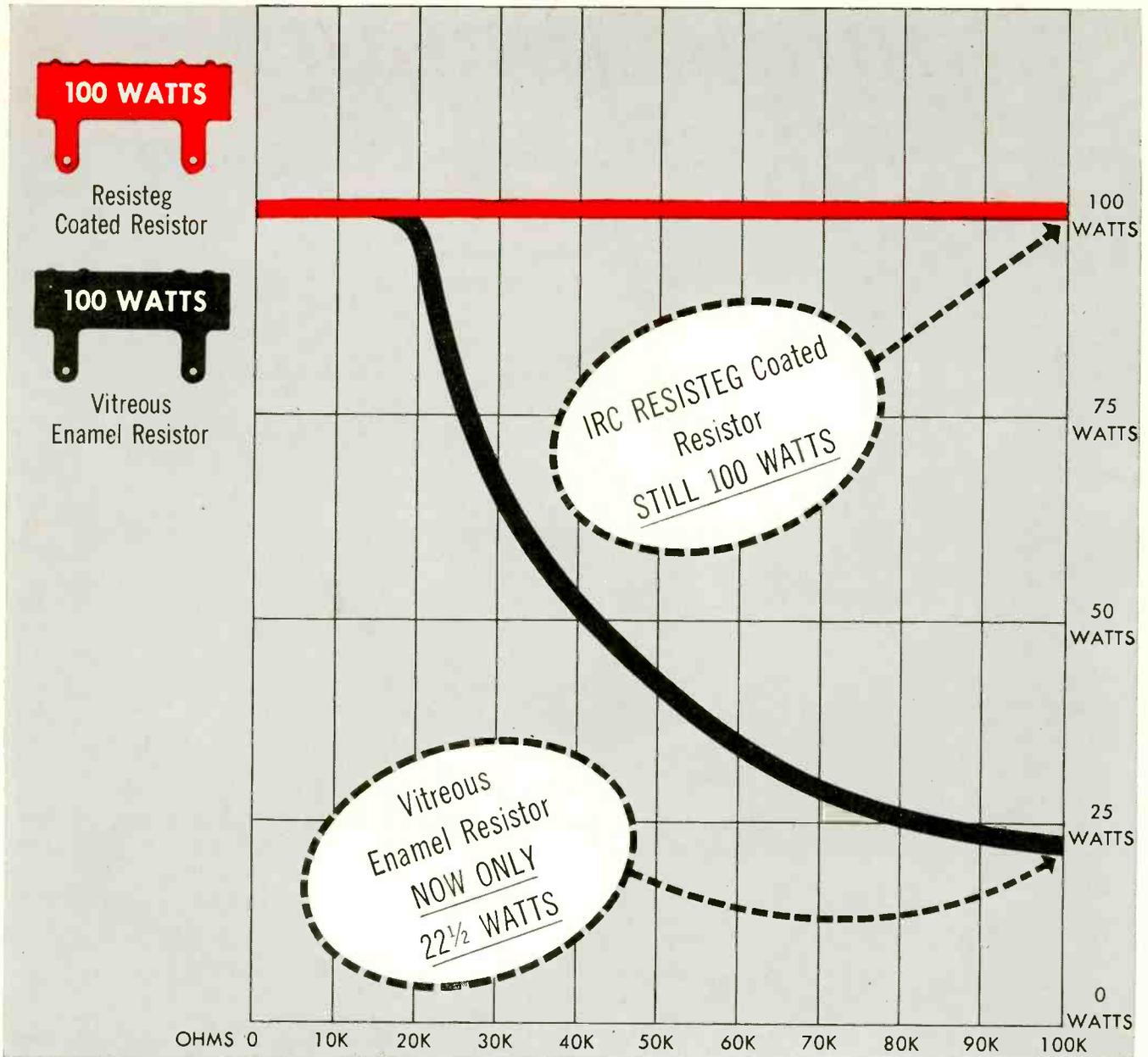
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September, 1958

FRONT COVER Stereo 1959 is an invitation to a new horizon of audio and electronic activity which is bound to encourage a demand for conversions, new equipment, and installations. It is a practical guide to understanding stereo. See "Stereo—New Opportunity for Technicians" on page 27. Full index of contents of Stereo 1959 section on page 43.

FEATURES and ARTICLES

Raise Standards for TV Receiving Tubes	11
Stereo—New Opportunity for Technicians (Editorial)	27
"Tuning in the Picture"	28
Atomic Radiation and Television X-Rays	30
<i>Albert J. Forman</i>	
Servicing 110° Vertical Sweep Circuits	32
<i>Jesse Dines</i>	
"Tough Dog" Corner	33
<i>Ivan White</i>	
Integrated Test Equipment Spreads TV Alignment	34
<i>Victor Robinson</i>	
Building a Technical Library	36
Shops Hints	38
<i>R. E. Davis, Paul Katz</i>	
Free Literature	39
Maintaining 2-Way Mobile Radio	114
Standards for Stereophonic Disc Records	122
<i>Record Industry Ass'n.</i>	
New Products	123

STEREO 1959 41-100

DEPARTMENTS

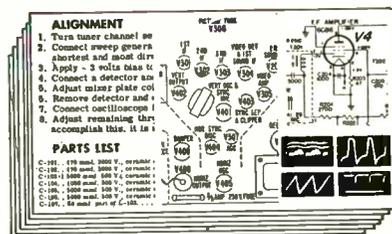
Editor's Memo	6	Reps. & Dists.	23
Letters to the Editor	14	Catalogs & Bulletins	25
New Books	21	Calendar of Coming Events	29
News of the Industry	22	Audio Newsletter	110
<i>Association News</i>	119		

CIRCUIT DIGESTS 133

IN THIS ISSUE

(16 pp. latest schematics—see last page)

- ADMIRAL: TV Chassis 20B6C, T; 20UB6C, T
- GENERAL ELECTRIC (Canada): Transistor Radio P750A
- MONTGOMERY WARD: Hi Fi AM-FM Radio Phono Serial No. 75X
- MOTOROLA: TV Chassis PT5546, Y
- PACKARD-BELL: TV Chassis 98D4
- RCA: TV Chassis KCS122A, B, C, D, E, F, H, J, K, L, M, N, P, R, AD, AE

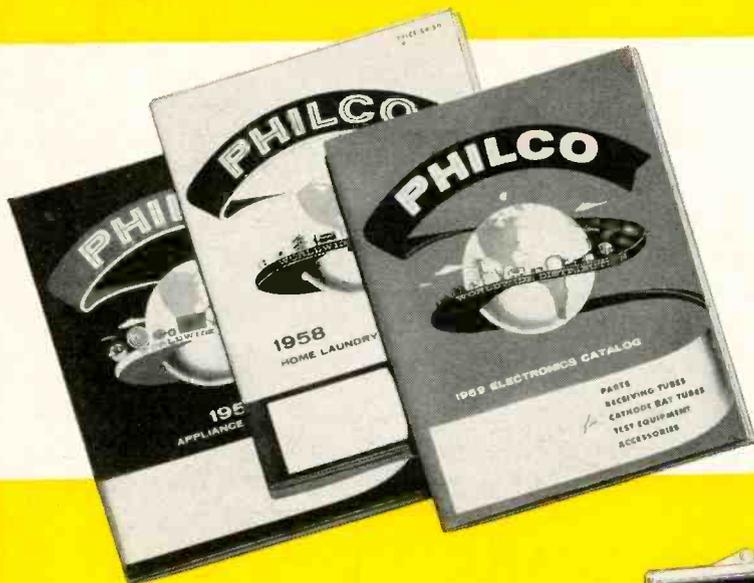


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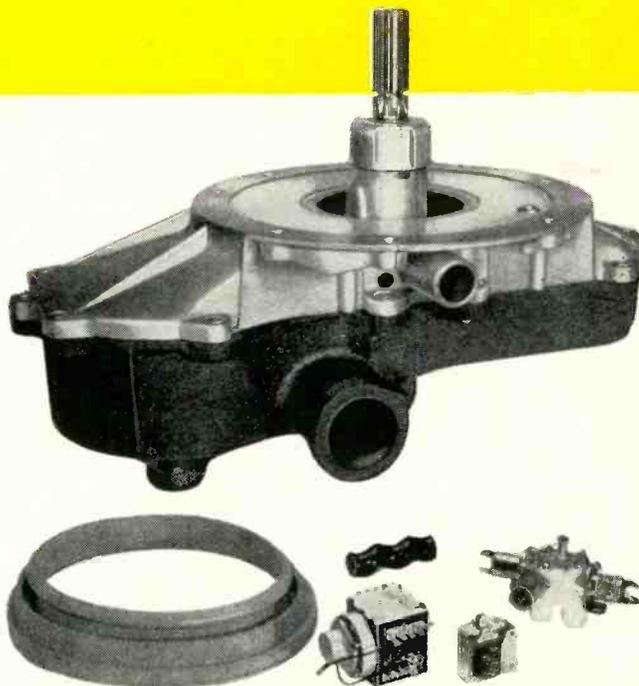


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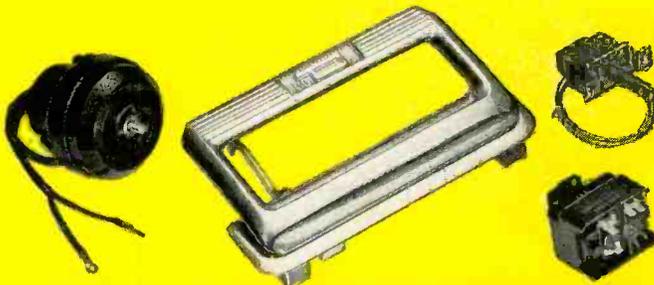
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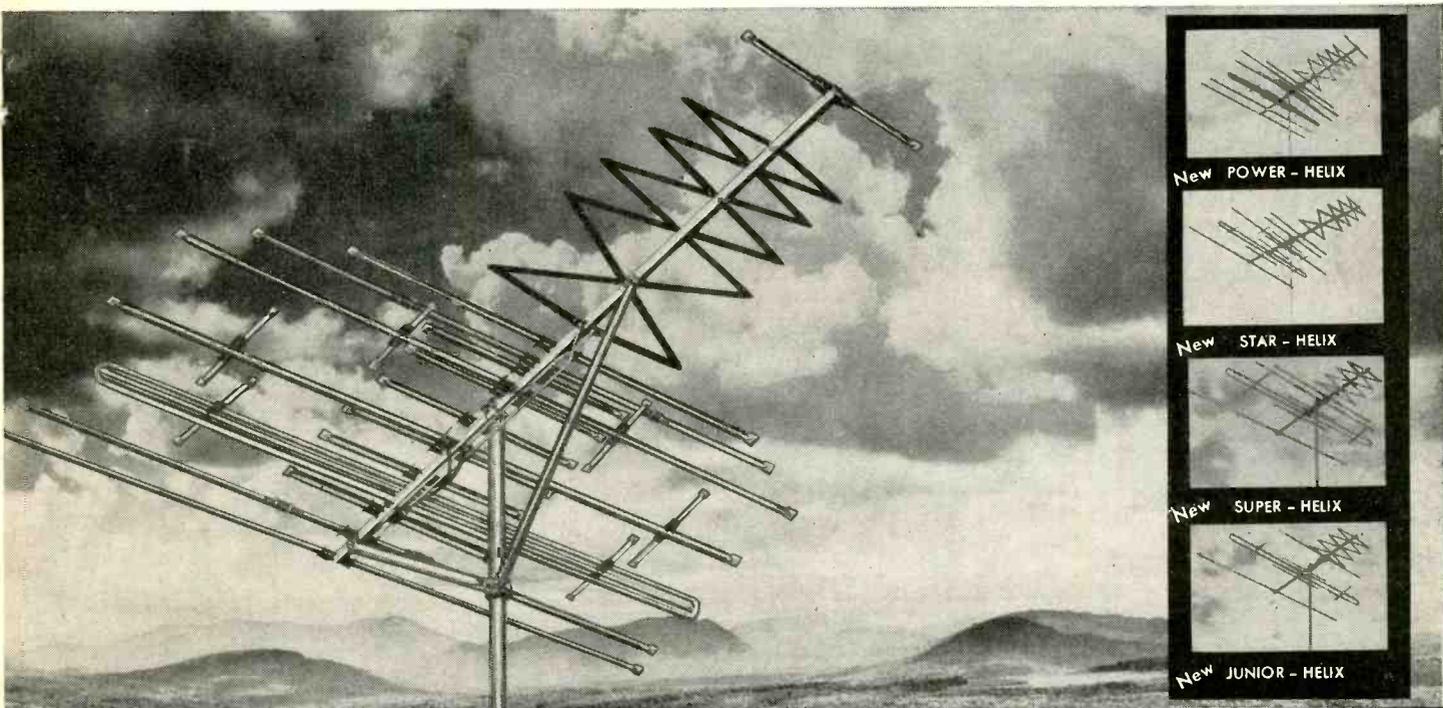
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sell the



SATELLITE-HELIX

the TV antenna that **shrinks the miles...
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FLASH!...ALL HELIX COLORTENNAS NOW FEATURE ADVANCED SLEEVE DIPOLE DESIGN!

No other fringe TV antenna has ever captured the imagination of service-dealers like the exciting Satellite-Helix. *Proof is the fact that more Satellite-Helices have been sold in the last 6 months than any other deep-fringe TV antenna!*

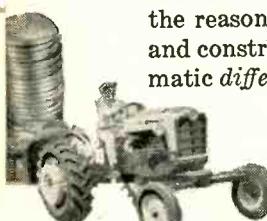
Profit-squeezed servicemen, installers and dealers know that here at last is the antenna that gives their customers the reasons to buy *now*—performance and construction features with the dramatic *difference* they can *show* and *sell!*

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- * ROCK-OF-GIBRALTAR RUGGEDNESS!
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- * A HARVEST OF PROFITS FOR YOU!
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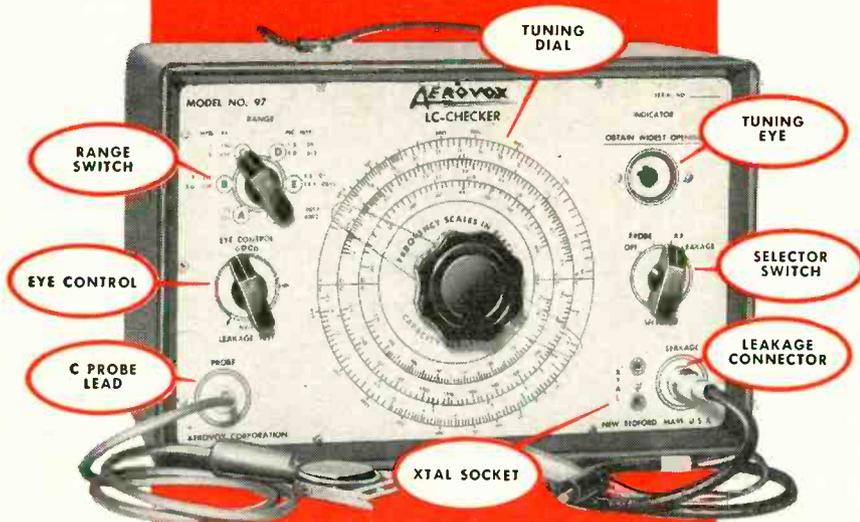


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only the
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AEROVOX
LC-CHECKER**



**can do SO MANY
JOBS — SO WELL!**



INDUCTANCE LOOP AND C PROBE ASSEMBLED C PROBE ASSEMBLY CLIP CORD

THE MODEL 97 LC-CHECKER **CAN DO ALL THESE JOBS!**

- | | |
|--|---|
| <p>1 Measure capacitance and relative "Q" of capacitors in circuit.</p> <p>2 Measure capacitor and insulation resistance.</p> <p>3 Align r-f and i-f circuits.</p> <p>4 Check super-het oscillator tracking with set "hot-or-cold."</p> <p>5 Align i-f channels in FM receivers and independent alignment of i-f transformers.</p> <p>6 Determine resonant absorption points.</p> <p>7 Locate resonant points in unused portions of coil assemblies in multi-range oscillators.</p> <p>8 Align video and sound i-f systems in TV sets.</p> <p>9 Precise alignment of 4.5 mc inter-carrier sound i-f channels.</p> | <p>10 Determine natural resonant points of r-f chokes.</p> <p>11 Determine natural period of antennas and transmission lines.</p> <p>12 Measure fundamental crystal frequencies and operation at harmonic levels.</p> <p>13 Measure transmitter buffer, amplifier and tank circuits for parasitic current loops with power off.</p> <p>14 Measure correct wave-trap and filter tuning.</p> <p>15 With a standard plug-in crystal, can be used as an accurate signal generator for signal substitution and precise signal sources.</p> |
|--|---|

\$69.95

Write for name of nearest Distributor.

AEROVOX CORPORATION

DISTRIBUTOR DIVISION

NEW BEDFORD, MASS.

**Editor's
Memo**



There are always some suckers who will fall for a something-for-nothing come-on. Every business has a few overly sharp operators who use this approach.

In the stock market there are so-called "boiler rooms" where fast talking salesmen use the telephone to separate the get-rich-quick investor from his money with worthless stock.

In the electronic servicing business, there are some people who offer \$1 repair jobs and free tube testing in the home as come-ons. Some consumers fall for this—perhaps including those with a touch of larceny in their hearts and a something-for-nothing attitude in their minds.

But folks are not as gullible as we might think. I recently read about a test which should help restore our faith that you can't fool all the people all the time.

A major book publisher sent out a book club offering in three different versions. 50,000 letters asked the recipients to accept the first selection free. Another 50,000 asked 10¢ for the first selection. Still another 50,000 people received letters asking for 25¢.

Which offer pulled best?

Well, the 25¢ offer attracted 40% more takers than the free offer. The 10¢ offer pulled 60% better than the free offer.

Now this is not conclusive for all businesses, but it does indicate that plenty of folks are suspicious of something-for-nothing offers.

A few words about this month's Stereo issue. Our staff really worked to produce it, and we're proud to say that it scored several "firsts," including:

First comprehensive article-directory-catalog roundup on stereo ever published.

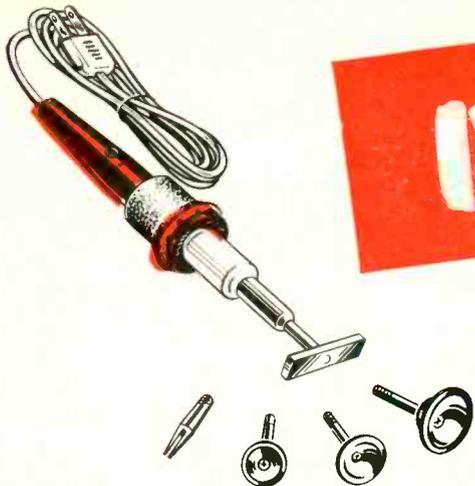
Largest issue—in pages and copies—ever published by any magazine in our field in all the years of ELECTRONIC TECHNICIAN's existence.

We've put a great deal of effort into stereo because it will be an important factor in your future servicing operations.

Incidentally, we'll be exhibiting at the New York High Fidelity Music Show, Sept. 30-Oct. 4, at the N. Y. Trade Show Bldg. If you attend, stop by and see us at Room 420.

We'll be glad to discuss any questions you have on getting into the stereo business.

Al Forman



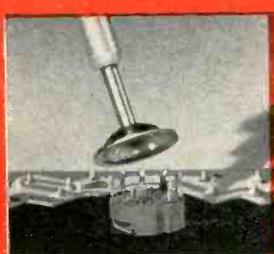
IT'S NEW

**IT'S FAST
IT'S EASY
IT'S SAFE**

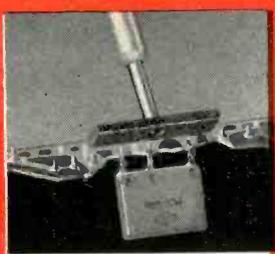
FOR PRINTED CIRCUIT REPAIR



DE-SOLDERING KIT #270



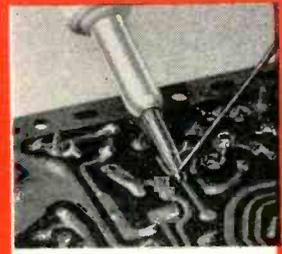
New Cup Shaped De-Soldering Tiplets remove all solder from circular multi-lug components in one operation.



Bar Type De-Soldering Tiplet removes solder from all straight line component junctions at one time.



Slotted De-Soldering Tiplet straightens bent tabs and removes solder in one easy motion.



Slotted De-Soldering Tiplet flows solder neatly to replace, repair and rebuild circuit lines.



Morris Weisenberg, Chief Technician
Universal TV Co., Los Angeles, Says...

**"We Saved 70% of Time and Temper
In De-Soldering Printed Circuits ..."**

"As one of the largest service organizations, with a fleet of 28 trucks, saving time for our 45 personnel is important. In the past, we found that regular soldering irons and tips, when used for de-soldering, would break off lugs or ruin the printed board.

Ungar's De-Soldering Kits permit the easy, quick removal of multi-lug components without disturbing printed wire continuity. Any part is speedily removed without damage."

Mfd. by Ungar Electric Tools, Inc., 4101 Redwood Ave., Los Angeles 66



SAVE OVER \$2.00

- #776W Handle \$1.25
- Super Hi-Heat Unit 3.00
- #857 Slotted Tiplet60
- 3 Circular Tiplets @ 75 ea. 2.25
- Rectangular Tiplet75
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Regular List **\$7.95**

INTRODUCTORY

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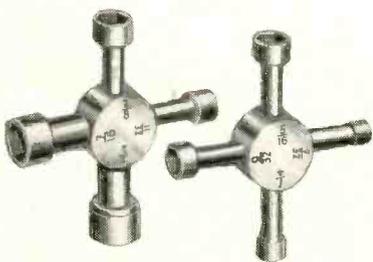
©1958 UNGAR ELECTRIC TOOLS INC.

PATENT PENDING

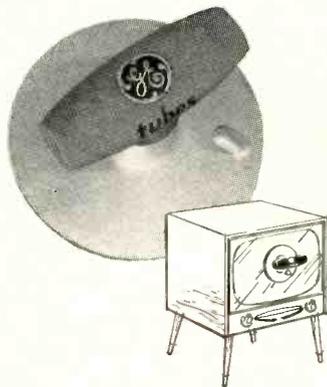
SPEED REPAIRWORK ***FIELD-TESTED TV SERVICE***

Time saved is money saved when repairing television sets. Because of this, General Electric has developed a whole series of original tools and devices to cut your servicing time and costs. They've been exhaustively field-tested, field-proved. They add profit hours to the work week of the television technician.

Read about these ingenious aids below! See them on your next visit to your G-E tube distributor's! Only General Electric makes available this group of special service devices—each and every one a time and trouble saver. They're easy to use . . . and easy to obtain. Ask your G-E distributor how to get them! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Kentucky.*



TWIN-X WRENCH SET (ETR-752)—designed and built expressly for TV-radio repairwork. Replaces eight hex-head socket wrenches $\frac{3}{8}$ " to $\frac{1}{2}$ ". Sizes are clearly marked for quick selection. Hollow shafts permit wrench to grip the nut over protruding end of bolt. Chrome-plated case-hardened steel—will stand up in long, hard service.



SAFETY-GLASS PULLER (ETR-1592). Now you can remove the television safety glass easily, without risk of cracking or chipping. Handle of this device controls a three-inch rubber suction cup with vacuum-release tip.



NEW TUBE-FUSE-LAMP CHECKER (ETR-981A). Only $3\frac{1}{2}$ " by $2\frac{3}{4}$ " by $1\frac{7}{8}$ ". Can easily be carried in pocket. Powered by 3 "C" flashlight batteries. Will check 7- and 9-pin miniature tubes, also lock-in and octal-base types . . . picture-tube heaters . . . all TV and radio fuses . . . all filament-type pilot lamps. A "must" for technicians.

PLUS...

New G-E Chassis-Jack (ETR-1470)

Picture-Tube Nek-Rest (ETR-1169)

Picture-Tube Pillow (ETR-1469)

All-Type Tube Puller (ETR-1094)

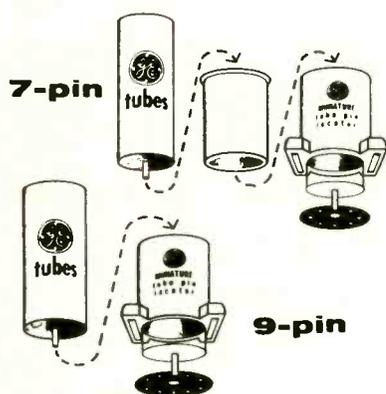
Service Drop Cloth (ETR-1021)

Adjustable Bench Mirror (ETR-1275)

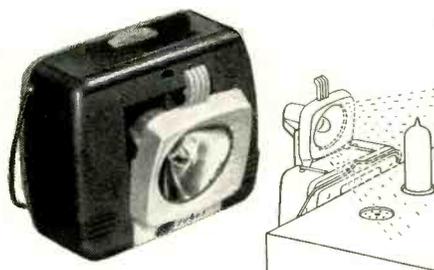
WITH G-E AIDS!

SEE THEM ON THIS PEG-BOARD COUNTER DISPLAY!

Your G-E tube distributor features this large peg-board display of TV-service aids. Inspect them in detail! All are safety-packaged in heavy transparent plastic, which keeps them clean, protects them from scratches or other injury. Be sure to look for this display at your distributor's—be sure to study the useful service aids. You'll want them all!



PIN-LOCATOR FOR MINIATURE TUBES (ETR-1540). Use it to place miniatures in hard-to-reach sockets. Centering plug positions the locator above pin holes. Magnets then hold locator while tube is turned till pins drop into socket.



MAGNETIC SWING-BEAM SERVICE LIGHT (ETR-1593). Magnet holds the light securely to chassis of set, so that both your hands are free for work. Swing-beam design puts illumination just where you need it. A time-saving aid you'll want on every job. Small, fits easily in your service case. Strongly made, durable . . . uses standard flashlight bulb and batteries.



TRI-PLEX EXTENSION LEAD (ETR-1527). New in design. Compact for your service case, with only one lead plus adapter. Practical and easy to use. Like other G-E service aids, the Tri-Plex Extension Lead comes in a protective, reusable polyethylene container.

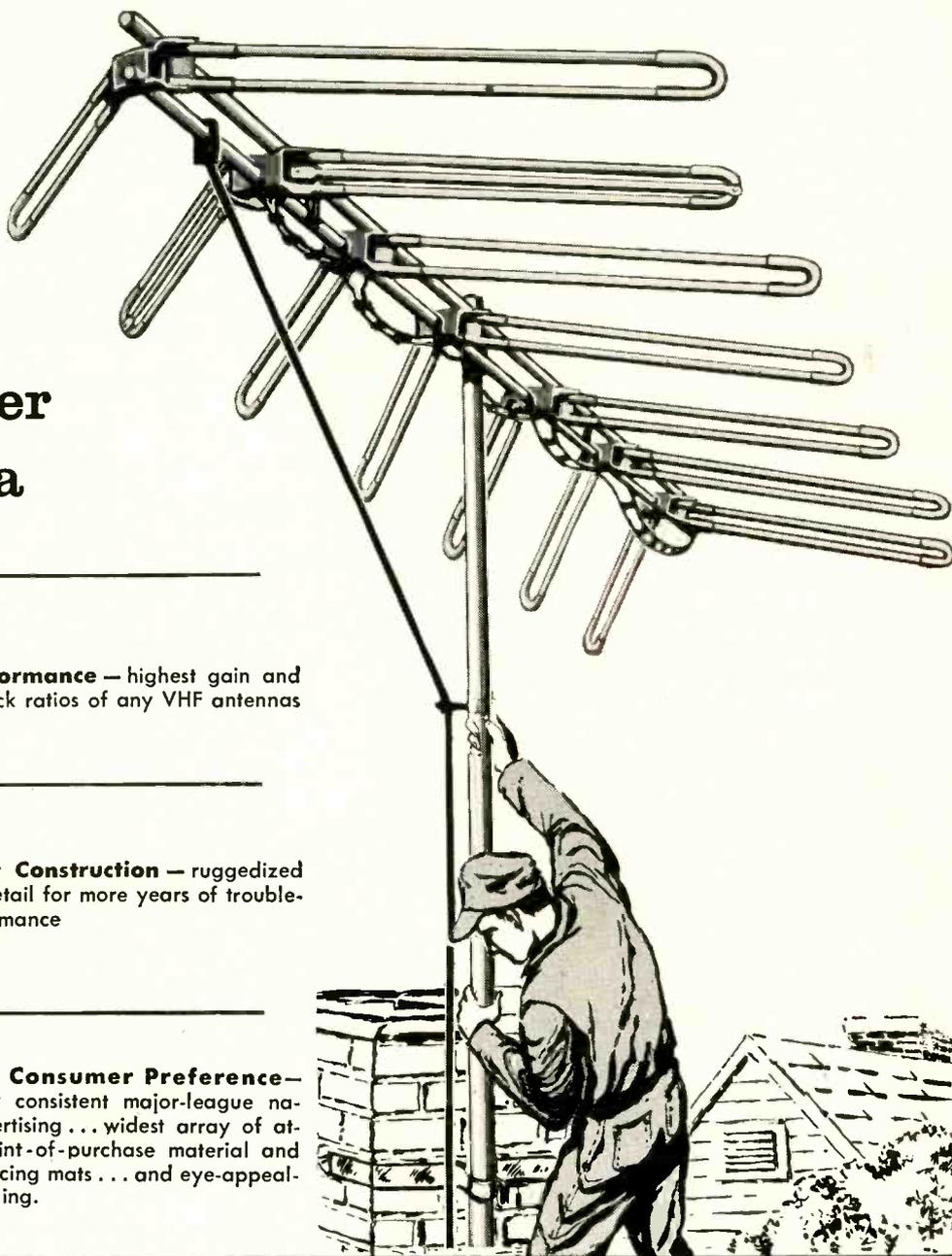
Progress Is Our Most Important Product

GENERAL  ELECTRIC

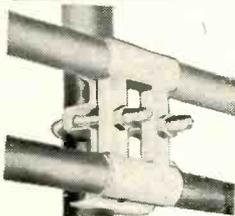


up goes another *CHANNEL MASTER® T-W*

On more
fringe area
roof tops
than any other
TV antenna



Best Performance — highest gain and front-to-back ratios of any VHF antennas



Strongest Construction — ruggedized in every detail for more years of trouble-free performance



Greatest Consumer Preference— created by consistent major-league national advertising... widest array of attractive point-of-purchase material and sales producing mats... and eye-appealing packaging.

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Raise Standards For TV Receiving Tubes

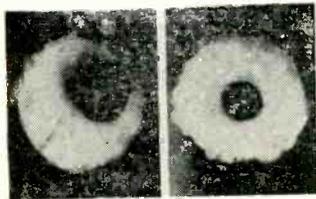
• Improvements will extend to TV some of the high reliability features originally developed for military tubes.

General Electric reports these advances:

1. "Snow-White" manufacturing procedures—to minimize lint and dust—have been extended to all receiving tube manufacturing at a cost of over \$1 million.

2. Adoption of an accelerated heater cycling test to make sure tubes will perform properly under wide variations in household line voltage. Recent surveys indicate a national average of 122 volts (compared to the nominal 117-volt standard) which necessitates this new design requirement.

3. Attaining greater uniformity by cross-the-board use of a new method of testing for shorts or opens within a finished tube by using dc instead of ac.



Magnified views of tube heater wire show new and old ceramic coating. Inter-element shorts, and "hot spots," are avoided.



Tapered Pins on octal-base receiving tubes save time and avoid socket damage when inserting in hard-to-reach spots.

4. Building receiving tubes to meet life tests twice as rigid as the Joint Army-Navy specifications.

5. A new method of controlling the insulation coating on heater wire to prevent "hot spots" that tend to cause tube failure, and to allow closer control of warm-up time.

6. Tapering the ends of pins on octal tube bases to save time in inserting and removing tubes, and to prevent socket damage.

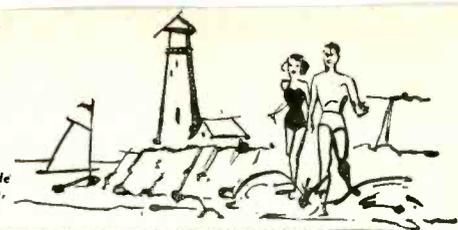
7. Extending stiff military-type glass strain specification test to tubes; for example, tough pin-seal strength tests and a thermo-shock test involving immersing tubes alternately in boiling water and ice-water.

8. Development of new materials for use in tubes.

9. Use of a new hard-to-remove branding ink to prevent removing the warranty date code either by accident or by deliberate erasure by tube counterfeiters.

Many other improvements are being made on individual tube types. •

Model No. 6506
6 transistors,
1 thermistor, 1 diode
5 3/4" long, 3" high,
1 3/8" deep



New!

CHANNEL MASTER® Transistor Radios

Behind every one of these tiny electronic marvels stands Channel Master's outstanding reputation for quality and dependability. These radios make sweet music for profit-minded dealers.

DESIGNED for powerful, satisfying performance.

BUILT for rugged use, in unbreakable "Impact" case.

STYLED to sell on sight.

PRICED to give the consumer today's greatest value in radios.

Special 4" Dual Range Extension Speaker Available.

Extra: Free Replacement Warranty. See your Channel Master distributor for full details.

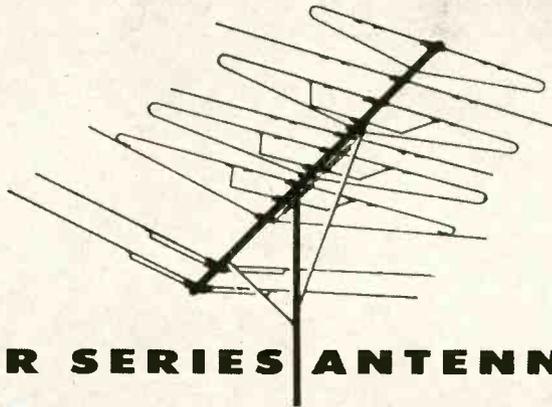


Model No. 6501
6 transistors, 1 diode
4 3/4" long, 2 3/4" high, 1 1/4" deep

the big news is coming from
MASTER

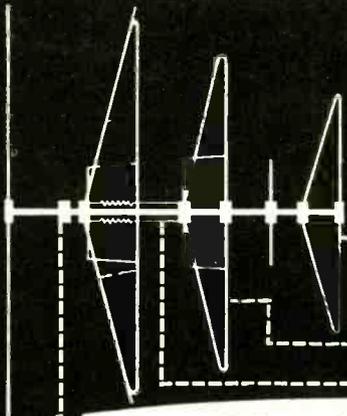
The Most Advanced TV ANTENNAS in the World!

TRIO®



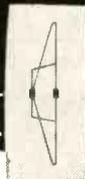
ZEPHYR AND COLOR SERIES ANTENNAS

Look for these 4 Great Features in 1959



Wing Dipole

Today's most powerful dipole! Contains three active elements on the high—forward Vee to the low band section—plus integrated director.



Wing Director

Today's most powerful director! A composite director designed to obtain results from the powerful Wing Dipole.



no-strip

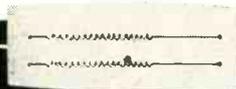
lead-in connector

Requires no stripping, no soldering, or wire holders—holds the complete insulated wire.



dyna-coil phasing

Increased performance from uniform transmission of signal strength of each active dipole in a multi-dipole system—AND MAKES POSSIBLE COMPLETE FACTORY ASSEMBLY.



Choose from . . . TRIO'S COMPLETE LINE

COLOR ROYAL—The ultimate in color television reception—or black and white.

ZEPHYR ROYAL—Extraordinary power and sensitivity.

ZEPHYR PIONEER—For extreme distance.

COLORITE—For color and black and white in areas formerly using conicals.

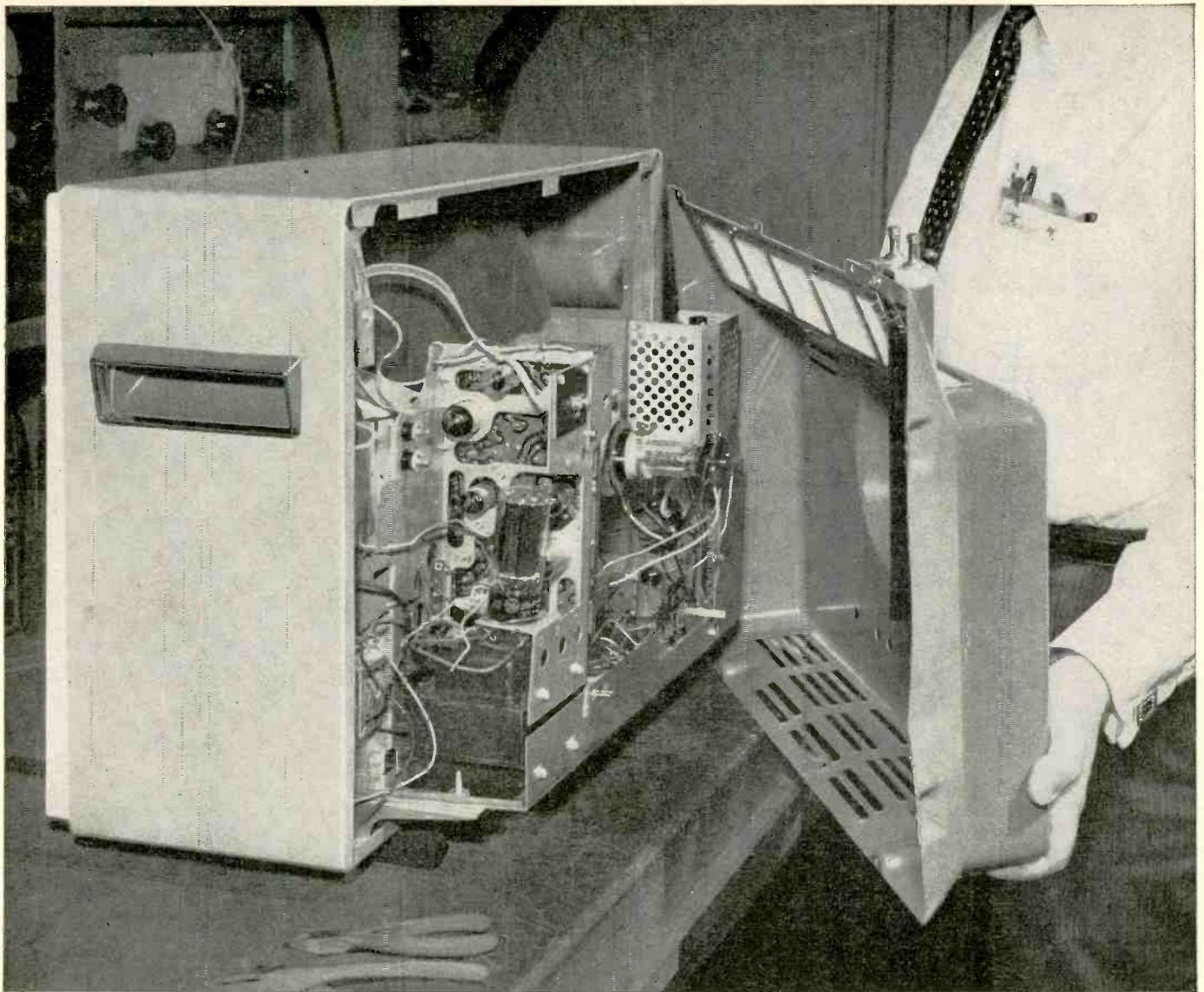
Sharpshooters, Conicals and Yagis

Patents: U.S. 2772413—Canada 541670

Copyright 1958, Trio Mfg. Co.



TRIO® Manufacturing Company GRIGGSVILLE, ILL.



Take the back off the General Electric "Designer" TV set and you can do 85%-90% of service jobs without pulling the chassis

You cut your time-per-repair by up to 40% . . . make more calls—and money—in the same amount of time!

Take off the back and there you are—in easy reach of up to 90% of service jobs. Look at the chart!

Look inside! Both sides of the reliable printed circuit boards are easy to reach for service.

No series string filaments—no extension cables needed . . . the new "Designers" are certainly the easiest-to-service sets in all television. You'll wish every set was a General Electric "Designer."

Progress Is Our Most Important Product

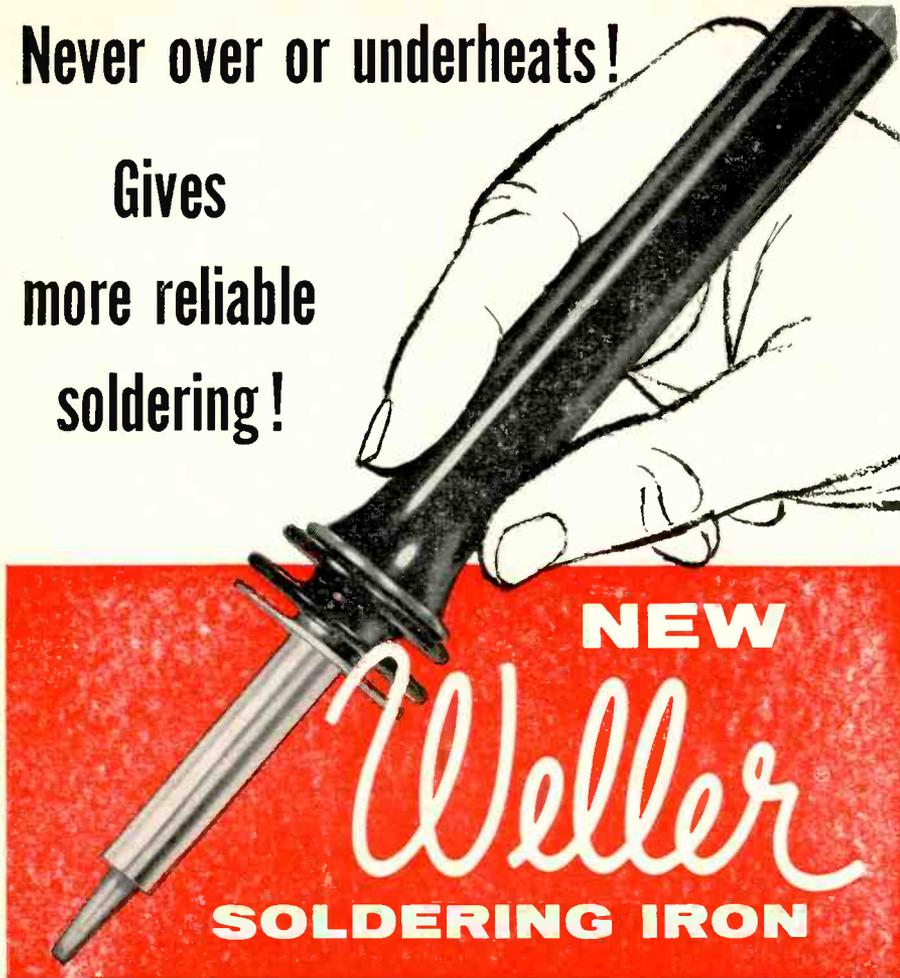
GENERAL  ELECTRIC

TEN TYPICAL JOBS THAT CAN BE DONE WITHOUT REMOVING THE CHASSIS				
JOB	G-E "Designer"	Set A	Set B	Set C
Replace most resistors	yes	no	no	no
Replace most capacitors	yes	no	no	no
Replace deflection yoke	yes	no	no	no
Replace video detector	yes	yes	no	no
Replace audio detector	yes	no	no	yes
Replace horizontal phase detector	yes	no	yes	yes
Replace power rectifier	yes	no	no	yes
Adjust tuner oscillator	yes	no	yes	yes
Replace inter-stage transformers	yes	no	no	no
Replace size and linearity controls	yes	no	yes	yes

General Electric Co., Television Receiver Dept., Syracuse, N. Y.

Never over or underheats!

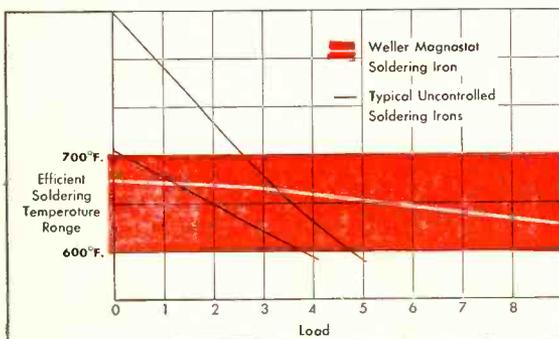
Gives
more reliable
soldering!



with built-in **MAGNASTAT**
Temperature Control

A revolutionary new soldering tool from Weller—long-time leader in the soldering field. Automatically maintains correct soldering temperature—and it's all self-contained. Sensing device is in the tip. Unmatched for reliable TV, radio, printed circuit and other precision soldering. 3 models available for all your service requirements from controlled lower temperature to heavy electrical soldering. Priced from \$8.00 list, up.

SOLDERING IRON PERFORMANCE — Temperature vs Load



Order From Your Distributor or Write for Bulletin

WELLER ELECTRIC CORP.

601 STONE'S CROSSING ROAD
EASTON, PA.

LETTERS

To the Editor

Stereo Reprints

Editor, ELECTRONIC TECHNICIAN:

"Stereo 1959" looks like it might be a terrific edition. I would appreciate about five extra copies, and also the cost of reprints in lots of 100, 250 and 500.

CECIL E. HEARD

Heard's Radio Service
Austin, Texas

• We hope you find "Stereo 1959" (pages 41-100 in this issue) interesting. More important, we hope you will distribute or sell the reprints to promote your hi-fi stereo work among your customers. Reprints of this 60-page section, nationally advertised at 50¢ each, are available to the trade at the following prices:

Single copies	.....	20¢ ea.
10 to 49 copies	.....	12¢ ea.
50 to 99 copies	.....	11¢ ea.
100 to 499 copies	.....	10¢ ea.
500 to 999 copies	.....	9¢ ea.
1,000 and over	.....	8¢ ea.

—Ed.

Radiation Hazards

Editor, ELECTRONIC TECHNICIAN:

We know that prolonged exposure to certain rays can be detrimental to our health. We understand that a TV set throws out a certain amount of X-rays. What is involved with color TV? What is the best protection? How will it affect us? I don't know if I have raised a question you can't answer yet, but information on this score would benefit all electronic technicians.

MICHAEL LIZAK

Elmont, N.Y.

• After studying the problem for more than two years, we can answer your questions. See "What Every Technician Should Know About Atomic Radiation & TV X-Rays," pages 30-31 in this issue.

—Ed.

Honest Date

Editor, ELECTRONIC TECHNICIAN:

Considering the complaints you are receiving on the delivery time of your magazine [August Letters], you might want to know that at least this technician appreciates the fact that you do not falsely date your issues one month ahead. I've been in the field since 1932, and I receive only three trade magazines. August issues of all three arrived within one week. Those who complained should retain their subscriptions so they will continue to receive accurate and up-to-date information.

VERN W. MAXWELL

Radio & TV Sales and Service
Cantrall, Ill.

(Continued on page 18)



For dependability and long life use ZENITH QUALITY BATTERIES



EXTRA PROFIT ITEM!

Zenith Mercury Batteries

Zenith pioneered the use of Mercury cells for transistor radios. They are easy to sell, because they provide up to four times the playing life of ordinary cells — and they provide extra profits because of higher unit price.

Specially engineered for transistor radio operation

Dependability is built into every battery that carries the Zenith name. Advanced design provides maximum hours of listening pleasure. Special construction insures long life and keeps batteries fresh longer.

Rigid manufacturing specifications, production quality controls and performance tests make doubly certain that all Zenith batteries are completely dependable and insure customer satisfaction. A complete line of Zenith batteries is available from your Zenith distributor.

*40 years of leadership in radionics exclusively.
The quality goes in before the Zenith name goes on.*

SEE YOUR ZENITH DISTRIBUTOR

ZENITH [®] MEANS QUALITY

ZENITH RADIO CORPORATION • PARTS AND ACCESSORIES DIVISION
6001 W. DICKENS, CHICAGO 39, ILLINOIS

HOW TO CREATE MORE CONFIDENCE IN YOUR SERVICE BUSINESS

FREE! Colorful comic books, window streamers, window display to help tell your customers all that goes into servicing TV sets!

It takes a lot of work, costly equipment and know-how to be a radio and TV serviceman. No one knows this better than you. But, chances are, your customers *don't!*

But now you can give them an insight into your work with this free "The Story Behind TV Service" kit that tells how complicated your job is . . .

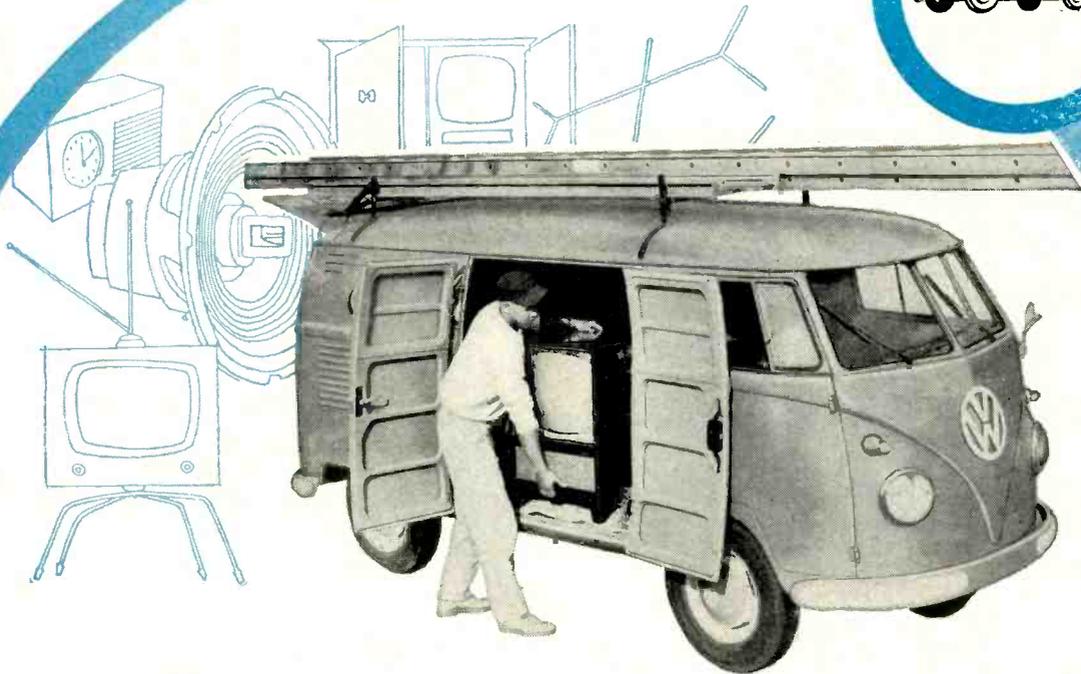
how much study it required to learn . . . and how expensive it was getting started. Told in interesting cartoon technique, the booklets are something everyone will read—and understand!

So put these good-will ambassadors to work building consumer confidence for you.

CALL YOUR WESTINGHOUSE DISTRIBUTOR

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

Electronic Tube Division • Elmira, New York



Makes friends on every call...and money, too!

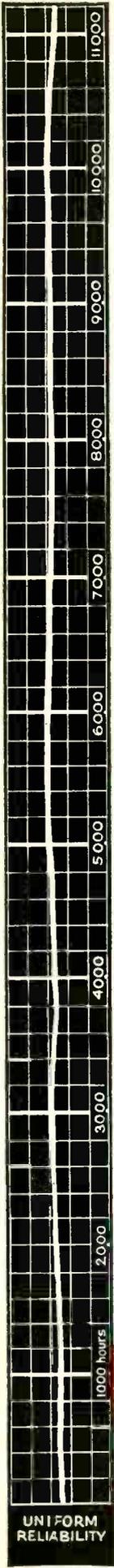
The Volkswagen Panel Delivery gives you more usable, easily accessible loading space . . . 170 cu. ft., with a payload of 1830 lbs. You can install a complete shop inside for tools, parts and test equipment. This saves time, money and unnecessary trips. Plus: plenty of advertising space to promote your business.

Besides Volkswagen's roomy and practical design, outstanding gas economy, ease of handling and parking, its great popularity is based on its remarkably low maintenance. The engineered dependability of every Volkswagen is backed up by world-famous  service in all 49 states. When service is needed, every  owner gets the best. The investment in a Volkswagen Truck pays dividends. Real savings mile by mile add up year by year. Ask your authorized  dealer to show you the operating cost records for a Pick-up Truck, Panel Delivery, or Kombi Station Wagon. A Volkswagen costs less to buy, run, and maintain.

VOLKSWAGEN DELIVERS THE GOODS...FOR LESS!



VOLKSWAGEN



RCA "SPECIAL RED" TUBES

10,000 hours—
minimum tube life



Recommended whenever uninterrupted service, unattended operation, and absolute reliability are demanded in industrial electronic equipment. Each tube is warranted for 10,000 hours, minimum life. Available at your RCA Industrial Tube Distributor.



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

New characteristics booklet (RIT-104A) on RCA "Special Red" Electron Tubes—and other RCA Receiving-Type Tubes for Industry and Communications. For your free copy, write RCA Commercial Engineering, Section 1-46-Z, Harrison, New Jersey.



(Letters. Continued from page 14)

We're Lifesavers

Editor, ELECTRONIC TECHNICIAN:

I am very pleased with my subscription to your magazine. Your July 1958 issue was my lifesaver. My scope is working again.

ALBERT J. ZIMA

Pittsburgh, Pa.

Transistor N 'n P

Editor, ELECTRONIC TECHNICIAN:

I have been wondering why the transistor manufacturers don't use the letters P and N, instead of just N, as in 2N111. I'd suggest they use the letter P in designating PNP units, and N for NPN types.

THELMAR LELAND

Joliet, Montana

A Winner

Editor, ELECTRONIC TECHNICIAN:

You may be interested to learn that my first draft of the winning entry in the RCA Serviceman Contest this spring was made on the entry blank on the back of your publication. This won me the top prize in this area of an MG roadster. My own initials!

M. G. GOLDBERG

Beacon Radio & TV Service
St. Paul, Minn.

Joining IRE

Editor, ELECTRONIC TECHNICIAN:

I am interested in industrial electronics and communications. How do I get into the Institute of Radio Engineers?

MITCHELL E. MILLER

Augusta, Ga.

• Write for an application blank to the Institute of Radio Engineers, 1 E. 79 St., New York 21, N.Y. The application requires references from three IRE members. And don't forget membership in your local service association.—Ed.

Association Listing

Editor, ELECTRONIC TECHNICIAN:

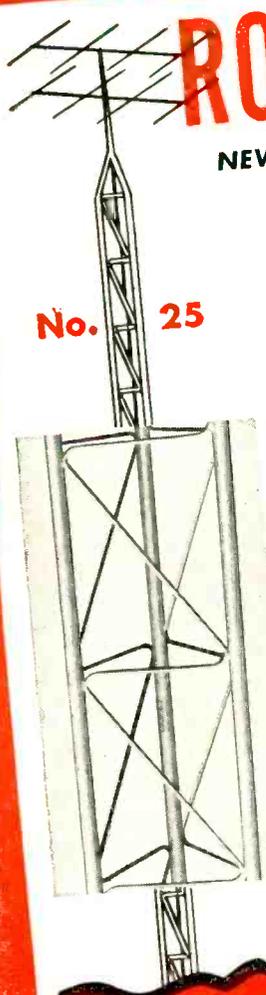
Our association was conspicuously missing from your May Directory listing. TEA of Houston, Texas has been in existence since Oct. 13, 1949, beginning with 12 members. Now we have just under 100 member shops, including most of the larger independents. We are part of the TEA statewide organization, and are not affiliated in any way with ETA or TESA (HATS) of Houston.

WM. A. SMITH
Secretary

Texas Electronic Technicians Assoc.
Houston, Texas

ROHN Designs Amazing No. 25 Tower to reach new heights in tower engineering

NEW GENERAL-PURPOSE COMMUNICATION OR HEAVY-DUTY TV TOWER



ROHN now offers a tower a full 33% stronger and more durable than similar sized and similar type towers that are found on the market today!

These amazing results are achieved through using heavier-duty side rail tubing, quality steel that is of the highest grade and a new "zig-zag" cross bracing design.

The strength of this tower allows it to be self-supporting under most condi-

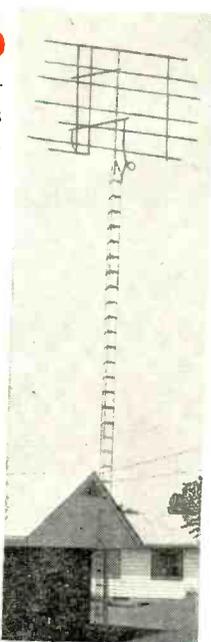
tions to 50' and under guyed conditions up to 150'. The tower has been built to fit a tremendously wide range of needs in communications, amateur use and as a heavy-duty TV tower.

FLASH! The "RohnKote" enameling plant is in operation and ROHN products are available not only in **HOT-DIPPED GALVANIZING** but also in a specially developed 6-step enameling process known as "RohnKote".

NOW! 10 Different Lines of ROHN TOWERS, Including:

No. 6

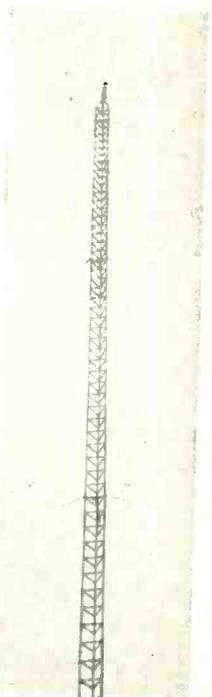
Widely used for home TV, this tower features "magic triangle" cross bracing construction.



Packaged Towers in which the sections nestle inside each other.

No. 40

Heavy-duty communications tower suitable self-supporting at heights up to 60' or guyed as high as 300'. Ideal for communications uses of all types, microwave, radio telephone, etc.

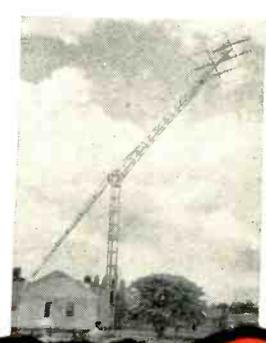


No. 20 & 30

Heavy-duty communications towers in RohnKote enamel.

Fold-Over Towers

Ideal for amateurs and experimenters inasmuch as the tower folds over for convenient antenna changing, etc. Supplied in both medium and heavy-duty sizes to handle practically any size beam.



Look to ROHN for these requirements, too:

A wide line of all types of accessories for towers is available but in addition, ROHN produces a complete line of:

MASTS

ROHN masts are outstanding in design and have special features that make them the best in the field and in addition, are as low or lower in cost than any other.

TUBING

Complete line of tubing, either plain or with 6" expanded end; in 10' and 5' length; 16 or 18 gauge; and in either hot-dipped galvanized or "RohnKote" enameling.

ROOF TOWERS

Specially designed roof towers have received tremendously wide acceptance and are available from heights of 2 1/2' to 10'.

BASES

A wide selection for mast and other type installations; wall mounts—for inexpensive installations; gable mounts; special mounts for antennas; drive-in ground mounts; and dozens of other specially designed items.

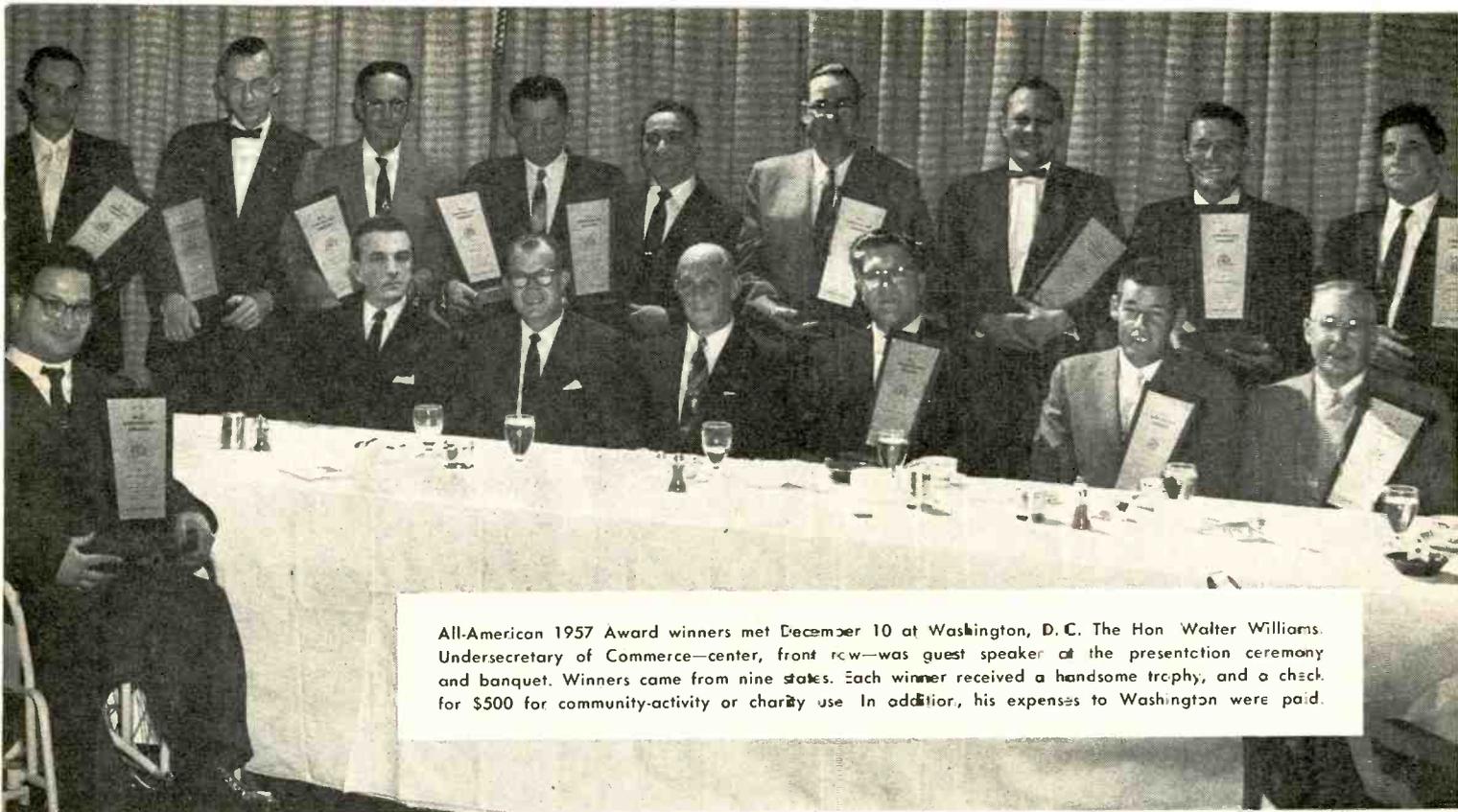
Make sure you have full details, catalog and prices on the entire ROHN line. Contact the ROHN representative in your area, or distributor, or contact:

ROHN Manufacturing Company

116 LIMESTONE, BELLEVUE

PEORIA, ILLINOIS

PHONE 4-9156



All-American 1957 Award winners met December 10 at Washington, D. C. The Hon. Walter Williams, Undersecretary of Commerce—center, front row—was guest speaker at the presentation ceremony and banquet. Winners came from nine states. Each winner received a handsome trophy, and a check for \$500 for community-activity or charity use. In addition, his expenses to Washington were paid.

1958 ALL-AMERICAN AWARDS AGAIN WILL SPOTLIGHT COMMUNITY SERVICE BY TV TECHNICIANS!

In LIFE on September 22, General Electric will advertise to 25,000,000 readers how they can help honor the many unselfish activities of TV technicians the nation over.

Afterwards—with its climax the December All-American Award presentations—a three months' General Electric advertising and public-relations campaign will underscore the message so forcefully presented in 1957: that the technicians who render television service, always are first to respond when public need arises.

Your professional standing—your service volume—will benefit from the recognition the 1958 All-American Award campaign brings you. Identify yourself closely with this nationwide program! Ask your G-E tube distributor for display and other material to help make your shop All-American headquarters! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro Ky.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

11-11-126



YOUR TV SERVICE TECHNICIAN ...
Helping others is his hobby!

General Electric announces the second annual All-American Awards for Television Service Technicians who have distinguished themselves in public service.

Who ever community needs a helping hand, the TV Technicians of America willingly give it their time and skills. Last year G.E. published the 1957 All-American Award to honor recipients in their own field for their very public service activities, honoring them because pictured on this page along with seven others.

This year, ten TV Technicians who, in the opinion of the Judges, have achieved the most distinguished records in public service in the 12 months ending September 30, 1958, will receive coveted All-American Award trophies plus \$500 each with which to further their community activities.

General Electric All-American Awards judges for 1958 will be: **W.F.S. Williams, Undersecretary of Commerce, Washington, D.C.** and **Walter Williams, Undersecretary of Commerce, Washington, D.C.**

Don't lose it again! If you know a TV Service Technician who qualifies for one of these awards, send his name, address, and description of his community activities to: **All-American Award Committee, Attention: Tube Distributor, General Electric Company, Owensboro, Kentucky.**

WINNERS TO BE ANNOUNCED IN DECEMBER

GENERAL ELECTRIC



New Books

Books marked with an asterisk (*) may be obtained prepaid from Electronic Technician

***MAGNETIC RECORDING TECHNIQUES.** By *W. Earl Stewart*. Published by McGraw-Hill Book Co. 272 pages. Hard cover. \$8.50.

This technical text on magnetic recording devices, performance and operating procedures should appeal to the advanced technician involved in audio work. From basic recording and reproducing processes, the text goes through materials, ferromagnetism, mechanisms, recording standards and equipment function and design.

***OSCILLOSCOPE TECHNIQUES.** By *Alfred Haas*. Published by Gernsback Library. 224 pages. Soft cover, \$2.90; hard cover \$4.60.

Hundreds of scope pattern photos are included in this practical volume on working with the oscilloscope. Accessories such as the electronic switch, wobulator, calibrator and marker are described, along with fault patterns, methods of checking receiver circuits and display characteristics of rectifiers, tubes, dielectrics and other components are discussed.

TECHNILOG. Prepared by *University Loudspeakers*, 80 S. Kensico Ave., White Plains, N.Y. 64 pages. Soft cover. \$1.

A most informative manual on sound system planning, complete with charts, tables and product information on the company's line, this book focuses on a wide variety of speakers. Selection and installation for various applications are explained in detail. Included are drivers, reflex trumpets, projectors, paging speakers, explosion-proof and submergence-proof types and line matching transformers.

HOW TO MARK GOODS FOR A PROFIT. By *Irving Goldenthal*. Published by Chilton Co., 56 & Chestnut Sts., Philadelphia 39, Pa. 57 pages. Soft cover. \$1.25.

This compact little book presents the basic elements of cost and pricing analysis, including markon percentages, cash discounts and retail psychology. Typical problems are presented for practice computation. It's an elementary book for the merchandising beginner.

***ELECTRONIC COMPONENTS HANDBOOK.** Edited by *Keith Henney and Craig Walsh*. Published by McGraw-Hill Book Co. 368 pages. Hard cover. \$12.50

Intended primarily for equipment designers, this second volume also contains much information of interest to electronic technicians. Subjects covered include power sources, fuses, circuit breakers, indicating instruments, printed wiring, solder, blowers and transmission lines.

TOBE

America's Fastest-Growing Service Capacitor Line...



NEW!

TOBE MYLAR* MOLDED TUBULAR CAPACITORS

- Molded of DuPont Mylar, one of the finest insulation materials ever developed.
- Thermoset Case Construction secures leads and sections firmly to withstand extremes of handling, vibration, shock and soldering temperatures.
- High Insulation Resistance: Average megohm values per unit 10,000 at 25°C. Small capacitance variation with thermal change.
- Temperature Operating Range: -55° to +130°C.
- Moisture Resistant: Exceeds JAN-C-91 requirements.
- Non-Inductive: Extended foil construction insures low resistance connections and low RF impedance.

DESIGNED FOR SERVICE DEALERS



NEW TOBE MYLAR* CAPACITOR KIT

FREE KIT CONTAINS
80 CAPACITORS

ONLY

\$15⁸⁴

Compact, clear-plastic dispenser contains an assortment of 80 Tobe Mylar capacitors in the most popular sizes, ratings and quantities for quick, efficient servicing. Covers over 60 different ratings at 200, 400 and 600 working volts and from .0001 to 1.00 mfd. Dealer pays only for the Tobe Mylar capacitors, kit is free.

Today, order
your Tobe Mylar
Kit from your
Tobe Distributor



TOBE

RADIANT

CAPACITORS

CORNELL-DUBILIER CAPACITORS



The extra values are "on the house"

Want more capacitor for your dollar? Here's how:

Cornell-Dubilier has originated a "preferred-type" program on twist-prong electrolytics. Now, a relatively few types fill over 90% of all replacement requirements. You need less — to do more. Fewer types means improved production efficiency, lowered costs — savings to you. How is it done? Instead of producing hundreds of types with odd and critical capacitance and voltage ratings, each "preferred type" carries the *highest* value and rating called for in each category. In most cases you get *more* capacitor at *lower cost* — plus added safety factor, improved performance and "call-back" protection. It's on the house! To get more capacitor for *your* dollar, ask your C-D Distributor about Preferred Type Twist-Prong Electrolytics or write Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.



CORNELL-DUBILIER CAPACITORS

Consistently Dependable

*MAGNETIC TAPE RECORDING. By H. G. M. Spratt. Published by The MacMillan Co. 319 pages. Hard cover. \$8.50.

This thorough technical text starts with principles of magnetism and recording, goes through tape manufacture and testing, and into recording machines for music and dictation. One chapter is devoted to testing tape recorders, and another covers tape recording applications such as machine tool control, medical and data recording uses.

Specially Selected
List of Electronic Books
See Pages 36 & 37

News of the Industry

INTERNATIONAL RECTIFIER CORP. has promoted J. T. CATALDO to Vice Pres. in charge of sales.

VOKAR CO. has moved to larger quarters. The new address is 201 East Catherine St., Ann Arbor, Mich.

PACO ELECTRONICS CO. is now making test equipment kits available factory pre-wired, tested and calibrated, to supplement the existing series.

GENERAL ELECTRIC Receiving Tube Dept. reports that the 1958 All-American Awards program will, as in the past, bring trophies and checks for \$500 to ten TV service technicians who have performed outstanding community services. Nomination deadline is Oct. 12.

P. R. MALLORY & CO. INC. announces the promotion of IRA SLATER to Manager, Sales Engineering, Vibrator Division, from Sales Manager of the division. FRED H. LARRABEE, JR. becomes the division's Sales Manager.

GOOD-ALL ELECTRIC MFG. CO. recently dedicated the opening of the firm's fifth separate manufacturing plant in Ogallala, Nebr. Electronically operated golden shears cut the ribbon opening the new plant.

JERROLD ELECTRONICS CORP. has purchased the Muscle Shoals Television Cable Corp., which brings to 10 the number of community antenna systems owned by the firm, and the number of subscribers to approximately 30,000. Also, continuing their sales organization expansion program, JEREMIAH E. HASTINGS has been appointed Assistant Sales Manager of System Sales Division.

JENSEN MFG. CO. reports that **FRANK D. LINTERN** has joined the firm as Assistant Sales Manager of the Distributor Division.

CBS-HYTRON announces a new full color 19" x 23½" picture tube display card, which tells customers "You can check your own picture tube." The card asks questions and gives answers to potential tube purchasers.

INTERNATIONAL TELEPHONE & TELEGRAPH CORP. reports the appointment of **JOHN E. GINGRICH**, Vice Pres., as Director-Special Programs for ITT. **GINGRICH**, formerly Pres. of Federal Telephone & Radio Co., a division of ITT, will be succeeded in that post by **DELBERT L. MILLS**, Exec. Vice Pres. of FTR.

VACO PRODUCTS CO. reports the promotion of **ROY VETZNER**, from Sales Manager, to Vice Pres. and Director of Sales. Also, **SAM POLLACK**, a Director of the Company, has been named Executive Vice Pres. and Treas.

CORNELL-DUBILIER ELECTRIC CORP. and the **RADIART CORP.** has named the top prize-winner in their nationwide contest as **FREDERICK DIEHL**, TV service manager for **TRAY-NOR DEAN**, Tampa, Fla. He has been awarded a new 1958 Plymouth station wagon for submitting the best name for the new TR 15/16 CDR Antenna Rotor that is being marketed by both firms. There were over 15,000 entrants.

Reps & Distributors

NAT'L ELECTRONIC DISTRS ASS'N (NEDA) will hold its 13th Regional Seminar at Kansas City, Mo., Sept. 19, 20, and 21. NEDA states that those in attendance at the previous 12 seminars derived many benefits from these short course educational forums.

TRIAD TRANSFORMER CORP. has added the following sales representatives: **BERLIANT ASSOCIATES**, with offices in Long Island, Albany and Syracuse, for upper New York state; **BLAIR-STEINBERG CO.**, with offices in Yonkers and Moorestown, N. J., for metropolitan New York; **GENE S. ROOT & CO.**, Pittsburgh, for western Penna. and W. Va.; **ARTHUR H. BAIER CO.**, Cleveland, for Ohio jobber sales; **FRANK KAHSAR**, Cincinnati, for Ohio industrial sales; **CHARLES BOISENET**, **TRIAD TRANSFORMER CORP.**, Huntington, Ind., for Ind. jobber sales; **E. S. NEEDLER**, Ft. Wayne, for Ind. industrial sales; **HENSCHEN**, **JENSEN & CO.**, Detroit, for Mich.

CORNELL-DUBILIER VIBRATORS



Built to last... a type for every radio

The C-D brand name on a vibrator is your guarantee of dependable performance, long trouble-free service. Because C-D vibrators are built to last, you can use them with full confidence. That's why it pays to reach for a C-D when a replacement is called for.

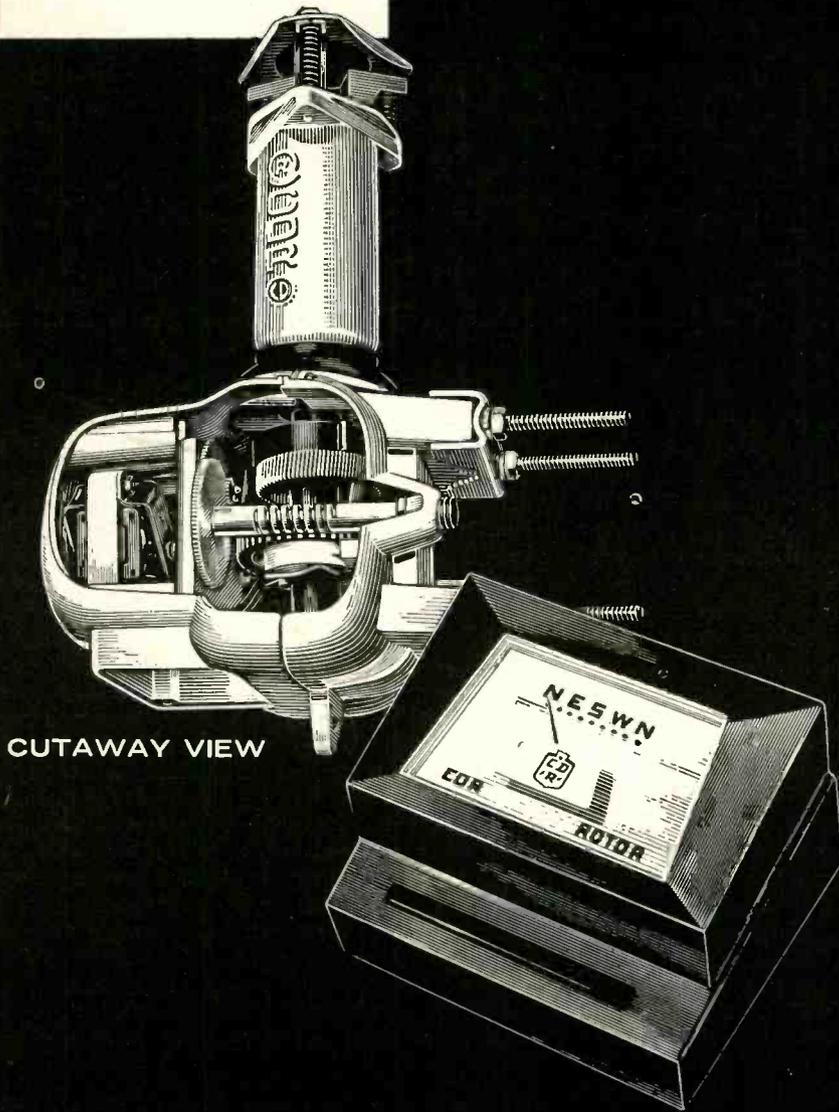
Remember, too, that there's a C-D vibrator type for every make and model car on the road. And the C-D VIBRATOR REPLACEMENT GUIDE makes it quick and easy for you to select the exact type required. Ask your local C-D distributor for a free copy of VIB-3, or write to Cornell-Dubilier Electric Corp., S. Plainfield, N. J. Dept. RT-98.



CORNELL-DUBILIER VIBRATORS

Old Hands at Dependability

CDR ROTORS



All new features

Completely designed from the ground up, CDR Model TR-15 and TR-16 Rotors have features never before available in the popular price range. Check these refinements and you'll see why: Quick mounting mast collet... speedy installation (no loose parts to assemble)... self-centering sawtooth clamps take masts up to 1½" O.D.... instant locking prevents drift... mechanical brake releases magnetically... instantly reversible... makes complete revolution in 45 seconds... meets JAN salt water test... great strength thrust bearing support... low weight... completely weather-sealed... fits standard towers... streamlined to reduce wind resistance... mahogany or blonde finish control box. Get full details today from your local CDR distributor.

CORNELL-DUBILIER ELECTRIC CORP.
South Plainfield, New Jersey

THE RADIART CORPORATION
Indianapolis, Indiana



CDR

Antenna Rotors

Old Hands at Dependability

VOKAR CO. has appointed **MINGINS SALES CO.** as the firm's metropolitan New York distributor representative.

JERRY GREENBERG ASSOCIATES, mfrs' rep firm, is now located in new quarters at 514 Broadway, New York 12, N. Y.

JERSEY SPECIALTY CO. reports appointment of **MORTON L. FRIEDMAN,** Chicago, Ill., as the firm's representative for Ill. and eastern Wis.

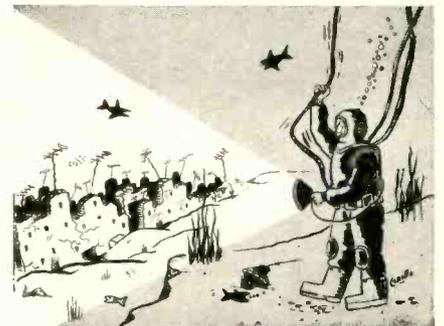
PEERLESS PRODUCTS INDUSTRIES has announced the appointment of 3 representatives: **J. F. ANDERSON CO.,** Alexandria, Va.; **E. L. PARK,** Southampton, Pa.; **THOMAS P. ANDREWS & CO,** Lakewood, Ohio.

HENRY LAVIN ASSOCIATES announces that **VERNON A. LEE,** formerly sales manager of Sessions Clock's industrial products div., has joined their organization as associate sales engineer.

THOMAS SHELBY & CO., 319 S. Franklin St., New Bremen, Ohio, is a new rep firm serving distributors and manufacturers in Ohio, western Penna. and W. Va. **SHELBY** formerly was general sales manager for **CROWN CONTROLS CO.**

"**THE REPRESENTATIVES**" of Electronic Products Mfrs. has set up a new geographical district system by which the country is divided into three districts. Each district is headed by its own vice president, who have been appointed as follows: **NORMAN KATHRINUS,** of St. Louis, Central District; **WALLY SHULAN,** Jersey City, N. J., Eastern District; **W. BERT KNIGHT,** Los Angeles, Western District.

ERIE RESISTOR CORP. announces the following appointments as sales reps for the distributor div.: **JAMES ECKERSLEY,** Portland, Ore., for the Northwest territory; **BRANUM SALES,** Dallas, Texas, for the Southwest territory. **HAROLD MOYER,** Haddenfield, N.J. will handle sale of amplifier kits, tuners and cartridges for the Mid-Atlantic territory. **MARTIN & DIAL,** Highland Springs, Va., will sell these products in Va.



Catalogs & Bulletins

COMPONENTS: A new 24-page catalog covers pressurized and waterproof plugs and receptacles; caps; waterproof cable clamps. Includes illustrations and specifications. H. H. Buggie, Inc., P. O. Box 817, Toledo 1, Ohio (ELECTRONIC TECHNICIAN B9-3)

CAPACITORS: Type WT, wire tantalum capacitors in subminiature sizes are covered in a catalog sheet. Operating temperature, voltage, ratings, stock values and other specifications are included. Aerovox Corp., New Bedford, Mass. (ELECTRONIC TECHNICIAN B9-1)

CAMERA ENCLOSURES: A new catalog sheet describes and illustrates weather proof and dust proof enclosures for closed-circuit TV cameras. Both air-cooled and water-cooled units are covered. Dage Television Div., Thompson Products, Inc. Michigan City, Ind. (ELECTRONIC TECHNICIAN B9-6)

WIRE MARKERS: A new 8-page, 3-color catalog covers a wide variety of pressure sensitive wire markers which are available on instant-release dispensing cards. Illustrations and price lists included. North Shore Nameplate, Inc., 214-27 Northern Blvd., Bayside 61, N. Y. (ELECTRONIC TECHNICIAN B9-7)

TRANSFORMERS: Catalog No. P258G is a comprehensive reference manual of 102 pages designed to serve as a guide for the selection and ordering of variable transformers. Connection diagrams and ratings are included. Superior Electric Co., Bristol, Conn. (ELECTRONIC TECHNICIAN B9-11)

TEST EQUIPMENT: A new catalog, No. ASC-300, describes: The AR-660 Multitester, a miniature unit weighing 10 oz., and the AR-230 Power Megaphone weighing 4 $\frac{1}{4}$ lbs. including batteries. This megaphone is a hand-held type, with pistol grip. Argonne Electronics Mfg. Corp., 165-11 South Rd., Jamaica 33, N. Y. (ELECTRONIC TECHNICIAN B9-2)

CAREER GUIDEBOOK: "How To Make Money In Radio, TV, Electronics & Color TV" is a 16-page catalog giving full descriptions of radio-TV courses and complete listing of all lessons for each course. The Career Opportunities section gives a breakdown of positions, qualifications, salary range, etc. Radio-Television Training Association, 52 E. 19 St., New York 3, N. Y. (ELECTRONIC TECHNICIAN B9-9)

(Continued on page 102)

RADIART VIBRATORS



Consistently dependable power

Next time an auto-radio vibrator replacement is called for, try Radiart. There's a complete line for all 6-volt and 12-volt applications. And no waiting for the type you want, because your local Radiart Distributor maintains a full stock for your convenience. Ask him for your free copy of the Radiart Vibrator Replacement Guide, or write to Dept. ET-9, The Radiart Corporation, Indianapolis 5, Indiana.



RADIART TOBE Vibrators

Old Hands at Dependability

a RAYTHEON designed tube



the OZ4

has set the most spectacular record in receiving tube history

Way back in 1937, the Raytheon Manufacturing Company introduced and produced the Raytheon OZ4 — a gas-filled rectifier tube designed specifically for car radios. So nearly perfect is this tube in design, construction and operating ability, that it has never been equalled. For more than 21 years it has withstood performance challenges from many prototypes, but, one by one, all have fallen by the wayside and the Raytheon designed OZ4 remains the ideal tube for the job it was designed to do.

We point with pride to the OZ4 triumph because it is engineering and design know-how like this, teamed with production skill and craftsmanship, that goes into the design and manufacture of the complete line of Raytheon TV and Radio Tubes. That's why you can use Raytheon Tubes for replacement work with complete confidence that you are giving your customers tubes that are second to none in design, in quality, in performance — tubes that are truly RIGHT...for SOUND and SIGHT!

And Now From Raytheon, The "Voice" of The Satellites

Today, as yesterday, Raytheon leads the way. Raytheon Transistors help send coded messages from America's Satellites to receiving stations on earth. 14 of America's major guided missiles use Raytheon Tubes and Semiconductors — further proof of the superior performance, dependability and manufacturing excellence of Raytheon products.



RAYTHEON MANUFACTURING COMPANY

DISTRIBUTOR PRODUCTS DIVISION

NEWTON 58, MASS. CHICAGO, ILL. ATLANTA 6, GA. LOS ANGELES 7, CALIF.
55 Chapel Street 9501 Grand Ave. (Franklin Park) 1202 Zonolite Rd. N.E. 2419 So. Grand Ave.

Raytheon makes all these } Receiving and Picture Tubes, Reliable Subminiature and Miniature Tubes, Semiconductor Diodes and Transistors, Nucleonic Tubes, Microwave Tubes.



Excellence in Electronics

ELECTRONIC TECHNICIAN

Including
Circuit Digests

Stereo—New Opportunity for Technicians

Stereophonic sound is the latest and most exciting development in high fidelity. It has stirred the public's desire to add the dimension of depth to its listening pleasure.

Service technicians have been playing an increasingly important role in installing, selling and repairing monophonic hi-fi. With stereo their role is vital.

This month marks the opening of the stereo boom. Stereo equipment has already been placed on the market by many manufacturers; still more is on its way. Millions of music lovers in every village and city will be actively interested in adding stereo to their home entertainment. Stereo has broad market appeal, far beyond the limited audiophile interest of past years.

The overwhelming majority of potential stereo customers are not skilled in electronics. Only a relative few are technically qualified to convert their monophonic sound systems to stereo. So whether a complete new stereo installation is required, or a conversion, the electronic service technician is the man to do the job. He has the know-how, instruments and invitation into the home.

Service dealers are selling, as well as servicing stereo. Those who can afford to stock such equipment often buy directly from the manufacturer. But most act as non-stocking dealers, buying components from their local hi-fi distributor at a discount below consumer price. When a service dealer makes a sale, he derives profit both from the dis-

count margin and the installation charge.

The technician is the only electronic expert in regular contact with the public, so consumers naturally turn to him for hi-fi advice. Based on a recent study by the Institute of High Fidelity Manufacturers, during the past year, over 8,000,000 Americans did just this. With stereo now on its way toward a fabulous future, still more consumers will be asking for your advice . . . and services.

To help you answer consumer questions on stereo—and to provide you with the basic background required for getting stereo business—a complete section of this issue is devoted exclusively to the subject. In addition to technical articles and a stereo manufacturer directory, this pioneer publishing project—STEREO 1959—includes the first stereo product catalog. For your own reference, and to sell or give away to your prospective stereo customers as part of an educational-sales program, extra copies of STEREO 1959 are available at moderate cost.

If you have ever hoped to get in on the ground floor of some financially rewarding phase of electronic servicing, we can only say that stereo is it. Putting it off will only mean that other electronic-TV service outlets will have become the hi-fi stereo sales and service centers in their areas.

Get into stereo now. If you have technical or business questions, ask ELECTRONIC TECHNICIAN's editors. We have helped other readers get started. We can help you.

Tuning In the

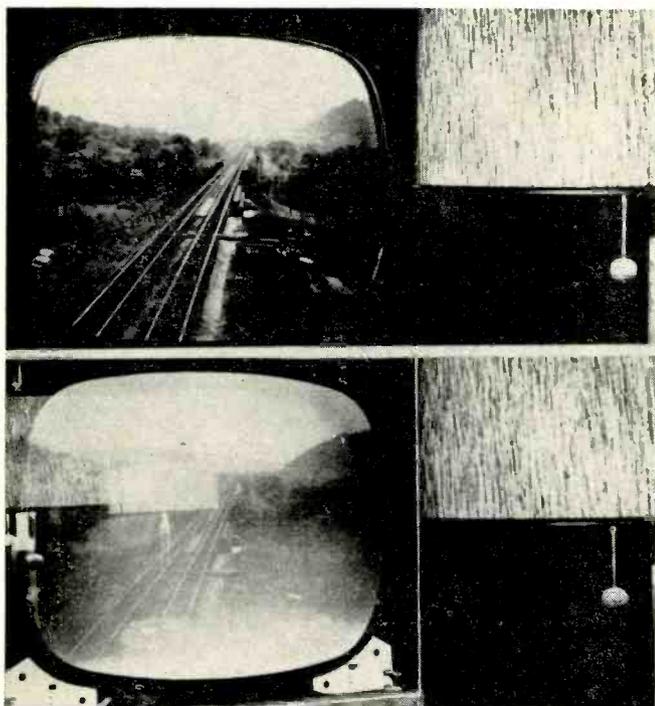
UHF VIEWER HOMES decreased 8% from 3,864,560 in 1956 to 3,563,960 in 1958, reports Nielsen. However, the ratio of UHF-TV viewers to non-viewers in areas served by UHF stations actually increased because the total number of TV homes in these areas decreased 24% to 5,238,180 currently. Geographic breakdown of UHF homes, together with 2-year gain or loss, is as follows: Northeast, 1,108,160, up 15%; North Central, 1,465,480, up 4%; South, 701,020, down 31%; West, 289,300, down 38%; and Pacific, 289,300, down 38%.

SUBSCRIPTION TV has been placed on the shelf again. Under pressure from Congress not to grant pay TV licenses until legislation has been considered, the Federal Communications Commission has decided not to grant trial authorizations until the adjournment of the next session of Congress. The FCC will continue to accept applications, however, while maintaining the status quo.



FEDERAL TRADE COMMISSION has approved a consent order prohibiting Muntz TV from exaggerating the horizontal size of picture tubes in its sets, or misrepresenting that the sets are sold directly from factory outlets when they were in fact sold by retailers who buy the receivers from the company. When diagonal measurements are used in promotion, this fact or the actual viewing area in square inches must be conspicuously disclosed.

CRT ELIMINATES FACE PLATE



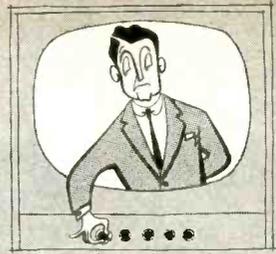
New picture tube (top) developed by Pittsburgh Plate Glass eliminates conventional safety glass (bottom). Curved etched window is laminated to tube face by layer of polyester resin. Improvements reported are less reflection, 8 to 9% brightness increase, no inside glass surface cleaning, and 3 to 4 in. shallower cabinet depth possible.

BUSINESS UPSWING in the third and fourth quarters of 1958 is expected by most manufacturers, reports the National Credit Office.

EMPLOYMENT OUTLOOK FOR TECHNICIANS, a report by the Bureau of Labor Statistics and Veterans Administration, states that technicians who work with engineers are one of the fastest growing occupational groups. The government employs over 31,000 technicians, with close to 6000 of them electronic technicians. Two out of three earn between \$4525 and \$6250. In private industry, electronic technicians earn between \$1.75 and \$3 an hour. Listed as VA pamphlet No. 22.1, the report is available from the Superintendent of Documents, Washington 25, D. C., for 25¢.

NEW SEMICONDUCTOR DEVICE called a silicon controlled rectifier is capable of replacing relays and certain industrial power tubes, according to its developer, General Electric. These rectifiers, still in the laboratory stage, will be ready for commercial use in motor controls and switching panels in the fall of 1958. Their application in home appliances is at least two or three years away.

Picture



OLD STORY. Los Angeles newspapers played up the arrest of employees and owners from three TV repair firms for fraudulent overcharges. Bunko squad detectives were quoted as saying the arrests were "only the beginning." Not even in small type was mention made of the hundreds of thousands of customers who received good service at fair—or even too low—cost.

ELECTRONIC SEX DETECTOR was displayed by Farnsworth Electronics Div. of ITT at the Wescon show in Los Angeles. Show visitors stepped in front of an infrared magic eye, causing a "man" or "woman" light to flash. It's done by heat detection, a woman radiating more heat than a man. Men's trousers inhibit heat radiation reaching the detector, while women's stockings do not. Of course, the machine is not too clever; a man in shorts could easily confuse it.

CALENDAR OF COMING EVENTS

- Sept. 15-19: Instrument-Automation Conference and Exhibit, Convention Hall, Philadelphia, Pa.
- Sept. 24-25: Industrial Electronic Conference, Rockham Memorial Bldg., Detroit, Mich.
- Oct. 1-2: 4th Conference on Radio Interference Reduction and Electronic Compatibility, Museum of Science & Industry, Chicago, Ill.
- Oct. 2-4: Electronic Trade Exposition, Minneapolis Auditorium, Minneapolis, Minn.
- Oct. 8-10: IRE Canadian Convention, Exhibition Park, Toronto, Can.
- Oct. 13-15: National Electronics Conference, Hotel Sherman, Chicago, Ill.
- Oct. 19-21: Electronic Industry Unity Conference, The Concord, Kiamesha Lake, N. Y.
- Oct. 27-29: Radio Fall Meeting, Sheraton Hotel, Rochester, N. Y.
- Oct. 30-31: Electron Devices Meeting, Shoreham Hotel, Washington, D. C.
- Nov. 20-22: 56th Meeting Acoustical Society of America, Chicago, Ill.
- Dec. 3-5: Eastern Joint Computer Conference, Bellevue Stratford Hotel, Philadelphia, Pa.
- Dec. 9-11: Mid-America Electronics Convention, Municipal Auditorium, Kansas City, Mo.

Hi-Fi Shows

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

Rigo Enterprises Hi-Fi Shows

- Sept. 19-21, Syracuse; Sept. 26-28, Rochester; Oct. 3-5, St. Louis; October 10-12, Cincinnati; October 17-19, Detroit; Nov. 7-9, Omaha; Nov. 14-16, Kansas City, Mo.; Nov. 21-23, Seattle.

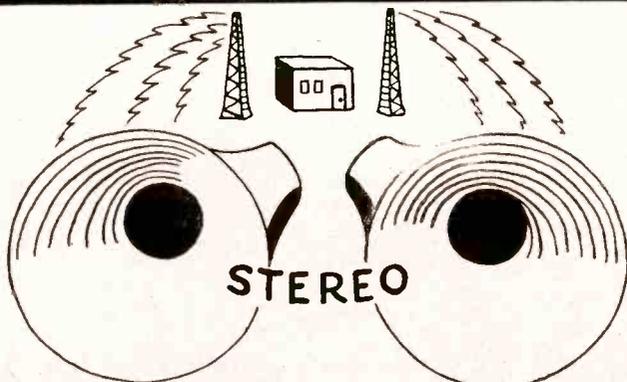
Visit ELECTRONIC TECHNICIAN

New York High Fidelity Music Show

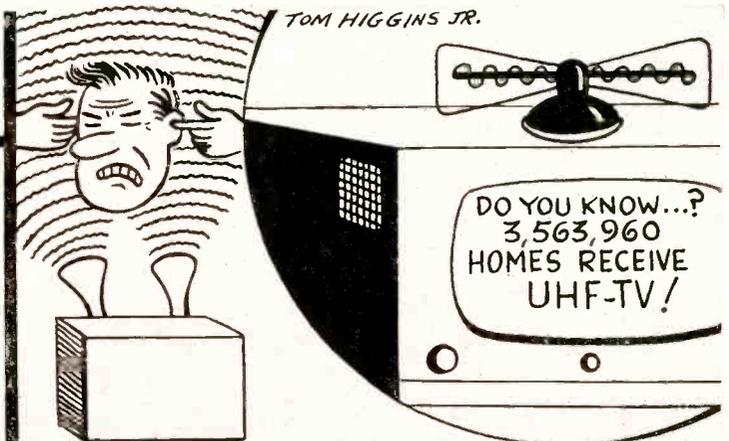
Room 420, New York Trade Show Building

September 30—October 4, 1958

RANDOM NOISE



ONE OUT OF EVERY 4 FM STATIONS AFFILIATED WITH AM STATIONS ARE BROADCASTING FM/AM STEREO PROGRAMS



COMPRESSED AIR LOUDSPEAKER BY RCA GENERATES 160 DB NOISE---20,000 TIMES AS GREAT AS NORMAL HOME PHONO LEVEL - IT'S REPORTED TO BE WORLD'S LOUDEST CONTROLLED NOISE

Atomic Radiation And

Basic Facts On Health Hazards, Allowable Dosage

ALBERT J. FORMAN
EDITOR

• Some people call this the Atomic Age. Others call it the Electronic Age. The two are closely related, not only by their mutual utilization of sub-atomic particles, but also by the use of electronic devices to control and measure atomic energy. For the future, we may expect atomic energy to be used to power electronic equipment.

All of us live in this era of radioactive fallout, charged atmosphere and still more highly charged emotions, wondering, curious, even anxious. Machines such as dental X-rays and TV receivers are now viewed with a more critical eye. The electronic technician, as the technical expert in greatest contact with the public, should have more than average interest in this subject.

Let us view the basic facts about atomic radiation. Through understanding, our curiosity and concern may be placed in proper perspective.

Before the A-Bomb

In 1895, fifty years before the atomic bomb, X-rays were discovered by Wilhelm Roentgen. Essentially, X-ray radiation is the product of charged particles striking targets made of certain substances.

Shortly thereafter, Henri Becquerel and Pierre and Marie Curie discovered the radioactive effects of the unstable element radium when it disintegrates and transforms itself into another element. Many other scientific pioneers became interested in radiation, and it was not long before two major medical facts were established: Radiation could cure people; Radiation could kill people.

Basic Definitions

The following technical terms are basic to the understanding of atomic radiation:

ROENTGEN (abbreviation: r) Quantity of radiation absorption, measured by the number of ions

produced in a cubic centimeter of air at standard conditions.

CURIE: (abbreviation: c) Quantity of radioactivity, or disintegrations/second, given off by 1 gram of radium.

HALF-LIFE: Time for a substance to decay to half its current radioactivity.

Health Hazards

Three factors make radiation (this article refers only to atomic or nuclear radiation, not electromagnetic) a matter of particularly serious concern.

1. Radiation effects on humans are the same whether the source be man-made X-rays, natural radioactive ores, or artificial isotopes (atomic variations of the same element) from H-bomb fallout.

2. Unlike X-rays which may be turned off, radioactive matter continues to give off its penetrating particles for a long time. The half-life of radium, for example, is 1600 years; after 6400 years it would still retain 1/16th of its radioactivity. For strontium-90, half-life is 28 years.

3. The cumulative impact of radiation is serious. That is, a radioactive dose does not simply strike the body and go away. Part of it adds to the total of all radiation absorbed previously. Perhaps after a latent period, many years later, the effect shows up in destroyed tissue such as eye cataracts, in sterility, undesirable genetic effects, or death.

We must temper our concern over radiation with the realization that it offers medical benefits. X-rays take photos of broken bones. Direct radiation sometimes cures cancer and ulcers. Radioactive tracers can show malfunctions in the digestive and blood systems. The problem is in control and understanding.

How Radiation Destroys

The process of radiation destruction of human tissue is extremely complex. Essentially it relates to the breakdown of normal functions in

the living cell. This is the result of radiation-caused ionization, which in turn triggers a chemical chain reaction.

The actual destruction or disturbance of molecules in the cell is not the direct cause of major damage. A dose large enough to kill a man would only affect about one molecule for every 12 million in the cell. However, the fluid in the cell also reacts to radiation, decomposing a small part into free radicals. These interact to form poisons, which damage the vital enzyme and other molecules in the cell.

Here the multiplier effect takes place, one enzyme molecule changing thousands of other molecules needed to keep the cell alive and healthy.

Poisons from the dead cells, inadequate blood supply, and other local effects destroy still more tissue.

How Much Radiation?

A dose of 500 r will usually kill a man. 250 r will give most people radiation sickness; some would die. These dosages apply to radiation of the entire body over a short period of time. The same amount of radiation given in small doses over a long period of time would probably not kill, indicating that the body has some ability to recuperate. However, damage will be sustained, and since radiation has a tendency to add up cumulatively, painful injury may show up years later. Life span is certainly shortened, about one week for every 2 or 3 r of exposure. Among the more radiation sensitive parts of the body are the sex organs, bone marrow and white cells in the blood.

The body can withstand much larger doses when applied to a limited area. For example, it is not unusual in the treatment of localized cancer to employ X-ray or radioactive cobalt radiation levels in excess of 3000 r. Such irradiation causes some damage, but the benefits are thought to outweigh them.

Television X-Rays

And Radiation From TV Picture Tubes.

Yes, radiation can either cause or cure cancer.

What is "safe" radiation? Expert opinions differ, but the general agreement appears to be 0.3 r/week or about 15 r/year. Some years ago, before new knowledge was uncovered, higher limits were thought to be safe.

With an eye on the long-term effects, radiologists have set out limits for accumulated dosages over a lifetime. Up to 28 years, 50 r is suggested; up to 38 years, 100 r; up to 48, 150 r; up to 58, 200 r. This means the 15 r/yr. limit is not recommended for exposure every year.

Typical radiation received by a 28-year old from normal background sources, such as cosmic rays from outer space, runs about 5 r, or about one-tenth of the suggested limit. However, this is just a start. A chest X-ray on film might be about 0.1 r, a fluoroscope 1 r, though an improperly operating machine often produces a 100 r dose. Dental X-rays often fall in the 2r to 8r range per photo. While these exposures are localized, and consequently not as dangerous as whole-body exposures for which the limits are prescribed, they still merit serious attention.

In addition, we must consider the increase in background radiation from bomb test fallout. Also, radioactive fallout particles which enter the body through food and water raise the body's dosage still further. We have not reached a truly dangerous fallout level yet, but we can see that scientists' concern for the future has a reasonable basis.

Radiation from TV

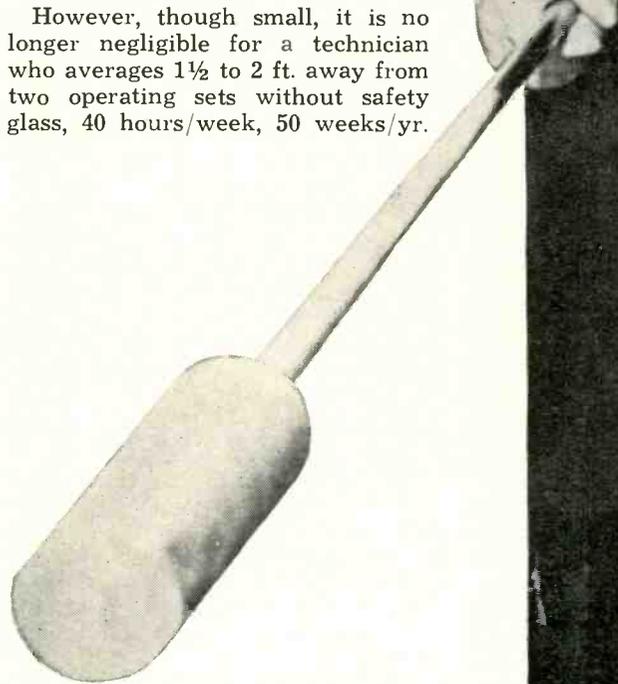
When an electron beam strikes the screen of a cathode-ray tube, X-rays are produced. Fortunately, the level is so low that the dose received by a typical home viewer is negligible. For the technician who works with TV sets day in and day out, there is still no hazard . . . but the dosage is no longer infinitesimal.

Tests indicate that a picture tube operating at 17 kv gives off less than

0.02 mr/hr. of soft (less penetrating) X-rays, at a distance of 2.5 inches from the faceplate.

X-ray radiation follows the square law similar to light intensity. That is, double the distance is one-fourth the intensity. Furthermore, the safety plate can cut radiation down by as much as a factor of about 5. So even an ardent viewer who watches 1000 hours/year from a distance of a little over 6 ft. away would receive only about 0.004 mr/yr. That is negligible, and with lower second anode voltages than 17 kv, radiation is still less.

However, though small, it is no longer negligible for a technician who averages 1½ to 2 ft. away from two operating sets without safety glass, 40 hours/week, 50 weeks/yr.



The radiation dosage would then be about 0.8 mr/yr.

Tests on 25 kv color tubes show soft X-ray radiation (hard X-rays are produced in the 50 kv range) of 0.03 mr/hr., 2.5 in. from the tube, with safety glass in place. This would indicate around 0.15 mr/hr. without the glass, or seven to eight times more potency than black-and-white tubes. Under equivalent time and distance conditions as noted above, technicians would receive 6

(Continued on page 116)

Servicing 110

Vertical Sweep Circuits

Circuit Modifications Improve Efficiency And Stability.

Minimum Additional Components Used To Obtain Increased Drive.

JESSE DINES

• The 110° CRT is part of a continuing chain of events which is changing both the physical and electrical character of the modern TV set. As streamlining goes hand-in-hand with higher speeds, and smaller TV cabinets go with the wider angle deflection tubes, so must some of the electrical circuits be modified to keep in step with some of the changes.

The vertical sweep system is no exception and enough new features have been incorporated to warrant the technician's attention. At first glance there appears to be no difference in the vertical circuits used in some of the newer sets. In spite of the fact that a 110° yoke produces a greater and more concentrated

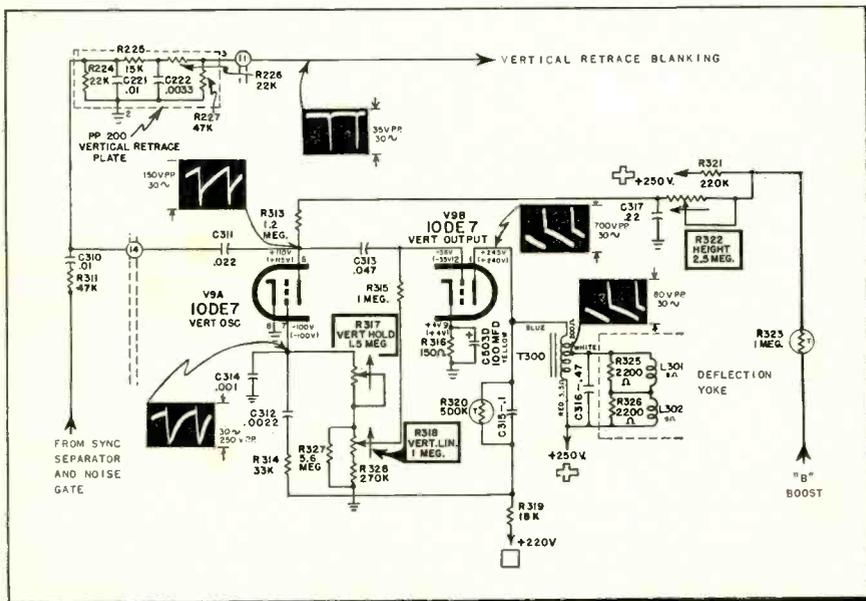
magnetic field, it requires about 20% more current than its 90° cousin.

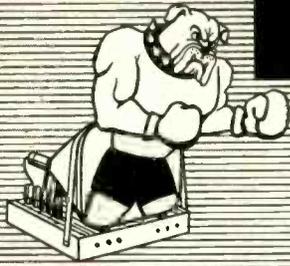
One of the later types of vertical sweep circuits for a 110° CRT is shown in Fig. 1. This circuit is unique in that it employs two thermistors for the purpose of maintaining constant raster height and frequency stability as the set warms up. The use of thermistors in this circuit is probably the beginning of a new trend in TV receiver design. Some other differences to be found include a vertical output autotransformer, having a primary winding resistance of only 200 ohms instead of the usual 500 to 2,000 ohms. A factor not readily detected from an examination of the schematic is circuit efficiency. It is sometimes more economical to improve efficiency than it is to increase the size of the power supply. Often it is necessary to do both. Except for the yoke, and thermistors, a visual

inspection of the components in the vertical section will reveal no differences. The 110° yoke is conspicuous by its very wide flare, and its smaller opening. The wide flare is necessary to permit the yoke to be positioned over the center of the deflection point, which is further forward, as shown in Fig. 2. Note how the core material is shaped to follow the contour of the CRT. Final centering adjustments are accomplished by a magnetized retaining band, or other arrangement of magnets.

Before going into a discussion of how the thermistors function, the operation of the multivibrator circuit should be understood. Fig. 3 is a simplified version of this circuit. The 10DE7 dual, but dissimilar triode tube is used as a plate-coupled multivibrator, and drives the vertical
(Continued on page 104)

Fig. 1—Except for thermistors R320 and R323, which stabilize height and oscillator variations, this 110° vertical sweep circuit is conventional.





"Tough Dog"

Corner



Difficult Service Jobs Described by Readers

Saturated Flyback

A Raytheon TV set, model C2138, came up with the bends. Horizontal pulling—to be more technical. Investigation showed that the bends occurred only when the brightness and contrast controls were set slightly higher than normal. This is a fairly common characteristic in sets not equipped with keyed agc, except that the brightness control is usually not involved.

The signal at the video detector was normal. The 6AL5 horizontal phase detector tube was removed from its socket and the hold control manipulated to obtain a stationary picture. The bend was still present. This eliminated the sync circuits as the cause of the complaint and indicated trouble beyond the horizontal afc circuit. The scope showed unwanted video signal at the plate of the horizontal oscillator tube, but not at the grid. It was now evident that the oscillator was being modulated by video information, but how? B+ was clean, there was no video signal in the power supply, and the afc and sync circuits were isolated when the 6AL5 was pulled. A careful examination of the chassis followed. The common ground on the brightness and horizontal hold controls were checked, terminal strips were examined for leakage, the chassis was examined for stray video pickup, leads were dressed and redressed, tube shields were installed—all to no avail.

I now decided to prove conclus-

ively that the fault was in the oscillator circuit. To do this I disconnected the grid of the output tube and connected an external sawtooth oscillator to it. With this substitute oscillator there was no bend. This was proof. I now checked for video signal in the output stage, expecting it to be absent. It was still there.

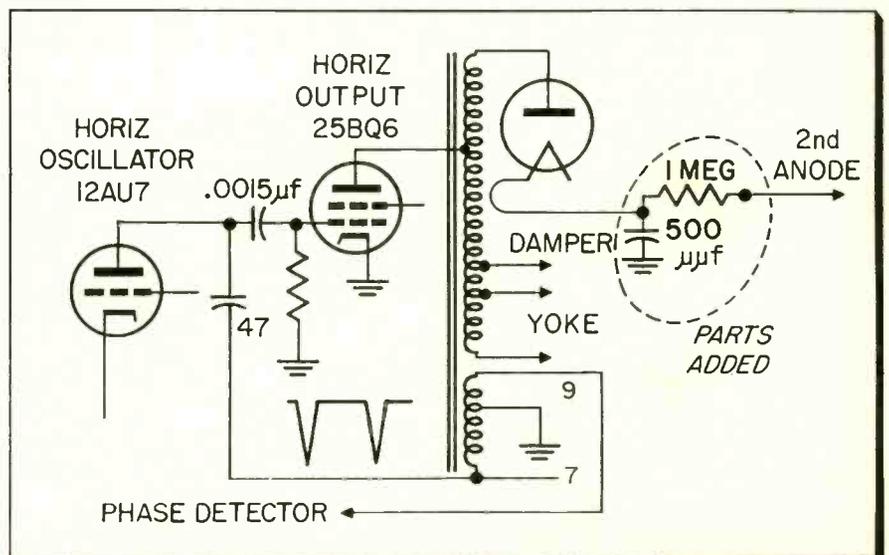
The video signal was present in the output transformer and was fed back to the oscillator phase detector circuits by way of the lines connected to pins 7 and 9 on the flyback.

The video signal appeared in the output transformer because of poor regulation. With a high brightness control setting, more current is drawn through the high voltage transformer. Also when a bright scene is scanned the current increases still further. Conversely a dark scene will cause less current to flow. Because these variations

which are actually an image of the video signal, appeared in the output transformer, either by transformer action or core saturation, the signal was reflected back to the horizontal oscillator. Of the two most likely causes, saturation is suspect because this condition would become more aggravated as the brightness control was advanced. This could occur in the nonlinear or knee portion of the permeability curve for the transformer. In this area small changes in current can cause large changes in inductance.

The output transformer was examined and appeared to be in good condition. It checked good on a "Q" type tester. I decided this was an inherent design problem. Additional filtering in the anode supply, as shown, was tried and it corrected the trouble.—Ivan White, Albuquerque, N. M.

Video signal modulated high voltage supply and caused crosstalk with horizontal sync.



TOUGH DOGS WANTED!

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

Integrated Test Equipment

Fast and Simplified Sweep Alignment

VICTOR ROBINSON
CHIEF ENGINEER
PRECISION APPARATUS CO. INC.

• Time is one of the most important factors in the successful operation of a TV service business. The obvious need for speed in processing repair jobs often leads the technician to overlook certain quality aspects of the business, which can lead to long-term customer confidence. Localizing trouble, replacing components and placing an inoperative set back into working condition is obviously basic. However, a small amount of additional time spent in checking the overall response curve of a repaired set does yield dividends. For example, one shop affixes the following printed tag to each shop-serviced set:

"This TV set has not only been restored to normal operating condition through component replacement and/or repair methods detailed

on your service bill, but has been further checked by oscillographic means for conformance with alignment standards prescribed by the manufacturer of your set. This time-consuming testing procedure, performed with special test instruments is intended to extract the maximum picture clarity and sound reproduction from your set. This special service is performed at no extra-charge and is a part of our desire to establish a long-term relationship with you, based upon genuine service and high quality workmanship."

This type of approach can help the customer appreciate that his set received the necessary attention.

In order for this procedure to be accepted and become routine, it is necessary that it be rapid, straightforward, and fairly easy to perform. One nice part of this activity is that the more often a technician uses it, the less time it takes and the better is his understanding of the principles involved. Some expert technicians particularly those who work on the same type of a set all the time, are so familiar with the procedure, that they can completely align a set in a matter of minutes. It

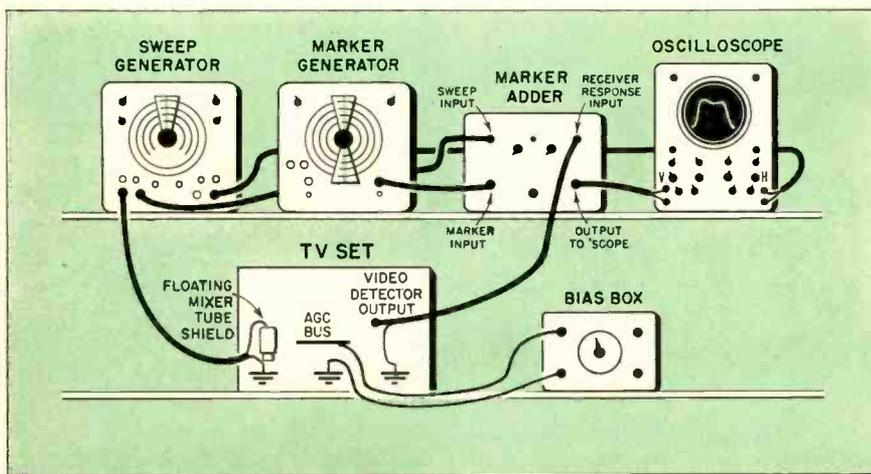
is quite interesting to watch them adjust the top and bottom slugs of an i-f transformer at the same time, using one adjusting tool in each hand.

For fast checks of the response curve using the sweep-alignment technique, sweep generator, marker generator, oscilloscope and other accessories such as probes, marker adder and bias box should be readily accessible. A permanent well-rounded grouping of these instruments, (preferably on an above-the-bench shelving arrangement) helps to facilitate connection of the equipment to the chassis. Interconnections between instruments can be left intact, and thus further speed up the procedure. In a typical set up, Fig. 1, it is only necessary to attach the input and output leads from the equipment and the leads from the bias box to the TV set.

Marker

In the past, one of the difficulties the technician had to contend with was the marker pip. Before the marker adder came along it was necessary to feed the marker signal in with the sweep signal. Because both signals passed through the receiver, extra precautions to avoid overloading had to be observed. To keep the marker generator from loading down the circuit, its leads were loosely coupled to the receiver either by clipping onto the insulated portion of the sweep generator's leads, or to the chassis. While this simple injection method kept the distortion of the response curve reasonably low, the amplitude and resultant visibility of the marker was not particularly large. The most serious objection to this method is the fact that the marker signal varies in visibility at different points on the response curve. The amplitude of the marker is dependent upon the instantaneous amplitude of the response curve. As the response curve approaches the baseline, less

Fig. 1—Sweep alignment test equipment mounted above the bench, interconnected, and ready for use. Only two cables and the bias box are connected to the set. The marker adder can superimpose wider or narrower, and larger or smaller markers on the response curve without loading the receiver.



Speeds TV Alignment

Technique Can Become Routine.

"The Technician Who Needs
New Test Equipment... Is
ALREADY PAYING FOR IT!"

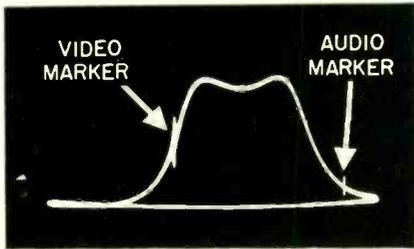


Fig. 2—Normal video i-f response curve showing proper bandwidth and location of video and audio markers.

and less swept signal is available to beat with the marker signal, and the marker becomes smaller and smaller until finally it disappears.

Low marker amplitude and absence of markers at important check points such as trap and discriminator midpoints are serious detriments to fast alignment techniques. In addition, spurious markers generated by multiple signals from the sweep generator are sometimes difficult to distinguish from the correct marker pip. These marker-identification problems have discouraged some technicians from successfully applying the sweep-alignment technique. The marker adder injection method simplifies matters considerably. It adds the marker signal to the response curve after it has passed through the set. Because the marker is not fed through the receiver, its size is not dependent upon the set's varying response nor can it overload the receiver and distort its response curve.

I-F Response

Initially it is better to take a quick look at the i-f section first. This is one way to isolate tuner difficulties and it is easy enough to switch the input leads to include the tuner response after the i-fs have been checked. To sweep check the response of the video i-fs, couple the output of the sweep generator to the TV set mixer and ground, or the injection point recommended by the set manufacturer. A floating tube

shield on the mixer tube will do in most cases. The output of the video second detector is fed to the scope through the marker adder. AGC over-ride should be applied in accordance with the set maker's recommendations, to simulate i-f amplifier sensitivity under signal conditions. Some sets may require the application of more than one voltage. Some bias boxes do supply several voltage outlets, and thus make it unnecessary to use more than one such unit. This procedure applies even in those setups where a marker adder is not used. In the absence of a marker adder, it will be necessary to use a proper de-

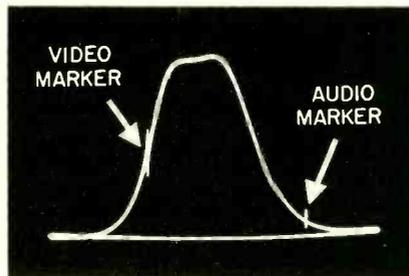


Fig. 3—Reduced bandwidth and increased gain may be desirable in fringe areas. Little or no picture deterioration can be noticed.

coupling network between the receiver and the scope.

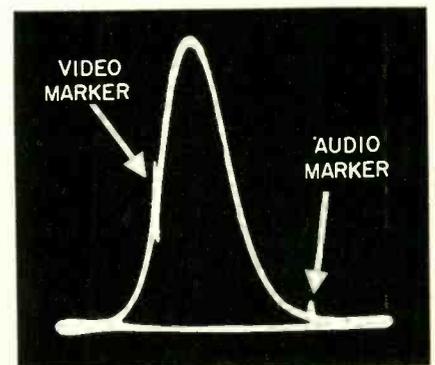
The output of the sweep generator should be advanced until obvious flattening and distortion occurs, and then reduced until the level is safely below the overload point. All the cables should be checked and moved around a bit to make sure that the shape of the response curve does not vary. If it does, it is an indication that distortion created by standing waves and insufficient equipment grounding, exists. Metallic bench plates are quite helpful in insuring good ground conditions. It is good practice as well as a safety factor for personnel and equipment to use an isolation transformer. By varying the marker generator frequency and noting the markers, the

response curve's frequency and bandwidth become quickly and clearly evident.

Fig. 2 shows a normal video i-f response curve; bandwidth is good, and video and audio markers are in their normal position. Fig. 3 indicates a somewhat narrower bandwidth, but the sound and picture markers are still properly oriented. Deterioration in picture quality is very slight and probably not noticeable. Reduced bandwidth usually results in increased gain, which may be desirable in fringe areas. Fig. 4 illustrates an excessively narrow bandwidth condition, which will show up as a noticeable lack of fine detail in the picture. Increased bandwidth and low gain is shown in Fig. 5. Other abnormal conditions of misadjusted traps, sound and video not properly positioned on the response curve, regeneration, etc., are easily and quickly detected.

For the benefit of this rapid alignment procedure it is not necessary to obtain perfect realignment. In many cases a 20% or 30% tilt is quite acceptable. If a reasonably normal shaped curve having proper position of video and sound markers is obtained, satisfactory results can be expected. If the waveform is approximately correct, and if it is desirable to improve its shape, the
(Continued on page 113)

Fig. 4—Sharply reduced bandwidth shows up as a loss of fine detail in the picture.



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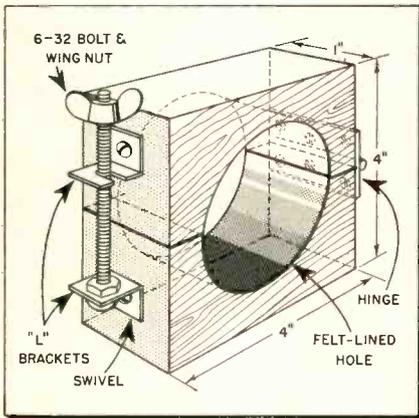
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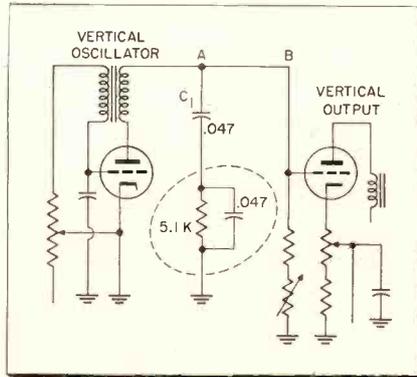
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Stock block supports yoke on test CRT.

mounting the top angle, cut a slot from the hole to one of its sides. Insert a 6-32 machine screw through the bottom angle and lock it with a nut.

Add a wing nut, and line the opening with a piece of felt or cloth. The wing nut can be loosened and swung aside to open the block. The block can then be mounted around the neck of the tube. Use common sense when tightening the wing nut. Excessive pressure can do damage. If it appears to be too hazardous, a rubber band slipped over the angles can be used instead.—Paul Katz, Bayonne, N. J.



RC network eliminates vertical compression.

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One manufacturer has a service note stating that on their receivers there is a jumper across a 68,000 ohm resistor between points A and B and that if a squeeze is encountered the direct connection should be opened. We have yet to see this resistor on any chassis.

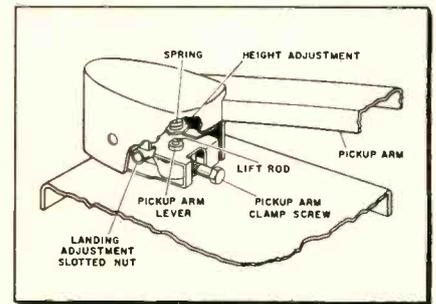
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Loosen clamp screw to remove pick-up arm.

ables the arm assembly to be self positioned for correct landing. It is only necessary that the arm be in the approximate correct position, tightening the clamp screw will then bring it to the correct position. Tighten the clamp screw securely and put the mechanism through several complete cycles while checking landing position. An adjusting screw at the side of the arm permits fine adjustment of the set-down position.

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STEREO 1959

CONTENTS

Entire STEREO 1959 Contents on Pages 41-100

FEATURES and ARTICLES

The Meaning of Stereo	47
Stereo Discs—Two Channels In One Groove	48
Master Control for Stereo	50
Converting to Stereo	52
The Stereo Cartridge	54
Needles for Stereo	56
Multiplex Stereocasting	60
Stereo Tape and Tape Recorders	64
Speaker Arrangements for Stereo	66
Changers and Turntables for Stereo	71
Readers Inquiry Card	73
Stereo Glossary	98

PRODUCT CATALOG

Amplifiers & Preamps	75	Microphones	81
Arms	77	Speakers & Enclosures	81
Cartridges	78	Tape Recorders	84
Changers	79	Tuners	85
Control Units & Adapters	80	Turntables	86
Conversion Kits	80		

BUYERS DIRECTORY

Amplifiers, Preamplifiers & Controls ..	88	Speakers & Cabinets	89
Cartridges, Stereo Phono	88	Tape	90
Changers, Turntables & Arms	88	Tape Recorders, Playbacks & Accessories	90
Conversion Kits	88	Tuners	90
Microphones & Accessories	89	Alphabetical List of Manufacturers ..	91
Needles, 0.5 or 0.7 Mil	89	Industry Associations	93
Phonograph Systems	89		
Records, Stereo	89		

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STEP TWO

Includes an 8" coaxial speaker such as:
E-V CORONET* (with SP88), Net \$65
E-V BARONET* (with SP88), Net \$74.50
 SP88: Wide range, economical, super-efficient coaxial speaker. Small high-frequency propagator insures fine dispersion.

Includes a two-way separate system such as:
E-V CORONET IA, Net \$102
E-V BARONET III, Net \$111.50
E-V REGAL IA, Net \$129

or includes a 12" coaxial speaker such as:
E-V MARQUIS* (with SP128), Net \$98
E-V ARISTOCRAT* (with SP128), Net \$107
 SP128: Added efficiency with lower resonance. Extends fundamental low range. Excellent dispersion for widest stereo effects.

Includes three-way speaker such as:
E-V MARQUIS* (with 12TRXB), Net \$129
E-V ARISTOCRAT* (with 12TRXB), Net \$130
 12TRXB: Has all the features of the SP128—plus a separate high-frequency driver with electrical crossover for still lower distortion. Gives widest spread of vital stereo range to achieve large stereo listening area.

such as the new **E-V REGAL III**
REGAL III Super-compact, specially designed system with tailored components to give enhanced range and purity of tone with least loss of efficiency. Does not require high powered amplifier. Net \$147.50

Includes a 15" line-array speaker such as:
E-V EMPIRE* (with 15TRXB), Net \$178
EMPIRE* 15TRXB: Similar to added bass efficiency from large cone, and delivering lower bass response.

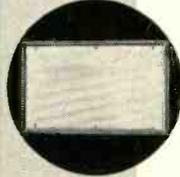
You need the totally compatible E-V STEREO CARTRIDGE

- * the first stereo cartridge
- * the only field tested stereo cartridge
- Thousands already in use prove it
- * Plays ALL RECORDS BETTER
- Unexcelled for stereo; superior even to your present cartridge for monaural compliance
- * Highest vertical and horizontal
- For superior tracking, longest record wear
- * Best channel separation
- over 20 db between channels
- * Flattest response
- Flat beyond audibility to RIAA curve
- * Hum and rumble far below any magnetic cartridge
- * Two ceramic elements deliver precise RIAA curve with no hum!
- * Exclusive E-V Built-in Vertical Rumble Suppressor allows record changer use for stereo
- * .7-mil replaceable (diamond or sapphire) stylus is the ideal size... gives you better reproduction, longer record wear

Then choose a second amplifier and pre-amplifier. If this is your initial high fidelity system, start with any stereophonic dual amplifier-pre-amplifier. Play monaurally until you add a second speaker for stereo.



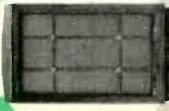
The **E-V Totally Compatible Stereo Cartridge** is the industry's standard. Choose the model to fit your needs:
MODEL 21D—Stereo with .7-mil Diamond Stylus, Net \$19.50
MODEL 26DST—Dual Stylus Turnover from .7-mil Diamond Stereo to 3-mil Sapphire Monaural, Net \$22.50
or the E-V Velocity Stereo Cartridge
MODEL 21MD—Stereo with .7-mil Diamond Stylus, Net \$19.50
MODEL 26MDST—Dual Stylus Turnover from .7-mil Diamond Stereo to 3-mil Sapphire Monaural, Net \$22.50



Add-on E-V BARONET*...

smallest folded-horn corner enclosure for best musical balance and response range; phenomenal bass range; extended two full octaves. Matches the Coronet and other comparable speaker systems. With SP88, Net \$74.50, or BARONET III with SP88 and T35B VHF driver, Net \$111.50

Add-on E-V ARISTOCRAT*...



popular folded-horn corner enclosure... compact, economical... delivers most extended bass range for its size. With SP128, Net \$107.00; with 3-way 12TRXB, Net \$135

Add-on E-V MARQUIS*...



matching along-the-wall counterpart of the popular Aristocrat. Response down to 40 cps. With SP128, Net \$98.00; with 3-way 12TRXB, Net \$129



Add-on E-V REGAL III...

super-compact, specially designed system with tailored components to give enhanced range and purity of tone with least loss of efficiency. Does not require high powered amplifier. Net \$147.50



Add-on E-V EMPIRE*...

direct radiator Klipsch-licensed low-bay enclosure tailored for use along-the-wall or in corner. Smooth, extended bass response. With Electro-Voice 15TRXB 3-way speaker, Net \$178

Add-on the new E-V CORONET*...

true, balanced high fidelity reproduction in extremely small economical space saving form: only 10 inches of wall space required.



Complements Aristocrat, Marquis, Barronet or comparable speaker system. With SP88 8-inch speaker, response down to 70 cps., Net \$65.00 or add-on CORONET IA with SP88 and T35B VHF driver, \$102.00, or add-on RECAL IA, Net \$103

Add-on STEREO IA

The all-new Electro-Voice speaker system that solves your space problem—saves you money. Where space doesn't permit you to add a second full-range speaker, a Stereo IA the answer. It's compact, because the Stereo reproduces only those frequencies needed for stereo. Bass below 300 cps. does not contribute to the stereo effect...

...to bass from both is handled by your present full-range speaker through the accessory X33 Stereo Control Filter. (Finest E-V mid-bass, treble and high frequency components give smooth response from 300 to 19,000 cps.)



STEREO IA—for systems of normal efficiency, Net \$99.50
X33 STEREO CONTROL FILTER, Net \$30

Systems shown are but a few of the multitude of E-V combinations found in every price class. Ask your dealer or write Electro-Voice for information on the industry's most complete line of high fidelity speakers and enclosures.

Electro-Voice

ELECTRO-VOICE, INC., BUCHANAN, MICHIGAN
 Branches in Electro-Voice—Microphones, Piano-Corngers, High-Fidelity Loudspeakers and Enclosures, Public Address Speakers, Marine Equipment, E-V Pro

* E-V systems which can be expanded with E-V Building Blocks whenever your budget permits.

NOTE: All E-V enclosures also available in limed oak or walnut finish.

costing between **\$60-\$90**

costing between **\$90-\$120**

costing between **\$120-\$140**

costing between **\$140-\$200**

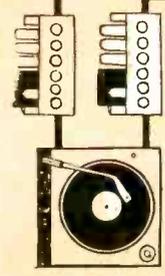
STEP-UP

TO THE FINEST ELECTRO-VOICE



STEREO'S STANDARD

if this is your present or proposed speaker system



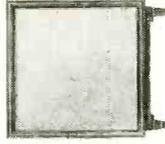
step one

you need the totally compatible EV STEREO COMPONENT

Thousands already in use prove it plays all records better, unexcelled for stereo; superior even to your present cartridge for monoaural. Highest vertical and horizontal compliance. Best channel separation; over 20 db between channels. Finest responses: flat beyond audibility to RIAA curve. Hum and rumble are far below any magnetic cartridge. Two ceramic elements deliver precise RIAA curve with no hum! Exclusive EV Built-in Rumble Suppressor allows record changer use for stereo. 7 mil replaceable (diamond or sapphire) stylus is ideal since it gives better reproduction, longer record wear.

The E-V Totally Compatible Stereo Cartridge is the industry's standard. Choose the model to fit your needs:
 MODEL 21D—Stereo with 7 mil Diamond Stylus Net \$19.50
 MODEL 26DST—Dual Stylus Turnover from 7 mil Diamond Stereo to 3 mil Sapphire Monoaural Net \$22.50
 or the E-V Velocity Stereo Cartridge
 MODEL 21MD—Stereo with 7 mil Diamond Stylus Net \$19.50
 MODEL 26MDST—Dual Stylus Turnover from 7 mil Diamond Stereo to 3 mil Sapphire Monoaural Net \$22.50
 Then choose a second amplifier and pre-amplifier. If this is your initial high fidelity system, start with any stereo-phonetic dual amplifier-preamplifier. Play monoaurally until you add a second speaker for stereo.

4-way 12-inch speaker system costing between \$200 and \$300 such as the E-V Duchess IVE (Net \$292)



Add-on the E-V DUCHESS IVE

Unexcelled for purity of tone and range through highly developed 4-way driver system. Super-efficient, smooth re-ponse through use of diffraction horns to give wide stereo listening area; bass is especially extended in range through E-V Phase-Loading principle with 12-inch horn mounted low and at rear of enclosure. Compares in performance to corner best stereo over widest listening area.

Net \$292

3-way speaker system costing between \$300 and \$325 such as the E-V Marquis III or the E-V Aristocrat III (Net \$312)

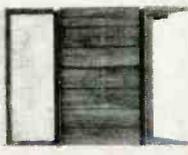


Add-on the E-V MARQUIS III

Compaction piece matches Aristocrat III. Uses same driver system. Designed to operate optimally in along-the-wall position where a corner is not available.

Net \$303

4-way 15-inch speaker system costing between \$325 and \$375 such as the E-V Carlton IV (Net \$359)

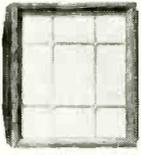


Add-on the E-V CARLTON IV

Deluxe version of the Duchess IVE in smart, handsome, low-key design; harmonizes gracefully with many modern furnishing modes. A complete Phase-Loaded System, affording unusual bass response with smooth, resonance-free characteristics. Includes deluxe 15-inch indirect bass driver 4-way components.

Net \$359

1-way 18 inch speaker system costing between \$375 and \$400 such as the E-V Regency III (Net \$393)

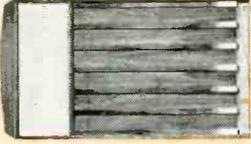


Add-on the E-V REGENCY III

The versatile Regency III deluxe separate 3-way system allows operation in the corner for full bass efficiency or along the wall for convenience. Powerful 15-inch bass driver crosses over at 800 cycles per second and to diffraction-type treble and very high frequency components to give maximum dispersion and full stereo effect.

Net \$393

4-way corner 15-inch speaker system costing between \$480 and \$600 such as the E-V Georgian 600 (Net \$490)



Add-on the E-V GEORGIAN 600

Utilizes same horn construction and driver complement of Cardinal IV enclosed by beautiful contemporary housing functionally styled by Robert W. Fuldner.

Net \$490

4-way corner 18-inch speaker system costing over \$600 such as the incomparable E-V Patrician (Patrician IV Traditional, \$970; Patrician 600 Contemporary, \$819 Net)



Add-on the incomparable PATRICIAN

World's largest, most deluxe loud-speaker system for those discriminating listeners who demand ultimate tonal perfection. The epitome of style combined with peak performance for the ultimate illusion of reality. Available as the Patrician IV in traditional styling.

Net \$970

Patrician 600 in Fuldner-designed contemporary housing. **Net \$819**
 Special models available to custom-finish specifications . . . at higher price.



Systems shown are but a few of the multitude of E-V combinations found in every price class. Ask your dealer or write Electro-Voice for information on the industry's most complete line of high fidelity speakers and enclosures.

step two

ADD-ON E-V STEREOON III or alternate step two

The all-new Electro-Voice speaker system that solves your space problem—saves you money. Where space doesn't permit you a full range speaker, a Stereoon III is the answer. It's compact, because the Stereoon reproduces only those frequencies needed for stereo (bass below 300 cps does not contribute to the stereo effect . . . so bass from both is handled by your PRESENT full-range speaker through the accessory XX3 Stereoon Control Filter).

Stereoons have the finest E-V mid-bass, treble and high frequency components. (Frequency response: 300 to 19,000 cps).
 STEREOON III for high efficiency systems. **Net \$129.50**
 XX3 STEREOON CONTROL **Net \$30.00**

NOTE: All E-V Systems also available in lined oak or walnut finishes.

Electro-Voice
 ELECTRO-VOICE, INC., BUCHANAN, MICHIGAN
 Powers in Electro-Acoustics—Microphones, Phone-Cartridges, High-Fidelity Loudspeakers, and Electro-Voice Systems—Used in Home, Commercial, and Military Applications.



Every part of every *Collaro* changer is precision-engineered to meet the rigid demands of Stereo

The new stereo records require a higher standard of performance from your record changer than do standard LP's because stereo cartridges are extra-sensitive to noise. That's why, in planning your stereo system, you begin with the Collaro. Every part of every Collaro changer is precision-engineered to meet the rigid quality demands of stereo.

The motor (see A above) is dynamically balanced, so rigidly mounted that wow and flutter specifications are superior to any changer.

The spindle assembly (B) reflects this precision quality in every part. The spindle itself is micro-polished for complete smoothness.

The sensitive velocity trip mechanism (part shown in C) has been designed so that the

changer can trip at extraordinary light tracking pressures.

The exclusive Collaro transcription-type tone arm (D) with the new plug-in head (E) is designed to eliminate all resonances in the audio spectrum. The new four-pin head — the only high fidelity changer with this feature — provides the ultimate in noise-reduction circuitry.

There are three Collaro changers ranging in price from \$38.50 to \$49.50. No matter which you select, you're sure to start your system off right when you choose Collaro — the turntable that changes records.

For new Collaro catalog write to Dept. ET-9, Rockbar Corporation, Mamaroneck, New York.



Rockbar is the American sales representative for Collaro, Ltd.

The Meaning of Stereo

Stereo means a new horizon of electronic entertainment. A refreshing treat is in store for the thousands of audio enthusiasts and millions of music lovers who have made the term High Fidelity a byword in American homes.

Stereo—short for stereophonic sound—adds the dimension of depth to our listening pleasure. It enhances the sense of realism in sound reproduction.

How Stereo Works

Just as our eyes perceive depth by each eye seeing a particular scene slightly different from the other, so our ears detect depth in sound.

In the conventional monophonic sound system, a single one-channel program is reproduced. Even the use of two speakers does not provide a real sense of depth in monophonic sound because the sound reaching the ears does not have the information needed for the stereo effect.

With stereo, two (or more) spaced microphones record the program material in separate channels. Each channel recording is different, in an amount determined by the relative intensities and location of the program source or sources in relation to the microphones.

When the program recordings are picked up and reproduced through separate amplifier-speaker channels, and a greater portion of the sound from each channel reaches each ear, respectively, in a manner similar to the original sound reaching the microphones, depth is perceived aurally.

Equipment for Stereo

Stereo on magnetic tape came first. Recording multiple tracks on a single tape enables the two sound channels to be kept apart and reproduced through separate electronic channels in the same machine.

With disc recordings in very wide use, the industry sought a practical means for producing and reproducing from stereo records. To the notable credit of industry engineers, a means was developed for recording two channels of sound in a single record groove. The two channels are picked up by a single needle in the new stereo cartridges. Basically, this is accomplished by the groove imparting up-and-down motion to the needle, in addition to the conventional side-to-side.

The electrical signals from the cartridge are passed through two preamp/amplifier channels, and reproduced in two speaker systems placed apart in a manner which provides the stereo effect.

Stereo has even entered broadcasting, one sound channel being broadcast on FM, the other on AM. For the future, tuners may be adapted to receive multiplex signals; that is, two channels on one FM station.

Stereo—Now!

Stereo is no longer a drawing-board concept. A wide selection of stereo equipment from many manufacturers is available today at reasonable cost. Good equipment will not only give you stereo . . . it will give you stereo high fidelity.

If you presently own good monophonic equipment which you do not wish to discard, units for the second channel can be added for stereo. For the many people who are not adept at making electronic hookups, the local electronic service technician has the know-how and equipment to make the conversion.

If you are starting afresh, a wide range of attractive equipment, specially designed for stereo, is yours to select.

A rapidly growing number of stereo discs are becoming available.

Get more listening pleasure. Get stereo!

Stereo Discs— Two Channels In One Groove

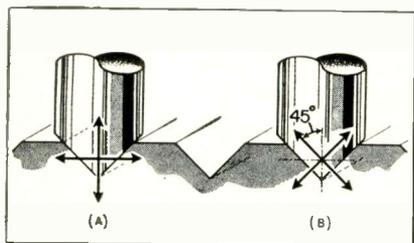
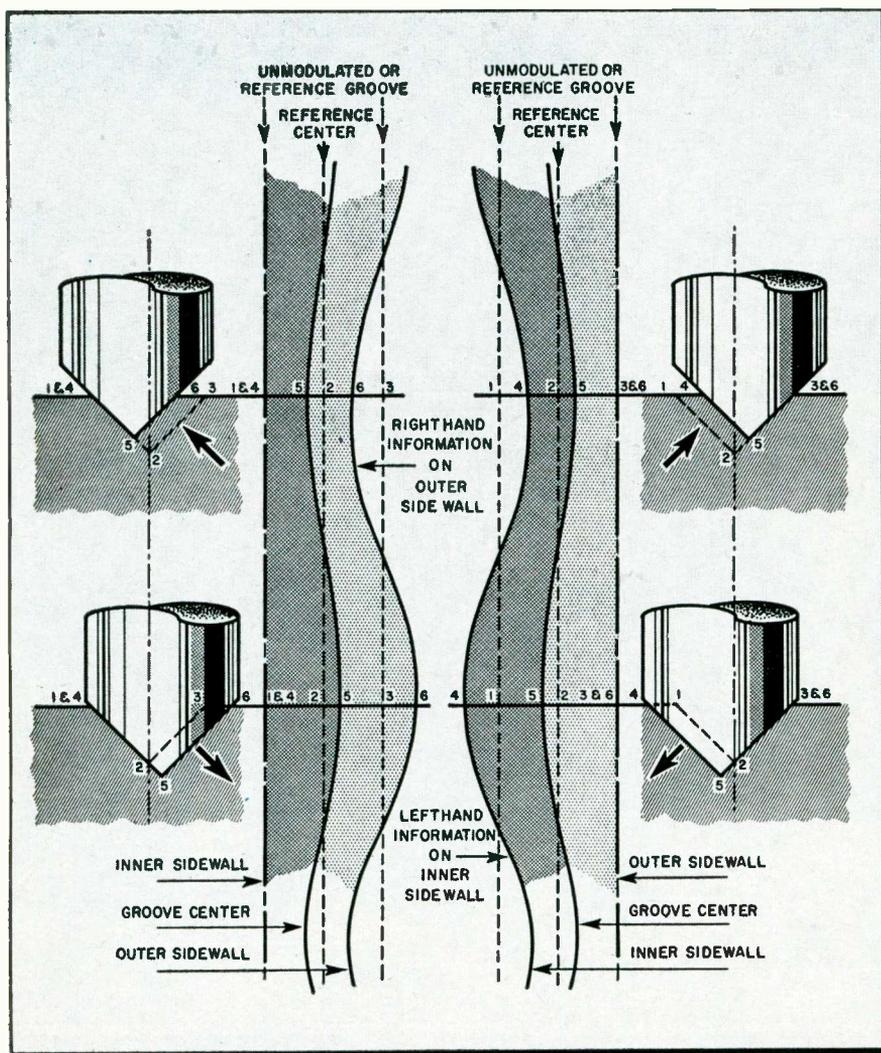


Fig. 1—Early single groove stereo discs had a vertical and horizontal axis. The 45/45 Westrex system, shown on the right, maintains the same relative position between the two axes, but both axes are rotated 45°, as a unit, to obtain symmetry of movement.

Fig. 2—A. Right channel modulates outer side wall. Stylus travels up to the left and down to the right. B. Inner side wall is modulated by the left channel. Stylus travel is up to the right and down to the left. Groove center is always midway between both walls.



• The intelligence in the modern monophonic LP record is pressed into the groove in such a manner as to enable a cartridge whose stylus is moving in a horizontal plane to recover the information on playback. Older forms of records, now obsolete, required the playback stylus to move up and down. London Records used a combination of these two movements for monogroove stereophonic recording. Demands on the cartridge for equally high compliance in both the horizontal and vertical direction presented difficult mechanical problems. Some of these problems were alleviated when Westrex introduced the 45/45 system. While the 90° relationship between the vertical and horizontal axis was maintained, both axes were rotated 45°, as shown in Fig. 1. Symmetry of movement was thus achieved for each channel.

In this system the stylus is forced to travel a diagonal path for each channel. The right hand channel modulates the outer side wall of the groove, which means that the stylus has to travel up to the left and down to the right as shown in Fig. 2A. Part B of this figure shows that for the left hand channel, which modulates the inner side wall, the stylus must travel up to right and down to the left. In both cases the side wall which is not modulated remains straight. (The groove traverses a spiral path. To simplify drawings and text the unmodulated groove is presented as a straight line which is essentially true for the relationship between the cutting stylus and the groove. The concept of what actually

THE STEREO RECORD

Westrex 45/45

Diagonal Motion
Horizontal Components
Vertical Components

Mechanical Phase

In-Phase
Vertical Movement
Out-Of-Phase
Horizontal Movement

Electrical Phase

In-Phase
Horizontal Movement
Out-Of-Phase
Vertical Movement

Movement Indicators

Groove Width
Vertical Displacement
Groove Center
Lateral Displacement

happens is not affected thereby.) As the stylus rides up and down, the groove becomes narrower and wider respectively, and as the stylus moves back and forth the center line of the groove moves accordingly. It is well to keep in mind that the needle point is always in the groove center, and that the needle always contacts both sidewalls.

This is true, even though there are two different signals impressed in each groove and one sidewall may have many more curves than the other; and the needle may trace out circles, and ellipses; if the stylus is tracking properly it must maintain contact with both sidewalls at all times.

Contrary to some published statements the stylus cannot trace out a corkscrew motion. All motion is confined to the vertical plane which cuts the record in half along its diameter. Vertical, horizontal and diagonal stylus motions are all on this plane. The stylus cannot, or at least is not supposed to, travel either backwards or forwards. This of course applies to actual stylus motion. Relative motion between the groove and stylus—if projected in a drawing—could in some cases appear as a corkscrew.

At any given instant the stylus is in one position only. This position "defines" both walls. The question now is what happens to the stylus when both channels are differently modulated at the same time. Fig. 3 illustrates how the stylus motion and relative groove width, at any given instant, corresponds to the different forces at work. When both channels are pushing up at the same time and the same amount, the stylus will travel straight up.

This in-phase motion can also
(Continued on page 96)

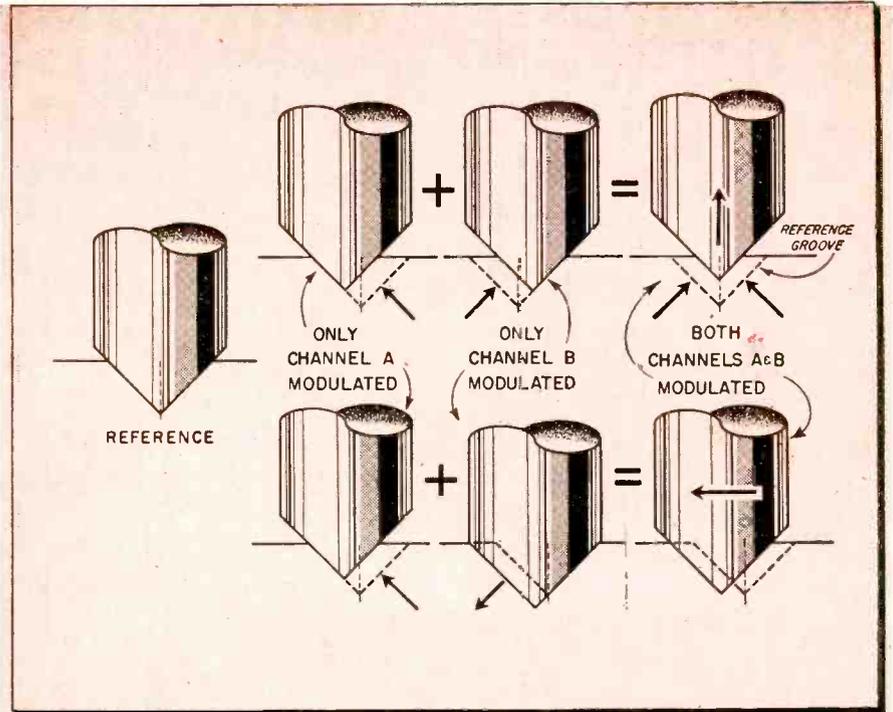
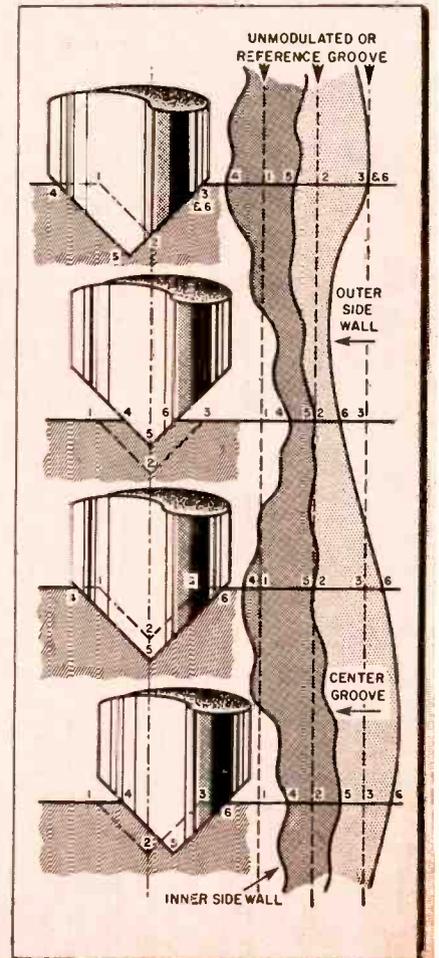
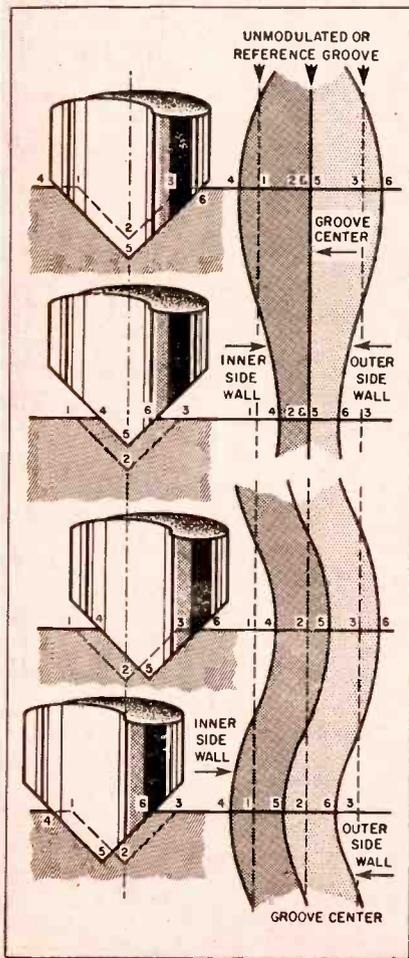


Fig. 3—Stylus position on disc for various conditions of modulation. The stylus may move up or down, and right or left depending upon the information impressed on each channel.

Fig. 4—Top. Pinching and expanding grooves cause stylus to rise and fall. Straight center line indicates that there is no lateral motion. Bottom. Equal size grooves allow the stylus to ride without vertical displacement. Curved center line shows lateral motion.

Fig. 5—Combination of both lateral and vertical displacement at the same time, and varying conditions from one instant to the next give the groove a shape that seemingly cannot be tracked. It can—see text!



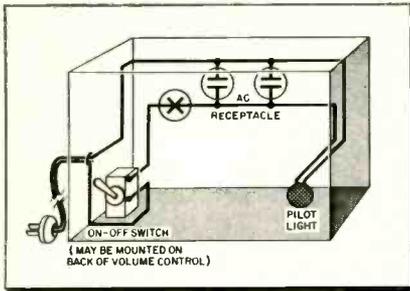


Fig. 1—Switch and outlets on master control box can turn the entire system on or off. It is possible to have the switch on an automatic record player perform this function by inserting it in the line at point X.

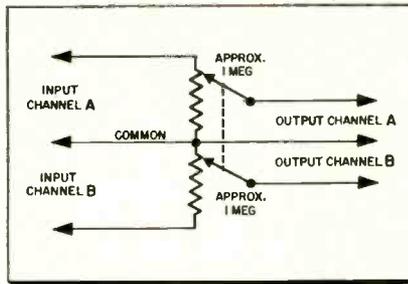


Fig. 2—Dual linear controls, each wired in reverse order can equalize the sound from both channels without changing the overall volume level. As one level goes up the other goes down.

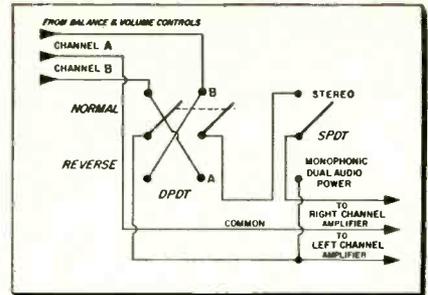


Fig. 3—The SPDT switch enables the listener to change from stereo to monophonic with either channel fed into both amplifiers and speaker systems. The stereo channel reversing switch also determines which signal channel is used for monophonic purposes.

Master Control For Stereo

One-Knob Control For Both Channels.

● Getting stereo is one thing; controlling it to give its best is another. All of the three potential sources, radio, tape, or disc may be present, but the program must be balanced, both tonally and stereophonically, and at the right listening level for best enjoyment. The control unit may be part of the preamplifier, or a separate but complete master control center. The master control may consist of passive and amplifier circuits, or passive circuits only with just switches, plugs, and other controls. It may also contain equalization and other matching networks. The import of the question, "Do we want more or fewer knobs?" is now multiplied by two, and then some.

At first thought it may seem as though the control center would assume monstrous proportions, but actually compact units about $\frac{1}{3}$ rd the size of a tuner are available, or can be constructed. However, the amount of electrical accomplishments and added convenience this little box provides are so great that they may spell the difference between selecting a stereo program in the same manner as an ordinary program from a table radio by just flicking a switch, or selecting an attack of stereo knobitis.

It is possible to perform most or all of the following functions, with a properly designed control box, and with minimum effort:

1. Power—Turn the complete system on or off.
2. Balance—Or focus, equalize output from both channels, without changing volume.

3. Volume—Control volume level without losing balance.
4. Stereo—Normal stereo program in, normal stereo out.
5. Reverse—Reverse stereo program in, normal stereo out; or vice versa.
6. Monophonic—(A) Monophonic program on one channel only. (B) On both channels in parallel for dual power, and use of both speaker systems. (C) Stereo program in, monophonic out of one or both channels.

True, these are a lot of functions, but once the system is installed, there should be no unusual difficulty or need for excessive knob handling. There are as many if not more controls and adjustments on a TV set. Once the system is in operation it is only necessary to flip one switch to turn on the system, select the program, and adjust the volume control.

The control box may also provide tone controls, loudness contour controls, rumble filter and a blend control. So far as the consumer is concerned, this is as far as he has to go, but the technician must consider a mass of additional detail. Like any control center in any mechanical or electrical system, connections to the various components to be controlled must be provided. To obtain the desired functions just described the following jacks or connectors should be available, preferably in the rear of the unit.

1. AC power outlets
2. Audio outputs
3. Tuner Inputs

4. Tape Inputs
5. Phono Inputs

Power Outlets

The power outlets and associated wiring should have sufficient wattage ratings to safely handle the load. If all the a-c power is fed through the switch and outlets on the control box, as shown in Fig. 1, then all the components can be controlled by one switch. It is also possible to arrange a system in which the record changer can shut off all equipment after the last record is played. Usually no more than two outlets are required because the amplifier and other components have power outlets which can be used. It may also be desirable to have a pilot light in the control box.

Balance & Volume

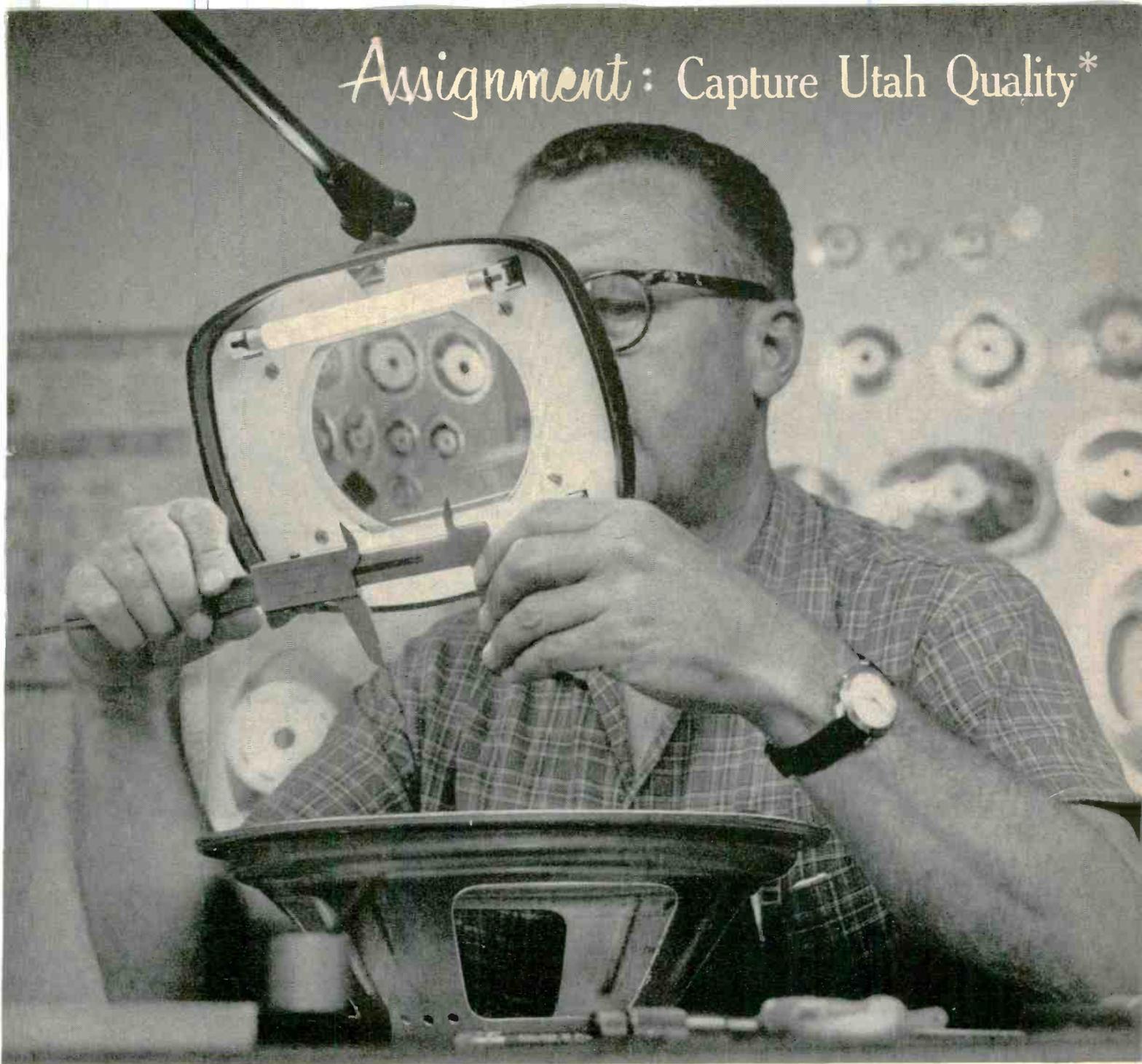
It would seem ideal in a stereo system to gang almost all the similar controls in both channels; equalization, volume, loudness, and tone. This makes for simplicity. If the volume and loudness controls are stacked, a balance or focus control is needed. Although a 1 db change in level is difficult to detect on a single channel, it does make a noticeable difference in stereo. This is a good reason for checking balance with a known stereo recording, while sitting in a desirable position. Separate test and level adjustments of first one channel and then the other is hardly adequate.

Because stereo balance is fairly critical, the balance control may

(Continued on page 94)

Circle 51-01 on inquiry form p. 73 →
ELECTRONIC TECHNICIAN • Stereo, 1959

*Assignment: Capture Utah Quality**



THANK THE KEEN-EYED SNOOPER

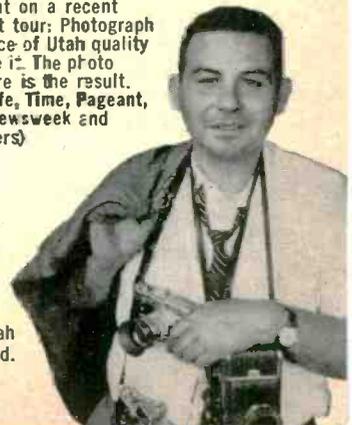
As little as .0035 of an inch off in the dimensions of this Utah speaker basket—and a reject hits the bin! At Utah the quality of final performance in the speaker you buy is a jealously guarded value. If you could visit our Huntington plant you'd probably agree with Ace Photographer Lieberman that Utah speakers prove rejection is the foundation of perfection.

Pre-assembly, plating, coil winding, wiring . . . at every step down the production line stand the "keen-eyed snoopers." They search ruthlessly for the tiniest defect that could mar, even minutely, the response performance of a Utah.

Make certain your next speaker is a Utah. Know that your sound will be as perfectly reproduced as human skills, controlled by rigid inspection, can produce.

See the Utah Custom Line: a quality speaker for every system need.

* ARCHIE LIEBERMAN, famous newsmagazine* photographer, was given this assignment on a recent Utah plant tour: Photograph the essence of Utah quality as you see it. The photo shown here is the result. (*Look, Life, Time, Pageant, Parade, Newsweek and many others)



Let your ear decide

Utah
SPEAKERS

the ultimate choice

Send for the big Utah Catalog, Dept. 2, Utah Radio & Electronic Corp., Huntington, Ind.

Converting to Stereo

Present Record Players Can Accept The New Stereo Cartridges.

• Probably the most critical portion of the work is in the installation of the stereo cartridge. In most cases it will be necessary to run a new lead through the pickup arm to accommodate the 3rd or 4th terminal. In anticipation of the conversion job, many new cartridges are packaged with the necessary terminals, wire, spacer washers, and screws. Conversion kits are also available for the various record changers and turntables. Tone arms having plug-in cartridge holders, equipped with only two terminals present a bit of a mechanical problem if the plug-in feature is to be maintained.

Most conversion kits solve this problem by providing a new 3 or 4-terminal fitting and shell. However, in some cases it is necessary to dismantle the tone arm to assemble these new parts. It may be possible to do this without upsetting too many adjustments on some changers. It is therefore important that no more work or dismantling be accomplished than is absolutely necessary. Once a changer tone arm is worked on, it becomes necessary to check stylus pressure, set down, trip mechanism and arm elevation during the change cycle. In the absence of a conversion kit it is possible to fit a flat piece of metal into the rear portion of some cartridge shells, where the terminals are, in such a manner as to contact another

flat piece of metal which has to be installed on the tone arm, as shown in Fig. 2. This is tricky, and can be avoided by sacrificing a little mobility. Run the third wire directly to the cartridge. Leave enough slack to disengage the shell, and to slide the wire clip on or off the cartridge terminal.

Still another problem manifests itself, if for some reason it is desired to plug in a two-terminal shell and its monophonic cartridge after the arm has been wired for stereo. One of the hot leads for the stereo cartridge will have to be grounded for

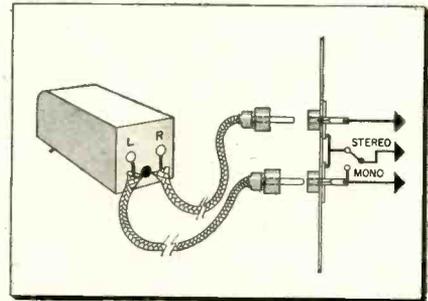


Fig. 3—To revert back to a monophonic shell, once a conversion has been accomplished, it is necessary to provide a hum-free switch.

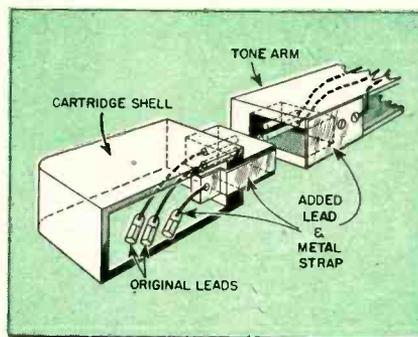


Fig. 2—To convert a two-pin shell to accept a stereo cartridge, it is necessary to provide a connection for the added terminals.

the monophonic cartridge. Looking at the terminal end of a stereo cartridge with the stylus pointing down, the pin on the right is for the right channel, and the pin on the left is for the left channel. The center terminal or terminals go to ground. In the four-pin cartridge the two center terminals may or may not be tied together depending upon wiring and electrical requirements. Since the monophonic cartridge utilizes the two outer terminals, what now constitutes one hot terminal for one stereo channel will have to become a ground connection for the monophonic cartridge. It then becomes necessary to install a SPDT switch as close to the cartridge as possible. The farther away this switch is installed, the greater is the possibility of introducing hum. All this of course points up the fact that the more functions that are

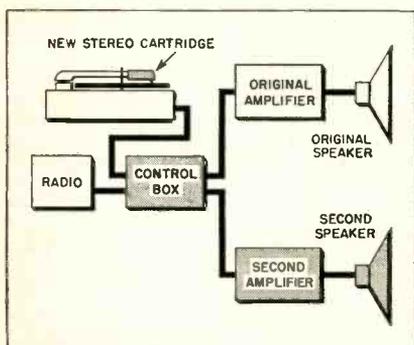
added, and the more complex the installation becomes, the noisier the system is going to be. If the monophonic cartridge is installed in a stereo shell, it can be wired to an appropriate end terminal and the center ground terminal. Keep the installation as simple as possible. Except for very rare occasions, there should be no need to switch back to a monophonic cartridge once a stereo unit is installed.

If the two elements of the stereo cartridge are connected in parallel, it will become fairly insensitive to vertical stylus movement and may even render superior performance on a monophonic system. This is another good reason for installing a stereo cartridge as soon as possible even before the additional amplifier and speaker are obtained. Also, some monophonic cartridges could damage the new stereo discs.

Impedance matching and amplifier input sensitivity are important, and require the same care and consideration as before. As a general rule, the former high-impedance amplitude-sensitive ceramics require still higher input impedance to avoid loss of bass, but in most cases do not require preamplification or equalization. The low-impedance, velocity-sensitive magnetics, moving coil, moving iron and variable reluctance types should be played through a preamplifier and equalization circuitry. Both types give a smaller output voltage to each stereo amplifier. In most cases sufficient reserve power is available.

(Continued on page 58)

Fig. 1—To establish the second channel for stereo disc programs, it is necessary to add a second amplifier and speaker, and to change the cartridge. The control box is optional.

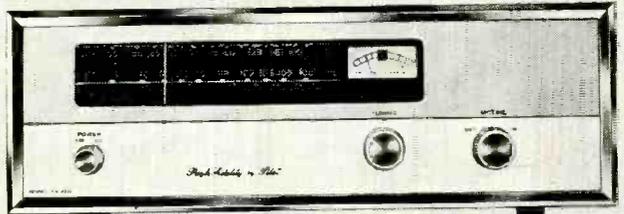




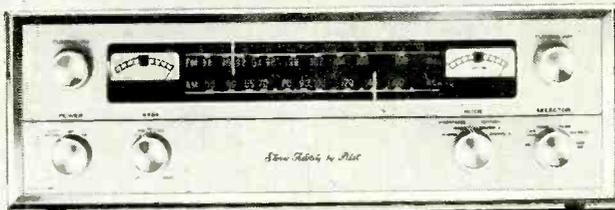
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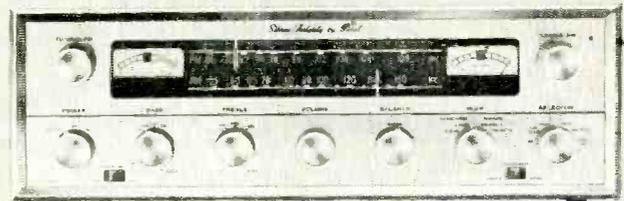
FA-670, Deluxe FM-AM Tuner, \$179.50



FM-660, Deluxe FM Tuner, \$149.50



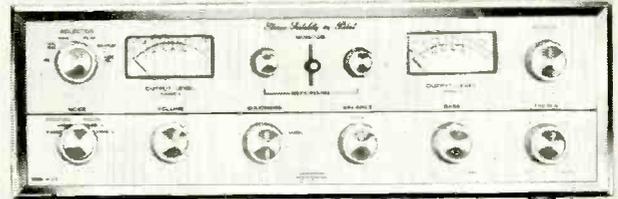
FA-680, Deluxe Stereo FM-AM Tuner, \$199.50



FA-690, Deluxe Stereo FM-AM Tuner and Preamp, \$269.50



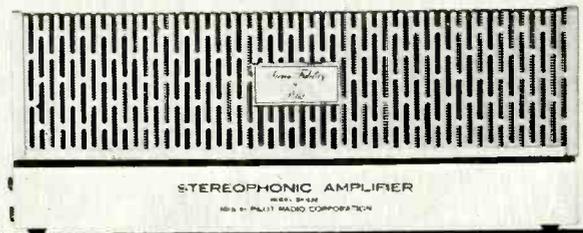
SP-210, Stereo Preamp, \$89.50



SP-216, Stereo Preamp and Audio Control, \$189.50



SM-245, Stereo Preamp and Control Amplifier, \$189.50



SA-232 (64 Watts Peak), Stereo Basic Amplifier, \$89.50
SA-260 (120 Watts Peak), Stereo Basic Amplifier, \$129.50

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Electronics manufacturer for more than 39 years.



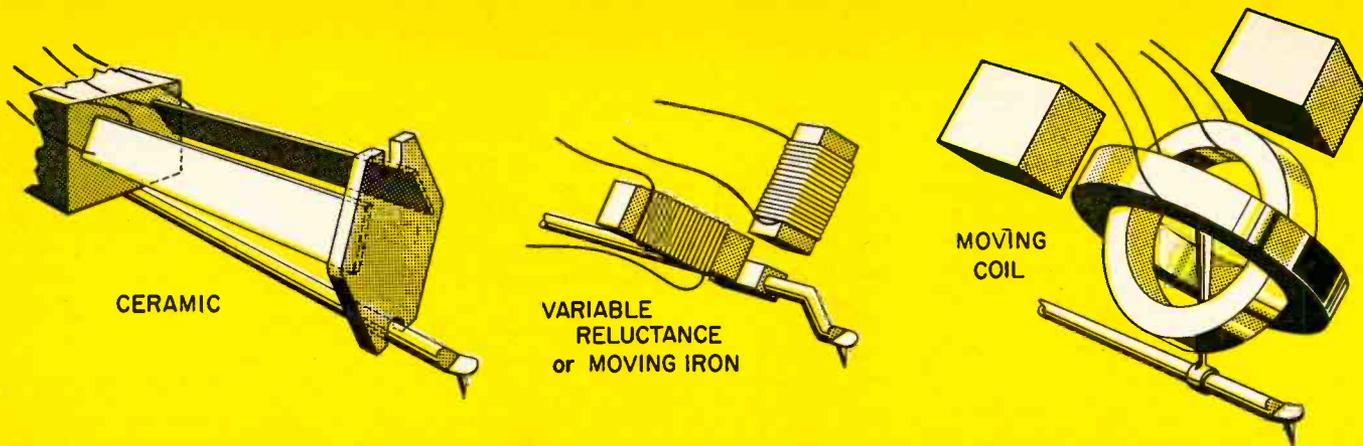


Fig. 1—The stereo cartridge has two elements set at right angles to each other, and 45° from the vertical. The elements may be ceramic, moving coil, moving iron or other conventional types. Cartridges may have 3 or 4 pins. They can be used on monophonic discs.

The Stereo Cartridge

Complex Mechanical Forces Work On Cartridge Having

One Stylus, Two Elements, Three Or Four Terminals.

STEREO CARTRIDGE

Velocity Sensitive

Moving Coil
Magnetic
Variable Reluctance

Amplitude Sensitive

Ceramic

Output

Levels
High
Low

Impedance

High
Low

Terminals

3 pin
4 pin

Phasing

Mechanical
Electrical

Rumble Suppression

Mechanical
Electrical

terms of inherent characteristics. Inherent characteristics have been compensated for to the point where a normally non-linear device is more linear than some units which naturally have good linear qualities. This is true for the many other characteristics; so much so, that each cartridge should be evaluated on an individual basis rather than according to type.

Before the engineers could claim victory over all of the problems in monophonic cartridge design, stereo stuck its two-element head into the laboratory.

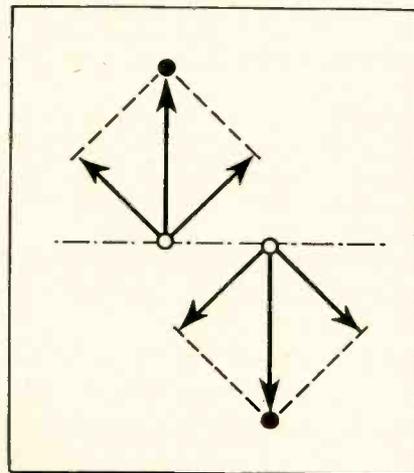
The problems now multiplied at a rate that was pretty much in step with the square law. Twice as many channels meant four times as many complexities.

Several new parameters appeared such as separation between channels, uniform and equal output from both channels, and susceptibility to vertical rumble. The problems of distortion and intermodulation distortion have yet to be resolved 100%. In the early days the cartridge people needed a test stereo disc. The disc people needed a stereo cartridge. Because the final results depended on the quality of both items, and because of an absence of a standard, it looked as though this bottleneck would last a long time.

However, once the stereo ball

started to roll, various segments of the high fidelity industry began to move at once. Now in something better than record time, the stereo cartridge is a reality, as are the stereo disc and the components to play them. Except for three or four terminals the outside appearance of the cartridge is conventional. Internally, almost all stereo cartridges have another element added. The two elements are arranged so that they are at a 90° angle from each other, but at a 45° angle from the vertical, as shown in Fig. 1. The elements used may be any of the conventional types, mov-

Fig. 2—Vertical stylus displacement is a result of in-phase mechanical forces.



• The stereo cartridge is another example of modern ingenuity. For a long time the industry was wrestling with gigantic monophonic cartridge problems dealing with frequency response, output characteristics, compliance, stylus pressure, undesirable resonance conditions, hum and noise suppression, etc. So much work was accomplished that no longer was it valid to think in

ing coil, magnetic, crystal, etc. It may even be possible to use a combination of different elements. Because both elements in the cartridge are placed on a 45° angle, they are sensitive, to a degree, to both vertical and lateral movements. The up and down displacement is a vectorial sum of in-phase mechanical motion as shown in Fig. 2. Since it is specified that the signal must be out of phase for this condition, either one element or its leads must be reversed. This is accomplished in the manufacturing process. Fortunately, this also satisfies the requirement that an in-phase signal be derived from a horizontal motion. Fig. 3 illustrates relative output voltages for different stylus motions.

This also happens to be a very desirable feature for monophonic playback. By connecting both elements in parallel, the cartridge becomes insensitive to vertical motion. (Equal and opposite voltages cancel each other.) For stereo applications it is also possible electrically to mix a portion of the low frequencies in both channels so that the vertical rumble component is cancelled out. It can be done without compromising the stereo effect. Many cartridge makers are using mechanical vertical-suppression devices, usually in the form of a bumper or buffer wedged between the stylus and cartridge body. Some are using the electronic mixing method which may consist of a bridging resistor from one element to the other.

3-Pin or 4-Pin

Some question will no doubt be raised about the use of 3 or 4-terminal cartridges. For most applications the 3-terminal units are quite satisfactory, and if all other

conditions are the same, no difference in performance will be noticed. An advantage offered by the 4-terminal cartridge is the availability of separate ground connectors. Benefits from this feature can be realized if a ground loop is encountered or if for some other reason unstable problems should arise from a common ground connection at the cartridge end.

If it should become necessary to alter the phasing characteristics of the stereo cartridge, in the field, it could be readily accomplished with the 4 terminal units. The systems have been standardized to the point, where it should not be necessary to resort to such phasing gimmicks. The experimenter may for some reason wish to connect both elements in series; this configuration is possible with either the 3 or 4 terminal cartridge. In some cases, in order to minimize hum and satisfy wiring conditions the two ground terminals in the 4-terminal cartridge may have to be tied together. However, the added flexibility of the fourth terminal is desirable, but not necessary, for some of the reasons advanced. A certain amount of precaution should be exercised when interconnecting two ac-dc type amplifiers, or other equipment, especially if the chassis are connected to one side of the power line. If the low side of the plugs or jacks are connected to the chassis there is a danger of placing 117 volts across the two ground terminals on the 4-pin cartridge which may be spaced less than 1/16" apart, as shown in Fig. 4. Normally these jacks are not at chassis ground. Concern here is not so much for equipment protection as it is for protection of the equipment user. The 3-terminal

cartridge in this situation would be a safer bet, because the house fuse or wires going to the cartridge would let go instead of leaving a potential shock hazard. Fortunately most if not all high fidelity equipment is power transformer equipped and line voltage leakage to ground is within safe limits.

Impedance Matching

In general, impedance matching requirements are the same. However, in all cases the manufacturer's specifications should be consulted. Certain normal load conditions which may be satisfactory in many instances can be noticeably improved by the addition or change of only one resistor. The velocity sensitive cartridges which include the

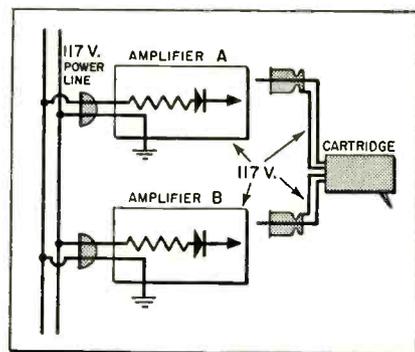


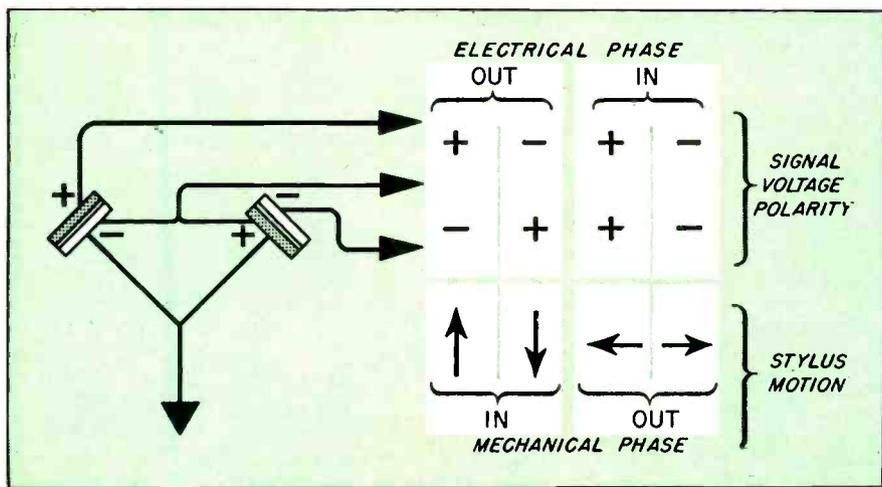
Fig. 4—Possible shock hazard may be set up, with some AC/DC equipment and cartridges.

magnetic, variable reluctance, moving coil, and moving iron require an equalized preamplifier for each channel. The conventional types are satisfactory in most cases. The ceramics and other high level output cartridges generally can work directly into the amplifier. The output versus frequency response curve for these cartridges are equal to the compliment of the RIAA recording curve, and therefore the amplifier should have a flat frequency response.

When the normal high impedance input in amplifiers which are in the order of 500,000 ohms are used for stereo, they will attenuate some of the low frequencies. This condition is easily remedied by following the instructions for each cartridge, which usually specifies an increase in the input resistance. In some cases up to 8 megohms are recommended.

Certain desirable design characteristics are responsible for smaller signal output from the stereo cartridge. There is usually more than enough reserve gain in the preamplifier and amplifier to provide a satisfactory output level. •

Fig. 3—Relative output voltages obtained from various stylus motions. In-phase mechanical forces result in out-of-phase electrical signals. Conversely, out-of-phase mechanical forces cause in-phase signal. Because low frequencies are essentially in-phase signals, they will be found mostly in the horizontal components of the stereo disc.



Needles For Stereo

Vertical Sensitivity Of Cartridge Requires Additional Precautions To Avoid Distortion And Tracking Problems.

CHARACTERISTICS

Electrical

Distortion
IM
Harmonic
Noise

Mechanical

Excessive Wear
Tracking

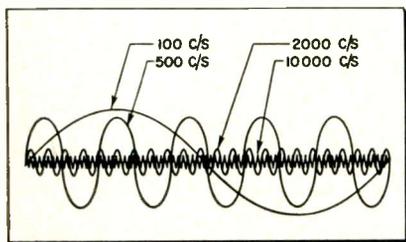
Installation

Alignment
Pressure
Size
Material
Quality

• In spite of certain claims of compatibility in various respects for the new stereo disc systems, a closer look reveals that, while the same stylus and pickup will play both the monophonic and the new stereo discs it is advisable to use the right stylus for each. Here's a quick rundown on the way the new stereo records affect the needle problem.

Both systems use the RIAA curve, therefore the problem frequencies (preemphasized highs) are the same as regards to having the needle follow the groove. This is shown in Fig. 1. The extremely vigorous movement represented at 10,000

Fig 1—Relative stylus motion at different frequencies at maximum recording level for four frequencies, using the RIAA curve.



cycles is offset for much of the time by the relatively low level of these high frequencies. But, certain sounds with high impact components, such as cymbal clashes, triangle, drummer's traps, a plucked steel guitar, xylophone or marimba played with hard-surface mallets, can produce an extreme demand on needle movement. These place the greatest strain

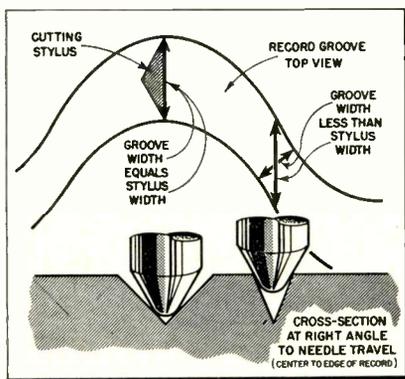


Fig. 2—Sidewise motion of the cutter makes the groove narrower and subsequently forces a round stylus to rise. A 1,000 cycle sine wave even though impressed laterally, causes the playback needle to rise and fall 2,000 times.

on stylus and disc in both systems, often amounting to 2,000 times the normal force required to move the stylus.

There has been much talk about pinch effect. Pinch in a monophonic record is actually a narrowing of the groove width, caused by sidewise movements of the cutting stylus, during the recording process. When the relative motion between the disc and cutter is straight ahead, the width of the groove is maximum. Thus when recording a sinusoidal signal the groove width is maximum only at the peaks, also when there is no modulation, as shown in Fig. 2. Because the playback needle is round, (same radius in all direc-

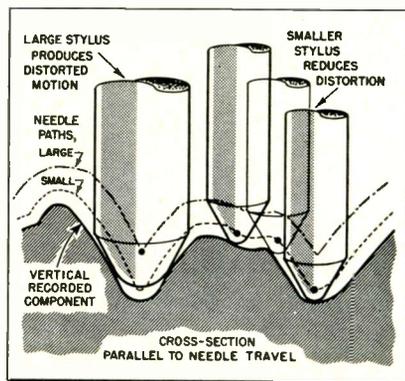
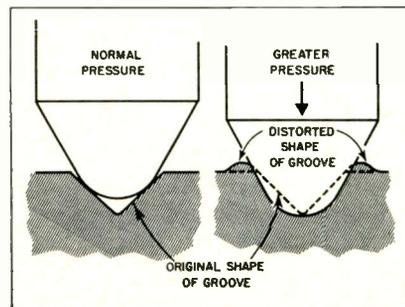


Fig. 3—The path of the larger stylus differs from the actual vertical component causing distortion. The smaller stylus minimizes this distortion. Compare dotted and solid lines.

tions) it is forced to travel up and down twice for each sine wave, or 2,000 times for a 1,000 cycle signal. Provided vertical motion of the stylus produced no output from the pickup, this was relatively unimportant. But stereo records use vertical motion as well as lateral (even though it may be resolved as 45/45), therefore pinch effect can no longer be inconsequential. Pinch effect in stereo discs has three kinds of pickup between vertical and (Continued on page 97)

Fig. 4A—Larger stylus with normal pressure is liable to bounce. (B) Increased pressure improves tracking, but deforms the groove.



**Best for
Conversion
or Replacement**

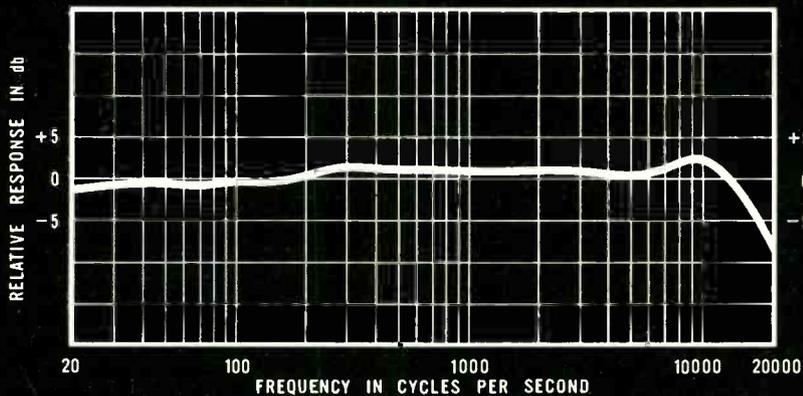
COLUMBIA CD

**...by design the
most linear Stereo Cartridge**

Now is the time to profit from stereo. And for stereo conversion or replacement, Columbia CD cartridges are designed to be your best choice. Note the advantages of their constant displacement design. Check specifications.

Ask your CBS-Hytron distributor or write us for helpful free bulletins: An Introduction to Stereophonic Sound, E-305; Hints on Using the Columbia CD Stereo Cartridge, E-306; Instruction Sheet for the CD, E-289. Order these bulletins and your Columbia CD cartridges . . . today.

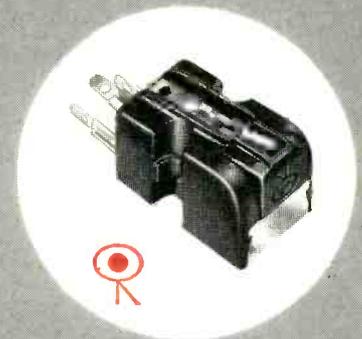
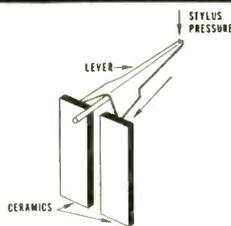
RESPONSE OF COLUMBIA CD CARTRIDGE



COLUMBIA CD Linkage

In Columbia Constant Displacement cartridges, motion of the stylus is transmitted directly to the two wafers that generate the output voltages. This is accomplished by a simple lever, frictionless and featherweight. The precise mechanical design assures that, regardless of frequency, the output voltage is essentially constant for a given displacement of the stylus.

Ask to hear the CD. Discover for yourself that Columbia Constant Displacement cartridges are designed to reproduce *all* the exciting breadth, depth and realism of stereo records. Remember, the Columbia CD was designed by CBS-Hytron's sister division Columbia Records drawing on its over 60 years of recording experience. Get the best. Insist on Columbia Constant Displacement cartridges.



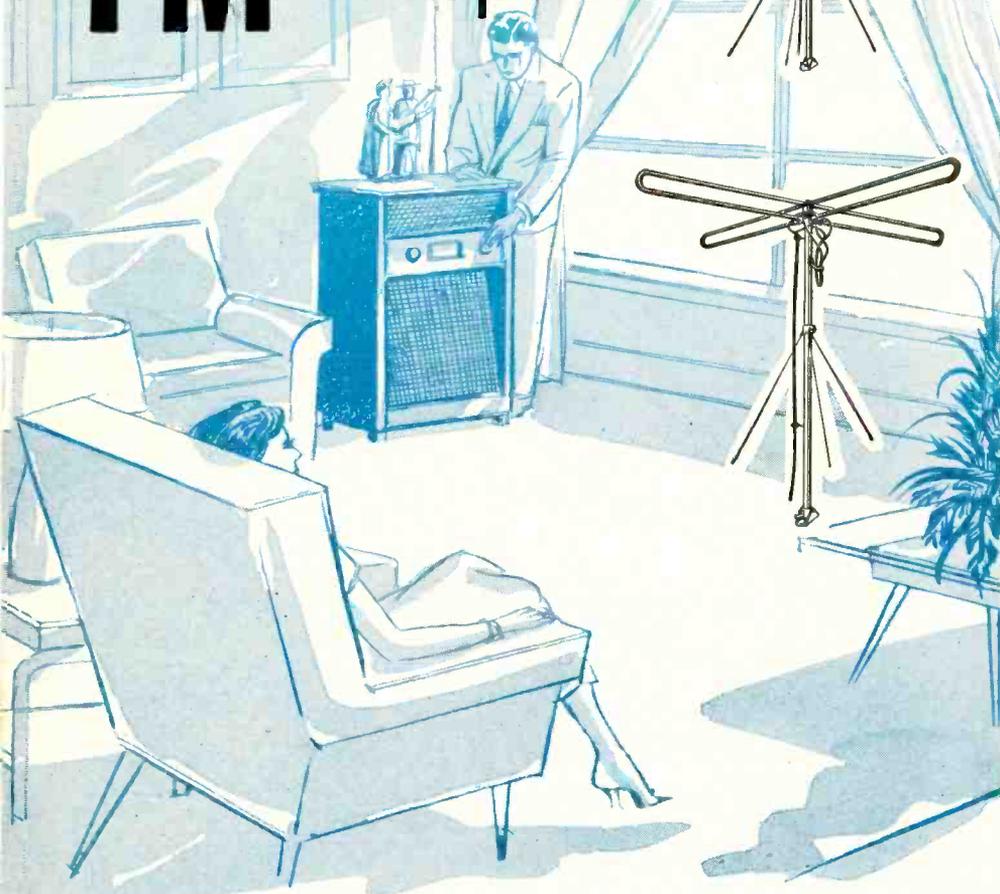
SPECIFICATIONS

- Diamond stylus 0.0008 inch radius
- Recommended needle force 5 to 7 grams
- High compliance. superior tracking and reproduction
- Open-circuit voltage 0.5 volts
- Extended stereo range, ± 2.5 db . . . 20 to 16,000 cps
- Channel separation in excess of 20 db
- Complete compatibility stereo and monaural
- 4 speeds 33 $\frac{1}{3}$, 45, 78 and 16 $\frac{3}{4}$

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

Circle 57-01 on inquiry form page 73

high fidelity FM reception



demands a fine antenna . . . *

. . . and the audiophile's best bet for clear, sparkling FM sound is an AMPHENOL broadband FM antenna. Available in two popular models, AMPHENOL FM antennas have been carefully engineered for specific reception problems. The 114-008 "Inline-type" folded dipole and reflector offers the unidirectional directivity pattern, high gain and mechanical rigidity that have made AMPHENOL's tv Inline antenna famous. The 114-010 "Turnstile" double folded dipole is intended for use in urban areas where there are many FM stations. Its circular directivity pattern assures efficient pick-up of such stations.

* *Do it yourself*

COMPLETE KITS \$16.25 each, list



AMPHENOL ELECTRONICS CORPORATION *chicago 50, illinois*

Stereo Conversions

(Continued from page 52)

If a problem of excessive vertical rumble from the record changer should present itself on stereo programs, it is possible to make the stereo pickup less sensitive to vertical displacement by placing a resistor across the two hot leads on the cartridge. It will also be necessary to connect both ground leads together on a 4-pin cartridge. The stereo effect will not be materially compromised by this gimmick. The value of this resistor can best be determined by experiment; $\frac{1}{2}$ to 2 megohms should do the trick in most instances.

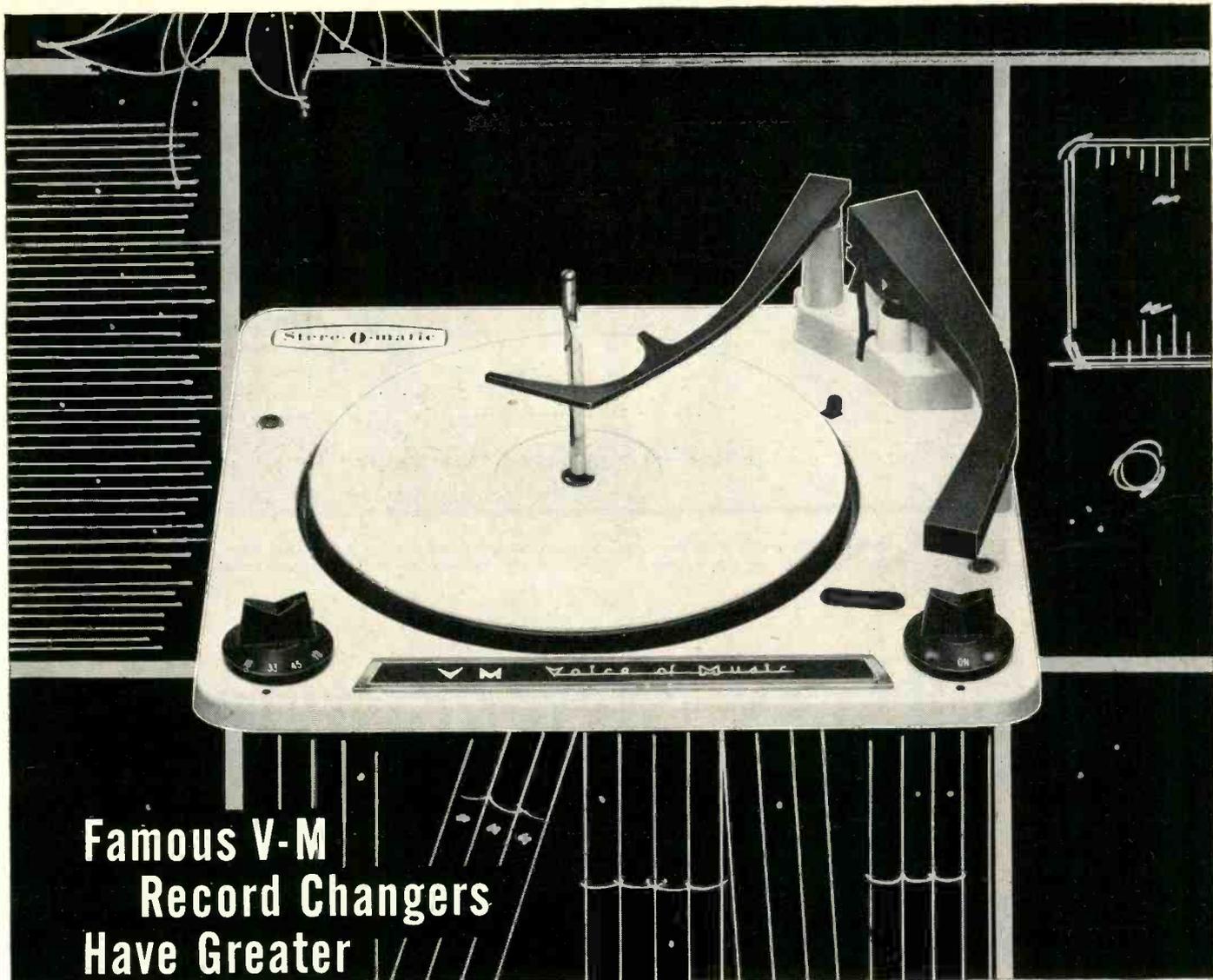
Extra shielding and precautions are necessary for hum-free listening. It may be necessary to try several different methods to obtain best results. Because of the low signal levels at the cartridge output and the necessary high amplification factors, any noise or hum that gets into the front end of the amplifier is going to be heard. Because of this and the increased number of interconnections from one unit to another, an undesirable ground loop may develop. In stubborn situations, it may be necessary to try a different cartridge. In most situations observing the rules laid down by the manufacturer for grounding and connecting his piece of equipment will do.

The muting switch on a record changer presents a problem and the technician's mechanical ingenuity will come to light. The switch normally grounds the hot terminal during the change cycle and sometimes when the tone arm is in its resting position. The problem stems from the fact that a duplicate set of contacts is needed for stereo. In some cases it may be possible to improvise another effective electrical pole by substituting a conducting rather than an insulating switch armature. Other switch modifications will suggest themselves upon inspection. In all probability, later versions of record changers will eliminate this problem by incorporating a dual switch.

Stereo is here . . . and conversions to stereo can be difficult for the inexperienced. In the light of present developments it is worthwhile to install a stereo cartridge as soon as possible. For best results, the conversion should be performed by people with the skills of a qualified technician. •

◀Circle 58-01 on inquiry form p. 73

ELECTRONIC TECHNICIAN • Stereo, 1959



**Famous V-M
Record Changers
Have Greater
Consumer
Acceptance
THAN ANY
OTHER MAKE!**

V-M HAS MANUFACTURED MORE STEREO CHANGERS THAN ANY OTHER MANUFACTURER!

The All-New V-M 'STERE-O-MATIC'® 4-SPEED RECORD CHANGER

This is the *one* automatic record changer that matches all other changers feature *and then some!* V-M's 'Stere-O-Matic' Model 1201 comes wired for stereo with stereo cartridge installed! Complete with dual output jacks and stereo/monaural switch. \$50.00 List*

SEE AND TEST THIS HIGHEST QUALITY STEREO RECORD CHANGER WITH TRUE, TRANSCRIPTION-TURNTABLE PERFORMANCE!

RUMBLE: —48 db for 120 cycle rumble when tested on XLP414 test record (recorded velocity approximately 3.4 cm/sec. at 1,000 cycles.)

WOW AND FLUTTER: ¼ RMS

TURNTABLE: Balanced to assure constant speed. Bearing materials and finishes controlled for minimum noise and friction. Spindle bearing area centerless ground to reduce frictional drag.

MOTOR SPEED: Constant, positive for permanent true pitch.

TONE ARM: Resonance-free. Easily adjustable for any cartridge weight. Compensated to eliminate variation from bottom-to-top of record stack. Jewel-type anti-friction bearings eliminate vertical friction. Stereo cartridge installed. Will accept all popular stereo or monaural cartridges without alteration.

TRACKING ANGLE: Variation reduced to a maximum of 2°

AUTOMATIC SHUT-OFF: Unit shuts off automatically after last record plays.

RECORD INTERMIX: Will intermix changing of 10" and 12" records of the same speed. V-M 45 spindle fits easily over Tri-O-Matic spindle for 45 rpm records.

Model 1202 has 4-pole motor and plug-in head for GE and other magnetic cartridges. All stereo leads, jacks and switch included. \$50.00 List*

Both available with matching base-pan as Models 1226 and 1228.

V-M—PIONEER IN STEREO—YOUR ASSURANCE OF THE HIGHEST QUALITY®

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World Famous for the Finest in Tape Recorders, Phonographs and Record Changers

Circle 59-01 on inquiry form page 73

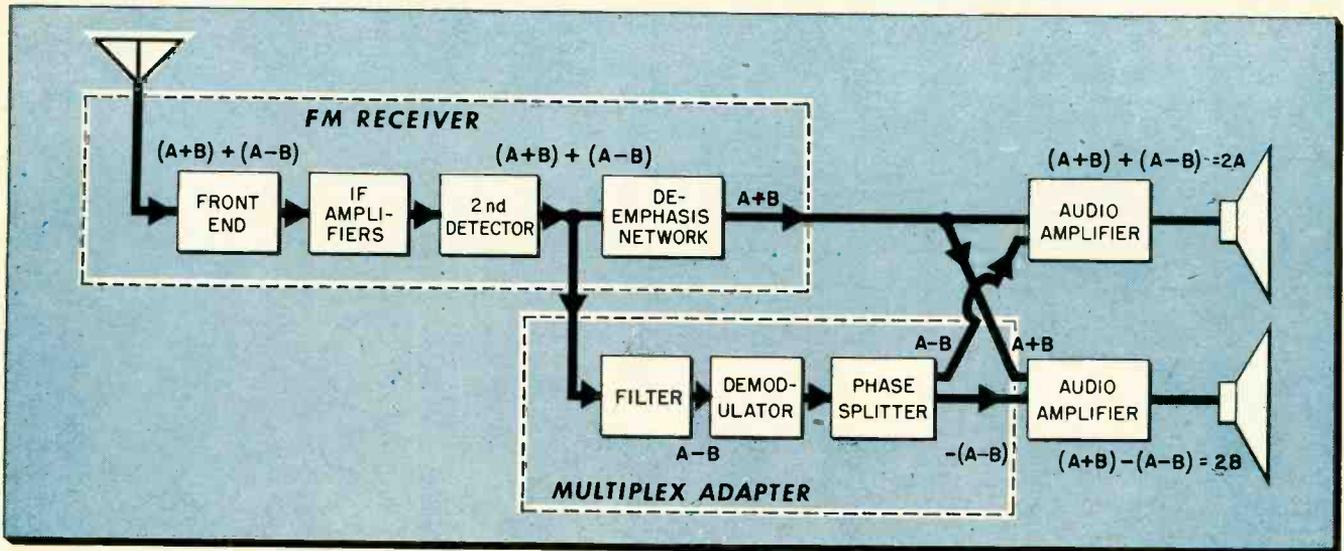


Fig. 1—Conventional FM receiver picks up the entire multiplexed program, but only the monophonic information $(A+B)$ can be heard. The $(A-B)$ signal can be picked off by a multiplex adaptor and fed into both speaker systems to establish the left and right sense.

Multiplex Stereocasting

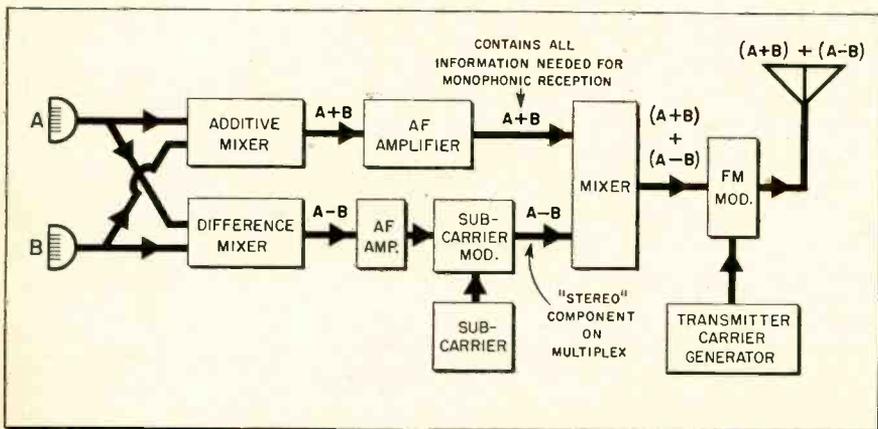
• Multiplex transmission very simply stated is the transmission of more than one program on the same carrier. This differs from the type of transmission found in TV. True, two programs (sound and video) are sent over one TV channel, but separate carriers are used for each, and it is possible to tune in one or the other. In the case of multiplexing, a portion of its carrier is left clear of the main program to accommodate a second channel without increasing bandwidth. To help iden-

tify the various portions, they are termed main carrier and subcarrier. Unlike the TV signal it is not possible to tune in the subcarrier without receiving the main carrier. However, it is possible to filter out the information on the main carrier leaving only the intelligence contained in the subcarrier. Just as it is possible to create a so-called second channel with its related subcarrier, it is possible to subdivide the main carrier into many subcarriers, and transmit many different programs at the same time. Some FM stations which are already using multiplex to broadcast a pro-

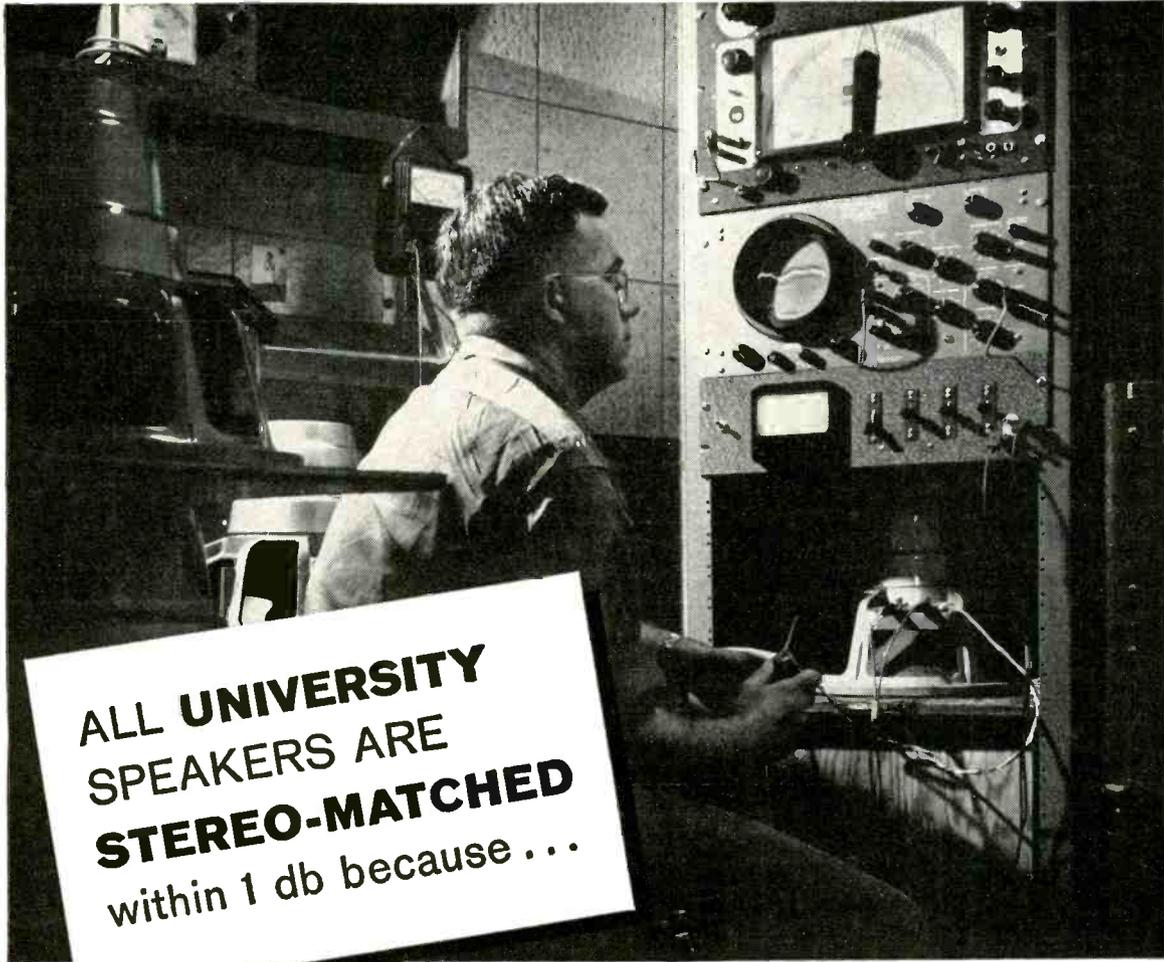
gram into the home, free to the listener, and beam a background music program into commercial establishments for pay, are considering the use of a second subcarrier for stereocasting. This would probably divide the station's signal so that the major portion of the carrier would consist of the main broadcast program; the next adjacent subcarrier would carry the information needed for stereo; and the end subcarrier would continue to provide a source of income from commercial listeners.

How to maintain compatibility to enable the regular FM listener to get his full quality program without interference from the other portions of the multiplexed signal, and how to avoid other problems of poor signal-to-noise ratio, crosstalk, and distortion for the listener of the subcarrier portions, presented some mean problems to the broadcasters. That they have succeeded in developing a workable system is very much to their credit. In the AM-FM technique of broadcasting stereo, it is necessary for each of the two channels to contain all the program information. Therefore the microphone for each channel must, in this application, be placed fairly close together and in the center. This close spacing was also used in some early multiplexing efforts; it goes
(Continued on page 62)

Fig. 2—Sum and Difference technique supplies all the information needed for monophonic listening to the main program. The sum signals modulate the main carrier and the difference signals are impressed on the subcarrier.



This is part of one of the four testing bays at University where each speaker that leaves the factory goes through a series of exacting tests. Here we see a Model 315-C 15" 3-way Diffaxial being tested for frequency response. As the speaker is "swept" through the entire frequency range, its audio output is fed via a sound box, microphone and amplifier to the oscilloscope where marker lines check that it conforms to laboratory standards within 1 db.



**ALL UNIVERSITY
SPEAKERS ARE
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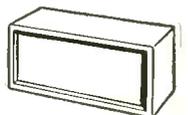
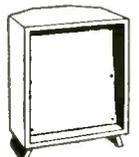
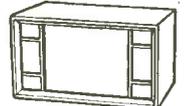
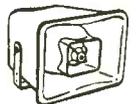
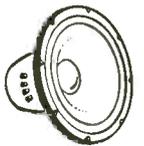
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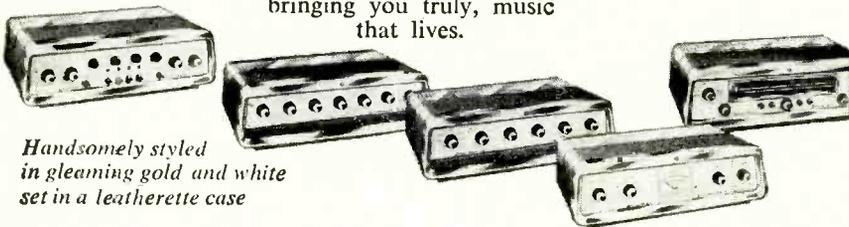
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Multiplexing

(Continued from page 60)

back to the pre-stereo days when binaural was contemplated. The binaural concept was to feed each ear the same type of information as would be heard from some theoretical ideal listening point. This was accomplished by placing the microphones apart as little as six inches, which is supposed to be the distance from ear-to-ear on an average person, and then feeding this information through two separate amplifiers, and finally to the listener's ears via a set of headphones.

The concept of present day stereo provides considerably more freedom and a more realistic listening condition in the home. No longer is it

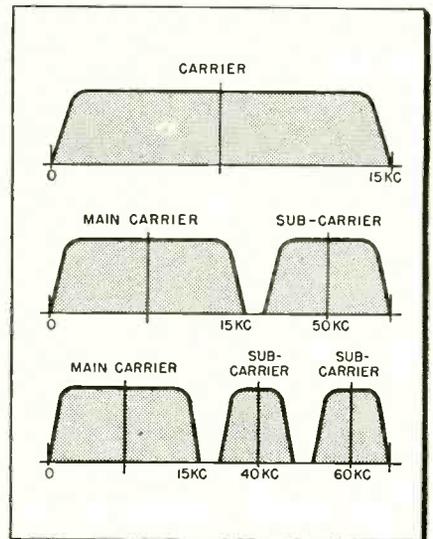


Fig. 3—By restricting the deviation of the main program, it is possible to leave enough room for one or more subcarriers to convey additional programs. Relative deviation and distribution of energy are shown.

necessary to wear a pair of ear-phones. When the listener is sitting off to one side of the room, it is as though he were off to one side in a concert hall; by the same token if he were seated in the center of the room, the feeling would be as though the musicians were spread out in front of him. In other words, stereo offers certain desirable spatial characteristics that binaural doesn't.

Because it is not necessary for the stereo subcarrier to stand on its own feet so to speak, it is possible to take advantage of another microphoning technique which improves the stereophonic effect and still leaves all the necessary information

in the main carrier for monophonic listening. Thus a listener who does not have a multiplex setup will still be able to get his FM station without any noticeable loss in quality.

The manner in which, this is accomplished is quite interesting. The microphones can now be placed further apart and at more advantageous positions. Microphoning techniques are a study unto themselves. There are an infinite number of points where they can be located, and an equal number of directions they can be facing. Directional characteristics of each microphone used also plays a vital roll in the stereo production. However, the important thing at the moment is what happens to the signals after they leave the microphones. Fig. 2 shows how the two signals from each microphone (A and B, or L and R for left and right) are added and fed into the main channel. This is essentially what is done in monophonic practice. Since all the information is present in this A+B signal, it is

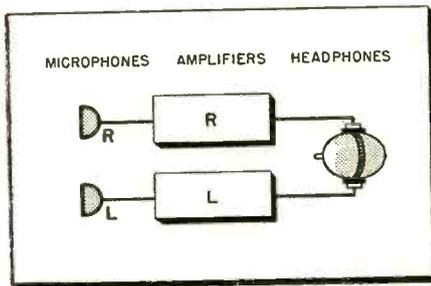


Fig. 4—The binaural concept projects a theoretical ideal listening point to the listener.

the one that is used to modulate the main carrier. For the other channel the two microphone outputs are combined to form a difference signal. This is not difficult; it is only necessary to pass one of the signals through a phase inverter. The A-B component thus developed is then used to frequency modulate the subcarrier, which in turn is used to frequency modulate the main carrier.

The signal A+B is fine for monophonic listening, even A-B may convey enough information to the inexperienced ear, but A+B and A-B as such do not as yet have any significance so far as stereo is concerned. Something else must happen before the right and left sense is restored. This is readily accomplished at the receiver end as shown in Fig. 1. By adding a portion of each signal to each stereo channel amplifier, but once again changing the phase of one signal in one channel, the righthand speaker will

(Continued on page 95)

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Stereo Cartridges and Garrard Players

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• Tape was really the first medium to find fairly extensive acceptance as a source for stereo programs. This was a natural development. Recordings were first placed on tape before transferring to disc for some time. The record companies found it useful to simultaneously record several different tracks from individual microphones placed in different positions and then blend them together later to obtain an optimized effect for transfer to the disc. This means

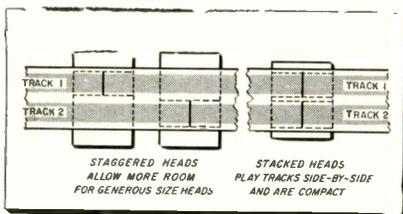


Fig. 1—Staggered and stacked heads as used in tape recorders. Some machines have both.

the record companies' master tapes, by accident or design, are already in a stereo form. As progress in stereo development went forward, it became evident that the new medium presented a potential for later release of the same monophonic programs in stereo.

The development of half-track tape (two tracks on one tape) as a source of extra-long-playing program material opened the way for using both tracks in the same direction and putting two-channel stereo on them.

While there is no doubt that tapes, made and transcribed on really top quality machines, can yield better quality than discs, the scaled down prerecorded tapes played on low priced tape players or recorders, have had a tough time competing with discs for quality in similarly priced systems, although they have

always had the advantage of longer uninterrupted playing time. This reduction in quality was forced by the question of economics in both tape and recorder cost.

Record masters have mostly used at least 15 inches-per-second (ips), and often wider than the standard $\frac{1}{4}$ " tape, to get the best possible dynamic range and quality. Prerecorded tapes have been transferred, by high-speed multiple-copying machines onto $\frac{1}{4}$ " tapes with two $7\frac{1}{2}$ ips tracks. Higher quality results at $7\frac{1}{2}$ ips, but the appeal of the longer playing time at lower cost will undoubtedly encourage the trend toward $3\frac{3}{4}$ ips. Most machines will run at either speeds.

This "stretching" of tape, getting onto narrower tracks, and running at slower speed, has not resulted entirely in proportionate loss of quality, because the head and tape manufacturers have been busy too. They have come up with products that utilize the lower speeds and narrower widths much more effectively. It is reported that a half-track $7\frac{1}{2}$ ips tape, recorded and played with today's best heads, is at least as good as yesterday's full-track 15 ips tapes.

Head Arrangements

Stereo presented a problem of how to arrange the two heads. In the early days materials and production techniques necessitated a fairly bulky head to get the best quality which led to the use of staggered heads. Because of tape stretch and other mechanical tolerances, it was obviously more logical to have both tracks run side-by-side, in time as well as place to avoid phasing problems. So another group preferred stacked heads. Both types are shown in Fig. 1. At present the stacked group seems to have had the best foresight. Techniques for making heads has improved to the point where just as good quality can be

obtained from the stacked arrangement. Some recorders have provision for playing both.

To keep pace with the competition from the new stereo discs, to make the use of tape more economical, and to further the art, the tape engineers have been working on quarter track tape for stereo. Before, there were two tracks on a $\frac{1}{4}$ " tape, which could be used separately for monophonic channels or together for stereo. The four channel tape shown in Fig. 2 will accommodate two separate two-channel stereo programs

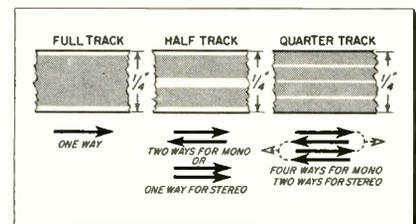


Fig. 2—Progressive development from the original full-track tape to half-track, and now to the new quarter-track, which can be played stereophonically in both directions.

or four single channel recordings. All other things being equal, this would again result in a deterioration of dynamic range. But again production methods, both on tape and heads, continue to develop and it may result in no deterioration in comparison with former one-way stereo tapes.

A recently introduced tape cartridge (all tape wound inside the cartridge) using a four track, $\frac{1}{4}$ ", 600' tape at a speed of $3\frac{3}{4}$ ips, reduces the amount of manipulation required to set up, and eliminates conventional reels and the need for threading. Tracks 1 and 3 are used for stereo play in one direction, and tracks 2 and 4 in the other. Automatic and semi-automatic machines to handle these tape magazines or cartridges have been demonstrated. At this time only a limited number

of cartridge machines are on the market. Sound quality is said to be as good as the two-channel tapes.

One of the big attractions to tape recorders, is the ability to make recordings. Most of the earlier stereo systems could be converted to, or were provided with facilities for playback but not recording stereo. A number of the newer releases have provision for recording stereo. Home stereo recording requires more know how. Most recordings will probably be made in the living room. The average living room requires a very different technique from that used in stereo recording studios.

Two directional type microphones are desirable. A pair of quality cardioids can give very good results. The microphones could then be directed toward different parts of the room, group, piano, etc. Because the directional effect in sound is due to either a difference in sound intensity or a phase difference, and because in the average size living room there is only moderate difference in sound intensity when a person is speaking from a few feet away or from the opposite side of the room, it is essential that the microphones have good directional characteristics for good stereo effect.

In an auditorium or other fairly large area, there may still be some advantage to using directional microphones, but good results can be obtained with the ordinary, mostly omnidirectional, types usually furnished with the recorder.

Techniques will vary with each set-up. If possible it is a good idea to conduct a few trial runs before attempting to record a formal program. Theoretically, the microphones should be placed in the same position and same spacing as the ears of an ideal listener; but because of the absence of certain psychological effects, including the inability to see the performers or their instruments when the recording is played back, wider spacing of the microphones will help create the stereo effect. A distance of about 3 feet may be a good start. When recording piano music, it may be possible to place a mike on each side. Thus one will pick up the bass while the other will receive the sound from the treble strings.

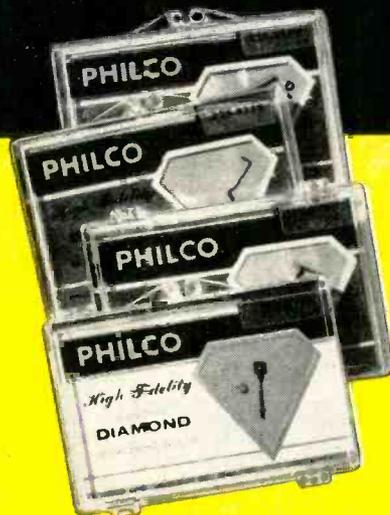
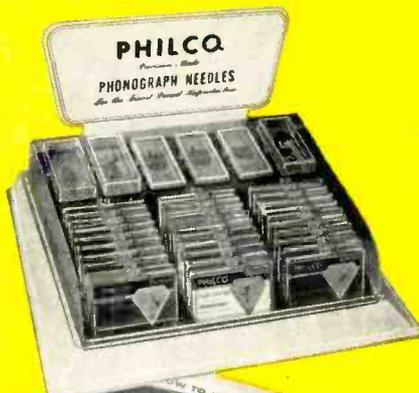
If the mikes are placed too far apart, "ping pong" and other undesirable effects may be encountered. As a general rule, directional microphones may be placed closer together while omnidirectional types will create a better stereo effect if placed closer to the dominant ends of the sound source. •

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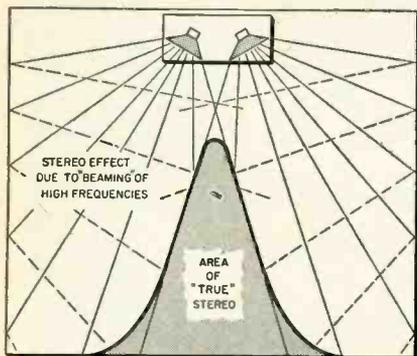


Fig. 1—Two speakers in one enclosure, angled away from each other can create pleasing stereo effects even when the listener is not seated in the true stereo area.

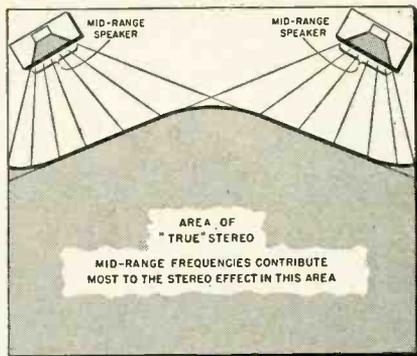


Fig. 2—Separate speaker systems are more desirable particularly for larger listening areas.

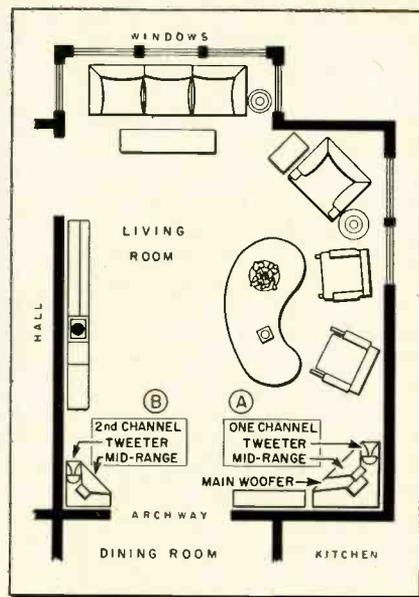


Fig. 3—Multiple speaker system arranged so that the high frequencies are projected along the sides of the wall while the midrange is aimed at a central rearward portion of the room. Because of space limitations only one woofer is used at position A to furnish the necessary bass.

Speaker

Arrangements For Stereo

same advantages, and for the same reasons, found in monophonic hi-fi practice.

This is an easy basic rule, but in actual practice modifying and adapting to suit the circumstances of individual living rooms will be required. Room shape, furnishings, and position of doors, windows, etc., will often make it impossible to adopt the ideal speaker placement and listening positions.

To provide the foundation for approaching any particular installation so as to make the best of the circumstances, it is necessary to know just what it is that stereophonic sound has to do. Many conflicting statements have been made by different authorities on just how stereophonic effects are really achieved, so differences of opinion are inevitable.

Practical experimentation has shown that the bass frequencies (below about 250 cycles) do not in themselves contribute anything to the stereophonic effect. However, sounds below 250 cycles do have a sense of direction, but it is due to their harmonics and other components which are above this range.

These low frequencies are the ones that require the larger speakers and enclosures. However, in small rooms, speakers using the acoustic suspension principle have the advantage of smaller enclosures and good bass response. If there is only one good corner location, or a position where a bass reflex or other type of enclosure, which can do a good job of reproducing the low frequencies, it will be quite in order to use a smaller speaker for the second side without attempting to get too much bass out of it. Bass frequencies referred to are those below 250 cycles. Provided adequate bass is fed into the room from at least one of the speakers, the stereophonic illusion or effect will be satisfactory.

If this method is used, it is well to employ a multi-speaker system for the side that delivers the bass, preferably with a turnover in the region of 250 cycles, and certainly not higher than 350. This enables the woofer to concentrate on the low notes and permits the midrange and tweeter, speakers to perform the function of delivering the stereo effects with maximum efficiency.

- A good general rule to use as a starting point is that the smaller living room, up to 12 feet by 14 feet, can be served by two enclosures or a single enclosure type of stereophonic speaker system, with the speakers sufficiently separated and pointing outwards as shown in Fig. 1. For larger rooms it is better to arrange two separate enclosures and their speakers along the shorter wall of the room as shown in Fig. 2. While corner placement is desirable, it isn't absolutely necessary. The shaded portion indicates the so called true stereo listening area. The direction or angle of the speakers is also important. Generally, the high frequencies should be directed down the sides of the room, and perhaps a bit toward its adjacent side wall. This helps to get the higher frequencies into portions of the room where the true stereo effect is not realized, but will nevertheless help to create a pleasing stereo illusion. Angling the woofers so that it covers the central listening area offers the

This range from 250 to 1,500 cycles may be termed the range of true stereo. It is this range of frequencies that conforms best to the theory of stereo. But this does not mean that it is only necessary to concentrate on getting only 250 to 1,500 cycles. Frequencies above and below this range are also important for getting good stereophonic reproduction, but for different reasons.

The so-called true stereo effect is most critical of listening position. If the midrange frequencies only

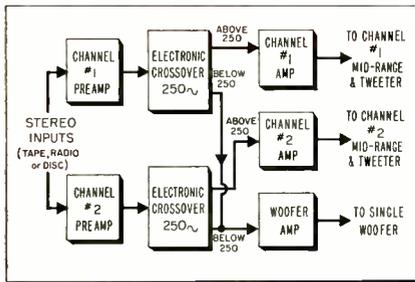


Fig. 4—Electronic crossover removes the bass component from each channel and feeds it into another amplifier and speaker system to form a third channel.

were present, the stereo effect would only be achieved in the shaded areas in Figs. 1 & 2. But, still other effects contribute to the desired stereo illusion, much more than many people seem to realize. The distribution of the high frequencies, those above 1,500 cycles, can help considerably.

This can be demonstrated by the arrangement shown in Fig. 1. The stereo effect in this case is obtained by beaming the high frequencies from each channel directly at the adjacent side wall. Thus one group of high frequencies is coming toward the listener seated off to one side, while the other group of high frequencies is directed away. This give an overall effect, at positions off-center, very similar to sitting at one side of a concert hall. By this means a very real sense of perspective is retained even though the true stereo effect which is dependent principally upon the mid-range frequencies is lost when not in the center of the room. The general effect of a speaker system of this type in a smaller room, with a reasonable degree of furnishing, can be quite pleasing.

Typical Problems

In the first place it is necessary to know how much one is prepared to spend. Then it can be decided whether to get single extended-range speakers or multiple-unit types. With a good extended range type speaker, the stereo effect based on the mid-range frequencies must

be depended upon, because extended range units tend to scatter the high frequencies in a rather indeterminate fashion compared with most tweeters. On the other hand the multiple speaker systems can be used to make the best of some awkward listening room conditions or to extend the useful listening area.

To better understand the applications of these principles, consider some of the more difficult but not unusual situations. This fairly large living room has a relatively large opening in the shorter wall leading into the dining room, as shown in Fig. 3. A corner type enclosure with a multiple speaker system could be placed in the position marked A. Then the most desirable position for the second speaker would be somewhere in the vicinity marked B. But there is very little room to put a speaker here; certainly not a large corner or wall type enclosure. The corner type would project into the opening, while the wall type, with its back against the wall, would project the sound in the wrong direction. This location calls for a much smaller speaker-enclosure arrange-

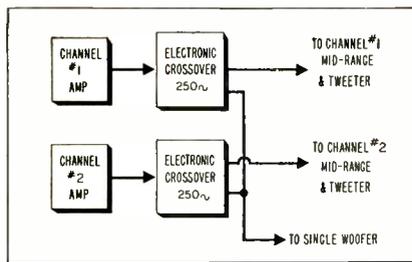


Fig. 5—If the crossover network is inserted between the amplifiers and speakers, it is possible to avoid the use of a third amplifier, and still have the third channel.

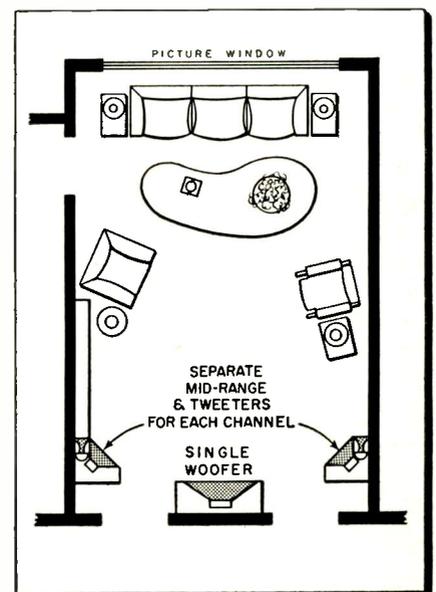
ment. It now becomes a case for the speaker positioned at A to furnish all the bass. It is possible but not necessary to elaborate on this system by combining the bass from both channels using a couple of electronic cross-overs and feeding it to the woofer. Thus relying entirely on the separation of those frequencies above 250 cycles for each channel, to get the stereophonic effect, as shown in Fig. 4. This hookup shows three amplifiers. It can be done with two amplifiers by inserting the crossover network between the amplifier for each channel and the speakers as shown in Fig. 5. The midrange speakers should be directed so that the true stereo effect, is achieved in the central part of the far end of the room. The high frequencies from the tweeters could be directed to cover the areas not properly covered by true stereo.

Therefore, the midrange speakers should be aimed toward the middle of the room, a little more toward the rear, while the tweeters should be aimed down the sides of the room. In some speaker arrangements it is possible to adjust the angle of the speaker at any time to suit the program material and seating arrangement. In some installations where the speaker enclosure itself is sitting inside another piece of furniture, it is possible to angle the enclosure without upsetting the straightforward look.

An extra large living room having two openings at one end and window space at the other, as shown in Fig. 6, may be placed so that the speakers are against the narrow wall as shown, or against the window area, depending upon furniture arrangement. There are several good speaker arrangements. One way requires three speakers. The middle and high frequency range, is covered by the units in the corners. This is an advantage in that normally only relatively small speakers can be used in these spaces. The low-frequency unit should be placed against the wall between the other two speakers. One of the crossover networks just described should be used. If this room had a center opening on the shorter wall and more corner space, an ideal arrangement would consist of two properly baffled full range speaker systems.

The use of the third speaker in the center opens the way for considerable debate on the best approach or technique to use. The

Fig. 6—A large room using widely spaced speakers may require a third speaker in the center to improve the overall stereo presentation and minimize the "hole in the middle" effect.



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center speaker can be used to eliminate a "hole in the middle" effect. Wide spacing between the speakers on each end to accomplish even greater directional characteristics amplify the problems of the hole in the middle. Since it is generally conceded that the base frequencies do not have directional qualities, one school of thought is that the logical place for the third speaker is in the center and that it should furnish the low notes. This leaves the end speakers to provide the true stereo effect. Still another group of engineers believe that a third channel in the center containing bits of information from each of the end channels will not only take care of the hole in the middle problem, but that it creates a better relationship between center stage and the other areas without detracting from the overall sense of lateral spaciousness between one end of the stage and the other. Fig. 7 illustrates one way to tap off the third speaker so that it can provide this information. It should be noted that the center speaker in this application does not have to carry any appreciable amount of bass.

The L-shaped room found in many modern homes, seemingly has

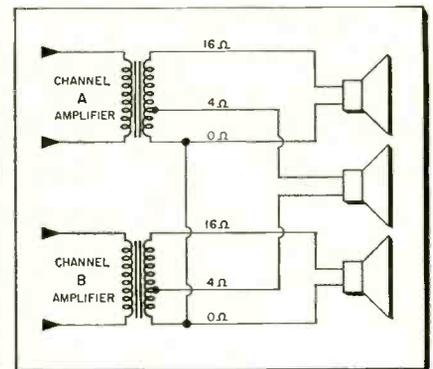


Fig. 7—Another convenient way to establish a third channel. While this method does not add anything to the bass response, it does improve the directional sense with respect to the center of the program source.

its share of problems. One solution is to use the principle embodied in the single enclosure, full range speaker systems.

Two wide-range multiple speakers (or good extended range speakers if the budget dictates) are placed in the positions shown in Fig 8. The object is to have one channel feed each major section of the room. In the central area of the room the true stereo effect is realized. In other positions the effect is of listening directly to one speaker and hearing the other one playing in another room. With proper balance

this can be quite an effective way of presenting stereophonic sound in a rather difficult situation.

If a room has plenty of carpeting and upholstered furniture it will not produce many undesirable reflections, and full use can be made of a wide-range system. Recreation and other rooms having linoleum or tiled floors, painted walls and perhaps wrought iron furniture, reverberation can be quite a problem. In fact, it becomes difficult to present

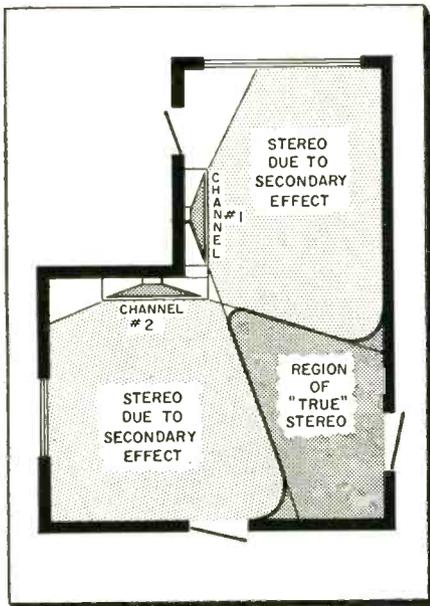


Fig. 8—The problems of the "L" shaped room can be overcome considerably by using two wide-range multiple speaker systems. Good extended range speakers may do.

a good stereo effect in a room like this, because of the way the sound bounces around.

In such a room a good extended range loudspeaker may be the best one to use, because the high frequencies will do little if any good. Much more care should be given to careful angling of the units to avoid bouncing the sound directly back from the opposite wall. Face the speaker units so that the sound hits the opposite wall at an angle. In general it might be better to consider another room for listening to stereophonic sound. Recreation rooms are not necessarily the best listening places for high fidelity stereo or monophonic programs.

Speaker Matching

A question often asked is whether or not to continue using an existing high fidelity speaker. This brings up the question of matching speakers. The answers depend on the type of existing speaker. Two of the large complex type speaker systems each using a fairly widely separated midrange and tweeter as

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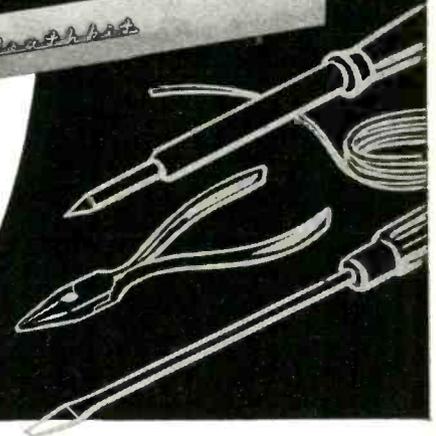
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used in some hi-fi installations, are not advisable for stereophonic presentation. They confuse the sound too much. It is better to use the well-integrated type. It is particularly important for the mid-range and tweeter units to be as close together as possible. Even in the example illustrated in Fig. 3, where the tweeter is directed along a different line from the mid-range unit, they should be mounted close together so that the areas fed by these units will not receive the impression of any noticeable separation between the sounds from its particular channel.

Another important consideration is the question of speaker phasing. First, it is particularly important to have the speakers in the same enclosure correctly phased so there is no dissociation effect at the crossover frequency. This can best be checked by playing a single channel and listening critically. Connect the tweeter first one way, then another. Listen for smoothest response and the best sense of integration. Use program material such as a solo voice. The same method can be repeated for the woofer and mid-range. Here particular attention should be given to the smoothest fill-in of frequencies around 250

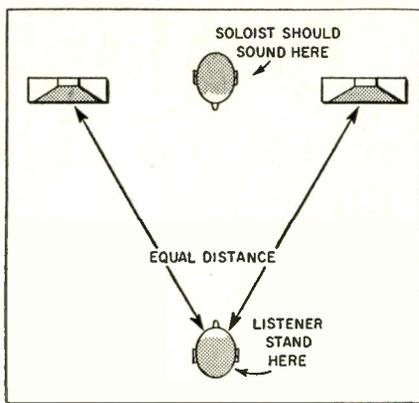


Fig. 9—A soloist's voice will appear to come from the center when the speaker output is properly phased and balanced.

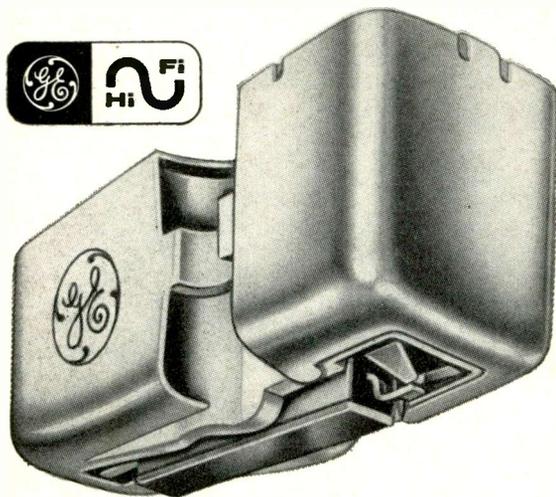
cycles, or whatever crossover is used.

If multiple speaker systems are used in each channel, it is essential that each bank of speakers in the channel be properly phased before attempting to check the phase of the overall stereo system. A simple method is to try reversing the connection to any one channel's speakers to discover which gives the best sense of position for solo program. Select a program where the soloist is intended to be approximately in the middle, and listen from a central positions as shown in Fig. 9. The thing to listen for when the two

speakers are operated at the same level is the soloist's voice. It should appear to come from a point midway between the two speakers. If the sound seems to get lost in the room, try reversing the connections to one speaker. If the system uses woofers in both channels, the low frequencies can also be helpful, if each channel is correctly phased within itself.

Contrary to instructions on phasing which have appeared in print from time-to-time, speakers for each channel of a stereo system should be phased when listening to the desired stereo program, and not with batteries or monophonic material played over both channels simultaneously. This is particularly significant if due to the use of dissimilar amplifiers, preamplifiers or if conditions of program material are such that the two channels are not in phase going into the amplifiers, the program fed to the speakers in each channel are out of phase. To correct this condition, it is simply a matter of reversing the leads going from one amplifier to its speaker. This may make the speakers out of phase in the "battery test" sense, which is exactly opposite to the correct phasing situation for conventional monophonic listening. •

STEREO PROFITS START HERE



New G-E "Golden Classic" Stereo-Magnetic Cartridge

Easier to sell...because it's magnetic
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Stereo installations and conversions can open up a whole new field of profitable business for you. And you can start your customers converting to stereo *right now*—with G.E.'s new "Golden Classic" stereo-magnetic cartridge (fully compatible with LP monaural records). It's easy when you tell them how a magnetic cartridge can best provide the high compliance, low distortion, and channel separation required by the new stereo discs. Just as important, General Electric is the name *all* your customers know and trust.

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GENERAL ELECTRIC

Specialty Electronic Components Dept., W. Genesee Street, Auburn, N. Y.

Circle 70-01 on inquiry form p. 73

ELECTRONIC TECHNICIAN • Stereo, 1959

Changers & Turntables For Stereo

Lower Recording Level, Vertical Rumble & Arm Consideration

• The controversy of record changer vs. turntable now has a new slant, with the advent of stereo. The argument for the turntable is the one of simplicity. Where the objective is smooth motion without flutter, wow or rumble, a simple mechanism should stand the best chance of achieving the ideal. The argument for the record changer is that it does what a lot of people want it to do. Expert design, close quality control, coupled with precision methods, have provided record changers and turntables whose performance is quite satisfactory for stereo purposes.

Some high fidelity enthusiasts will not look at changers for another reason; they want to keep up with the latest developments in tonearms and pickups. The changer is not readily adaptable for use with a variety of arms. One major advantage the turntable has at the moment is the

ability to operate with lower stylus pressure, but the changer people are working on this and have made some progress.

As quick as a problem is recognized, that is how fast the engineers and manufacturers set about trying to lick it. The sensitivity to the vertical component as found in stereo pickups, has spurred all facets of the record player industry into action. Improvements already incorporated and some yet to come in the changer and turntable field indicate that the relative merits and arguments for the changer and turntable will stay in about the same perspective.

Flutter, Wow, Rumble

Flutter and wow show up exactly the same on stereo as they do on monophonic records. Rumble, on the other hand, has another chance of breaking through in stereo. With a

monophonic pickup the only form of vibration normally picked up is in a horizontal direction.

Since stereo pickups are sensitive to both vertical and lateral vibrations, rumble components now become a more important factor.

To help offset this problem, some of the new stereo pickups include an acoustic, or mechanical filter, to avoid picking up low frequency vertical components. This is permissible because in any legitimate stereo disc recording the low frequencies are essentially in the lateral groove motion. Losing the vertical component at low frequencies should not materially deteriorate the stereo effect, and it does filter out some vertical rumble.

Recording Level

It is more difficult to obtain the high percent of modulation that has lately been impressed on most

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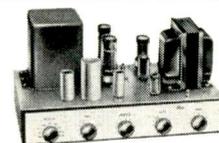
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Concerning the EICO 60-watt Power Amplifier: "Listening tests confirmed the fine instrument test results without question. Our HF-60 produced firm, well-defined bass and clear, sweet treble on the finest speaker systems available. It clipped momentary overloads very well and recovered quickly, and this gave listeners the impression of tremendous reserve power. In our opinion, it is one of the best-performing amplifiers extant; it is obviously an excellent buy."
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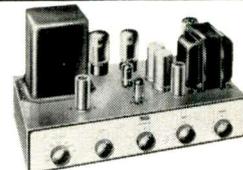
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"For those who have been looking for a well-engineered yet inexpensive power amplifier, the newly-released EICO Model HF-20 unit might offer a simple solution to their problem. Not only does this unit provide 20 watts of power but the circuit incorporates a preamplifier and a variety of controls on a single chassis."
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— J. Gordon Holt, Technical Editor, HIGH FIDELITY.

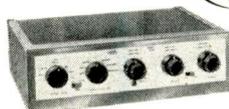


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Complete high fidelity three tube amplifier system with two 4" phased speakers in handsome two-tone fashion-fabric cabinet. Separate bass, treble and volume controls for second channel. Kit includes hi-fi ceramic turnover stereo cartridge, mounting accessories, phono jack and 15 feet of extension cable to unit.

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monophonic records, onto the new stereo recordings without running into much more severe distortion. Consequently the stereo records so far released are recorded at lower levels. From a compatibility viewpoint this level difference has some justification because the addition of the stereo quality to a presentation makes it seem louder than the same level played over a single channel.

Because the lateral component of a stereo record is recorded at lower level, a given amount of rumble will become correspondingly more noticeable. In some instances this can mean the difference between rumble that was not heard and its becoming objectionable. So some units that might have rated as acceptable for monophonic use may not be quite good enough for stereo.

Arm Pivots

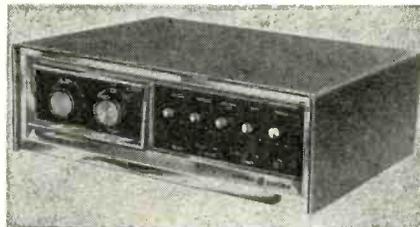
Another factor that affects arms, whether on record changers or turntables, is the matter of pivot friction. Stereo records use smaller styli. Smaller styli mean that a given stylus pressure produces more wear. The minimum stylus pressure is decided by the pickup design. But if there is any appreciable friction in the arm pivot, the stylus pressure must be increased.

So, with the exception that vertical components of rumble vibration now assume a much greater importance, the effect of stereo's advent on arms, changers and turntables is mainly that the already rigorous requirements become just a little more so. Undoubtedly this will stimulate further improvements in each kind of equipment, but most of the existing models can be used for stereo. ●

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JENSEN DS-100 DUAL 3-WAY SYSTEM WITH THE NEW,

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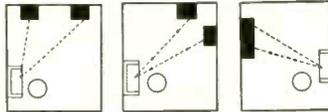
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A pair of these Director assemblies are used in the DS-100 Dual 3-way System (illustrated above), a single assembly in the SS-100, mounted inside on the shelf above the Flexair woofer enclosure. Chassis easily rotated without moving cabinet, has an 8" m-f unit, compression-driver tweeter, network and control. All frequencies above 600 cycles are reproduced by the Stereo Director assembly. Complete system is also available in kit form.



Jensen STEREO DIRECTOR lets you place the speakers wherever decor dictates, square to the wall for best appearance. You send the sound to you, instantly adjust for best stereo listening without moving cabinet.



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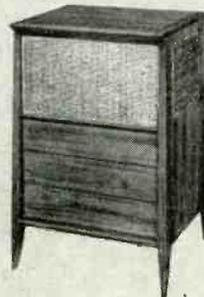


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STEREO DIRECTOR

Equivalent in performance to one section of the DS-100 Dual Stereo system, this elegant model includes Stereo Director Chassis and 12" Flexair woofer in the Jensen Bass-Superflex enclosure for smooth coverage of the range from 20 to 15,000 cycles. Adequately driven to normal room levels with a 10 watt amplifier. Two SS-100's are ideal for stereo in the difficult-to-arrange living room, assuring perfect sound in the favored listening area. 32" H., 21" W., 18 1/4" D. Available in Walnut, Tawny Ash and Mahogany.

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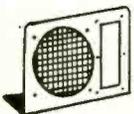


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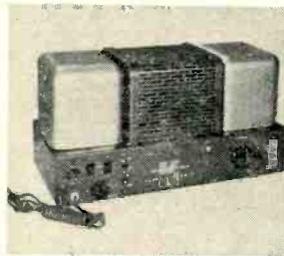
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For more information on these products
SEE INQUIRY COUPON ON PAGE 73
& Directory of Manufacturers on Page 88

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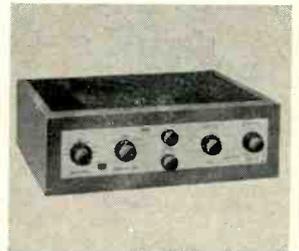
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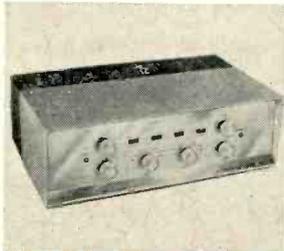
EICO HF-81

Dual preamp/amplifier, 14 watts per channel, has 10 cps to 100 kc response ± 0.5 db at 2 watts. IM distortion 0.5% at 5 watts/channel. Harmonic distortion less than 1%. Hum and noise -75 db. Speaker impedances 4, 8 and 16 ohms. \$109.95 wired, with cover; \$69.95 kit.



ARKAY SA-25

Dual preamp drives 25-watt Williamson amplifier in channel 1. Output of channel 2 is fed to existing monaural amplifier. IM distortion 1.8% at 20 watts. Harmonic distortion 1.5%. Hum -90 db. Damping factor 16. Kit \$59.95. Also, not shown, SP-6 dual preamp/amp kit \$39.95.



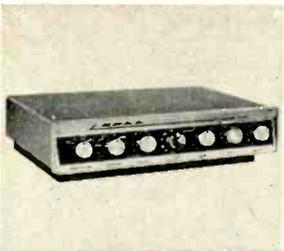
EICO HF-85

Dual preamp and control center has independent level controls with built-in clutch, hum balance control. 30 db feedback. Response 5 to 200,000 cps ± 0.3 db, to 3 v rms out. Hum 75 db. IM distortion 0.03% at 1 v. Harmonic distortion 0.1% at 3 v. \$64.95 wired; \$39.95 kit.



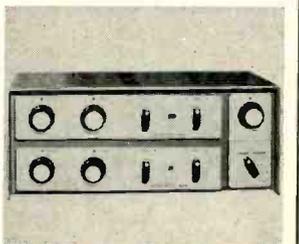
BELL 3030

Dual preamp/amplifier, 15 watts/channel, has 20 to 20,000 cps response ± 0.5 db. Harmonic distortion is 0.5% at 1 db below 15 watts. Hum -79 db. Dual outputs, 4, 8, 16 ohms and hi-Z. \$169.95. Also, not shown, Model 2221 dual channel 10-watt preamp/amplifier @ \$129.95.



FAIRCHILD 248

Dual preamp consists of stacked Model 245. Harmonic distortion is less than 1% at 1 v. Noise -85 db. Voltage gain is 60 db in phono and tape inputs. Record changer position provides RIAA curve and rumble filter. Ganged volume control. \$239.50. Model 245 monaural, \$119.50.



BOGEN DB212

Dual preamp/amplifier, 12 watts/channel, has speaker phasing switch. Response is 20 to 20,000 cps ± 1 db. Noise and hum -80 db. Harmonic distortion 0.5% at rated output. Chassis \$115.00; enclosure and legs \$7.50. Also, not shown, AC-10 single channel amplifier \$55.00.



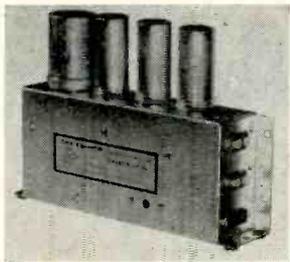
FISHER X-101

Dual preamp/amplifier, 20 watts/channel, has 0.7% harmonic distortion at rated output. IM distortion 2%. Hum and noise -80 db. Crosstalk 50 db between channels. Sensitivity 2 mv for phono input. 6 pairs of stereo inputs. 4, 8 and 16 ohm outputs. \$189.50.



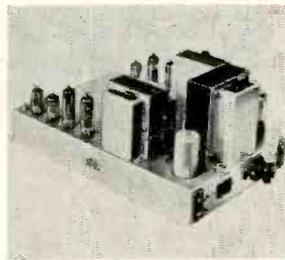
FISHER PR-66

Dual preamp, self-powered, has no controls, is designed for remote control. 2 inputs and 2 outputs for connection to audio control. AC hum balance pot. Response 20 to 20,000 cps ± 2 db. Gain 40 db. Hum & noise -68 db. Distortion 0.2% for 2 v out. Cross-talk -60 db. \$29.95.



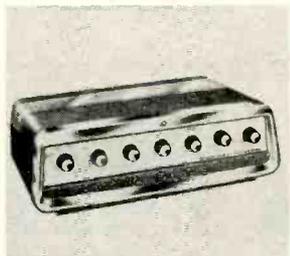
LEAK 20

Dual amplifier, 12 watts/channel, has 20 to 20,000 cps response ± 0.5 db. Harmonic distortion 0.1% at 10 watts. Hum & noise -80 db. 26 db feedback. Input sensitivity 125 mv for 10 watts. \$139. Also, not shown, Model 50 stereo, \$179; Point One pre-amp, \$109.50.



GROMMES 40PG

Dual preamp/amplifier, 20 watts/channel, has 20 to 20,000 cps response ± 0.5 db. Harmonic distortion 1%, IM distortion 2% at rated output. Hum & noise -80 db. Push-button rumble & scratch filters. \$159.50. Also, not shown, Model 24PG, 12 watts/channel, \$99.50.



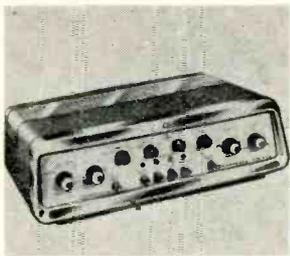
MADISON FIELDING 320

Dual preamp/amplifier, 20 watts/channel, has 20 to 20,000 cps response ± 0.5 db. Hum & noise -75 db. Power is calibrated on knobs in peak watts. Magic eye aids pre-program level settings. 4, 8 and 16 ohm speaker outputs. \$169.95. Enclosure is \$19.95. Also, Model 340



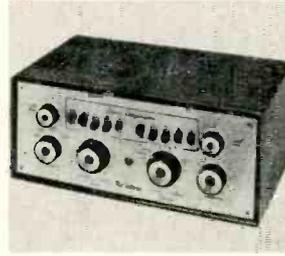
GROMMES 209

Dual preamp with dc filaments has 10 to 20,000 cps response ± 0.25 db. Harmonic distortion 0.05%, IM distortion 0.1% at rated output. Hum & noise -80 db. Output 1 v, up to 20 v without overload. \$159.50. Also, not shown, Model 214 dual pre-amp priced at \$99.50.



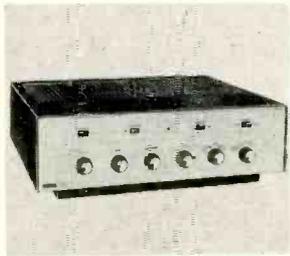
McINTOSH C-85

Preamp is designed for adding stereo to existing monaural system. Stereo balance control permits both channels to be balanced with one control. Includes mode selector, rumble filter and record compensator. \$99. Blonde or mahogany enclosure \$10 extra.



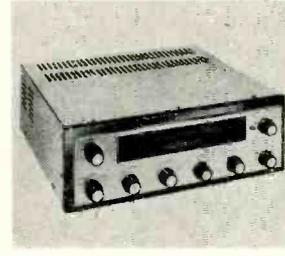
HARMAN-KARDON A-250

Dual preamp/amplifier, 25 watts/channel, has 20 to 20,000 cps response ± 1 db at 20 watts. Harmonic distortion less than 0.5% at 20 watts, IM distortion 2%. Separation over 50 db. Has filters, dc filaments. \$179.50. Enclosure \$12.50. Also, not shown, AX20 stereo, \$99.95.



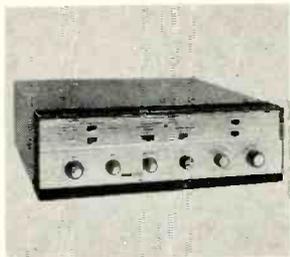
PILOT SM-244

Dual preamp/amplifier, 14 watts/channel, has 20 to 20,000 cps response ± 1 db. Hum & noise -80 db. Harmonic distortion 1%, IM 1.5%. Balance control, dc filaments. \$189.50. Also, not shown, SP-215 stereo pre-amp with two VU meters for setting reference levels, \$189.50.



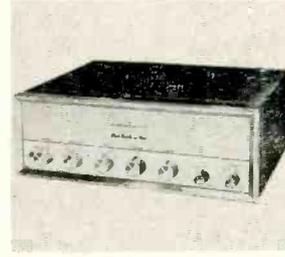
HARMAN-KARDON A-224

Dual preamp/amplifier, 12 watts/channel, has 45 to 20,000 cps response ± 1 db at 12 watts. Harmonic distortion less than 1%, IM 2%. Hum -80 db. Channel separation over 50 db. Separate ganged controls, mode switch, balance control, rumble filter. \$99.95. Enclosure \$7.



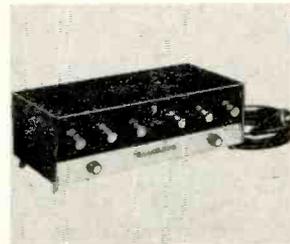
PILOT SP-210

Dual preamp may be powered from separate stereo amplifier (SA-232, \$89.50; SA-260, \$129.50, not shown) or separate power supply (P-10, \$19.50). Response 20 to 20,000 cps ± 1 db. Hum & noise -80 db. Harmonic distortion 0.2% at max. sensitivity. \$89.50.



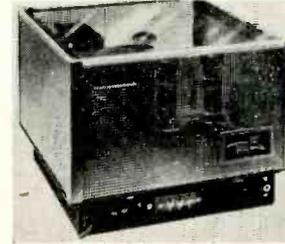
HEATH SP-2

Dual preamp has built-in power supply and scratch filter. Features 2-channel mixing and remote balance control with 20 ft. of cable. Includes 6 inputs with 4 level controls. Sensitivity 2.5 mv. 2 on-off switches, one for ac receptacles. \$56.95 in kit form.



REGENCY HF-50

Single channel 50 watt amplifier has 20 to 20,000 cps response ± 0.2 db. Harmonic distortion 1%, IM distortion 1%. Output 8 and 16 ohms. 1.5 v input for rated output. Negative feedback circuits. Available wired at \$89.50; kit \$74.50.



**SARGENT-RAYMENT
SR-17-17**

Dual preamp/amplifier 17 watts/channel, has 20 to 15,000 cps response ± 1 db. Harmonic distortion 0.32% at 17 watts, IM 1.5%. Hum & noise -70 db. Ganged controls. Balance control. \$189.60. Also, not shown, SR-534 dual channel 17 watt stereo amplifier, \$106.60.



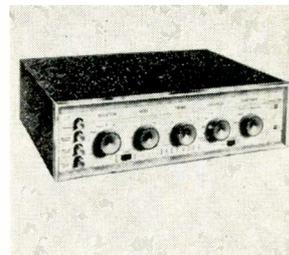
H. H. SCOTT 299

Dual preamp/amplifier, 17 watts/channel, has rumble and scratch filters. Harmonic distortion 0.8% at full power, IM 0.3%. Noise & hum -80 db. DC on filaments. Phase reversing switch. \$199.95. Also, not shown, 209 dual preamp/amplifier, 15 watts/channel, \$139.95.



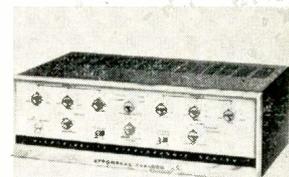
SHERWOOD S-4000

20-watt amplifier with pre-amp has dual controls, reverse and phase inversion switches, for converting monaural system to stereo. Response is 20 to 20,000 cps ± 1.5 db at rated output. Hum & noise -80 db. Also, not shown, S-5000 dual 20-watt preamp/amp.



**STROMBERG-CARLSON
ASR-433**

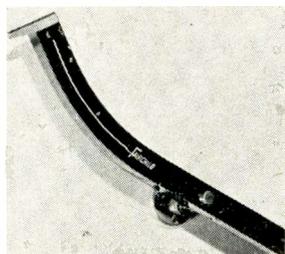
Dual preamp/amplifier has 1% distortion at usual listening levels. Controls include channel selector, master volume control, and individual channel controls. \$119.95. Also, not shown, are single channel amplifiers AR-430, 431 and 432 @ \$59.95, \$99.95 and \$119.95.



Arms

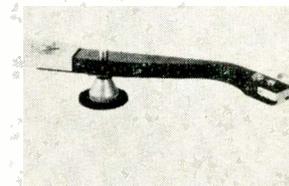
FAIRCHILD 282

Arm wired for 4-pin cartridges is designed for records up to 12"; usable to 16". Operates down to 2 grams stylus force, adjustable by thumbscrew. Self-contained arm locking detent. No arm rest required. Separate ground wire. Black anodized aluminum. \$42.50.



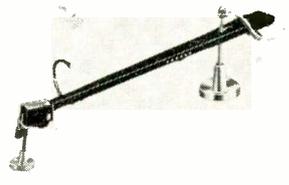
GRADO

Arm of gunstock walnut wood features one-piece construction. One knob adjustment for tracking force, ± 7 grams. Tracking error 0.8° . Resonance 10 cps. Offset angle 24.5° . Wired for stereo cartridges. For 12" records, \$29.95; 16" transcription arm \$32.50.



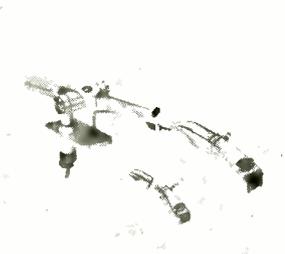
PICKERING 196

Arm includes same design cartridge as Fluxvalve Model 371. Single pivot bearing. Will mount on motorboard measuring only $15\frac{1}{2}'' \times 15\frac{1}{2}''$. Uni-mount installation employs single thumbscrew and bolt. Arm rest with sable brush keeps stylus dust free. \$59.85.



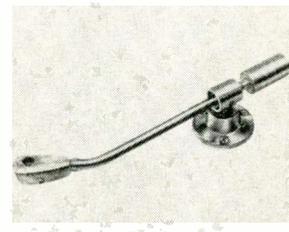
GARRARD TPA/12

Arm with plug-in head replaces TPA/10 tone arm. Two leads wired for stereo to take any cartridges. Usable for up to 16" records. Fixed length and tracking angle preset. Independent weight adjustment screw atop arm. Single hole mounting. Price \$19.50.



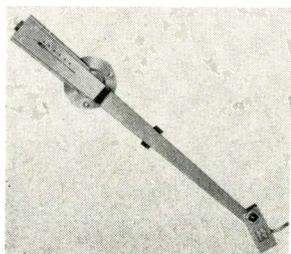
REK-O-KUT S-120

Arm of tubular aluminum, die-cast zamak cartridge shell and brass counterweight, has 2 ball bearing races. Plug-in shell takes 3 and 4 pin cartridges. Resonance 12 to 15 cps. 12" stereo unit \$27.95. Also S-160 16", \$30.95. PS-20 4-pin lead & extra shell \$5.95.



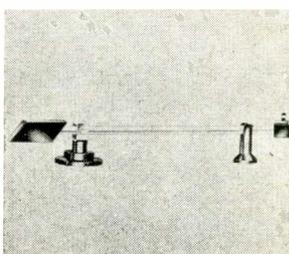
**GENERAL ELECTRIC
TM-2G**

Arm, statically balanced, features 2-step adjustment for precise setting of tracking force between 0 and 6 grams. Play up to 12" records. Designed for VR-II cartridge. Built-in arm rest. Height adjustable from $\frac{3}{8}''$ to $2\frac{1}{4}''$. 1 ground & 4 lead terminals. \$29.95.



H. H. SCOTT 1000

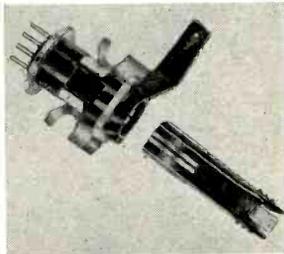
Arm with magnetic stereo cartridge (made in conjunction with London Recording) is 12.5" long. Optimum tracking force is 3.5 grams. Stylus tip 0.5 mil, output 4 mv. Height adjustable $1\frac{1}{2}''$ to $2\frac{1}{2}''$. Crosstalk better than -20 db. With arm rest, hardware. \$89.95.



CARTRIDGES

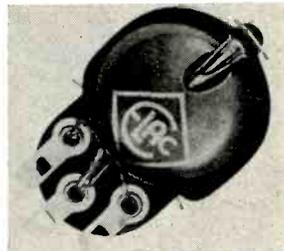
ASTATIC 13TBX

Stereo ceramic plug-in turn-over cartridge has 20 to 15,000 cps response. 4 terminals. Tracking is 5 to 7 grams. Separation -25 db. Compliance 2. Output 0.5 v/channel. Load 2 meg. With holder and 0.7 mil diamond & 3 mil sapphire \$20.50. Model 13TB, 2 sapphires, \$7.95.



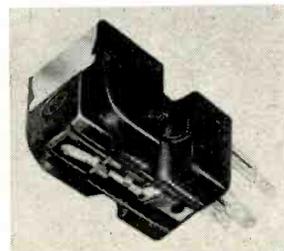
AUDIOGERSH 200

Stereo variable reluctance cartridge has 30 to 18,500 cps response ± 2 db. 3 terminals. Tracking force 4 to 6 grams. Crosstalk less than -20 db. Compliance 4. Output 25 mv at 1 kc for 10 cm/sec. Recommended load 37 k. Completely shielded. With 0.7 mil diamond \$59.50.



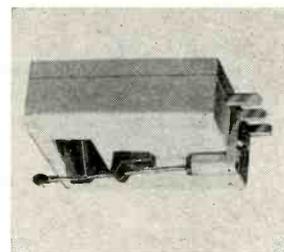
COLUMBIA SC-1

Stereo ceramic cartridge has 30 to 16,000 cps response ± 2.5 db. 3 terminals. Tracking 5 to 7 grams. Separation 20 db. Compliance 2. Output 0.4 v at 1 kc for 5 cm/sec. Load 1.2 meg. With flexible cable, hardware and 0.8 mil diamond needle \$36.25.



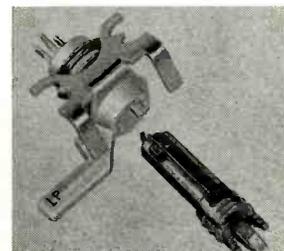
DUOTONE GPs80-1

Stereo ceramic cartridge has 20 to 17,500 cps response ± 2 db. 3 terminals. Recommended tracking force is 6 grams. Output 1 v. Compliance 2. Channel separation 20 db. Floating needle action nullifies pinch. With 0.7 mil diamond \$31.25; sapphire \$20.



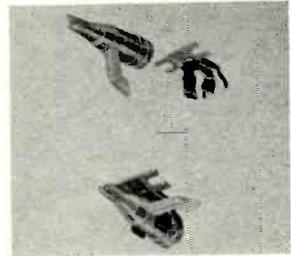
ELECTRO-VOICE 66DS

Stereo ceramic plug-in cartridge has 20 to 15,000 cps response. 3 terminals. Tracking 5 to 8 grams. Compliance 1.8. Output 1 v. With 0.7 mil diamond and 3 mil sapphire \$19.50. Both sapphires \$5.95. Mount \$1. Also, not shown, 21D, \$32.50, PZT magnetic \$16.50-\$37.50.



ERIE

Stereo ceramic plug-in cartridge has 0.4 v output. 3 terminals. Turnover design. Single ceramic element. Recommended tracking force 5 to 6 grams. Separation 20 db over most of frequency range. Compliance 1.7. With diamond and sapphire needles \$24.50; 2 sapphires \$5.95.



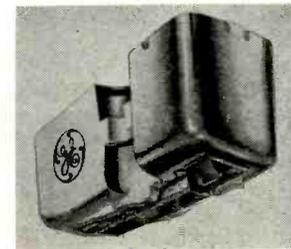
FAIRCHILD 232

Stereo dual rotating coil cartridge will track 30 cm/sec at 1 kc with 4 grams of stylus force. 4 terminals. Output 3 mv/channel. Impedance 600 ohms. Fits both $\frac{1}{2}$ " and $\frac{7}{16}$ " mounting centers. With extra twisted pair leads and diamond needle \$49.50.



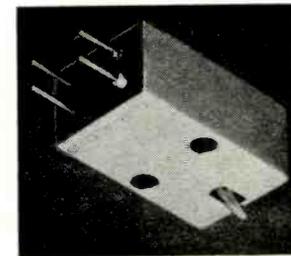
GENERAL ELECTRIC GC-7

Stereo magnetic variable reluctance cartridge has 20 to 17,000 cps response. Output 6 mv/channel. Lateral compliance 3; vertical 2. Tracking 3.5 to 7 grams. With 0.7 mil diamond needle \$23.95. Model CL-7 with sapphire \$16.95. Model GC-5 with 0.5 mil diamond \$26.95.



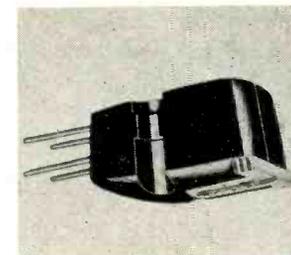
GRADO

Stereo dynamic cartridge has 5 mv/channel output @ 10 cm/sec. 4 terminals. 10 to 35,000 cps. Tracking force 2 grams. Channel separation is 25 db. Compliance 8. IM distortion approximately 2%. Impedance 600 ohms. Input load over 5 k. Stylus mass 1 mg. \$49.50.



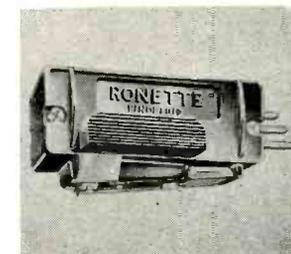
PICKERING 371D

Stereo magnetic cartridge has flat stereo range response ± 2 db. 4 terminals. Inter-channel interference -20 db. Includes hum rejection circuit. Recommended load resistance 27 k to 47 k. T-guard stylus for quick replacement. With 0.7 mil diamond stylus \$29.85.



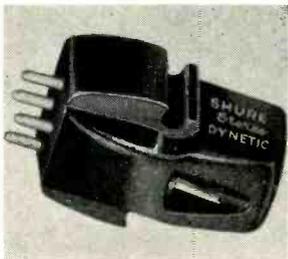
RONETTE BF-40

Stereo cartridge has 20 to 10,000 cps response. Optimum tracking force 4 to 6 grams. Lateral and vertical compliances 3.5. Dual-element Binofluid unit with clip-in diamond needle. Model BF-40D is priced at \$18.60. Model BF-40S with sapphire needle is \$12.



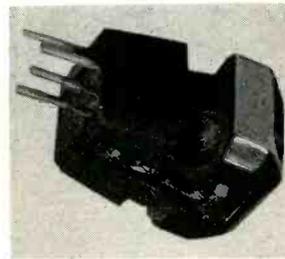
SHURE M3D

Stereo "dynetic" cartridge has 20 to 15,000 cps response ± 3 db. 4 terminals. Channel separation -20 db. Output 5 mv. Recommended load 50 k. Compliance 4. Recommended tracking force 3 to 4 grams. DC resistance 440 ohms. With 0.7 mil diamond needle \$45.



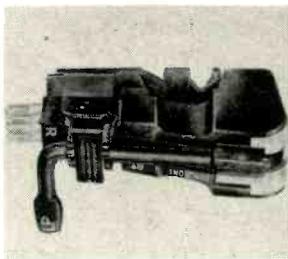
TANNOY

Stereo variable reluctance cartridge has 30 to 16,000 cps response ± 2 db. Output is 6 to 8 mv/channel. Tracking force is 3 to 4 grams. Not recommended for record changers or record players with heavy tracking force. With 0.7 mil diamond needle \$37.



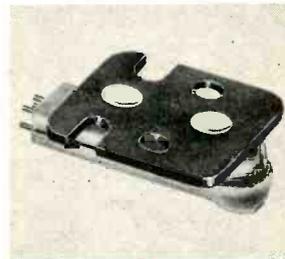
SONOTONE 8T

Stereo turnover ceramic cartridge has 20 to 12,000 cps response. 4 terminals. Tracking force 5 to 7 grams. Output 0.3 v. Compliance 2. Isolation -20 db. Recommended load 1 to 5 meg. With 0.7 mil diamond and 3 mil sapphire \$24.50; both diamond \$34.50; both sapphire \$14.50.



WEATHERS

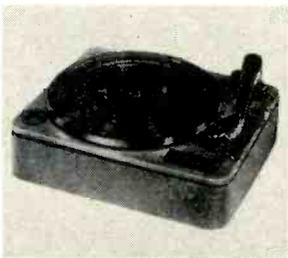
Stereo ceramic cartridge has 15 to 30,000 cps response. Output 0.25 v at 7 cm/sec. Recommended tracking force 2 grams. Separation between channels 25 db. Completely shielded. Complete with pick-up leads, connectors. With diamond needle \$17.50; sapphire needle \$9.75.



CHANGERS

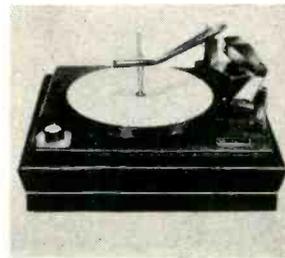
AUDIOGERSH XS-200

Four-speed automatic and manual changer with push-buttons has rubber matted turntable. Intermixes 10" and 12" records in any sequence. Single play and automatic spindles. \$67.50. With GE cartridge, diamond needle, \$86.25. Also, not shown, XM-110A manual, \$37.50.



GLASER-STEERS GS77

Four-speed automatic and manual changer has stereo-monaural switch, muting switch, receptacle for automatic amplifier shut-off. Turntable pauses during change cycle. Intermixes 33 1/3 and 45 records. Automatic speed selector. \$59.50. 45 rpm spindle \$3.60.



COLLARO TSC-840

Four-speed automatic & manual changer has 2-piece arm with 5-terminal plug-in head. 7", 10" and 12" automatic intermix. Wow and flutter 0.25%. Counterbalanced arm. \$49.50. Also, not shown, TSC-740 4-speed, \$42.50; TSC-640, 4-speed, one-piece arm, \$38.50.



VM 1201

4-speed changer includes stereo cartridge. Stereo-monaural switch and jacks. Jam-proof spindle. Rumble -48 db. Tracking angle variation 2°. 4-pole motor. \$50. As replacement changer on metal base pan, Model 1226, \$56. Model 1202, with plug-in head, no cartridge, \$50.

GARRARD RC88

Four-speed automatic and manual changer comes with interchangeable spindles. Plug-in head. Muting switch. With GE cartridge, diamond & sapphire, \$73.80; changer alone, \$54.50. Also, not shown, RC98 alone, variable speed, \$67.50; RC121 automatic alone, \$42.50.

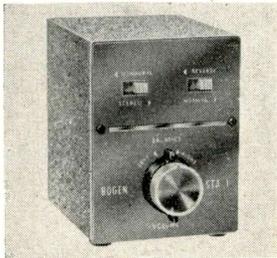


For more information on these products
SEE INQUIRY COUPON ON PAGE 73
& Directory of Manufacturers on Page 88

CONTROL UNITS & ADAPTERS

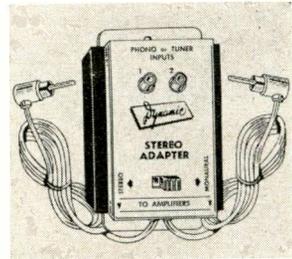
BOGEN STA-1

Stereo adapter permits single knob control of both channel volumes. Monaural-stereo switch. Reverse and normal switch. Left-right balance adjustment for 2 speakers. Connects to 2 amplifiers. \$13.50. Also, not shown, ST10-A adapter-amplifier, \$52.50.



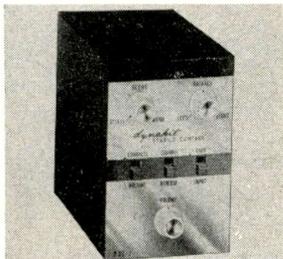
DYNAMIC SA-70

Stereo adapter permits coupling cartridges, tape heads or tuner to 2 amplifiers. 2 inputs with stereo-monaural slide selector switch. With two 31" shielded leads and molded-on pin plugs \$7.50.



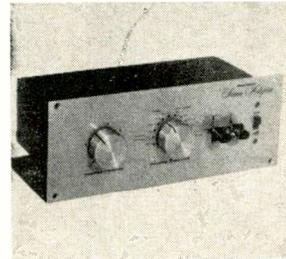
DYNAKIT DSC-1

Stereo control unit adds control facilities to pair of preamps. Passive network. 3 controls include volume, balance and blend to fill "hole in middle" by feeding input through both amplifiers. Reverse, loudness & tape switches. Kit \$12.95.



MARANTZ 6

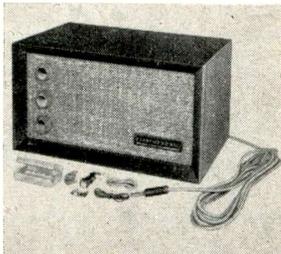
Stereo adapter provides step-attenuator master volume control. Selector switch chooses phono, tuner, tape, TV, extra, stereo or monaural. Speaker reversal switch. 12 inputs, 2 recording outputs. With 2 output cables to preamps. \$45.



CONVERSION KITS

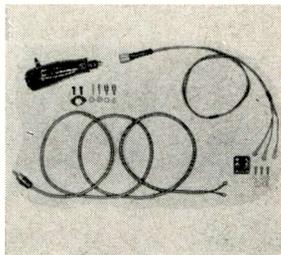
FANON STK-10

Conversion kit adapts any phono to stereo. Includes 2-way speaker system with 3" and 8" speakers, 5-tube amplifier. With stereo cartridge, wood cabinet jacks, leads, \$59.95. Also STK-5 \$49.95; STK-4 with 3-tube amplifier, two 4" speakers, \$39.95.



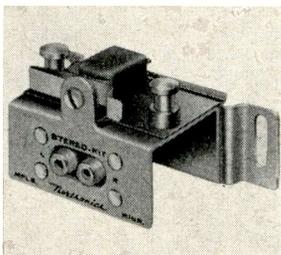
GARRARD SCK-1

Kit converts company's record players for stereo. Consists of female connector wired with 2 leads for tone arm, audio cable for second amplifier, cartridge shell and hardware. No soldering. For RC 88, 98, 121 and Tmk II, \$4.95. Also SCK-2 for RC 121/II.



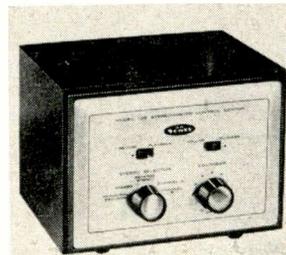
NORTRONICS SK-100

Kit converts monaural tape recorders to 1/2-track, 2-channel stereo when proper amplifiers are added. Playback and record functions. Includes head and wired assembly. Crosstalk -50 db. 4 mv out @ 1 kc. \$23.50. Also, not shown, SK-50 1/4-track, 4-channel \$26.



H. H. SCOTT 135

Stereo-Daptor permits simultaneous control of 2 separate amplifiers. Master volume control for both channels. Function selector. Passive circuit. Loudness control. Input 300 k, output 100 k. Reverse stereo. Record-play-back switch. \$24.95.



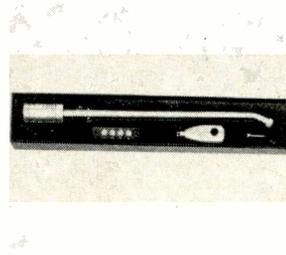
For more information on these products

SEE INQUIRY COUPON ON PAGE 73

& Directory of Manufacturers on Page 88

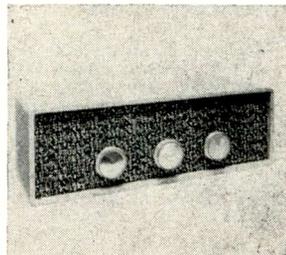
REK-O-KUT SC-12

Stereo arm conversion kit includes all parts and two simple tools to convert company's A-120 and A-160 arms to stereo. Includes plug-in head, terminal board and basic arm element. For 12" arm, \$17.95. Model SC-16 for 16" arm, \$19.95.



WALCO

Complete conversion kit for home phono includes stereo cartridge, 0.7 mil diamond needle, 4-watt, 5-tube amplifier and preamp for second channel, speaker in enclosure and related hardware. Amplifier has separate treble and bass controls. \$69.50.



MICROPHONES

SONOTONE

Model CM-10 omnidirectional high-impedance ceramic type has 50 to 13,000 cps response. ± 3 db. Sensitivity -57 db. Perforated aluminum grid damping. With 7' of shielded cable terminating in standard phone plug, \$19.50.

AMERICAN

D204 dynamic type, 70 to 9500 cps, -57 db output, with pushbutton, for tape recording and general purpose, \$7 to \$24.30. D9A low impedance dynamic cardioid, 100 to 7000 cps, -57 db, \$82.50. D22 dynamic omni-directional, 50 to 12,000 cps, -55 db, variable Z, \$99.50.

ELECTRO-VOICE

Model 951 cardioid crystal type, 50 to 11,000 cps, -55 db, hi-Z, \$49.50. 664 cardioid dynamic, 40 to 15,000 cps, -55 db, \$85. 926 omnidirectional crystal, 60 to 8,000 cps, -60 db, for pa and recorders, \$29.50. 666 cardioid dynamic, 40 to 15,000 cps, -55 db, \$150.

SHURE

Model 535 omnidirectional dynamic, 60 to 13,500 cps, -59 db, \$72.50. Model 55S unidirectional dynamic, 50 to 15,000 cps, -60 db, \$83. Model 777 general purpose crystal, 60 to 10,000 cps, -62 db, \$25. Model 737A super-cardioid crystal, -54 db, \$46.

TURNER

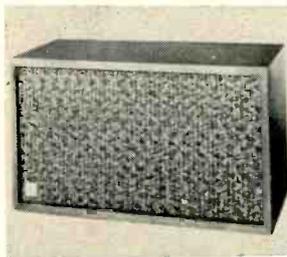
Model L-100 crystal type, 50 to 10,000 cps, -52 db level, with 20' shielded cable, \$12.50. Model 139 multi-impedance dynamic, 60 to 10,000 cps, -52 db, \$45. Model 98 cardioid dynamic, 65 to 11,000 cps, -52 db, \$59.50; on-off switch add \$4.

SPEAKERS & ENCLOSURES

ACOUSTIC RESEARCH

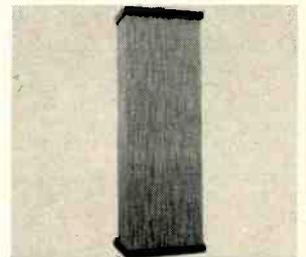
AR-2

Speaker system with acoustic suspension has two 5" cone tweeters, and 10" woofer with 1.1 lb. Alnico magnet, resonant frequency 58 cps. 40 to 15,000 cps. 20 to 40 watts. 13½" x 11" x 24". 8 ohms. 2000 cps crossover. \$96. Also, not shown, AR-1 @ \$185.



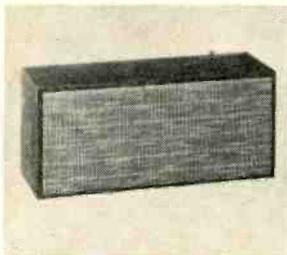
AUDIOSPEAKER 12

Enclosure with wrap-around cloth is 4' high, takes up 1 sq. ft. of floor space. Anechoic design. Standard model for 12" speakers \$79; also for 8", \$59; 15", \$89. Utility models, painted plywood, \$39, \$49 and \$59. Also, not shown, Custom 16 woofer, 18 cps res., \$89.



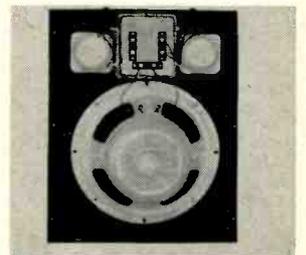
ARGOS TSE-1

Enclosure with forward front design and ducted ports has 2165 cu. in. volume. Size 24" x 11" x 10½". This bookshelf arrangement can accommodate an 8" woofer plus tweeter. Covered with ribbed pyroxylin fabric. \$16.50. Also, not shown, DSE-2 @ \$44.50.



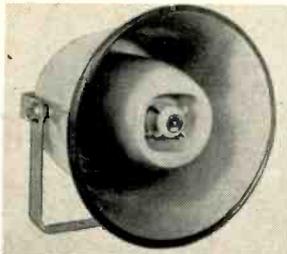
CLETRON C-1233

Woofer-tweeter combination with crossover network mounted on sounding board comprises 12" woofer with 21-oz. Alnico magnet and two 3" tweeters. Board 16" x 20" x 7". 30 to 18,500 cps. Resonance 35 cps. 35 watts. \$60. Also, not shown, C-15PC coax, 15", \$59; C-8JC \$18.



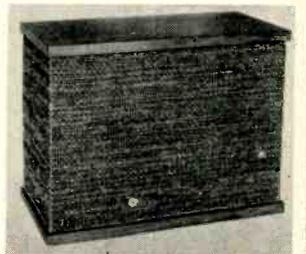
ATLAS WT-6

Outdoor coax-projector speaker comprises weather-proof cone type driver with 6" throat coupled to individual woofer horn. Separate pressure-type driver and tweeter horn. 15 watts. 140 to 15,000 cps response. 8 ohms. 15" bell opening, 12" depth. \$34.50.



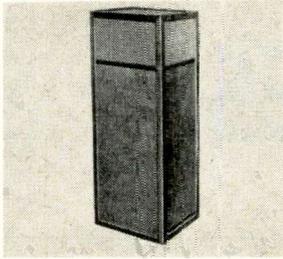
DYNAMIC S-4

Speaker system with one 8" woofer, two 5" midranges and one 4" tweeter and crossover measures 18" x 14" x 10". In walnut, mahogany or blonde. \$39.50. Model S-2 with woofer and one midrange \$29.50. Also, not shown, Model S-12, 12" coax and 4" tweeter, \$49.50.



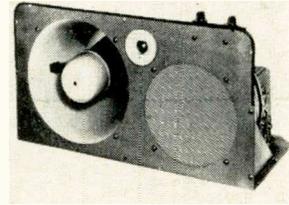
EICO HFS-2

Speaker system completely wired and assembled is omnidirectional. 36" x 15 $\frac{1}{4}$ " x 11 $\frac{1}{2}$ ". 45 to 20,000 cps flat. Has coax with free floating cone and slot loaded split conical horn. 30 watts. 16 ohms. \$139.95. Also, not shown, HFS-1 two way system \$39.95.



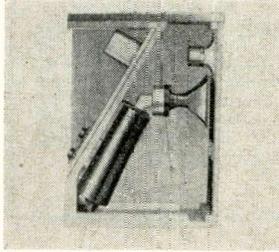
JENSEN KT-44

4-way speaker component kit 15" woofer, 8" upper lf unit, midrange and supertweeter. 40 watts. 16 cps to beyond audibility. 16 ohms. \$192.50. On DC-4 (\$15.95) chassis as shown, when mounted in E-200 enclosure, (\$295.50) SS-200 Stereo Director (not shown), \$439.50.



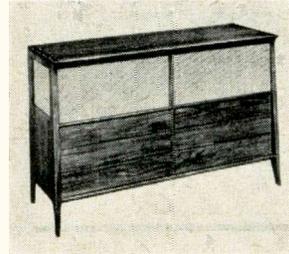
ELECTRO-VOICE 1A

Coronet model speaker system measures 25" x 9 $\frac{1}{2}$ " x 17 $\frac{3}{8}$ ". It includes the company's SP8B coax, T35V vhf driver, X36 crossover and AT37 level control. \$102. Enclosure alone \$35.50. Also, not shown, are speaker systems Patrician IVD \$1086; Centurion IV \$392; Aristocrat \$72.



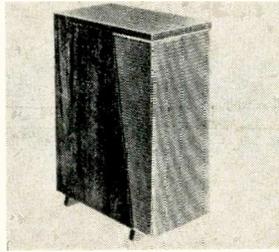
JENSEN DS-100

Dual 3-way speaker system has two 3-way Stereo Directors, each with 12" woofer, 8" mf, compression hf unit. Directors may be rotated to beam sound. 32" x 52" x 18 $\frac{1}{4}$ ". 20 to 15,000 cps. 30 watts/channel. \$369.50. Also, not shown, SS-100 single 3-way system \$179.95.



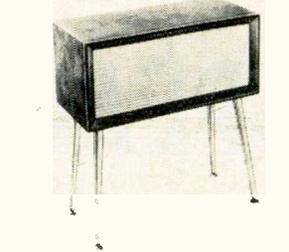
ELECTRO-VOICE

Second channel "Stereon" speaker system eliminates need for full range by producing main stereo frequencies above 300 cps. Lower frequencies phased to main speaker by XX3 filter. 3-way, \$129.50 and \$99.50. Also, not shown, enclosure kits KD1 through KD7, \$118 to \$26.



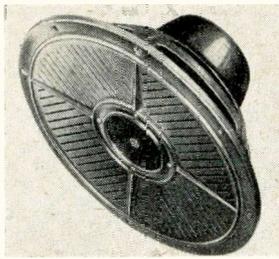
KINGDOM KAL

2-way speaker system has 35 to 17,000 cps range. 14 watts. 11" x 23 $\frac{3}{4}$ " x 10". leatherette covered, \$49.50. 15" brass legs \$5.95. Also, not shown, Audette Senior 2-way system, 35 to 17,000 cps, 22 $\frac{1}{4}$ " x 22 $\frac{1}{4}$ " x 10 $\frac{1}{2}$ ", \$69.50. Compass-1, 20 to 20,000 cps, \$149.50.



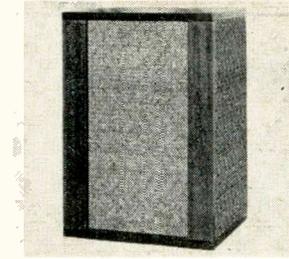
GENERAL ELECTRIC A1-401

12" golden coax speaker has 40 to 15,000 cps response. 25 watts. 8 ohms. 14.5 oz. Alnico woofer magnet, 6.8 oz. for tweeter. 1500 cps crossover. Slotted plate baffles tweeter. \$49.75. Also, not shown, Model 850 8" extended range, 50 to 12,000 cps, 8 ohms, \$10.95.



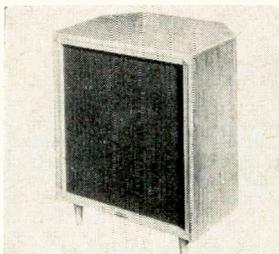
KLIPSCH H

3-way speaker system is designed to derive a third stereo channel from 2 sound tracks. 11" x 12" x 16". With 12" woofer \$198; with 8" woofer \$188. Also, not shown, Model T Shorthorn, 30 to 22,000 cps, \$382; Deluxe Klipschorn \$785; economy model \$460.



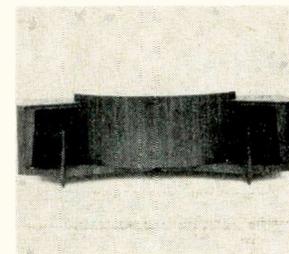
GENERAL ELECTRIC A1-406

6 cu. ft. distributed port enclosure is designed for 12" speakers. May be used in straight wall or corner locations. 25 $\frac{3}{8}$ " x 18 $\frac{1}{4}$ " x 31 $\frac{1}{4}$ ". Heavily lined absorbent interior. \$64.95. Also, not shown, A1-411 enclosure, 26" x 11" x 10", 1.2 cu. ft. \$35.95.



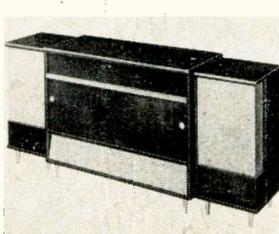
JAMES B. LANSING D44000

Dual 3-way system has two sets of JB 150-4C 15" woofers, 375 hf drivers, 075 ring radiators, and dividing networks. 33 $\frac{3}{4}$ " x 24 $\frac{1}{2}$ " x 106". \$1830 and \$1884. Also, not shown, D42216 system, 11 $\frac{7}{8}$ " x 24" x 12", \$84.30; D130 extended range 15" speaker, \$84.



HEATH SE-1/SC-1

Speaker enclosures SC-1, left and right models, flank equipment cabinet SE-1. Available in birch and mahogany. Wing speaker enclosures are open backed to hold closed systems; 16" x 29 $\frac{1}{4}$ " x 14 $\frac{1}{2}$ " inside. Cabinet 47 $\frac{1}{4}$ " x 36 $\frac{1}{2}$ " x 20". SE-1 \$149.95; SC-1 \$39.95 ea.



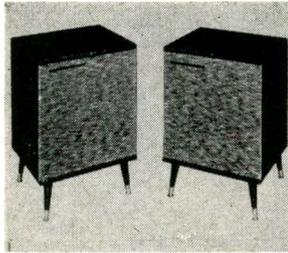
OXFORD 3W20

3-way speaker components include 12" woofer, 8" mid-range, 3 $\frac{1}{2}$ " tweeter and hardware. To 15,000 cps. \$39. OXN-31 crossover network shown, \$12.30. Also, not shown, bass reflex cabinet, 33 $\frac{3}{8}$ " x 23 $\frac{3}{4}$ " x 17", \$111; C15L608 15" coax, 30 to 15,000 cps, 25 watts, \$43.50.



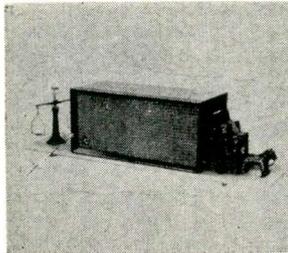
RCA SHS11

Speaker system has 8" woofer-midrange and two 3½" tweeters. 29¾" x 20" x 16". Ebony, mahogany, oak and walnut finishes. With 25' connecting cable, \$49.95 ea. Also, not shown, SHS10 corner system, \$49.95; SHS12 bookshelf, \$19.95; SHS8, \$125.



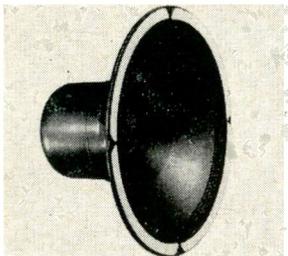
RJ Super 8

Speaker system with 8" full range speaker for bookshelf installation, \$50.50 unfinished, \$59.50 finished. 11" x 23½" x 10". Enclosure alone, \$28.50 and \$37.50. Also, not shown. Model 12-S enclosure, 24" x 21" x 10", \$49.50; Model 13 enclosure, 20" x 20" x 16", \$56.



SONOTONE WR-8

Wide range 8" speaker has 55 to 15,000 cps response, 8 watts, 8 ohms. Flux density 12,000 gauss. \$12. Also, not shown, speaker in Caprice enclosure, 20" x 11" x 10", ¾" plywood hand finished, \$53.50; CA-12A coax speaker, 35 to 20,000 cps, 10 watts, 8 to 16 ohms, \$27.50.

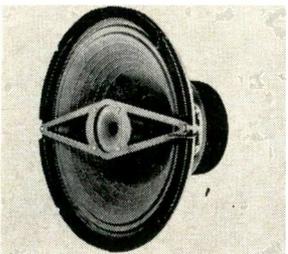


STENTORIAN HF1016U

10" universal speaker with 30 to 15,000 cps response has 35 cps cone resonance. 16,000 gauss, 3½ lb. Alcomax magnet. Option of 4, 8 or 16 ohms, \$36.50. Also, not shown, 3½" cone tweeter T-359, 3000 to 17,000 cps, 15 watts, 16 ohms, 9000 gauss, \$14.95.

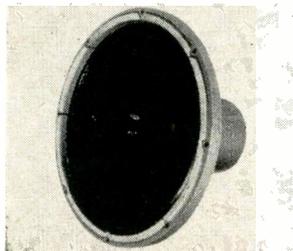
STEPHENS BWD

2-way speaker system includes Model 120W 12" woofer (\$60) with 30-watt, 30 cps resonance ratings, and Model 5-KT toroid tweeter (\$49.50) with high pass filter and brilliance control. Also, enclosures from 815 bookshelf @ \$48 to Eames E-3 with 3-way @ \$595.



STROMBERG-CARLSON RF483

Coax speaker, 15" woofer and tweeter, has 25 to 18,000 cps response. 45 cps free air resonance. 16 ohms. \$99.95. Also, not shown, RF-480 8" speaker, 18 watts, 30 to 17,000 cps, \$24.95; RS-461 labyrinth system, 2-way, second channel, 40 to 18,000 cps, \$69.95.

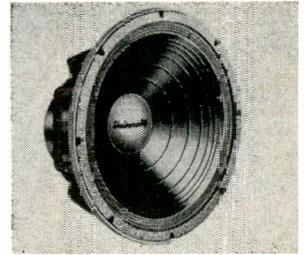


TANNOY 15

Dual concentric 15" speaker is rated at 25 watts, 15 ohms. Resonance 40 cps. Crossover 1000 cps. Complete cone assembly may be removed for lamp cleaning. Less than 2% IM products. 18,000 gauss in hf gap. Depth 9". \$159.

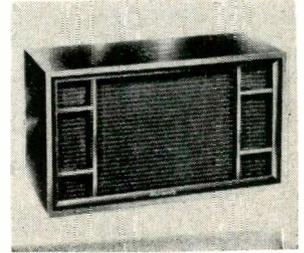
UNIVERSITY C-15HC

High compliance 15" woofer down to free air resonance, 15 cps, 800 cps cutoff. 20 watts. 4-8 and 10-20 ohms. Also, not shown, UXC-123 3-way dif-faxial, 45 to 17,500 cps, \$64; HF 206 tweeter, \$33; T-50 high frequency horn driver, \$49.50; C-12HC woofer, \$49.50.



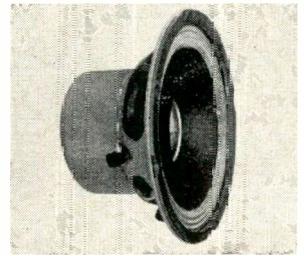
UNIVERSITY S-10

2-way speaker system with 12" woofer and tweeter has low 15-20 cps resonance. 1500 cps crossover. Full bass response down to 30 cps. 25" x 14" x 14½". \$139. Also, not shown, S-11 3-way with 15" woofer, \$245; EN-15LH multiple speaker enclosure, \$139.50.



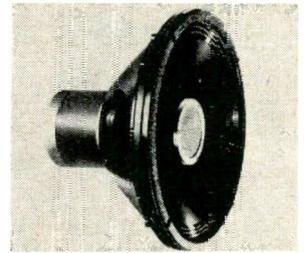
UTAH C8S

Expanded range 8" speaker, 20 to 15,000 cps. 16 ohms. solderless terminals. \$47.50. Also, not shown, are C8R 8" low frequency unit @ \$54.95; C12S expanded range, \$52; C12R 20 to 7500 cps, \$59.95; C15R \$67.50; CT5JN 5" tweeter, 3500 to 20,000 cps, \$19.50.



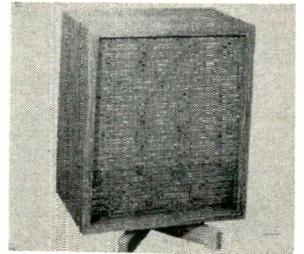
VITAVOX DU-120

Coax speaker with 12" woofer and 3" tweeter has 30 to 15,000 cps response is rated at 30 watts. 15 ohms. Resonance 40 to 45 cps. Crossover 2000 cps. Tweeter has polyester film diaphragm. External dividing network other than capacitor not required. \$89.50.



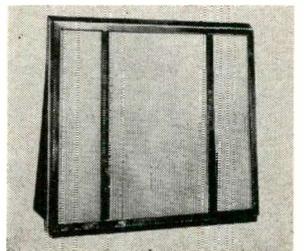
WELLCOR CBC-8-12

Bass reflex enclosure with inclined port allows floor to act as cabinet extension. Over 3 cu. ft. Cut out for 8" and 12" speakers. 22½" x 19¼" x 13¾". On swivel base. \$24.45. Also, not shown, CS-12 corner enclosure, 24" x 28" x 21", precut 12 and 15", \$72.



WHARFEDALE SFB/3

Custom model 3-way speaker system with 12" woofer, 10" midrange and 3" tweeter has sand-filled baffle. 30-35 cps resonance. 20 to 20,000 cps. 15 ohms. 34" x 31" x 12". \$199. Also, not shown, Deluxe model \$249; W/AF/1 2-way system, 30" x 17" x 12", \$144.50.



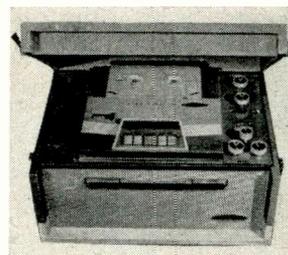
TAPE RECORDERS

AMPLIFIER CORP. 611-D
 "Stereo-Magnemite" tape recorder has battery-operated motor. 50 to 7500 cps. 50 db range. 17 lbs. 0.1% flutter. 7½ ips. 5 v out. Earphone stereo playback. In weather-tight case \$445. 611-C, 3¾ ips, 100 to 3000 cps, \$405; 611-E, 50 to 15,000 cps, \$475.



PENTRON

Stereo tape playback and monaural recorder plays 4-track RCA tape cartridge which snaps into position, eliminating conventional reels. 3¾ and 7½ ips. 40 to 15,000 cps. Separate preamp for each channel. VU meter. Auto shutoff. Index counter. \$269.50.



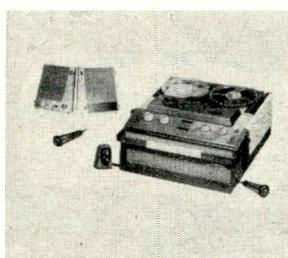
BELL T-203/RP-120

Tape transport (T-203) with monaural and stereo inline and offset erase/record-playback heads is \$139.95. With two RP-120 record-playback preamps, \$59.95 each, response is 20 to 10,000 cps ±2 db. Sensitivity 0.001 v on mike. 5 v out. 50 db S/N. 1% distortion.



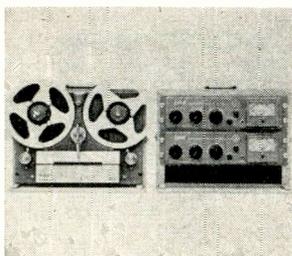
PENTRON NL-4

Dual channel unit records and plays back 2- & 4-track stereo. 40 to 15,000 cps at 7½ ips; 40 to 10,000 cps at 3¾ ips. 50 db S/N. Flutter 0.3%. 8 speakers. \$349.95. ES-2 speakers \$59.95. RC-6 remote control \$9.95. Not shown, NL-1S stereo \$139.95.



BERLANT-CONCERTONE 33-2

2-channel stereo tape recorder includes separate erase on each channel. 7½ and 15 ips. 55 db S/N. 40 to 15,000 cps at 15 ips. 0.1% flutter and wow. \$995. Also, not shown, Model 63 dual record and playback stereo, \$695; with case \$755.



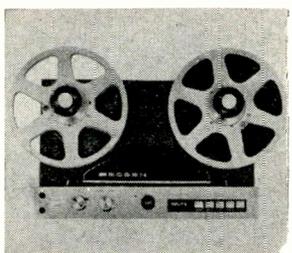
ROBERTS 90-5

Dual channel unit plays back stereo and records stereo from broadcasts and stereo recordings. Hysteresis-synchronous drive motor. 40 to 15,000 cps ±2 db at 7½ ips; 40 to 7500 cps ±2 db at 3¾ ips. Dual remote speaker outputs. \$325.



BOGEN TR-30

Tape recorder designed for half-track monaural recording and stacked stereo playback. Built-in dual preamps. 7½ and 15 ips. 50 db S/N at 3% distortion. 40 to 15,000 cps at 15 ips; 50 to 10,000 cps at 7½ ips. 3 motors. Takes 10½" reel. About \$400.



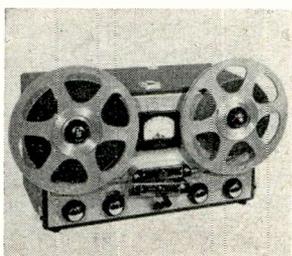
SUPERSCOPE DK-555A

Dual channel unit records and plays back stereo. 30 to 16,000 cps at 7½ ips. 30 to 10,000 cps at 3¾ ips. Flutter and wow 0.2%. 2% harmonic distortion. 4 watts output. Stacked heads. -50 db crosstalk. With 2 Sony mikes \$525. Portable case \$70.



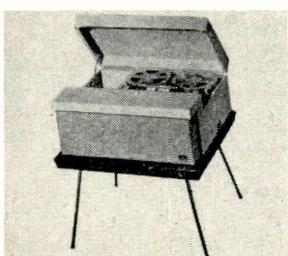
CROWN

Imperial model tape recorder with monaural record and stereo inline playback provision takes up to 10½" reels. Two tracks. 30 to 15,000 cps ±2 db at 7½ ips. 0.15% flutter. 52 db S/N. \$535. Also available, not shown, Stereo-X for stereo record.



V-M 750

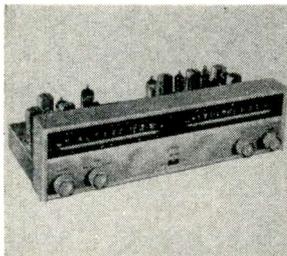
Tape recorder plays back stereo and records monaural. 45 db S/N ration. 5 watts output. 0.4% flutter and wow. 7½ and 3¾ ips. Storage compartment for 16 reels plus accessories. \$275. Also, not shown, Model 714, plays stacked and staggered tapes, \$225.



TUNERS

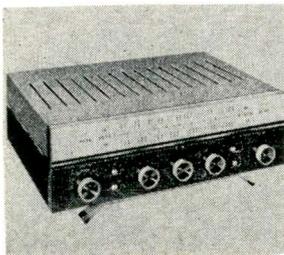
ARKAY ST-11

Tuner provides simultaneous FM/AM reception. FM sensitivity 4 μ v for 20 db quieting. Hum -65 db. 20 to 20,000 cps \pm 0.5 db. Distortion 1%. Selectivity 200 kc 6 db down. \$49.95 kit, \$74.50 wired. Also, not shown, FM-8 tuner, \$39.95 kit, \$59.95 wired.



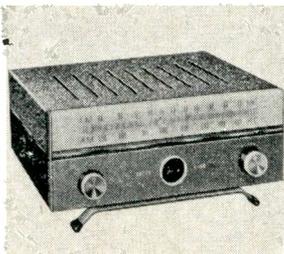
BOGEN RB115

FM/AM tuner with single channel preamp and 15 watt amplifier has 20 to 20,000 cps response \pm 1 db. Distortion 2%. FM sensitivity 3.5 μ v for 30 db quieting. Selectivity 180 kc, 3 db. \$149.50. Enclosure \$7.50. Also, not shown, TC-100 FM/AM tuner \$87.50.



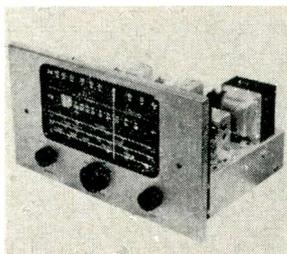
BOGEN T661

FM/AM tuner has FM sensitivity of 2.5 μ v for 30 db quieting, 300 ohm antenna. Selectivity 180 kc, 3 db down. 20 to 18,000 cps \pm 0.5 db. Distortion 1.5%. Hum -60 db. \$129.50. Enclosure \$6. Also, not shown, RB-140 FM/AM tuner-amplifier \$249.50.



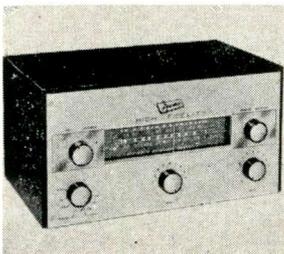
CHAPMAN S-5E

FM/AM/SW tuner has 2 i-f stages. Sensitivity 4 μ v on FM for 20 db quieting. Selectivity 200 kc, 3 db down. EM-81 tuning eye. Tuning ranges are 1.1-3.3 mc, 3-8.5 mc, 8.1-23 mc, 88-108 mc, and 545-1600 kc. High and low impedance outputs. \$149.95.



DYNAMIC AF-250PA

FM/AM tuner with built in single channel preamp and 12 watt amplifier has 11 tubes. 20 to 20,000 cps response. Loudness, bass, treble and function controls. \$129.50. AF-250 without preamp, \$119.50. Also, not shown, T2000 FM/AM tuner alone, afc, \$99.50.



EICO HFT 90

FM tuner with traveling neon indicator has 20 to 20,000 cps response \pm 1 db. Sensitivity 2.5 μ v for 30 db quieting. I-F bandwidth 260 kc, 6 db down. Hum -60 db. Maximum drift 20 kc from cold start. Kit with front end wired \$39.95; wired \$65.95. Enclosure \$3.95.



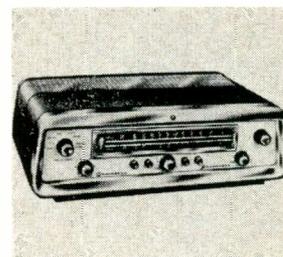
FISHER 101-R

FM/AM tuner has 20 to 20,000 cps response \pm 1 db. FM sensitivity 2.2 μ v for 30 db quieting. I-F bandwidth 180 kc, 3 db down. 60 db signal/hum. Crosstalk -80 db. Separate FM and AM indicator. \$229.50. Also, not shown, Model 90-T FM/AM with preamp \$239.50.



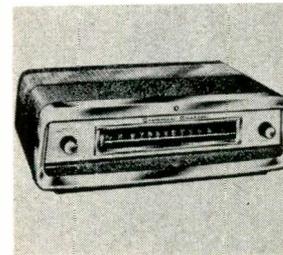
GROMMES 120GAT

FM/AM tuner with single channel preamp and 20 watt amplifier has 20 to 20 cps response \pm 1 db. 1% harmonic distortion, 2% IM. FM sensitivity 2 μ v for 20 db quieting. Selectivity 250 kc, 6 db down. Amplifier hum and noise -80 db. Filters. \$169.50.



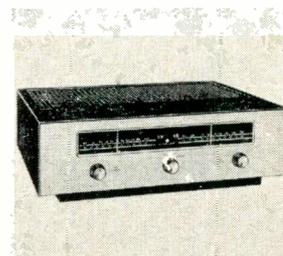
GROMMES

FM tuner with electronic eye, afc, two i-f stages and two limiters has 20 to 20,000 cps response \pm 0.5 db. Sensitivity 1 μ v for 20 db quieting. 2% IM and 1% harmonic distortion. Hum & noise -60 db. \$79.50. Also, not shown, 102GT, FM/AM, \$119.50.



HARMAN-KARDON T-224

"Duet" FM/AM tuner with separate channels for each, 30 to 15,000 cps \pm 0.75 db. Sensitivity 3.5 μ v for 20 db quieting. Selectivity 240 kc, 6 db down. Drift 5 kc max. IM 0.5%. Hum -60 db. \$114.95. Also, not shown, TX20 single channel FM/AM, \$99.95.



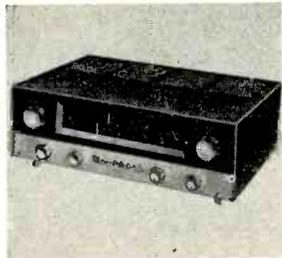
HARMAN-KARDON TP200

FM/AM tuner with dual preamps has 12 operating controls. Separate FM and AM sections. Indexer identifies FM/AM station pairs. 15 to 30,000 cps \pm 0.5 db. 0.3% IM and harmonic. Hum -80 db. Crosstalk -50 db. \$189.95. Also, not shown, T-250 tuner \$139.95.



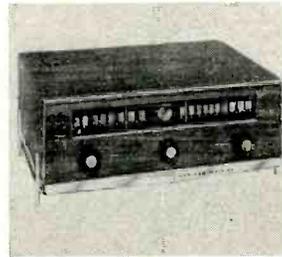
HEATH PT-1

FM/AM tuner has 16 tubes, afc and AM variable bandwidth control, 15 kc on narrow, 35 kc on broad, 6 db down, 300 kc i-f band for FM. 600 kc FM discriminator. I-F strip consists of two printed circuit boards. Kit form, front end prewired, \$89.95.



MADISON FIELDING 330

FM/AM tuner with two channels has tuning indicator for simultaneous tuning of FM and AM, 20 to 20,000 cps ± 1 db. I-F bandwidth 420 kc, 6 db down. AFC. AM sensitivity 15 μ v per meter loop. \$149.95. Enclosure \$149.95 in mahogany, walnut, blonde.



McINTOSH MR-55

FM/AM tuner has afc, 20 to 20,000 cps response ± 3 db. FM sensitivity 3 μ v at 100% modulation. 4 i-f stages. 2 limiters. Hum -75 db. Drift 30 kc without afc. Capture ratio 1 to 0.8. AM distortion 1%. Whistle filter. \$249. Enclosure \$25.



PILOT FA-680

FM/AM tuner for simultaneous reception has separate AM and FM tuning meters. 3 i-f stages, 2 limiters. Sensitivity 1 μ v with 30% modulation for 20 db quieting. 1 kc wideband detector eliminates afc. \$199.50. Also, not shown, FA-690 FM/AM tuner, \$179.50.



PILOT FA-690

FM/AM tuner with dual preamp has 2 tuning meters, and other specifications similar to Model FA-680. Pre-amp ratings for each channel are 20 to 20,000 cps ± 1 db, output 1 v, hum and noise -80 db below 1 v, 0.2% harmonic distortion. \$269.50.



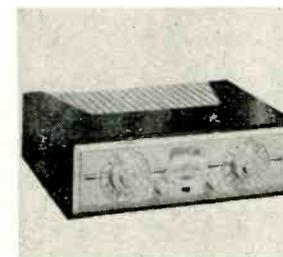
SARGENT-RAYMENT SR-380

FM/AM tuner with dual preamp 20 to 20,000 cps response ± 1 db. Sensitivity on FM 3 μ v for 20 db quieting. Harmonic distortion 0.17% for 1 v out. Hum -75 db. Rumble and scratch filters. Cathode follower outputs. Carbon deposited resistors in preamp. \$189.60.



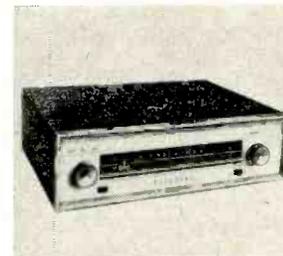
H. H. SCOTT 330-C

FM/AM tuner has sensitivity of 2 μ v for 20 db quieting. Includes tuning meter and vernier tuning controls. AGC. Separate channels. 2 limiter stages. \$209.95. Also, not shown, are Model 300 FM/AM tuner with single channel preamp \$167.95; 310-B FM \$178.45.



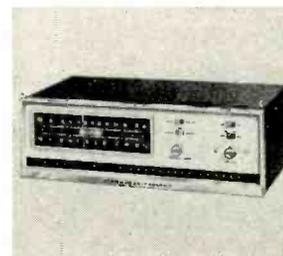
SHERWOOD S-2000

FM/AM tuner has 20 to 20,000 cps response ± 0.5 db. Sensitivity on FM 1.8 μ v for 30 db quieting. IM 0.25% at 100% modulation, 400 cps. Hum -60 db. AFC. 2 v out. \$139.50; with case \$144.50-\$154.50. Also, not shown, S-2000 FM tuner \$99.50 without case.



STROMBERG-CARLSON SR-440

FM/AM tuner has 20 to 20,000 cps response. FM sensitivity 1.8 μ v for 20 db quieting. I-F bandwidth 200 kc. 11 tubes. AM bandwidths 15 kc in broad position, 7 kc in sharp. Low impedance cathode follower output. \$159.95 without top cover.



TURNTABLES

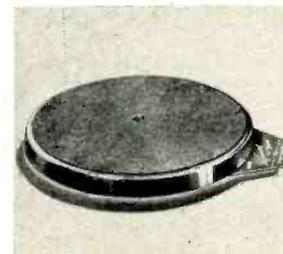
COLLARO 4TR200

4-speed turntable has 4-pole motor isolated by 3 tension springs parallel to unit plate. Bearing with steel ball takes total thrust. Shuts off each time before changing speed. Black rubber mat. \$49.50. Also, not shown, manual player TP59, 4 speeds, \$29.50.



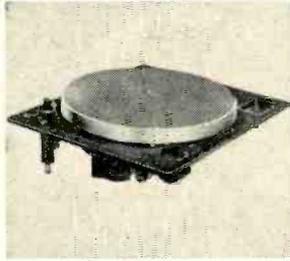
COMPONENTS

Four-speed turntable has 33 1/3 pulley; others interchangeable. Noise -60 db. Wow and flutter 0.25%. Speed accuracy 0.5%. 4-pole induction motor. Professional Jr., \$39.50. Extra pulleys \$2.50. Base \$10. Also, not shown, Models PBT & PBT4, \$99.50 & \$109.



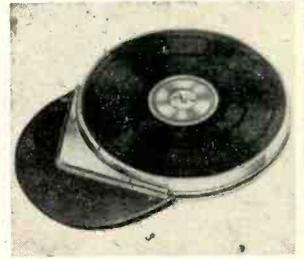
CONNOISSEUR

Three-speed turntable with continuously variable speeds, $\pm 2\%$ around each speed range. Wow less than 0.15% of rated speed. Rumble better than -50 db at 7 cm/sec and 500 cps. 12" non-magnetic table. Synchronous hysteresis motor. With Mark II tone arm \$110.



REK-O-KUT K33

Single-speed 33 1/3 rpm turntable with 4-pole induction motor has built-in strobe for checking speed. Table tapered for easy disc handling, made of lathe turned aluminum. Noise -47 db. Comes in kit form, requiring about 30 minutes for assembly. \$39.95.



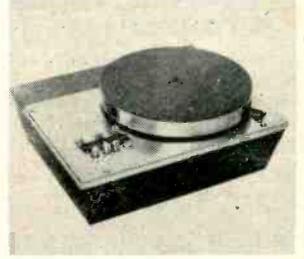
FAIRCHILD 412-4

Four-speed turntable has electronic control regulator consisting of variable frequency oscillator/amplifier, which drives motor; speed determined by control frequency, adjustable $\pm 5\%$. \$229.50. Two speed without electronic regulator, \$129.50; one speed, \$99.50.



H. H. SCOTT 710-A

Three-speed turntable has each speed range adjustable by $\pm 5\%$. Expanded scale optical strobe. Rumble -60 db. Wow and flutter 0.1%. Machined aluminum casting table. Slip clutch for cueing. Induction motor. Helical drive gears in oil transmission. \$139.95.



GARRARD 4HF

Four-speed turntable is variable around each speed. 12" table. Automatic start-stop in arm rest. Lift arm to start; replace to stop. \$59.50. With GE cartridges, \$68.45 to \$83.45. Also, not shown, 301 turntable only @ \$89; Model T complete \$56.45.



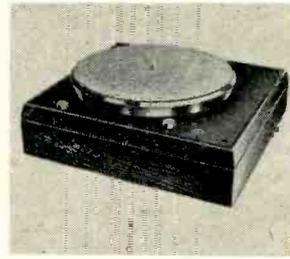
STROMBERG-CARLSON PR-499

Continuously variable turntable from 14 to 80 rpm has 4-pole motor. Stroboscopic window pilot light. Noise level -55 db. Wow 0.18% rms. Flutter 0.1% peak, 0.01% rms. Elastic drive belt. Deck provided with legs for operation without base. \$99.95.



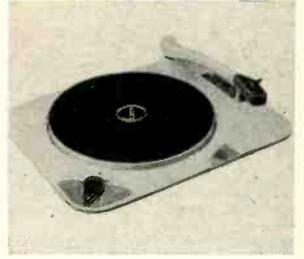
PICKERING 800

Single-speed 33 1/3 rpm floats on air cushion. Vertical period of spring suspension below 5 cps. Noise -65 db. Speed accuracy $\pm 0.2\%$. Built-in precision leveling indicator. Foam rubber mat. Plays 7" to 12" records. \$59.85. Bases available at \$7.50 and \$12.



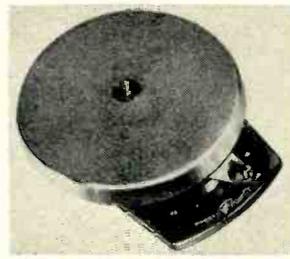
THORENS TD-134

Four-speed turntable with transcription arm has adjustment provision for speed. With line cord and shielded cable \$59.95. Wood base \$9. Also, not shown, TD-184 with dialing arrangement to set arm on disc's lead-in groove, priced at \$74.95.



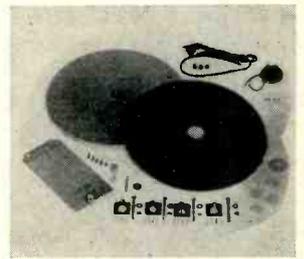
PRESTO T-18A

Three-speed turntable has 11 7/8" table. Speed selector has 5 positions, two offs included. Wow and flutter 0.2%. Rumble -47 db. With 4-pole induction motor \$75. T-18-AH with hysteresis motor \$131. Also, not shown, T-2 @ \$59.50.



WEATHERS

Single-speed 33 1/3 rpm turntable kit comes up to synchronous speed in 3/4 of a revolution. Conical spring shock mounting isolate turntable from table vibrations. Turntable pad touches outer rim of discs, not grooves. Small 12-pole synchronous motor. \$34.50.



REK-O-KUT B-12H

Three-speed turntable requires no external 45 adapter. Neon light on-off indicator. Noise -57 db. Strobe disc affixed. With hysteresis synchronous motor \$129.95. Similar Rondine B-12GH \$99.95. Also, not shown, B-12 @ \$84.95; N-33H @ \$69.95; L-34 and L-37 @ \$59.95.



For more information on these products
SEE INQUIRY CARD ON PAGE 73
& Directory of Manufacturers on Page 88

STEREO BUYERS DIRECTORY

Manufacturers grouped in 12 product categories

1—AMPLIFIERS, PREAMPLIFIERS, & CONTROLS

Amplifiers, 1-channel	1
Amplifiers, 2-channel	2
Control Units, stereo	3
Preamplifiers, 1-channel	4
Preamplifiers, 2-channel	5

Acro Products Co., 369 Shurs Lane, Philadelphia 28, Pa.-1-2-4-5
 Alliea Radio Corp., 100 N. Western Ave., Chicago 80, Ill.-1-2-3-5
 Altec Lansing Corp., 1515 S. Manchester Ave., Anaheim, Calif.-1-2-3-4-5
 Ampex Audio, Inc., 1020 Kifer Rd., Sunnyvale, Calif.-1-5
 A.R.F. Products, Inc., 7627 Lake St., River Forest, Ill.-1
 Arkay Radio Kits, 120 Cedar St., New York 6, N.Y.-1-2-3-5
 Barker Sales Co., 339 S. Broad Ave., Ridgefield, N.J.-1-4
 Bell Sound Systems, 555 Marion Rd., Columbus 7, Ohio-1-2-4
 Blonder-Tongue Labs., 9 Alling St., Newark 2, N.J.-1-4
 Bogen Co., David, P.O. Box 500, Paramus, N.J.-1-2-3-4-5
 Brand Products Inc. (Madison Fielding), 11 Lorimer St., Brooklyn 6, N.Y.-2-5
 British Industries Corp. (Leak) 80 Shore Rd., Port Washington, N.Y.-1-2-4-5
 Capehart Co. 216 W. 14 St., New York 11, N.Y.-1-2
 Components Corp., 106 Main St., Denville, N.J.-5
 Cook Laboratories, Inc., 101 2 St., Stamford, Conn.-1-2-4-5
 DeRo Electronics 134 Nassau Rd., Roosevelt, L.I., N.Y.-3
 DeWald Radio, Div. United Scientific Labs., 35-15 37 Ave., Long Island City 1, N.Y.-1-2
 Dynaco Inc., 617 N. 41st., Philadelphia 4, Pa.-3
 Dynamic Electronics-New York Inc., 73-39 Woodhaven Blvd., Forest Hills, L.I., N.Y.-1-2-3-4
 Electron Enterprises, 6917 W. Stanley Ave., Berwyn Ill.-1-2
 Electronic Applications, 194 Richmond Hill Ave., Stamford, Conn.-2
 Electronic Development Associates, 126 E. 46 St., New York 17, N.Y.-1-2-4-5
 Electronic Instrument Co. (Eico), 3300 Northern Blvd., Long Island City 1, N.Y.-1-2-4-5
 Electro-Voice, Inc., Buchanan Mich.-3
 Ercora Corp., 16 W. 46 St., New York 36, N.Y.-1-2-3
 Erie Resistor Corp., 644 W. 12 St., Erie 6, Pa.-1
 Fairchild Recording Equipment Corp., 10-40 45 Ave., Long Island City 1, N.Y.-1-2-4-5
 Fannon Electric Co., 98 Berriman St., Brooklyn 8, N.Y.-1-2-3
 Fen-Tone Corp., 106 5 Ave., New York 11, N.Y.-1-2-4-5
 General Electric, Specialty Electronic Components Dept., W. Genesee St., Auburn, N.Y.-1-4
 Greene Co., L. Charlton, 314 Washington St., Newton 58, Mass.-1
 Harman-Kardon Inc., 520 Main St., Westbury, N.Y.-1-2-3-4-5
 Heath Co., Benton Harbor, Mich.-1-3-4-5
 Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y.-1-2-3-4-5
 McIntosh Lab. Inc., 2 Chambers St., Binghamton, N.Y.-1-3-4-5
 Marantz Co., 25-14 Broadway, Long Island City 6, N.Y.-1-3
 Musicaid Corp., 4512 W. Jefferson, Los Angeles 16, Calif.-1-2-4-5
 Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, Calif.-2
 Nortronics Co., 1015 S. 6 St., Minneapolis 4, Minn.-1-2-3-4-5
 Pentron Corp., 777 S. Tripp Ave., Chicago 24, Ill.-4-5
 Permoflux Products Co., 4101 San Fernando Rd., Glendale 4, Calif.-1-2-4-5
 Pilot Radio Corp., 37-06 36 St., Long Island City, N.Y.-1-2-3-4-5
 Powers Co., J.J., 1317 S. 5 Ave., Maywood, Ill.-1-2
 Precise Development Corp., 2 Neil Court, Oceanside N.Y.-1-2-4

Precision Electronics Inc., (Grommes) 9101 King St., Franklin Park, Ill.-1-2-3-4-5
 Radio Music Corp., 84 S. Water St., Port Chester, N.Y.-1-2-4-5
 Regency Div., Icoo Inc., 7900 Pendleton Pike, Indianapolis 26, Ind.-1-4
 Roberts Electronics, 1028 N. LaBrea Hollywood 38, Calif.-5
 Sargent-Rayment Co., 4926 E. 12 St., Oakland 1, Calif.-2-5
 Scott Inc., H.H., 111 Powder Mill Rd., Maynard, Mass.-1-3-4-5
 Setchell-Carlson, Inc., New Brighton, St. Paul 12, Minn.-2
 Sherwood Electronics Labs., 4300 N. Calif. Ave., Chicago 18, Ill.-1
 Simpson Mfg. Co., Mark, 32-28 49 St., Long Island City 3, N.Y.-1
 Stromberg-Carlson, Special Products Div., 1400 N. Goodman St., Rochester 3, N.Y.-1-2-4-5
 Tannoy (America) Ltd., P.O. Box 177, E. Norwich, L.I., N.Y.-1-4
 Tech Master Corp., 75 Front St., Brooklyn 1, N.Y.-1-2-3-4-5
 Telectro Industries Corp., 35-16 37 St., Long Island City 1, N.Y.-1-2-3-4-5
 Universal Woodcrafters Inc., La Porte, Ind. 1-2-4-5
 Video Instruments Co., 3002 Penna. Ave., Santa Monica, Calif.-1-2-4-5
 Weathers Industries, 66 E. Gloucester Pike, Barrington, N.J.-2
 Webcor, Inc., 5610 W. Bloomingdale Ave., Chicago 39, Ill.-3
 Webster Electric Co., 1900 Clark St., Racine, Wis.-1-2-4-5
 Wells-Gardner & Co., 2701 N. Kildare Ave., Chicago 39, Ill.-1-2-3-4-5
 Whitley Electronics, Inc., 411 S. Chauncey St., Columbia City, Ind.-1-3

2—CARTRIDGES, STEREO PHONO

American Microphone Mfg. Co., 412 S. Wyman St., Rockford, Ill.
 Astatic Corp., Harbor & Jackson Sts., Conneaut, Ohio
 Audiogersh Corp., 514 Broadway, New York 12, N.Y.
 Barker Sales Co., 339 S. Brodd Ave., Ridgefield, N.J.
 Berger Communications, 109-01 72 Rd., Forest Hills, N.Y.
 CBS-Hytron, 100 Endicott St., Danvers, Mass.
 Duotone Co., Locust St., Keyport, N.J.
 Electro-Sonic Labs., 35-54 36 St., Long Island City 9, N.Y.
 Electro-Voice Inc., Buchanan, Mich.
 Ercora Corp., 16 W. 46 St., New York 36, N.Y.
 Erie Resistor Corp., 644 W. 12 St., Erie 6, Pa.
 Fairchild Recording Equipment Corp., 10-40 45 Ave., Long Island City 1, N.Y.
 Federal Electronics Sales, Federal Electronics Bldg., Rockville Centre, L.I., N.Y.
 Fen-Tone Corp., 106 5 Ave., New York 11, N.Y.
 General Electric Specialty Electronics Components Dept., W. Genesee St., Auburn, N.Y.
 Heath Co., Benton Harbor, Mich.
 Jensen Industries 7333 W. Harrison St., Forest Park, Ill.
 Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y.
 Miller Mfg. Co., M. A., 4 & Church St., Libertyville, Ill.
 Pickering & Co., Sunnyside Blvd., Plainview, L.I., N.Y.
 Radio Music Corp., 84 S. Water St., Port Chester, N.Y.
 Recoton Corp., 62-35 Barnett Ave., Long Island City 4, N.Y.
 Ronette Sales Corp., 190 Earle Ave., Lynbrook, N.Y.
 Scott Inc., H. H., 111 Powder Mill Rd., Maynard, Mass.
 Shure Bros., 222 Hartrey Ave., Evanston, Ill.
 Sonotone Corp., Elmsford, N.Y.
 Tannoy (America) Ltd., P.O. Box 177, E. Norwich L.I., N.Y.
 Televex Co., 46 Lakeview Ave., Yonkers, N.Y.
 United Audio Products, 202 E. 19 St., New York 3, N.Y.
 Weathers Industries, 66 E. Gloucester Pike, Barrington, N.J.
 Webster Electric Co., 1900 Clark St., Racine, Wis.

3—CHANGERS, TURNTABLES & ARMS

Arms	1
Changers	2
Turntables	3

American Microphone Mfg. Co., 412 S. Wyman St., Rockford, Ill.-1
 Astatic Corp., Harbor & Jackson Sts., Conneaut, Ohio-1
 Audiogersh Corp., 514 Broadway, New York 12, N.Y.-2-3
 Bogen Co., David, P.O. Box 500, Paramus, N.J.-3
 British Industries Corp. (Garrard), 80 Shore Rd., Port Washington, N.Y.-1-2-3
 Components Corp., 106 Main St., Denville, N.J.-3
 Electronics Applications, 194 Richmond Hill Ave., Stamford, Conn.-3
 Electro-Sonic Labs., 35-54 36 St., Long Island City 6, N.Y.-1
 Ercora Corp., 16 W. 46 St., New York 36, N.Y.-1-2-3
 Fairchild Recording Equipment Corp., 10-40 45 Ave., Long Island City 1, N.Y.-1-3
 Fen-Tone Corp., 106 5 Ave., New York 11, N.Y.-2
 General Electric, Specialty Electronic Components Dept., W. Genesee St., Auburn, N.Y.-1
 Glaser-Siebers Corp., 20 Main St., Belleville 9 N.J.-2
 Heath Co., Benton Harbor, Mich.-3
 Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y.-1-2-3
 Metzner Eng'g Corp., 1041 N. Sycamore Ave., Hollywood 38, Calif.-3
 Pickering & Co., Sunnyside Blvd., Plainview, L.I., N.Y.-1-3
 Radio Eng'g Co., Inquirer Bldg., Philadelphia 30, Pa.-2
 Radio Music Corp., 84 S. Water St., Port Chester, N.Y.-1-3
 Rek-O-Kut Co., 38-19 108 St., Corona 68, N.Y.-1-3
 Riemer Co., David, (Rystl), 601 W. 26 St., New York 1, N.Y.-1
 Rockbar Corp., (Collaro), 650 Halstead Ave., Mamaroneck, N.Y.-2
 Ronette Sales Corp., 190 Earle Ave., Lynbrook, N.Y.-1
 Scott Inc., H. H., 111 Powder Mill Rd., Maynard, Mass.-1-3
 Shure Bros., 222 Hartrey Ave., Evanston, Ill.-1
 Smolin Labs., Woodbrook Dr., Springdale, Conn.-2
 Stromberg-Carlson, Special Products Div., 1400 N. Goodman St., Rochester 3, N.Y.-1-2-3
 Thorens Co., Thorens Ave., New Hyde Park, N.Y.-2-3
 United Audio Products, 202 E. 19 St., New York 3, N.Y.-2
 V-M Corp., Benton Harbor, Mich.-2
 Weathers Industries, 66 E. Gloucester Pike, Barrington, N.J.-3
 Webcor, Inc., 5610 W. Bloomingdale Ave., Chicago 39, Ill.-2

4—CONVERSION KITS

Stereo Phono	1
Stereo Tape Recorder	2

Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.-1
 Altec Lansing Corp., 1515 S. Manchester Ave., Anaheim, Calif.-1
 American Electronics, Inc., 9449 W. Jefferson Blvd., Culver City, Calif.-2
 Ampex Audio Inc., 1020 Kifer Rd., Sunnyvale, Calif.-1-2
 A.R.F. Products, Inc., 7627 Lake St., River Forest, Ill.-1
 Audiogersh Corp., 514 Broadway, New York 12, N.Y.-1
 Blonder-Tongue Labs, 9 Alling St., Newark 2, N.Y.-1-2
 Bogen Co. David, P.O. Box 500, Paramus, N.J.-1
 British Industries Corp., 80 Shore Rd., Port Washington, N.Y.-1

Capehart Corp., 216 W. 14 St., New York 11, N.Y.-1
 Components Corp., 106 Main St., Denville, N.J.-1
 Dynamic Electronics-New York Inc., 73-39 Woodhaven Blvd., Forest Hills, L.I., N.Y.-1
 Electron Enterprises, 6917 W. Stanley Ave., Berwyn, Ill.-1
 Electronic Applications, 194 Richmond Hill Ave., Stamford, Conn.-2
 Electronic Development Associates, 126 E. 46 St., New York 17, N.Y.-1
 Electrovox Co. (Walco), 60 Franklin St., E. Orange, N.J.-1
 Ercona Corp., 16 W. 46 St., New York 36, N.Y. 2
 Fanon Electric Co., 98 Berriman St., Brooklyn 8, N.Y.-1
 Fen-Tone Corp., 106 5 Ave., New York 11, N.Y.-2
 Miller Mfg. Co., M. A., 4 & Church St., Libertyville, Ill.-1
 Nortronic Co., 1015 S. 6 St., Minneapolis 4, Minn.-2
 Olympic Radio & Television, 34-01 28 Ave., Long Island City 1, N.Y.-1
 Pentron Corp., 777 S. Tripp Ave., Chicago 24, Ill.-2
 Pickering & Co., Sunnyside Blvd., Plainview, L.I., N.Y.-1
 Pilot Radio Corp., 37-06 36 St., Long Island City 1, N.Y.-1
 Powers Co., J. J., 1317 S. 5 Ave., Maywood, Ill.-1
 Rek-O-Kut Co., 38-19 108 St., Corona 68, N.Y.-1
 Revere Camera Co., 320 E. 21 St., Chicago 16, Ill.-2
 Roberts Electronics, 1028 N. La Brea, Hollywood 38, Calif.-2
 Scott Inc., H. H., 111 Powder Mill Rd., Maynard, Mass.-1
 Smolin Labs., Woodbrook Dr., Springdale, Conn.-2
 Stromberg-Carlson, Special Products Div., 1400 N. Goodman St., Rochester 3, N.Y.-1
 Tech Master Corp., 75 Front St., Brooklyn 1, N.Y.-1
 Telectro Industries Corp., 35-16 37 St., Long Island City 1 N.Y.-1-2
 Viking of Minneapolis, 9600 Aldrich Ave. S., Minneapolis 20, Minn.-2
 V-M Corp., Benton Harbor, Mich.-1-2
 Weathers Industries, 66 E. Gloucester Pike, Barrington, N.J.-1
 Webcor, Inc., 5610 W. Bloomingdale Ave., Chicago 39, Ill.-1
 Webster Electric Co., 1900 Clark St., Racine, Wis.-1-2
 Wells-Gardner & Co., 2701 N. Kildare Ave., Chicago 39, Ill.-1
 Whitley Electronics, Inc., 411 S. Chauncey St., Columbia City, Ind.-1-2

5—MICROPHONES & ACCESSORIES

Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.
 Altec Lansing Corp., 1515 S. Manchester Ave., Anaheim, Calif.
 American Geloso Electronics, Inc., 312 7 Ave., New York 1, N.Y.
 American Microphone Mfg. Co., 412 S. Wyman St., Rockford, Ill.
 Astatic Corp., Harbor & Jackson Sts., Conneaut, Ohio
 Duotone Co., Locust St., Keyport, N.J.
 Electronic Applications, 194 Richmond Hill Ave., Stamford, Conn.
 Electro-Voice Inc., Buchanan, Mich.
 Ercona Corp., 16 W. 46 St., New York 36, N.Y.
 Fen-Tone Corp., 106 5 Ave., New York 11, N.Y.
 Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y.
 Luxo Lamp Corp., 102 Columbus Ave., Tuckahoe, N.Y.
 North American Philips Co., 230 Duffy Ave., Hicksville, N.Y.
 Riemer Co., David, (Rystl), 601 W. 26 St., New York 1 N.Y.
 Shure Bros., 222 Hartrey Ave., Evanston, Ill.
 Sonotone Corp., Elmsford, N.Y.
 Stephens Trusonic Inc., 8538 Warner Dr., Culver City, Calif.
 Tannoy (America) Ltd., P.O. Box 177, E. Norwich, L.I., N.Y.
 Turner Co., 909 17 St., N.E., Cedar Rapids, Iowa
 Webster Electric Co., 1900 Clark St., Racine, Wis.

6—NEEDLES, 0.5 OR 0.7 MIL

American Phono Needle Co., 1 Continental Ave., Forest Hills 75, N.Y.
 Astatic Corp., Harbor & Jackson Sts., Conneaut, Ohio
 Berger Communications, 109-01 72 Rd., Forest Hills, N.Y.
 Duotone Co., Locust St., Keyport, N.J.

Electrovox Co. (Walco), 60 Franklin St., E. Orange, N.J.
 Fen-Tone Corp., 106 5 Ave., New York 11, N.Y.
 Fidelitytone Inc., 6415 Ravenswood Ave., Chicago 26, Ill.
 General Electric, Specialty Electronic Components Dept., W. Genesee St., Auburn, N.Y.-1
 Jensen Industries, 7333 W. Harrison St., Forest Park, Ill.
 Miller Mfg. Co., M. A., 4 & Church St., Libertyville, Ill.
 Pfansfleh Chemical Corp., 104 Lake View Ave., Waukegan, Ill.
 Pickering & Co., Sunnyside Blvd., Plainview, L.I., N.Y.
 Recoton Corp., 62-35 Barnett Ave., Long Island City 4, N.Y.
 Shure Bros., 222 Hartrey Ave., Evanston, Ill.
 Televox Co., 46 Lakeview Ave., Yonkers, N.Y.
 Webster Electric Co., 1900 Clark St., Racine, Wis.

7—PHONOGRAPH SYSTEMS

Accessories 1
 Stereo, complete 2

Admiral Corp., 3800 W. Cortland St., Chicago 47, Ill.-2
 Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.-2
 Ampex Audio Inc., 1020 Kifer Rd., Sunnyvale, Calif.-2
 A.R.F. Products, Inc., 7627 Lake St., River Forest, Ill.-2
 Audio-Master Corp., 17 E. 45 St., New York 17, N.Y.-2
 Berger Communications, 109-01 72 Rd., Forest Hills, N.Y.-2
 British Industries Corp., 80 Shore Rd., Port Washington, N.Y.-1
 Capehart Corp., 216 W. 14 St., New York 11, N.Y.-2
 Components Corp., 106 Main St., Denville, N.J.-2
 DeRo Electronics, 134 Nassau Rd., Roosevelt, L.I., N.Y.-1
 Duotone Co., Locust St., Keyport, N.J.-1
 Dynamic Electronics-New York Inc., 73-39 Woodhaven Blvd., Forest Hills, L.I., N.Y.-1-2
 Electron Enterprises, 6917 W. Stanley Ave., Berwyn, Ill.-2
 Electrovox Co. (Walco), 60 Franklin St., E. Orange, N.J.-1
 Emerson Radio & Phono Corp., 14 & Coles Sts., Jersey City 2, N.J.-2
 Fairchild Recording Equipment Corp., 10-40 45 Ave., Long Island City 1, N.Y.-2
 Fanon Electric Co., 98 Berriman St., Brooklyn 8, N.Y.-2
 Fen-Tone Corp., 106 5 Ave., New York 11, N.Y.-1
 Fidelitytone Inc., 6415 Ravenswood Ave., Chicago 26, Ill.-1
 General Electric, Specialty Electronic Components Dept., W. Genesee St., Auburn, N.Y.-1
 Granco Products, Inc., 36-07 20 Ave., Long Island City 5, N.Y.-2
 Greene Co., L. Charlton, 314 Washington St., Newton 58, Mass.-1
 Hallmark Electronics Corp., 383 Concord Ave., New York 54, N.Y.-2
 Heath Co., Benton Harbor, Mich.-2
 Leslie Creations, Lafayette Hill, Pa.-1
 Magnavox Co., 2131 Bueter Rd., Ft. Wayne, Ind.-2
 Microtran Co., 145 E. Mineola Ave., Valley Stream, N.Y.-1
 Miller Mfg. Co., M. A., 4 & Church St., Libertyville, Ill.-1
 Motorola, Inc., 4545 W. Augusta Blvd., Chicago 51, Ill.-2
 Musical Corp., 4512 W. Jefferson, Los Angeles 16, Calif.-2
 Olympic Radio & Television, 34-01 28 Ave., Long Island City 1, N.Y.-2
 Philco Corp., "C" & Tioga Sts., Philadelphia 34, Pa.-2
 Pilot Radio Corp., 37-06 36 St., Long Island City 1, N.Y.-2
 Precise Development Corp., 2 Neil Court, Oceanside, N.Y.-2
 Radio Corp. of America, Cherry Hill, Delaware Township, Camden 8, N.J.-2
 Recoton Corp., 62-35 Barnett Ave., Long Island City 4, N.Y.-1
 Riemer Co., David (Rystl), 601 W. 26 St., New York 1, N.Y.-1
 Robins Industries Corp., 36-27 Prince St., Flushing 54, N.Y.-1
 Setchell-Carlson, Inc., New Brighton, St. Paul 12, Minn.-2
 Stevens Products, Inc., 86 Main St., East Orange, N.J.-1
 Stromberg-Carlson, Special Products Div., 1400 N. Goodman St., Rochester 3, N.Y.-2
 Telectro Industries Corp., 35-16 37 St., Long Island City 1, N.Y.-2
 United Audio Products, 202 E. 19 St., New York 3, N.Y.-1
 Vidair Electronics Mfg. Co., 44 Church St., Baldwin, L. I., N.Y.-1
 V-M Corp., Benton Harbor, Mich.-1-2
 Walsco Electronics Mfg. Co., 100 W. Green St., Rockford, Ill.-1

Waters Conley Co., 17 E. Chestnut St., Chicago 11, Ill.-2
 Webcor, Inc., 5610 W. Bloomingdale Ave., Chicago 39, Ill.-1-2
 Wells-Gardner & Co., 2701 N. Kildare Ave., Chicago 39, Ill.-2
 Wendell Plastic Fabrics Corp., 1220 Broadway, New York 1, N.Y.-1
 Westinghouse Electric Corp., Metuchen, N.J.-2
 Whitley Electronics, Inc., 411 S. Chauncey St., Columbia City, Ind.-2
 Zenith Radiocorp., 6001 W. Dickens Ave., Chicago 39, Ill.-2

8—RECORDS, STEREO

Audio Fidelity, Inc., 770 11 Ave., New York, N.Y.
 Columbia Records, 799 7 Ave., New York 19, N.Y.
 Components Corp., 106 Main St., Denville, N.J.
 Concertapes, Inc., P.O. Box 88, Wilmette, Ill.
 Cook Laboratories, Inc., 101 2 St., Stamford, Conn.
 Counterpoint Recordings Inc., 333 6 Ave., New York 14, N.Y.
 Decca Records, 50 W. 57 St., New York 19, N.Y.
 Elektra Corp., 361 Bleecker St., New York 14, N.Y.
 Fidelity Distributors, 7803 Sunset Blvd., Hollywood 46, Calif.
 Hallmark Electronics Corp., 383 Concord Ave., New York 54, N.Y.
 Int'l Pacific Recording, (Omega) 854 N. Vine St., Hollywood 38, Calif.
 London Records, 539 W. 25 St., New York, N.Y.
 Mercury Records, 35 E. Wacker Dr., Chicago 1, Ill.
 Radio Corp. of America, RCA Records Div., 155 E. 24 St., New York, N.Y.
 Smolin Labs., Woodbrook Dr., Springdale, Conn.
 Stere-O-Craft, Div. Craft Recording Corp., 1650 Broadway, New York, N.Y.
 Stereo Sound Studios, 238 E. 26 St., New York 10, N.Y.
 Urania Records, 233 Main St., Belleville 9, N.J.
 Vanguard Recording Society, 256 W. 55 St., New York 19, N.Y.
 Vox Productions (Stereovox), 236 W. 55 St., New York 19, N.Y.
 Westminster Recordings Co., 275 7 Ave., New York 1, N.Y.
 Zodiac Recording Co., 501 Madison Ave., New York 22, N.Y.

9—SPEAKERS & CABINETS

Enclosures & Cabinets 1
 Speakers & Speaker Systems 2

Acoustic Research, Inc., 24 Thorndike St., Cambridge 41, Mass.-2
 Allied Radio Corp. (Knight), 100 N. Western Ave., Chicago 80, Ill.-1-2
 Altec Lansing Corp., 1515 S. Manchester Ave., Anaheim, Calif.-1-2
 American Loudspeaker Div., Contemporary American Furniture, 1821 Berteau, Chicago 13, Ill.-1
 Ampex Audio Inc., 1020 Kifer Rd., Sunnyvale, Calif.-2
 A.R.F. Products, Inc., 7627 Lake St., River Forest, Ill.-1
 Argos Products Co., 301 Main St., Genoa, Ill.-1
 Arnhold Ceramics Inc., Isophon Div., 1 E. 57 St., New York 22, N.Y.-2
 Atlas Sound Corp., 1449-39 St., Brooklyn 18, N.Y.-2
 Audiogersh Corp. (Kingdom), 514 Broadway, New York 12, N.Y.-2
 Audiospeaker Laboratories, 1114 E. Emporia St., Ontario, Calif.-1-2
 Barker Sales Co., 339 S. Broad Ave., Ridgefield, N.J.-2
 Becker Electronic Mfg. Corp., 1091 Rockaway Ave., Valley Stream, N.Y.-2
 Berger Communications, 109-01 72 Rd., Forest Hills, N.Y.-1
 Blonder-Tongue Labs., 9 Alling St., Newark 2, N.J.-1-2
 Bozak Sales Co., R. T., Box 1166, Darien, Conn.-1-2
 Bradford Audio Corp., 27 E. 38 St., New York 16, N.Y.-1-2
 British Industries Corp. (Wharfedale, R-J) 80 Shore Rd., Port Washington, N.Y.-1-2
 Cabinet Div., G & H Wood Products, 99 N. 11 St., Brooklyn 11, N.Y.-1
 Calif Cabinet Co., 522 S. San Pedro St., Los Angeles 13, Calif.-1
 Capehart Corp., 216 W. 14 St., New York 11, N.Y.-1
 Cletron, Inc., 1974 E. 61 St., Cleveland 3, Ohio-2
 DeRo Electronics, 134 Nassau Rd., Roosevelt, L.I., N.Y.-1
 Duotone Co., Locust St., Keyport, N.J.-1
 Dynamic Electronics-New York Inc., 73-39 Woodhaven Blvd., Forest Hills, L.I., N.Y.-1
 Electron Enterprises, 6917 W. Stanley Ave., Berwyn, Ill.-1

Electronic Applications, 194 Richmond Hill Ave., Stamford, Conn.-2
 Electronic Instrument Co. (Eico), 3300 Northern Blvd., Long Island City 1, N.Y.-1-2
 Electro-Voice, Inc., Buchanan, Mich.-1-2
 Ercona Corp., 16 W. 46 St., New York 36, N.Y.-1-2
 Fourjay Industries, 2360 W. Dorothy Lane Dayton 39, Ohio-1
 General Electric, Specialty Electronic Components Dept., W. Genesee St., Auburn, N.Y.-1-2
 Granco Products, Inc., 36-07 20 Ave., Long Island City 5, N.Y.-2
 Greene Co., L. Charlton, 314 Washington St., Newton 58, Mass.-1
 Hallmark Electronics Corp., 383 Concord Ave., New York 54, N.Y.-2
 Hartley Products Co., 521 E. 162 St., New York 51, N.Y.-2
 Heath Co., Benton Harbor, Mich.-1
 Jensen Mfg. Co., 6601 S. Laramie Ave., Chicago 38, Ill.-1-2
 Klipsch & Associates, Hope, Ark.-2
 KLH Research & Devel. Corp., 30 Cross St., Cambridge, Mass.-2
 Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y.-1-2
 Lansing Sound Co., James, 3249 Casitas Ave., Los Angeles 39, Calif.-1-2
 Lowell Mfg. Co., 3030 Laclede Station Rd., St. Louis 17, Mo.-2
 Mobil Electronics Mfg. Co., 1111 State Rd. 67 E., Anderson, Ind.-1
 Neshaminy Electronic Corp. (JansZen) Neshaminy, Pa.-2
 North American Philips Co., 230 Duffy Ave., Hicksville, N.Y.-1-2
 Olympic Radio & Television, 34-01 28 Ave., Long Island City 1, N.Y.-1
 Oxford Components, Inc., 556 W. Monroe St., Chicago 6, Ill.-1-2
 Pentron Corp., 777 S. Tripp Ave., Chicago 24, Ill.-2
 Permoflux Products Co., 4101 San Fernando Rd., Glendale 4, Calif.-1-2
 Pickering & Co., Sunnyside Blvd., Plainview, L.I., N.Y.-2
 Pilot Radio Corp., 37-06 36 St., Long Island City 1, N.Y.-2
 Powers Co., J. J., 1317 S. 5 Ave., Maywood, Ill.-2
 Quam-Nichols Co., 226 E. Marquette Rd., Chicago 37, Ill.-2
 Racon Electric Co., 1261 Broadway, New York 1, N.Y.-1-2
 Radio Merchandise Sales, 2016 Bronxdale Ave., New York 62, N.Y.-1
 Riemer Co. David, (Rysti), 601 W. 26 St., New York 1, N.Y.-2
 Rockbar Corp. (Goodman) 650 Halstead Ave., Mamaroneck, N.Y.-1-2
 Saxton Products, Inc., 1661 Boone Ave., New York 60, N.Y.-1
 Setchell-Carlson, Inc., New Brighton, St. Paul 12, Minn.-1-2
 Smolin Labs., Woodbrook Dr., Springdale, Conn.-2
 Sonotone Corp., Elmsford, N.Y.-2
 Stephens Truson Inc., 6538 Warner Dr., Culver City, Calif.-1-2
 Stromberg-Carlson, Special Products Div., 1400 E. Goodman St., Rochester 3, N.Y.-1-2
 Tandberg of America, 10 E. 52 St., New York 22, N.Y.-2
 Tannoy (America) Ltd., P.O. Box 177, E. Norwich L.I., N.Y.-1-2
 United Audio Products (Wigo), 202 E. 19 St., New York 3, N.Y.-2
 Universal Woodcrafters Inc., La Porte, Ind.-1-2
 University Loudspeakers, Inc., 80 S. Kensico Ave., White Plains, N.Y.-1-2
 Utah Radio & Electronic Corp., 1124 E. Franklin St., Huntington, Ind.-1-2
 V-M Corp., Benton Harbor, Mich.-1-2
 Weathers Industries, 66 E. Gloucester Pike, Barrington, N.J.-1
 Webcor Inc., 5610 W. Bloomingdale Ave., Chicago 39, Ill.-2
 Webster Electric Co., 1900 Clark St., Racine, Wis.-2
 Wellcor, Inc., 1218 N. Wells St., Chicago 10, Ill.-1
 Wells-Gardner & Co., 2701 N. Kildare Ave., Chicago 39, Ill.-1
 White Inc., Stan, 725 S. LaSalle St., Chicago 5, Ill.-1-2
 Whitley Electronics, Inc., 411 S. Chauncey St., Columbia City, Ind.-1-2

10—TAPE

Blank 1
Pre-recorded stereo 2

Audio Devices Inc., 444 Madison Ave., New York 22, N.Y.-1
 Audio Fidelity, Inc., 770 11 Ave., New York, N.Y.-2
 Audio-Master Corp., 17 E. 45 St., New York 17, N.Y.-2
 Concertapes, Inc., P.O. Box 88, Wilmette, Ill.-2
 Cook Laboratories, Inc., 101 2 St., Stamford, Conn.-2
 Counterpoint Recordings, Inc., 333 6 Ave., New York 14, N.Y.-2

Duotone Co., Locust St., Keyport, N.J.-1
 Elektra Corp., 361 Bleeker St., New York 14, N.Y.-2
 Ercona Corp., 16 W. 46 St., New York 36, N.Y.-1
 Ferrodynamics Corp., Gregg St. & Route 17, Lodi, N.J. (Sonoramic)-1
 Fidelitone Inc., 6415 Ravenswood Ave., Chicago 26, Ill.-1
 Fidelity Distributors, 7803 Sunset Blvd., Hollywood 46, Calif.-2
 Int'l Pacific Recording (Omegatape), 854 N. Vine St., Hollywood 38, Calif.-2
 Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y.-1
 Livingston Audio Products, P.O. Box 202, Caldwell, N.J.-2
 Minnesota Mining & Mfg. Co., 900 Bush St., St. Paul 6, Minn.-1
 National Tape Library, 2413 Penna Ave., N.W., Washington 7, D.C.-2
 ORRadio Industries Inc. (Irish), Shamrock Circle, Opelika, Ala.-1
 Reeves Soundcraft Corp., 10 E. 52 St., New York 22, N.Y.-1
 Smolin Labs., Woodbrook Dr., Springdale, Conn.-2
 Stere-O-Craft, Div. Craft Recording Corp., 1650 Broadway, New York, N.Y.-2
 Stereophony Inc., 112 Oak Plaza, St. Paul 9, Minn.-2
 Stereo Sound Studios, 238 E. 26 St., New York 10, N.Y.-2
 Tandberg of America, 10 E. 52 St., New York 22, N.Y.-1
 Urania Records, 233 Main St., Belleville 9, N.J.-2
 Vanguard Recording Society, 256 W. 55 St., New York 19, N.Y.-2
 Vox Productions (Stereovox), 236 W. 55 St., New York 19, N.Y.-2
 Westminster Recordings Co., 275 7 Ave., New York 1, N.Y.-2
 Zodiac Recording Co., 501 Madison Ave., New York 22, N.Y.-2

11—TAPE RECORDERS, PLAYBACKS, & ACCESSORIES

Accessories 1
Heads, stereo 2
Recorders & Playbacks, stereo 3

Alonge Products Inc., 163 W. 23 St., New York 11, N.Y.-1
 American Electronics, Inc., 9449 W. Jefferson Blvd., Culver City, Calif.-1-2-3
 American Geloso Electronics, Inc., 312 7 Ave., New York 1, N.Y.-1
 American Microphone Mfg. Co., 412 S. Wyman St., Rockford, Ill.-2
 Ampex Audio Inc., 1020 Kifer Rd., Sunnyvale, Calif.-1-3
 Amplifier Corp. of America, 398 Broadway, New York 13, N.Y.-3
 Audio Devices Inc., 444 Madison Ave., New York 22, N.Y.-1
 Audiogersh Corp., 514 Broadway, New York 12, N.Y.-3
 Audio-Master Corp., 17 E. 45 St., New York 17, N.Y.-2
 Bell Sound Systems, 555 Marion Rd., Columbus 7, Ohio-1-3
 Berger Communications, 109-01 72 Rd., Forest Hills, N.Y.-2
 Bogen Co., David, P.O. Box 500, Paramus, N.J.-3
 Columbia Records, 799 7 Ave., New York 19, N.Y.-3
 Electronic Applications, 194 Richmond Hill Ave., Stamford, Conn.-2-3
 Ercona Corp., 16 W. 46 St., New York 36, N.Y.-1-2-3
 Fidelitone Inc., 6415 Ravenswood Ave., Chicago 26, Ill.-1
 General Kinetics Inc., 555 23 St., S., Arlington 2, Va.-1
 Int'l Radio & Electronics Corp., S. 17 St. & Mishawaka Rd., Elkhart, Ind.-3
 Lafayette Radio 165-08 Liberty Ave., Jamaica 33, N.Y.-3
 Lipps Eng'g Edwin A., 1511 Colorado Ave., Santa Monica, Calif.-1-2
 Magnecessories, Box 6960, Washington 20, D.C.-1
 Magnecord Div., Midwestern Instruments, P.O. Box 7186, Tulsa, Okla.-3
 Marco Industries, 3rd & Franklin Sts., Womelsdorf, Pa.-1
 Metzner Eng'g Corp., 1041 N. Sycamore Ave., Hollywood 38, Calif.-3
 Michigan Magnetics, Inc., Vermontville, Mich.-3
 Microtran Co., 145 E. Mineola Ave., Valley Stream, N.Y.-1
 North American Philips Co., 230 Duffy Ave., Hicksville, N.Y.-3
 Nortronics Co., 1015 S. 6 St., Minneapolis 4, Minn.-1-2
 Pentron Corp., 777 S. Tripp Ave., Chicago 24, Ill.-1-2-3
 Permoflux Products Co., 4101 San Fernando Rd., Glendale 4, Calif.-3
 Pro-Tex Reel Band, 2108 Payne Ave., Cleveland 14, Ohio-1

Radio Corp. of America, Cherry Hill, Delaware Twp., Camden 8, N.J.-8
 Reiter Co., F., 3340 Bonnie Hill Dr., Hollywood 28, Calif.-1
 Roberts Electronics, 1028 N. LaBrea, Hollywood 38, Calif.-1-3
 Robins Industries Corp., 36-27 Prince St., Flushing 54, N.Y.-1
 Saxton Products, Inc., 1661 Boone Ave., New York 60, N.Y.-1
 Scott Instrument Labs., 17 E. 48 St., New York 17, N.Y.-1
 Shure Bros., 222 Hartrey Ave., Evanston, Ill.-2
 Smolin Labs., Woodbrook Dr., Springdale, Conn.-3
 Superscope, Inc., 8520 Tujunga Ave., Sun Valley, Calif.-3
 Tandberg of America, 10 E. 52 St., New York 22, N.Y.-2-3
 Taylorel Corp., 185 Murray St., Rochester 6, N.Y.-1
 Telecro Industries Corp., 35-16 37 St., Long Island City 1, N.Y.-1-2-3
 Viking of Minneapolis, 9600 Aldrich Ave. S., Minneapolis 20, Minn.-1-2-3
 V-M Corp., Benton Harbor, Mich.-1-3
 Walsco Electronics Mfg. Co., 100 W. Green St., Rockford, Ill.-1
 Webcor Inc., 5610 W. Bloomingdale Ave., Chicago 39, Ill.-1-3
 Webster Electric Co., 1900 Clark St., Racine, Wis.-1-2-3
 Wollensak Optical Co., 20 E. 21 St., Chicago 16, Ill.-3

12—TUNERS

AM or FM "single play" 1
AM & FM "simultaneous play" 2
Multiplex adaptable 3

Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.-1-2
 Altec Lansing Corp., 1515 S. Manchester Ave., Anaheim, Calif.-1-3
 American Geloso Electronics, Inc., 312 7 Ave., New York 1, N.Y.-1
 Ampex Audio, Inc., 1020 Kifer Rd., Sunnyvale, Calif.-2-3
 Arkay Radio Kits, 120 Cedar St., New York 6, N.Y.-1-2-3
 Bell Sound Systems, 555 Marion Rd., Columbus 7, Ohio-1-2-3
 Blonder-Tongue Labs., 9 Alling St., Newark 2, N.J.-1
 Bogen Co., David, P.O. Box 500, Paramus, N.J.-1-2-3
 Brand Products Inc. (Madison Fielding), 11 Lorimer St., Brooklyn 6, N.Y.-2-3
 British Industries Corp., 80 Shore Rd., Port Washington, N.Y.-1
 Capehart Corp., 216 W. 14 St., New York 11, N.Y.-1-3
 DeWalt Radio, Div., United Scientific Lab., 35-15 37 Ave., Long Island City 1, N.Y.-1-2-3
 Dynamic Electronics-New York Inc., 73-39 Woodhaven Blvd., Forest Hills, L.I., N.Y.-1-2-3
 Electronic Development Associates, 125 E. 46 St., New York 17, N.Y.-1-2-3
 Electronic Instrument Co. (Eico), 3300 Northern Blvd., Long Island City 1, N.Y.-1-3
 Ercona Corp., 16 W. 46 St., New York 36, N.Y.-1
 Erie Resistor Corp., 644 W. 12 St., Erie 6, Pa.-1
 Granco Products, Inc., 36-07 20 Ave., Long Island City 5, N.Y.-1-2
 Harman-Kardon Inc., 520 Main St., Westbury, N.Y.-1-2-3
 Heath Co., Benton Harbor, Mich.-1
 Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y.-1-2-3
 McIntosh Lab. Inc., 2 Chambers St., Binghamton, N.Y.-1-3
 Miller Co., J. W., 5917 S. Main St., Los Angeles 3, Calif.-1-2-3
 Mobil Electronics Mfg. Co., 1111 State Rd. 67 E., Anderson, Ind.-3
 Pilot Radio Corp., 37-06 36 St., Long Island City 1, N.Y.-1-2-3
 Precise Development Corp., 2 Neil Court, Oceanside, N.Y.-1
 Precision Electronics Inc. (Grommes), 9101 King St., Franklin Park, Ill.-1-2-3
 Regency Div., Idea Inc., 7900 Pendleton Pike, Indianapolis 26, Ind.-1
 Sargent-Raymont Co., 4926 E. 12 St., Oakland 1, Calif.-1-3
 Scott Inc., H. H., 111 Powder Mill Rd., Maynard, Mass.-1-2-3
 Setchell-Carlson, Inc., New Brighton, St. Paul 12, Minn.-2
 Sherwood Electronics Labs., 4300 N. Calif. Ave., Chicago 18, Ill.-1
 Simpson Mfg. Co., Mark, 32-28 49 St., Long Island City 3, N.Y.-1
 Stromberg-Carlson, Special Products Div., 1400 N. Goodman St., Rochester 3, N.Y.-1
 Tech Master Corp., 75 Front St., Brooklyn 1, N.Y.-1-2-3
 Video Instruments Co., 3002 Penna. Ave., Santa Monica, Calif.-1-2
 Wells-Gardner & Co., 2701 N. Kildare Ave., Chicago 39, Ill.-1-3
 Whitley Electronics, Inc., 411 S. Chauncey St., Columbia City, Ind.-1

Alphabetical List of Manufacturers

(Numbers refer to sections
in which products are listed.)

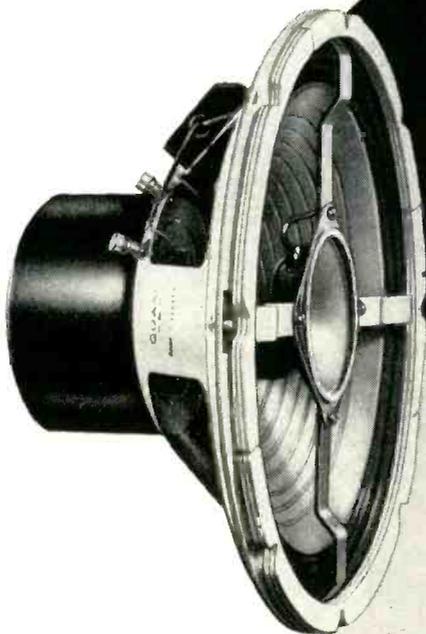
Acoustic Research, Inc., 24 Thorndike St., Cambridge 41, Mass.-9
Acro Products Co., 369 Shurs Lane, Philadelphia 28, Pa.-1
Admiral Corp., 3600 W. Cortland St., Chicago 47, Ill.-7
Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.-1-4-5-7-9-12
Alonge Products, Inc., 163 W. 23 St., New York 11, N.Y.-11
Altec Lansing Corp., 1515 S. Manchester Ave., Anaheim, Calif.-1-4-5-9-12
American Electronics, Inc., 9449 W. Jefferson Blvd., Culver City, Calif.-4-11
American Geloso Electronics, Inc., 312 7 Ave., New York 1, N.Y.-5-11-12
American Loudspeaker Div., Contemporary American Furniture, 1821 Berceau, Chicago 13, Ill.-9
American Microphone Mfg. Co., 412 S. Wyman St., Rockford, Ill.-2-3-5-11
American Phono Needle Co., 1 Continental Ave., Forest Hills 75, N.Y.-6
Ampex Audio, Inc., 1020 Kifer Rd., Sunnyvale, Calif.-1-4-7-9-11-12
Amplifier Corp. of America, 398 Broadway, New York 13, N.Y.-11
A.R.F. Products, Inc., 7627 Lake St., River Forest, Ill.-1-4-7-9
Argos Products Co., 301 Main St., Genoa, Ill.-9
Arkay Radio Kits, 120 Cedar St., New York 6, N.Y.-1-12
Arnhold Ceramics Inc., Isophon Div., 1 E. 57 St., New York 22, N.Y.-9
Astatic Corp., Harbor & Jackson Sts., Conneaut, Ohio-2-3-5-6
Atlas Sound Corp., 1449 39 St., Brooklyn 18, N.Y.-9
Audio Devices, Inc., 444 Madison Ave., New York 22, N.Y.-10-11
Audio Fidelity, Inc., 770 11 Ave., New York, N.Y.-8-10
Audiogersh Corp., 514 Broadway, New York 12, N.Y.-2-3-4-9-11
Audio-Master Corp., 17 E. 45 St., New York 17, N.Y.-7-10-11
Audiopoint Labs., 1114 E. Emporia St., Ontario, Calif.-9
Barker Sales Co., 339 S. Broad Ave., Ridgefield, N.J.-1-2-9
Becker Electronic Mfg. Corp., 1091 Rockaway Ave., Valley Stream, N.Y.-9
Bell Sound Systems, 555 Marion Rd., Columbus 7, Ohio-1-11-12
Berger Communications, 109-01 72 Rd., Forest Hills, N.Y.-2-6-7-9-11
Blonder-Tongue Labs., 9 Alling St., Newark 2, N.J.-1-4-9-12
Bogen Co., David, P.O. Box 500, Paramus, N.J.-1-3-4-11-12
Bozak Sales Co., R. T., Box 1166, Darien, Conn.-9
Bradford Audio Corp., 27 E. 38 St., New York 16, N.Y.-9
Brand Products Inc. (Madison Fielding), 11 Lorimer St., Brooklyn 6, N.Y.-1-12
British Industries Corp., 80 Shore Rd., Port Washington, N.Y.-1-3-4-7-9-12
Cabinart Div. G&H Wood Products, 99 N. 11 St., Brooklyn 11, N.Y.-9
Calif. Cabinet Co., 522 S. San Pedro St., Los Angeles 13, Calif.-9
Capehart Corp., 216 W. 14 St., New York 11, N.Y.-1-4-7-9-12
CBS-Hytron, 100 Endicott St., Danvers, Mass.-2
Cetron, Inc., 1974 E. 61 St., Cleveland 3, Ohio-9
Columbia Records, 799 7 Ave., New York 9, N.Y.-8-11
Components Corp., 106 Main St., Denville, N.J.-1-3-4-7-8
Concertapes, Inc., P.O. Box 88, Wilmette, Ill.-8-10
Cook Labs., Inc., 101 2 St., Stamford, Conn.-1-8-10
Counterpoint Recordings Inc., 333 6 Ave., New York, 14, N.Y.-8-10
Decca Records, 50 W. 57 St., New York 19, N.Y.-8
DeRo Electronics, 134 Nassau Rd., Roosevelt, L.I., N.Y.-1-7-9
DeWald Radio, Div., United Scientific Labs., 35-15 37 Ave., Long Island City 1, N.Y.-1-12
Duotone Co., Locust St., Keyport, N.J.-2-5-6-7-9-10
Dynaco Inc., 617 N. 41 St., Philadelphia 4, Pa.-1
Dynamic Electronics-New York Inc., 73-39 Woodhaven Blvd., Forest Hills, L.I., N.Y.-1-4-7-9-12
Electron Enterprises, 6917 W. Stanley Ave., Berwyn, Ill.-1-4-7-9
Electronic Applications, 194 Richmond Hill Ave., Stamford, Conn.-1-3-4-5-9-11
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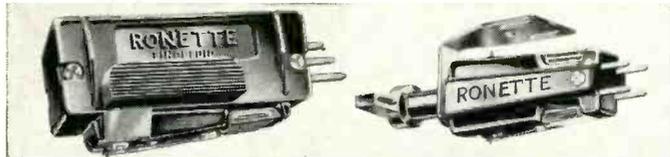
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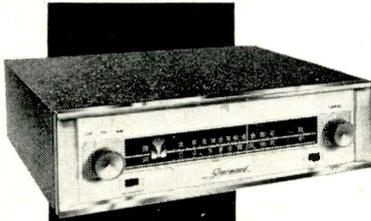
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Electrovox Co. (Walco), 60 Franklin St., East Orange, N.J.-4-6-7
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Emerson Radio & Phono. Corp., 14 & Coles Sts., Jersey City 2, N.J.-7
Ereona Corp., 16 W. 46 St., New York 36, N.Y.-1-2-3-4-5-9-10-11-12
Erie Resistor Corp., 644 W. 12 St., Erie 6, Pa.-1-2-12
Fairchild Recording Equipment Corp., 10-40 45 Ave., Long Island City 1, N.Y.-1-2-3-7
Fanon Electric Co., 98 Berriman St., Brooklyn 8, N.Y.-1-4-7
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Fen-Tone Corp., 106 5 Ave., New York 11, N.Y.-1-2-3-4-5-6-7
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Fidelitone Inc., 6415 Ravenswood Ave., Chicago 26, Ill.-6-7-10-11
Fidelity Distributors, 7803 Sunset Blvd., Hollywood 46, Calif.-8-10
Fourjay Industries, 2360 W. Dorothy Lane, Dayton 39, Ohio-9
General Electric Co., Specialty Electronic Components Dept., W. Genesee St., Auburn, N.Y.-1-2-3-6-7-9
General Kinetics Inc., 555 23 St., S., Arlington 2, Va.-11
Glaser-Steers Corp., 20 Main St., Belleville 9, N.J.-3
Granco Products, Inc., 36-07 20 Ave., Long Island City 5, N.Y.-7-9-12
Greene Co., L. Charlton, 314 Washington St., Newton 58, Mass.-1-7-9
Hallmark Electronics Corp. (Paramount), 383 Concord Ave., New York 54, N.Y.-7-8-9
Harman-Kardon Inc., 520 Main St., Westbury, N.Y.-1-12
Hartley Products Co., 521 E. 162 St., New York 51, N.Y.-9
Heath Co., Benton Harbor, Mich.-1-2-3-7-9-12
Int'l Pacific Recording (Omegatape), 854 N. Vine St., Hollywood 38, Calif.-8-10
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Jensen Industries, 7333 W. Harrison St., Forest Park, Ill.-2-6
Jensen Mfg. Co., 6601 S. Laramie Ave., Chicago 38, Ill.-9
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KLH Research & Devel. Corp., 30 Cross St., Cambridge, Mass.-9
Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y.-1-2-3-5-9-10-11-12
Lansing Sound, Inc., James B., 3249 Casitas Ave., Los Angeles 39, Calif.-9
Leslie Creations, Lafayette Hill, Pa.-7
Lipps Eng'g., Edwin A., 1511 Colorado Ave., Santa Monica, Calif.-11
Livingston Audio Products, P.O. Box 202, Caldwell, N.J.-10
London Records, 539 W. 25 St., New York 1, N.Y.-8
Lowell Mfg. Co., 3030 Laclede Station Rd., St. Louis, Mo.-9
Luxe Lamp Corp., 102 Columbus Ave., Tuckahoe, N.Y.-5
McIntosh Lab. Inc., 2 Chambers St., Binghamton, N.Y.-1-12
Magnavox Co., 2131 Bueter Rd., Fort Wayne, Ind.-7
Magnelectrics, Box 6960, Washington 20, D.C.-11
Magnezord Div., Midwestern Instruments, P.O. Box 7186, Tulsa, Okla.-11
Marantz Co., 25-14 Broadway, Long Island City 6, N.Y.-1
Marco Industries, 3rd & Franklin Sts., Womelsdorf, Pa.-14
Mercury Records Corp., 35 E. Wacker Dr., Chicago 1, Ill.-8
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Michigan Magnetics, Inc., Vermontville, Mich.-11
Microtran Co., 145 E. Mineola Ave., Valley Stream, N.Y.-7-11
Miller Co., J. W., 5917 S. Main St., Los Angeles 3, Calif.-12
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Musieall Corp., 4512 W. Jefferson, Los Angeles 16, Calif.-1-7
National Tape Library, 2413 Penna. Ave., N.W., Washington 7, D.C.-10
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Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, Calif.-1
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Oxford Components, Inc., 556 W. Monroe St., Chicago 6, Ill.-9
Pentron Corp., 777 S. Tripp Ave., Chicago 24, Ill.-1-4-9-11
Permoflux Products Co., 4101 San Fernando Rd., Glendale 4, Calif.-1-9-11
Pfanstiehl Chemical Corp., 104 Lake View Ave., Waukegan, Ill.-6
Philco Corp., "C" & Tioga Sts., Philadelphia 34, Pa.-7
Pickering & Co., Sunnyside Blvd., Plainview, L.I., N.Y.-2-3-4-6-9
Pilot Radio Corp., 37-06 36 St., Long Island City 1, N.Y.-1-4-7-9-12
Powers Co., J. J., 1317 S. 5 Ave., Maywood, Ill.-1-4-9
Precise Development Co., 2 Neil Court, Oceanside, N.Y.-1-7-12
Precision Electronics Inc. (Grommes), 9101 King St., Franklin Park, Ill.-1-12
Pro-Tex Reel Band, 2108 Payne Ave., Cleveland 14, Ohio-11
Quam-Nichols Co., 226 E. Marquette Rd., Chicago 37, Ill.-9
Racon Electric Co., 1261 Broadway, New York 1, N.Y.-9
Radio Corp. of America, Cherry Hill, Delaware Township, Camden 8, N.J.-7-11
Radio Corp. of America, RCA Records Div., 155 E. 24 St., New York, N.Y.-8
Radio Eng'g Co., Inquirer Bldg., Philadelphia 30, Pa.-3
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Radio Music Corp., 84 S. Water St., Port Chester, N.Y.-1-2-3
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Rek-O-Kut Co., 38-19 108 St., Corona 68, N.Y.-3-4
Revere Camera Co., 320 E. 21 St., Chicago 16, Ill.-4
Riemer Co., David, 601 W. 26 St., New York 1, N.Y.-3-5-7-9
Roberts Electronics, 1028 N. La Brea, Hollywood 38, Calif.-1-4-11
Robins Industries Corp., 36-27 Prince St., Flushing 54, N.Y.-7-11
Rockbar Corp., 650 Halstead Ave., Mamaroneck, N.Y.-3-9
Ronette Sales Corp., 190 Earle Ave., Lynbrook, N.Y.-2-3
Sargent-Raymont Co., 4926 E. 12 St., Oakland 1, Calif.-1-12
Saxton Products, Inc., 1661 Boone Ave., New York 60, N.Y.-9-11
Scott Inc., H. H., 111 Powder Mill Rd., Maynard, Mass.-1-2-3-4-12
Scott Instrument Labs., 17 E. 48 St., New York 17, N.Y.-11
Setchell-Carlson, Inc., New Brighton, St. Paul 12, Minn.-1-7-9-12
Sherwood Electronics Labs., 4300 N. Calif. Ave., Chicago 18, Ill.-1-12
Shure Bros., 222 Hartrey Ave., Evanston, Ill.-2-3-5-6-11
Simpson Mfg. Co., Mark, 32-28 49 St., Long Island City 3, N.Y.-1-12
Smolin Labs., Woodbrook Dr., Springdale, Conn.-3-4-8-9-10-11
Sonotone Corp., Elmsford, N.Y.-2-5-9
Stephens Trusonic Inc., 8538 Warner Dr., Culver City, Calif.-5-9
Stere-O-Craft, Div. Craft Recording Corp., 1650 Broadway, New York, N.Y.-8-10
Stereophony Inc., 112 Oak Plaza, St. Paul 9, Minn.-10
Stereo Sound Studios, 238 E. 26 St., New York 10, N.Y.-8-10
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Taylorel Corp., 185 Murray St., Rochester 6, N.Y.-11
Tech Master Corp., 75 Front St., Brooklyn 1, N.Y.-1-4-12
Telectro Industries Corp., 35-16 37 St., Long Island City 1, N.Y.-1-4-7-11
Televox Co., 46 Lakeview Ave., Yonkers, N.Y.-2-6
Thorens Co., Thorens Ave., New Hyde Park, N.Y.-3
Turner Co., 909 17 St., N.E., Cedar Rapids, Iowa-5
United Audio Products, 202 E. 19 St., New York 3, N.Y.-2-3-7-9
Universal Woodcrafters Inc., La Porte, Ind.-1-9
University Loudspeakers, Inc., 80 S. Kenico Ave., White Plains, N.Y.-9
Urania Records, 233 Main St., Belleville 9, N.J.-8-10
Utah Radio & Electronic Corp., 1124 E. Franklin St., Huntington, Ind.-9
Vanguard Recording Society, 256 W. 55 St., New York 19, N.Y.-8-10
Vidaire Electronics Mfg. Corp., 44 Church St., Baldwin, L.I., N.Y.-7
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Viking of Minneapolis, 9600 Aldrich Ave. S., Minneapolis 20, Minn.-4-11
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Vox Productions, Inc., 236 W. 25 St., New York, N.Y.-8-10
Walsco Electronics Mfg. Co., 100 W. Green St., Rockford, Ill.-7-11
Waters Conley Co., 17 E. Chestnut St., Chicago 11, Ill.-7
Weathers Industries, 66 E. Gloucester Pike, Barrington, N.J.-1-2-3-4-9
Webcor, Inc., 5610 W. Bloomingdale Ave., Chicago 39, Ill.-1-3-4-7-9-11
Webster Electric Co., 1900 Clark St., Racine, Wis.-1-2-4-5-6-9-11
Wellcor, Inc., 1218 N. Wells St., Chicago 10, Ill.-9
Wells-Gardner & Co., 2701 N. Kildare Ave., Chicago 39, Ill.-1-4-7-9-12
Wendell Plastic Fabrics Corp., 1220 Broadway, New York 1, N.Y.-7
Westinghouse Electric Corp., Metuchen, N.J.-7

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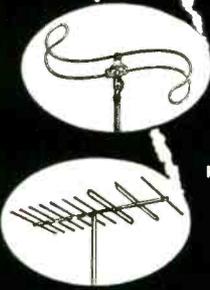
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ELECTRONIC TECHNICIAN • Stereo, 1959

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White Inc., Stan, 725 S. LaSalle St., Chicago 5, Ill.-9
Whitley Electronics, Inc., 411 S. Chauncey St., Columbia City, Ind.-1-4-7-9-12
Wollensak Optical Co., 20 E. 21 St., Chicago 16, Ill.-11
Zenith Radio Corp., 6001 W. Dickens Ave., Chicago 39, Ill.-7
Zodiac Recording Co., 501 Madison Ave., New York 22, N.Y.-8-10

Industry Associations

with name of secretary
unless otherwise noted

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American Institute of Physics 335 E 45th St New York 17 N Y Wallace Waterfall
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MICROPHONICS:

Negligible in amplifiers requiring an input voltage of at least 50 mv for an output of 5 watts. No special precautions against microphonics necessary even though the tube is mounted in the near vicinity of a loudspeaker with 5% acoustical efficiency.

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Better than —60 db relative to 50 mv when the grid circuit impedance is no greater than 0.5 megohms (at 60 cps), the center tap of the heater is grounded and the cathode resistor is by-passed by a capacitor of at least 100 mfd.

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ECC82/12AU7	Low-noise low- μ dual triode
GZ34	Cathode-type rectifier; 250 ma.
EZ80/6V4	9-pin rectifier; cathode; 90 ma.
EZ81/6CA4	9-pin rectifier; cathode; 150 ma.

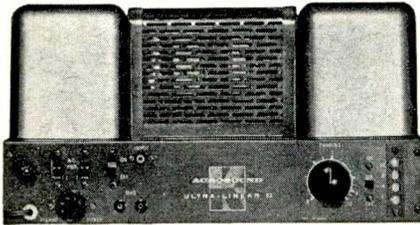
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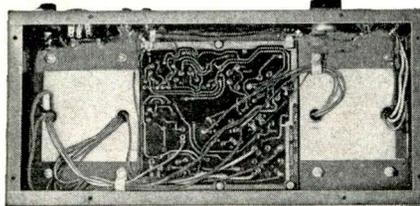


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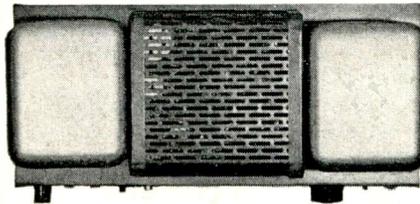
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ULTRA-LINEAR II
60 watt amplifier



DESIGN The combination of patented ULTRA-LINEAR circuitry—plus new HYBRID FEEDBACK principle—VARIABLE DAMPING control, and ULTRA STABILITY, represents a new high in the art of amplifier design... an example of ACROSOUND'S latest achievement in AMERICAN Know-How. This superiority of design now enables anyone with or without any previous knowledge of electronics to assemble for himself or herself... (yes! it's that easy!)... the finest of amplifiers and at a most reasonable cost, in only two hours!



PERFORMANCE By listening test, or by instruments... second to none in clarity and frequency response. Normal level distortion is virtually unmeasurable—IM 1% or less at 60 watts, 120 watts peak. Completely stable... unaffected by loads, perfect square waves.



QUALITY Every part going into the assembly of critical and even non-critical circuitry is tested and checked to allow no more than $\pm 1/2\%$ variation from ACROSOUND'S standards. Specialized test equipment unavailable commercially was designed in ACROSOUND'S laboratories to achieve this result. Every printed circuit board is placed in trial operation on a laboratory amplifier. Output tubes are matched by trial and double checked.



COMPONENTS ACRO'S newest TO-600 output transformer with special hybrid winding—separates functions of output circuit and feedback circuit. Heavy duty, completely assembled, and thoroughly tested, printed circuit board assures uniformity of performance. Low distortion EL34 output tubes are operated well within their ratings ensuring long tube life and optimum performance.

PRICE In preassembled kit form so that you may save money, learn while doing, and have the proud satisfaction you built the best for only \$79.50 net... or if you feel you would prefer it laboratory assembled it still represents a bargain at \$109.50 net.

HEAR IT AT YOUR DEALER NOW!

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Circle 94-01 on inquiry form p. 73

Master Control

(Continued from page 50)

need some attention when the loudness level is changed appreciably or when the seating arrangement is altered. A possible solution and simplification may be in the use of a recently introduced dual volume control which may be adjusted individually and then operated jointly by locking the concentric shafts.

A desirable characteristic of a balance control is to be able to balance the output level of each of the two channels, one against the other, without altering the overall volume level. This can be accomplished by stacking two linear potentiometers and wiring one in reverse order as shown in Fig. 2. Adjusting this control lowers the volume of one channel and increases the volume of the other, thus keeping the total output at the same level.

It is possible to use a compensated type of volume control as a combination loudness contour and volume level adjuster. Provisions may be employed to switch the compensation network out, and leave the control function to handle the volume level only. Still another way is to use separate controls and networks for each of these functions.

Functions & Modes

The most convenient way to choose a program source is to be able to turn a switch to the desired position. A rotary-selector, multi-gang switch with up to 12 positions may be used for this purpose. The complexity of the switch may be minimized by limiting its functions only to the job on hand. Further simplification can be achieved by using the same input on the control box for more than one program source. Consideration must be given to the impedance and amplification

requirements of the program source. Where more than one source has the same output characteristics, it can be fed into the same jack on the master control.

Fig. 3 shows a simple arrangement of two switches which can reverse the two channels, or permit them to play straight through. It is also possible to select either channel and feed it into both amplifiers for monophonic listening on both amplifiers and their respective speaker systems. This in effect doubles the amount of power output.

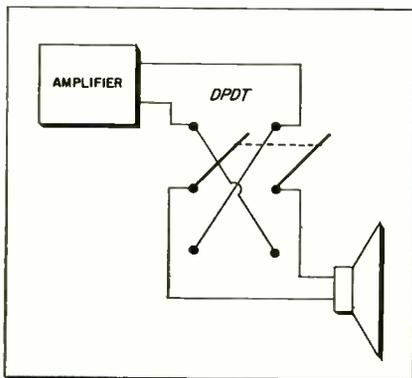
Other than the balance and volume controls nothing thus far has gone into the control box that would materially alter the requirements for matching impedances and other pre-amplifier functions. Manufacturers specifications for matching and equalization should be followed. If the amplifier and preamplifier do not have the appropriate circuitry, it may be built into the control box. Some manufacturers have input adapters which can be plugged into the line between the program source and the preamp.

In the absence of equalization networks it is possible to set the bass and treble controls for proper playback, but the correct position of the controls will have to be predetermined and marked.

With stereo via FM multiplex there is a very nice feature: because of the sum and difference type of program makeup, the output from the difference channel can be adjusted and faded in. Without the difference channel, both speaker systems get the same program; they are virtually in parallel. As the difference channel component is brought up, the stereo effect appears without abruptly changing the output from either speaker. This makes quite a sophisticated demonstration.

This can also be done with other stereo program source material, but it requires elaborate equipment to convert the signal to sum and difference components. Just one more switch, but not on the master control, to consider. This is a speaker phasing arrangement for only one channel as shown in Fig. 4. Since it is possible, for several different reasons, to have stereo program material, at the output of each amplifier, in phase from one program source and out of phase from another, and since the only valid way to phase speaker systems for stereo is by listening to the stereo program, a phasing switch is most convenient. This switch can be located either near the amplifier or the speaker. •

Fig. 4—Speaker phasing switch provides a quick way to check for proper stereo phasing while listening to a stereo program.



Multiplexing

(Continued from page 63)

have the same information as the righthand microphone and the left speaker will have the same information that was impressed on the left microphone.

$$(A+B) + (A-B) = 2A$$

$$(A+B) - (A-B) = 2B$$

The way the subcarrier is developed is very interesting, and also very complex. The problems of signal-to-noise ratio, and cross talk are still occupying the full-time efforts of many engineers. However, sufficient progress has been demonstrated to justify consideration by the FCC for multiplex broadcasting. The subcarrier for FM multiplexing is nothing more than a continuous sinusoidal signal operating at a frequency of over 20,000 cycles. The reason for selecting an ultrasonic frequency is to prevent it from being heard and thus interfering with the main program in a regular FM receiver not equipped for multiplex. Also the receiver deemphasis network does much to kill this high frequency signal and keep it from getting into the audio amplifier stages. From 30 kc to 70 kc could be used in actual practice. Some work is now going on in approximately the 32 kc to 67 kc range.

At the receiver end, the FM station is picked up and handled in the conventional manner up to the point just past the second detector and before the deemphasis network.

The A+B portion is allowed to go straight through the receiver to both amplifiers, while the A-B signal is picked off by a bandpass filter before the deemphasis network has an opportunity to attenuate it. This signal is then demodulated and passed through a phase splitter. The in-phase part of the A-B signal is fed to one amplifier and the out-of-phase part of the A-B signal is fed to the other amplifier. As was shown, this action restores the right and left signals.

Adapters are available for use in those areas presently experimenting with FM multiplex for stereo. These units range in price from approximately \$50 to \$100.

The FCC has already granted permission to some broadcasters to experiment with multiplexed stereo-casting on FM, and it looks as though multiplexed stereo will be another program source for stereo in the very near future. ●

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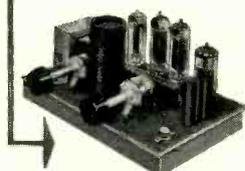
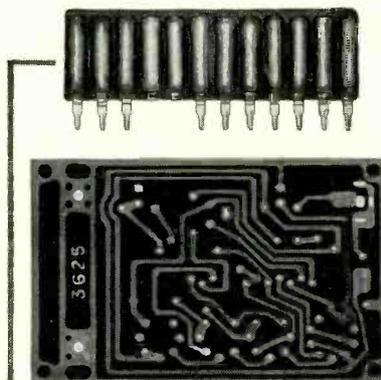
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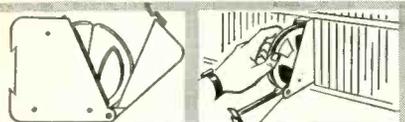
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Circle 96-02 on inquiry form p. 73

Stereo Discs

(Continued from page 49)

cause the needle to go straight down if both channels are equally pulling in a downward direction. An out-of-phase force, that is, one channel pushing up and the other channel pulling down, will cause the needle to travel laterally to one side or the other depending upon the direction of the forces. Thus the stylus can travel in any direction depending upon the forces exerted on it. From this it can be seen that even though the information is cut into the groove at a 45° angle, the stylus is displaced either horizontally or vertically or both from the reference groove at any given moment. Even if only one channel is modulated, there is a diagonal movement which consists of horizontal and vertical components. The RIAA standard specifies that lateral modulation of the stereo disc produce in-phase signals to the speakers. This in-phase signal condition differs from the in-phase mechanical motion of the stylus and should not be confused.

One of the most difficult-to-understand phenomena of the single-groove stereo record is how the stylus can track a groove that seemingly has one sidewall going one way, and another sidewall going another as shown in Fig. 5. Perhaps this is due to difficulties engendered by the inability to use old concepts to explain new ones, and worse still, to at least temporarily discard any previous ideas. The first and probably most important misconception to eliminate is that the weaving back and forth of the groove's sidewalls indicate lateral motion. The groove in Fig. 4 has sidewalls going back and forth in a Mae West fashion, yet there is no lateral motion on the part of the stylus. However, this pinching and expanding does indicate a rising and falling stylus. It is the center of the groove that describes lateral motion.

Since the stylus can assume a position that is displaced both horizontally and vertically from a given reference point, it is possible for the groove to have different widths, and different lateral displacement from one instant to the next. Therefore the groove walls do not appear to be symmetrical. The center line at point A in Fig. 5 shows lateral movement to the left, and the wider distance between the walls shows vertical modulation in a downward direction. At point B the stylus is riding high

but without any lateral displacement. Again there is no horizontal offset at point C, but the stylus is way down. Point D indicates that the stylus is off to the right but riding at reference height. If at this point not too much confusion has set in, it should be evident that it is possible for a stylus to track such a groove.

This brings up a rather controversial point. Since the stylus contacts both sidewalls at any given instant, and since both its relative width and lateral displacement transmits the intelligence to both elements in the cartridge, is it correct to say that one wall contains the intelligence in one channel and the other wall contains the other channel? Where would the needle be if one wall were left out? Even so, in the illustration in Fig. 5, the inner sidewall represents the left channel which in this case contains a higher frequency signal than the right channel, which in turn is responsible for the shape of the outer wall. It is the combination of the two walls and their relative position which provides the information to the stereo or monophonic cartridge. Suffice it to say that it works, and it is revolutionizing the hi-fi industry. •



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Circle 96-03 on inquiry form p. 73
ELECTRONIC TECHNICIAN • Stereo, 1959

Needles for Stereo

(Continued from page 56)

lateral components, which can produce corresponding distortions in both "45" channels:

1. The 2nd harmonic of lateral components appear in the vertical channel. At high frequencies this is relatively unimportant. But . . .

2. IM products (difference frequencies) from the lateral components also appear in the vertical. This can produce a buzzing sound on high-amplitude, complex high-frequency sounds, such as those high impact items.

3. Lower frequency components of vertical movement can intermodulate the higher frequency lateral components, producing a "dithery" effect in the reproduction.

Stylus Size

There is still another effect due to the vertical component of the recording. The size of the stylus can cause increased 2nd harmonic distortion in the vertical component plus the production of difference frequencies (IM) within these components, thus exaggerating #2 effect considerably. Fig. 3 shows how the path traversed by a larger needle differs from the actual vertical component. Compare the shape of the dotted line with that of the actual cutting. The smaller the needle, the more nearly its path agrees with the original recording.

The answer for this is a smaller stylus, which reduces both pinch effect and its associated distortions, and the dominantly vertical distortion. Early experimental stereo records and styli for them have been using a tip radius of 0.7 mil, as compared with the standard 1 mil for monophonic LPs and 3 mils for the 78s. The RIAA recommendation for the future is 0.5 mil—and not without good reason, from what we have seen!

But what does reducing tip size do? If the pickup design remains about the same, the effective compliance of the record vinyl at the stylus tip will increase, so the resonant frequency will come down, unless the mass of the stylus and its mounting comes down proportionately. This means it is more important than ever to have a clean mounting.

Reducing tip size, and keeping the stylus pressure the same means the pressure per square inch (which already measures in tons per square inch) will be radically increased. A

change from 1 mil to 0.5 mil will multiply this wear-producing pressure by about 4 times.

Needle Material

Since the advent of LPs, the transition from steel-to-sapphire-to-diamond has been gaining momentum. Now it is widely recognized that diamonds are not only the best, but by far the cheapest both for records and styli. The step to 0.5 mil should multiply this incentive toward the use of diamond needles.

Diamonds should be good: accurately shaped, precision mounted, and micropolished. Extra care is needed when installing these new needles. The life of a diamond can not be taken for granted. It should be checked regularly.

It is false economy to get a pickup with one stylus and expect it to do dual service. Figs. 4 and 5 show what

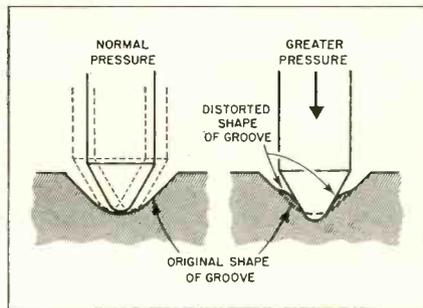
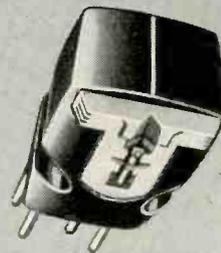


Fig. 5—Small stylus with normal pressure will slide along the bottom of the groove in an erratic manner. (B) Increased pressure reduces erratic behavior, but increases wear.

using a large stylus in a small groove, or vice versa, will do. Either way, if only the regular pressure is used, distortion is apt to result. Fig. 4A shows how a needle, which is too large but with normal pressure, rides high in the groove. Distortion due to a tendency to bounce, and in severe cases serious tracking problems are introduced such as groove skipping, and in the case of changers, failure to trip the cycling mechanism. Distorted records and excessive wear can be expected if stylus pressure is increased, as shown in Fig. 4B. On the other hand, too small a stylus, with normal pressure, has a tendency to move about in the bottom of the groove in an erratic manner causing distortion and excessive needle scratch, as shown in Fig. 5A. Increasing needle pressure in this case also results in distorted discs and excessive wear. Increasing the pressure to avoid this distortion also results in considerably increased wear in the styli. •

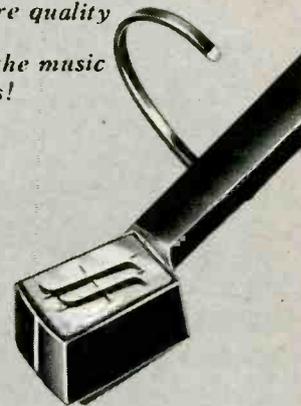
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Stereo Glossary

balance control: A differential gain control, whose function is to increase the level in one channel, while reducing it in the other, or vice versa, without affecting the overall volume level of the stereo system.

binaural: Two eared; applied to a kind of recording to be played into separate headphones to create a sense of depth which does not necessarily reflect actual listening conditions in the studio or concert hall.

cardioid: As applied to microphones, heart-shaped sensitivity pattern. Provides maximum pickup in front, and minimum pickup from the rear of the microphone.

compatibility: The ability of a new and old system to be used interchangeably. Specifically, a stereo system usable with monophonic program source; or stereo program that can be reproduced monophonically on a monophonic system.

carrier: Unmodulated radio signal used to convey information through space.

compliance: Ability to yield or flex. In stylus and cartridge measurements it is expressed as an integral number which is equal to the number of 10^{-6} cm moved by 1 dyne of force. The higher the number the better.

counter: A type of FM demodulator, particularly suitable for a multiplex subcarrier. It counts the number of cycles and gives an output proportional to its count at any instant.

decoding: In multiplex, a process of separating the subcarrier from the main carrier.

difference channel: A combination of the difference between left and right stereo channels.

focus control: See balance control.

forty-five/forty-five: The accepted type of monogroove stereo recording, so named because the stylus motion for each channel is at a 45° angle.

hole-in-the-middle: An effect of a divided sound source sometimes encountered in an area midway between speaker systems. An out-of-phase condition can exaggerate this effect, as can too widely separated speakers.

integrated: Applied to speakers or enclosure design, arrangement of speakers, usually on a common axis to create the impression that the sound is coming from a point source, especially the middle and high frequencies (in the same stereo channel).

matrixing: The process of combining left and right channels, to produce sum and difference signals. Also the reverse process, to restore left and right channels from the sum and difference signals.

monaural: One eared. Frequently used loosely instead of monophonic.

monophonic: Single channel, whether presented over one or more speaker systems.

monogroove stereo disc: A stereo recording in which all the program is contained in one groove.

multiplex: A method of simultaneously carrying one or more additional radio programs on one radio transmission within the assigned bandwidth.

omnidirectional: As applied to microphones, uniform pickup of sound from all directions.

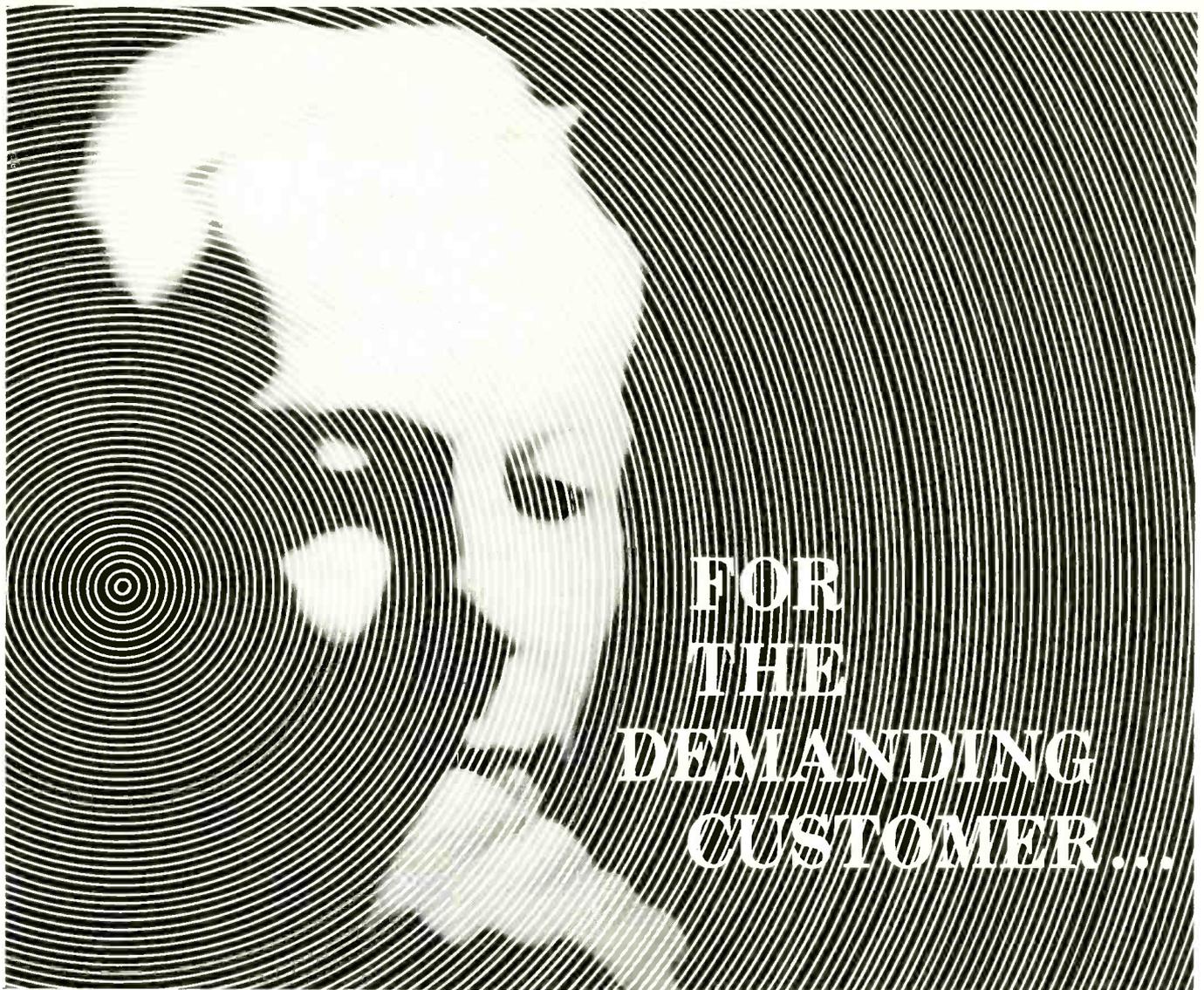
ping-pong effect: Dissociation due to some sounds coming first from one speaker, and then from the other.

stereophonic: Also referred to as stereo. Two or more separate channels of sound blended in a listening area in such a manner as to create a sense of realism and depth in sound reproduction.

subcarrier: A relatively low ultrasonic frequency used to accept modulation from additional programs, such as a second stereo channel, and then modulating the main radio station carrier.

sum channel: A combination of left and right stereo channels. It is identical to the program which may be recorded or transmitted monophonically.

vertical-lateral: A type of stereo monogroove recording in which one channel is recorded by vertical movement and the other by lateral movement of the stylus; as a basic system, this has been rejected in favor of 45/45.



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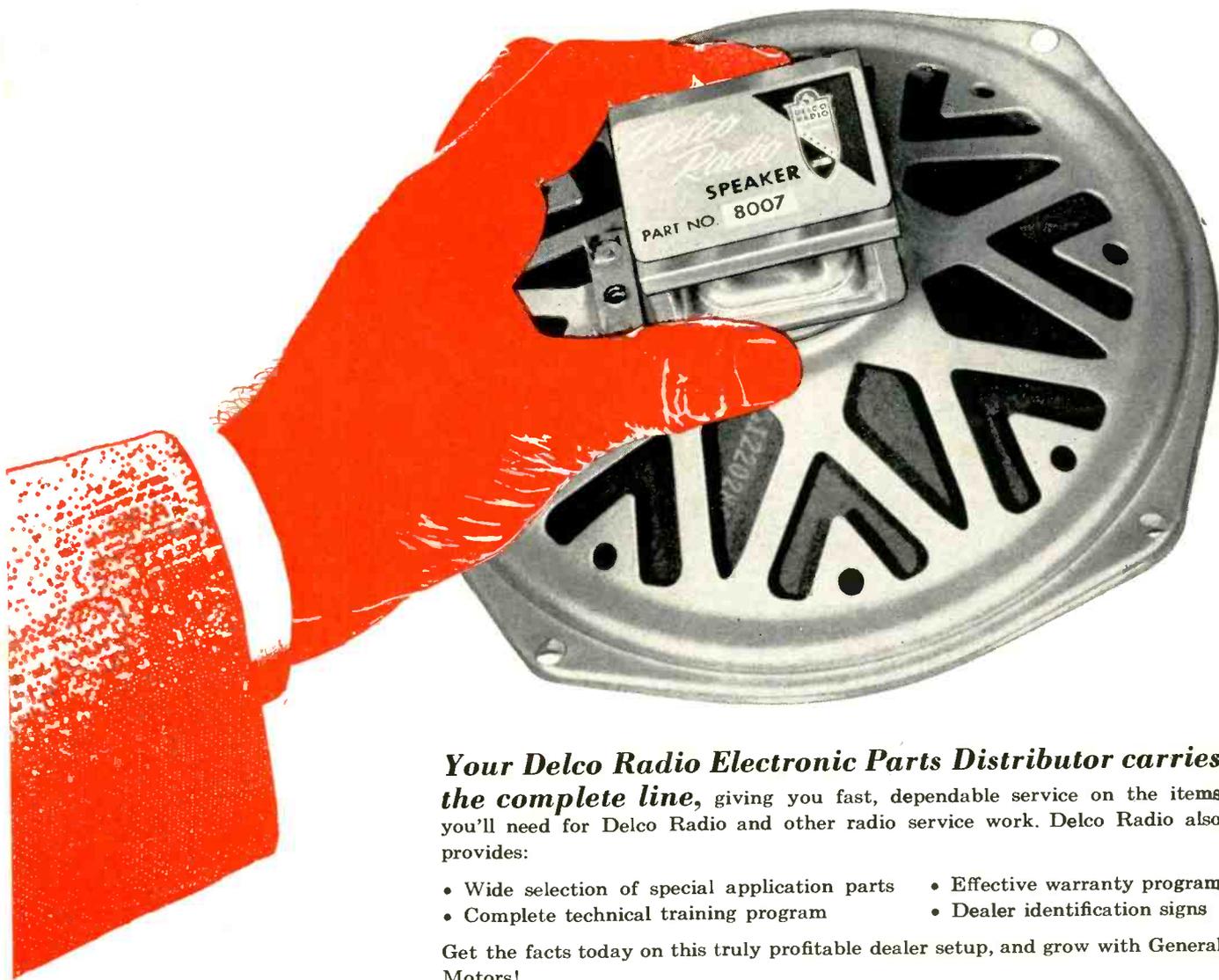
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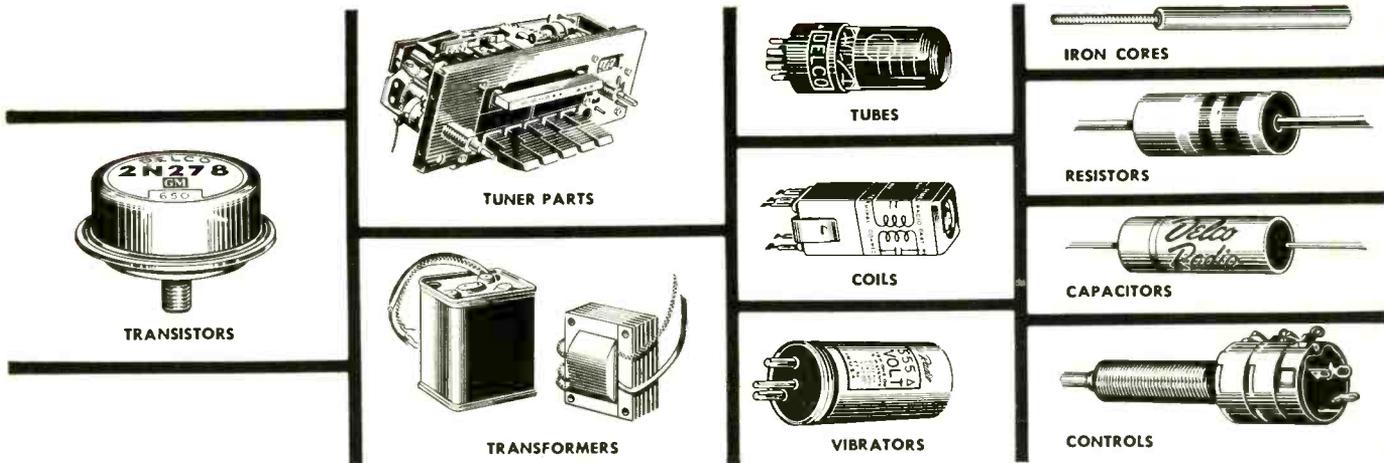
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- Amplitude of color subcarrier and color-burst signal adjustable from front-panel for checking color synclock action of set
- Both rf and video output available—video output has both "+" and "-" polarity
- RF output voltage, at least 0.01 volt peak to peak; video output voltage—at "Lo" connector, at least 0.25 volt peak to peak across 75 ohms; 8 volts peak to peak across 4700 ohms at "High" video output terminal



Write for technical literature describing these RCA Test Instruments and for the line flyer describing RCA's complete line of both color and black-and-white test instruments.



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

RCA Commercial Engineering, Section 1-46-W
 Harrison, New Jersey

Rush me the following literature on RCA professional Test Equipment!

- CD-57-6 (RCA WR-61B Color Bar Generator) 3F764 (RCA Test Equipment Line Flyer)
 CD-57-7 (RCA WR-46A Video/Dot Crosshatch Generator)

Name.....
 Company.....
 Address.....
 City..... Zone..... State.....

Catalogs & Bulletins

(Continued from page 25)

TERMINALS: A new solderless terminal catalog No. T-70 illustrates terminals in actual size, with schematic drawings, and detailed specifications. Illustrates new bolt cutter, crimping tool and terminal paks, kits and displays. Vaco Products Co., 317 E. Ontario St., Chicago 11, Ill. (ELECTRONIC TECHNICIAN B9-10)

TRANSISTORS: Bulletin E-288 covers a new line of PNP germanium power transistors which allows the customer to specify his choice of five packages, thirty-six collector-to-base voltages, and large current gains, in 20, 30, or 40-watt sizes. CBS-HYTRON, Danvers, Mass. (ELECTRONIC TECHNICIAN B9-4)

TV PICTURE TUBES: A new 12-page, 3-color, illustrated brochure outlines the firm's facilities for the manufacture of TV picture tubes for the replacement market. Includes illustrations of the various processes in CRT production. Continental Electronics Corp., 1900 W. Allegheny Ave., Philadelphia, Pa. (ELECTRONIC TECHNICIAN B9-5)

ELECTRONIC INSTRUMENTS: A new 12-page catalog groups into sections for easy reference, more than 50 instruments for measurement and analysis. A summary of their applications in testing equipment and analyzing data is given. Panoramic Radio Products, Inc., 514 S. Fulton Ave., Mt. Vernon, N. Y. (ELECTRONIC TECHNICIAN B9-8)

RESISTORS: Bulletin 155 describes new, even smaller, metal film precision resistors. Gives details on the increased resistance range offered by these units, despite their reduced size, and describes new shapes and lower temperature coefficient of resistance now established as standard for these units. Ohmite Mfg. Co., 3696 W. Howard St., Skokie, Ill. (ELECTRONIC TECHNICIAN B9-12)

INDEX: A 48-page book gives complete information for quickly finding diagrams and service data in 17 "Most-Often-Needed Radio Diagrams" manuals published by the firm, covering radio receivers from 1926 to present 1958 sets. Includes index to 13 Television Servicing Information volumes. Normally the Index sells for 25¢, but will be supplied to ELECTRONIC TECHNICIAN's readers for 5¢ in stamps for postage. Write direct to Supreme Publications, 1760 Balsam Rd., Highland Park, Ill.

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antenna promotion of the year!*

Winegard's "Dealer Double Profits Program"

down with the old! up with the gold!

To make this fall your biggest ever for TV antenna profits, just pick up the selling tools from Winegard! They're all wrapped up in the new Double Profit promotional package that gives you everything you need to pull the customers in — and sell twice as much to double your antenna profits.

It's a money-maker you can't afford to miss!

coming soon!

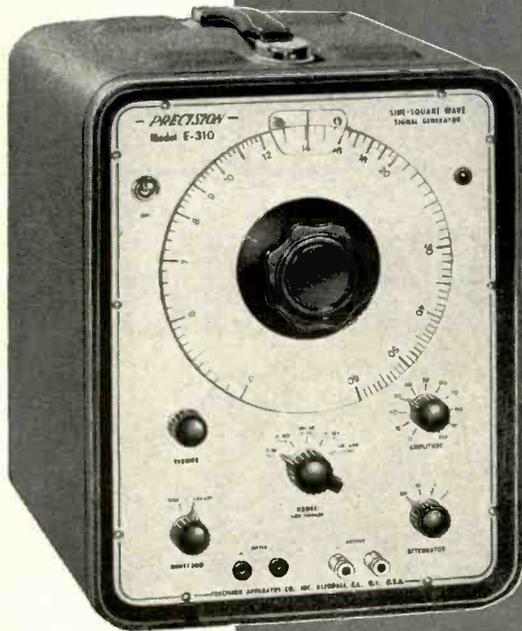


see your jobber or write for full details

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SINE WAVES
from 5 cps to 600 kc

SQUARE WAVES
from 5 cps to 600 kc

all for **\$165⁰⁰** NET

with the

PRECISION MODEL **E-310**

WIDE-RANGE SINE and SQUARE WAVE GENERATOR

The only generator on the market today offering both sine and square wave coverage of the subsonic, audio, supersonic and lower RF spectra at a moderate price. The 6-inch tuning dial has a 12:1 drive ratio and provides an effective scale length of 85 inches over the 5 tuning bands. Tuning accuracy is within 1% from 100 cps to 600 kc and within 1 cycle below 100 cps. Output is within ± 1 db over each of the 5 bands and within ± 1 db from band to band. Distortion is less than 1% at the maximum output level of 10 volts (r. m. s.) into 600 ohms. Square wave rise time is 0.15 μ sec.

The complete **PRECISION** line, comprising a wide range of high-quality electronic test instruments, includes the suitable vacuum-tube voltmeters and oscilloscopes to complement the Model E-310 for exacting waveform analysis and frequency response tests. Write for detailed new catalog describing and illustrating the entire line.

PRECISION Model ES-550

Cathode-Ray Oscillograph \$235.00 net

- Ideal companion instrument to the E-310
- 5 Mc bandwidth
- 10 mv/inch sensitivity



PRECISION test equipment is available and on display at leading electronic parts distributors.

PRECISION Apparatus Company, Inc.

70-31 84th Street, Glendale 27, Long Island, New York
Export: Morhan Exporting Corp., 458 Broadway, N. Y. 13, N. Y., U.S.A.
Canada: Atlas Radio Corp., Ltd., 50 Wingold Ave., Toronto 19, Ontario



MANUFACTURERS OF HIGH-QUALITY ELECTRONIC TEST EQUIPMENT FOR OVER 26 YEARS

110° Vertical Sweep Circuits

(Continued from page 32)

output transformer directly. Sections V1 and V2 are, in essence, two resistance-coupled amplifiers. The output of V1 feeds the input of V2 through C313. The output of V2 is fed back to V1 through C312. Two conditions necessary for sustained oscillations are thus established, sufficient amplification to overcome circuit losses and feedback of an in-phase signal.

One way to troubleshoot this circuit is to open one side of capacitor C312 and feed a 60-cycle sine-wave into the grid of V1 and check for presence of signal and relative gain at the plate of V1, and grid and plate of V2. Instead of using an 18-volt peak-to-peak voltage taken from a 6.3 volt filament supply as a test signal, as is a customary practice, the voltage taken from the filament string at pin 5 of this tube is

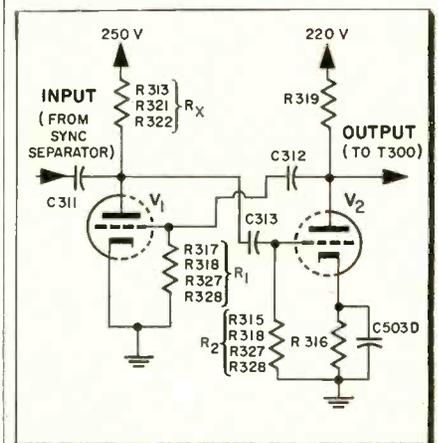


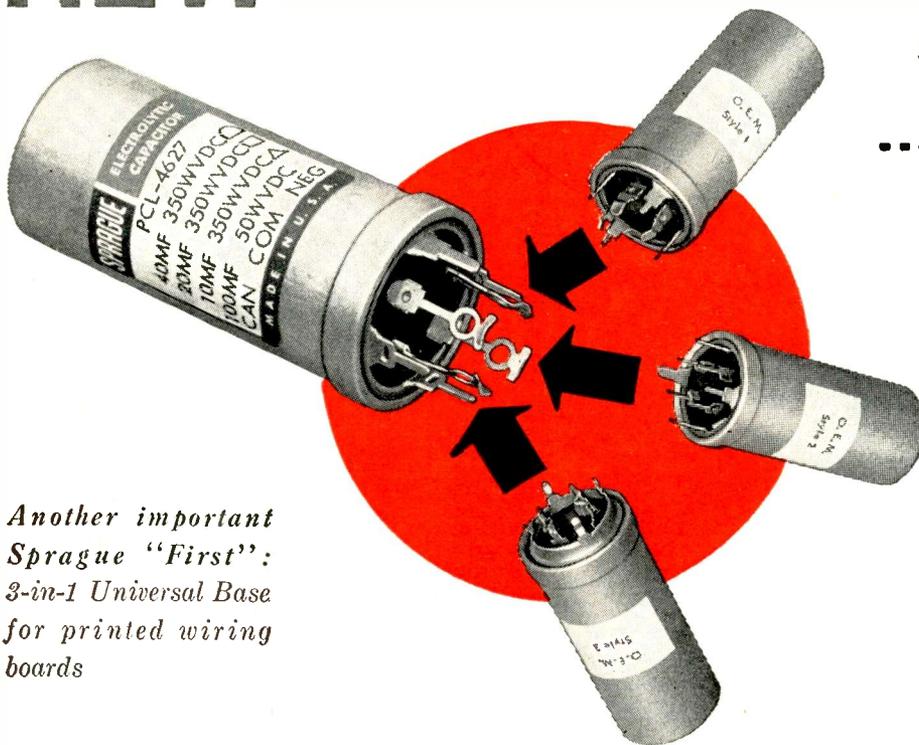
Fig. 3—Simplified version of the heart of the sweep section shown in Fig. 1. Plate-coupled multivibrator serves as oscillator, sync phase inverter, and vertical output circuit.

almost of proper amplitude and more convenient. The action of this multivibrator circuit is typical. When B+ is first applied, one of the stages will conduct slightly more than the other. If V2 starts to conduct more heavily, its plate voltage will decrease more than the plate voltage of V1, and appear as a negative going signal. This negative going signal is coupled to the grid of V1 and causes V1 to conduct less. The resulting increase in V1's plate voltage is coupled to the grid of V2 and causes V2 to conduct more heavily. This process continues very rapidly until V1 is cut-

(Continued on page 106)

**NEW
NEW
NEW**

Sprague PRINT-LOK^{*} 'lytics
with universal bases
for printed wiring boards
simplify servicing
...reduce inventory



*Another important
Sprague "First":
3-in-1 Universal Base
for printed wiring
boards*

Sprague's new PRINT-LOK Electrolytic Capacitors have a newly-developed universal base that's designed to fit all sets. A touch of your pliers is all that's needed to adapt PRINT-LOK capacitors to any one of three different types of printed circuit bases!

How's that for simplified servicing? And just as important, you need only stock a third as many 'lytics as were required previously. Still another feature—PRINT-LOK capacitors also replace standard twist-base electrolytic capacitors.

^{*}Trademark

PRINT-LOK capacitors are hermetically sealed in aluminum cases to give extra long life and top performance under extremely high temperatures and high surge voltages, as well as in high ripple selenium rectifier circuits.

Sprague's new TV Electrolytic Capacitor Replacement Guide K-103 gives complete listings for PRINT-LOK 'lytics as well as standard TWIST-LOK capacitors. Get your free copy from your distributor, or send 10c to cover handling to Sprague Products Co., 65 Marshall Street, North Adams, Massachusetts.

don't be vague...insist on

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SPRAGUE RESEARCH IS CONSTANTLY PRODUCING NEW AND BETTER CAPACITORS FOR YOU

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with the
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**AUTOMATIC PT5
SILICON
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General Instrument Distributor Division
RADIO RECEPTOR COMPANY, INC.
Subsidiary of General Instrument Corporation
240 Wythe Avenue, Brooklyn 11, N. Y. EVergreen 8-6000



- Easy pigtail installation
- Hermetically sealed
- No pressure contacts used
- No heat sinks required

(Continued from page 104)

off. A steady state condition exists momentarily at this point, with no varying signal applied to the grid of V2, its plate current remains constant. The coupling capacitor C312 now has an opportunity to discharge itself through the lumped resistance R1, R319 and B+. When enough of the negative charge leaks off, V1 will start to conduct and send a negative going signal to the grid of V2. The same sequence of events takes place, only this time V2 is cutoff. The conditions for a free running oscillator are thus established with its frequency dependent upon the time constant of the coupling capacitors and their associated resistors. Actual free running frequency is set slightly below the desired 60 cycles to allow the incoming sync pulse to set the exact speed.

The method used to apply the sync pulse is unusual and interesting, and while it has nothing to do with 110° deflection, it is worthwhile to take notice of it. A positive sync pulse is required at the grid of V1 to trigger it into conduction. This action

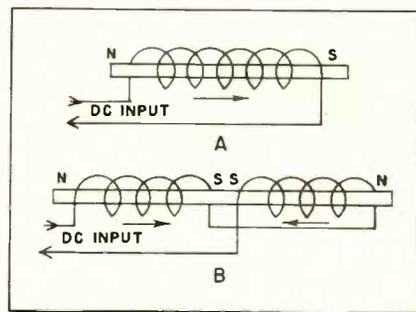


Fig. 4—As direct current flow increases in coil A, the magnetic field increases until saturation is reached. When this happens no further increase in the magnetic field is possible. If the magnetic fields due to dc are cancelled, all of the core material is then available for the a-c signal.

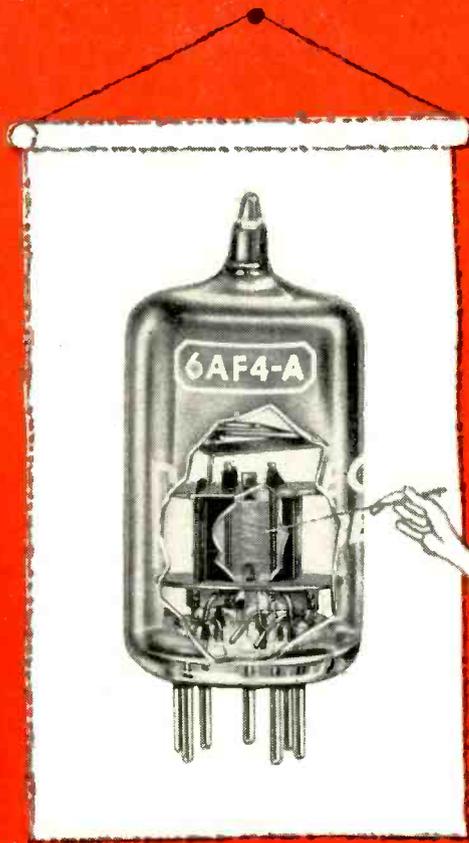
speeds up the oscillator to the desired frequency. Because the incoming sync pulse from the sync separator is negative going it is first fed to the grid of V2 where its phase is reversed and then fed to the grid of V1 through C312 and R314. This coupling network also acts as a filter and removes most of the sawtooth portion and passes the remaining positive going sync pulse.

Thermistor Action

Many things happen during the warm up period, when a set is first

(Continued on page 108)

anatomy
of the
tube...
LESSON #1



GRID

How RCA builds special
prescription grids...extends 6AF4-A life!

RCA's redesign of the 6AF4-A has resulted in minimized slump, product uniformity, and projected average life of 4,000 hours or more!

Here are some of the materials RCA "prescribes" in manufacturing the new 6AF4-A. The grid is plated with Palladium, a rare metal capable of withstanding high temperatures. The use of this grid structure minimizes interelectrode leakage, prevents grid loading, and as a result, provides stable tube performance. The cathode, a nickel alloy, is specially selected to reduce interface resistance and thus minimizes slump. The use of pins which are silver-plated reduces skin effect at ultra high frequencies and improves tuner performance.

All these features, in addition to dynamic life tests, help to assure long and dependable performance. No wonder RCA's 6AF4-A is tops!

So, here's the #1 lesson in radio, phonograph, and TV service—when ordering tubes for replacement, specify "RCA Tubes only."



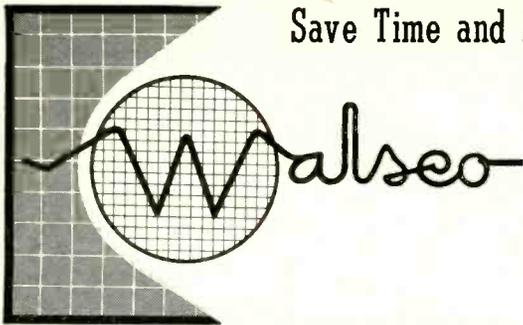
RADIO CORPORATION OF AMERICA

Electron Tube Division

Harrison, N. J.

Save Time and Effort with these handy

TUBE SERVICING AIDS



WALSCO TEST SOCKET ADAPTERS

Now you can make measurements of voltage, resistance, audio and video from the top of the chassis. Save time and work by testing tube circuits while in full operation. Made of low-loss phenolic, these tube socket adapters have an insulation resistance of 500,000 megohms (40% RH-24° C). High voltage breakdown between elements exceeds 1700 volts AC-DC. Test tabs on adapters are extended for easy use with prods or alligator clips.

Cat. No.	Description	Dealer Net
1949-07	7-pin miniature	\$1.65
1949-08	8-pin octal	1.55
1949-09	9-pin miniature	1.85
1949-01	Duo-Decal for CRT	1.95

WALSCO SOCKET PROTECTORS

Prevent excess wear and tear of sockets on tube checkers and other electronic equipment. Walsco socket protectors eliminate the necessity of checking and replacing original sockets. Time-saving and easy to use. With silver-plated phosphor bronze contacts and pins for lasting service.

Cat. No.	Description	Dealer Net
1946	7-Pin Miniature	\$1.95
1947	8-Pin Octal	1.95
1948	9-Pin Miniature	1.95

110° BASE ADAPTERS



Convert 110° CRT type base to Duo-Decal base for rejuvenators, test equipment, tube checkers, etc.

Cat. No. 1944 (RCA)
Dealer Net \$1.50
Cat. No. 1945 (Sylvania)
Dealer Net \$1.50

110° TUBE PIN STRAIGHTENER



For RCA type 110° picture tubes. They straighten bent pins quickly and easily. May also be used as base protector. A handy time-saving piece of equipment.

Cat. No. 1941
Dealer Net \$.51

NEW WALSCO TUBE GUIDE



Eliminates fumbling when inserting 9 and 7 pin tubes. Center pin of tube guide aligns tube with center hole of socket and guides tube in easily and quickly.

Cat. No. 1942 (7 pin)
Dealer Net \$.42
Cat. No. 1943 (9 pin)
Dealer Net \$.42

(Continued from page 106)

turned on, resistors, coils, tubes and even capacitors undergo changes in value which may cause more or less current and voltage values to be developed. If the circuit is stable and well designed, little or no difference in operation is noticed by the set owner. The use of temperature compensated components in oscillators, power supplies and many other electronic devices is not new. Thermistors exhibit a negative temperature coefficient, that is the resistance decreases as the temperature increases. It is a ceramic like material and available in many different shapes, beads, rods, discs, etc. (For more information on thermistors, see page 30 in the February 1958 issue of Electronic Technician.) In this particular application, both thermistors compensate for voltage and current variations due to warm up and ambient temperature conditions. Both vertical size and frequency are thus held fairly constant. Thermistor R323 is located inside the high voltage cage, where the rise in temperature is just right to cause proper corrective action. This thermistor controls the amount of boost voltage fed to the oscillator section and minimizes height variations. R320 assures proper oscillator action for varying conditions of temperature, current and voltage.

The autotransformer, new yoke design and smaller picture tube neck have all contributed to the higher efficiency requirements of the 110° deflection circuits.

130° Deflection

With the advent of the 130° CRT and possibly even higher deflection angles, even more efficiency will have to be obtained from these circuits if additional stages, special purpose tubes and increased demands for power is to be avoided.

For example, the horizontal sweep circuit in this 110° receiver is able to improve efficiency still more by feeding B+ through the horizontal output transformer in such a way as to minimize core saturation. Fig. 4A shows a typical iron core electromagnet. As the direct current flow is increased the magnetic field increases until saturation occurs. When this happens no further increase in the magnetic field is possible even though more current is forced through this coil. In part B of Fig. 4 another winding is added to the core. The windings of both coils are in the same direction, but

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A Division of Textron Inc.
West Coast Plant: Los Angeles 18, California
MAIN PLANT: 106 W. GREEN ST., ROCKFORD, ILL., U.S.A.
In Canada: Atlas Radio Corporation, Toronto 10, Ontario

wired so that the magnetic fields oppose each other. If both windings are equal the total magnetic field will be zero regardless of how much dc flows through the coils.

Fig. 5 is a simplified horizontal output circuit and shows how the output transformer is wired to take advantage of this principal. The arrows indicate the direction of B+

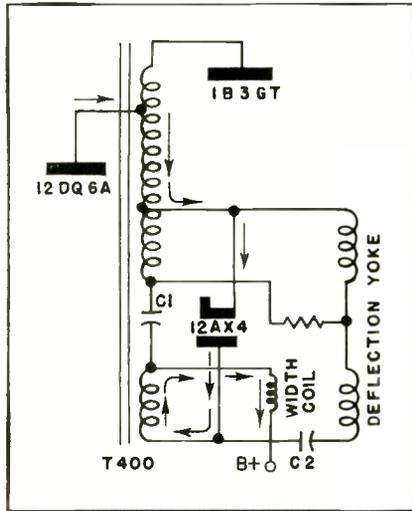


Fig. 5—Direct current flow, in opposite directions, through the output transformer eliminates magnetic fields due to dc and increases efficiency. AC flows in the usual manner.

and boost voltage flow. The current is flowing from both ends toward the middle just as in Fig. 4B. By cancelling out the magnetic field due to the d-c component, all of the core material is available for the desired a-c signal.

So far as the a-c signal is concerned the hookup looks like a conventional autotransformer with capacitor C1 acting as a connecting link. C2 prevents dc from flowing through the yoke. Some manufacturers have been centerfeeding B+ through the vertical yoke windings; others have used varying amounts of B+ to provide electrical centering control; and still others have blocked the dc component from getting into the vertical yoke windings. However, most set makers still pass B+ through most or all of the output transformers winding in one direction. Whether or not this technique will also be used in the vertical output transformers, either to reduce the amount of iron and size of transformer, or to increase efficiency for larger deflection angles yet to come, remains to be seen. •

Illustration Credits

Sylvania Electric Products, Inc.

Note the improvement

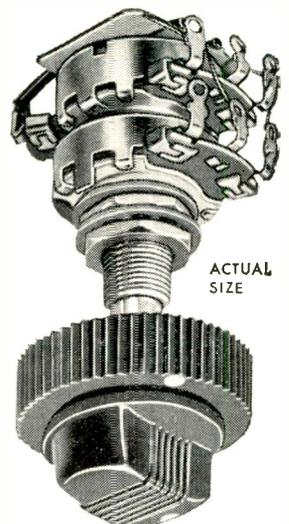


You can easily make music sound richer with Centralab Compentrol®

Put Centralab Compentrol in your customers' radios and TV sets, and *presto!* Sound satisfaction! That's because this remarkable control with built-in compensating circuits provides perfect tonal balance of the highs and the lows—and does it automatically at any volume level. Unlike ordinary controls, Compentrol brings out the full richness of the sound . . . brings hi-fi into any living room.

Compentrol is easy to install in any radio, TV, or hi-fi set. You merely replace the existing control . . . no circuit changes required.

FREE: A booklet describing in detail how the Compentrol works and how easy it is to install. Write directly to Centralab for your copy.



6 MODELS AVAILABLE—Replace standard volume controls without rebuilding. Fit all hi-fi's, record players, radios, TV, pre-amplifiers, amplifiers, tuners, and tape recorders.

B-5839

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IN CANADA: 804 MT. PLEASANT ROAD • TORONTO, ONTARIO

... another
MALLORY
 service-engineered
 product

New Contact Design Makes Mallory Gold Label Vibrators Better than Ever



It's real news when the best gets better . . . and that's just what has happened to Mallory Gold Label Vibrators. The exclusive buttonless contact design that enabled these vibrators to set the replacement service standard for long life, quiet operation and constant output has now been improved.

A unique dual-leaf construction provides *two* contact areas on the same arm . . . assuring positive starting even if a tiny fleck of dust should lodge on *one* of the contact areas. This feature makes Mallory Gold Labels more than ever the surest-starting vibrators made.

Your Mallory distributor has *new* Gold Label Vibrators in stock now. Order from him today.

- Capacitors
- Vibrators
- Resistors
- Power Supplies
- Mercury and Zinc-Carbon Batteries
- Controls
- Switches
- Filters
- Rectifiers



FANON announces a stereo phono line, priced \$89.95 to \$109.95.

HEATH Pres. Robert Erickson has moved to BECKMAN INSTRUMENTS as exec VP.

PICKERING has published a 12-page booklet, "It Takes Two to Stereo."

OXFORD appoints two reps: Weller-Rahe Co., Cleveland; Southern Sales Co., Angola, Ind.

FAIRCHILD sales manager Robert G. Bach has resigned to set up a rep organization handling the line in the New York area.

TANNOY has introduced the Belvedere enclosure, 26" x 18" x 12", finished on four sides, with 12" dual concentric speaker @ \$195.

RADIO ENGINEERING has announced a record changer with automatic record restacking, which lifts discs to the top of the spindle after last play, and starts playing again. Also, automatic interval timer provides silence from 10 to 60 minutes. Model R11-1 is \$195.25; Model R10, \$242.35.

UNIVERSITY has published a new 64-page "Technilog." This fact-packed loudspeaker manual includes numerous charts and tables, and technical discussions of matching, phasing, type selection, building specs, etc. Price is \$1.

ORRADIO July sales are up 89% over last year. Says VP Nat Welch, "Ordinarily, following the summer period, we don't experience an upturn in business before September, but this year the upswing started in July. We believe this to be positive indication that business will be exceptionally good this fall."

PENTRON appoints RAYTHEON International Div. as exclusive overseas distributor.

BRITISH INDUSTRIES appoints Ed Cornfield sales manager for Wharfedale speakers and Riveredge cabinets. Cornfield was previously executive secretary of IHFM.

SONOTONE's new approach with its 4T ceramic turnover cartridge is the inclusion of two 1-mil needles, eliminating the 3-mil needle. With sapphires, cost is \$4.95; bracket is 50¢ more.

ELECTRO-VOICE announces the Model 20 PZT magnetic stereo cartridge with 13 mv output. Stylus is snap-in replacement type. Offered in 4 models with diamond and sapphire styli in turnunder and fixed types, prices range from \$16.50 to \$37.50. The company also reported holding a 3-day sales and engineering Electro-Acoustic Seminar. 25 top distributors attended.

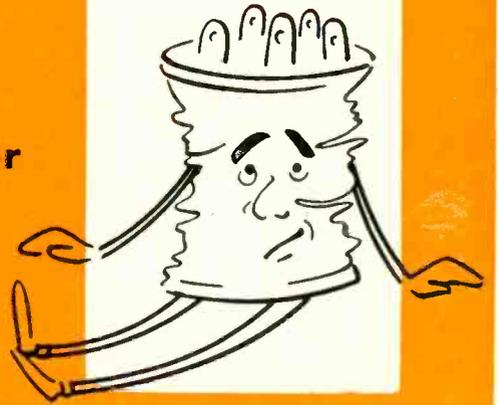
RENEWED FM ACTIVITY. Institute of High Fidelity Mfrs. has completed a survey of 665 FM stations, 319 replying. Complete survey report, with state breakdown and multiplex data, indicates 54 FM stations affiliated with AM outlets are broadcasting FM/AM stereo, 165 are not, 94 no answer. 8 say they are multiplexing stereo, 51 are multiplexing background music, 6 are multiplexing both.

JENSEN INDUSTRIES Pres. Karl Jensen challenges the claim of British widow Maria Killick that her husband invented the sapphire stylus. She remarked, "In America I understand \$78 million worth of sapphire styli have been sold. I intend to sue all companies there which have infringed my patent." Criticizing the British court ruling in favor of Killick as preposterous, Jensen reports that he has a record older than Mrs. Killick that starts out: "This record is being played by a sapphire needle."

(Continued on page 117)

... another
MALLORY
service-engineered
product

watch out for
shrinking
capacitance



—insist on

Etched Cathode

Ever notice how some capacitors fail before their time? In just a few weeks, especially in a high ripple circuit, they begin to develop hum.

This is due to loss of capacitance, and it's a common ailment of capacitors with plain foil cathodes.

You'll never have this trouble with Mallory FP's and popular Mallory tubular electrolytics... because they have *etched cathode* construction. It's a standard feature of Mallory electrolytics that insures against "missing microfarads."

See your local Mallory distributor for full facts on why etched cathode is important to you—and to your customers!

- Capacitors
- Vibrators
- Resistors
- Power Supplies
- Mercury and Zinc-Carbon Batteries
- Controls
- Switches
- Filters
- Rectifiers

P. R. MALLORY & CO. Inc.
MALLORY

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

GE NARROW BAND KITS

New conversion kits are now available to help 2-way radio users to make the transition from wide-to-narrow band. The FCC still has Docket 12,295 pending on the subject of implementing the rules. Licensees may want to wait until rules are finalized before making conversions. However, the new kits take into consideration possible requirements which may result from FCC action. General Electric Communication Products Dept., Syracuse, N. Y. (ELECTRONIC TECHNICIAN 9-36)

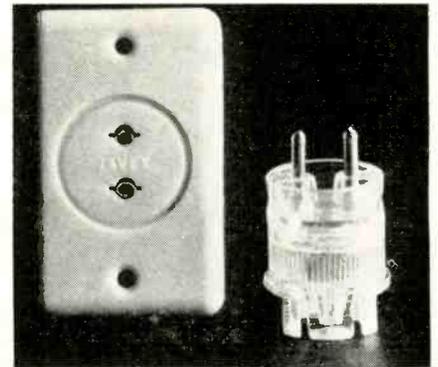
Hewlett-Packard VTVM

A logarithmic meter movement providing greater readability and accuracy than previous scales is designed to eliminate optical confusion and to provide an accuracy which is a constant percentage of the reading. This was accomplished by expanding the lower portions of the voltage scale and by providing a linear db scale which spread 12 db over the full scale length. The 400L has two voltage scales from 0.8 to 3.2 and from 2.5 to 1. The 12 db scale is spread across a scale length of 4.9

inches. Each db has five divisions. The 400L measures from 0.3 mv to 300 v., from 10 cps to 4 mc. Accuracy is $\pm 2\%$ of reading or $\pm 1\%$ of full scale, whichever is more accurate, to 500 kc. \$325. Hewlett-Packard Co., 275 Page Mill Road, Palo Alto, Calif. (ELECTRONIC TECHNICIAN 9-26)

Javex MULTI-SET COUPLERS

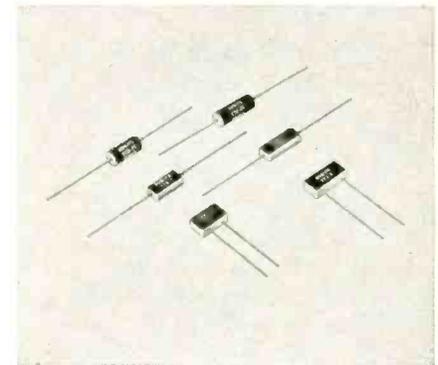
One antenna in a good signal area is all that is required for any multi-set installation, including FM, by using the new MI-50 Multi-TV Isolator. A community system of up to 500 TV's can be operated by using a booster or signal amplifier at the antenna, and MI-50



isolators at each outlet. It is supplied in miniature as well as in intermediate and full size NEMA design customized wall plate outlets, complete with plug, and solderless. Javex Electronics, P. O. Box 646, Redlands, Calif. (ELECTRONIC TECHNICIAN 9-22)

Ohmite FILM RESISTORS

Series 77 metal film precision resistors are now smaller, yet offer higher maximum resistance than the previous models. At the same time, prices of these units have been reduced. Two radial shapes, a tubular shape and a "flat-side" shape which offers space economy. A radial lead style is also fur-



nished. Resistance range is 25 to 400K ohms. Tolerance is $\pm 1\%$. They may be used at full $\frac{1}{4}$ watt rating at 150 C or $\frac{1}{2}$ watt at 105 C. Low reactance and noise level. Ohmite Mfg. Co., 3695 Howard St., Skokie, Ill. (ELECTRONIC TECHNICIAN 9-9)

ADDS INCOME 2 WAYS

1. Tests and Repairs Picture Tubes
(110° Tubes and Color Tubes too, with new C40 Adapter)

2. Makes New Tube Sales Easier

CATHODE REJUVENATOR TESTER

CRT 400 PROVES REAL MONEY-MAKER

Thousands of servicemen today make money and keep customer good-will by checking and correcting b&w picture tube troubles with the famous B&K CRT 400, right in the home without removing tube from set. Restores emission and brightness. Repairs inter-element shorts and open circuits. Checks leakage. Indicates picture quality customer can expect. Life Test checks gas content and predicts remaining useful life of picture tube. Makes new picture tube replacement sales easier!

Model 400 (without adapter) Net, **\$59⁹⁵**

NEW MODEL C40 ADAPTER DOUBLES VALUE OF B&K CRT

Designed for use with all B&K Models 400 and 350 CRT's. Makes it easy to test and rejuvenate TV color picture tubes and 110° picture tubes. Isolates and detects difficult color troubles. Tests and rejuvenates each gun of the color picture tube separately the same way as a black & white tube.

Model C40 Adapter Net, **\$9⁹⁵**

See your B&K distributor, or write for Bulletin AP12-T

New C40 Adapter for
110° Tubes and Color Tubes



Makers of CRT, DYNA-QUIK, DYNA-SCAN and CALIBRATOR

B & K MANUFACTURING CO.

3726 N. Southport Ave. • Chicago 13, Illinois



Test Equipment

(Continued from page 35)

i-f slugs can be adjusted one at a time. If the shape does not improve with a particular adjustment the slug should be returned to its original position, and a different one tried. If, to begin with, the response curve is radically distorted, a course adjustment of the i-fs can be rapidly made and then touched up the second time around.

To include the tuner's response in the overall alignment check, the lead from the sweep generator is transferred from the mixer stage to the antenna. Normally antenna matching is an important consideration. In most instances the distortion introduced by the mismatch at the antenna can be discounted, especially if the waveform remains substantially the same, and if the picture is good. However, it is a simple

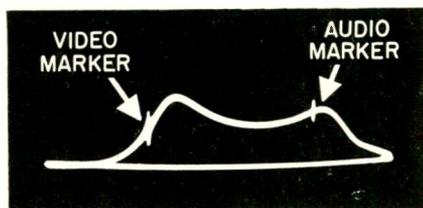
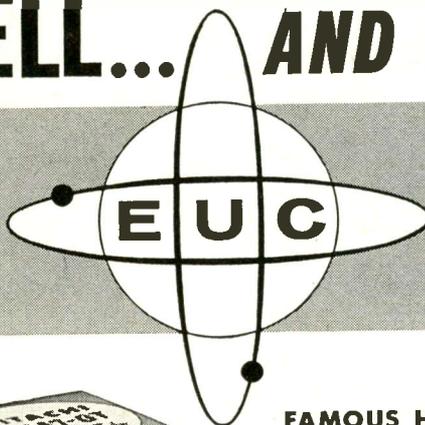


Fig. 5—Excessive bandwidth and reduced gain. Audio marker badly misplaced.

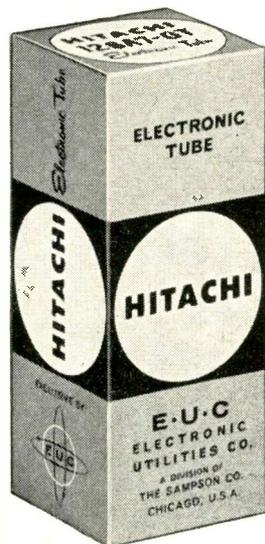
matter to provide a proper dummy antenna. A radical change in the response curve is an indication of front-end trouble.

It is common practice to adjust the tuner oscillator slugs using an off-the-air signal. Many technicians peak the sound take-off coil and audio i-f's by hairline adjusting technique and listening for maximum output. However, this equipment setup lends itself very nicely to precision type alignment. It is possible to use an off-the-air signal and align the oscillator so that the sound and video carriers accurately fall in on the proper part of the response curve. It is also possible to observe the response of the audio i-f amplifiers and align the audio detector circuit if necessary. Since this equipment is the same as required for other alignment techniques, no additional expenditures are required. If the saving in time and simplification of procedure encourages more technicians to use alignment equipment, more technicians will have more satisfied customers. •

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TRANSISTOR RADIO EARPHONES

Exceptional quality and value have earned nationwide acceptance for these small, compact, lightweight earphones. Magnetic type receiver provides remarkably fine reproduction. Plastic and metal case is designed for comfortable fit. Available in 3.2 ohm, 15 ohm, 2000 ohm, and 4000 ohm models.

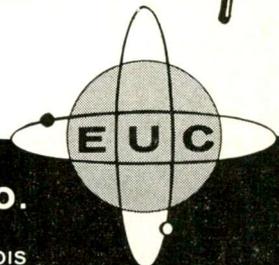


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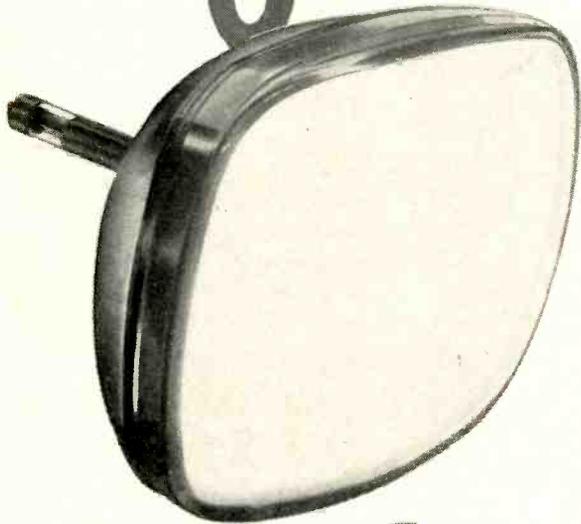
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Maintaining 2-Way Mobile Radio

*How To Make Money
In This Growing Field.*

• No mobile-radio system can be better than its maintenance. The original installation can be of the best, but unless it is properly maintained the operating costs, the technical performance, and the conformance with FCC regulations all will degrade as time goes on. Mobile-maintenance work needs to be considerably above the calibre of the average home-radio service, and by the same token the rewards should be larger.

All mobile-radio installations must operate according to regulations of the Federal Communications Commission. The FCC classifies these installations as the Safety and Special Radio Services, which include such widely diversified users as:

Police Depts.	Garages & Wreckers	REA Utilities
Fire Depts.	Taxis	Forestry Depts.
Gas Cos.	Fishing Boats	Mining Cos.
Doctors	Agricultural Packers	Buses
Petroleum Cos.	Farmers	Airlines
Power Cos.	Loggers	Construction Cos.
Railroads	Contractors	Private Aircraft
Ambulances	Trucking Cos.	Auto Clubs,
Highway Depts.	Geologists	etc.

The frequencies now used in mobile radio, range all the way from 1,610 kc to 460 mc, with concentrated bands at 2.0 to 3.0 mc, 30 to 47 mc, 72 to 76 mc, 152 to 175 mc, and 450 to 460 mc. Besides the above frequencies, most of the services have allocations in the microwave region from 900 to 3,000 mc. However, at present there is very little activity in that part of the spectrum.

Each mobile-radio installation consists of a transmitter and a receiver; at the base station the transmitter usually operates from ac power, and is rated at 30 to 250 watts; the mobile transmitter averages 5 to 30 watts and runs on a 6-volt or 12-volt storage battery. The receivers are tuned for a single-frequency, are single or double-conversion superheterodynes, use crystal-control on the conversion oscillators, have selectivity of 20 to 40 kc, sensitivity of 1 microvolt or less, and a squelch circuit to quiet the loudspeaker in the absence of a signal. All adjustments, checks, and repairs on the transmitter which are made during installation, servicing, or tests must be made by, or under the direct supervision of a licensed radio operator, either first or second-class, radiotelephone or radiotelegraph grade. This is a commercial operator's license, as distinguished from an amateur license. The license costs nothing, and is obtained by passing an examination at one of the FCC offices.

This creates a wonderful opportunity for the wide-awake radio and TV technician. Each one of these mobile outfits must be installed, then reinstalled each time the vehicle wears out or is replaced. Further, this equipment works best with "preventive maintenance," which means periodic inspection, alignment, and replacement of weak parts, before they blow. Finally, measurements of fre-

quency, modulation, and power input must be made at least every 6 months.

Usually, a home-radio and TV technician is called upon only when some trouble is found in a set. Mobile-service engineers, on the other hand, are continuously needed since the equipment must be kept running, around the clock, 365 days a year. Some engineers take full-time, salaried jobs with the big operators of vehicular fleets; others, and by far the majority, operate as independents and contract to maintain a number of smaller radio systems throughout their area.

In general, there are two classes of arrangements between the service engineer and his client: (1) payment for service is made on a simple time-plus-material basis, as need for work arises; (2) payment for services is made on a contract basis.

The most frequently reported arrangement is an annual contract, between the engineer and a number of mobile-radio users, or licensees. The contract must tell what work is covered by the fee, or retainer. Usually it calls for a periodic check, and correction as indicated, on each radio unit, at intervals of 30, 60, or 90 days; it includes the FCC maintenance checks, and usually the FCC paper work on license applications, construction permits, and renewals. It does not include installing, moving, or re-installing equipment; nor does it ordinarily include parts which are furnished extra at regular retail prices.

Test Equipment

If you are already in the TV and radio repair business, chances are you already have the following: Tube Tester, RF Signal Generator, VTVM, VOM, Signal Tracer, Battery Eliminator (both 6 and 12 volt).

In addition, for two-way radio maintenance work you will need:

1. Dummy RF load—with this you can operate the transmitter at normal input and output without transmitting a signal beyond your shop. (The FCC requires that mobile units be measured under load conditions equivalent to actual operating conditions.) You can make this dummy load, or you can find several moderately priced ones (sometimes called "dummy antennas") at most radio-parts distributors.

2. Grid-dip meter—very handy for checking the resonant frequency of tuned circuits without applying power to the equipment. Also convenient for determining the approximate output frequency of the various multiplier and amplifier stages in transmitters, and for checking conversion oscillators in receivers.

3. FM modulation meter—this must measure FM deviation, plus or minus, from center frequency of the transmitter. FM transmitters in these services operate on frequencies from 25 to 500 mc. Since the FCC regulations say the maximum modulation deviation shall not exceed a certain limit, the meter should respond to actual voice peaks, not just to average or sine-wave modulation.

4. Frequency meter—this instrument must show whether or not a transmitter frequency is within the tolerance specified by the station license. As noted above, you can have occasion to measure frequencies from as low as 290 kc up to 460 mc.

5. AM modulation meter—actually, you may not need this piece of equipment, as the vast majority of transmitters in these services use frequency modulation. However, marine, aircraft, and some police transmitters below 30 mc do use amplitude modulation.

The two-way radio industry is rapidly growing, and a number of alert and ambitious radio technicians will see their business grow with it. Will you be one of them? —Lampkin Laboratories, Inc., Bradenton, Fla. •

FOR A brighter

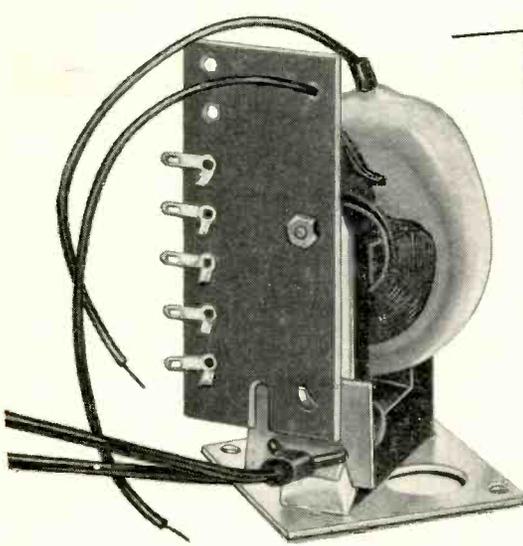


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This table of STANCOR'S exact replacement flyback coverage is based on an actual count of the models listed in the latest STANCOR TV Replacement Guide. *Only exact replacement flybacks are listed.* These percentages do not include flybacks that require chassis or circuit alteration. Actually, true coverage is even higher than these figures indicate since STANCOR covers *all* of the most heavily produced models.

Manufacturer	Stancor EXACT Repl. Flybacks	COVERAGE
Admiral	9	83%
Airline	11	81%
General Electric	14	95%
Olympic	4	83%
Philco	12	90%
RCA	11	91%
Silvertone	11	74%
Zenith	14	97%

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Atomic Radiation

(Continued from page 31)

mr/yr. from color sets. This amount is still very low, and apparently safe. Remember, 15,000 mr/yr. is the recommended total limit. However, when added to radiation normally received from other sources, TV X-rays add one more tiny straw to the proverbial camel's back.

Conclusion

People who have been exposed to excessive radiation doses often do not suffer immediate effects, so they are mistakenly led to believe that they have not been injured. However, radiation effects show up many years later. Atomic radiation is not a trifling matter.

Fortunately, most of us do not handle radioactive chemicals, and normal contact with background radiation is safe. To safeguard against harmful long-term effects to ourselves and our descendants, it appears desirable to limit medical fluoroscopes and X-ray photos to those that are necessary. Newer equipment in competent, properly trained hands is your best protection.

TV sets give off X-rays, but these are of such low intensity as not to present a hazard. Nevertheless, since nothing is gained by even this minimal exposure, it is suggested that technicians do not keep more picture tubes than necessary operating every day in very close proximity to their bodies.

By understanding both the positive and negative potentials of atomic radiation, and acting accordingly, we can face the Electronic-Atomic Age without fear or anxiety.



"I think I have the trouble localized."

(Audio Newsletter
Continued from page 111)

ARGOS PRODUCTS has announced the TSE-1 8" speaker enclosure @ \$16.50.

EUGENE R. KUN has introduced a new dc motor, battery-operated, for portable phonos and tape recorders. Features low noise, low breakaway torque.

"HI-FI PLAYED HERE" is promoted by Japanese restaurants, similar to how we used to merchandise air conditioning, reports Jack Gilbert.

ROBINS INDUSTRIES has introduced the TK4-STD accessories kit for tape recorders @ \$12. It contains splicer, tape, threader, cleaner, clips, labels and booklet for editing and maintenance.

KINGDOM PRODUCTS has introduced the 4-lb. "Fi-Cord" transistorized tape recorder. Speeds are 1-7/8 and 7 1/2 ips, response 50 to 12,000 cps within 3 db. Batteries are rechargeable. Size 9-5/8" x 5 x 2-5/8".

HAVE TROUBLE SLEEPING? GARDNER ELECTRONICS has announced the Sleepatron, a 7-transistor sleep inducer reproducing the sound of falling rain. "No more need to take harmful and dangerous sleeping pills and drugs. Restful sleep can now be obtained electronically," says the manufacturer. "\$125 for a lifetime of sound sleep."



"This one sells by the yard."

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Now in Complete, Easy-To-Install Kit!

Now the world's first fully amplified home system comes in a lightweight kit that's a handsome selling tool with everything you need to bring hi fidelity TV and FM reception to every room of a home!

Each kit contains a broadband VHF (TV & FM) amplifier, sufficient 300 ohm Twin-Lead, and 5 outlets for surface or flush mounting, creating a complete system for any new or existing home.



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Hallmark CONSOLE

Newest in the line of stereophonic record sound systems is the 2-speaker, dual-amplifier President, model 715 Custom Console. The central control unit features a 4-speed stereo record player and dual push-pull amplifier with separate bass, treble and volume controls for each speaker. The speakers are easily positioned in the home to ensure true stereophonic sound reception. Paramount Enterprises, Inc., 303 Concord Ave., New York 54, N. Y. (ELECTRONIC TECHNICIAN 9-37)

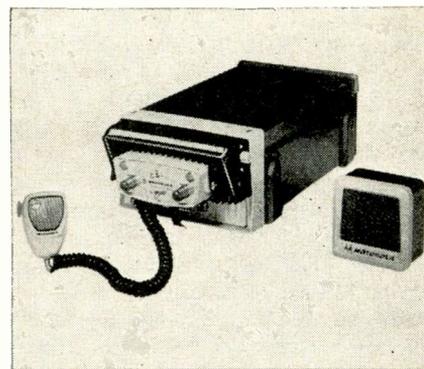
RCA DRIFT TRANSISTORS

The 2N373 and 2N374 are drift transistors of the germanium p-n-p alloy type specifically designed for use in entertainment-type battery-operated AM receivers. The 2N373 and 2N374 feature very low feedback capacitance, stability and uniformity of characteristics. The 2N273 is intended primarily for 455 kc i-f amplifier applications. Its low feedback capacitance makes possible a useful power gain of 34 db without a neutralizing network. In circuits where maximum power gain is required and

a neutralizing network is used, the 2N373 can provide a useful power gain of 39 db. The 2N374 is like the 2N373 but its characteristics are controlled to meet the requirements of converter and mixer-oscillator applications in the AM broadcast band. The 2N374 provides a useful conversion power gain of 40 db at the center of this band. Radio Corp. of America, Semiconductor Div., Somerville, N. J. (ELECTRONIC TECHNICIAN 9-24)

Motorola "T-POWER" RADIOPHONE

A new mobile 2-way radiophone operating in the 450-470 mc frequency band features a transistorized power supply and an advanced unified chassis design. The new unit provides greater reliability and operational benefits. The unified chassis design, which combines transmitter, receiver and power supply portions on one chassis rather than three, plus many other design features,

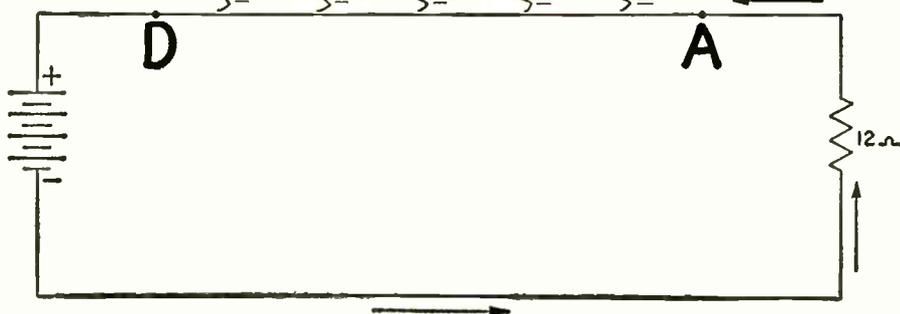


such as new type final amplifier tubes and a single crystal oven, aid overall equipment reliability. It weighs 34 pounds, compared to 74 in former 450-470 mc mobile radiophones. It is packaged in a 30% narrower 10 inch housing, enabling both under-dash and trunk mounting. It provides 18-watts transmitter power output and a new high of 3-watts receiver output. Motorola Communications & Electronics, Inc., 4501 W. Augusta Blvd., Chicago 51, Ill. (ELECTRONIC TECHNICIAN 9-38)

GE POWER TRANSISTORS

Line of 30-volt, one-half ampere PNP germanium transistors for use in industrial equipment have been designed for medium power amplifier and low frequency, high current switching applications. The four models, designations 2N524, 2N525, 2N526, and 2N527, have a triangular lead arrangement and are housed in the JETEC TO-5 package. The 2N525 and 2N524 are the electrical equivalents of the 2N43 and 2N44 transistors, respectively. 4000-hour life test data for typical units show that beta varies less than 10% and I_{co} changes less than 20% at a 100° C. storage temperature. Typical alpha cut-off frequency is 2.0, 2.5, 3.0 and 3.3 mc, respectively. General Electric Co., Semiconductor Products Dept., Syracuse, N. Y. (ELECTRONIC TECHNICIAN 9-35)

No. 4 of a series of questions for progressive technicians. Can You Handle This Problem?



At what speed do the electrons travel from A to D in this circuit?

1. Very slowly, not more than a few inches per minute.
2. At the speed of light (186,000 miles per second).
3. At a speed authorized by the Federal Communications Commission.
4. At a speed slightly slower than that of the speed of light.
5. At varying speeds between 10,000 and 80,000 miles per second.

(Answer Printed Below)

The answer to this one may seem obvious. Probably you know your principles well enough to handle this one easily enough. But ask yourself honestly, do you know enough fundamental electronic theory really to capitalize on the opportunities that are waiting for you right now?

Letters and reports regularly received from technicians like yourself continu-

ally stress two factors, which are the direct results of training in fundamentals:

- (1) Increased income potential
- (2) More interesting work

Replacing tubes and burned-out resistors in television sets can get very boring. The challenge of new electronic devices in the home as well as in industry is a welcome and profitable change of pace.

The answer to our little problem is given below. If you want a complete solution, just fill out the coupon and mail to us.

Answer to Problem Above:

(1) Very slowly, not more than a few inches per minute.

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Please send me detailed solution to problem above and information on how I may prepare for the increasing opportunities in electronics. There is no obligation.



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T-13

Association News

California

RTA Magazine, spokesman for Radio TV Association of Santa Clara Valley, reports that Pres. Richard J. Kelso has appointed a fact finding committee to study the sponsorship of an apprenticeship training program. It would provide for 40 hours of on-the-job training plus school time. This program would steer more technicians toward independent servicing, rather than manufacturer employment.

Florida

Radio-TV Technicians Guild News states that over 450 service dealers and technicians paid \$2 each in registration fees during the four-day exhibition and lecture series at the first annual Southeastern Electronic Service Convention (SESCO) in Miami. Speakers included Commissioner Robert T. Bartley, FCC; Frank Moch, NATESA; Bob Middleton, RETS; Bud Cook, RCA; Bill Ashby, Cornell-Dubilier; Tom Blackwell, Sylvania; George Crossland, GE; and Bob Andrews, Tung-Sol.

Illinois

In a policy statement on radio-TV service by manufacturers, NATESA announced from Chicago; "We believe no justification exists for this unwarranted encroachment. . . . No proof exists that fully qualified service on an ethical basis is not available in every city and hamlet. . . . We are prepared to arrange for highly qualified professional service at rates compatible with the area, for any manufacturer who is not now getting such service."

Indiana

The Hoosier Test Probe, official organ of the Indianapolis Television Technicians Association, reflects the rising opposition toward free service warranties by set makers. "Take the 90-day free service deal. . . . To give this free service, a certain sum is buried in the list price of the set. Does the customer know that he is paying for this free service? No! He thinks he is getting service for nothing, and next to nothing is what he will be willing to pay to an independent service dealer later on."

Michigan

TSA News, voice of the Television Service Association of Michigan,

editorializes: "It is the right of any manufacturer to price his sets with or without service, 90 days or one year on parts. However, we service people do object to calling it free service . . . also object to offering the service to the service industry at such a ridiculously low figure that it is impossible to break even."

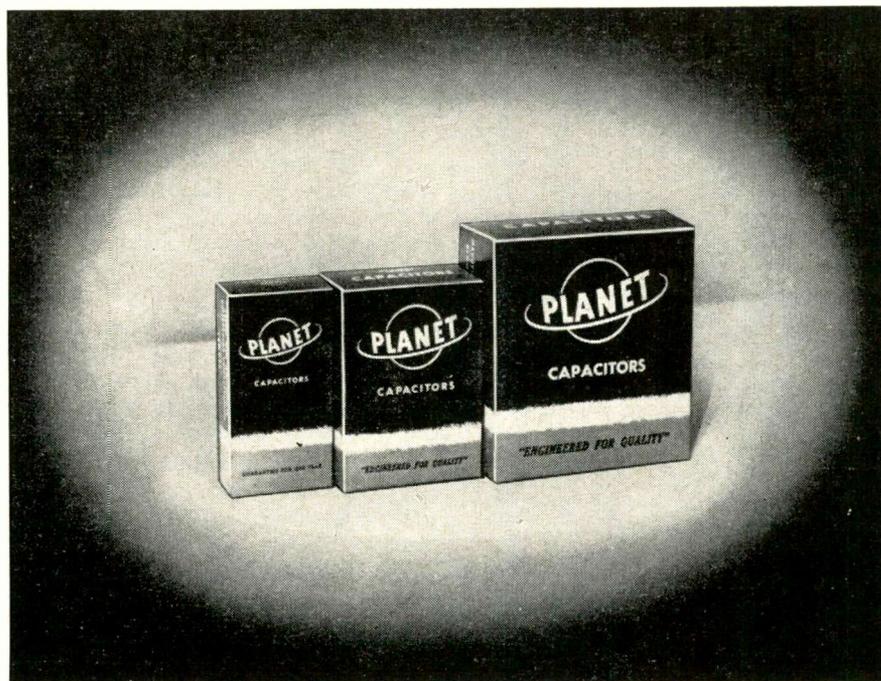
Missouri

The Midwest Electronic Alliance was formed at a July 19-20 meeting in Toledo, and is incorporated in Missouri. It is the result of efforts

by officers and members of ETAT, Toledo; ITTA and IESA, Indiana; ARTS, Illinois; and TEAM, Missouri. Officers are Verne La Plante, president; Robert Sickles, VP; Howard Wolfson, Secretary-Treasurer. Inquiries about the service association alliance may be directed to the secretary at 433 S. Wabash Ave., Chicago 5, Ill.

Ohio

ARTSD News, voice of the Associated Radio-Television Service Dealers in Columbus, reports prog-



The Capacitor Package that means Quality

1 year service guarantee

When you see this package in the familiar red and black box, you know it contains "trouble-free" Planet capacitors—mechanically and electrically tested throughout manufacture. This

rigid system of quality control makes our unconditional one-year guarantee possible. But making Planet capacitors correctly from the start means reasonable prices too!

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BASIC PULSES by Irving Gottlieb, P.E. Pulses direct the high speed operation of all types of computers; underlie the functioning of radar systems for early warning, recognition, fire control—in general the gathering of information from distant points by electromagnetic radiation means. Pulses guide industrial operations that require split-second timing for mass production—counting, sorting and testing. Virtually every form of electronic timing involves the use of pulses. The functioning of every television system—over the air, or closed circuit—depends on correct pulse frequencies, duration and shape; in fact the application of pulses recognizes almost no boundaries in the field of electronics. You can learn all about pulses and expand your opportunities in these fields, quickly and easily with this one volume "picture-book" training course. **BASIC PULSES** is a thorough, crystal-clear presentation of the nature, measurements and application of pulses—what they are and how they are used. The book covers these major areas: what is a pulse; measurement of pulses; composition of pulses; energy storage viewpoint of pulses; waveshaping techniques; and describes and analyzes all known pulse generators including tube and transistorized types. Every equation is made understandable by numerical examples. A glossary of pulse terms is provided. Number 216, soft cover, 176 pages \$3.50.

PORTABLE AND CLOCK RADIOS, by Ben Crisses and David Gnessin. You can learn all about portable and clock radios—their circuitry, their repair, in this modern book. Beginning with typical portable radio circuits, emphasis is placed on filament circuitry and how major problems of current dispersion are handled. Transistor circuitry is covered. Stress is placed on portable radio power supplies for battery circuits and battery and AC-DC circuits. Numerous battery testing techniques explained. Covers repair, replacement and alignment plus a detailed discussion of probable mechanical troubles, replacement procedures and short-cuts. Tips on extending the life of the set are discussed. Clock radios, their circuitry, a wide variety of clock movements, how to adjust them and locate defects also covered. Tips on cleaning and lubricating clock mechanisms. #224. \$2.75.

HOME AIR CONDITIONING—Installation & Repair by J. Derman, F. Makstein, H. Seaman. This modern, completely practical text by three experts in the field of home air conditioning, enables anyone to understand the organization, operation, installation and repair of all types of home air conditioners. Both electrical and mechanical components are fully identified, described and illustrated, permitting instant recognition of the parts. Function of each part, its contribution to the entire unit is explained in detail. Troubleshooting and repair techniques are completely covered plus information on how to pinpoint specific troubles by their symptoms. Typical window & package installations and smaller commercial installations are discussed. Tells how to select the proper unit. Excellent for all who seek entry into the lucrative air conditioning field. #211, \$3.50

TV PICTURE TUBE-CHASSIS GUIDE, by Rider Lab Staff. This easy-to-use TV tube type chassis guide covers all picture tube types used in TV receiver production from 1946 to February 1957—over 7,000 listings. Organized by chassis number, and in some cases, by models so that the technician can immediately locate the correct picture tube type simply by knowing the chassis number, #204, Only \$1.35.



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ress on their draft of a licensing ordinance being prepared for submission to city officials. Seven parts jobbers were visited, and all expressed support of the proposed legislation.

Pennsylvania

In a campaign against captive service, *TSA News* reports that the Television Service Association of Delaware Valley and other groups in Pennsylvania, Delaware and New Jersey adopted the following resolution: "Whereas many of the TV, radio and hi-fi set manufacturers have instituted a policy of one year warranty on parts and receiving tubes; Be it resolved that the Television Service Association of Delaware Valley will not be obligated to honor any manufacturers warranty after the standard 90 day period."

The dedication of Settle Hall in Philadelphia, by the Delaware Valley Electronic Service Industry, was an inspiring occasion for every one. At the conclusion of the dedication address by R. H. Cherrill, president of TSA of Delaware Valley, a new Settle Hall plaque and portrait of Charles Settle was unveiled by Mrs. Settle. In a brief address, Mrs. Settle paid tribute to the industry for carrying on the work to which Charlie Settle had devoted most of his life. In the presence of Richard Barnett, of Barnett Bros.; Al Green, of Almo Radio Co.; Henry Lapinski, of Hot Point Appliance Co.; Al Steinberg, of Albert M. Steinberg & Co., and Frank Schuslag, of Allied Electric Parts Co., representing Philadelphia and Delaware Valley headquarters; Harry Fallon, of Radio Electric Service Co., addressed the gathering and paid tribute to Charlie.

Texas

The Texas Electronic Association held its 6th Annual Clinic and Fair at the Statler-Hilton Hotel in Dallas, Texas, August 1, 2, and 3, and featured Morris L. Finneburgh, Sr., V.P. of The Finney Company, as their keynote banquet speaker. In his return engagement, Finneburgh spoke on "The Future Belongs to Those Who Prepare For It—Second Edition." He is nationally known as a dramatic and forceful speaker in the vital field of sales promotion, customer relations and psychology. He is a native born Texan. Estimated attendance was 1,500 dealers from Texas, Oklahoma, New Mexico, Arkansas and Louisiana.

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- ★ **Selenium Rectifiers** checks forward and reverse currents.

Controls are accurately set for each transistor by referring to replaceable set-up chart on rear. Test leads or socket provides for fast hook-up. See your parts distributor.



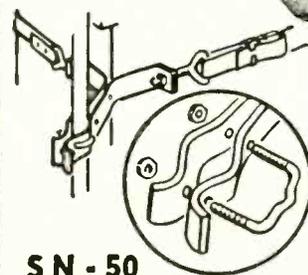
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with unique U-Bolt INSTEAD OF SCREWS for easy one hand "Spintite" fastening. Hot Dip Galvanized — 12 Ft. Straps, two to a set. Same Unique U-Bolts used on Snap-in Wall Brackets. Also Available with Stainless Steel Banding.

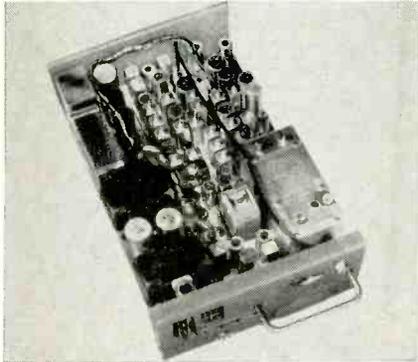
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SOUTH RIVER
 METAL PRODUCTS CO., INC.
 South River, New Jersey

pioneer &
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 producer of
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 of antenna
 mounts

Gonset 2-WAY RADIO

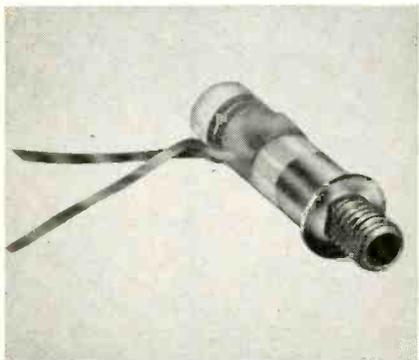
New 2-way mobile radio features "S" strip construction. The series features three parallel "strip" chassis which are held securely and protected by a strong outer housing. All of the several types of transmitters, receivers and power supplies are individually mounted on the same size and type of strip chassis. Units may therefore be changed readily to facilitate re-arrangement, checking



or replacement. Transmitters are available in three power ranges, 30, 60 and 100 watts in frequency ranges of 25-54 mc and 152-174 mc. Receiver strips can be supplied with "Super-G" band-pass filters for broad, medium, or narrow-band selectivity. Split-Channel operation can be accomplished readily. Link-by-Gonset Div., Young Spring & Wire Corp., 801 S. Main St., Burbank, Calif. (ELECTRONIC TECHNICIAN 9-39)

JFD L-C TUNERS

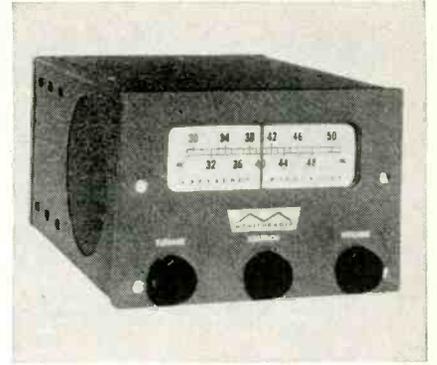
The new tuners combine a variable inductance and a capacitor in a single versatile unit. The inductor winding, which also acts as the capacitor plates, is metallized on a highly stable glass cylinder. Movement of a piston in the cylinder changes both the inductance and the capacitance. The nature of resulting change in the resonant fre-



quency is determined by the design of the unit and the manner in which it is used. Characteristics are: capacitance range, 1-17pf; self resonating frequency range, 450 to 1,000 mc; loaded tuners will resonate from 80 to 300 mc according to type of load. Characteristics given can be varied. JFD Electronics Corp., 6101 6th Ave., Brooklyn 4, N. Y. (ELECTRONIC TECHNICIAN 9-40)

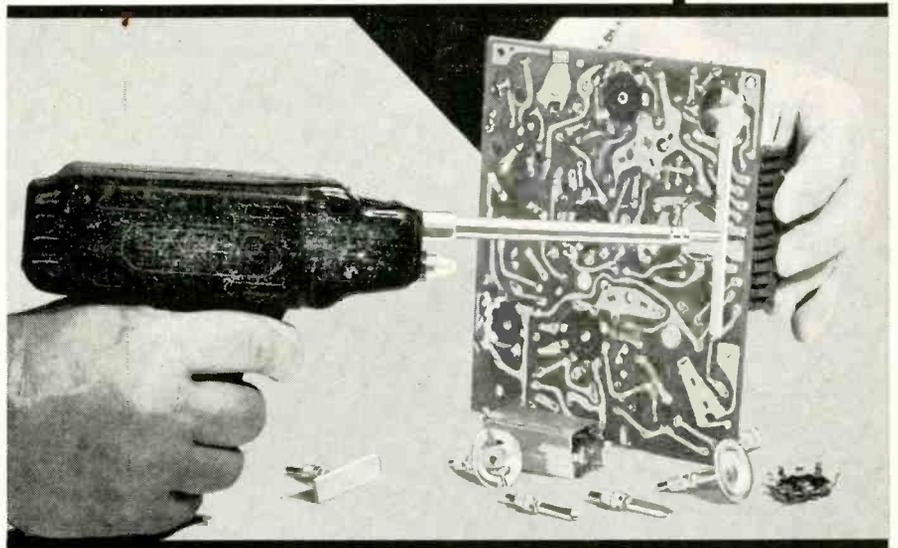
Monitoradio RECEIVERS

Two new receivers are reported to be the only tunable mobile receivers operating in the 30-50 mc and 152-174 mc emergency communication bands, model M-40 is for the 30-50 mc band and model M-160 is for the 152-174 mc band. Both sets feature double conversion tuned r-f stages, 2 μ v sensitivity, and built in squelch adjustable from the front panel. Monitoradio Div., I.D.E.A. Inc., 7900 Pendleton Pike, Indianapolis 26, Ind. (ELECTRONIC TECHNICIAN 9-41)



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- Two second heating — no waiting. Heat is generated right at the soldering point.
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KINGSTON
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Models EA-1 and VS-5 Kingston Absorption Analyzers provide electrostatic signal tracing and extreme sensitivity. For trouble-shooting any equipment with wave forms. CRT displays wave-form from each stage.



Model PO-1 Kingston Absorption Analyzer allows conventional oscilloscopes to be used in trouble-shooting electrostatically. Built-in speaker for use as an audio analyzer.



Accessory Probes for miniature, sub-miniature and shielded tubes. Also Direct Probe for use with VS-5 and EA-1. Transistor Radio Probe simplifies trouble-shooting of transistorized radios.



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Probe-Master. Built-in capacitive network allows by-passing of stages, coupling of signals from one stage to another. Most versatile testing probe on the market. Complete with two clips and neon bulb.

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Standards For Stereophonic Disc Records

• The following are the findings of the Engineering Committee with respect to stereophonic disc phonograph records, which were accepted by the Board of Directors and approved as RIAA standards on March 25, 1958:

1. In stereophonic disc phonograph records, the two channels shall be orthogonal modulations of a single groove.
2. In the 45°-45° system of stereophonic disc phonograph recording, the two axes of displacement modulation are inclined 45° to the disc surface.
3. In 45°-45° stereophonic disc phonograph records, the right-hand information as viewed by the listener, shall appear as modulation of the outer side-wall of the groove.
4. In 45°-45° stereophonic disc phonograph records, equal in-phase signals in the two channels shall result in lateral modulation of the groove.
5. Lateral modulation of the stereophonic disc record shall produce equal in-phase acoustical signals at the loudspeakers.
6. The 45°-45° system is recommended as a standard for stereophonic disc phonograph records.

It is further recommended that:

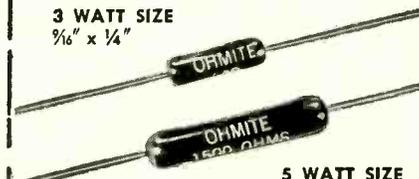
1. The desirable tip radius for reproducing stereophonic disc phonograph records be 0.5 mils.
2. The included angle of the groove be 90°.
3. The bottom radius of the groove of the finished record be 0.2 mils maximum.

The Board also approved for stereophonic disc records the same recording and reproducing characteristics and the same dimensional standards as have previously been adopted for 45 rpm and 33 $\frac{1}{3}$ rpm records as outlined in RIAA Bulletins E1 and E2.—Record Industry Association of America, Inc. •

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3 WATT SIZE
5/16" x 1/4"



5 WATT SIZE
1 1/8" x 1/2"

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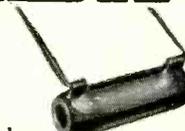
Vitreous-enameled, power-type, axial-lead units designed to withstand high temperatures.



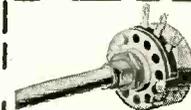
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RESISTOR

For easy replacement in many television receivers. 1 1/2" Tinned wire leads.

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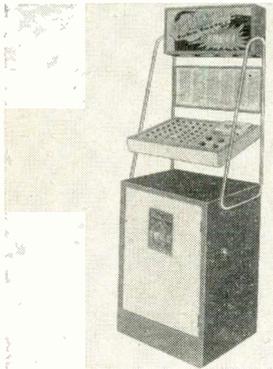
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New Products

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Affiliated SELF-SERVICE TESTER

"Atlas," a new self-service tube tester, features guaranteed non-obsolence. Built into the Atlas is a memory bank. Leads from 40 sockets are connected to the bank by a unique system of plugs and connectors. For a new tube series, the Atlas owner will receive a simple diagram instructing him on



whatever new connections are to be made. The entire procedure can be done in minutes, without soldering or tools. Cabinet will store more than 600 tubes. Tube chart lists 370 of the most popular tube types. \$129.95. Affiliated Television Labs., Inc., 112-07 Francis Lewis Blvd., Queens Village, N. Y. (ELECTRONIC TECHNICIAN 9-18)

Hickok PORTABLE TESTER

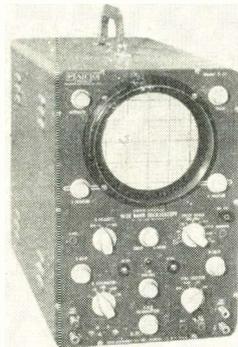
Traceometer for testing transistorized portable and automobile radios includes an easy to learn course in transistor radio servicing. It is actually three instruments in one: tuned receiver, 200 kc to 575 kc for i-f stages, and 550 kc to 160 kc for r-f stages. Audio amplifier and 400 cps output. AM signal genera-



tor covers same ranges. Transistor tester checks leakage and gain. Loud-speaker is an indicator for signal tracing. This Model 810 in portable steel case. 105-125 v. ac. Hickok Electrical Instrument Co., 10523 Dupont Ave., Cleveland 8, Ohio. (ELECTRONIC TECHNICIAN 9-10)

Paco WIDEBAND SCOPE

Model S-55 5" wideband, dc oscilloscope kit is suited for industrial testing, radio and TV service and high fidelity. Vertical channel sensitivity, dc 70 mv/in., ac 25 mv rms/in.; frequency response, dc 3 db to 4.5 mc, ac 3 db 1 cps to 4.5 mc; rise time, better than 0.08 m sec.; input 1.5 meg. Horizontal channel



sensitivity, 0.6 v. rms/in.; frequency response, 3 db from 1 cps to 400 kc. 5 meg input. Linear time base frequency range, 10 cps to 100 kc sawtooth; sync, automatic "positive" and "negative" internal, 60 cps. \$87.50. Wired probe AS-1, \$14.95. PACO Electronic Co., Inc., 70-31 84th St., Glendale 27, New York, (ELECTRONIC TECHNICIAN 9-14)

Philco SIGNAL GENERATOR

AM r-f Generator, Model 7200, with frequency range of 100 kc-280 mc, facilitates alignment work on all channels. The generator can also be used as a marker at r-f frequencies in TV receivers. Features include high uniform output, stable operation and light weight. It has large vernier scale per-



mitting an accurate adjustment to all frequencies, high r-f output making possible extreme accuracy in checking single stages, and uniform modulation for checking gain and distortion. Philco Accessory Div., "C" and Westmoreland St., Philadelphia 34, Pa. (ELECTRONIC TECHNICIAN 9-13)

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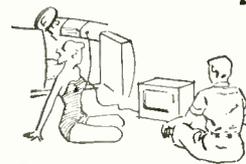
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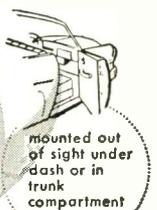


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Heath TEST OSCILLATOR

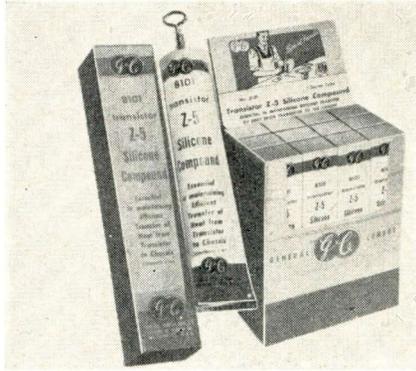
Model TO-1 test oscillator kit provides test frequencies most often used in the repair and alignment of super heterodyne broadcast receivers. 262 kc, 455 kc, 465 kc, 600 kc and 1400 kc are quickly selected. Two crystal sockets are switch-selected for any frequency you may use. R-F output may be un-



modulated, 400 cps modulated, or audio used separately. Output level is adjusted by continuously variable control. Construction is simplified through use of a pre-assembled and aligned frequency selector switch. \$16.95. Heath Co., Benton Harbor, Mich. (ELECTRONIC TECHNICIAN 9-15)

G-C SILICONE COMPOUND

A compound called "G-C Transistor Z5 Silicone Compound" for use in servicing transistorized circuits is effective in transferring heat away from transistors, thus preventing burnouts. If the protective grease is removed during replacement of a transistor in a circuit, the resulting inefficient transference of



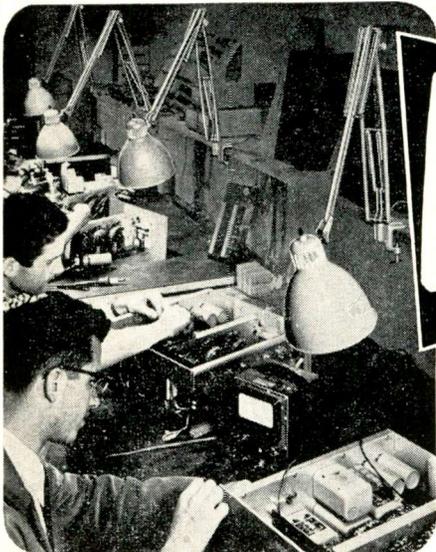
heat may cause the transistor to burn out. Z5 is applied between transistors and chassis to dissipate that heat. Z5 compound (G-C No. 8101) is available in handy 1 oz. tubes for \$2.25 list. General Cement Mfg. Co., (div. Textron), 400 S. Wyman St., Rockford, Ill. (ELECTRONIC TECHNICIAN 9-17)

Walsco "FREEZ-MIST"

Defective circuit components of an intermittent nature due to temperature change can now be located instantly with the aid of Freez-Mist. The solution, when sprayed on the circuit, cools it instantly, thus pinpointing faulty capacitors, resistors, transistors, cold solder and oxidized junctions due to



temperature variances. It is a time-saver since it allows component checks in operation without removing them from the circuit. Packaged in a colorful aerosol-type spray can, its list price is \$3.25. Walsco Electronics Mfg. Co., 100 W. Green St., Rockford, Ill. (ELECTRONIC TECHNICIAN 9-20)



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NEW IMPROVED SENCORE LC3 Leakage Checker



Check these outstanding New Features
Now — For the first time ...

- Checks 144 different tube types — more than any other "grid circuit" type checker. Includes UHF and latest type tubes.
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- Dynamic Filament checks including heater to cathode leakage & shorts — no need for a second filament tester.
- Two spare preheating sockets to cut down testing time.
- Capacitor checks simplified.

The LC3 provides all these new improved features in addition to those employed in earlier leakage or "grid circuit" testers. A must for any TV service technician.

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B&K PIX-SOUND GENERATOR

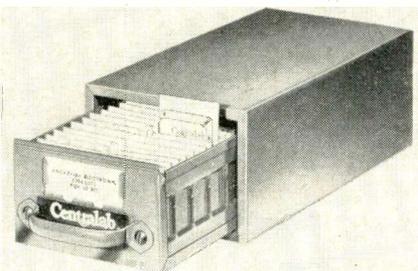
Model 1150 automatic picture and sound generator makes it easy to operate your own closed-circuit TV system. It transmits pictures from your own 35mm (2x2) slides, with simultaneous sound to any number of TV receivers. Uses any of five TV channels (2 to 6) for separate closed-circuit



telecasting or for interjection between regular TV station broadcast programs. Can be used as a fixed station or conveniently transported. Also for community TV or master antenna systems with closed-circuit channel. \$895. B&K Mfg. Co., 3726 N. Southport Ave., Chicago 13, Ill. (ELECTRONIC TECHNICIAN 9-16)

Centralab PEC KIT

A new kit of PEC packaged circuits, known at the PCK-40 Kit, contains 40 units divided among 14 of the most frequently use types. This carefully balanced inventory will cover 80% of PEC packaged circuit replacement needs.

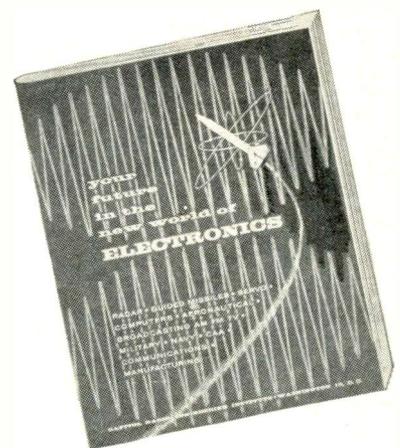


Each unit is in an individual rigid plastic package, arranged for instant identification is a sturdy metal cabinet. The kit sells for \$26.93 dealer net and the cabinet, valued at \$4.75, is supplied free. Centralab, 900 East Keefe Ave., Milwaukee 1, Wis. (ELECTRONIC TECHNICIAN 9-12)

Ram FLYBACKS

Two replacement flyback transformers are Model X163, which replaces Westinghouse & Airline numbers 493-V004M02, M04, M05, M06, 493V002H02, H04, H05, H06; and X164, which replaces 493V004M01, M03, 493V004H01, H03. Ram Electronics Sales Co., Paramus, N. J. (ELECTRONIC TECHNICIAN 9-32)

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Rogers FLYBACK REPLACEMENTS

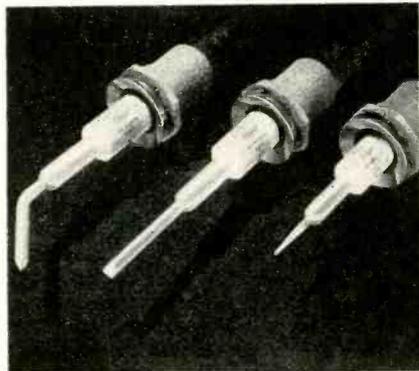
Two exact replacement flyback transformers for CBS TV receivers are EFR 202, an exact replacement for CBS 12001251; and Model EFR 203, an exact replacement for CBS 12001181. These units are designed for exact connection by connection replacement in CBS chassis 1621, 3001, 3002, 3003, 3012, 3013, and 3015. Complete with all necessary parts for rapid installation, in sealed plastic bag. Rogers Electronic Corp., 43-49 Bleecker St., New York 12, N. Y. (ELECTRONIC TECHNICIAN 9-31)

Westinghouse RECEIVING TUBE

A new 9-pin miniature beam power pentode designed for use as a vertical output deflection amplifier in 110° TV sets is now available. The 6/12DT5 has a controlled plate current characteristic featuring high zero bias plate and screen voltages of 250. Closely controlled for microphonism, the DT5 is capable of sweeping a 24-inch 110° cathode ray tube with ample reserve power. Westinghouse, Electronic Tube Div., Elmira, N. Y. (ELECTRONIC TECHNICIAN 9-28)

Ungar SOLDERING TIPS

Tiplet No. PL 338 brings needle-point precision wherever subminiature soldering is required. For extremely fine, delicate soldering and close hard-to-reach locations, it provides the perfect answer. It is also useful for cleaning eyelets on printed circuit boards. Heat range 600° to 800°. Tiplet PL 833 is a 2"



straight chisel tip adaptable for extra deep chassis soldering. It has a 3/16" diameter and is made for use with the new 4045-47 1/2 watt heating unit. Iron clad to provide extra long life. Ungar Electric Tools, Inc., 4101 Redwood Ave., Los Angeles 66, Calif. (ELECTRONIC TECHNICIAN 9-19)

Tung-Sol TRANSISTOR

New power switch transistors include Types 2N378, 2N379, 2N380, 2N459, germanium power transistors in new all copper "cold well" package. Features are maximum thermal resistance of 1.2°C/watt, increased gain and current ratings. New computer transistors include Types 2N578, 2N579, 2N580, 2N581, 2N582. Tung-Sol Electric Inc., 95 8th Ave., Newark 4, N. J. (ELECTRONIC TECHNICIAN 9-25)

Amperex FRAME GRID TUBES

Two new tubes for TV, 6ES8 and 6DJ8, incorporating frame grid construction make possible an increase in effective TV signal reception area. Low noise is the outstanding feature of these tubes. Frame grid construction makes it possible to use extremely fine wire for the grid and achieve the closest approximation now practical to the physicist's "ideal" grid. This ideal is an infinitely thin conducting plane which offers no resistance to the passage of electrons except that due to its electrostatic potential. Unlike conventional grids in which the wire supports the rods, frame grid wires have only an electronic function, the mechanical being fulfilled by a self-supporting frame consisting of two molybdenum centerless ground rods connected by four spot-welded molybdenum strips. Grid-to-cathode spacing can be reduced, resulting in an increase of the gain-bandwidth product, another factor increasing the efficiency of frame grid structure. Amperex Electronic Corp., 230 Duffy Ave., Hicksville, N. Y. (ELECTRONIC TECHNICIAN 9-23)

WRIGHT WIRE STRAND PERFORMS LIKE A KING AND IS NON-SNARLING

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NEW

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TRANSISTOR-RADIO TESTER



Model 810

3 TESTERS IN 1

- ★ Tuned Receiver
- ★ AM Generator
- ★ Transistor Tester

Specifically designed with all necessary features for complete troubleshooting of transistor radios. Almost all portables made today are transistorized. With the 810 you can profit immediately from service in this large, new field. The instruction book included contains an easy-to-learn course in transistor radio servicing. Now, any serviceman can quickly troubleshoot and profitably repair transistor radios.

TUNED RECEIVER—200 to 500 KC for troubleshooting IF. 550 to 1600 KC for troubleshooting RF. A cathode follower input probe minimizes loading. Loudspeaker indicator for signal tracing.

AM SIGNAL GENERATOR—200 to 575 KC for IF alignment. 550 to 1600 KC for RF alignment. 400 cycle audio output for signal injection.

TRANSISTOR TESTER—Test circuit for checking transistors—leakage and gain.

The 810 will pay for itself in a short time . . . and give you many years of accurate, dependable service.

\$109⁹⁰ NET

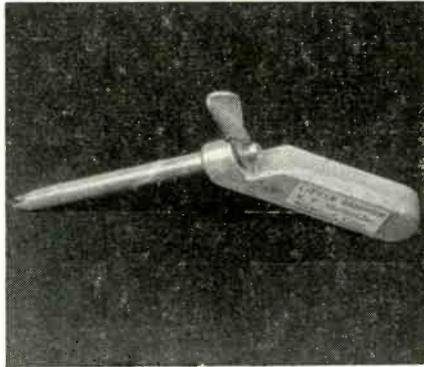
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Nielsen WIRE CUTTER

A wire cutter based on new principles is ideal for work in crowded electronic chassis. Called "Little Snipper," the cutter features a radial shearing action, implemented through a spring-loaded thumb lever. To use, simply hold Little Snipper like a pistol; the thumb naturally falls on the lever intended for it. Wire to be cut is picked up in the cut-



ting jaw at the end of the barrel, and light thumb pressure applied. The 10 to 1 leverage makes it easy to cut copper wire up to No. 8, or stainless steel up to No. 20. May also be used as pincers. Available in 2-inch, 4-inch, and 6-inch. E. V. Nielsen, Inc., 575 Hope St., Stamford, Conn. (ELECTRONIC TECHNICIAN 9-21)

Jerrold UHF CONVERTERS

Ultracon UHF converter Model TCU, is designed for primary reception areas. Unit features continuous coaxial tuning over entire UHF band, preselection stage, low-noise mixer, and slide-rule dial coupled to vernier tuning. \$22.95. Model FTC is a deluxe UHF converter for reception in poor signal areas. It combines high gain amplification with low-loss circuitry, and has wiperless coax tuner. For local area reception, Model FTC contains a built-in UHF antenna. List is \$39.95. Jerrold Electronic Corp., 15 St. & Lehigh Ave., Philadelphia 32, Pa. (ELECTRONIC TECHNICIAN 9-27)

Shure MICROPHONE

Communications microphone "Ten-Four" is tough enough to survive the weight of a load-bearing truck. It is encased in synthetic resin and weighs only about half as much as the standard, die-cast metal microphone. It will not chip or crack in normal use and is impervious to grease, acids and salt spray. Ten-Four means "message received" in the official communications code of the Associated Police Communication Officers. Heart of the Ten-Four is the controlled magnetic cartridge. Complete microphone, including plug and cable, weighs only 8 oz. Shock hazard is eliminated. Low thermal conductivity allows the Ten-Four to feel comfortable, even in extreme hot or cold weather. Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill. (ELECTRONIC TECHNICIAN 9-30)

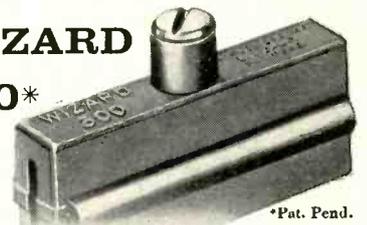


Partners Ray Kirkhart and Joe Kopin of Picture Tube Center, 1541 North Western Avenue, Hollywood 27, California.

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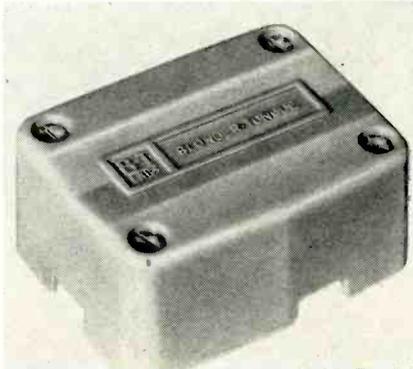
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New Products

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BT MULTI-SET TV COUPLERS

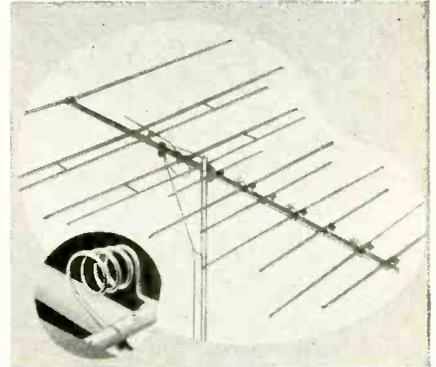
Series of 300 ohm TV and "Exact-Match" Couplers feature maximum signal transfer and isolation. A-102 2-set Coupler feeds two receivers from one antenna or mixes four antennas into one line. It delivers 12-20 db isolation and only 7.5 db loss. In weather proof



cases, "Exact-Match" Couplers can be mounted indoors or on an outdoor antenna mast with A-100 kit. Kit provides rustproof bolts and assembly for easy installation. Blonder-Tongue Labs., 9 Alling St., Newark 2, N. J. (ELECTRONIC TECHNICIAN 9-1)

Channel Master VHF ANTENNAS

SkyBlazer Model No. 334, an all-channel VHF antenna designed for economy fringe-area installations, uses impedance compensating inductance coils, which do not resonate at high band frequencies. This results in a flat response pattern on all channels. The SkyBlazer delivers high front-to-back



ratios, and high gain on VHF. Full-wave parasitic directors provide extra gain boost on channels 7-13. \$21.53 list. Although not available in a stacked model, it can be stacked by connecting rod 335-3 at \$2.22. Channel Master Corp., Ellenville, N. Y. (ELECTRONIC TECHNICIAN 9-3)

Charles MULTI-SET COUPLERS

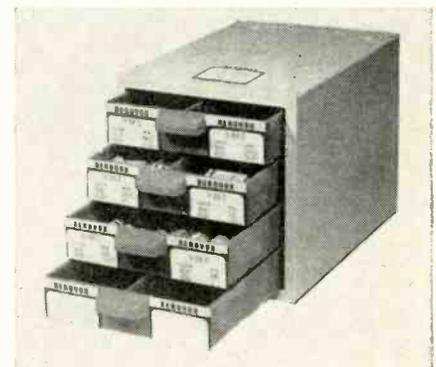
Wizard 300 TV-FM coupler will operate up to 20 or more sets from one antenna without amplification in normal signal areas. Designed for apartments, motels, TV sales rooms, homes, etc. Simple to install. Principal of electro-magnetic coupling is used, with no separate inductive or capacitive components. It contains two coupling elements



which make no direct electrical or mechanical connection with antenna line, thereby reducing insertion loss. \$1.95 list. Also Wizard 450 for open line spaced 1" or more, \$3.30/pair. Charles Engineering Inc., 6053 Melrose Ave., Los Angeles 38, Calif. (ELECTRONIC TECHNICIAN 9-2)

Aerovox MYLAR CAPACITOR KITS

Two new mylar tubular capacitor kits, with humidity resistant ceramic cased units. Each kit contains an assortment of only the most popular Type V84C capacitors widely used by service technicians, and does not contain seldom used values. Units are packaged in a free, four-drawer metal cabinet with



divided plastic drawers. Kit AK-100 consists of 75 Type V84C capacitors rated at 600 vdcw in 12 values. Kit AK100HS contains 76 units rated at 600 vdcw in 14 values. Distributor Div., Aerovox Corp., New Bedford, Mass. (ELECTRONIC TECHNICIAN 9-5)

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17G1-	290/R	590/R	540
41MC	29U	40U	550
18U	290-	40R	560
20G1-	21MC	420/R	57R-
41MC	300	42U	57R-41MC
20U	300-	43G1-	57R
20Q/R	21MC	41MC	580
21Q	30G-	430	590
21R	41MC	450	59R-
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23U	330	47Q	60R
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24R	41MC	480	21MC
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250-	41MC	480/R	41MC
21MC	330-	49U	66U
25R-	21MC	49R	67U
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27R	350/R	41MC	710-
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21MC	35R	51Q	73Q
27G1-	360-	41MC	21MC
41MC	21MC	51R-	53R-
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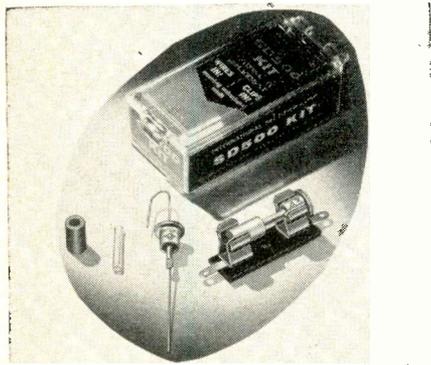
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Int'l Rectifier ADAPTER KIT

The SD-500 Kit offers a fast, simplified means of replacing all existing radio-TV silicon rectifier types. It contains an hermetically sealed, pigtail diode which may be wired in to replace axial lead types, or plugged into existing fuse-clip type sockets. It can operate at 100°C ambient with resistive, inductive or capacitive load, and can



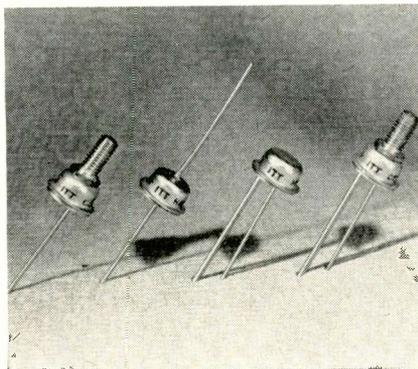
supply full-rated power under normal convection cooling. The SD-500 may also replace existing selenium rectifier types, or if a direct mechanical replacement is required, Unistac TV-500 may be used to replace selenium units with no conversion required. International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif. (ELECTRONIC TECHNICIAN 9-4)

Motorola CABINET REPAIR KIT

Cabinet repair kit is designed for the use of the service technician as a new service aid. Intent of the kit is to supply the materials and knowledge necessary to perform minor cabinet repairs simply and easily without the knowledge or know-how of the professional finisher. Included are 13 jars of stains, solvents and pigments that can be used in combination to duplicate exactly any finish. Touch-up brushes, steel wool and complete instructions are also included. Motorola, Inc., 4545 W. Augusta Blvd., Chicago 51, Ill. (ELECTRONIC TECHNICIAN 9-34)

ITT SILICON RECTIFIERS

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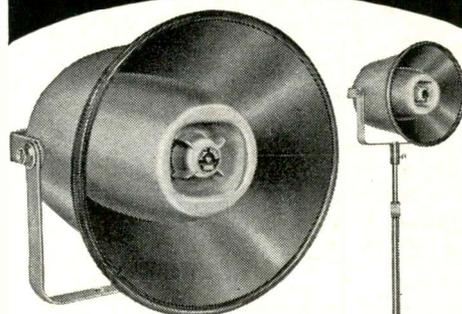


at 600 v. are usable at ambient temperatures up to 150°C. They are reliable components for power supply applications and for use in instruments and other types of industrial electronic equipment. Components Div., of International Telephone and Telegraph Corp., 100 Kingsland Road, Clifton, N. J. (ELECTRONIC TECHNICIAN 9-11)

Workman PIN STRAIGHTENER

ST-1 pin straightener for 110° picture tubes having the RCA-type wire pin base is made of durable black bakelite. It is designed so that it can be used in limited space. After use, it can be easily and safely removed from the base of the picture tube by means of finger pressure. No twisting or "rocking" is necessary. The glass button base of these 110° tubes is easily fractured and to try and straighten bent pins with a pair of pliers is to run the risk of cracking the glass. Workman TV Inc., 309 Queen Anne Road, Teaneck, N. J. (ELECTRONIC TECHNICIAN 9-29)

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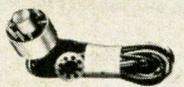
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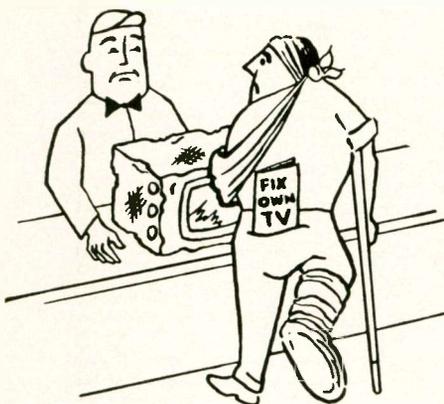
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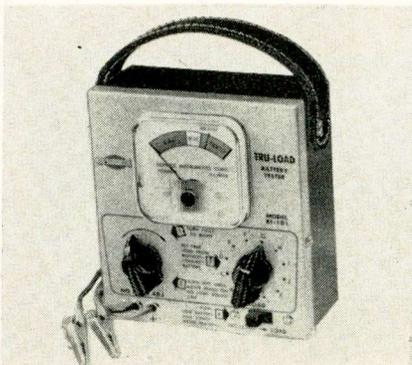
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Sencore BATTERY TESTER

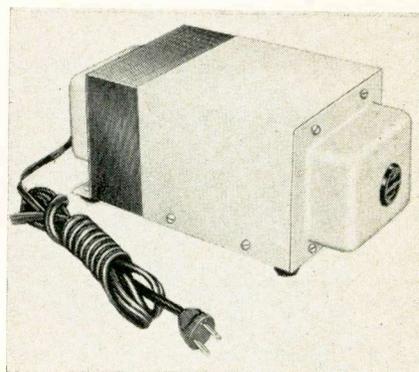
Tru-Load battery tester, Model BT-101, is capable of checking all types of dry and mercury cell batteries under "optimum" load as specified by the battery manufacturers. Mercury cells of the hearing aid type can be checked without danger of damage. The BT-101 is especially useful in transistor. Com-



plete with test leads and carrying handle. A complete battery chart, listing over 100 different types of batteries by manufacturers number, is attached. Dealer net is \$15.95. Service Instruments Corp. (Sencore) 121 Official Road, Addison, Ill. (ELECTRONIC TECHNICIAN 9-6)

Acme VOLTAGE STABILIZER

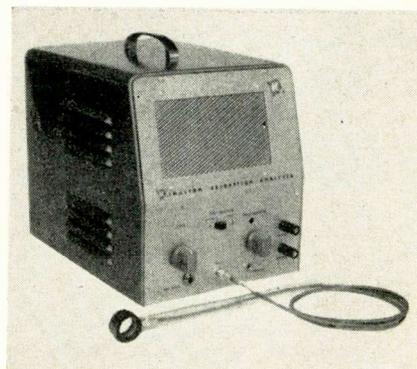
A new automatic voltage stabilizer that will maintain a 118 v. output even though the input may vary from 95 to 130 v., is designed especially for TV receivers, amplifiers, hi-fi sets and other equipment, where excessive or low voltage often cause performance troubles. Rated at 200 VA, it can ac-



commodate 24" TV sets. Noiseless and free from harmonic radiation. Built-in relay automatically disconnects primary circuit when TV set is turned off, stopping coil magnetism. Acme Electric Corp., Cuba, N. Y. (ELECTRONIC TECHNICIAN 9-8)

Kingston ABSORPTION ANALYZER

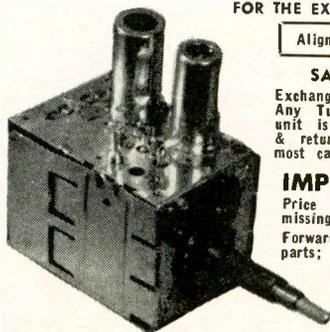
New absorption analyzer, Model PO-1, is designed to add the electrostatic pick-up and other analyzer features to conventional oscilloscopes. Used with a scope in the same manner as a pre-amplifier, the PO-1 makes it possible to pick up and trace signals electrostatically in any electronic circuit which has periodic wave forms between 3 and 240 mc. It increases the sensitivity of scopes from 10 to 100 times depending on the circuit. A built-in speaker provides audible signal tracing. \$197.50. Kingston Electronic Corp., Medfield, Mass. (ELECTRONIC TECHNICIAN 9-7)



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INDEX TO ADVERTISERS

September, 1958

Acro Products	94	Mallory & Co., Inc. P. R.	110, 111
Aerovox Corp.	6	Merit Coil and Transformer Corp. ...	132
American Microphone Manufacturing Co.	68	Milwaukee Resistor Co.	116
American Television & Radio Corp.	123	Multicore Sales Corp.	125
Amperex Electronic Corp.	93		
Amphenol Electronics Corp.	58	Ohmite Manufacturing Co.	122
Atlas Sound Corp.	129	Oxford Components, Inc.	95
B & K Manufacturing Co.	112	Philco Corp.	2, 3, 65
British Industries Corp.	63, 125	Pickering & Co., Inc.	97
Bussmann Manufacturing Co.	Cover III	Pilot Radio Corp.	53
		Planet Sales Corp.	119
Capitol Radio Engineering Institute	125	Precision Apparatus Co., Inc.	104
Castle TV Tuner Service	130	Precision Electronics, Inc.	62
CBS-Hytron	57		
Centralab Div., Globe-Union, Inc.	109	Quam-Nichols Co.	91
Channel Master Corp.	10, 11		
Charles Engineering, Inc.	127	Radiart Corp.	24, 25
Chemical Electronic Engineering, Inc.	129	Radio Corp. of America	18, 102, 107,
Chicago Standard Transformer Corp.	116	Cover IV	
Cleveland Institute of Radio Electronics	118	Radio Receptor Co., Inc.	106
Collaro	46	Raytheon Manufacturing Co.	26
Columbia CD	57	Rek-O-Kut Co., Inc.	42
Cornell-Dubilier Electric Corp.	22, 23, 24	Rider Publisher, Inc., John F.	120
		Rierner Co., Inc., David	96
Delco Radio Div., General Motors	101	Rockbar Corp.	46
De Ro Electronics	98	Rohn Manufacturing Co.	19
Deutschmann Corp., Tobe	21	Ronette Acoustical Corp.	91
Duofone Co., Inc.	93		
		Sampson Co.	113
EICO	71	Seco Manufacturing Co.	131
Electronic Technician	40	Service Instruments Corp.	120, 125, 128
Electronic Utilities Co.	113	Sherwood Electronic Laboratories, Inc.	92
Electro Products Laboratories	124	Shure Brothers, Inc.	99
Electro-Voice, Inc.	44, 45	Sonoramic Tape	96
Erie Resistor Corp.	95	South River Metal Products Co., Inc.	120
		Sprague Products Co.	105
Fairchild Recording Equipment Corp.	98		
Fanon Electric Co., Inc.	72	Technical Appliance Corp.	93
Federated Television Mart, Inc.	128	Tobe Deutschmann	21
Ferrodynamics Corp.	96	Trio Manufacturing Co.	12
		Tung-Sol Electric, Inc.	114, 115
Garrard Sales Corp.	63		
General Cement Manufacturing Co.	130	Ungar Electric Tools, Inc.	7
General Electric Co., Tube Dept.	8, 9, 20	United Catalog Publishers	130
General Electric Co., TV Receiver Dept.	13	University Loudspeakers, Inc.	61
General Electric Co., Hi-Fi Div.	70	Utah Radio & Electronic Corp.	51
Gregg Electric Sales Co.	121		
Grommes	62	V-M Corp.	59
		Volkswagen of America, Inc.	17
Harman-Kardon	100		
Heath Co.	69	Walsco Electronics Manufacturing Co.	108
Hickok Electrical Instrument Co.	127	Weller Electric Corp.	14
		Westinghouse Electric Corp.	16
International Resistance Co.	Cover II	Winegard Co.	96, 103
		Wright Steel & Wire Corp.	126
Jensen Manufacturing Co.	74		
Jerrold Electronics Corp.	117	Zalytron Tube Corp.	126
JFD Electronics Corp.	4, 5	Zenith Radio Corp.	15
Kingston Electronic Corp.	122		
Luxo Lamp Corp.	124		

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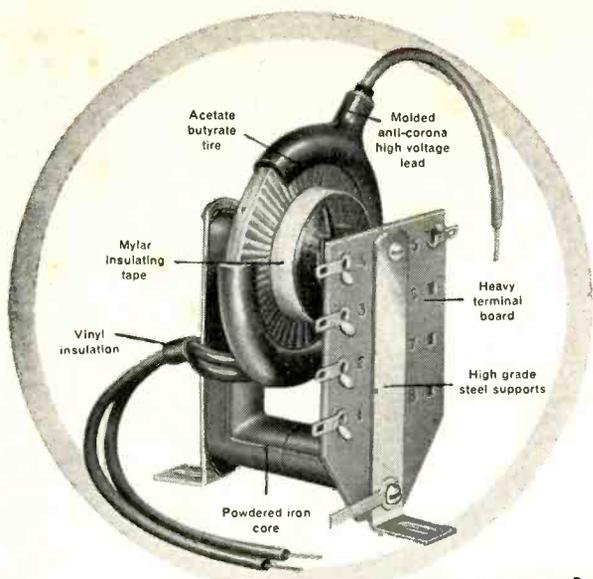
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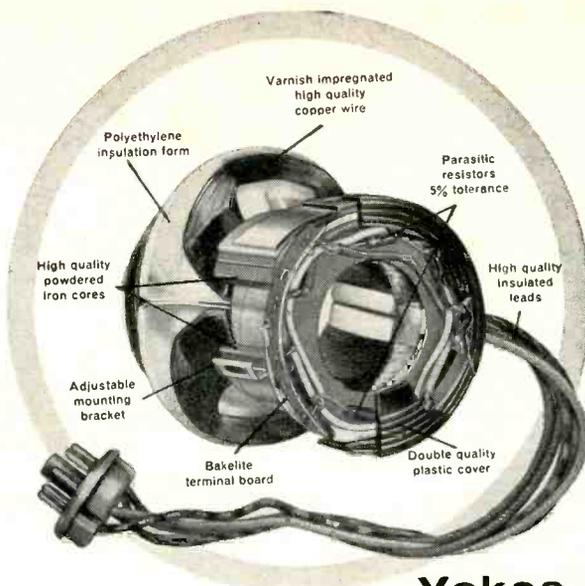
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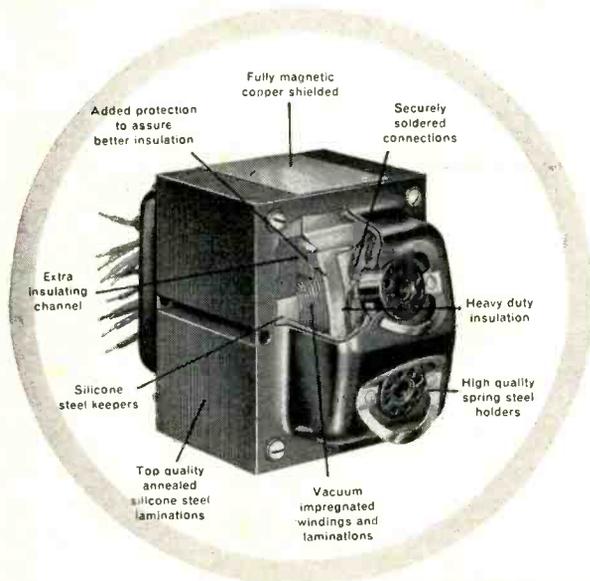
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 **5015 Penn Avenue So.
Minneapolis, Minn.**



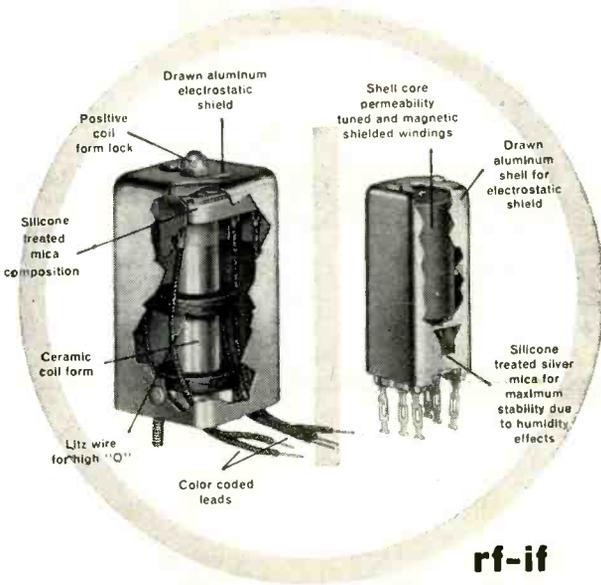
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Transformers



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Transformers
and Coils**

MERIT COILS and TRANSFORMERS are the first choice of Independent Service Dealers and Technicians

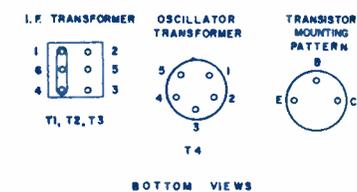
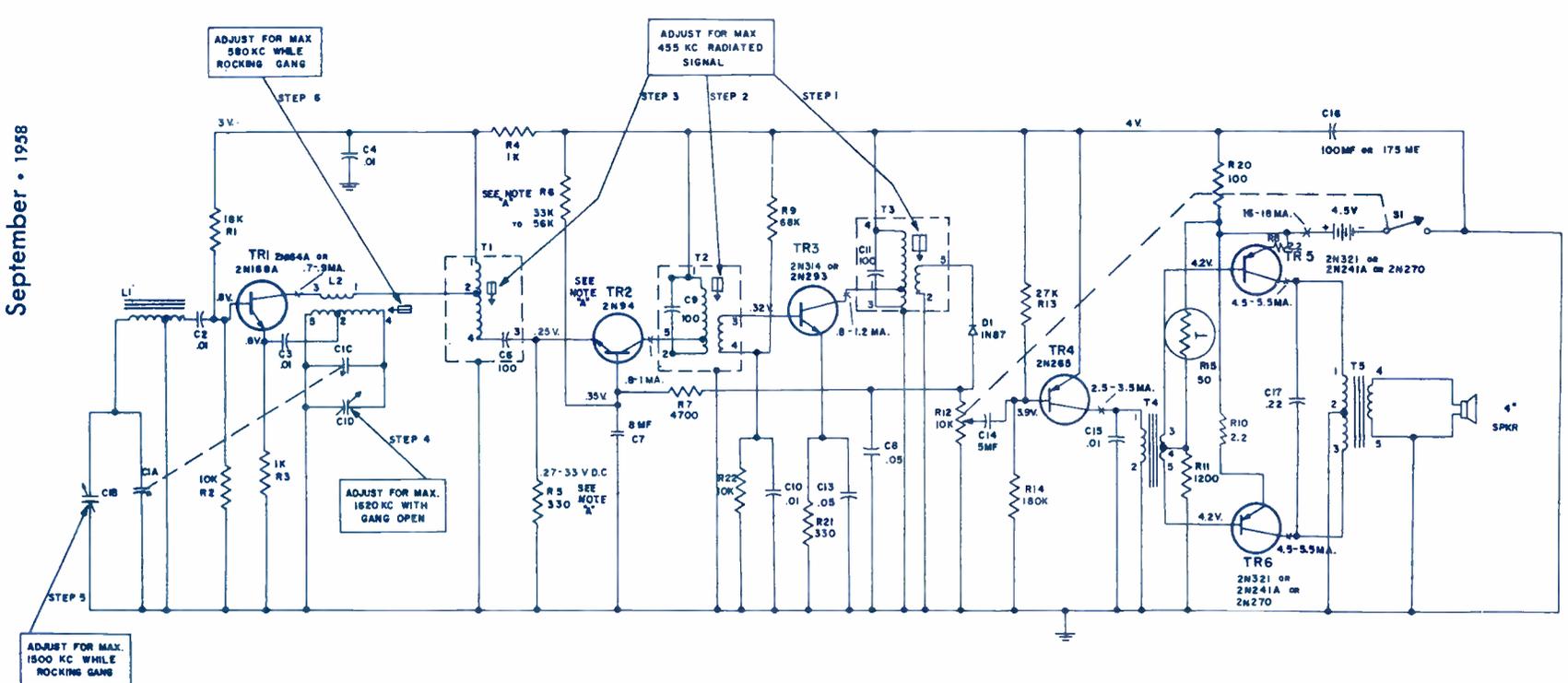
FIRST in Quality • FIRST in Sales Aids!



"COMPARE IT WITH MERIT"

MERIT COIL AND TRANSFORMER CORP.
MERIT PLAZA • HOLLYWOOD, FLORIDA

September • 1958



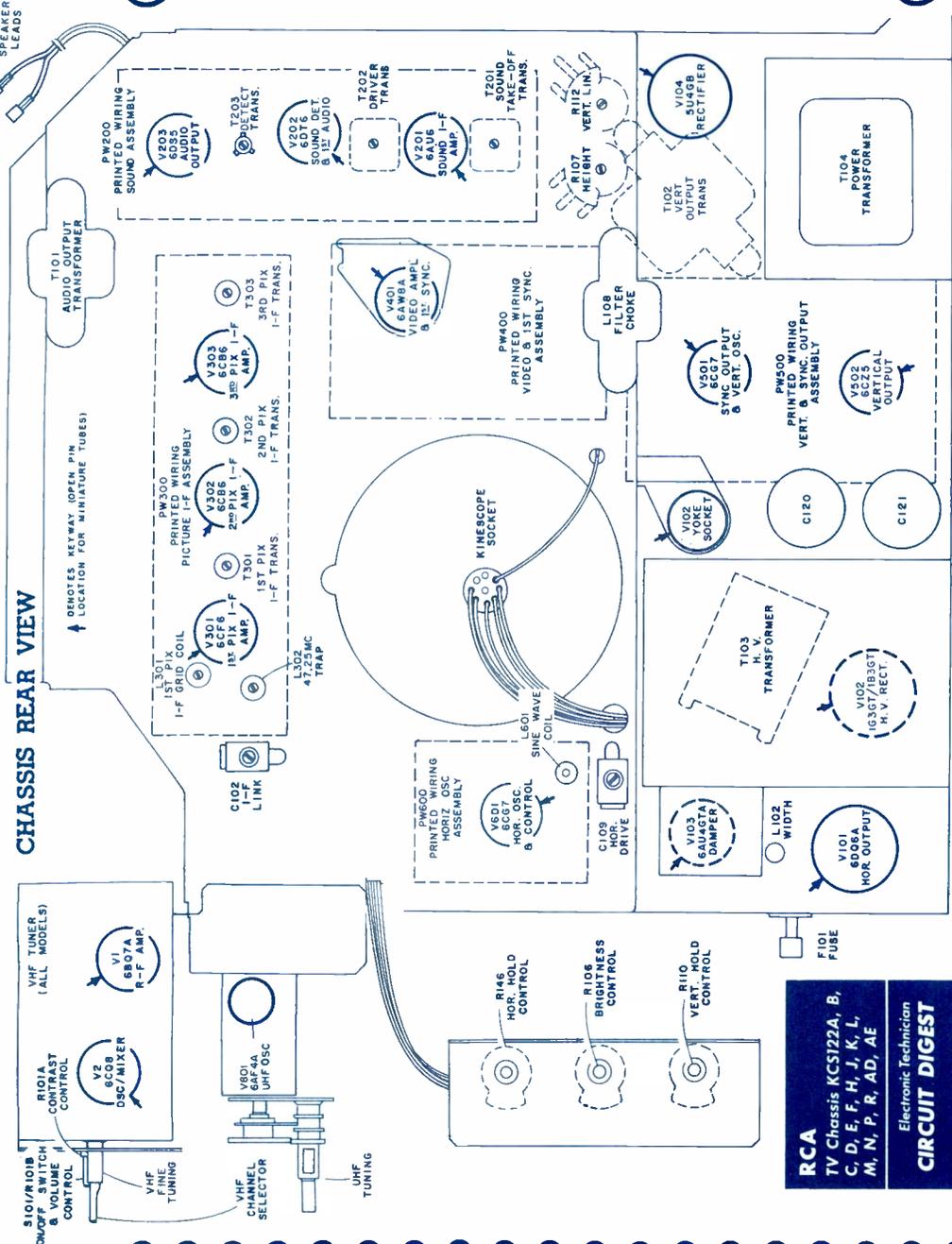
ALIGNMENT
SET VOLUME CONTROL AT MAXIMUM. CONNECT OUTPUT METER OR SCOPE ACROSS VOICE COIL INDUCTIVELY COUPLE SIGNAL GENERATOR TO RECEIVER.
STEP 1 - 2 & 3 - SET SIG. GEN. AT 455 KC, WITH RECEIVER TUNING GANG OPEN.
STEP 4 - SET SIG. GEN. AT 1620 KC, WITH RECEIVER TUNING GANG OPEN.
STEP 5 - SET SIG. GEN. AT 1500 KC, TUNE RECEIVER TO 1500 KC.
STEP 6 - SET SIG. GEN. AT 580 KC, TUNE RECEIVER TO 580 KC.

NOTE
AFTER REPLACING TR2, CHECK VOLTAGE ACROSS R5, IF NOT WITHIN RANGE, CHANGE VALUE OF R6 UNTIL VOLTAGE ACROSS R5 IS WITHIN VOLTAGE RANGE SHOWN.

UNLESS OTHERWISE NOTED—
CAPACITORS MORE THAN 1-MMF
CAPACITORS LESS THAN 1-MMF
RESISTORS ARE 1/2 WATT
K=1000

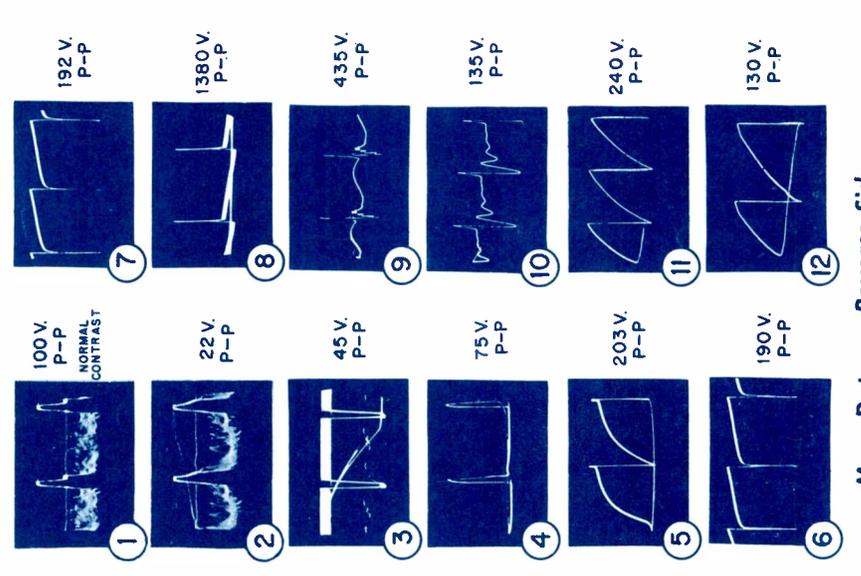
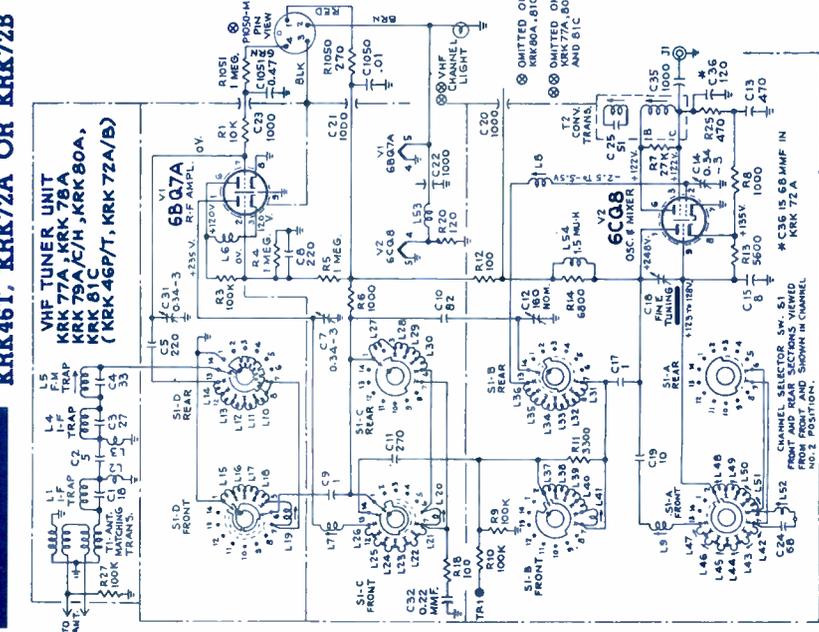
ALL VOLTAGES ARE POSITIVE
WITH RESPECT TO GROUND.

CHASSIS REAR VIEW



RCA
TV Chassis KCS122A, B,
C, D, E, F, H, J, K, L,
M, N, P, R, AD, AE
Electronic Technician
442
CIRCUIT DIGEST

**VHF TUNER FOR KRK46P
KRK46T, KRK72A OR KRK72B**



More Data on Reverse Side

ELECTRONIC TECHNICIAN

CIRCUIT DIGESTS

In This Issue (No. 73)

Circuit Digest No.

ADMIRAL 439

TV Chassis 20B6C, T; 20J86C, T
Models CH21H32, 33, 34, 41, 43, 44
CH21UH32, 33, 34, 41, 43, 44
LH21H22, 23, 24, 32, 35
LH21UH22, 23, 24, 32, 35
TH21H22, 23; TH21UH22, 23

GENERAL ELECTRIC (Canada) 443

Transistor Radio P750A

MONTGOMERY WARD 441

Hi Fi, AM-FM Radio Phono
Model GEN 2645A, B, C; GEN 2646A, B, C
Serial No. 75X

MOTOROLA 444

TV Chassis PT5546, Y
Model 21PIB, BR, GY; Y21PIB, BR, GY

PACKARD-BELL 440

TV Chassis 98D4
Models 21DC9, 10; 24DC5

RCA 442

TV Chassis KCS122A, B, C, D, E, F, H,
J, K, L, M, N, P, R, AD, AE
Models 21-T-9132-5-7 & U;
21-T-9152-5-6-7 & U;
21-T-9215-6-7 & U;
21-T-9225-6-7 & U;
21-T-9235-6-7-8 & U;
21-T-9255-6-7-8 & U;
21-T-9315-6-7-8 & U;
21-T-9355-6-7 & U;
21-T-9396-7-9 & U;
21-T-9415-7 & U

73

More Data
on Reverse Side

START RESTRINGING WITH LARGE UHF PULLEY
IN MAX COUNTERCLOCKWISE POSITION (AS
VIEWED FROM FRONT OF TUNER).



DIAL LIGHT, NEON
BULB N.E. #51
* 65K746835

UHF TUNER

UHF MODELS ONLY

2AF4A UHF OSC

5U8 RF OSC CONV

4BC8 RF AMP

38Z6 1ST IF

38Z6 2ND IF

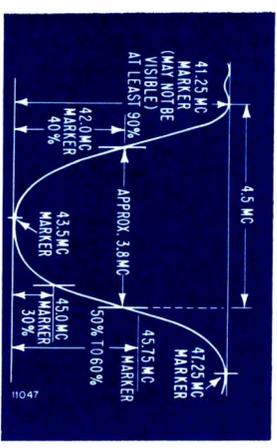
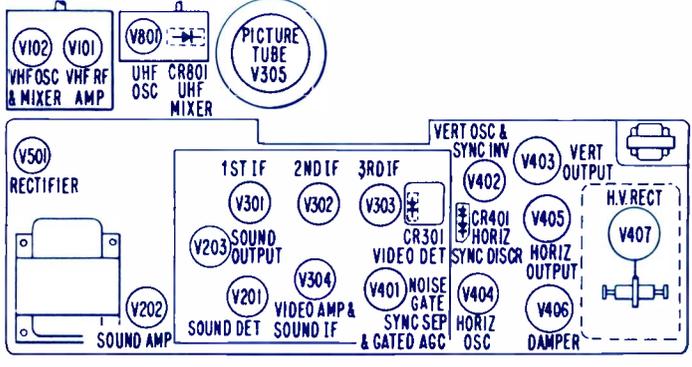
38Z6 3RD IF

38Z6 XTAL

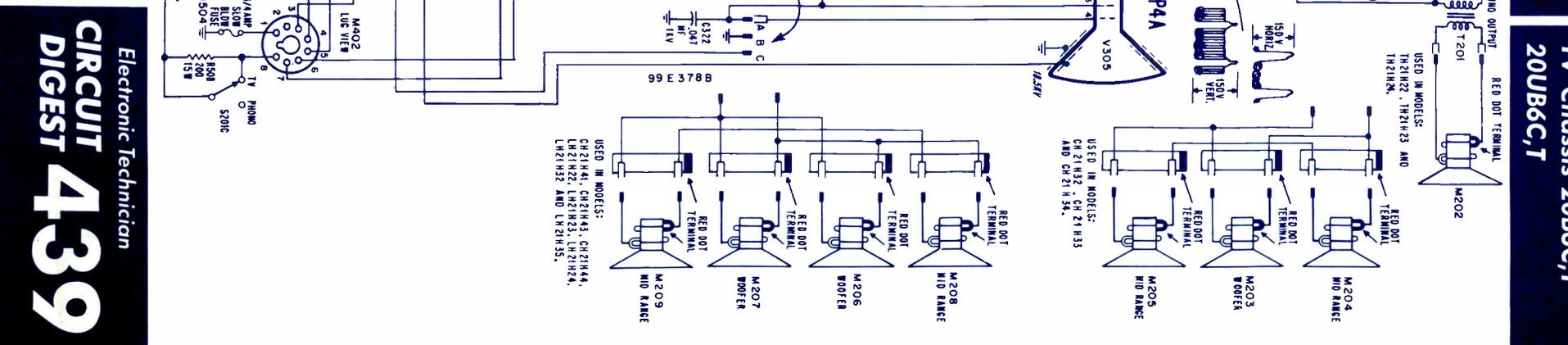
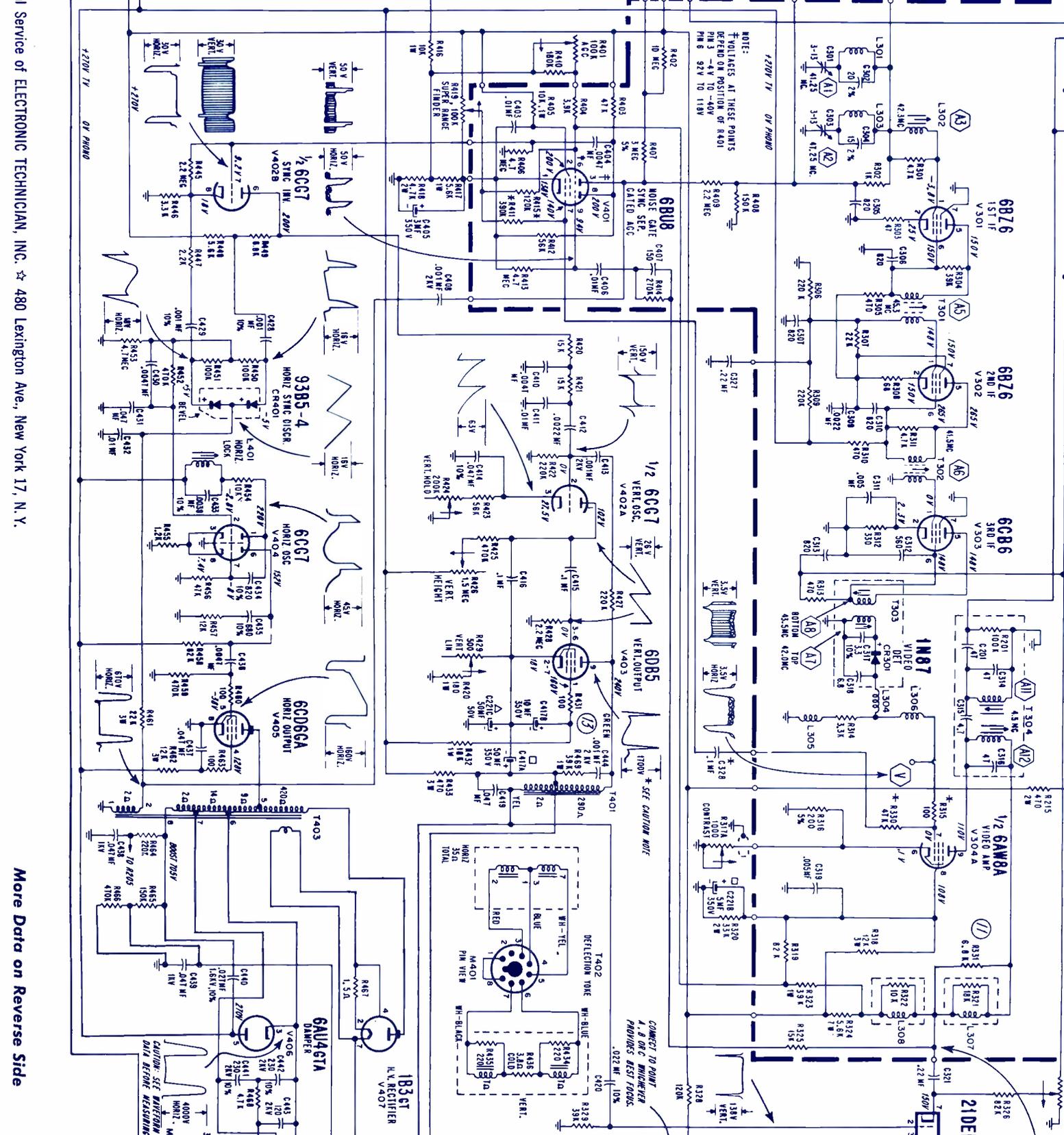
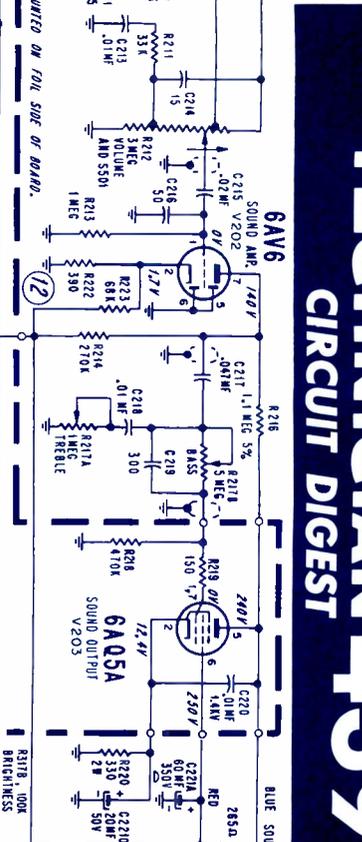
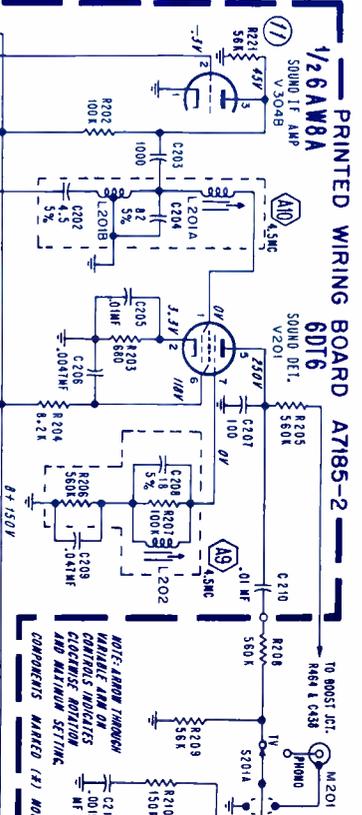
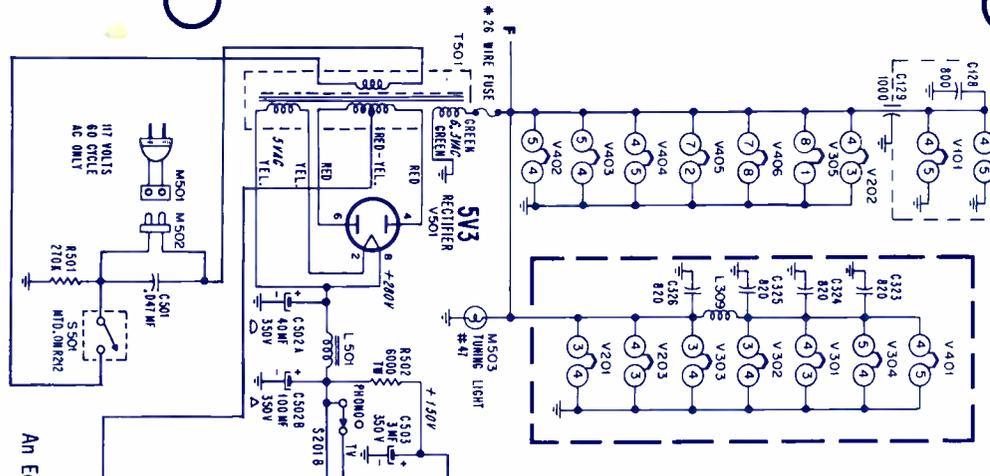
38Z6 4BK747350

38Z6 48K747350

TUBE LOCATIONS FOR 20UB6C AND 20UB6T CHASSIS



IF Response Curve.

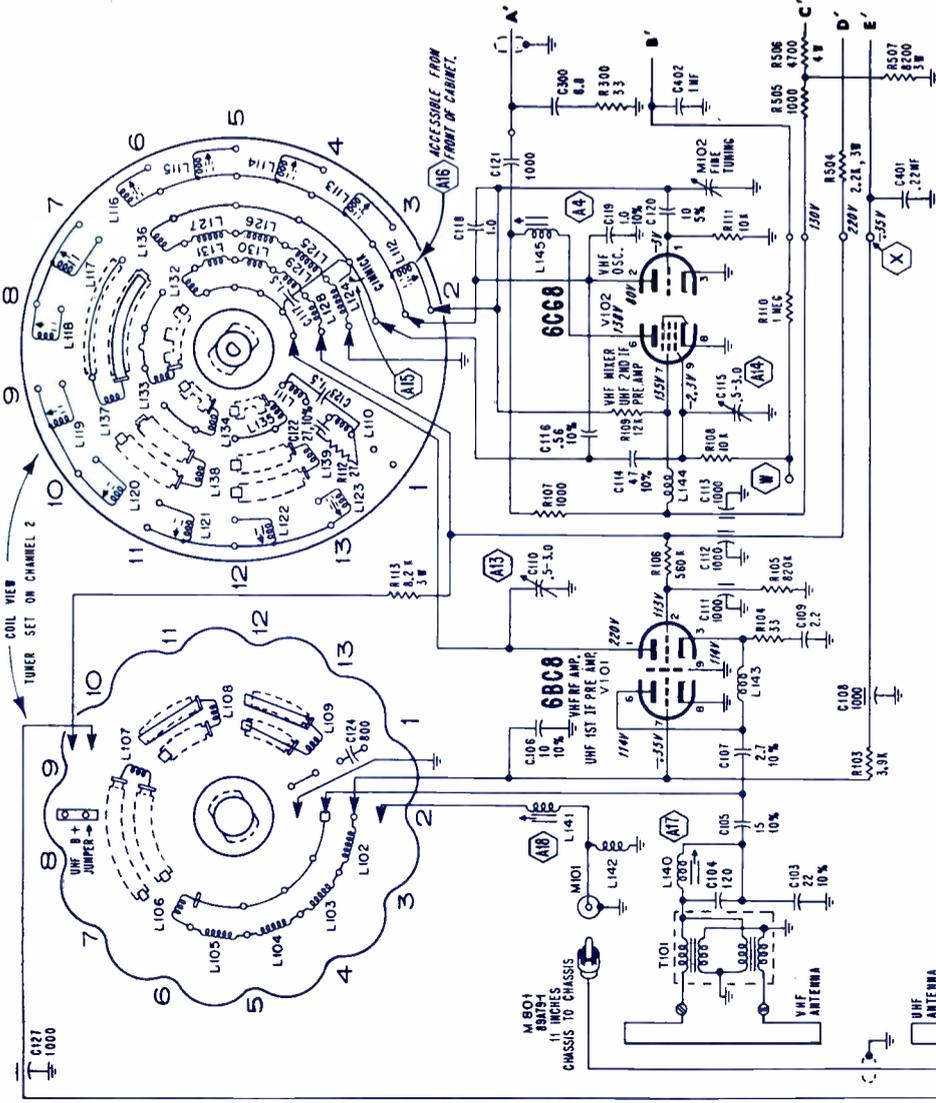


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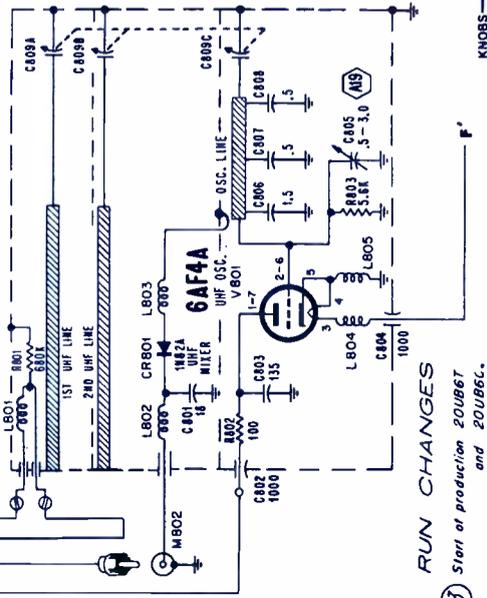
More Data on Reverse Side

Electronic Technician
CIRCUIT DIGEST 439

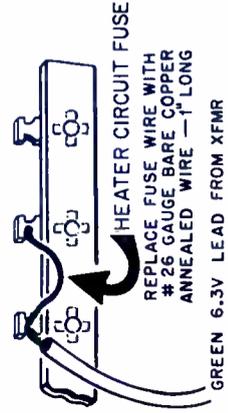
VHF TUNER 94 E 160-2



UHF TUNER 94 D 162-1



RUN CHANGES
Start of production 20UB6T and 20UB6C.



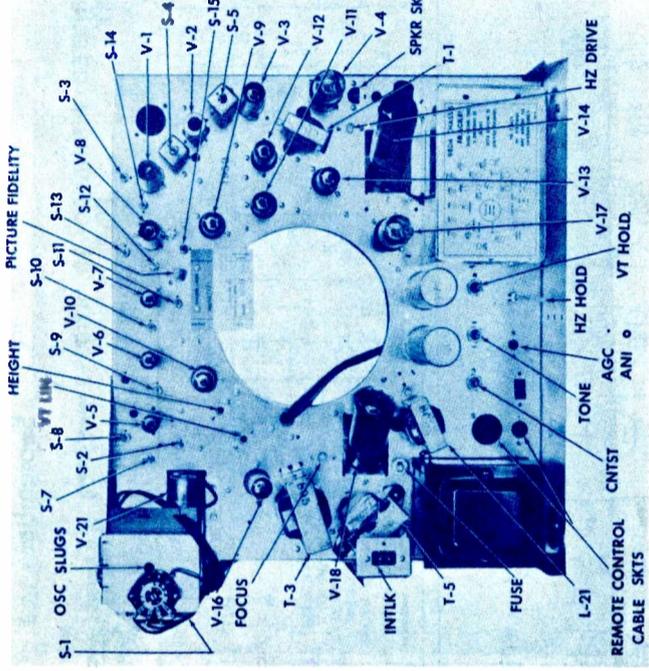
Heater Circuit Fuse Location.

ADMIRAL
TV Chassis 20B6C,T
20UB6C,T

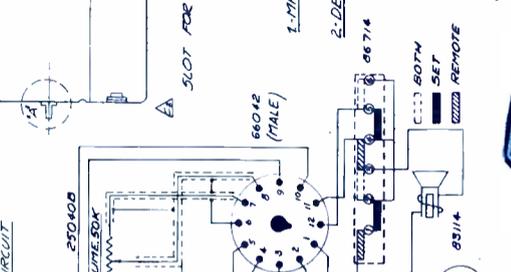
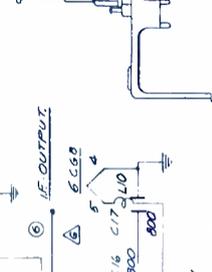
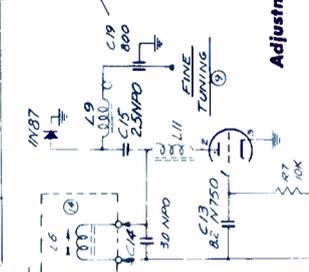
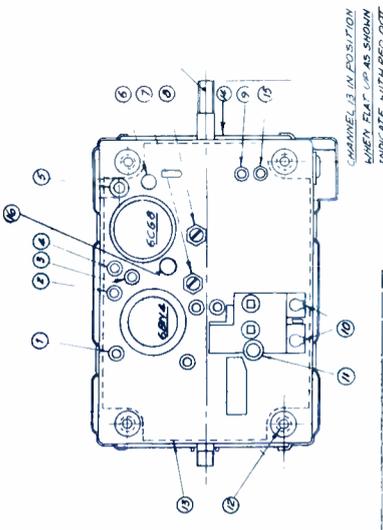
CIRCUIT DIGEST

439

More Data on Reverse Side



ITEM NO.	DESCRIPTION
1	A.G.C.
2	RFT TEST
3	HEATER
4	IF ADJUST.
5	I.F. TERMINAL
6	MIXER TRIM
7	FINE TUNING
8	EPES ADJUST.
9	35C SLUG ADJUST.
10	ACCESS TO MIXER GRID
11	ANTENNA
12	B-32 TAP HOLES
13	MOUNTING CLEARANCE
14	35C SLUG ADJUST.
15	B-26OV.
16	ACCESS TO MIXER GRID



PACKARD-BELL
TV Chassis 98D4

CIRCUIT DIGEST

440

More Data on Opposite Page

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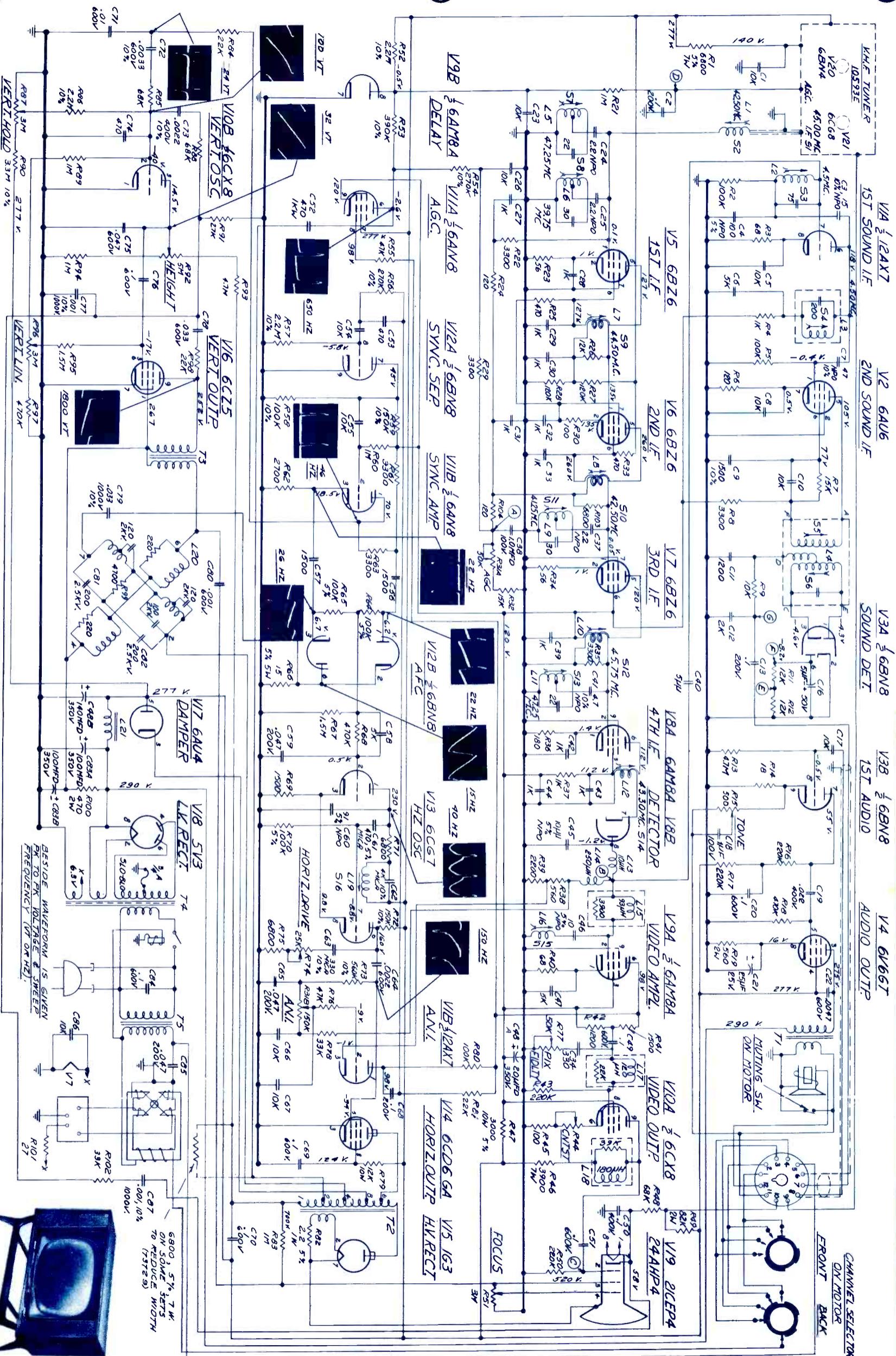
ELECTRONIC TECHNICIAN 440

CIRCUIT DIGEST

PACKARD-BELL

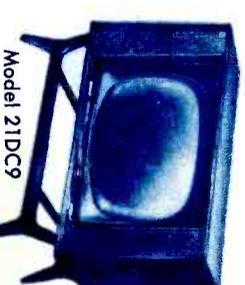
TV Chassis 98D4

Models 21DC9, 10, 24DC5



More Data on Opposite Page

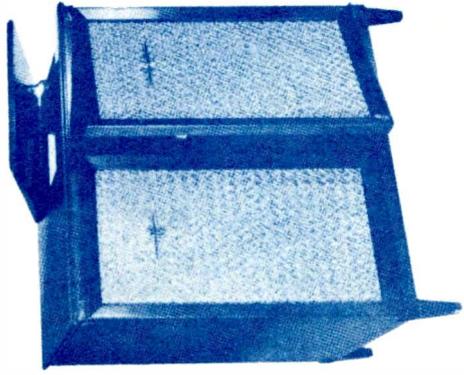
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Model 21DC9

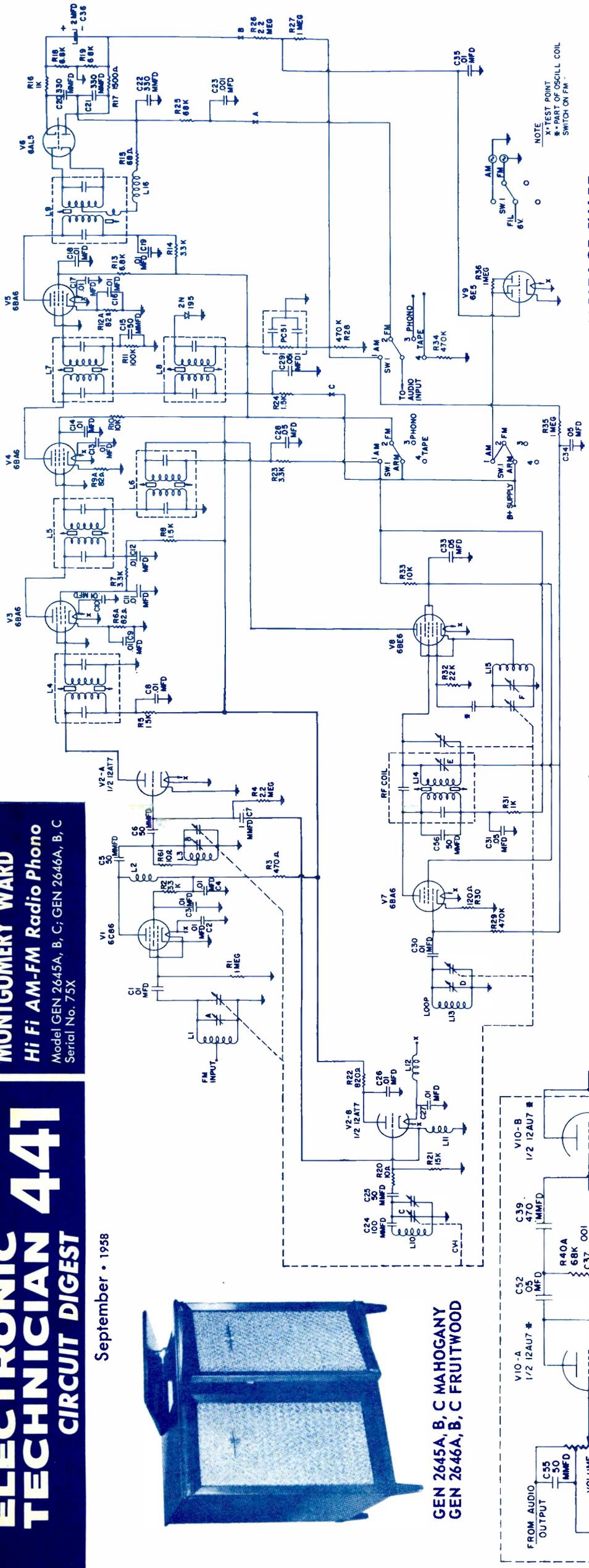
Electronic Technician
CIRCUIT DIGEST 440

September • 1958



MONTGOMERY WARD
Hi-Fi AM-FM Radio Phono
Model GEN 2645A, B, C; GEN 2646A, B, C
Serial No. 75X

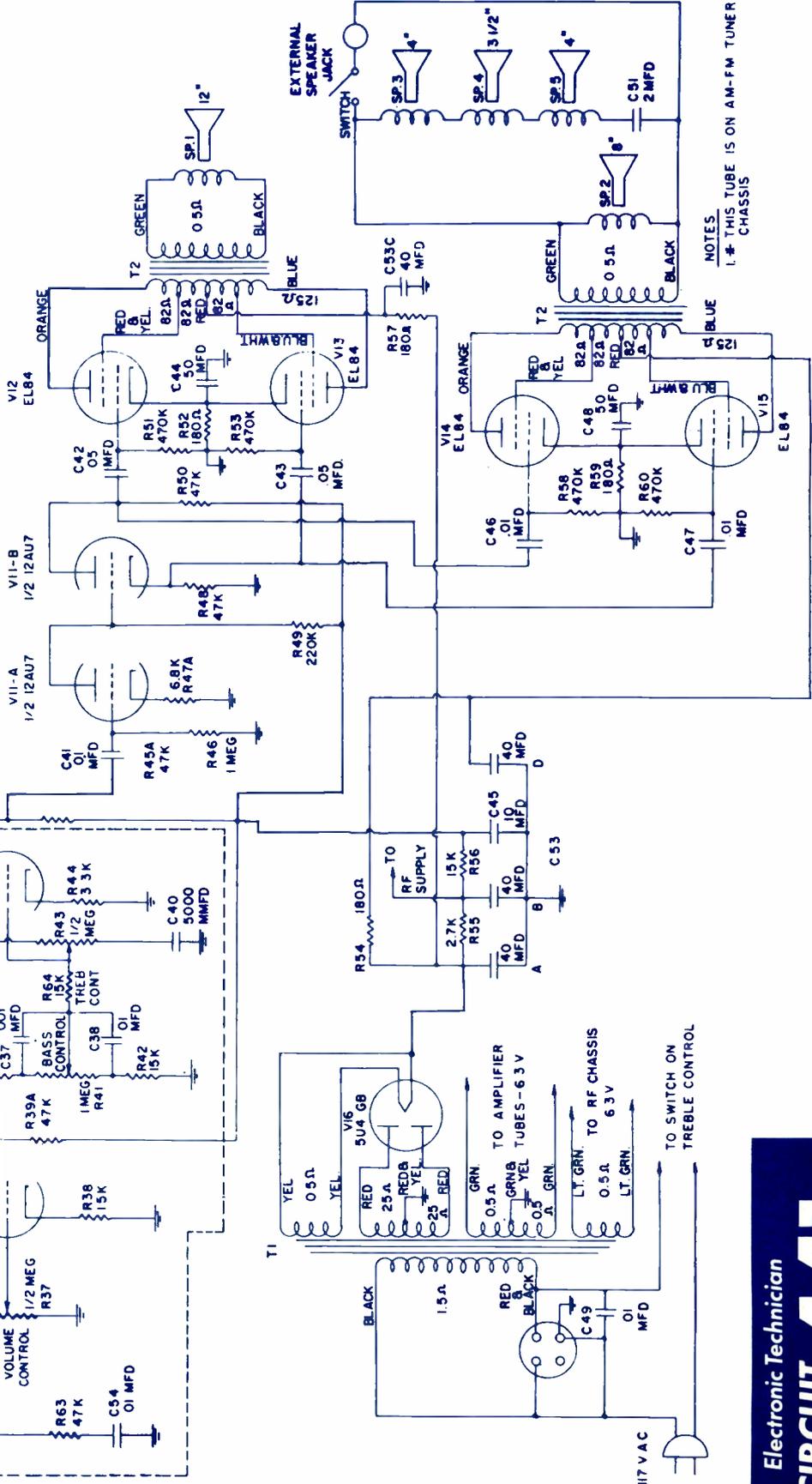
GEN 2645A, B, C MAHOAGANY
GEN 2646A, B, C FRUITWOOD



VOLTAGE CHART

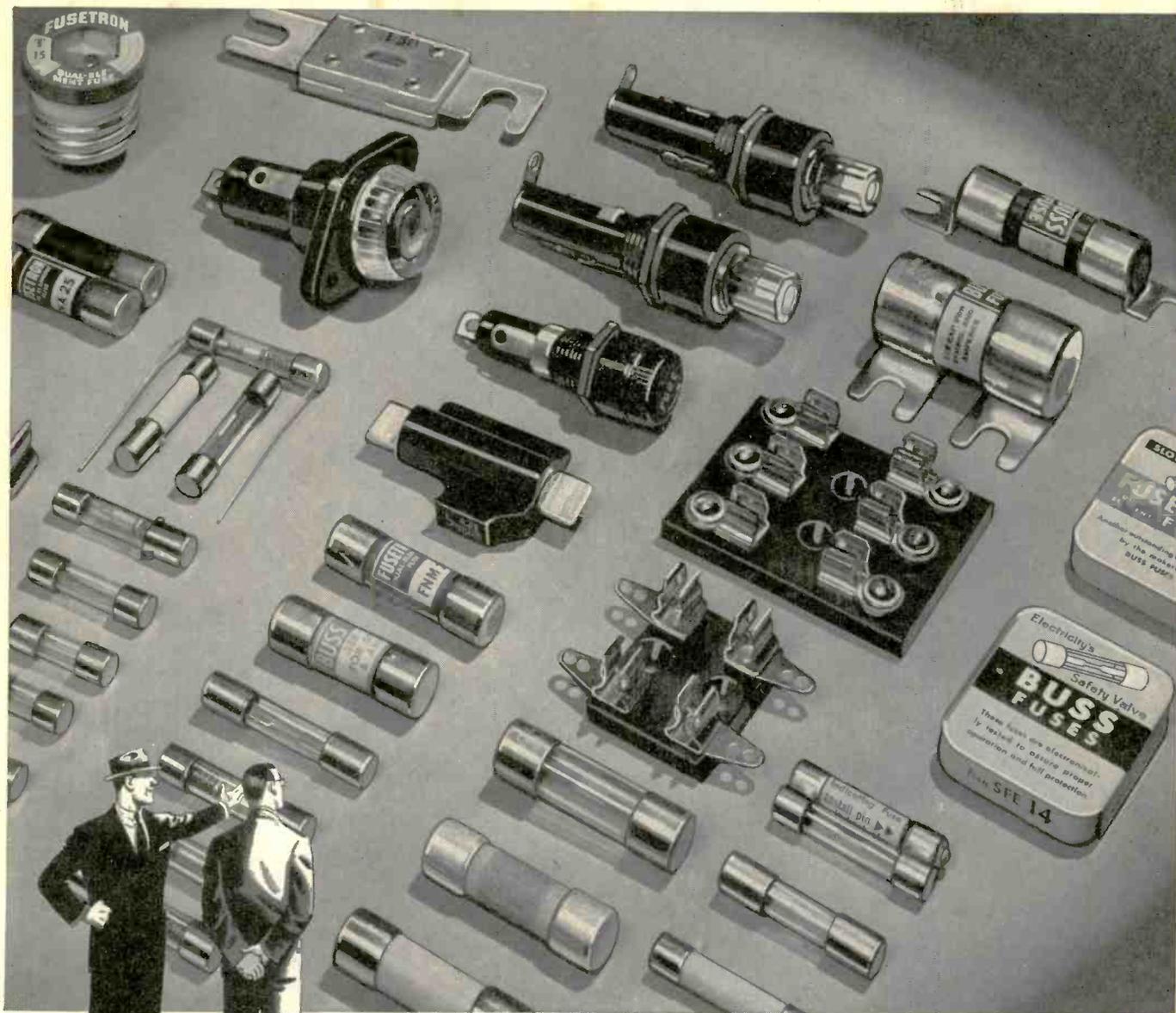
ITEM	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
* V1	6CB6	-4	0	0	6.3AC	+120V	0	0	0	0
* V2	12AT7	+120V	-6	0	6.3AC	+125V	-1.25	-1.25	0	0
* V3	6BA6	0	0	0	6.3AC	+110	+90	+1.5	0	0
* V4	6BA6	0	0	0	6.3AC	+110	+90	+1.25	0	0
* V5	6BA6	0	0	0	6.3AC	+100	+100	+1.35	0	0
* V6	6AL5	+75	-1	0	6.3AC	0	0	+1.35	0	0
* V7	6BA6	0	0	0	6.3AC	+165	+100	+1.35	0	0
* V8	6BE6	-4.0	0	0	6.3AC	+200	+100	0	0	0
* V9	6E5	0	+90	0	6.3AC	0	0	0	0	0
* V10	12AU7	+90	0	+2	6.3AC	6.3AC	+85	0	0	6.3AC
* V11	12AU7	+70	0	+1.3	6.3AC	6.3AC	+100	+70	+75	6.3AC
* V12	EL84/8D5	HC	0	+10	6.3AC	6.3AC	HC	+240	HC	+245
* V13	EL84/8D5	HC	0	+10	6.3AC	6.3AC	HC	+240	HC	+245
* V14	EL84/8D5	HC	0	+10	6.3AC	6.3AC	HC	+240	HC	+245
* V15	EL84/8D5	HC	0	+10	6.3AC	6.3AC	HC	+240	HC	+245
* V16	5U4-GB	0	+205	0	20AC	0	20AC	0	+205	0

* Measured in FM-AFC Position □ Measured in Phone Position
 All Measurements made with V.T.V.M.
 Δ Measured in AM Position



TUNING GANG FULLY OPENED 2 TURNS

NOTES:
 THIS TUBE IS ON AM-FM TUNER
 I.# CHASSIS



BUSS FUSES help you avoid adjustments and call-backs.

Faulty fuses can cause trouble for you and your customers by failing to protect — or by blowing needlessly . . . but, with BUSS fuses you can be sure of dependable protection under all service conditions.

Every BUSS fuse you sell or install is tested in a sensitive electronic device. Any fuse not correctly calibrated, properly constructed and right in all physical dimensions is automatically rejected.

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Protect yourself against faulty fuses causing trouble by relying on BUSS fuses. To meet service needs, there is a complete line of BUSS fuses available.

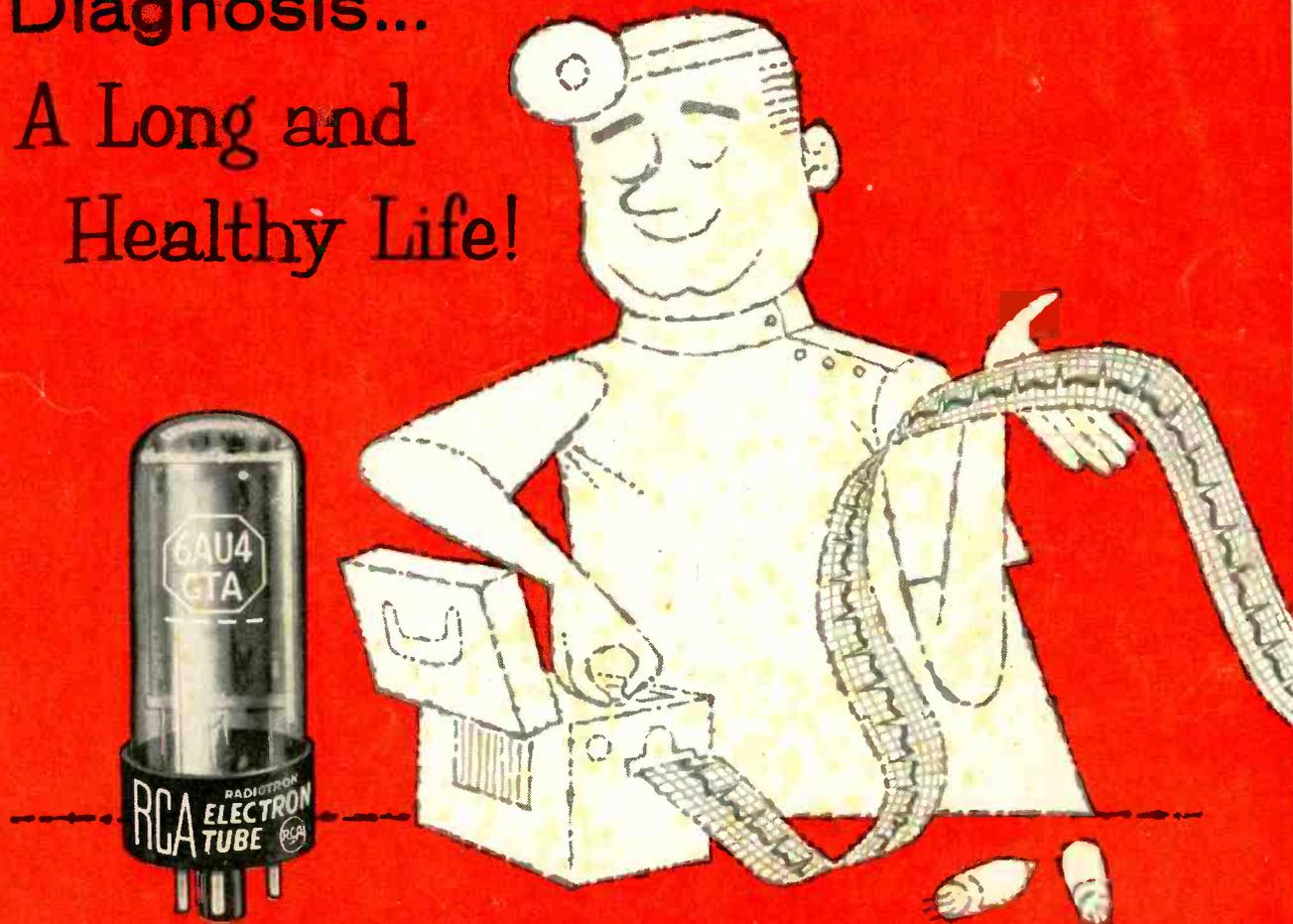
For more information on the complete line of BUSS and FUSETRON Small Dimension Fuses and Fuseholders . . . Write for bulletin SFB. Bussmann Mfg. Division McGraw-Edison Co. University at Jefferson, St. Louis 7, Mo.

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



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...for the **RCA-6AU4-GTA**

A "diagnosis" of the RCA-6AU4-GTA shows why it gives top performance for extended hours of operation.

Tube life is increased through improved heat dissipation, achieved with an increased bulb area, new plate shape, and the use of special "clad" plate material. *Early-hour failure is minimized* by elaborate precautions against internal contamination during production. *Borderline tubes are eliminated* through emission tests at extremely low heater voltage, and by aging and life tests at increased plate dissipation. The result is a tube with an unusual ability to resist plate-to-cathode arcing and internal breakdowns.

RCA-6AU4-GTA—*preferred* for TV damper circuits by original equipment designers—is a tube you can rely upon for replacement purposes. Do the same as *all* experienced TV technicians do, always ask your RCA Tube Distributor for RCA tubes!



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