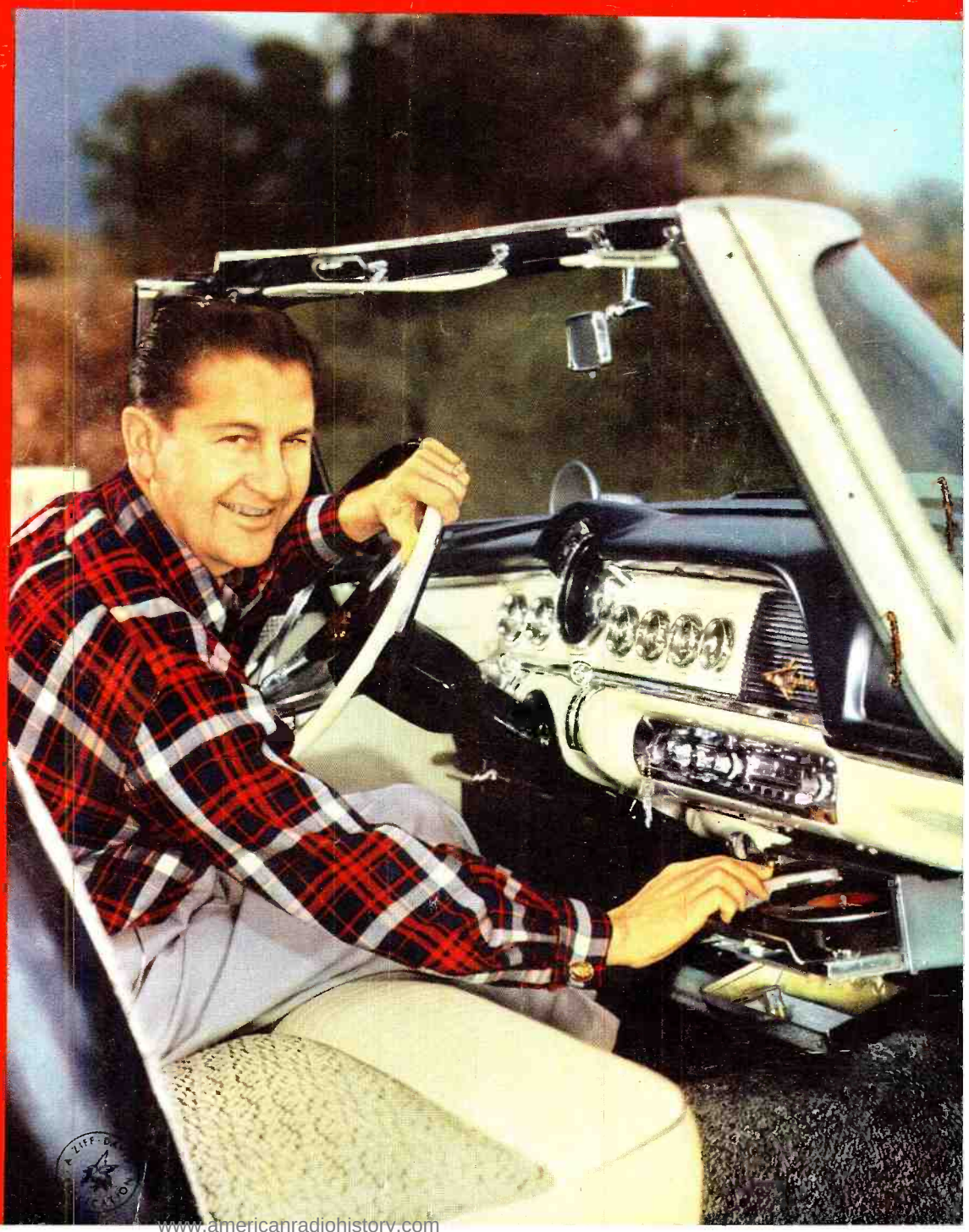
A GEIGER COUNTER FOR HOME CONSTRUCTION

RADIO & TELEVISION NEWS

APRIL
1956
35 CENTS
in U.S. and Canada

World's Leading Electronics Magazine

IN THIS ISSUE



"2300 RAYTHEON TUBES PERFORMANCE TESTED WITHOUT ONE FAILURE"

RAYTHEON

RAYTHEON RECEIVING TUBES for replacement pass every test for performance and quality at HOWARD W. SAMS & CO., INC.

The results of this thorough, impartial test of regular production Raytheon Tubes provide potent evidence that Raytheon Tubes are tops in quality and performance. Here's what the report says:

"Raytheon tubes were substituted in basic chassis, representing several hundred models. In these tests 2300 Raytheon tubes were tried in 230 different circuit applications with no apparent tube performance failure. Conditions were arranged to simulate fringe area as well as prime signal area, when testing tube types in RF, IF, Video, Sync, Vertical Oscillator and Horizontal Oscillator Circuits. Low Voltage Rectifiers, High Voltage Rectifiers, Vertical and Horizontal Oscillator, and Horizontal Output Tube types were also checked under low line voltage conditions. No types were found incapable of providing satisfactory results in these circuits, after adjustments of service controls."

What more can we add to this conclusive proof that Raytheon Receiving Tubes are truly RIGHT . . . For SOUND and SIGHT.

RAYTHEON MANUFACTURING COMPANY

Receiving and Cathode Ray Tube Operations

Newton, Mass. • Chicago, Ill. • Atlanta, Ga. • Los Angeles, Calif.

Raytheon makes all these { Receiving and Picture Tubes, Reliable Subminiature and Miniature Tubes, Semiconductor Diodes, Power Rectifiers and Transistors, Nucleonic Tubes, Microwave Tubes

RAYTHEON®

Excellence in Electronics

Visit Raytheon Booth No. 4 at the Electronics Parts Distributors Show—May 21-24

RADIO & TELEVISION NEWS is published monthly by Ziff-Davis Publishing Company, William B. Ziff, Chairman of the Board (1946-1953), at 64 E. Lake St., Chicago 1, Ill. Entered as second-class matter July 21, 1948, at the Post Office, Chicago, Ill., under the act of March 3, 1879. Authorized by Post Office Department, Ottawa, Canada, as second-class matter. SUBSCRIPTION RATES: Radio & Television News—one year U. S. and possessions, and Canada $4.00; Pan-American Union countries $4.50; all other foreign countries $5.00.

COVER PHOTO: Lawrence Welk, band-leader-star of "Lawrence Welk Show" on ABC-TV, listens to one of his own recordings on his "Highway Hi-Fi" record player in his 1956 Dodge. His TV show is sponsored by Dodge Div. (Ektachrome by Peter J. Samerjan)

First in radio-television-audio-electronics

RADIO & TELEVISION NEWS

Reg. U. S. Pat. Off.

Average Net Paid Circulation 235,788

Radio News Trademark Reg. U. S. Pat. Office • Television News Trademark Reg. U. S. Pat. Office.

CONTENTS

APRIL, 1956

DEPARTMENTS

ZIFF-DAVIS PUBLISHING COMPANY
WILLIAM B. ZIFF (1898-1953) FOUNDER
Editorial and Executive Offices
366 Madison Ave., New York 17, N. Y.
VOLUME 55 • NUMBER 4

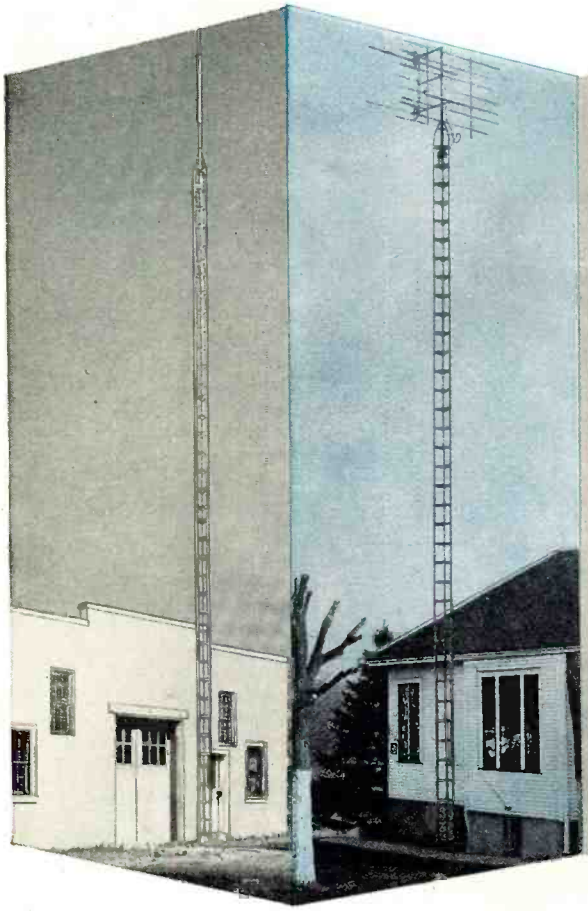
Member Audit Bureau of Circulations

SUBSCRIPTION SERVICE: All communications concerning subscriptions should be addressed to Circulation Dept., 64 E. Lake St., Chicago 1, Ill. Subscribers should allow at least four weeks for change of address. Include your old address as well as new—enclosing, if possible, an address label from a recent issue of this magazine.

CONTRIBUTIONS: Contributors are advised to retain a copy of their manuscripts and illustrations. Contributions should be mailed to the New York Editorial Office and must be accompanied by return postage. Contributions will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Any copy accepted is subject to whatever adaptations and revisions are necessary to meet the requirements of this publication. Payment covers all author's, contributor's, and contestant's rights, title, and interest in and to the material accepted and will be made at our current rates upon acceptance. All photos and drawings will be considered as part of the material purchased.

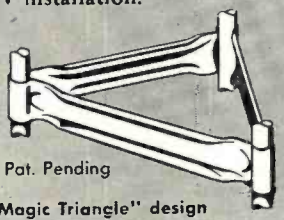
these 3 **hot dipped galvanized** towers are exclusive with ROHN

No guying needed to 40—50—or 60 feet! Guyed heights safely up to 200—300 feet!



NO. 6 TOWER

Features unexcelled 12½" equilateral "magic triangle" design with electric welding throughout. Self-supporting to 50', the Rohn No. 6 is ideal for home TV installation.



Pat. Pending

"Magic Triangle" design utilizes mass production machines —means sturdier towers, uniformity and lower costs!

"PACKAGED" TOWER

Constructed for ease in shipping and storage. A 48' tower comes in six 8' sections bound together in a single 8' x 20" package! Self-supporting and available in 24' to 64' sizes.

and now, a new and **completely hot-dipped galvanized,** heavy duty

NO. 40 COMMUNICATIONS TOWER

For extreme heights and communication purposes of all kinds, the Rohn No. 40 gives you strength and durability on which you can depend. The time tested and proven equilateral triangle design using extra heavy duty tubing and corrugated steel cross-bracing is utilized in this new Rohn Tower. The No. 40 is structurally sound so that you can install it for heights up to 300'; and is preferred for lesser heights when considerably greater strength is required because of excessive wind or antenna loading, etc. Check this tower for your requirements of this type. You'll find it just can't be beat, neither structurally nor price-wise!

Note: For lesser heights, use the Rohn No. 20 or No. 30 Tower . . . for experimental operation, use the Rohn "Fold-Over" Tower.

All Rohn Towers are quickly erected- shipped in easy-to-handle sections; and, Rohn-Designed accessories are available with each tower.

Check the complete line of Rohn Towers, including Roof Towers, Masts and Tubing . . . plus a full line of tower and TV installation products such as bases, house mounts, brackets, service tables, guy brackets and rings plus dozens of other items.

ROHN *Manufacturing Company*

116 LIMESTONE, BELLEVUE
PEORIA, ILLINOIS

MAIL THIS COUPON FOR FREE LITERATURE!

Rohn Manufacturing Company
116 Limestone, Bellevue
Peoria, Illinois

Gentlemen: Please rush me complete details on the full line of Rohn Towers and Accessories.

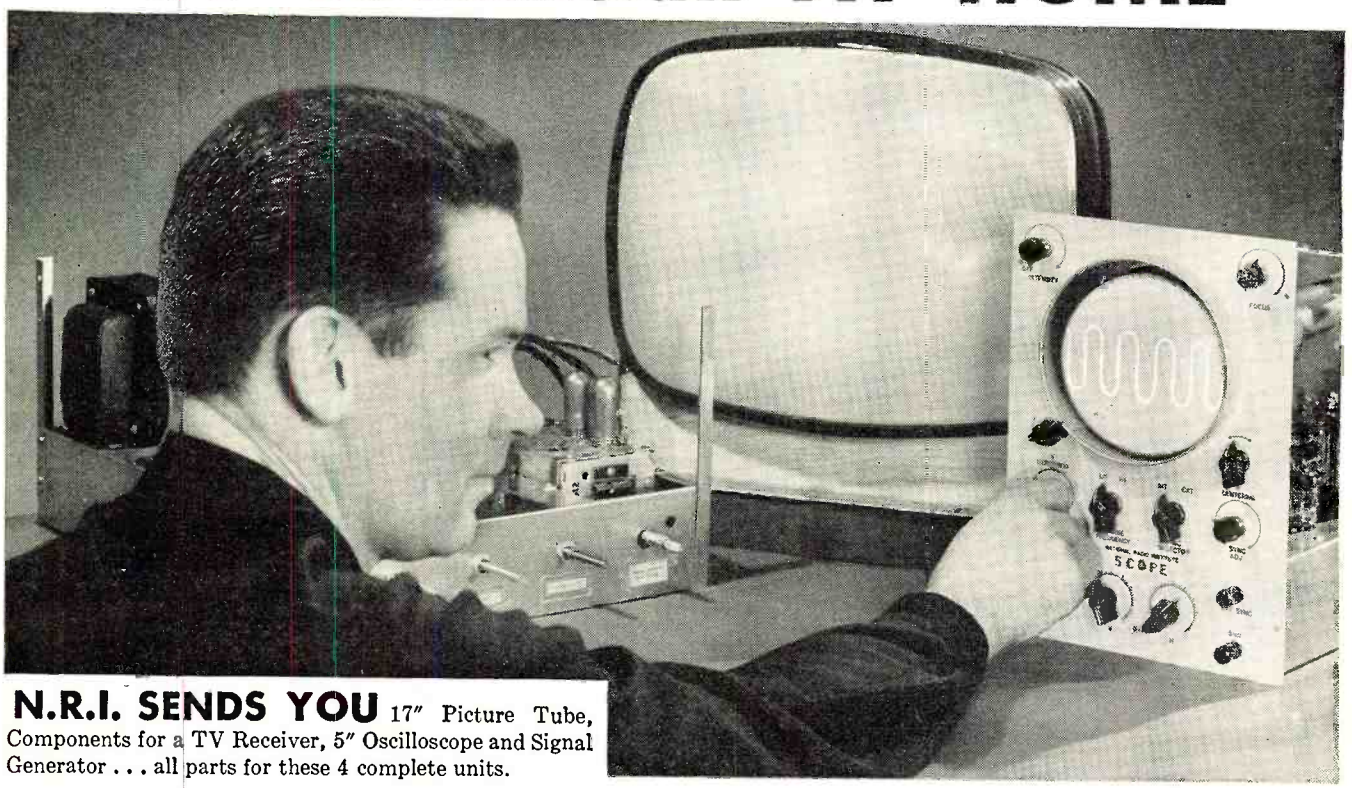
Firm_____

Name_____ Title_____

Address_____

City_____ State_____

Lea n o be a PROFESS ONAL TV Technician AT HOME



N.R.I. SENDS YOU 17" Picture Tube, Components for a TV Receiver, 5" Oscilloscope and Signal Generator . . . all parts for these 4 complete units.

N.R.I. All-Practice Method Trains You in Spare Time to Fix TV Sets Quickly, Correctly, with Confidence

How many times have you day-dreamed of being your own boss? Or thought about what you could do if you were the man who made the decisions. The man who knows the answers—the well trained Technician—enjoys the prestige, gets the better jobs, higher pay.

It's time to stop dreaming. Here is the learn-by-practice training that shows you the way to be the boss, to earn top pay. Television Servicing needs well trained men.

Yes, if you have a basic knowledge of radio and electronics you can make some Television repairs some of the time. You can make some simply by trial and error. But sooner or later you will face Television Service problems you cannot solve. All the diagrams in the world won't help you then. And you can't get the training you need while customers wait.

NRI Is Oldest and Largest Home Study Radio-TV School

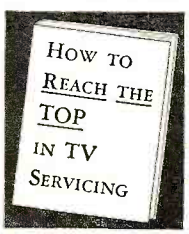
Forty years experience, and the record and reputation of NRI, back up this learn-by-doing Professional TV Servicing course. Instead of reading about TV problems, you build and conduct experiments on circuits in a TV receiver. Because you learn methods, "tricks of the trade" used and proved by top TV Servicemen, you recognize and repair defects quickly and accurately. Learn to fix any set . . . any make, any model . . . with confidence. Earn a Diploma that certifies to your training.

Television Is Forging Ahead with More Sets, More Color, Hi-Fi

TV Servicing has only started to grow in importance. New sets, portables, color TV, constant changes, improvements make this a genuine "gold rush" for the man who is trained and ready. Know . . . so you can get ahead. Learning how to build and use a professional-type 5" Oscilloscope is part of the practice you get in this NRI All-Practice Training. Installing front-end channel selector strips, distinguishing between faulty blocking oscillator or a defect in the sync circuit, etc., are just a few of the important TV Servicing facts you learn through practice.

Not for Beginners

Here is a course for men who know basic theory, either from Radio or TV Servicing experience or planned training, but realize the need for more knowledge to be able to forge ahead. Get details of this course now. Mail coupon today. Address: Professional TV Servicing, National Radio Institute, Washington 9, D. C.



Send for FREE BOOK

NATIONAL RADIO INSTITUTE
Dept. 6DET Washington 9, D.C.

Please send FREE copy of "How to Reach the Top in TV Servicing." I understand no salesman will call.

Name..... Age.....

Address.....

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

APPROVED MEMBER, NATIONAL HOME STUDY COUNCIL

For the RECORD

BY THE EDITOR

EARTH SATELLITES

ELECTRONICS will again play a major role in an outstanding scientific achievement when the first earth satellite is launched in the latter part of 1957. Based on the evidence to date, this event will be more extensively publicized than any other scientific development in the history of man. Radio and television coverage (undoubtedly in color!) will be extended to all corners of the globe where facilities are available, and newspaper coverage will be universal. The actual launching will undoubtedly be witnessed by more individuals, *via* TV, than any other event since the world began. Excitement is already at a fever pitch, and is building up constantly.

Although exact details of the satellite and launching techniques have not as yet been established, enough is known to permit fairly accurate speculation. Launching techniques, fuels, rocket motors, and the like have already been extensively tested in connection with the military V2 rocket program, and performance can be predicted with considerable accuracy.

It is probable that the first satellite will be launched by means of a three-stage rocket. The first two stages will be required to propel the satellite to the desired height, perhaps 200 to 400 miles, and the third will give it the necessary orbital velocity (about 18,000 miles per hour), after it has been given the proper heading.

Other launching techniques are being investigated, and may receive a trial during one of the ten or so launchings which will take place during 1957 and 1958. For example, it may be possible for the assembly to be lifted by balloon up to a height of about 20 miles and the rocket then fired. This technique would have a tremendous advantage in that the rocket fuel requirements would be greatly lessened. A large proportion of the fuel in a surface launching would be expended in accelerating the assembly through the dense lower atmosphere. By using this technique, it might even be possible to get by with a two-stage rocket.

Rocket fuels have been intensively investigated, but many of the results have been cloaked in military secrecy. However, enough is known to speculate that the first two stages of the rocket will be powered by liquid fuels, with a solid propellant probably being employed for the final stage.

The actual size of the satellite will be comparable to a basketball, and the weight somewhere in the neighborhood of 30 pounds. Shape will probably be spherical, but may be elongated somewhat to fit in the nose of the final rocket. It will be crammed with various kinds of instrumentation, including a telemetering system to transmit information back to the earth. Some of the measurements to be made will include ultraviolet and x-ray intensities of the sun's rays, cosmic ray intensity and direction, and density of the atmosphere. Many other measurements are contemplated, and it seems reasonable to assume that several different combinations of instruments will be employed in the various satellites.

Instrumentation and telemetering equipment of this nature will require power for operation. Most likely, the power supply will consist of mercury batteries as they have a high energy-to-weight ratio. However, this energy must be carefully conserved, so the telemetering signal will probably be transmitted intermittently — perhaps on signal from a ground station. It has been estimated that an r.f. power output of 1 watt from the satellite should give an adequate signal over a reasonable area of the earth's surface.

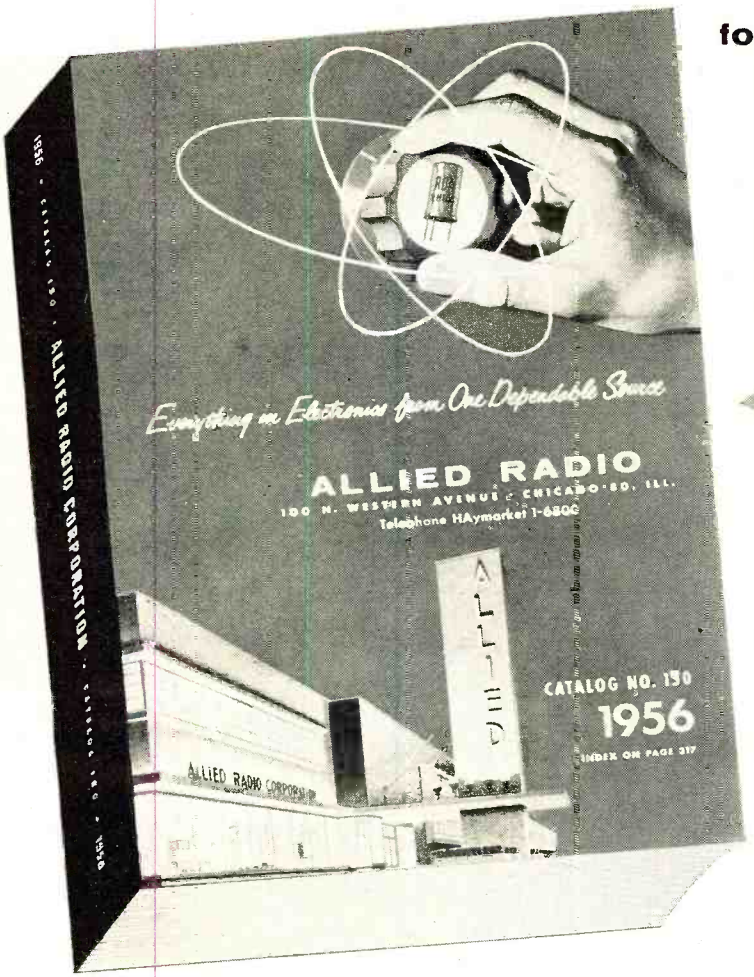
The advent of the sun battery poses the possibility that power for the satellite may be obtained from such a source. If this could be done, information could be transmitted continuously, even if the satellite remained aloft for a year or more. The possibility of using transistors to reduce weight and power consumption must not be overlooked.

It appears likely that the first launching will take place at the Air Force missile test base at Cape Canaveral, Florida. This base is already equipped with some of the necessary instrumentation for launching and tracking, and the direction of travel would be such that the rocket motors used in the launching and propulsion operations would not fall into populated areas when they are dropped. This is, of course, a matter of vital concern.

There are a great many more matters which could be discussed, such as possible orbits, altitude, probable life, visibility, etc. However, we wanted to acquaint you here with a few of the suppositions regarding this project, in order to indicate the important role that electronics will play. Here, indeed, is a truly fascinating event, and we in the electronics industry are in on the ground floor. . . . . O. R.

free ALLIED'S 1956 value-packed 324-PAGE CATALOG

the only COMPLETE catalog for everything in TV, Radio, Hi-Fi and Industrial Electronics



Get ALLIED'S 1956 Catalog—it's *complete*, up-to-date—324 pages packed with the world's largest selection of quality electronic equipment at lowest, money-saving prices. Get *every* buying advantage at ALLIED: fastest shipment, expert personal help, lowest prices, assured satisfaction. Send today for your FREE copy of the big 1956 ALLIED Catalog.

World's Most Complete Stocks

- Latest Hi-Fi Systems and Components
- P.A. Systems and Accessories
- Recorders and Supplies • TV Tubes, Antennas, Accessories • Amateur Receivers, Transmitters, Station Gear
- Specialized Industrial Electronic Equipment • Test and Lab Instruments
- Huge Listings of Parts, Tubes, Transistors, Tools, Books

Featuring Super-Value Knight-Kits—
top quality electronic equipment in precision-designed kit form
BUY DIRECT AND SAVE

EASY-PAY TERMS

Use our liberal Easy Payment Plan—only 10% down, 12 months to pay—no carrying charges if you pay in 60 days. Available on Hi-Fi and P.A. units, recorders, TV chassis, test instruments, kits, Amateur gear, etc.

HI-FI SPECIALISTS

To keep up with the latest and best in High Fidelity, look to ALLIED. Count on us for *all* the latest releases and largest stocks of Hi-Fi equipment. We specialize, too, in TV supply—and are foremost in the field of Builders' Kits.

ALLIED RADIO
World's Largest Electronic Supply House

free — **send for the leading electronic supply guide**

ALLIED RADIO CORP., Dept. 1-D-6
100 N. Western Ave., Chicago 80, Ill.

☐ Send FREE 324-Page 1956 ALLIED Catalog.

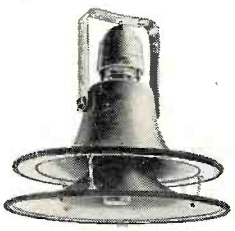
*Name*_____

*Address*_____

*City*_____ *Zone*_____ *State*_____

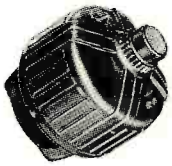
In one profitable package University offers everything in loudspeakers for sound reinforcement... and public address—

REFLEX TRUMPETS

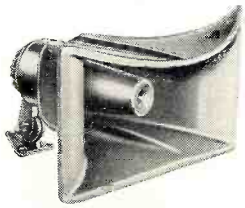


RADIAL PROJECTORS

WIDE-ANGLE HORNS



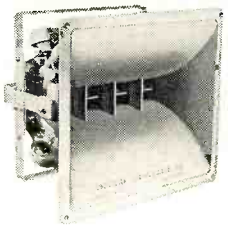
HIGH EFFICIENCY DRIVER UNITS



PAGING, TALK-BACK SPEAKERS

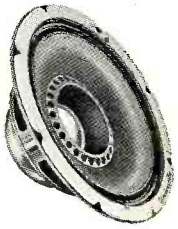
OUTDOOR MUSICASTING

EXPLOSION-PROOF SPEAKERS

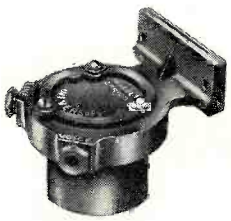


HIGH POWER SPEAKERS UP TO 720 WATTS

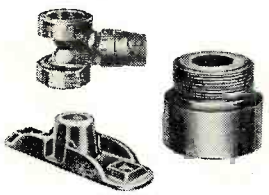
SUBMERGENCE-PROOF SPEAKERS



WIRED MUSIC SYSTEMS



WEATHERPROOF LINE-MATCHING TRANSFORMERS



ADAPTORS FOR DIVERSIFIED APPLICATIONS

People have come to expect the highest standard of quality in a product bearing the University label.

This kind of public acceptance is something that University has consistently worked to achieve. *First*—by backing you up with an advertising campaign that's making University a "buy-word." *Second*—by building the kind of quality into all our products that ensures your customers' satisfaction.

Yes, everyone is finding out, to his profit, that *"University sells on sound!"*

For information regarding products or technical data, write to Desk L6.

For an exciting preview of new products visit us at the **May Parts Show**, Conrad Hilton Hotel, Chicago, **Rooms 502 & 509 & Booth 874**, May 21-24.

University LOUDSPEAKERS, INC. 80 South Kensico Avenue, White Plains., N. Y.

5280 feet on every 10½" reel of PLUS 100

Thanks to its extra thin—extra strong magic Mylar* base, Soundcraft Plus 100 magnetic recording tape on a single 10½ inch reel gives you 5280 feet of clean, rewarding *professional* sound. Even on a conventional 7 inch reel, you take advantage of 2400 feet . . . the recording length that puts you on a par with the professionals.

With a 5 inch reel, Plus 100 gives you a full 1200 feet of recording pleasure.

The tape recorder expert who really *knows* his equipment will insist on Soundcraft Plus 100 magnetic recording tape—the EXTRA, *EXTRA* long-play quality tape. Ask for it wherever you buy hi-fi equipment.

*DuPont Polyester Film

FOR EVERY SOUND REASON

REEVES SOUNDCRAFT CORP.

10 East 52nd Street, New York 22, N. Y.

Spot Radio News

*** Presenting latest information on the Radio Industry.**

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

THE BOILING V.H.F.-U.H.F. debate between members of the Senate Commerce Committee and the Commission, that has rocked Washington for months, finally hit the hearing-room stage a few weeks ago, where it was hoped the problem would be resolved in a quiet way. But the opening session gave little evidence that formal niceties would obtain as the general tenor of the investigation.

No sooner had the FCC's headman begun to testify than he was hit by a barrage of stinging queries by Senator Pastore, who bluntly told the Commissioner that "we've got to act fast and get the allocation situation really straightened out."

Explaining that the job was a tough one, the Commission's spokesman reviewed the reasons why solutions were so difficult to find. On the high bands, it was recognized. he said. that broadcasters were having a tough time getting an audience, programming, and ad revenues, and a number of methods have been studied to find the answer. Specifically, added the chieftain, the FCC had examined proposals in five separate communities for channel reassignments, which would confine local channels to a single band; the u.h.f. band. In doing so, the Commission hoped to learn whether the public interest could be served by the use of the selective de-intermixture technique, the Senators were told. Unfortunately, the favorable answers did not appear in the demixing idea, and so, said the Commissioner. it was concluded de-intermixture did not offer a positive solution. The majority of the Commission, it was said, felt that there was serious doubt that scattered de-intermixture, adopted without reference to the general nation-wide problem, could provide significant lasting improvement.

To cope with the high cost of local programming, the engineering section of the Commission suggested satellites; stations that would be permitted to operate without their own locally-originated programs or local studios.

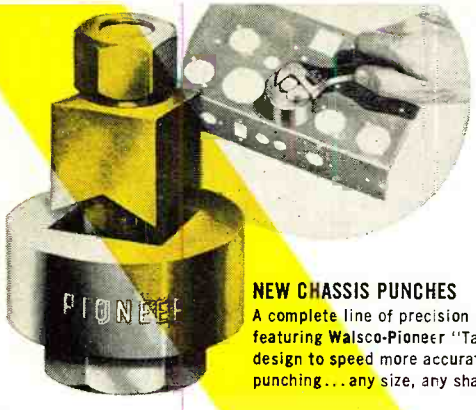
It was also believed, continued the Commissioner, that boosters would alleviate the situation; stations operating with limited power on the same channel as the main transmitter of ultra-high stations. Initially, the committee was told, the proposal was aimed primarily at reducing disparities between u.h.f. and v.h.f. service in rough terrain; later the Commission was asked to allow the very-high stations to boost their signals, too.

It was further believed that it would be practical to authorize low-power booster operation, so that perhaps existing boosters could continue operation without making major changes. But, engineering analysis convinced the Commission, the Senate committee was told, that such a move would be dangerous. For boosters are essentially squeeze-in channels, and as such derogate from the planned approach of the allocation rules. Operating as they do on the same channel as the parent station and usually from high elevations, there is no way, at least at the present, the Commission's engineers reported, of insuring that existing stations will be protected from interference. Although the actual coverage of boosters may be confined to a few miles, their signals, it has been found, can easily interfere with reception of signals within the normal coverage area of regular TV broadcast stations, as far as fifty miles away.

The answer may be in a new type of station, a *translator,* the chairman reported. As distinguished from boosters, translators pick up the signal from a parent station and "translate" the program to a new frequency before rebroadcasting. Thus. it is believed, the translator type of operation has the advantage of being able to select a frequency least likely to cause interference in a particular area. As a result of experimental studies, the Commissioner added, it has been possible to reduce operating requirements to the barest minimum consistent with dependable service and protection to other services.

It is proposed to confine translator stations to the channels between 70 and 83, and thus reduce the need for protection spacings with existing stations, because most u.h.f. stations operate on the lower channels. In addition, by confining translator operations to one portion of the u.h.f. band, it should be possible to develop and produce moderately priced equipment, that might sell for less than a thousand dollars.

SEVERAL MEMBERS OF THE SENATE Interstate and Foreign Commerce Committee felt that the Com-



NEW CHASSIS PUNCHES
A complete line of precision punches, featuring Walsco-Pioneer "Taper Wedge" design to speed more accurate hole punching... any size, any shape

NEW TEKNI-LABELS
A complete line of handy title and design decals for speedy labeling of electronic equipment

NEW PHONO-RECORDER DRIVES & BELTS
The first, complete line of vital replacements for all major phonographs and tape recorders. Packaged in convenient kits or sold separately

HARDWARE & SERVICE AIDS
A complete line of essential small component hardware, packaged in reusable plastic boxes Dial cord, feed-thru bushing, and other valuable service aids

CHEMICALS
A complete line of chemical specialties, including cements, solvents, and contact cleaners in bottles and handy spray cans.

If it makes servicing faster, easier, more profitable... you'll find it in the

COMPLETE WALSCO LINE

Walsco
ELECTRONICS CORPORATION
A SUBSIDIARY OF Telautograph CORPORATION

3602 Crenshaw Blvd.
Los Angeles 16, Calif.

Canadian Representative:
Atlas Radio Corp., Ltd.
50 Wingold Ave., Toronto, Canada

Overseas Representative:
Ad Auriema, Inc.
89 Broad Street, New York 4, N. Y.

ALIGNMENT TOOLS
A complete line of tools for every servicing job.

mission required an assist from industry, using the facilities of the 12-man *ad-hoc* committee appointed last June. So strongly did these Senators feel about this, that the engineering group was asked to work out an exploratory competitive allocations plan that could serve as a tool for testing various proposals and perhaps also as a practical basis for arriving at recommendations to be made to the complete Senate committee.

Among those who have been named to the *ad-hoc* committee are: William S. Duttera, staff allocations engineer for *NBC;* Haraden Pratt, IRE secretary; C. M. Jansky, Washington consultant; Dr. Allen B. DuMont; Frank Marx, engineering vice-president of *ABC;* Curtis Plummer, chief of the FCC broadcast bureau; Ralph Harmon, *Westinghouse* engineering vice-president; T. A. M. Craven, also a Washington consultant and former FCC chief engineer and commissioner; and William S. Lodge, *CBS* engineering vice-president.

FORWARD SCATTER, the recently discovered mode of radio propagation, believed to result from small inhomogeneities, due to turbulence in the atmosphere, which scatter radio waves in all directions, but predominantly forward, recently received an intensive experimental and theoretical review by the Bureau of Standards, based on their own investigation of this interesting subject.

Noting that there are two types of scatter, ionospheric and tropospheric, the Bureau's experts said that ionospheric scattering takes place in the lower part of the ionosphere; a region of electrified particles 40 to 200 miles above the surface of the earth. Tropospheric scattering occurs in the part of the atmosphere that lies below the ionosphere.

It has been found that tropospheric forward scatter appears to be useful for transmission over distances up to 600 miles, such as in air-to-ground communications between a plane in flight and its control tower, at frequencies from 100 to at least 10,000 megacycles. Ionospheric forward scatter permits communication in the range from 25 to about 60 mc., and over distances extending from approximately 600 to 1200 miles.

Three major factors seem to contribute to the ionization of the *E* region, which causes ionospheric scatter: direct solar radiation, corpuscular radiation, and meteors.

In one series of measurements over an arctic path (Anchorage to Barrow, Alaska), correlation with magnetic activity indicated a rise in signal strength at the receiver with increasing magnetic activity at the midpoint (Fairbanks). One explanation is that the contribution of the corpuscular radiation factor at these times is high; such radiation, presumably of solar origin, consists of atomic particles of matter, and the particles take from 18 to 30 hours to reach the earth from

(*Continued on page* 169)

Electronics Boom Seen

Need For Television Technicians To Rise

Industry Warned About Shortage Of Trained Men

TV SALES SET NEW RECORD

Sylvania Head Expects Huge Electronic Gains

Transistor Radios Developed

RCA HEAD PREDICTS SALES BOOM FOR COLOR TV SETS

VETERANS - - NON-VETERANS

Get Into The Field That's Making Headlines

L. C. Lane, B.S., M.A.
President, Radio-Television Training Association.
Executive Director, Pierce School of Radio & Television.

All over the nation the Television-Radio-Electronics industry is making News — News that means opportunity for YOU. You can cash in on the headlines.

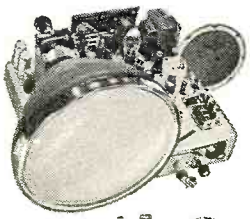
I WILL TRAIN YOU AT HOME FOR A TOP-PAY JOB IN TELEVISION

I will prepare you for a spot in America's fastest-growing industry. You can become a trained technician in your spare time without giving up your present job or social life. No experience needed.

LEARN BY DOING

Combination Voltmeter-Ammeter-Ohmmeter

C-W Telephone Transmitter



Super-Het Radio Receiver

AF-RF Signal Generator

Public Address System

As part of your training I give you the equipment you need to set up your own home laboratory and prepare for a top-pay job or set up your own business. You build and keep an Electromagnetic TV RECEIVER designed and engineered to take any size picture tube up to 21-inch. (10-inch tube furnished. Slight extra cost for larger sizes.) . . . also a Super-Het Radio Receiver, AF-RF Signal Generator, Combination Voltmeter-Ammeter-Ohmmeter, C-W Telephone Transmitter, Public Address System, AC-DC Power Supply. Everything supplied, including all tubes.

STUDY NEWEST DEVELOPMENTS

My training covers all the latest developments in the fast-growing Television-Radio-Electronics industry. You learn about FM — RADAR — COLOR TV — TRANSISTORS — PRINTED CIRCUITS, etc.

CHOOSE FROM THREE COMPLETE COURSES

covering all phases of Radio, FM and TV

1. Radio, FM and Television Technician Course — no previous experience needed.
2. FM-TV Technician Course — previous training or experience in radio required.
3. TV Cameraman and Studio Technician Course — advanced training for men with Radio or TV training or experience.

EXTRA TRAINING IN NEW YORK CITY AT NO EXTRA COST!

After you finish your home study training in Course 1 or 2 you can have two weeks, 50 hours, of intensive Lab work on modern electronic equipment at our associate resident school, Pierce School of Radio & Television. THIS EXTRA TRAINING IS YOURS AT NO EXTRA COST WHATSOEVER!

FCC COACHING COURSE

Important for BETTER-PAY JOBS requiring FCC License! You get this training AT NO EXTRA COST! Top TV jobs go to FCC-licensed technicians.

VETERANS

My School fully approved to train Veterans under new Korean G. I. Bill. Don't lose your school benefits by waiting too long. Write discharge date on coupon.

EARN WHILE YOU LEARN

Almost from the very start of your course you can earn extra money by repairing sets for friends and neighbors. Many of my students earn up to $25 a week . . . pay for their entire training with spare time earnings . . . start their own profitable service business.

FREE I'll send you my new 40-page book, "How to Make Money in Television-Radio-Electronics," a Free sample lesson, and other literature showing how and where you can get a top-pay job in Television.

MAIL THIS COUPON TODAY!

Mr. Leonard C. Lane, President
RADIO-TELEVISION TRAINING ASSOCIATION
Dept. T-4C, 52 East 19th Street, New York 3, N. Y.

Dear Mr. Lane: Send me your NEW FREE BOOK, FREE SAMPLE LESSON, and FREE aids that will show me how I can make TOP MONEY IN TELEVISION. I understand I am under no obligation.

(PLEASE PRINT PLAINLY)

Name_____ Age_____

Address_____

City_____ Zone____ State_____

I AM INTERESTED IN:

- ☐ Radio-FM-TV Technician Course
- ☐ FM-TV Technician Course
- ☐ TV Cameraman & Studio Technician Course

VETERANS! Write discharge date

NO OBLIGATION

Radio Television Training Association

52 EAST 19th STREET • NEW YORK 3, N. Y.

Licensed by the State of New York • Approved for Veteran Training

PRODUCTION TECHNIQUES:

for the manufacturing of High Reliability Capacitors

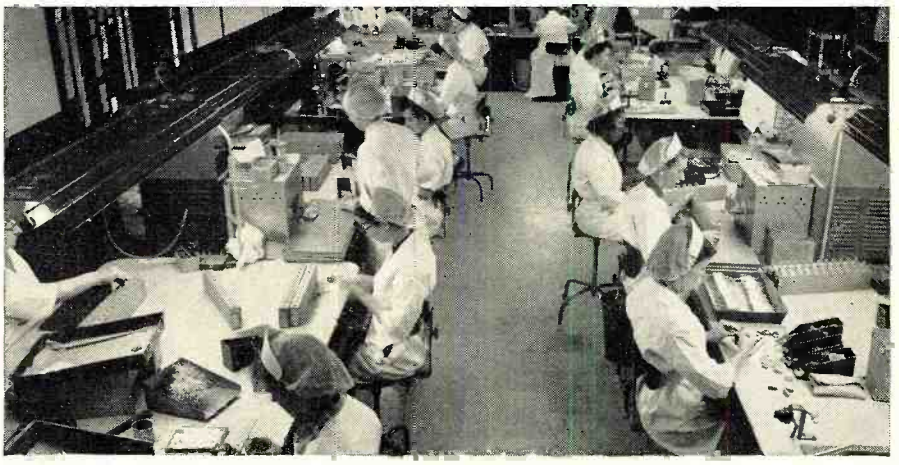
To produce capacitors free from any possibility of latent defects, for use in the most critical applications, the Sangamo Electric Company has recently intensified its high reliability program of fabrication and inspection methods.

Incoming materials are rigidly inspected to meet stringent high reliability standards and are stored in areas where temperature, humidity and dust are controlled at all times.

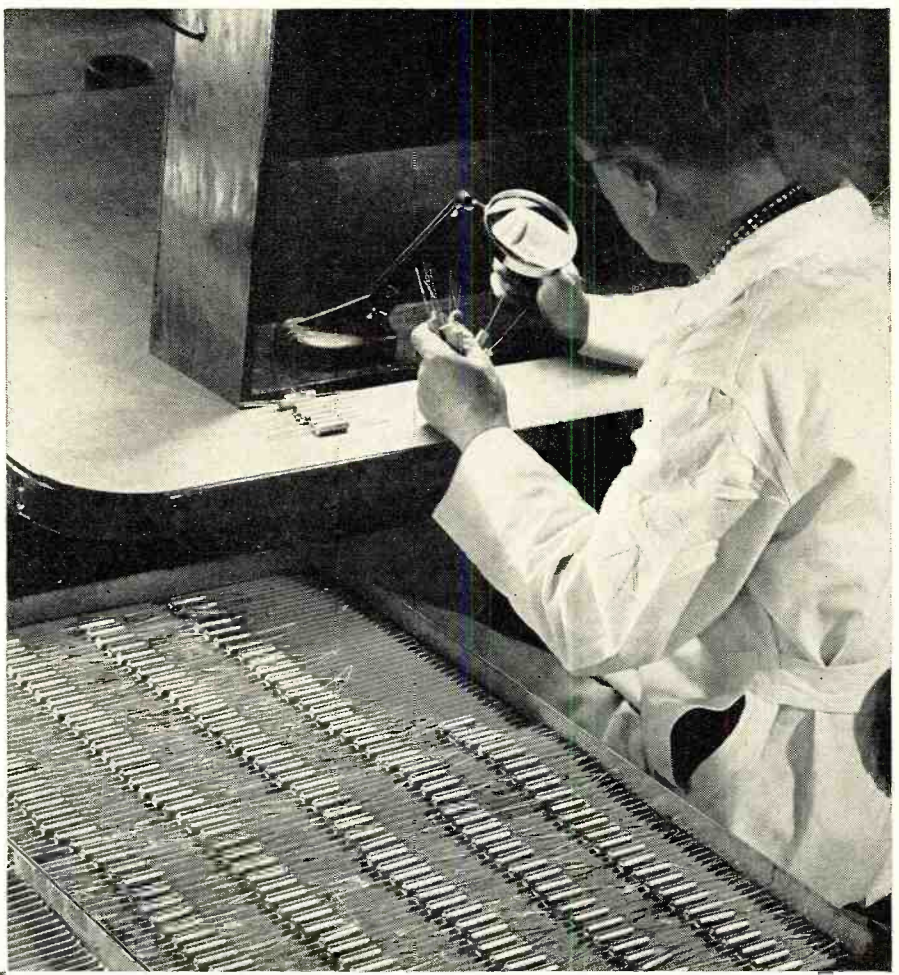
Complete production histories are kept on the basis of small capacitor lots. X-raying of individual units, heat tests, vibration tests, altitude tests, and total destruction tests of a given percentage of all finished units assure components with an extremely low AQL. Testing facilities and resultant performance characteristics are far in excess of military specifications. Specify these high reliability capacitors for your critical applications.

SANGAMO ELECTRIC COMPANY
MARION, ILLINOIS

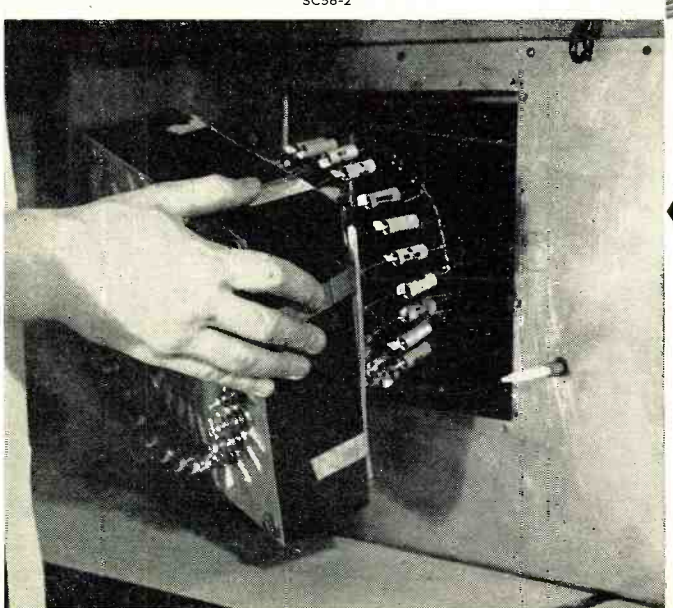
SC56-2



Separate facilities are maintained for the exclusive processing and manufacture of high reliability capacitors. Only specially trained, highly skilled operators, who wear special clothing to prevent any possible source contamination, work here.

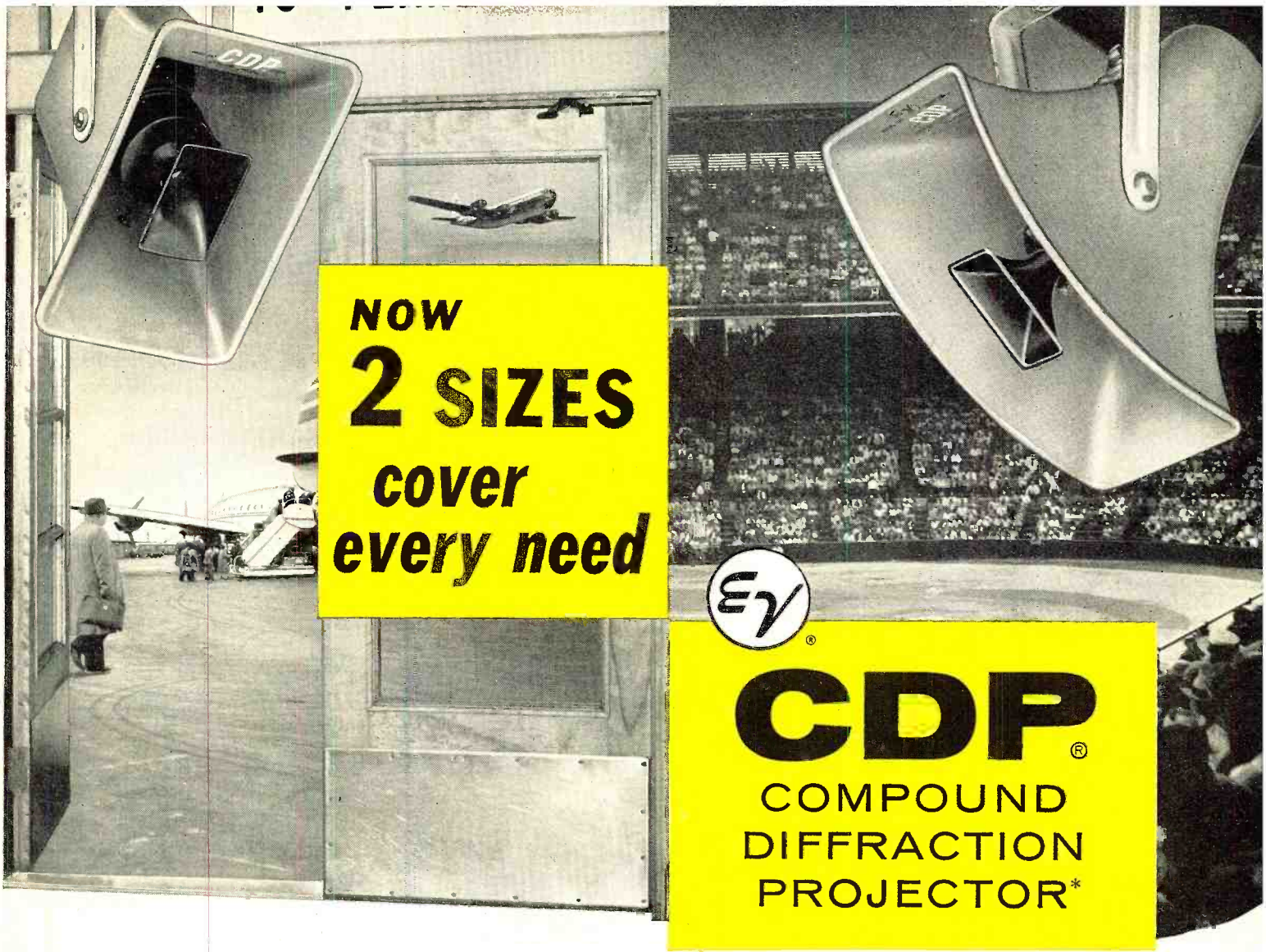


Oil-filled capacitors are subject to vacuum under elevated temperatures, then are individually examined to insure complete hermetic seal.



High temperature test ovens are used to check insulation resistance of Sangamo high reliability capacitors under sustained temperatures of 125° C.

This vibration testing machine brutally punishes Sangamo high reliability capacitors at accelerations up to 10 G's to determine their ability to resist vibration without damage to leads or elements.



NOW 2 SIZES cover every need

E-V®

CDP®

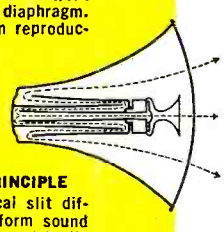
COMPOUND DIFFRACTION PROJECTOR*

NO DEAD SPOTS NO HOT SPOTS

Coverage is clear, penetrating, uniform, OFF AXIS and ON AXIS

COAXIAL WIDE-RANGE DESIGN
Two coaxially mounted diffraction horns work from opposite sides of a single diaphragm. Each horn is designed for optimum reproduction within its own range.

PHENOMENAL POLAR PATTERN
Smooth, peak-free, wide-range response with over 120° sound distribution at all frequencies up to 10,000 cps.



OPTICAL SLIT DIFFRACTION PRINCIPLE
Uses acoustic application of optical slit diffraction for perfected smooth, uniform sound dispersion over entire listening area, virtually independent of frequency. No pin-pointing effect.

Unit may be mounted horizontally or vertically to vary polar pattern for desired dispersion.

TOUGH—PRACTICALLY INDESTRUCTIBLE
Molded of fiberglass for improved acoustic properties and extra strength. Weatherproof, blast-proof, splash-proof.

Success of the CDP is in the record of public address installations. Now in addition to the "848," E-V brings you the new, smaller, lower-cost "847." Both now make it easy to take advantage of superior CDP wide-range performance for the smallest paging job as well as the largest stadium application, indoors and outdoors. Unique coaxial design, with its two specialized horn sections, provides smooth, extended high-frequency response and unusual low-frequency balance. Diffraction principle gives smooth, wide, uniform dispersion, without any cellular pin-pointing effect. Low distortion and high articulation improve speech intelligibility. Musicasting is full-bodied and clean. High efficiency and sensitivity provide superior coverage of the listening area with fewer units and at far less cost. There's no wasted power. Compare the CDP with any other unit in the environment in which it actually will be used—and *hear* the difference.

*Pat. D169, 904 and Pat. Pend.

For broadcast quality in public address, use E-V 664 cardioid dynamic microphone.

Model 847 CDP. 12 watts. 16 ohms. Response 250 to 10,000 cps. RETMA sensitivity rating 51 db. Crossover at 1500 cps. Size 7¾ in. wide, 11¾ in. high, 10-7/32 in. deep over-all. Includes mounting bracket. Net wt. 6½ lbs.
List, $43.50 Net, $26.10

Model 848 CDP. 25 watts. 16 ohms. Response 175 to 10,000 cps. Crossover at 1000 cps. Sensitivity rating 52 db. Size 10½ in. wide, 20½ in. high, 20 in. deep over-all. Includes mounting bracket. Net wt. 12 lbs.
List, $69.50 Net, $41.70

No Finer Choice than

Ask for a demonstration or get full facts. Send for CDP Bulletin No. 221. N64

Electro-Voice®

ELECTRO-VOICE, INC. • BUCHANAN, MICHIGAN

HIGH-FIDELITY SPEAKER SYSTEMS, MICROPHONES, AMPLIFIERS, TUNERS, PHONO-CARTRIDGES

G-E BIG TOP COMING TO YOUR TOWN.... YOUR STORE

5-Ring Circus of Service Values

1. Now G-E Aluminized Picture Tubes with the new "100-Series" red seal for quality!

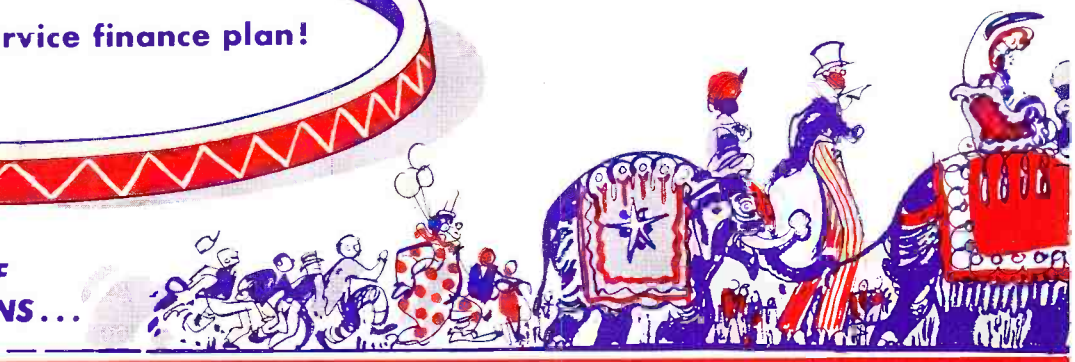
2. Six more brand-new General Electric Service-Designed Tubes!

3. TV-radio Tune-up Program, nationally advertised by G.E.!

4. Powerful local advertising support!

5. G.E.'s great TV-service finance plan!

FOLLOW THE PARADE OF SERVICE ATTRACTIONS...



GENERAL ELECTRIC

G-E TUBES

G-E 5-Ring Circus

G-E ALUMINIZED TUBES WITH THE RED SEAL. FINEST EVER!

TV owners will learn about them through big G-E color ads—"100-Series" G-E Aluminized Picture Tubes with the *red seal,* finest ever built! The new *red seal* stands for top picture tube quality. Bright, sharp, clear pictures; dependable performance that lasts throughout tube life—these spell customer satisfaction, establish you as a dealer handling only the best. Large-scale G-E advertising of "100-Series" Aluminized Tubes with the *red seal,* soon to commence on a nationwide basis, will boost your tube and service sales. Here is a new and important business and profit-builder—with all the sales impetus behind it of a tremendous national advertising campaign!

SIX MORE NEW G-E SERVICE-DESIGNED RECEIVING TUBES!

Ready to install: new types 1X2-B, 6AL5, 6BK7-A, 6BQ7-A, 6BZ7, 6CB6. Remember the fine reception given other G-E Service-Designed Tubes—how customer goodwill increased sharply, how service business boomed for dealers handling these superior tubes, made *only* by General Electric? The 6 new types will cut call-backs still more, increase your sales and profits further. A revolutionary new "lightning-rod" design, new low-level tube microphonics, greater sturdiness, longer tube life—these and many other vital improvements are included. Now—in all—you will have 20 G-E Service-Designed Tubes which will out-perform and outlast their prototypes!

SURE-FIRE BUSINESS-BUILDERS, ALL 5 ATTRACTIONS!

NATIONALLY ADVERTISED TV-RADIO TUNE-UP PROGRAM!

Biggest boost to TV-radio service ever undertaken! That's G.E.'s nationally advertised Tune-up Program. Through large G-E color ads in 6 national magazines—reaching every home in your neighborhood—your customers will learn that a TV-radio tune-up *now* is essential to high-quality pictures and clear, clean reception. Every ad will ask that readers see or phone you, their local independent technician. This plan for TV-radio service action will greatly increase your customer list, keep your telephone ringing busily. You will sell more profitable G-E Aluminized Picture Tubes, more receiving tubes and TV-radio parts, than you have ever sold before!

MOST ATTRACTIVE DEALER ADVERTISING AIDS EVER OFFERED!

Strong local advertising tie-ins will increase your sales still more. G.E. has ready for you a real Big Top group of colorful displays and other helps. Many of them are shown on the following page. Besides wall and window-banners, they include window-stickers—TV-radio spot commercials—point-of-purchase selling aids—direct-mail pieces—other items. Vivid, fresh, *new*, these advertising aids underscore G.E.'s nationwide TV-radio Tune-up advertising, and focus its appeal to set-owners on *your* store or shop. Become the service center for your neighborhood by using these Big Top tie-ins! Your G-E tube distributor has them. Ask his salesman for details!

G-E SERVICE FINANCE PLAN! YOUR CUSTOMERS CAN PAY OUT OF INCOME!

Most powerful stimulus ever given to tube, parts, and service sales, is G.E.'s great Service Finance Plan. Now the latest instalment methods are available for the benefit of dealers handling G-E tubes. Your customers' needs can be filled immediately and paid for out of income. They no longer will feel they must wait to replace worn-out picture tubes with new G-E Aluminized Tubes—instead, can afford, on an easy instalment basis, the best in tubes and service. Costly installation jobs will be far easier for you to sell. Your whole business will feel the beneficial effects of General Electric's pace-setting Service Finance Plan! Here is a Grade-A sales and profit-builder!

NEXT PAGE: HOW G.E. SPOTLIGHTS YOU TO REAP THE BENEFITS!

Every parent will want one or more of these fascinating books for their children's enjoyment. Amusing rhymes; appealing outline sketches to be filled in with crayons. A top-notch store traffic-builder!

G-E Big Top wall and window-banners, window-stickers, colorful tie-ins galore, will target your store as TV-radio service headquarters. All are available from your G-E tube distributor!

Television-radio service—how much it means to high-quality performance; why owners should consult their local independent technician—will be pushed from coast to coast, border to border, during General Electric's TV-radio Tune-up campaign. Giant *2-page magazine ads in color* will seize and hold readers' attention, show why regular service attention is a TV-radio "must". Six big national magazines will be used, all with many millions' circulation—Life, Look, Collier's, American Weekly, This Week, and TV Guide.

Tie-in displays are ready for you. Part are shown on this page—though justice can't be done here to their many bright colors, or smart and novel appeal. Eye-stoppers, every one! These Big Top tie-ins will focus sharply on *your* establishment all of General Electric's gigantic TV-radio service advertising effort.

Lead the TV-radio service parade! Profit from the business-building attractions G.E.'s Big Top holds! Your G.E. tube distributor is waiting to hear from you. *Tube Dept., General Electric Co., Schenectady 5, N. Y.*

GENERAL ELECTRIC

Get more money! More security! More out of life!

Learn TELEVISION · RADIO · ELECTRONICS

Get the best!

Get National Schools' SHOP-METHOD HOME TRAINING!

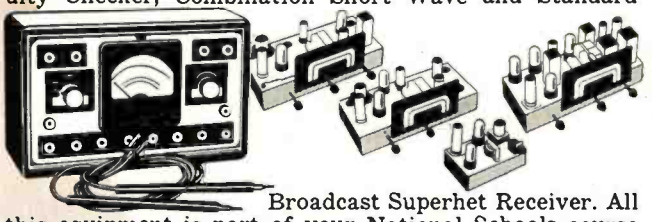
Start now! Why wait around for that raise or promotion that may never come? Get started *now* in high-paying TV-Radio-Electronics! National Schools' SHOP METHOD Home Training prepares you for success in a top-salary job or in your own business. You learn *all three*... Television, Radio, Electronics...in one complete course. Our Shop-Tested lessons and manuals help you master all phases in shortest possible time! Send coupon, find out today!

WHY NATIONAL SCHOOLS LEADS THE FIELD

Located in the "Television Center" of the world, our staff is in close touch with latest developments and opportunities. We give you personalized job placement assistance. We also give you confidential help with both technical and personal problems relating to your training. We show you how to make Part Time Earnings as you progress. Whether you live 30 miles away, or 3,000, you will always be pleased with our prompt, friendly service!

DRAFT AGE? Our home training helps you achieve specialized ratings and higher pay grades if you go in service.

We send you this precision-tested Multitester! Plus parts to build Oscillators, Receivers, Signal Generator, Continuity Checker, Combination Short Wave and Standard



Broadcast Superhet Receiver. All this equipment is part of your National Schools course NO EXTRA CHARGES! Send coupon for free books!

NATIONAL SCHOOLS, world-famous technical trade school. Now in our 50th year!

NATIONAL SCHOOLS

TECHNICAL TRADE TRAINING SINCE 1905

LOS ANGELES 37, California • CHICAGO: 187 N. La Salle St.

IN CANADA: 811 West Hastings Street, Vancouver, B. C.

- APPROVED FOR G. I. TRAINING
- BOTH HOME STUDY AND RESIDENT COURSES OFFERED

30 MILLION TV SETS

need regular repair! Color TV means more sets than ever before. NOW is the golden opportunity to cash in on this multi-billion-dollar industry. Or "write your own ticket" in broadcasting, manufacturing, and other specialized phases!

YOUR AGE IS NO OBSTACLE!

Send for FREE LESSON!

FREE BOOK & SAMPLE LESSON will convince you! SEND COUPON TODAY!

MAIL NOW TO OFFICE NEAREST YOU!

(mail in envelope or paste on postal card)

NATIONAL SCHOOLS, Dept. RH-46

4000 SOUTH FIGUEROA STREET LOS ANGELES 37, CALIFORNIA — OR — 187 N. La SALLE STREET CHICAGO 1, ILLINOIS

Please rush FREE BOOK, "My Future in Radio-Television-Electronics," and FREE LESSON at once. I understand there is no obligation, and no salesman will call.

NAME _____ BIRTHDAY _____ 19__

ADDRESS _____

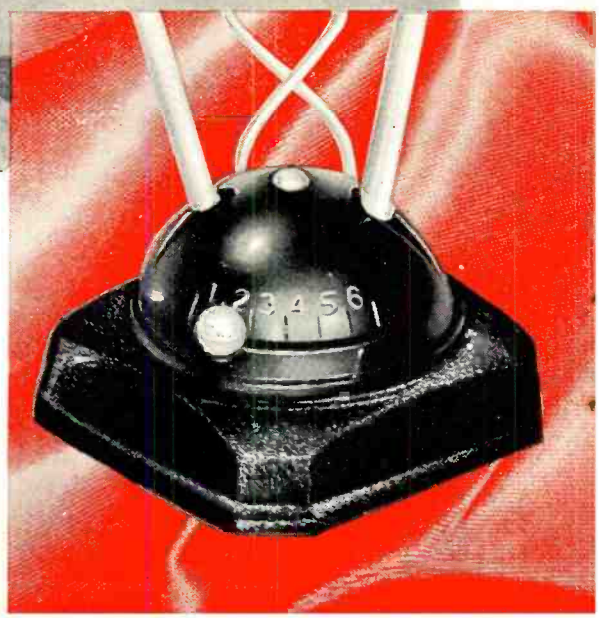
CITY _____ ZONE _____ STATE _____

☐ Check if interested ONLY in Resident Training at Los Angeles.

VETERANS: Give date of discharge _____

Dealers by the thousands are making the SWITCH to this great insulator idea!

when we say SWITCH — we mean business!



New indoor antenna has gliding SWITCH

Only CHANNEL MASTER®

STANDOUT

insulators

have this revolutionary 2 in 1 design

It's a wood-screw insulator
. . . it's a machine-screw insulator
. . . and it's ***BETTER*** *in both applications!*

STANDOUT insulators and buckles are already outselling all others — *after only a few months on the market!* This remarkable record provides positive proof of the solid acceptance STANDOUTs have won among dealers all over the country.

Why has the response to STANDOUTs been so enthusiastic? BECAUSE they cut space and dollar investments in accessories by more than 65% . . . BECAUSE they increase space and dollar turnover by more than 200% . . . BECAUSE they are easier to install, stronger, more durable.

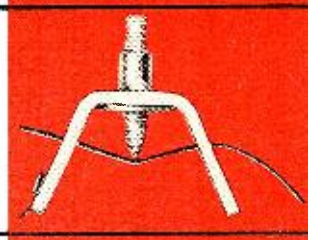
Millions already sold! Here's why:

"T-Nut" buckle with 8 threads.

More threads than any other buckle (nut type or extruded) — 8 full machined threads! Tighten as hard as you want, *you can't strip it!*

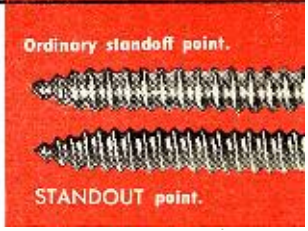
Pointed Screw makes positive contact.

Strap won't slip while you're tightening. Won't twist or slip on mast after installation. Straps have convenient "taper-tip."



Needle-sharp point

Finer thread, sharper point means easier starting — even in hardwood. Minimizes possibility of splitting.



All popular types and sizes available, including full assortment of specialized hardware. See your Channel Master distributor

CHANNEL MASTER'S new Glide-o-Matic

INDOOR TV ANTENNA

The Glide-o-Matic's sensational low-loss ***gliding switch*** is different from all others! Provides highest electrical efficiency . . . AND — it's the most convenient to operate!

Glide-o-Matic also gives you:

- Maximum performance on *all* channels — VHF and UHF.
- Weighted tip-proof base — with "can't scratch" felt covering.
- Ready for COLOR TV.
- Powerful retail merchandising support.

Available in 4 popular color harmonies:

Mahogany	with brass	model no. **3700**
Ebony	with brass	model no. **3701**
Ivory	with brass	model no. **3702**
Ebony	with aluminum	model no. **3703**

A performance hit with men . . .

A style hit with women!

Glide-o-Matic practically sells itself. Smartly styled . . . blends into any setting. Packed in colorful "tell and sell" carton with convenient "carry away" handle.

$9.95 list

Also available:

***CHANNEL MASTER'S* ALL-VU** model no. **381**, all-**VHF**, all **UHF**. — $8.95 list

***CHANNEL MASTER'S* PRE-VU** model no. **380** all-channel **VHF**. — $7.95 list

FIRST IN PREASSEMBLED ANTENNAS

®Trade Mark Reg. U.S. Pat. Off.

CHANNEL MASTER CORP.

ELLENVILLE, N. Y.

WORLD'S LARGEST MANUFACTURER OF TV ANTENNAS AND ACCESSORIES

TEST 5 TUBES in 4 SECONDS EACH...ACCURATELY!

WITH THE NEW ADVANCED ENGINEERED

precise MODEL 116

Gm. & Em. ULTRAFAST TUBE & TRANSISTOR TESTER

COMPLETELY **NEW!**

PRECISE MODEL 116K in kit form..... **$69.95**
PRECISE MODEL 116W factory wired $119.95

Servicemen know the Precise Model 111 (the winner in an independent survey) easily rates "the finest tube tester in the field" at any price, BUT FOR AN ON THE JOB QUICK-TEST . . . the fastest, most accurate is the PRECISE Model 116. What's more you test tubes the foolproof method inherent in the famous Precise Model 111.

Did you ever wish you could plug in 5 of the same type tubes at once and check each one individually by rotating a switch? YOU CAN WITH THE PRECISE MODEL 116—Plug in 5 IF tubes and let them heat up at once and then check each one separately by rotating the TUBE BANK switch. ACTUALLY CHECK 5 TUBES IN 20 SECONDS, 4 SECONDS PER TUBE.

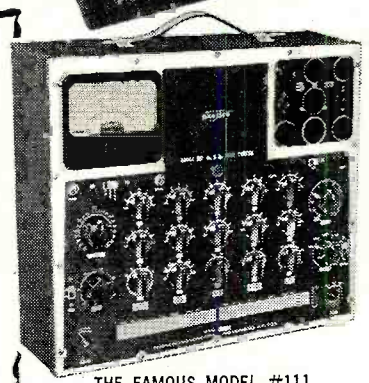
The Precise Model 111 taught the lesson that IF amplifier tubes (like the 6BC5 or 6AU6) should be tested for Gm (mutual transconductance) while the power amplifiers (like the 6L6) should be tested for Em (emission)—that's ULTRAFAST Model 116 test! It checks each section of each tube separately . . . by rotating the FUNCTION SWITCH . . . each triode of a dual triode is checked individually . . . each diode and the triode of a duo-diode-triode is separately tested and not lumped as in other testers . . . and a pentode is tested as a pentode—not a diode. TRANSISTORS, SHORTS, GAS, LIFE, Em, Gm etcetera can be tested with the PRECISE Model 116.

You can inexpensively extend the Precise Model 116 to test filament current, etc. The Model 116 gives an accurate, ultra-fast (3 basic knobs for testing) check of television tubes!

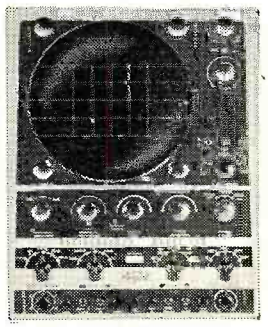
No Surplus—An etched panel—beautiful Moleskin covered wood carrying case and cover and specially simplified instructions makes the PRECISE MODEL 116 THE FINEST FAST-CHECK TUBE TESTER AND DOLLAR EARNING TRAVELING COMPANION A TV SERVICEMAN EVER HAD.

Not yet at your distributor. Order NOW to insure early delivery.

SEE YOUR LOCAL DISTRIBUTOR FOR PROOF OF WHAT WE OFFER — OR WRITE US FOR DOCUMENTARY RESULTS OF AN INDEPENDENT SCIENTIFIC SURVEY.

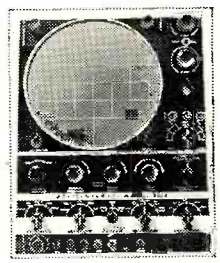


THE FAMOUS MODEL #111
111K **$79.95**
111W $139.95
INCL. CARRYING CASE & COVER



THE FIRST LOW PRICED 7" COLOR SCOPE
300K **$99.95**
300W $199.95

LOW PRICED 5" SCOPE
315K $49.95
315W $84.95



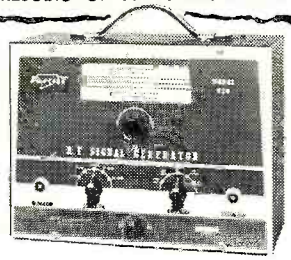
THE FIRST AND ONLY 8½" COLOR SCOPE
308K **$129.50**
308W $229.50

LOWEST PRICED WIRED 4½" VTVM
909K $25.98
909W **$37.50**

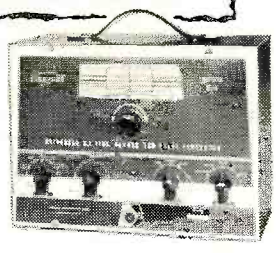
RF—AF—BAR GENERATOR with pre-assembled* head
630K $33.95
630KA* $38.95
630W $53.95

THE FINEST VOLT, REG, 7" VTVM KIT
9071K $35.95
9071W $49.95

WRITE FOR CATALOG RN 4-6



LOW PRICED RF SIGNAL GENERATOR "BEST BUY" IN GEN. FIELD
610K $23.95
610KA pre-assembled head..... $28.95
610W $39.95



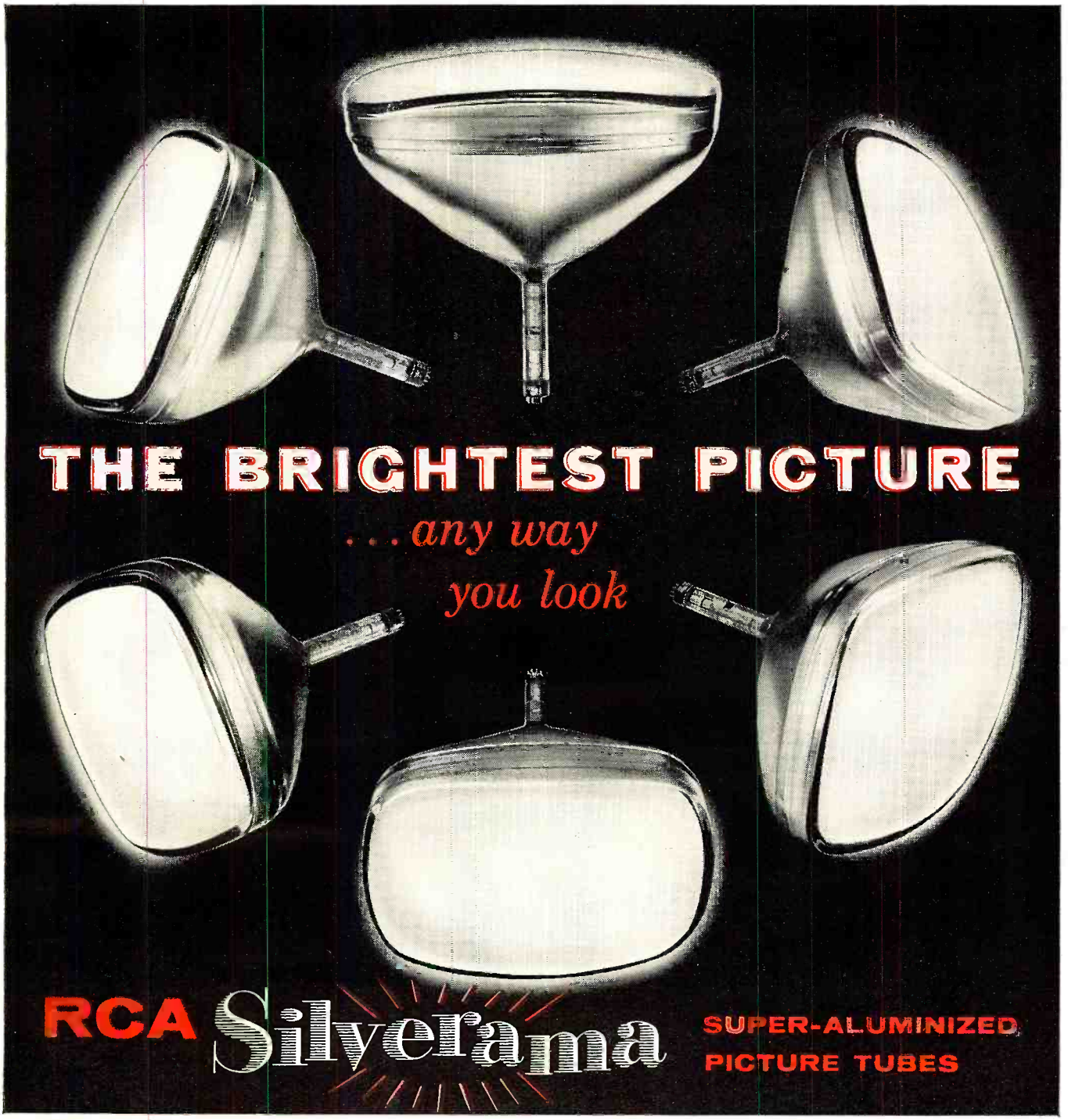
UNIV. AF, SINE, SQ, & PULSE GEN.
635K $33.50
635W $52.50

Prices slightly higher in the West. Prices and specifications subject to change without notice.

PTAK ..$2.95
PTAW ..$4.25

SEE THE MANY MORE PRECISE INSTRUMENTS AND PROBES AT YOUR DISTRIBUTOR TODAY!

precise DEVELOPMENT CORP. OCEANSIDE, NEW YORK, U.S.A.



Designed with a super-phosphor that develops greater light—and aluminized by an exclusive "advanced-technique" process that sharpens image contrast, does away with "mottling", increases picture "snap"—RCA SILVERAMA Picture Tubes are setting unparalleled records for superior performance. And RCA is telling this story to your customers across the nation—*through the most dynamic consumer advertising campaign in the history of picture tubes.*

Your RCA Tube Distributor can help you make this far-reaching advertising effort pay off for you NOW—with the most complete selection of sales promotion material ever created to sell picture tubes. Ask him for the facts. Let him show you how 25 types of RCA SILVERAMA Picture Tubes can handle over 110 replacement types for YOU. Be convinced that RCA SILVERAMA makes the brightest picture—any way you look.

PICTURE TUBES

RADIO CORPORATION OF AMERICA
HARRISON, N. J.

Ask your RCA Tube Distributor for your copy of the new RCA Picture Tubes Booklet (Form KB-106).

Nationwide Consumer Advertising

See RCA's hard-hitting consumer ads on SILVERAMA in LIFE, POST, and TV GUIDE. Watch RCA's dramatic commercials on top TV programs like MILTON BERLE, MARTHA RAYE, and NBC Spectaculars.

Philco breaks National Campaign to replace "Tired" Picture Tubes

Millions of TV Set owners get the call to action—to phone you immediately for a new picture tube

TV Guide, Saturday Evening Post, newspapers and TV commercials are ready to break the big replacement story and sell the Philco Star Bright 20/20 Aluminized Picture Tube for you. Be sure to have stock on hand when your phone starts ringing. Then you'll be ready to move into the homes of television owners and cash in on the greatest campaign of its kind ever to hit the public.

Invest in your future in Color TV Service and equip your shop FREE during the fabulous

PHILCO SHARE AND PROFIT

Dividend Opportunity

That's right, you can earn FREE color and B/W Test Equipment and Parts and Accessories by concentrating your radio and TV parts on Philco. With each purchase you get SHARE and PROFIT stamps, redeemable for the dividends of your choice at your Philco Distributor. They build EXTRA 100% PROFITS because they cost you nothing. See your Philco Distributor now for full details.

Now, an Exclusive Double Edged Selling Tool...

Bond plus Warranty

ON EVERY

PHILCO®

Star Bright 20/20

PHILCO PICTURE TUBE
BOND

Bonded by a leading Indemnity Co. to be built with all new picture making parts, to the same rigid standards of tubes in the newest Philco TV models.

PHILCO PICTURE TUBE
WARRANTY

Covers the picture tube for one full year. Combined with the new Philco bond, it offers the purchaser guarantees never before matched in television history.

SUPER ALUMINIZED! CLEAREST, MOST LIFELIKE PICTURE POSSIBLE

Regardless of the make or model of a TV set, a Philco Star Bright 20/20 Aluminized Picture Tube gives your customers a clearer, brighter, more lifelike picture than ever before . . . and builds confidence in you.

Yes, Philco gives you a double-edged selling exclusive to boost your replacement tube business. In addition to the one year warranty, the Philco Star Bright 20/20 Aluminized Picture Tube is BONDED to have all new picture making components. This bond protects your customers against counterfeit tubes and assures a picture tube that's built to the same rigid standards as those in original TV receiving equipment. The Philco Star Bright 20/20 is the only picture tube made that is backed by such a bond.

PHILCO CORPORATION

ACCESSORY DIVISION **PHILADELPHIA 34, PA.**

PHILCO Famous for QUALITY the World Over

Model 7100

Philco puts you in the color service business with this one compact instrument

PHILCO Universal COLOR BAR and DOT BAR Generator

It's new . . . highly efficient . . . designed to provide the widest possible variety of functions in the minimum amount of space. PHILCO MODEL 7100 is used to completely trouble-shoot circuits associated with color reproduction and make accurate convergence adjustments in any color television receiver on the market.

Within the Industry

SIDNEY LEVY has been elected president of *University Loudspeakers, Inc.*, of White Plains, New York succeeding the late Irving Golin. Arthur Blumenfeld, the third of the company's three founders, was named secretary-treasurer.

In addition to assuming their new executive posts, Messrs. Levy and Blumenfeld will actively continue with the departments they have supervised since the firm was founded almost twenty years ago. In conjunction with their executive duties, Mr. Levy serves as director of engineering and Mr. Blumenfeld as director of production.

* * *

LONDON AUDIO FAIR 1956 has been scheduled for April 13, 14, and 15 at the Washington Hotel, Curzon Street, London W. 1. The show will be open each day from 11:00 a.m. to 9:00 p.m.

This will be the first of what is intended to be an annual event. Approximately 40 top British manufacturers will exhibit and demonstrate their equipment. The show is being organized and promoted by a committee consisting of representatives from *Garrard Engineering Co. Ltd., Goodmans Industries, Ltd., The M.S.S. Recording Co. Ltd., Pamphonic Reproducers Ltd., The Trix Electric Co. Ltd.,* and *Vitavox Ltd.*

Additional information is available from the Secretary, London Audio Fair 1956, 17 Stratton St., London W.1.

* * *

HOWARD W. SAMS & CO., INC. is building a new wing on its plant at 33rd & Sutherland Ave. in Indianapolis which will add 18,000 square feet to the present structure in Sams Park. The new facility will house printing, warehousing, and mailing activities . . . **CARTER MOTOR CO.** is building a new manufacturing plant a few blocks from the present main office and factory on Maplewood Ave. in Chicago . . . **NORTH ATLANTIC INDUSTRIES, INC.** has opened a new plant at 603 Main Street in Westbury, New York . . . A 12,000 square foot plant expansion has just been completed by **VOLKERT STAMPINGS, INC.** of Queens Village, New York, increasing production capacity by 25 per-cent . . . **SYLVANIA ELECTRIC PRODUCTS INC.** has announced plans for a new engineering and pilot production building to be constructed in North Towanda, Pa. The 48,000 square foot building is expected to be in operation by the summer of 1957 . . . **BARNETT BROS. RADIO CO.** has moved to new and larger quarters at 622 Arch Street, Philadelphia. The 4-story building has 12,000 feet of floor space . . . The research and technical laboratories of **CONDENSER PRODUCTS COMPANY** has moved to 6457 Sheridan Road in Chicago . . . **COLLINS RADIO COMPANY** has opened a sales office at 1318 Fourth Avenue in Seattle, Washington to service the Northwest area . . . **SUPERIOR TUBE COMPANY** will replace its present Wapakoneta, Ohio plant with a new half-million-dollar plant and office building. Completion is scheduled for November of this year . . . **PARKSIDE WIRE COMPANY** has moved to 2535 W. Armitage Avenue, Chicago 47, Illinois . . . **RADIO MANUFACTURING ENGINEERS,** a division of **ELECTRO-VOICE,** has moved to larger quarters at 501 Walnut Street, Washington, Illinois, a suburb of Peoria . . . **THE MAGNAVOX COMPANY** will build a new plant at Jefferson City, Tennessee, for the manufacture of cabinets for radio and television sets. The factory will occupy 75,000 square feet of floor space and employ approximately 400 people. Operation is scheduled to start in June . . . **ACE ELECTRONICS ASSOCIATES** has moved into new and larger quarters at 103 Dover Street, Somerville 44, Massachusetts . . . **SYLVANIA ELECTRIC PRODUCTS INC.** will double the size of its television picture tube division plant in Fullerton, California. The new addition is scheduled to be completed in May . . . Full operation of its new 204,000 square foot plant at 8311 West North Avenue, Chicago, has been announced by **RAYTHEON MANUFACTURING COMPANY.**

* * *

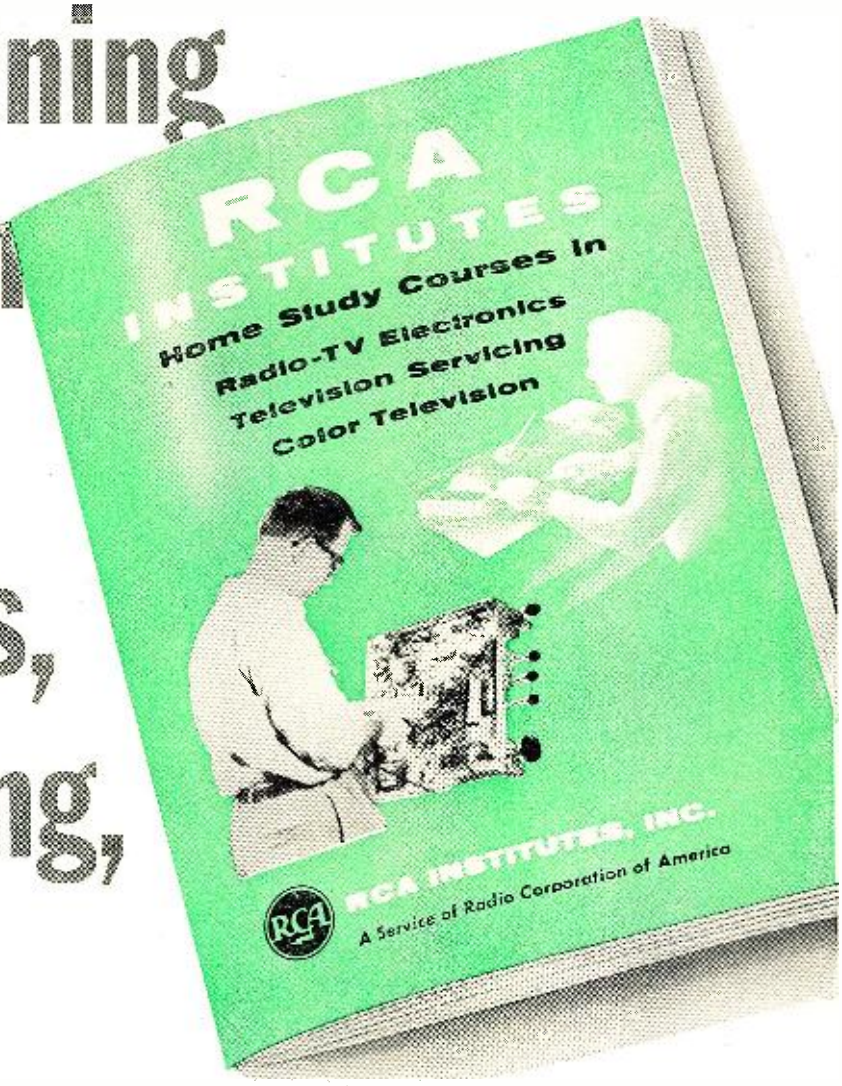
FRANK M. THOMAS has been appointed manager of equipment development for the electronics division of *Sylvania Electric Products Inc.* In his new assignment he will be responsible for the mechanical, electrical, and electronic development departments of the division and the coordination of its mechanization program.

Before moving to the company's Woburn, Mass., plant to take up his new duties, Mr. Thomas was manager of equipment engineering for the firm's atomic energy division at Highsville, Long Island, New York. He has been with the company since 1952.

* * *

GEORGE SILBER of *Rek-O-Kut Company,* New York has been named president of the Institute of High Fidelity

RCA offers you the finest training at home in Radio-TV electronics, TV servicing, Color TV



SEND FOR THIS FREE BOOK NOW!

The instruction you receive and equipment you get (and keep) will start you on your way. Pay-as-you-learn. You pay for only one study group at a time. This 52 page book contains complete information on Home Study Courses for the beginner and the advanced student.

RCA Institutes, Inc., Home Study N-46,
350 West Fourth Street New York 14, N. Y.
Without obligation, send me FREE CATALOG on Home Study Courses in Radio, Television and Color TV. No salesman will call.

Name .....
Please Print

Address .....

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

IMPORTANT
Be sure to write for RCA Institutes catalog before signing up for any Radio-TV course

RCA INSTITUTES, INC.
A SERVICE OF RADIO CORPORATION of AMERICA
350 WEST FOURTH STREET, NEW YORK 14, N.Y.

Manufacturers, Inc., a trade association formed a year ago and now comprising 55 member and associate member companies.

Serving a two-year term with Mr. Silber are Walter Jablon of *Presto Recording Corp.*, vice-president and Vinton K. Ulrich of *David Bogen Co., Inc.*, secretary-treasurer.

Directors elected for two-year terms include Mr. Silber, Avery Fisher of *Fisher Radio Corp.*, and Sid Harman of *Harman-Kardon, Inc.* Joe Benjamin of *Pilot Radio Corp.*, Al Kahn of *Electro-Voice, Inc.*, and William Thomas of *James B. Lansing Sound Inc.* were elected for one-year terms.

The association maintains headquarters at 25 Broad Street, New York 4, N. Y.

* * *

REAR ADMIRAL FREDERICK R. FURTH, USN (Ret.) has joined *International Telephone and Telegraph Corporation* as assistant to Dr. Harvard L. Hull, president of the *Farnsworth Electronics Company Division* in Fort Wayne, Ind.

In his new post, Mr. Furth will be active in new product development for the division. As chief of naval research in 1954 and 1955, he directed the expansion and use of new techniques in the Navy's continuing support of upper atmosphere research, a program that has permitted the Navy to move ahead with the technical portion of the earth-satellite program.

* * *

IRE has announced several of its sponsored and co-sponsored meetings which are of general interest to the industry.

Harvard University, Cambridge, Mass. will be the scene of a three-day meeting on ferrite devices for microwaves, April 2nd, 3rd, and 4th. April 5th and 6th a conference on magnetic amplifiers will be held in Syracuse, New York. The 7th Regional Technical Conference and Trade Show has been set for the Hotel Utah in Salt Lake City, April 11th through 13th, while the 10th Annual Spring Technical Conference will be held in Cincinnati on April 13th and 14th.

The New England Radio Engineering Meeting will be held at the Sheraton-Plaza in Boston on the 23rd and 24th while the symposium on nonlinear network theory will convene at the Engineering Societies Building in New York City on April 25th through 27th.

* * *

SYLVANIA ELECTRIC PRODUCTS INC. has formed a manufacturing subsidiary, **SEMSA ELECTRONICA, S.A.**, which will produce television receivers and picture tubes in a new 40,000 square foot building at Monterrey, Mexico . . . **HUNTER MANUFACTURING CORPORATION** has acquired all of the outstanding stock of **BRISTOL ENGINEERING**

(*Continued on page* 172)

It's easier to sell CBS

Silver Vision

the "High-Fidelity" Aluminized Tube

Your customer is aware that Hi-Fi does sound better . . . that it faithfully reproduces the original sound. And you can prove by demonstration that advanced-engineered CBS Silver Vision tubes can do for video what Hi-Fi does for audio.

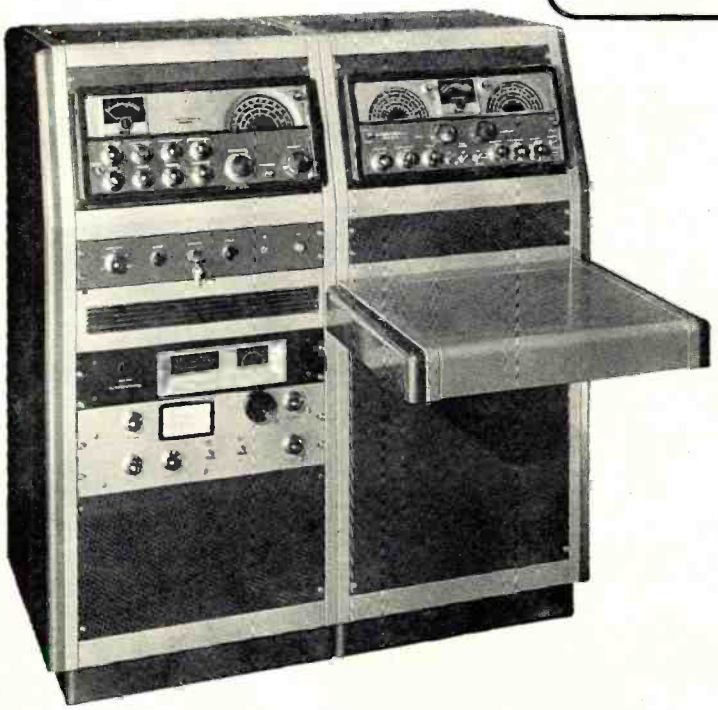
You know Silver Vision's aluminization . . . silver-activated phosphors . . . and small-spot gun can accomplish this. But technical details do not interest the lady. She does appreciate Silver Vision's sparkling whites . . . deep blacks . . . and wide range of middle gray tones. She likes the way they can be blended to give her truly high-fidelity reproduction of the telecast picture.

Here's a tube whose performance sells it. And Garry Moore makes it still easier by convincing your women customers over the CBS Television Network: "There are no better tubes made than CBS tubes, the tubes with the Good Housekeeping Guaranty Seal." Sell the easy way, follow Garry's lead. Sell CBS Silver Vision . . . the "high-fidelity" aluminized picture tube.

Always show her the CBS carton with the Good Housekeeping Guaranty Seal.

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

AVAILABLE NOW



For more than 22 years Hallicrafters has been closer to the radio amateur field than any other communications manufacturer. The many leading Hallicrafters developments have been based on what the amateur wanted and needed. The result of this close association is this radio man's ideal—the finest component units (Model SX-100 AM-CW-SSB receiver, Model HT-30 transmitter-exciter, Model HT-31 linear power amplifier) in a completely packaged radio station—

MODEL SR-500.

$1495.00

FOR THE FIRST TIME

commercial broadcast styling in a

complete amateur radio station.

HALLICRAFTERS MODEL SR-500

a single package for

PROFESSIONAL EFFICIENCY

FEATURES

Here is a completely contained unit in a handsome console cabinet—transmitter/exciter, linear power amplifier, receiver affording the finest in V.F.O. or crystal. SSB, AM and CW transmission and reception. You need supply only the antennae, microphone and AC power. All the wiring is complete and external connections are provided for antennae and microphone.

The transmitting and receiving units are located in coordinated operation for maximum efficiency, and a special communications speaker is positioned above the operating shelf directly in front of the operator.

The mobile console is mounted on casters and is easily expandable. Three blank panels are also provided in the basic cabinet for the installation of any additional equipment that may be desired.

The console incorporates all safety and protective features. It is completely enclosed, fused with the main power relay controlled by a key lock. For "extra" safety, the entire back of the cabinet is enclosed but perforated for maximum ventilation and heat dissipation.

FRONT PANEL CONTROLS, INDICATORS AND CONNECTIONS:

1. Antenna selector switch for 80, 40, 20, 11-10 meter and dummy or special antenna.
2. Master power switch "key lock" type operates main power relay to turn on or off all equipment.
3. Main power pilot lamp.
4. "On the air" pilot lamp.
5. Microphone input.
6. Key jack.

REAR PANEL:

1. Five coaxial connectors for 80, 40, 20, 11-10 antenna and dummy load or special antenna.
2. Dual 30 ampere fuse block.
3. Three spare AC power outlets.
4. Spare octal socket for beam controls, etc.

For further information see your Radio Parts Distributor or write

hallicrafters

CHICAGO 24.

INSTALLATION SIMPLIFIED

with the

Collaro

RC-54

Automatic Intermix
RECORD CHANGER

Pre-Mounted
and Pre-Wired

If installation is the big reason you've been 'putting off' that high fidelity system . . . then here's good news. The famous Collaro RC-54 Record Changer is now pre-mounted and pre-wired . . . 'ready-for-use' in your home music system.

Supplied with pre-cut, unfinished mounting board, the RC-54 can be installed into consoles or record cabinets with a minimum of carpentry . . . very much like an ordinary shelf. And all electrical work is eliminated. The unit is supplied with power cord and audio connecting cable already soldered in position. Just plug the power cord into an electrical outlet; connect the audio cable to your TV, radio or component amplifier . . . and you're ready for a new thrill in record reproduction.

The Collaro RC-54 is supplied with automatic 45 rpm spindle adapter, and offers a choice of pickup cartridges: either the G.E. dual-sapphire magnetic or Collaro Studio O dual-sapphire crystal.

Also available on hardwood base in Mahogany or Blond

Priced from **$56.00**

The Collaro RC-54 is featured as standard equipment by leading high fidelity manufacturers.

MEMBER INSTITUTE OF HIGH FIDELITY MANUFACTURERS INC

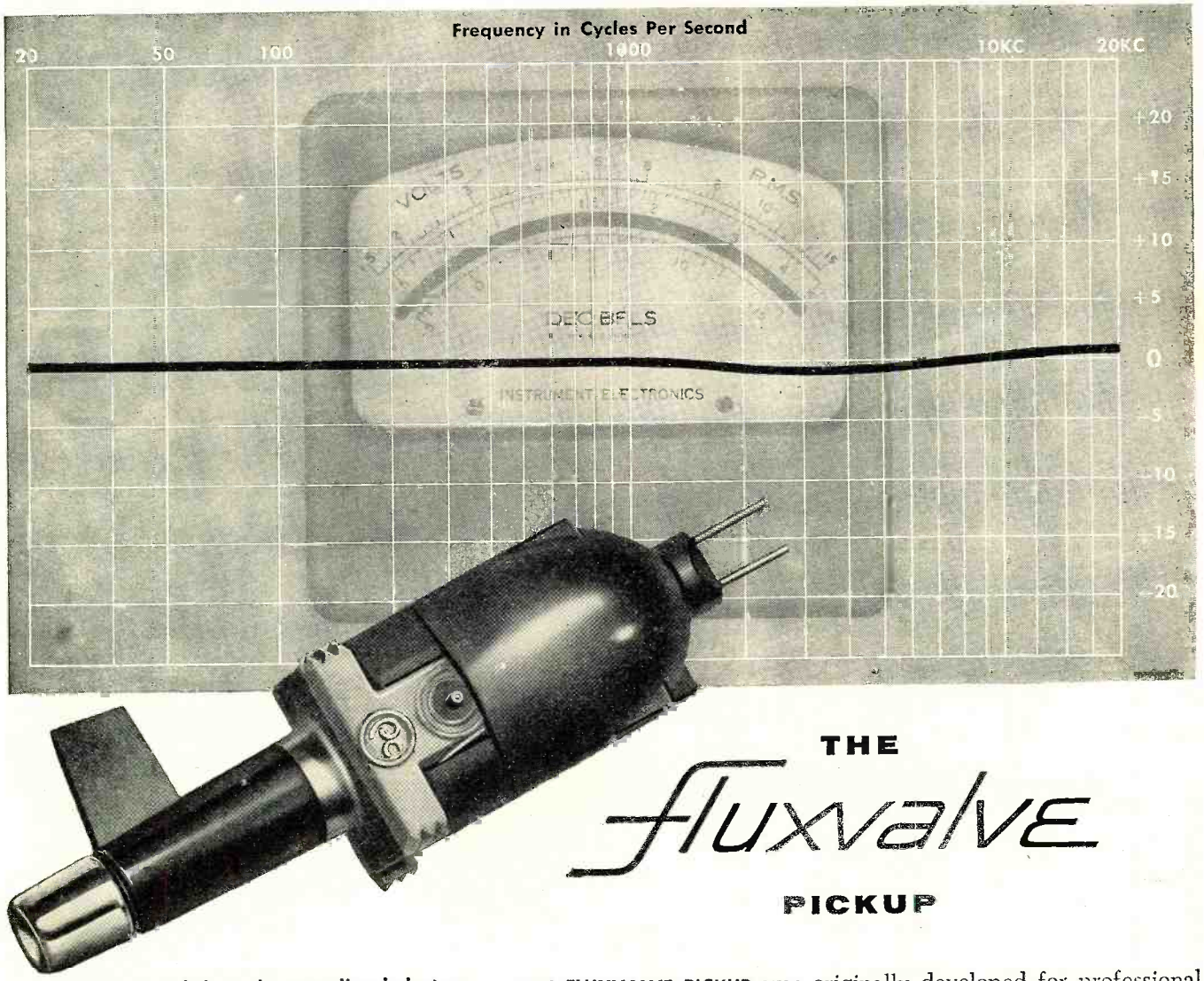
Write for complete specifications to Dept. ED-4

ROCKBAR CORPORATION • *215 East 37th Street, New York 16, N. Y.*

Made in England

At Last... and for the first time!

A PICKUP FOR CALIBRATING RECORDS!



THE *Fluxvalve* PICKUP

Important as it is to the recording industry, the FLUXVALVE offers values never before available to thousands of record playing enthusiasts!

- *Very Wide Range (VWR)*
- *Unequalled transient response*
- *Long record and stylus life*
- *Low overall distortion*
- *Hermetically sealed*
- *Easily replaceable styli* ✲

✲ **Less than 1 mil stylus on special order**

THE FLUXVALVE PICKUP was originally developed for professional applications, particularly recording studios where accurate correlation between lacquer, master and pressings is essential, and has always been difficult. Now with the FLUXVALVE magnetic turnover pickup with which to make precise and *reproducible* record-measurements, a vital control step is simplified.

For a new listening experience, ask your dealer to demonstrate the new FLUXVALVE *. . . words cannot describe the difference . . . but you will hear it!*

PICKERING & CO., INC. OCEANSIDE, N. Y.

Professional Audio Components

"For those who can hear the difference"

. . . Demonstrated and sold by Leading Radio Parts Distributors everywhere. For the one nearest you and for detailed literature: write Dept. C-10

EXPORT: AD. AURIEMA, INC., 89 BROAD ST., NEW YORK / CANADA: CHARLES W. POINTON LTD., 6 ALCINA AVE., TORONTO

NEW! COLOR and Black-&-White LAB & TV 5" OSCILLOSCOPE #460

KIT $79.95. Wired $129.50

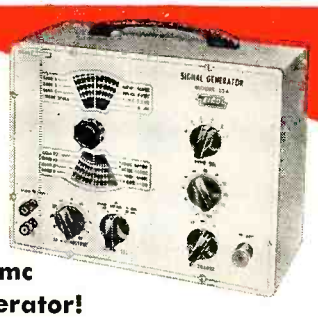
The FINEST professional 5 mc wide-band scope value. Ideal for research, h-f & complex waves, plus Color & Monochrome TV servicing. Flat from DC to 3.58 mc ±1 db (color burst freq.), flat DC to 4.5 mc +1, −3 db. Vert. sens. 25 rms mv/in. Vert. Z 3 megs. Has the following outstanding features not found in scopes up to several times its price, kit or wired:

VERTICAL AMPLIFIER: direct-coupled (DC) thruout to eliminate l-f phase shift; **push-pull thruout** for negligible distortion; **K-follower coupling** between push-pull pentode stages for extended h-f resp. (minimizes h-f phase shift, extends useful resp. to 10 mc); full-screen undistorted vert. defl; 4-step freq-compensated decade step attenuator up to 1000:1. **SWEEP CIRCUIT:** perfectly linear sweeps, 10 cps – 100 kc (ext. cap. for down to 1 cps); **pre-set TV vert. & hor. positions** (30 & 7875 cps); automatic sync. ampl. & limiter eliminates sync amplitude adj. **PLUS:** direct or cap. coupling; bal. or unbal. inputs; edge-lit engraved lucite graph screen; dimmer; anti-glare filter; bezel fits std photo equipt. **OTHER IMPORTANT FEATURES:** High intensity trace CRT. Finest sq. wave resp. (.06 usec rise time). Push-pull hor. ampl., flat to 400 kc, sens. 0.6 rms mv/in. Built-in voltage calibration. Intensity mod. Sawtooth & 60 cps outputs. Astigmatism control. Retrace blanking. Instant, drift-free full-screen vert. positioning & 2X full-screen hor. positioning. **Bal., cal., astig. adj. externally accessible.** 5UP1 CRT, 2–6AU8, 2-6CB6, 1-12AU7A, 2-6J6, 1-6AX5, 1-1V2. Deep-etched satin aluminum panel, rugged grey wrinkle steel cabinet. Designed for easy building at home with no special equipment. 13" x 8½" x 16". 30 lbs.

SCOPE DIRECT PROBE* #PD: KIT $2.75. Wired $3.95. Eliminates stray-pick-up & signal re-radiation.

SCOPE DEMODULATOR PROBE* #PSD: KIT $3.75. Wired $5.75. Demodulates AM carriers between 150 kc and 250 mc.

SCOPE LOW CAPACITY PROBE* #PLC: KIT $3.75. Wired $5.75. For signal tracing in high frequency, high impedance & wide-band circuits (as in TV) without distortion from overloading or frequency discrimination.



150 kc to 435 mc with ONE generator!

New! RF SIGNAL GENERATOR #324

KIT $26.95. Wired $39.95

for COLOR and Monochrome TV servicing

New wide-range, stable generator – better value then generators selling at 2 or 3 times its cost! Ideal for: IF-RF alignment, signal tracing & trouble-shooting of TV, FM & AM sets; marker gen.; 400 cps audio testing; lab. work. 6 fund. ranges: **150-400 kc, 400-1200 kc, 1.2-3.5 mc, 3.5-11 mc, 11-37 mc, 37-145 mc; 1 harmonic band 111-435 mc. Freq. accurate to ±1.5%;** 6:1 vernier tuning & excellent spread at most important alignment freqs. Etched tuning dial, plexiglass windows, edge-lit hairlines. Colpitts RF osc., directly plate-modulated by K-follower for improved mod. Variable depth of int. mod. 0-50% by 400 cps Colpitts osc. Variable gain ext. mod. amplifier: only 3.0 volts needed for 30% mod. Turret-mounted coils slug-tuned for max. accuracy. Fine & Coarse (3-step) RF attenuators. RF output 100,000 uv; AF sine wave output to 10 volts. 50-ohm output Z. 5-way jack-top binding posts for AF in/out; coaxial connector & shielded cable for RF out. Tubes: 12AU7, 12AV7, selenium rectifier; xfmr-operated. Deep-etched satin aluminum panel, rugged grey wrinkle steel cabinet. 8" x 10" x 4¾". 10 lbs.

The specs are the proof...

4 NEW BEST BUYS by EICO

for COLOR and Monochrome TV servicing

New! PEAK-to-PEAK VTVM #232 & UNI-PROBE (pat. pend.)

KIT $29.95. Wired $49.95

UNI-PROBE: exclusive with EICO! Terrific time-saver! Only 1 probe performs all functions—a half-turn of probe-tip selects DC or AC-Ohms.

The new leader in professional peak-to-peak VTVMs. Latest circuitry, high sensitivity & precision, wide ranges & versatility. **Calibration without removing from cabinet.** New balanced bridge circuit. High Z input for negligible loading. 4½" meter, can't-burn-out circuit. **7 non-skip ranges on every function.** 4 functions: +DC Volts, −DC Volts, AC Volts, Ohms. Uniform 3 to 1 scale ratio for extreme wide-range accuracy. **Zero center.** One zero-adj. for all functions & ranges. **1% precision** ceramic multiplier resistors. Measure **directly** peak-to-peak voltage of complex & sine waves: 0-4, 14, 42, 140, 420, 1400, 4200. DC/RMS sine volts: 0-1.5, 5, 15, 50, 150, 500, 1500 (up to 30,000 v. with HVP probe, & 250 mc with PRF probe). Ohms: 0.2 ohms to 1000 megs. 12AU7, 6AL5, selenium rectifier; xfmr-operated. 8½" x 5" x 5". Deep-etched satin aluminum panel, rugged grey wrinkle steel cabinet. 7 lbs.

Calibration without removing from cabinet

New! DELUXE PEAK-to-PEAK VTVM #249 with 7½" METER & UNI-PROBE (pat. pend.)

KIT $39.95. Wired $59.95

All the advanced & exclusive features of #232—PLUS the extra convenience and readability of its big 7½" meter. Your ideal bench instrument.

VTVM RF PROBES* #PRF-11 or PRF-25: KIT $3.75. Wired $4.95. Accuracy ±10%. Use with any 11 or 25 megohm VTVM.

VTVM HV PROBE #HVP-2: Wired $4.95. Complete with multiplier resistor. Measures up to 30 kv with any VTVM or 20,000 ohms/volt VOM.

*Only EICO Probes have all these features: fully shielded; rugged terminal board parts mounting; shock-mounted floating construction; swivel-action color-coding; easy parts accessibility.

COMPLETE with Preamplifier, Equalizer and Control Section

New! 20-WATT Ultra-Linear Williamson-type HIGH FIDELITY AMPLIFIER #HF20

KIT $49.95. Wired $79.95

A low-cost, complete-facility amplifier of the highest quality that sets a new standard of performance at the price, kit or wired. Every detail, down to the etched, brushed solid brass control plate, is of the fine quality EICO is famous for.

Rated power output: 20 watts (34 w peak). **IM distortion (60 cps: 6 kc/4:1) at rated power:** 1.3%. **Mid-band harmonic distortion at rated power:** 0.3%. **Maximum harmonic distortion between 20 and 20,000 cps at 1 db under rated power:** approx. 1%. **Power response (20w):** ±0.5 db 20-20,000 cps; ±1.5 db 10-40,000 cps. **Frequency response (¼w):** ±0.5 db ±13-35,000 cps; ±1.5 db 7-50,000 cps.

5 feedback equalizations for LP's & 78's including RIAA. Variable turnover feedback tone controls do not affect volume & permit large boosts or cuts at either end of audio spectrum with mid-freqs. unaffected. Loudness control & separate level set control on front panel. Low Z output to tape recorder. 4 hi-level switched inputs: tuner, tv, tape, auxiliary (xtal/ceramic phono or 2nd tuner); 2 low-level inputs for proper loading with all leading magnetic, FM & quality xtal cartridges. Hum bal. control. Extremely fine output transformer has interleaved windings, tight coupling, careful balancing & grain-oriented steel. 8½" x 15" x 10". 24 lbs.

These amazing EICO values are **NOW IN STOCK** at your nearest distributor. Examine them side-by-side with **ANY** competitor. You'll see for yourself why indeed EICO is your **BEST BUY.** Fill out coupon on reverse page.

EICO®

TURN PAGE FOR MORE EICO VALUES...

84 Withers Street, Brooklyn 11, New York

Prices 5% higher on West Coast.

Do you OVERPAY for QUALITY instruments?

EICO's mass purchasing and world-wide distribution, together with advanced electronic design, produce values never before possible . . . to give you **Laboratory Precision at Lowest Cost!**

GET the MOST for YOUR MONEY! Don't buy ANY test instrument till you put the EICO INSTRUMENT (kit or wired) equivalent before you—and . . .

Compare **advanced electronic design:** see the latest in circuitry and features.

Compare **finest components:** see the famous brands you know and trust, such as GE, Centralab, Mallory, etc.

Notice **ease of construction and operation:** Exclusive "Beginner-Tested" Manuals make assembly and operation step-by-step, quick, crystal-clear. "You build them in one evening—they last a lifetime!"

Check **5-Way Guarantee:** Only EICO gives you this exclusive **complete** protection! EICO guarantees components, instructions and satisfactory operation – **AND** guarantees **service and calibration** for the **LIFETIME** of the instrument, at less than cost of handling.

Compare **feature for feature, dollar for dollar.**

There's an EICO distributor right nearby in your own neighborhood — over 1200 coast-to-coast. EICO planned it that way so that you can easily examine EICO **BEFORE YOU PUT DOWN ONE CENT OF YOUR MONEY!**

COMPARE any of EICO's 46 models **SIDE BY SIDE** with **ANY** competitor. Then YOU judge who's giving you the **MOST** for your money.

Over 500,000 EICO instruments in use . . . You'll agree EICO gives you **LABORATORY PRECISION AT LOWEST COST.**

Turn page for other EICO ad

FREE 1956 EICO CATALOG!

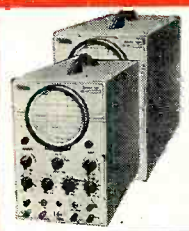
Tells you how to SAVE 50% on your test equipment costs!

TUBE TESTER #625
KIT $34.95
Wired $49.95
• tests 600 mil series string type tubes
• illuminated roll-chart

Pix Tube Test Adapter $4.50

New! GEIGER COUNTER #803
KIT $19.95 Wired $29.95

(less batteries)
Professional, all-electronic, sensitive, rugged—at lowest cost! Indicates by neon lamp & headphone clicks.



5" PUSH-PULL OSCILLOSCOPE #425
KIT $44.95
Wired $79.95
•
7" PUSH-PULL OSCILLOSCOPE #470
KIT $79.95
Wired $129.50

VACUUM TUBE VOLTMETER #221
KIT $25.95
Wired $39.95
•
DELUXE VTVM # 214 (7½" METER)
KIT $34.95
Wired $54.95

RF SIGNAL GENERATOR #320
KIT $19.95
Wired $29.95
150 kc-34 mc, calibrated harmonics to 102 mc. Pure or mod. RF, & Colpitts osc. 400 cps sine outputs.

CATHODE RAY TUBE CHECKER #630
KIT $17.95 Wired $24.95

Easy, fast test of all types & sizes TV pix & scope CR tubes, in set or carton.

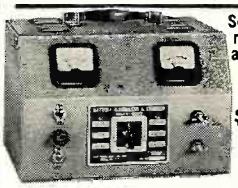
#944 FLYBACK TRANSFORMER & YOKE TESTER
KIT $23.95
Wired $34.95
• fast check all flybacks & yokes in or out of set.
• spots even 1 shorted turn!

Range 500 kc—228 mc on fund. Cont. sweep width control, 0—30 mc.
KIT $34.95
Wired $49.95

TV/FM SWEEP GENERATOR #360
5MC-4.5MC CRYSTAL ..... $3.95 ea.

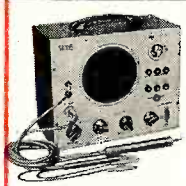
1% accuracy on all 7 ranges. Range 75 kc—150 mc. Volt reg.
KIT $39.95
Wired $59.95

DELUXE RF SIGNAL GENERATOR #315



Sep. volt-meter & ammeter
KIT $29.95
Wired $38.95

6V & 12V BATTERY ELIMINATOR & CHARGER #1050



Sep. hi-gain RF & lo-gain audio inputs. Special noise locator. Calibrated wattmeter.
KIT $24.95
Wired $39.95

DELUXE MULTI-SIGNAL TRACER #147

Reads 0.5 ohms—500 megs, 10 mmfd—5000 mfd, power factor.
KIT $19.95
Wired $29.95

R-C BRIDGE & R-C-L COMPARATOR #950B

***New!* BATTERY TESTER #584**
KIT $9.95
Wired $12.95
•
Tests A & B portable radio, hearing-aid, lantern, other batteries—in or out of equipment.

20,000 Ohms/Volt MULTIMETER #565
KIT $24.95
Wired $29.95

1000 Ohms/Volt MULTIMETER # 536
KIT $12.90
Wired $14.90

VTVM PROBES	KIT	Wired
Peak-to-Peak	$4.95	$6.95
RF	$3.75	$4.95
High Voltage Probe-1		$6.95
High Voltage Probe-2		$4.95
SCOPE PROBES		
Demodulator	$3.75	$5.75
Direct	$2.75	$3.95
Low Capacity	$3.75	$5.75

For FREE 1956 catalog, mail coupon NOW!

EICO®

84 Withers St. • Brooklyn 11, N. Y.

Prices 5% higher on West coast and subject to change without notice. ©55

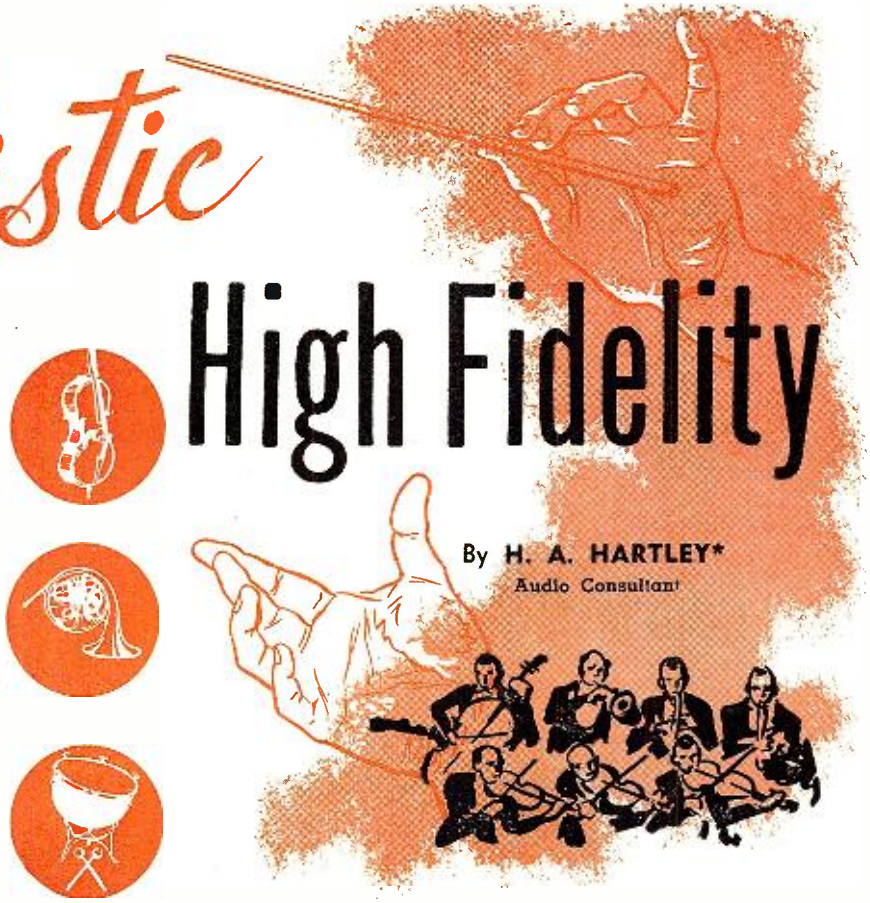
EICO, 84 Withers Street R-4
Brooklyn 11, New York

Send FREE 1956 Catalog and name of neighborhood EICO jobber.

Name.....
Home Address.....
City.....Zone.....State.....
Occupation.....

1945 to 1955: a decade of Know-How & Value Leadership in Kits & Instruments—over ½ million sold to date!

Realistic High Fidelity



By H. A. HARTLEY*
Audio Consultant

Part I. "Is today's high-fidelity really realistic?" is the subject chosen by noted authority in the field of audio for his opening article. Subsequent articles in this series will cover—in layman's language—facts about room acoustics and the design and operation of all the various units in a home sound reproducing system setup.

THE object of this series of articles is to show you how to achieve very good musical reproduction in your home without putting you to the task of learning mathematics, electronic theory, and acoustics, while saving you from the snags of making unsuitable purchases in your equipment. Many people with a cultivated taste in music have spent large amounts of currency putting together a music system and some have not bothered about the music very much, but have paid a great deal of attention to reproducing very high treble and very low bass. Both types are called "high-fidelity fans" and I am going to suggest that except in rare cases the results they get are not music. Perhaps no compact phrase has ever been so overworked as "high-fidelity," so before I show you how it may be achieved (and it can be achieved at quite modest cost) it would be a good idea to let us work out a definition of what it really means. In case you wonder what qualifications I may have for such a discussion I can only say that as I was the inventor of the phrase, 'way back in 1927, I know, at least, what was in my mind when I first used the words.

I had been in radio and audio research ever since the "wireless" industry came into existence. I was also interested in music. In those days the reproduction obtainable from the usual commercial equipment may have satisfied the ordinary listener, but no one with any knowledge of what live music sounded like could pretend that it was anything better than a very thin ghost of the real thing. With a few co-workers of similar outlook I came to the conclusion that something could be done about it, and we developed amplifiers and speakers that were immeasurably better than anything on the commercial market. We tried out our equipment on the sales department of the company for which we worked, and it was turned down flat because it sounded uncomfortable. It was criticized because the reproduction was edgy and thin, and had no nicely rounded "tone" (whatever that meant). Actually what was wrong with the idea was that in reproducing all that was best in the whole chain of sound reproduction it also reproduced all the defects, and the salesmen said that although we might have gotten something if we could make the regular equipment sound better, they couldn't sell something that made it sound worse.

This very primitive argument contains the whole schedule of drawbacks of what we christened high-fidelity reproduction, for when we said something was high-fidelity reproduction we meant simply that the equipment itself did not add distortion to the signal going into it. Of course, we needn't have used the word "high" at all, for fidelity without any qualification is just fidelity, no more, no less; but those were the days when the cheapest and most loathsome radios were advertised as having "perfect reproduction," so the addition of "high" was just a gimmick.

However, although the commercially-minded gentlemen wouldn't have anything to do with our new sound, the idea clung to a number of enthusiasts and tempted your present contributor to throw up his job as a scientific worker in a commercial organization and start in the hard way, by becoming his own boss. What I have to tell you, therefore, is the cumulative experience of over twenty-five years of specializing, commercially, in high-fidelity sound reproduction; and particularly during the past two or three years I have noted that advertising agents, with their customary ingenuity, have found that "hi-fi" today is nearly as effective as the "perfect reproduction" of twenty years ago, and means as little.

I am not going to suggest that this misuse of the term is always intended to be misleading. Certainly some quite ordinary equipment is labeled "high fidelity" when the manufacturer knows perfectly well that it isn't; but if the market has become conditioned to the broad principle that high-fidelity equipment is something better than ordinary equipment (which it is, since the

* Mr. Hartley is one of the "old timers" in the electronics field having served his apprenticeship in British broadcasting during its experimental phases at Writtle, Essex. With P. K. Turner, he founded Hartley-Turner Radio Ltd. to manufacture hi-fi equipment. When the plant was destroyed during the war, Mr. Hartley switched to the design of airborne radar. In 1946, the Hartley-Turner firm was reactivated as H. A. Hartley Co. Ltd. and is still operating in London. Mr Hartley sold his British interests in 1953 and is now scientific and technical adviser to Hartley Products Co., New York.

factors outside the control of the listener have so profoundly improved in recent years) then it is but a small slide down in ethics to jump onto the hi-fi bandwagon, and makes life that much easier. The real trouble is that there is no standard definition for high-fidelity reproduction. If we are to assume that the use of the phrase implies that the equipment has a wide frequency range and is free from distortion, then we might very well ask "how wide a frequency range?" and "how much distortion?", for it is quite obvious that mere mortals like ourselves cannot produce perfect equipment, nor can we expect perfect phonograph records, microphones, and transmitters. There has got to be a compromise between perfection and possibility at a price the people can pay, and where that compromise is established is a matter of considerable dispute.

The engineer can lay down what he considers the correct specification. Sounds can be analyzed, auditorium acoustics studied, pickups, tuners, amplifiers, speakers, and speaker housings can be designed to deal with the frequency range in a way which produces no more distortion than the ear has been measured to accept as fidelity. By scientific method it could probably be shown that a musical score could be translated into reproduced sound in such a way that the composer's intentions had been realized. And I assert, in the teeth of objections by my fellow engineers, that the result would *not* necessarily be high fidelity.

The reason for my being apparently "difficult" is that I insist that what I originally meant by high-fidelity, and what I should think the average music-lover supposes he wants when he buys high-fidelity equipment, is sound emerging from the speaker which is a very close approximation of the sort of thing I hear when I go to a concert. The whole idea of music is to create certain effects in the mind of the listener and the composer of the music intends, and has always intended, that the musical sounds he has invented or created shall be heard "live" at first hand. I agree that there is a school of thought which argues that there is a new field of enterprise for musical composers to think in terms of electronic reproduction, and I have no fault to find with such a philosophy; but this sort of musical composition must not be allowed to impinge on the music that has been written for direct hearing.

Mozart, Beethoven, Brahms, Berlioz, Elgar, Walton, Copland, to mention only a few composers who are "hi-fi-genic" (if I may coin a terrible word) intended their music to be heard directly by the human ear and not through a loudspeaker. The coming of electrical reproduction made it possible for a much wider audience to participate in the delights of listening to their compositions, but the interposition of the electrical reproducer must not permit any coloration to act as a sort of filter between the live music and the listener's ear. If a musically trained listener, fully aware of what a particular symphony sounds like in a properly designed concert hall when played by a competent orchestra, can hear the same work through a reproducing system in an ordinary living room and get practically the same aesthetic enjoyment from it, then he will be listening to what I call high-fidelity reproduction, and, from the artistic point of view, it doesn't matter two hoots what the frequency response is or what electrical and acoustical tricks the designer has played on him. What matters is the end product. For the purposes of these articles I am calling the system of reproduction *realistic high fidelity* simply because there are quite a number of excellently designed audio devices, technically correctly labeled high fidelity, because they do give wide frequency response without appreciable distortion, but which do not give that aesthetic satisfaction the realist demands for adequate enjoyment.

I do appreciate that there are many people who are quite seriously interested in what can only be described as audio stunts, and a number of record manufacturers have produced special hi-fi demonstration records which show that the technique of recording can produce quite amazing results for people who want amazing results. Basically, however, we are most interested in deriving the utmost possible pleasure from the works of the musical masters, and that is what I shall try to see that you get. You might think that you have enough power of discrimination to choose what you like yourself, and I do not deny that you may have; but are you sure that your comparison tests are going to be fair to you? Let me give two examples of where they might not be.

Serious-minded dealers have gone to considerable trouble and expense to install A-B test demonstration rooms, so that you can judge for yourself which speaker you like best and which amplifier gives the best results on the speaker of your choice. Assuming the dealer has no ax to grind, that he has not loaded the dice in favor of the product which gives him the best discount, you are left with the inescapable fact that you are listening in an auditorium which probably has no acoustic properties resembling those of your own private room in which you do your listening. Other manufacturers have given public demonstrations of their equipment, where a live performance has been repeated as a recording and reproduction and you are invited to make the comparison.

Assuming the demonstration has been so good that you can't tell the difference, what does it prove beyond the fact that the demonstrator has so arranged matters that that is the impression he wished you to form. Technically speaking, it is comparatively easy to stage such a demonstration (I have done it myself many times) but it does *not* prove that this is the equipment you want in your home, for once again the acoustics of the demonstration auditorium do not resemble those of your private room. It might even be that equipment of less perfect performance would give better results in your own home.

Now you may well ask where do we go from here? And that is what I want to show you. Some of what I say you may have to take on trust until you can prove it independently. My technical facts will be beyond dispute, but when, as is inevitable, I have to wander a little into the intangibles, you will have to judge for yourself. But before you go wandering there is a well-marked technical route which cannot be left without disaster, so the technical side must come first, and I shall try to make the technology as easy to follow as possible. When you have got that far, then comes the final test by which your efforts and my arguments stand or fall. Go to concerts just to get accustomed to what real live music really sounds like; then go home and play your records. If you get the same pleasure at home as when you listened to the real thing, then you have achieved what you intended. And I assure you you can.

It is usual to liken sound waves to the ripples set up on the surface of a pond by dropping a stone into it. Except for the appearance of radiating circles which suggest that the sound waves radiate in a similar manner,

there is nothing else in common. If the pond is a rectanguar glass tank then disturbance of the surface at one end will enable you to see the cross-section of the moving water and an instantaneous photograph taken of the side along which the ripples travel will give a picture like Fig. 1A, which is obviously a sine-wave trace of gradually decreasing amplitude. Water is virtually incompressible and the amplitude of successive waves decreases simply because the diameter of the circular ripples is always increasing; since the original applied energy (produced by the dropping stone) is finite, the energy transferred from the first ripple to the larger second ripple can only produce a smaller displacement of the water. Note the three characteristics of water ripples produced by the impact of a solid body: the energy of the stone is transferred directly to the water (there is nothing between the stone and the water); the ripples lie in a plane surface normally quite flat; the ripples themselves do not move outwards but transfer their energy to adjacent still water to create this appearance, and the motion of transfer is sinusoidal. On none of these three counts do sound waves agree with water waves.

First, to create a sound something has to be interposed between the actuating object and the air itself. For example, in a violin bowing the strings (the equivalent of dropping the stone in the pond) sets them vibrating, but this vibration in itself produces practically no sound at all; but the strings are stretched across the little bridge which rests on the belly of the instrument, and the vibration of the strings is therefore transferred to the belly, which in turn acts as a piston to set the air in motion. Even wind instruments without reeds or other moving parts, like horns, flutes, and the diapason pipes of the organ, have a "piston" in the form of the air enclosed within the tube of the sound-maker, this air resonating at a frequency determined by the dimensions of the tube. So the surrounding air is set in motion by a solid or pneumatic piston, not directly by the original application of energy.

Secondly, sound waves, in still air, travel outwards not as circles but as spheres centered on the point of origin.

Thirdly, the transfer of energy from the point of origin outwards into space is quite different from the behaviour of ripples. The diagram of Fig. 1A shows that the ripples move sinusoidally across the datum line represented by the surface of still water. They are, therefore, *transverse waves* since they are continually crossing the line of propagation. Since water cannot be compressed the radiating energy must be transferred in this way; but air is an elastic medium and it can be compressed and rarefied, so the propagation of sound waves is by a successive compression and rarefaction of the air along the line of propagation—there is no movement to left or right or up and down. Such waves are called *longitudinal waves* because they move along a line. In spherical radiation there must obviously be an infinite number of lines of propagation in all directions, but let us consider only one line.

The first impact of the piston produces a state of compression in the air immediately beside it. This compressed air wishes to expand, and in doing so pushes against the next small packet of air, which is compressed in its turn, and this pushes the next, and so on. But the first packet of air when expanding over-reaches itself somewhat and so becomes rarefied, and in resuming normal volume tends to draw back the air it has already pushed. Propagation of sound, therefore, from a point source involves the creation of a tiny sphere of compressed air which transfers its energy to another sphere just enveloping it, and so on. Instead of the sine wave of Fig. 1A we can represent this state of affairs as in Fig. 1B, where the short lines close together represent compression and the far apart lines rarefaction. It should be noted, however, that this diagram represents an instantaneous state, for the compressed area moves forward from left to right through the whole cycle and then repeats as long as the original sound is continued. As the compression and decompression can only occur as the result of the displacement of particles of air, it follows that each particle during the interval of one cycle must move forwards and then backwards to its original position. If the distance moved could be measured and plotted on a curve, above the datum line for forward movement and below it for backward movement, the curve would be sinusoidal.

It can be seen, therefore, that there is a sort of family relationship between water waves and sound waves in that one characteristic of each is of sine-wave form, but the peculiar characteristic of a sound wave is that it is created by little packets of compression traveling along a straight line, and when multiplied by infinity create spheres of compression traveling outwards. Each compressed packet is charged with energy which impinges on your ear drum. If the sound is *transient* then there is only one impact on the ear; if a steady tone, then the ear is successively hit with packets of air as frequently as the originating "piston" moves the air. If *X* and *Y* in Fig. 1B are the points of maximum compression, then the distance *XY* is called the *wavelength* of the sound, and the wavelength is a function of the frequency.

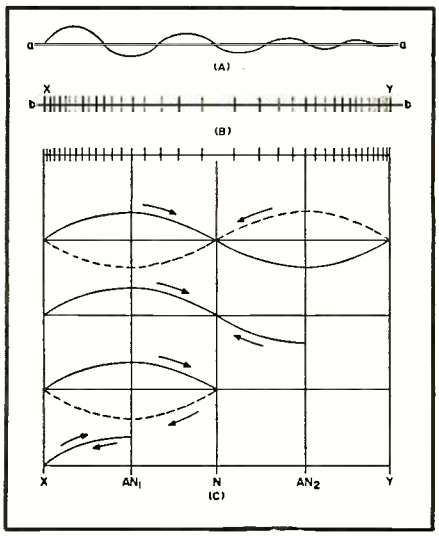
The discussion thus far deals only with a simple wave having indirect sinusoidal motion of the type described. The behaviour of the air can be analyzed by strict mathematical methods, but there seems little point in giving the mathematical proof if you are prepared to accept what I have written as correct. The discussion, and its mathematical treatment, can be developed for complex waves, which consist of a fundamental frequency and one or more harmonics, each harmonic having a frequency which is 2, 3, 4, 5 .....times the fundamental frequency. The movement of each particle of air is more complex, but follows the same general principles, as long as it is not confined in a closed space. But the room in which you will do your listening is an enclosed space, for it has walls, and the walls not only arrest the sound wave but reflect it back along its path.

Now you have seen that the wave assumes the form of an expanding sphere, and if the room in which it was generated was a sphere also then it requires little thought to imagine that the reflection would be constant throughout the room. Rooms being rectangular and not spherical, it follows that different sorts of reflection take place.

Let us return to a single ray of sound, one isolated wave traveling along a line of propagation. Let this ray continue until it meets a wall which is 100% reflective and perpendicular to it. Clearly, the sound will be reflected back along its original path. In Fig. 1B, the particles are moving to create compression and rarefaction and move from a condition of maximum forward movement through zero to maximum backward movement (which is the same as greatest negative forward movement). The maxima and minima of compression are called *nodes* and in Fig. 1B one node is exactly halfway between *X* and *Y*. Those points exactly halfway between the node and *X* and *Y* are called *antinodes*. As the linearly-increased density of the particles moves along the line of propagation there is no change of *position* and the amplitude is zero, but there is a change of *density* at the nodes; at the antinodes there is maximum amplitude but no change of density.

Now consider what happens when there is reflection. Assume a reflector, such as a hard polished wall, with 100% reflective power. In Fig. 1C the

Fig. 1. (A) Cross-section of transverse waves of water ripples. (B) Compression of longitudinal sound waves. (C) Effects of a reflector on sound waves at nodes and antinodes. Refer to article for details.



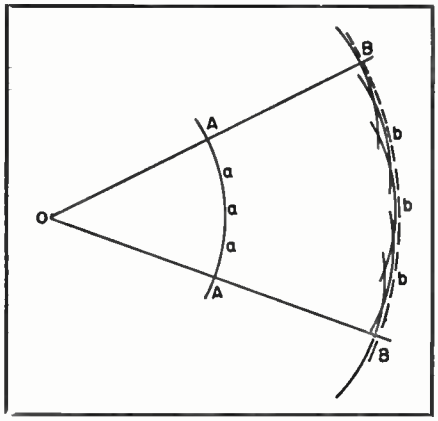


Fig. 2. Huyghens' principle of propagation of sound waves. This is discussed in text.

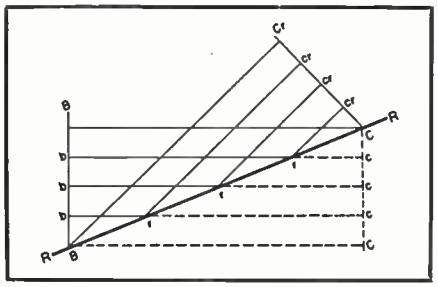


Fig. 3. Huyghens' principle, demonstrated in Fig. 2, applied to reflected sound waves.

first wavelength *XY* of Fig. 1B is shown at the top, and below it a pictorial representation of rate of change in density, which is of sine-wave form. The nodes *X* and *Y* are lettered as before and the intermediate node at half wavelength is lettered *N*; the antinodes are AN_1 and AN_2. The outgoing wave is shown as a solid line, and when reflected by the wall at *Y* it is dotted; the arrows show the direction of travel. With the reflector at a node it is seen that the resultant of the two waves is zero, but when the reflector is at an antinode the reflected wave takes the same course (of compression and decompression) as the original wave. It is obvious, therefore, that the position of the reflector has a profound bearing on the sound wave, which means simply that a sound wave originating in a room will not have the same effect on the ear as the same sound wave originating in an open space, or in an anechoic room such as is found in well equipped acoustical laboratories (the word "anechoic" means simply no echoes, no reflection).

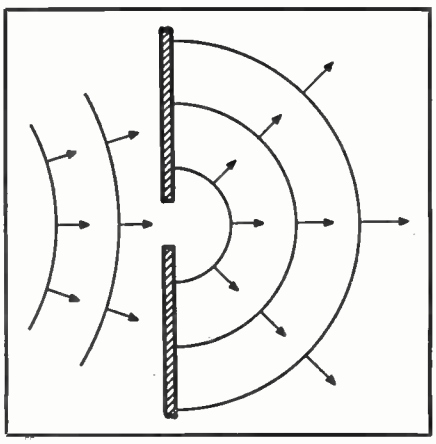
These results derive from the reflector being exactly at right angles to the line of propagation; to understand what happens when the sound wave falls obliquely on the reflector it is easier to consider what is usually called Huyghens' principle of wave propagation, for in any event we are interested not in waves proceeding in a straight line but in expanding spheres. A sphere is formed of an infinite number of cones, so let Fig. 2 represent the cross-section of one cone, the sound source being at *O*.

Huyghens' principle states that at any instant the wavefront of a sound wave is the envelope of wavelets whose origins are all the points comprising the wavefront which existed *t* seconds previously. In an isotropic medium at rest these wavelets are spherical and of radius *vt*, where *v* is the velocity of propagation of the waves in the given medium. (In strict accuracy it must be pointed out that Huyghens was primarily concerned with light waves, but the same argument applies to sound waves.) In Fig. 2 from the point *O* as center we describe an arc *AA*, which can be subdivided by the points *a, a, a*.....; these points can be considered air particles affected by the emergence of the original particle from *O*. In practice, of course, the distance *OA* would be extremely small, for we assume that only one particle from *O* affected several particles *a*.

From *AaaaA* we now describe a series of arcs of radius *AA* to produce the form shown at *BbbbB*. The envelope, that is the line enclosing this form and shown dotted, is the new wavefront. From this new wavefront a further series of arcs can be described, and so on indefinitely. The distance from *A* to *B* is *vt*. This principle of Huyghens was stated as long ago as 1678 and there is no proof that it is correct; yet it is generally accepted because it is a *reasonable* explanation of what happens, and experiment has not contradicted it. Moreover it does give an understandable picture of how a sound wave progresses, and since the factor *t* is involved it can be understood that the *scale* of the diagram, if one may use the term in this way, is dependent on the frequency of the sound wave in cycles-per-second.

Now consider Fig. 3. The reflector *RR* interrupts the passage of the sound wave whose wavefront is *BbbbB*. If it were not there the track of the sound wave would obviously be within the rectangle *BBCC*, but that part of the rectangle shown dotted is the part reflected by *RR*. Using the Huyghens' idea we can consider the approaching wavefront as *BB* with wavelets starting from the points *b, b, b*. The point of incidence of the lower *B* on the reflector indicates that at the instant this wavelet hits the reflector the wavelet from the upper *B* has still to travel the distance *BC*, and the intermediate wavelets the distances *br*. The dotted line *BC* represents the path of wavelet lower *B* if it were not reflected, but as it is reflected by a 100% efficient sound mirror it must have the same magnitude, so we describe an arc with center lower *B* and radius *BC*. Similarly, the wavelets emanating from *b, b, b* are reflected at *r, r, r* and are reflected onto the wavefront *CrC* at positions *cr*, the distances *rcr* being equal to the distances *rc*. So, then, at a given instant, part of the wavefront is wholly reflected, part is not reflected at all, and the intermediate wavelets are partially reflected. In the whole process it will be noticed that the wavefront is reversed with respect to the plane of the reflector.

Fig. 4. Dispersion effect of a sound barrier having a slot or hole. See article.



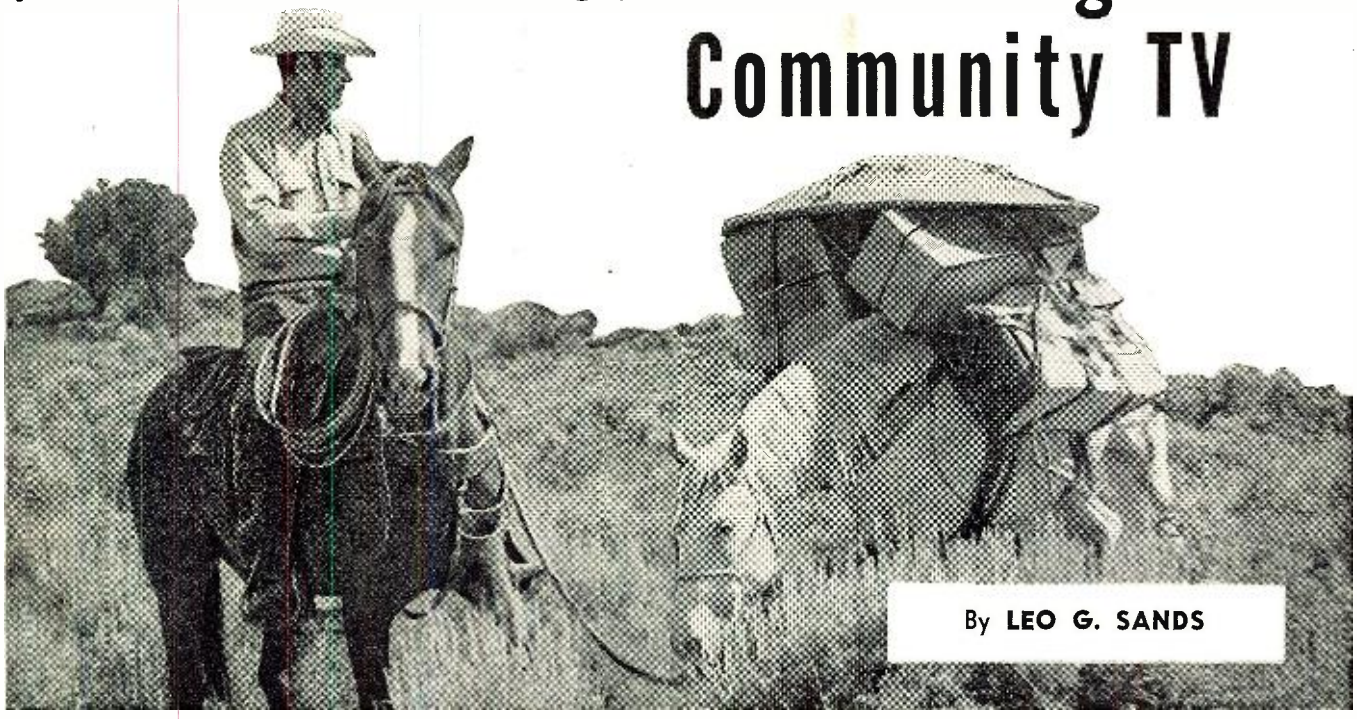
By a similar argument it can be shown that where the reflector is only a poor reflector, so that it is *transparent* to sound waves, refraction of the sound waves takes place in a manner similar to that of the refraction of light waves; this is of importance when considering the effect of hanging "diffusing" materials over the sound source, or, for that matter, the use of fabrics over the front opening of a speaker cabinet.

One further characteristic of the behaviour of sound waves should be noted before we apply these generalizations to the consideration of room acoustics. In Fig. 4 is shown the approach of a sound wave to a hole in a sound-insulating partition. Most of the wave is blocked, but that part passing through the hole takes on the characteristic spherical form. In other words the sound passing through the hole is diffused throughout the space on the forward side of the partition. This may not seem to be a very exciting thing to illustrate but it happens to be of considerable value in improving listening conditions with unsatisfactory speakers. We have not yet reached the stage when we can criticize speaker design but it will be within the knowledge of many of you that many speakers focus the high frequencies in a very pronounced manner. This is due to defective design, but it can be overcome in a very simple way.

If Fig. 4 is considered to be the cross-section of a board having a slot as wide as the speaker diaphragm, it follows that if such a board is placed before a speaker that "beams" the highs, the beam will be spread out in a horizontal plane if the slot is vertical and in a vertical plane if the slot is horizontal. The former condition is what we require for ordinary room listening. Obviously the board should not be so close to the speaker baffle or cabinet that it blocks the bass, but such a diffuser an inch or two in front of the speaker produces quite astonishing improvement of high note response off the axis of the speaker. The diffusing board can be cut from quarter-inch plywood, the sides about an inch greater than the speaker diaphragm diameter, and the slot about an inch wide.

(To be continued)

California Regulates Community TV



Establishing the microwave relay station on Spruce Mountain in eastern Nevada involves packing in the necessary equipment by horseback and, in some cases, on foot.

By LEO G. SANDS

A recent California ruling may point the way toward state supervision of television-signal distribution companies.

A RECENT development, which may be indicative of a coming trend, has taken effect in California with a California Public Utilities Commission ruling classifying as public utilities all companies that supply television reception to the public by cable.

The new ruling makes these companies subject to regulation similar to that imposed on telephone and telegraph common carriers. In California the rates will now be regulated by the state and no longer on the basis of what the traffic will bear. The California ruling was the result of a petition presented by a small group of subscribers who complained that the service being rendered by a certain community television signal distribution firm was inadequate.

At least one of the companies affected by the new ruling welcomes the move. William Gentry, president of *Television Transmission, Inc.* of Martinez, California, feels that by placing community television signal distribution companies under state regulation, the industry stands to gain prestige of the type accorded gas and electric service companies.

By being classed as a public utility community TV systems will find it easier to obtain financing since specific territories will probably be assigned to individual companies and investors thus be assured of greater protection against loss due to competition moving in.

Gentry's company now serves approximately 1250 subscribers in Contra Costa county. Present rates are $160 for initial connection and $3 per month for service.

In addition to State regulation, the company will soon be subject to Federal regulation when its subsidiary, *Television Microwave Company*, goes into operation serving nine small towns in Nevada with signals picked up from three TV stations in Salt Lake City, Utah. The new microwave system will operate in the common-carrier sector of the 6000 megacycle band.

Although there are three TV stations now in operation in Nevada (one in Reno and two in the Las Vegas-Henderson area), none of these stations can be used to service the area in which Mr. Gentry plans to operate because of the mountains intervening. In order to bring TV to Winnemucca, Ruth, Ely, McGill, Wells, Elko, Carlin, Battle Mountain, and Lovelock—all located in central Nevada—the TV signals from Salt Lake City will be picked up at Spruce Mountain in eastern Nevada and relayed west. It is expected that the mountain location will also be utilized by the CAA and the Nevada Highway Department. Two diesel-engine-driven generators will provide electric power for the TV receivers and microwave equipment as well as satisfy the requirements of other joint users of the site.

Ambitious projects such as these are not economically feasible unless there is some assurance that a competitive system will not be set up to service the same area. Although state regulation of community TV is not anticipated in Nevada, the operation of this particular microwave system will be under FCC regulation and, as a common carrier, tariffs must be filed and approved by that body.

What will happen in other states is hard to anticipate but the California ruling does have one salutary effect, namely, making it easier for community TV firms to take over in new areas since local governments and civic bodies are no longer the licensing agencies. —30—

One of the most serious problems facing a community TV system operator is maintaining service in both good weather and bad.

Servicing HIGHWAY Hi-Fi

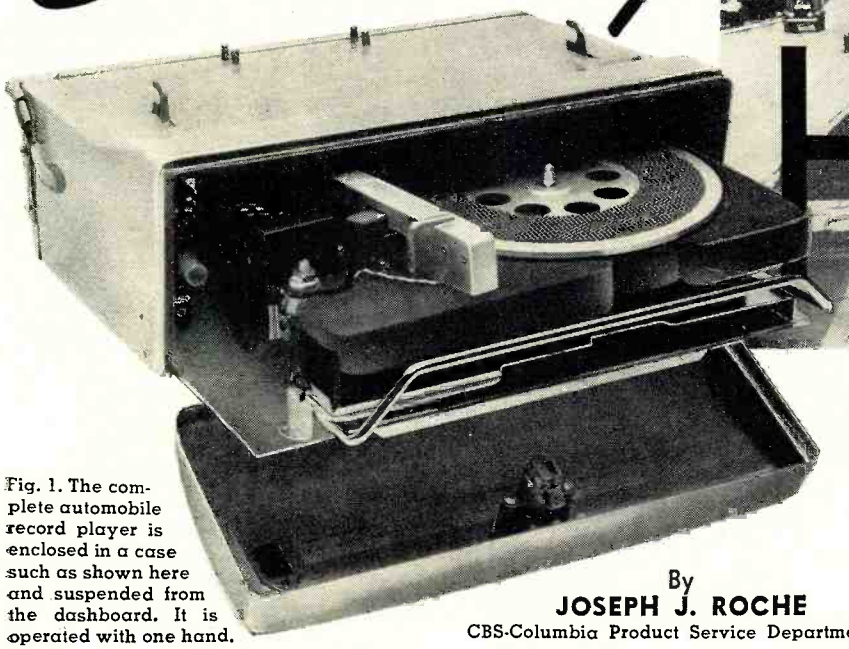


Fig. 1. The complete automobile record player is enclosed in a case such as shown here and suspended from the dashboard. It is operated with one hand.

By
JOSEPH J. ROCHE
CBS-Columbia Product Service Department

This latest automobile accessory, shown on the front cover, introduces some unusual servicing problems.

LAST fall the *Chrysler Corporation* made news when it announced that an automobile record player would be available for its 1956 model cars. Called "Highway Hi-Fi," these units are manufactured by *CBS-Columbia* and contain some interesting innovations.

The player uses a new 7-inch, extra long playing (XLP) record. The new record provides up to 45 minutes of music or one hour of speech on each side. This playing time is achieved by using a turntable speed of 16⅔ rpm, half that of the standard LP record, and employing 550 grooves per inch—twice that of the LP record. The new record requires a 0.25-mil radius stylus as compared to the 1-mil stylus used with present LP's.

The record player is mounted in a compact metal case under the dashboard of the car. To place a record on the turntable the player is pulled forward partially out of its case as shown in Fig. 1. A curved ridge, the same radius as the record, is located behind the turntable. Holding the record against this ridge aligns the record center hole with the turntable spindle. The record is then dropped in place on the turntable.

To permit convenient one-hand operation with a minimum of attention, a tone arm indexing device is provided. The tone arm locks in the "off" position. To start a record, a small tab on the side of the tone arm is depressed, as shown in Fig. 2. This releases the tone arm, which is then moved to the right until it strikes an indexing latch that positions the stylus over the run-in groove on the record. The tab on the side of the tone arm is then released and the stylus sets down on the start of the record. As the tone arm moves out of the rest position, the turntable drive linkage is automatically engaged and the record revolves.

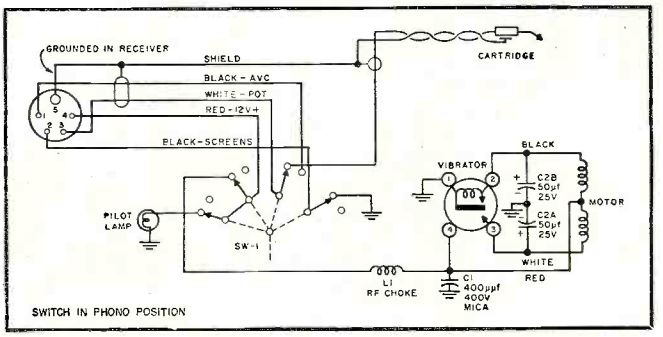
The pickup cartridge is a ceramic type designed especially for use in the unit. The cartridge provides an output substantially uniform from 50 to 10,000 cps and no further compensation is required. Stylus pressure is 2.5 grams.

The audio section of the automobile radio is used with the record player. A switch on the phonograph (see Fig. 1) permits selection of radio or phono operation. When the switch is placed in the phono position, the screen grids of the r.f. and i.f. stages of the receiver are grounded through a low resistance to render them inoperative, and the output of the record player is connected across the volume control of the radio, see Fig. 3.

Power for the a.c. induction motor used in the record player is obtained from a 60 cps vibrator operating off

Fig. 2. Pressing the small tab on the tone arm, shown here, releases the tone arm. Moving it to the right starts turntable.

Fig. 3. Simplified schematic diagram of the circuit of the "Highway Hi-Fi" unit. The car radio's amplifier and speaker amplify and reproduce the sound signal from the pickup.



the automobile's 12-volt d.c. electrical system. The motor speed remains substantially constant over a supply voltage range of approximately 10.5 to 16 volts—considerably in excess of that normally encountered in the car's electrical system.

If an attempt were made to operate an ordinary phonograph in an automobile, assuming that the necessary power supply were available, two main problems would be encountered; when the car started, stopped, changed speed, turned, or hit a bump, the stylus would jump out of the groove and the turntable speed would vary, and vibration and shock would be transmitted to the stylus and converted into objectionable noise in the audio output of the system.

To prevent vibration and road shock from being transmitted to the stylus, the player mechanism is mounted on special rubber shock-mount cushions. The natural period of vibration of the shock mount is lower than the cut-off frequency of the pickup cartridge. Thus, vibrations whose frequencies fall within the response range of the audio system are filtered out, while any remaining vibration which reaches the player is too low in frequency to be reproduced.

In home record players, weighted turntables are generally used to minimize wow. The heavy turntable provides a flywheel action which smooths out minor motor speed variations. If such a turntable were used in an automobile, it would be acted upon by the forces produced by the motion of the car, and would tend to change speed whenever the automobile's rate or direction of travel changed. To overcome this problem, the "Highway Hi-Fi" unit is equipped with an extremely light aluminum-alloy turntable. To minimize motor speed variation, the motor is equipped with a small flywheel. Because of its smaller mass, this flywheel is much less susceptible to forces resulting from the motion of the automobile. At the same time, because it revolves at the same speed as the motor, the small flywheel can provide the desired steadying effect.

Perhaps one of the most difficult problems which had to be overcome in the design of the automobile record player was the effect of changes in the automobile's speed and direction on the tone arm. With a tone arm of ordinary design, the stylus would skate across the record at the slightest pressure on the brake or accelerator pedal. Turning a corner would have a similar effect. When the car struck a bump the stylus would be lifted off the record.

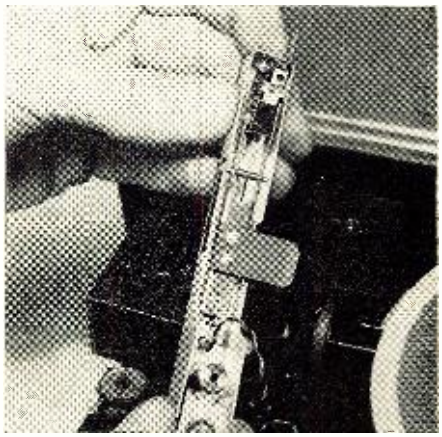


Fig. 4. Bottom view of the pickup arm showing the rocker assembly which holds the pickup, and the cylindrical pivot.

To overcome these problems, the tone arm in the "Highway Hi-Fi" unit is mounted on a cylindrical vertical bearing which is fastened to the motorboard. A close fitting cylindrical pivot on the underside of the tone arm, shown in Fig. 4, slides down into this bearing. This arrangement permits the tone arm to move around the pivot in the horizontal plane, but prevents it from moving up or down. The tone arm is provided with a counter-

(*Continued on page* 140)

TABLE 1. TROUBLESHOOTING CHART FOR SERVICING "HIGHWAY HI-FI" RECORD PLAYERS

Turntable does not revolve.

1. If motor flywheel is turning, check for:
   a. Motor coupling sleeve disengaged.
   b. Damping spring or idler lifter spring too tight, preventing idler wheel from contacting drive shaft.
2. If motor flywheel is not turning, check for:
   a. "Phono-Radio" switch in radio position.
   b. Defective vibrator. Check by touching vibrator with fingers to determine that it is vibrating. Determine cause of failure before replacing the vibrator.
   c. Motor coupling sleeve partially disengaged, jamming motor shaft.
   d. Motor bearing or armature binding. Motor bearings are self aligning. Using small screwdriver, lift copper bearing retaining springs, located on inner side of bearing cups, away from bearing and jiggle motor shaft until it turns freely.
   e. Open lead. Voltage across outer terminals of motor should be approximately 18 volts a.c.

Turntable continues to revolve when tone arm is in rest position.

1. Spring for idler lifter crank is too tight, causing crank to bind.
2. Idler lifter crank is bent out of shape. Remove crank and bend closer to tone arm.

Stylus does not track or sticks partially through record.

1. Pickup lead improperly dressed, preventing arm from moving freely.
2. Worn or broken stylus.
3. Insufficient stylus pressure.
4. Tone arm pivot dirty or improperly lubricated.

Turntable speed too slow.

1. Defective vibrator. Check by substitution. Determine cause of failure before replacing.
2. Motor coupling sleeve not properly seated.
3. Motor bearings binding. Jiggle motor shaft as described previously.
4. Oil or grease on rubber idler or turntable drive wheel.
5. Open motor lead.
6. Defective motor. Half of winding open.

Tone arm does not set down on start of record.

1. If stylus sets down before or after the run-in groove on record, adjust tone arm stop.
2. If arm does not stop when red tab is depressed and arm is moved to right:
   a. Indexing latch is set too high. Lower latch by adjusting set screw.
   b. Indexing tab on cartridge rocker assembly is bent.

Stylus skips or jumps grooves when car is in motion.

1. Insufficient stylus pressure.
2. Defective stylus.
3. Unbalanced rocker arm.
4. Unbalanced tone arm.
5. Tone arm pivot improperly lubricated.

No audio output (mechanical operation OK).

1. Pickup lead disconnected from cartridge.
2. Short or open in leads.
3. Defective pickup cartridge.
4. Defective "Phono-Radio" switch.

Stylus skates across record when car is in motion.

1. Unbalanced tone arm.
2. Tone arm pivot improperly lubricated.

Tone arm sticks on rest position.

Tone arm shell hooked over idler lifter crank. Lift tone arm straight up, and move crank clear of tone arm.

Audio output distorted.

1. Worn stylus.
2. Defective pickup cartridge.
3. Open section in 50-50 μfd. capacitor.

Wow.

(Speed variation of approximately 8 cps).

1. Warped record.
2. Oil or grease on turntable drive ring.
3. Oil or grease on rubber idler wheel.
4. Flat or bump on rubber idler wheel.
5. Frozen or tight nylon turntable support idler.
6. Worn knurl on turntable drive wheel.
7. Loose turntable mat.
8. Warped turntable.
9. Defective vibrator.

Flutter.

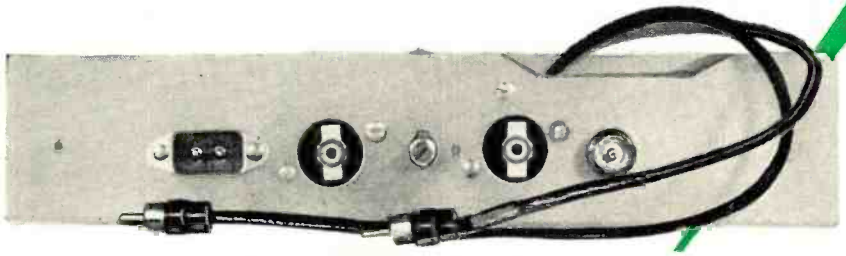
Flutter is a gurgling or thumping sound with a frequency of approximately 40 cps.

1. Shipping bolts not removed.
2. Motor mounts not properly seated.
3. Flat or bump on rubber idler wheel.
4. Motor coupling sleeve improperly seated.
5. Motor flywheel rubbing.
6. Rough or non-concentric bearing block shaft.
7. Rough nylon turntable support idler.

A Tape System You Can Build

By
JOHN L. MacALLISTER
Viking of Minneapolis

The Record-Playback Preamp



Front and rear views of commercial version of circuit described. It can easily be duplicated by the home constructor.

Part 3. Complete construction details on a record-playback preamp including a bias-erase oscillator which can be used with any tape deck that employs "Dynamu" type heads.

LAST MONTH, a simple, basic system for playback of recorded music tapes was described. This system, it may be recalled, consisted of the *Viking* FF75 monaural playback deck, fitted with a single head, and a preamplifier having the proper equalization characteristic for playback of NARTB tapes.

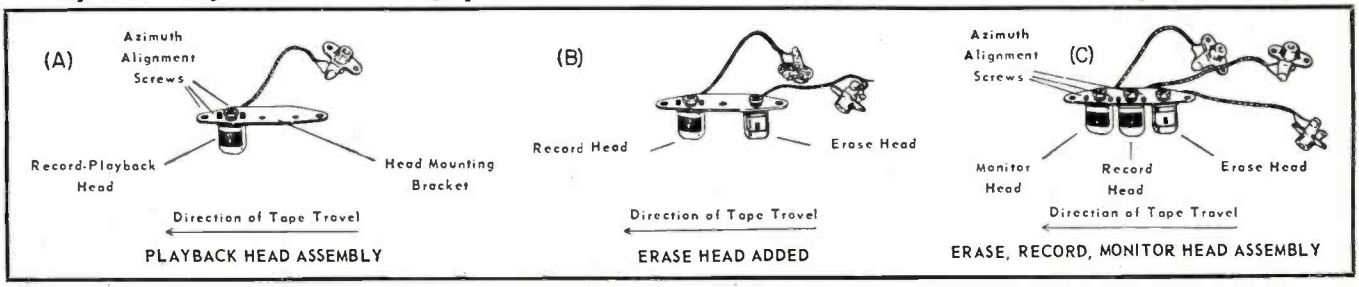
It is safe to assume that sooner or later the average user will wish to convert this simple playback system to one which permits recording as well as playback. Such a system will utilize the same deck, but now equipped with an erase head as well as the original record-playback head. It also requires a record-playback preamp, consisting of an amplifier channel which may be switched to provide either a recording or playback function, and an erase-bias oscillator. The specific head requirements and the construction of a suitable record-playback preamplifier are covered in this article.

The *Viking* FF75 tape deck, like any other presently available tape decks for this purpose, may be obtained as a complete, pretested unit equipped with heads of a desired configuration. The FF75R and FF75RM models are typical. However, one of the purposes of this series was to begin with the basic single-head deck and explain the evolution of the various modes of operation, and the components required. The system, as described, can be used with other tape decks providing the head equalization is properly adjusted and that it is compatible as far as adding the extra heads is concerned.

The simple, single-head assembly provided on the FF75 playback deck is shown in Fig. 1A. It consists of a head mounting bracket and a single head. This head, incidentally, serves with equal effectiveness for both recording and playback. Fig. 1B shows the same head and bracket assembly, but with an erase head added. The FF75 deck so equipped becomes an FF75R. The addition of the erase head is the only modification necessary to convert the basic playback deck for recording. The three-head assembly, shown in Fig. 1C, differs only in that the bracket permits addition of a second record-playback head for simultaneous monitoring from the recorded track on the tape. If a monitoring head is to be added, a playback preamplifier will be required. Such a unit was described in detail in Part 2 (March issue) of this series.

The purpose of the erase head is merely to remove any previously-recorded track from the tape before the tape passes over the record-playback head. In some recorders the erase function is contributed by an ordinary *Alnico* bar magnet over which the tape passes. This device effectively removes the previously recorded track from the tape, but the uniform polarization of the tape results in noticeable hiss upon playback. The more usual practice, therefore, is to use a head quite similar to a record-playback head, but with a considerably longer gap, and to drive this head

Fig. 1. Mounting head assemblies for playback, record, bias, and monitoring operations, available individually or in a group.



from an ultrasonic alternating current generator, *i.e.*, an erase oscillator.

The erase head used with this deck has heavier pole pieces than the record-playback head, and a gap length of 0.007" as compared to the 0.00015" gap length of the *Dynamu* record-playback head. Also, the pole pieces are wider, covering a track width of 0.125" as compared to the 0.090" recording track. Thus it can be seen that the erase head can be expected to fully cover the previously recorded track, erasing the tape before it reaches the record head. To accomplish this, the erase head must be energized with a driving current of approximately 13 ma. from the ultrasonic erase oscillator.

The Erase-Bias Oscillator

One of the first considerations in the design of the erase-bias oscillator is that of selecting a bias frequency. An immediate prerequisite is that the bias frequency must be at least four to five times that of the highest frequency which is to be recorded. This is due to the fact that the erase oscillator has one function other than supplying current to the erase head. During recording, a small portion of this same high frequency current is added to the signal applied to the record head. This is called a *bias current,* hence the name, erase-bias oscillator. The function of this current, added to the signal current, is to promote linearity of the flux pattern on the tape. It establishes the need, however, for a four or five to one bias-to-signal frequency ratio in order to avoid interaction of harmonics of the highest recorded frequencies with this bias frequency.

The immediate inference is that a frequency of 100 kc. or more should be selected, to permit recording of frequencies to 15,000 cycles, or more. This is entirely practical in commercial duplicating equipment or for exacting professional applications. At the home recordist's level, however, an erase bias frequency of this order is impractical for two reasons. First, a 100 kc. frequency takes on many of the characteristics of radio frequency. The shortest of leads between the oscillator and the heads are essential. Second, presently available erase heads are not easily driven at this frequency. Excepting such luxuries as double-gap erase heads, complete erasure becomes increasingly difficult as the erase frequency is increased.

Therefore, it can be stated that unless bulk-erasure is employed to bring tapes down to their virgin noise level prior to recording, a bias frequency of 60 kc. to 70 kc. is as high as is practical. This bias frequency permits recording audio frequencies as high as 12,000 cps without exceeding 2% distortion.

Equalization

Fig. 2, curve A, shows the response curve required for recording. This, as is the response characteristic for play-

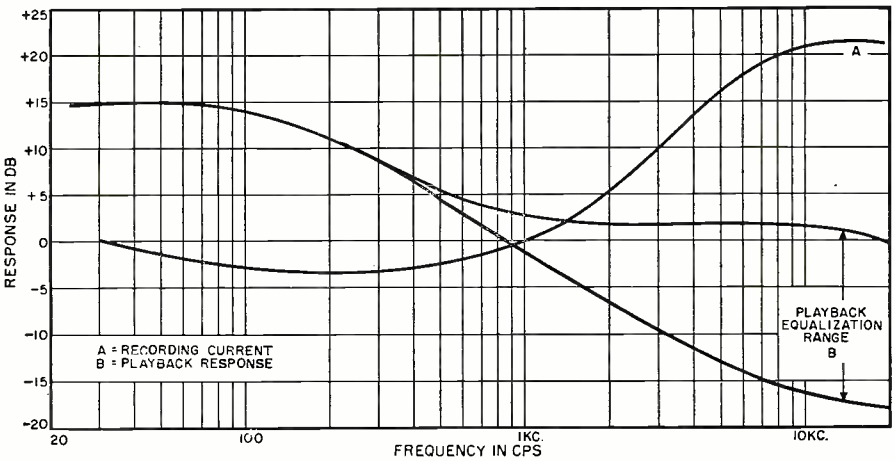


Fig. 2. Approximate record and playback equalization characteristics of unit.

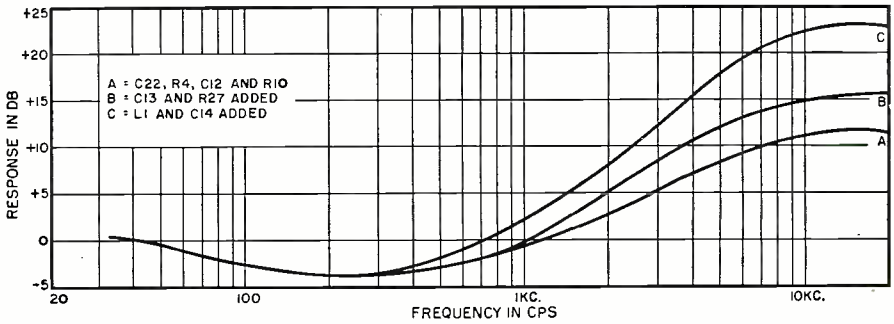
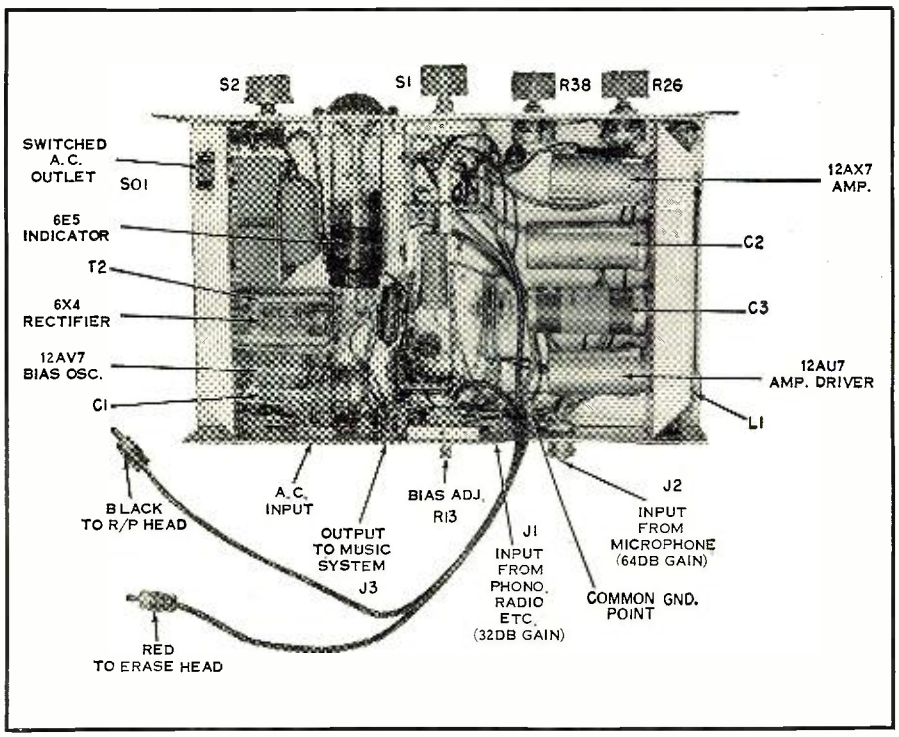


Fig. 3. Effect of equalizing networks, record operation. See discussion in text.

Fig. 4. Top chassis view of preamp with cover removed. All of the major components are identified. Of particular interest is the position of the side flanges. Both flanges are mounted 1½" in from the edge of the chassis. These flanges are welded in the commercial version. For home construction, they can be soldered, riveted, or bolted. The cover, which is not described in detail, completely encloses the top and both sides of the chassis. It is perforated for ventilation. It is shaped to fit the contour of the rear flange as shown in the over-all view on page 46 and in the mechanical diagram of the metal components. The only reason for this indentation is to permit the assembly of this unit as close to the tape deck as possible, without interfering with the fan in the tape deck. This indentation is not necessary if compactness is not required. The a.c. input, shown as a chassis receptacle, could be omitted if the a.c. power-line cord is connected directly into the preamp's power circuit.



back, curve *B*, is that required for over-all equalization to the commonly accepted NARTB standard.

It is immediately apparent that the two equalization characteristics (playback and record) are practically diametrically opposite. Thus, the switching circuitry employed must select equalizing circuit components as well as switch the input and output circuits for record and playback.

As stated in last month's article, the NARTB equalization characteristic requires pre-emphasis of the high frequencies during the recording process. This is necessary to compensate both for the recording characteristics of the tape itself and the losses which occur in playback.

An equalization factor of 6 db-per-octave is possible using an ordinary single-section *RC* network. It will be recalled that one such network sufficed in the design of the preamplifier described last month. A similar network, R_{28} and C_6, (see Fig. 5), serve for playback equalization in the preamp described here. The compensation required during recording, however, is too great to be attained with a single network and is too complex to be so easily achieved.

Actually three separate networks are involved. The additive effect of these networks is shown in Fig. 3. These curves, incidentally, are provided merely to illustrate the method of equalization. They are approximate, inasmuch as they are not based on measured data.

The first network consists of C_{22}, R_1, C_{12}, and R_{10}, and peaks at approximately 350 cps, resulting in an approximation of the curve shown in Fig. 3A. This is, in effect, a frequency discriminating voltage divider network, decreasing the signal applied to the grid of the third amplifier stage at frequencies in the region of approximately 350 cycles.

C_{13} and R_{27} at the cathode of the second triode section peak at approximately 500 cycles and act to change the response curve to that shown in Fig. 3B.

Finally, the network consisting of L_1 and C_{11}, at the cathode of the third triode section resonates at a frequency of 16,000 cycles. This results in a sharp drop in the impedance in the cathode of that stage with an equivalent increase in gain at frequencies in the 16,000 cycle region. This produces the ultimate curve shown in Fig. 3C.

No novelty is involved in these equalizing networks, they are proven circuits commonly employed in one form or another to obtain the required effect. The individual contributions of the circuit components are outlined here merely to satisfy the typical home experimenter who would rather know how it works than merely know that it works. The over-all compensation characteristic, it will be noted, serves not only to provide the prerequisite gain at the high-frequency end of the audio band, but also provides a rising characteristic below 100 cycles which compensates for the wrap-around loss which occurs at low frequencies, where the wavelength on the recorded track exceeds the width of the head.

Circuit Description

The complexity of the record-playback preamplifier described here should not be minimized. The switching circuit, for example, requires careful wiring. Because of the extensive decoupling networks and the equalization circuits, this preamp is more difficult to wire than an ordinary audio amplifier. Properly wired, however, and properly checked out as to bias adjustments, etc., this preamp is capable of professional quality recording as well as playback.

The erase and bias-current adjusting networks are of the proper value for use with the *Dynamu* heads. If the same preamplifier is to be used with heads other than the *Dynamu* units, circuit modifications would be essential both to provide the correct erase and bias currents and the proper equalization characteristics as well.

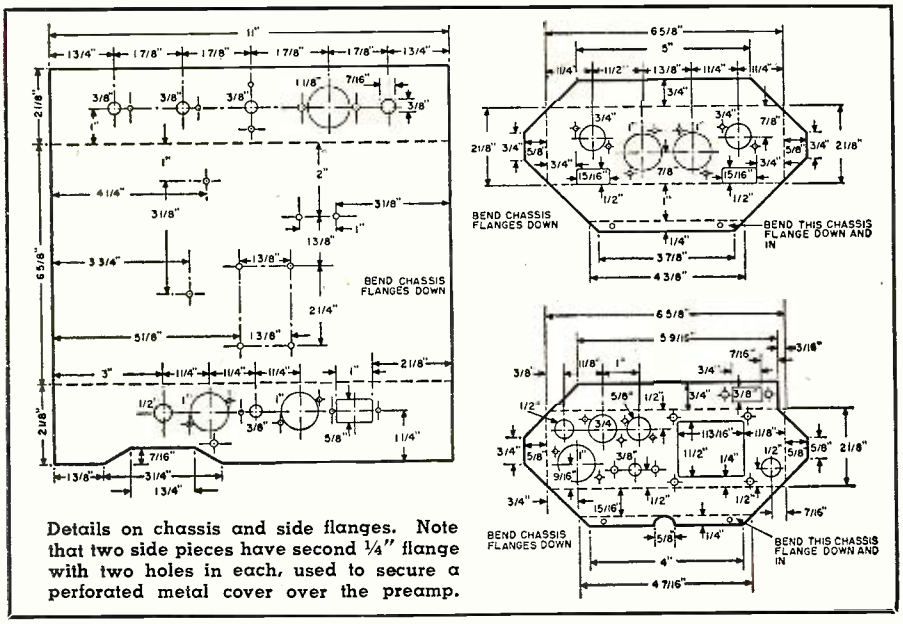
The preamplifier is provided with its own self-contained power supply. The bias-oscillator consists of a 12AV7 tube in a push-pull oscillator circuit. The related circuit components are those calculated to provide operation in the desirable frequency range between 60 and 70 kc. In the event a higher frequency is desired, it can be obtained by decreasing the value of capacitors C_{17} and C_{18}. If other values are substituted, however, they must be substituted in pairs, maintaining a balanced condition. Linearity and good waveform are essential if distortion is to be kept to a minimum. The oscillator output is adequate to provide the required 13 ma. current to the erase head. The voltage appearing here is then attenuated by the adjustable bias control R_{13} and series resistor R_9 to provide a bias current of 0.8 ma. to the record-playback head when recording (record-playback switch in *record* position). With this switch in the *play* position, plate voltage is removed from the oscillator.

The possibility of employing bulk-erasure in certain modes of operation will be of interest, particularly with respect to stereophonic recording which will be discussed next month. It should be noted that the erase head, although a part of the deck itself, forms the inductive load for the erase-bias oscillator. In the event that the preamp is to be used with a deck which is not equipped with an erase head, a 30 mhy. choke (or a spare erase head) must be substituted as a loading coil. This may necessitate some juggling of the resistance value of R_9 to provide the desired bias current of 0.8 ma. to the record head. This bias current value, incidentally, is one of the critical prerequisites to full-fidelity recording.

Two input connectors are shown. The first of these must be a shorting-type microphone connector and is used primarily for recording from a microphone. A total gain of 62 db is provided after equalization; sufficient to justify use of a professional type microphone. The high-level input provides a gain of 32 db and serves for recording from flat-response, radio, phono, or similar sources. Equalization is fixed in either case. The gain, or recording level, is adjusted by means of R_{26}.

The playback preamplifier output is derived from the third amplifier stage, a portion of which supplies a voltage through C_{10}. This voltage is rectified by a germanium diode CK705, and applied to the eye indicator tube which serves as the recording level indicator. The same recording signal voltage is fed also to the output jack where it is available for "earphone" monitoring of mike pickups, or may be used to drive the music system in the conventional manner when recording from radio, phono, etc.

With the record-playback switch in the play position, the shielded cable



Details on chassis and side flanges. Note that two side pieces have second ¼" flange with two holes in each, used to secure a perforated metal cover over the preamp.

from the record head is switched to the input of the preamp. At the same time, the recording compensation networks are removed from the active circuits and the single network consisting of R_{38} and C_6 is substituted. This provides the 6 db-per-octave attenuation shown in Fig. 2B.

Resistor R_2 and capacitor C_{24} at the input to the first amplifier stage are wired directly at the grid and cathode tube socket terminals and provide an effective filter for the 60-cycle buzz which can result from the sync pulses transmitted by television stations. This particular type of interference is easily differentiated from power supply ripple or hum because of its raspy sound. It succumbs easily, however, to the filtering effect of this simple network.

Mechanical Construction

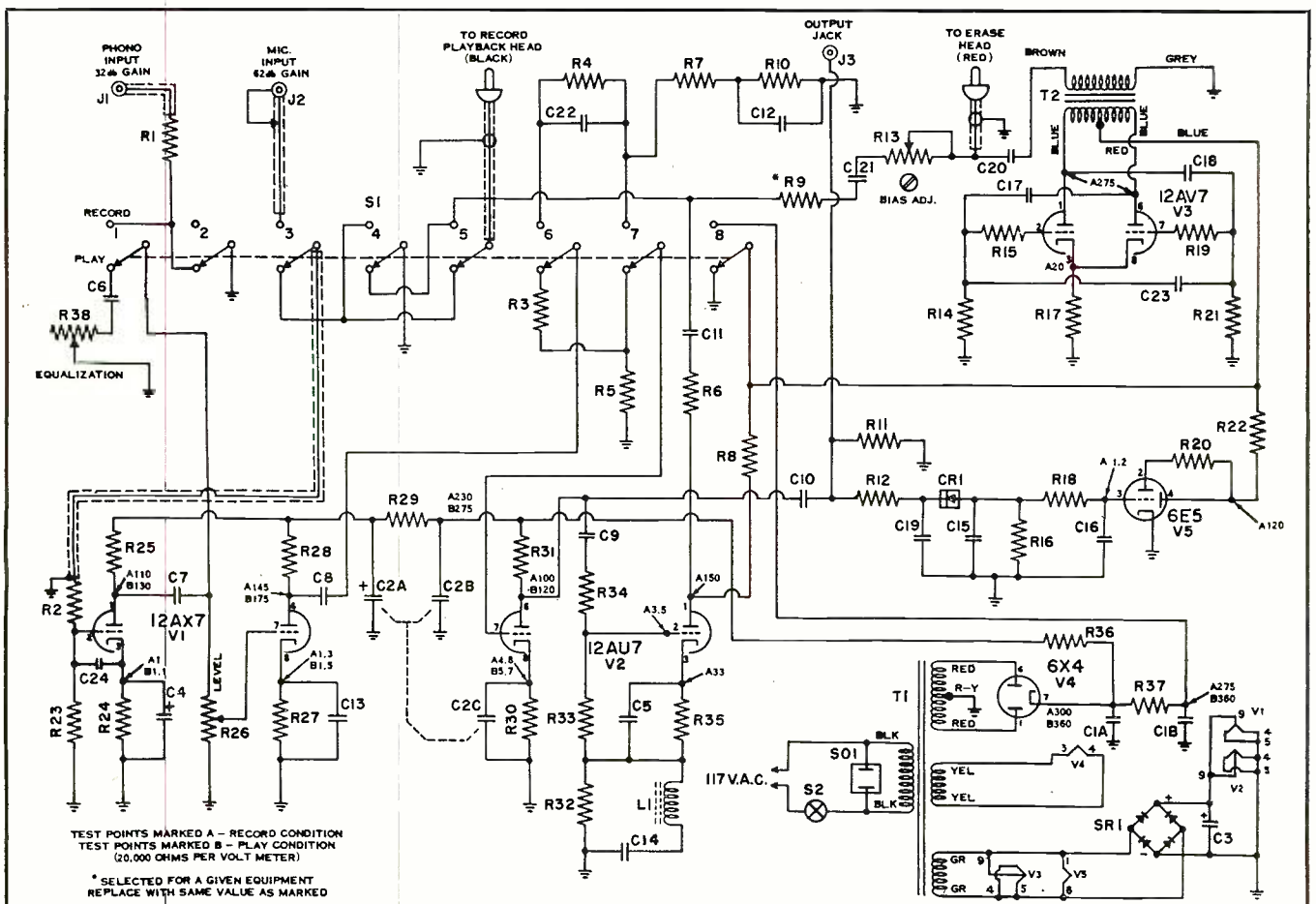
Box-type construction was dictated by the requirement for minimum size and the over-all requirement for a shape which would lend itself to cabinet installation along with the tape deck. A view of the unit with cover removed is shown in Fig. 4. The power supply and the not-so-critical erase-bias oscillator are contained in one end, the critical amplifier stages are at the other end, as far from the power supply as possible. The middle section of the box is utilized for the less critical wiring associated with the 6E5 indicator tube, the a.c. switch, gain and equalization controls, and the record-playback switching circuitry.

This switch consists of two decks with four switch sections per deck. The switch is special to the extent that it is ordinarily available only with ½-inch spacing between decks. New screws, shaft, and spacers must be added to provide 1-inch spacing, this, in order to eliminate the possibility of spurious oscillation.

All low-level signal leads must be run with *rubber covered* shielded wire. Be certain that the shielding is not inadvertently grounded to the chassis at

(*Continued on page* 122)

Fig. 5. Complete schematic diagram of the record-playback preamplifier and the companion bias oscillator unit.



R_1, R_7, R_{10}, R_{12}, R_{28}, R_{31}—100,000 ohm, ½ w. res.
R_2—1000 ohm, ½ w. res.
R_3, R_5, R_{11}, R_{13}, R_{21}, R_{22}, R_{23}—220,000 ohm, ½ w. res.
R_4—330,000 ohm, ½ w. res.
R_6, R_9—56,000 ohm, ½ w. res.
R_8—47,000 ohm, 1 w. res.
R_{15}—50,000 ohm log taper pot (Bias Adj. Control)
R_{15}, R_{19}—22,000 ohm, ½ w. res.
R_{16}—4.7 megohm, ½ w. res.
R_{17}, R_{37}—2200 ohm, 1 w. res.
R_{18}, R_{20}, R_{25}—1 megohm, ½ w. res.
R_{24}—2700 ohm, ½ w. res.
R_{26}—250,000 ohm audio taper pot
R_{27}, R_{30}—3300 ohm, ½ w. res.
R_{29}—68,000 ohm, 1 w. res.
R_{32}—10,000 ohm, ½ w. res.
R_{33}, R_{34}—470,000 ohm, ½ w. res.
R_{35}—1800 ohm, ½ w. res.
R_{36}—33,000 ohm, 1 w. res.
R_{38}—5000 ohm linear taper pot
All fixed resistors to be ± 10%
C_{1A}-C_{1B}—15/15 μfd., 475 v. elec. capacitor
C_{2A}-C_{2B}-C_{2C}—30/30/20 μfd., 250/250/25 v. elec. capacitor
C_3—1000 μfd., 15 v. elec. capacitor
C_4, C_5—25 μfd., 25 v. elec. capacitor
C_6, C_7, C_8, C_9, C_{10}—.05 μfd., 400 v. capacitor
C_{11}—.25 μfd., 400 v. capacitor
C_{12}—.1 μfd., 200 v. capacitor
C_{13}, C_{14}, C_{15}, C_{16}—.01 μfd., 200 v. capacitor
C_{17}, C_{18}—500 μμfd., 400 v. ceramic capacitor ±10%
C_{19}—500 μμfd., 400 v. disc ceramic capacitor
C_{20}—750 μμfd., 400 v. disc ceramic capacitor
C_{21}—250 μμfd., 400 v. disc ceramic capacitor
C_{22}—100 μμfd., 400 v. disc ceramic capacitor
C_{23}—1000 μμfd., 400 v. disc ceramic capacitor
C_{24}—50 μμfd., 400 v. disc ceramic capacitor
T_1*—Power trans. 250-0-250 v. @ 15 ma.; 6.3 v. @ .6 amp.; 6.3 v. @ 1.2 amp.
T_2*—Bias oscillator coil (Viking Part No. D501)
CR_1—1N66/CK705 germanium diode (Raytheon)
SR_1—Selenium rectifier bridge, 300 ma., 25 volts r.m.s. max. input, bridge center hole mounting
L_1*—10 mhy. iron-core choke
S_1—Dual-section selector switch, 4-poles per sec., non-shorting type, 1" spacing between sections
S_2—S.p.s.t. rotary switch
SO_1—Female a.c. receptacle, chassis-mounting type
J_1, J_3—Phone tip jack
J_2—Mic. jack, single-contact, insulated type
V_1—12AX7 tube
V_2—12AU7 tube
V_3—12AV7 tube
V_4—6X4 tube
V_5—6E5 tube
* Note: All parts thus indicated are special and may be obtained, along with an escutcheon of the type shown in the photograph, from Viking of Minneapolis, 3520 E. 43rd Street, Minneapolis 6, Minn.

Miscellaneous parts:
1—Escutcheon
1—Male a.c. receptacle, round pins, chassis-mounting type
1—117-volt line cord with female receptacle molded on

SERVICING SYLVANIA "HALOLIGHT"

This unique device can be serviced easily and quickly if you know how it works and what is likely to go wrong.

By **GEORGE C. CHERNISH**
Sylvania Electric Products Inc.

NOT infrequently, service technicians are inclined to shy away from troubles involving *Sylvania* "HaloLight." One reason, perhaps, is the abstract nature of this feature—divorced as it is from actual chassis operation. The "HaloLight" might be completely out of order, yet the set itself could be performing perfectly. A more probable reason, however, is the unfamiliarity of the average technician with this feature.

There is nothing mysterious about "HaloLight." A cold-cathode tube coated with special phosphors, it contains a closely-controlled mixture of argon and mercury. Gas pressure also is held within close limits. Strictly a gas tube, it does, however, exhibit characteristics somewhat unlike the familiar behavior of gaseous lighting.

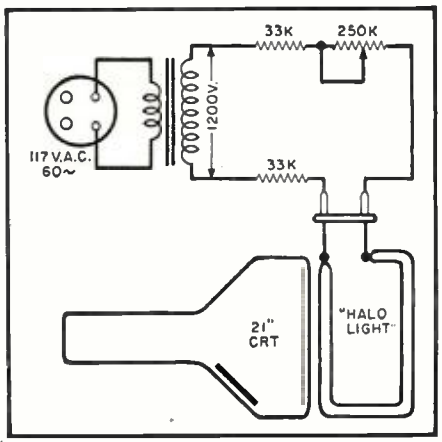
Fig. 1 shows the basic "HaloLight" circuit. Today, a potential of 1200 a.c. volts fires the lamp surrounding the 21" picture tube, while stable operation is maintained down to 900 volts, once the lamp is lit. This, in itself, is something of a feat. Before the development of "HaloLight," it was practically unheard of to operate such a long gas tube effectively on so low a voltage. As a matter of fact. to insure "HaloLight" stability, some of the earlier models were equipped with 2000-volt transformers, until the present lamp was designed.

The "HaloLight" tube, as manufactured today, has been in use ever since *Sylvania* introduced its first 21" TV receiver a number of years back. Therefore, in servicing "HaloLight," the technician will encounter 2000-volt transformers on all 17" and 20" sets, and a much smaller 1200-volt transformer on the 21" models. In the 24" receiver he will find a transformer delivering 1800 volts to the gas tube.

From a service standpoint, there are four main conditions confronting the technician. Once these defects are recognized, it is a simple matter to restore the unit to its proper level of performance.

If a lamp will not light, measure the voltage fed to its supply leads from the special socket in the power unit. Fig. 3 shows a "HaloLight" power unit, containing transformer, brightness control, and current-limiting resistors. If a potential of approximately

Fig. 1. Diagram of the main elements of the Sylvania "HaloLight" system. The gas tube surrounds the outside of the CRT.



1200 volts is indicated (1800 volts for 24"), the transformer has not failed. Earlier models, of course, should measure about 2000 volts.

With voltage apparently adequate, plug the chassis into a "Variac," or other source of 128 a.c. volts. If still no light results, the tube is defective and must be replaced. However, if the lamp should come on during this test, we must pause for a moment and take stock of the weather. On *Sylvania* receivers sold prior to the fall of 1954, hot and humid weather often brought a rash of complaints that the "HaloLight" would not start. Since that time, a transparent coating of special silicone has been applied to every lamp, and the trouble has ended. Consequently, if the TV set is located where the weather is often hot and humid, it will be necessary to remove the tube from its light-shield and brush on a thin coating of this special silicone, available at the company's service depots throughout the country.

Cold weather, also, causes starting difficulty. It's a fairly safe bet that no one would sit watching TV in a temperature below 50 degrees, but if he did, it is doubtful that the "HaloLight" would start. And if it did come on, it would flicker badly.

Flickering is another phenomenon which may draw complaints. It has been established that the silicone treatment also gives some relief here. But if the trouble persists even in normal, dry weather, chances are that the tube has aged and requires a greater "keep-alive" current to maintain adequate

ionization. Remove one of the current-limiting resistors found in the "HaloLight" power unit and replace it with one whose value measures about 20% lower.

In general, there will be some flickering, no matter how good the tube, at temperatures below 70 degrees F and above 85 degrees F. However, since the ambient temperature inside most cabinets lies in this range, there should be little trouble encountered on that score.

Yet another phenomenon which may draw complaints from the set-owner is a condition of intermittent firing or "blinking" of the tube. To clear this fault, the power unit must first be thoroughly checked. In some cases, this may require pulling the chassis. First, bridge the "HaloLight" brightness control with a clip lead. If the blinking continues, both current-limiting resistors should be checked by substitution. Some power units were provided with a switch, and this, also, should be temporarily bridged.

If the blinking persists, the gas tube itself should be inspected. Examine closely the plastic sleeving which fits over each end of the lamp. See Fig. 2. Minute cracks or punctures in the insulation are a sign of trouble, particularly when the light shield supporting the tube is made of metal. At any rate, detach the "HaloLight" and turn it on for a moment, holding it in your hand. There is no danger of shock if the lamp is gripped well back from its ends.

If the fault has disappeared, wind a few layers of cambric tape over the plastic sleeving before replacing the lamp in its light shield. But if the blinking persists, disconnect the lamp from its power unit and hold it up to the light. Look for a small blob of mercury rolling about as you jiggle the tube. If none is visible, tap both ends so that any mercury trapped around the electrodes will roll out. Persistent tapping and jarring should reveal at least one tiny drop of mercury; but if none appears, there is probably no appreciable surplus present. This, in turn, means that the "HaloLight" tube should be replaced; for there should always be visible a small surplus of mercury, no matter how warm the tube. As a matter of fact, when the lamp is manufactured, over ten times the required amount of mercury is injected, to ensure that a healthy surplus will always be present to prevent blinking and other related faults.

Occasionally, if a set-owner feels that his "HaloLight" is too dim, or too bright (some models are fixed), there is nothing wrong in changing the value of one of the current-limiting resistors in the power unit. The transformer is designed to take about a 20% increase in load. In lowering light levels by increasing fixed resistance, care must be taken that the current flow through the lamp is not restricted to the point where its "keep-alive" value is jeopardized. This, as observed earlier, would interfere with ionization and might result in an objectionable degree of flicker, if the tube has aged considerably. In general, however, there should be no problems.

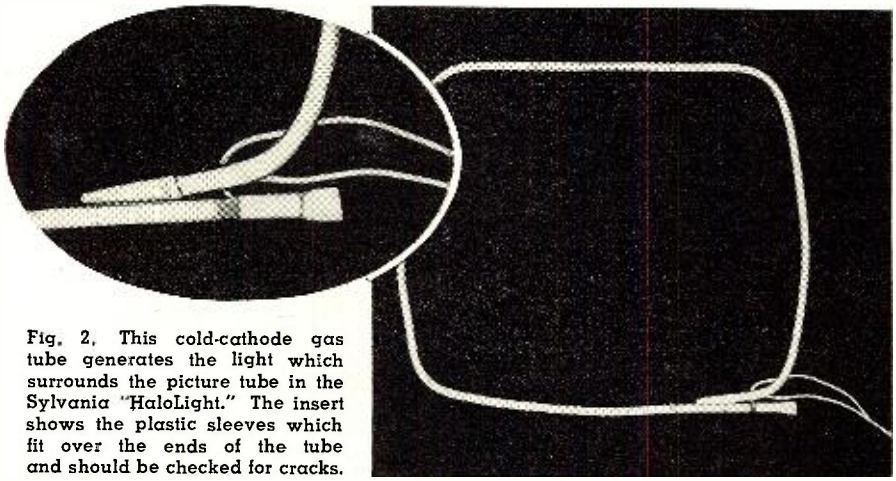


Fig. 2. This cold-cathode gas tube generates the light which surrounds the picture tube in the Sylvania "HaloLight." The insert shows the plastic sleeves which fit over the ends of the tube and should be checked for cracks.

In raising light levels by decreasing fixed resistance, care must be taken that the dissipation does not exceed the rating of the current-limiting resistors. Raising levels in variable "HaloLight" models is not recommended, since the control would be vulnerable to higher currents. However, there has rarely been a complaint about any variable model being too dim in its "bright" position. On the other hand, sometimes someone feels that the dim position is too bright.

Unless the room temperature is up around 80 degrees F, "HaloLight" will sometimes flicker for several minutes after a set is turned on. Accordingly, all optical tests should be performed with the tube thoroughly warmed up, preferably by running it at maximum brightness for ten or fifteen minutes.

In removing and replacing "HaloLight" tubes, the technician is cautioned against leaving smudges or dust of any kind on the light shield, tube, or mask. As a matter of fact, the mask and light shield should be washed in ordinary soap and water before the lamp is replaced. The slightest spot here would show up badly when the tube is on.

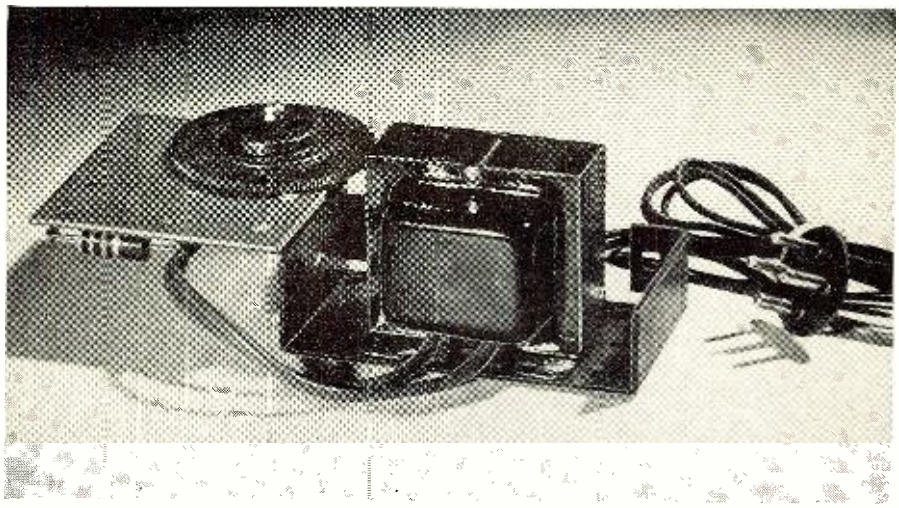
To gain access to the tube, it is rarely necessary to pull a chassis. The entire bezel assembly, which houses the gas tube and its power unit, may be removed from the cabinet and then temporarily replaced, so that the customer may operate his set while the lamp is being treated at the shop, or a new one ordered. There are no leads to untwist or cut, since the only electrical link with the chassis is a detachable plug.

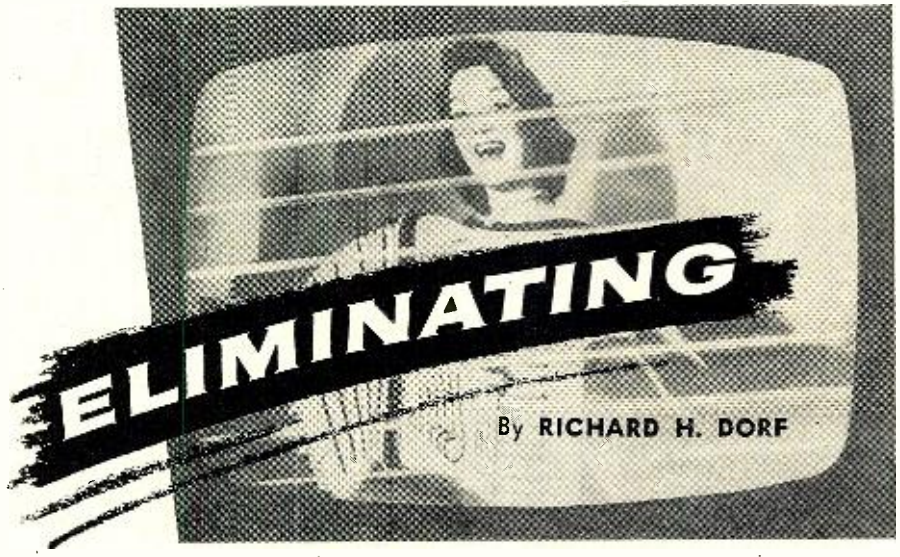
When a "HaloLight" tube is being replaced, care should be taken that the mask and light shield fit tightly together. Otherwise, light may escape and shine on the picture tube face, causing an annoying, hazy glow along the edges of the screen.

Since this particular feature has proven popular with the public, service technicians can expect to encounter many sets which incorporate the "HaloLight." Hence the importance of learning about its operation.

There have, of course, been cases in the past where service technicians have replaced "HaloLight" tubes unnecessarily, because of being on unfamiliar ground. However, if the foregoing procedure for troubleshooting is diligently adhered to, this undesirable situation should soon vanish.—30—

Fig. 3. The various electrical components of the "HaloLight" feature are shown here.





TV Retrace Lines

Remove annoying retrace lines from older TV sets and from new ones which do not include blanking.

ONE of the most annoying faults in a great many television receivers is the appearance of retrace lines during the vertical flyback time. Fortunately, it is an easy trouble to remedy in most cases, and most customers will be grateful for the relief. For the cure described here, the chassis need not even be removed from the cabinet. The whole job should take about 15 minutes at the most and involves just two new connections to the receiver.

The long vertical blanking pulse or pedestal which occurs in the composite video signal before, during, and after the vertical sync pulse, is supposed to bring the cathode-ray tube control grid to cut-off. When it does, the beam is extinguished and nothing that happens during vertical retrace time will be seen on the screen. However, either adequate d.c. amplification or very good d.c. insertion (clamping) is required to make the blanking pedestal bring the tube just to cut-off irrespective of the character of the picture information of preceding and following frames. Without a d.c. path for the detected video to the picture-tube grid or an efficient clamping circuit, the a.c. baseline will control effective pedestal height. As a result, the blanking pedestal will not drive the tube to cut-off during dark scenes and it will drive it—with some picture information—well beyond cut-off in bright scenes.

One bad effect in such a case is poor color and background values. Dark scenes have light backgrounds and light scenes have such sharp contrast that greys become black and gradations of shade tend to disappear. The fact is, however, that the poor shading and background values can be tolerated much more readily than the appearance of retrace lines for the same psychological reason that intermodulation distortion (introduction of new and discordant elements) can be tolerated much less readily in sound systems than poor frequency response (failure to transmit all the original elements). The retrace lines are new and unrelated elements and their automatic appearance in a picture whenever the scene darkens can, after a period of time, condition the viewer to painful wincing every time it happens.

Many modern receivers eliminate the retrace lines by using internal vertical blanking—using the receiver's own vertical sweep signal to blank the cathode-ray tube without depending on the signal pedestal. There are, however, large numbers of receivers in use which do not have internal blanking. The worst offenders are those which were designed without either d.c. restorers or d.c. video amplifiers, presumably for economy's sake.

They are not alone, however. Even the best d.c. amplifiers and clampers rarely attain that perfection of performance which gives a clean picture under all circumstances. In almost all receivers now without it, addition of the modern internal blanking circuit will pay.

Internal blanking is possible because of the shape of the vertical scanning voltage wave present in practically all receivers. Illustrated in Fig. 1, these trapezoidal pulses have practically the full width of the retrace time, meaning that the leading and trailing edges are nearly vertical. Their peak-to-peak value across the vertical deflection coils is usually in the neighborhood of 90 volts for a 16- to 21-inch picture tube. If these pulses can be applied in the proper polarity between picture-tube grid and cathode, they will drive the grid well past cut-off for almost the entire period of the vertical retrace. The result will be perfect blanking and elimination of retrace lines, irrespective of the video signal or the quality of d.c. insertion.

Most modern receivers are cathode-fed and it is convenient when the receiver is designed to provide some kind of take-off from the vertical output circuit to give pulses of the negative polarity necessary for the picture-tube grid for blanking. This means that the only varying voltage on the grid is the internal blanking pulse, eliminating possible effects of coupling on the video signal. A common source of the blanking pulse is the vertical deflection yoke coils from which a negative pulse is obtained by circuit design. However, such a pulse is not usually obtainable at this point in older sets without affecting the deflection characteristics.

A simple and effective method for obtaining the pulse for receiver modification is shown in Fig. 2. At the "hot" end of the vertical deflection coils the pulse polarity is positive, as in Fig. 1. The cathode is fed video from the plate of the final (or often the only) video amplifier tube through a d.c. voltage divider R_1-R_2, whose purpose is to set the d.c. voltage applied to the cathode at the right value. R_1 is bypassed by C_1 for video so that no video divider action takes place. The grid of the tube is used solely for brightness or background control, being bypassed by C_2 for video.

To add internal vertical blanking, vertical deflection voltage is taken from the top of the vertical yoke coils and applied to the cathode of the CRT.

(*Continued on page* 151)

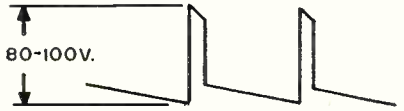


Fig. 1. Vertical deflection pulses of voltage such as shown here appear across the vertical deflection coils of most TV receivers and are used for blanking.

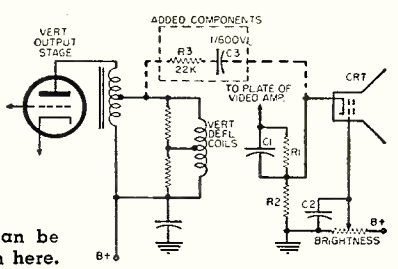


Fig. 2. Retrace line blanking can be added to a TV receiver as shown here.

5-Watt Transistorized Audio Amplifier

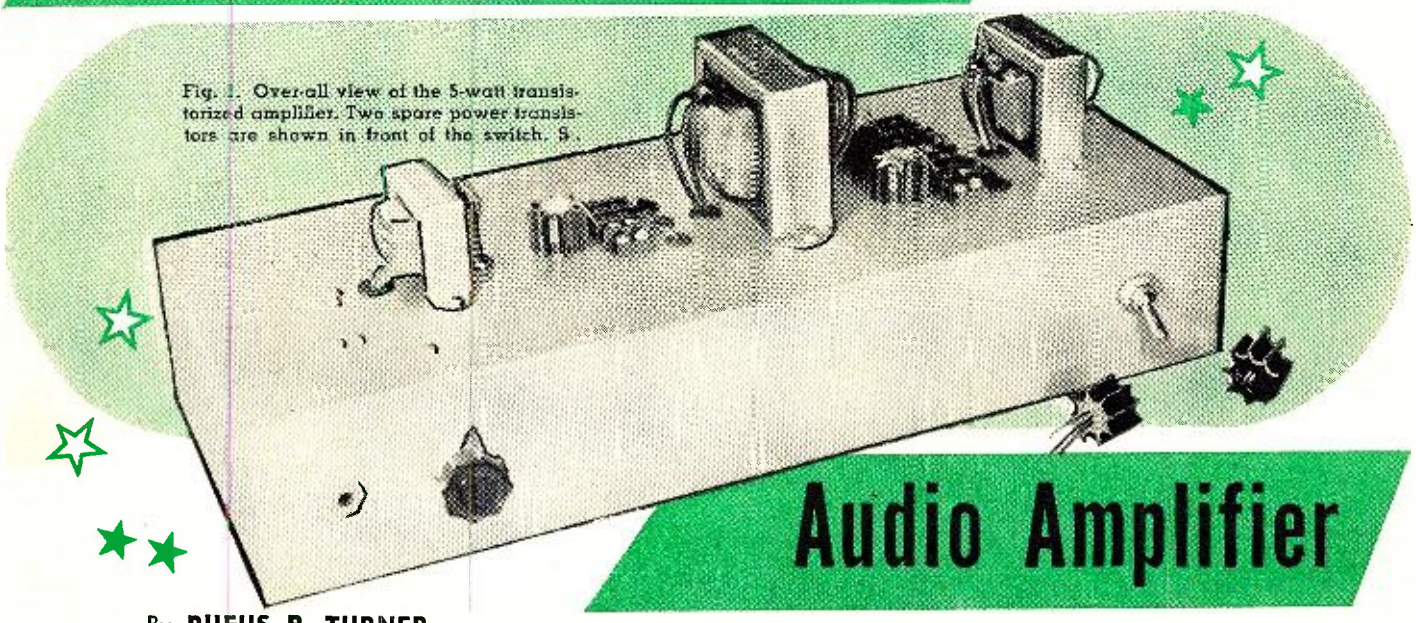


Fig. 1. Over-all view of the 5-watt transistorized amplifier. Two spare power transistors are shown in front of the switch, S.

By **RUFUS P. TURNER**
Consulting Engineer

Details on a p.a. unit which delivers 5 watts output with a 1 mv. input signal. It operates from 12 volt d.c. source.

THE audio amplifier described in this article was intended primarily as a p.a. unit for use in automobiles. At maximum gain, it delivers 5 watts of power to a 3.2 ohm loudspeaker voice coil, with a 1-mv. r.m.s. input. Total harmonic distortion is 11 per-cent. Response is 5 db down at 100 cycles and —5½ db at 10,000 cycles, both with respect to 1000-cycle response. Noise level is 6 mv. with the volume control set for maximum gain and the input circuit open. This is 56 db below maximum output.

The single d.c. supply is 12 volts, which will be recognized as the battery voltage in the new cars. The amplifier may also be operated from a pair of series-connected 6-volt hot-shot dry batteries with, of course, somewhat shorter battery life than when using storage batteries. Current drain is 200 ma. resting and 750 ma. on audio peaks. Compare this with the 5 to 10 amp. drain of a comparable tube-type amplifier operated from a vibrator-type power supply.

Particular advantages of the transistorized amplifier are: (1) light weight, the unit being slightly under 5 pounds, (2) instantaneous operation, (3) negligible heating, (4) complete freedom from both hum and microphonics, (5) safe, low-voltage operation, and (6) freedom from tube replacements. (Transistors are endowed with long life.)

This amplifier serves to illustrate some of the practical jobs which can be done with commercial power transistors. Aside from the intended use for p.a. purposes, possible applications may be found in modulation of portable transmitters, servo and magnetic amplifier adaptations, electronic sirens, and portable megaphones.

The high power output is obtained by means of a pair of power transistors operated push-pull class B in the output stage of the amplifier. The collector efficiency of this stage is 76 percent. Since the collector voltage is low (—12 v.), the current swing obviously must be high (0.55 amp.) to develop the high power output.

The amplifier is readily portable and, when encased, can be carried with little effort along with the two hot-shot batteries required for its operation.

Power Transistors

Sylvania type 2N68 *p-n-p* power transistors are used in two stages of the amplifier. The 2N68 is a comparatively small-sized unit, being 1 inch in diameter and $^{25}/_{32}$ inch high. Its casing is metallic and is provided with cooling fins. Three pigtail leads are provided for solder, plug-in, or screw connections. The case cooling structure is at collector potential.

The 2N68's are seen fastened in place on the top of the chassis in Fig. 1. Two extra power transistors are shown directly in front of the toggle switch in this same photo.

The 2N68 can supply a maximum of 10 watts output in push-pull class B at —24 volts d.c. It may be mounted in any position, has maximum dissipation ratings of 2½ watts in free air and 5 watts with an external heat sink, *alpha* of 0.975, and *alpha* cut-off frequency of 400 kc. Its collector capacitance is 300 $\mu\mu$fd.

Table 1 shows the important characteristics of the 2N68 in class A and class B operation. The reader's attention is directed particularly to the low input and load resistances of this transistor: 75 ohms input and 100 ohms load for class A; 50 ohms per base input and 12 ohms per collector load for class B.

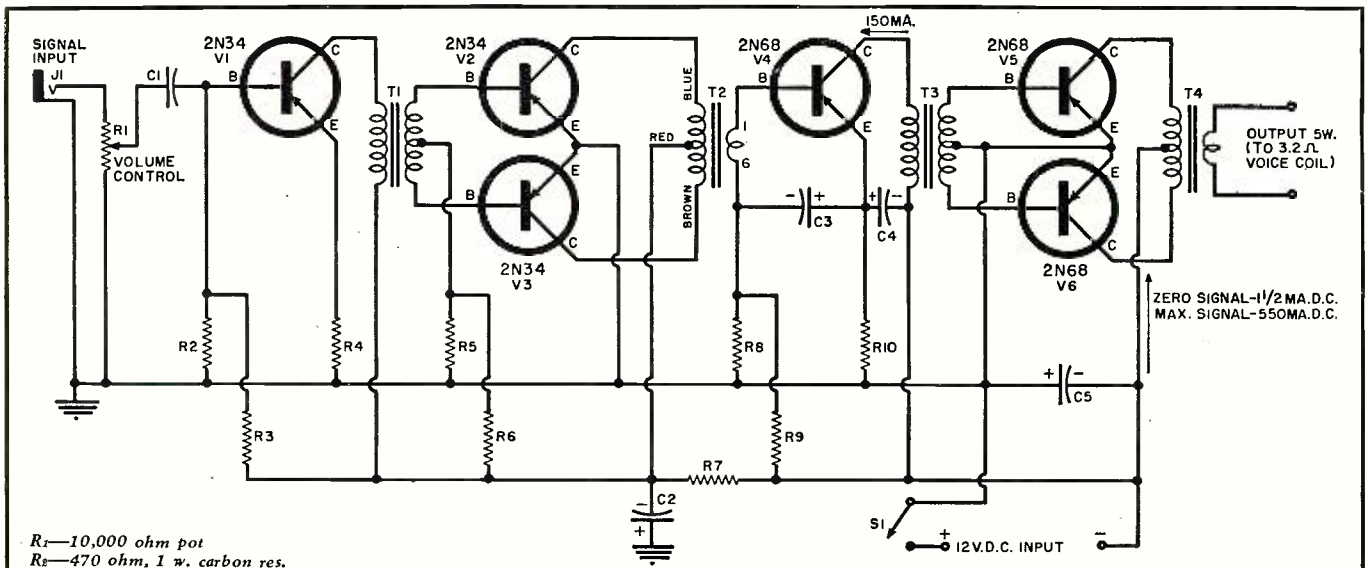
Amplifier Circuit

Fig. 2 shows the complete circuit of the transistorized amplifier.

The front end consists of a single-ended class A stage (V_1) transformer-coupled to a push-pull class A stage (V_2, V_3). Both of these stages employ conventional transistors (*Sylvania* 2N34). Bias stabilization is provided by resistance networks R_2-R_3 and R_5-R_6.

The push-pull class A stage is transformer-coupled to a single-ended class A driver employing a power transistor, V_1. The driver, in turn, is transformer-coupled to the push-pull class B output stage, V_5-V_6. The decoupling filter network, C_2-R_7, suppresses oscillation in the system.

A power-type stage (V_4) is employed as the driver to insure good signal-voltage regulation, since the power



R1—10,000 ohm pot
R2—470 ohm, 1 w. carbon res.
R3—47,000 ohm, 1 w. carbon res.
R4—82 ohm, 1 w. carbon res.
R5—100 ohm, 1 w. carbon res.
R6—4700 ohm, 1 w. carbon res.
R7—2700 ohm, 1 w. carbon res.
R8—180 ohm, 1 w. carbon res.
R9—1000 ohm, 1 w. carbon res.
R10—6.8 ohm, 1 w. carbon res.
C1—1 μfd., 200 v. metallized tubular capacitor (Aerovox P82)
C2, C3, C4—50 μfd., 50 v. elec. capacitor
C5—500 μfd., 25 v. elec. capacitor (Mallory TC-2505)
J1—Midget open-circuit phone jack
S1—S.p.s.t. toggle switch
T1—Miniature driver trans., 1H4 to push-pull 1J6's (Triad A-81X)
T2—Universal output trans., 20,000 ohms, c.t., to approx. 75 ohms (Stancor A-3823)
T3—Power transistor driver trans., 100 ohms @ 150 ma. pri.; sec. 50 ohms each side of center tap (Acme T-24041, see text)
T4—Power transistor class B output trans., pri. 12 ohms each side of center tap, 550 ma. center tap current, sec. 3.2 ohms (Acme T-24043, see text)
V1, V2, V3—"p-n-p" transistor (Sylvania type 2N34)
V4, V5, V6—"p-n-p" power transistor (Sylvania type 2N68)

Fig. 2. Diagram of the 5-watt transistorized audio amplifier. The transistors are of "p-n-p" type. See text for alternatives.

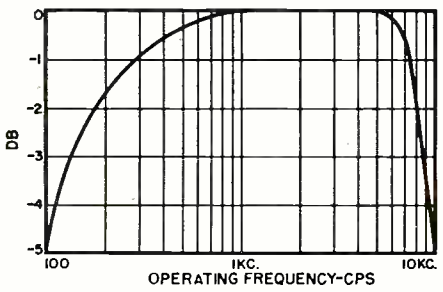


Fig. 3. Frequency response of the amplifier.

amplifier has ample reserve. The steady d.c. collector current of V_4 is 150 ma. Sufficient driving power undoubtedly can be obtained from a push-pull class B stage employing conventional transistors at greatly reduced d.c. drain. However, it was thought that a low-level class B stage in this position might add to the distortion, and also a suitable transformer for working from such a stage into the class B output stage was not readily available.

The measured idling (zero-signal) d.c. current drain is approximately 200 ma. at —12 volts, most of this being taken by transistor V_4. At maximum signal, the current rises to 750 ma., due to the excursion of output-stage collector current at 550 ma.

The input circuit of the amplifier is satisfactory for low-impedance microphones and pickups. It may be modified for crystal microphones and high-impedance pickups by inserting a high-impedance input transformer with 100:1 or 200:1 impedance stepdown ratio (such as *Stancor* UM-112, *UTC* SO-6 or SSO-6, or *Gramer* M-6) between jack J_1 and volume control R_1.

Fig. 3 shows the frequency response of the amplifier measured at the maximum output of 5 watts into a 3.2 ohm resistive load. The shape of this curve is governed principally by the characteristics of the first two stages (as has been discovered by separate frequency runs on the driver and output stages). Improved frequency response accordingly might be expected by substitution of larger, high-quality transformers for those specified at T_1 and T_2. Measured distortion was 11 per-cent. No attempt has been made to incorporate negative feedback, the full power output of the amplifier having been required. However, feedback would improve performance. Lower distortion is possible through use of the common-base configuration instead of the common-emitter in the output stage. However, the transformer requirements for the common-base circuit are somewhat more severe.

Other performance data were given in the first paragraph of this article.

The output of 5 watts was measured with a sine-wave input signal. Because of the power relations in speech waveforms, somewhat better output power capability might be expected, on an effective basis, when this class B amplifier is employed to plate-modulate a transmitter.

Coupling transformers T_1 and T_2 are standard units readily obtained from radio parts stores. T_1 is a miniature transformer (*Triad* A-81X) originally designed for use between a 1H4 driver and push-pull class B 1J6's. T_2 is a replacement-type universal output transformer (*Stancor* A-3823) with output connections made to secondary lugs 1 and 6. These two transformers, fortunately, provided the impedance stepdown required between the stages into which they are connected.

Transformers T_3 and T_4 have been designed especially for the author's use with the 2N68 power transistor but now are available to the reader. The driver transformer, T_3 (*Acme* T-24041), has a 100-ohm primary. The steady collector current of 150 ma. d.c. for the class A 2N68 (V_4) flows through

Table 1. Operating characteristics of the Sylvania type 2N68 "p-n-p" power transistor.

CLASS A AMPLIFIER, COMMON EMITTER	
Collector Supply Voltage	—12 v.
Collector Current	—150 ma.
Base Current	—5.0 ma.
Input Resistance	75 ohms
Load Resistance	100 ohms
Power Output	600 mw.
Gain	23 db
PUSH-PULL CLASS B AMPLIFIER, COMMON EMITTER (2 Transistors)	
Collector Supply Voltage	—12 v.
Collector Current: zero signal	—1.0 ma.
max signal	—550 ma.
Input Resistance (per base)	50 ohms
Load Resistance (per collector)	12 ohms
Power Output	5 watts
Gain	15 db

this winding. The secondary has an impedance of 50 ohms each side of center tap. The primary d.c. resistance is 3 ohms, while the secondary has a d.c. resistance of 4 ohms each side of center tap. The larger size of this transformer (see Fig. 1) results from the latter's heavier direct current requirements.

The output transformer, T_4 (*Acme* T-24043) has a primary impedance of 12 ohms each side of center tap and a secondary impedance of 3.2 ohms. Since the maximum-signal class B collector current of 275 ma. per transistor must flow through the primary of T_4, this winding must have extremely low d.c. resistance, in order to minimize voltage drop. At the high current level involved, a d.c. voltage drop of 0.275 volt-per-ohm will occur in each half of the T_4 primary. In the *Acme* T-24043, the resistance of each half of the primary is held to approximately two-tenths of an ohm.

Transformers T_3 and T_4 were developed in close cooperation with the author by *Acme Electric Corporation,* West Coast Division, 1375 W. Jefferson Blvd., Los Angeles, California, and may be ordered by type number.

Sylvania type 2N95 power transistors may also be employed in the amplifier. However, the 2N95 in an *n-p-n* type, so the battery *and* capacitor polarities must be reversed if the substitution is made. Also, the low-level transistors (V_1 to V_3) must be changed to *n-p-n* type 2N35.

Construction

Figs. 1, 4, and 5 show constructional details of the amplifier.

As can be seen in these photographs, the amplifier is built on a 17" x 7" x 3" chassis. This admittedly is a roomy layout and considerable size reduction is possible.

All components in the two input stages, except transformer T_2, are mounted under the chassis and may be seen (together with transistors V_1, V_2, and V_3) in Fig. 5. The latter three transistors are mounted by fastening their pigtails under the screws of *Cinch-Jones* Type 3-140 3-screw terminal blocks.

The power transistors are bolted directly to the chassis so that the latter may serve to conduct heat away from them. A ¼-inch 10-32 threaded hole has been provided, for mounting purposes, in the base of each transistor. However, since the metal structure of the 2N68 is at collector potential, it must, at the same time, be insulated from the chassis, otherwise the collectors will become grounded and short circuited. A small washer is cut for the purpose from 2-mil-thick mica and is placed between the 2N68 and chassis. A 5/16-inch clearance hole, drilled in the chassis, admits a shoulder-type insulating washer, from the under side, and this insulates the short 10-32 screw which is passed through the chassis and washers to secure the transistor. The 2N68 pigtails are bent over and downward and held under the

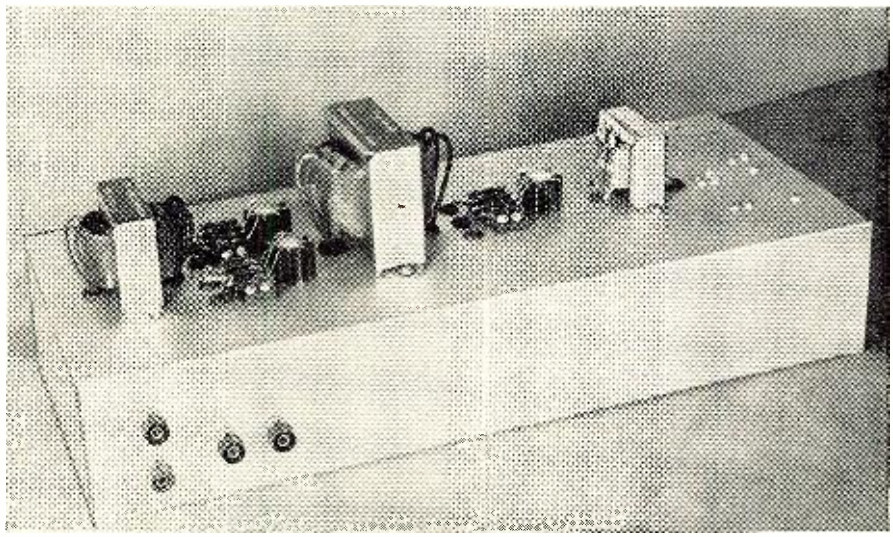


Fig. 4. Rear view of transistorized amplifier built by author.

screws of a *Cinch-Jones* 3-140 3-screw terminal block. Circuit connections are made to the soldering lugs under the mating screws.

Insulated binding posts on the back of the chassis provide the simplest method of connecting the 12-volt battery and loudspeaker. (See Fig. 4.) However, an individual builder may prefer plugs or disconnects for these terminals.

Wiring and layout are no more critical than in a vacuum-tube amplifier with comparable gain and power capabilities. The usual rules of good construction should be followed. That is, it is advisable to employ a single, common ground in each amplifier stage, to keep transformers well separated and correctly oriented to prevent feedback action, and to shorten all signal leads. Since the 12-volt leads carry high peak currents to the output stage, they should be heavy conductors. There is no objection to using cabled wiring if one prefers this to point-to-point.

The screw-type terminal blocks have been used as "sockets" for the transistors, to protect the latter from the heat of soldering. Make all soldered connections to these blocks *before* attaching the transistor pigtails. If it should become necessary later to do any soldering on these terminals, disconnect the pigtail beforehand and reconnect it only after the terminal has cooled completely.

Notes on Testing

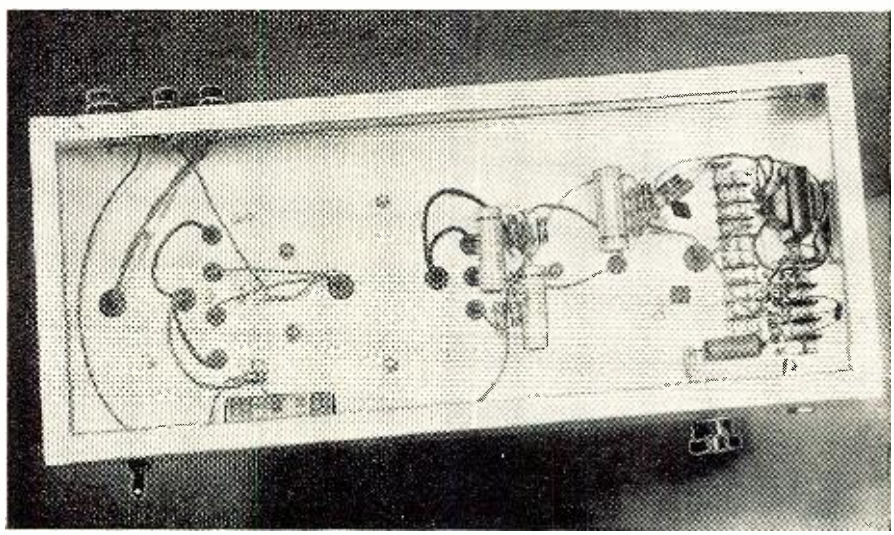
Whenever testing the amplifier with an input signal, it is advisable to monitor continuously the d.c. collector current of the class B output stage and the a.c. signal output voltage. This is to prevent overload. Observe the output waveform continuously with an oscilloscope.

The amplifier should not be allowed to operate steadily without being terminated either with a 3.2-ohm resistor or the matching loudspeaker. Collector dissipation in the output stage might easily exceed the safe maximum value under these conditions.

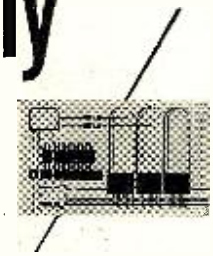
Although the amplifier has been operated steadily for long periods with sine-wave input, the power transistors have not overheated during such runs.

The work which led to the development of the amplifier described in this article was performed originally for *Sylvania Electric Products Inc.* —30—

Fig. 5. The under chassis view showing the principal wiring.



Handy Power Supply for Service Shop



By **LEONARD J. EISNER**

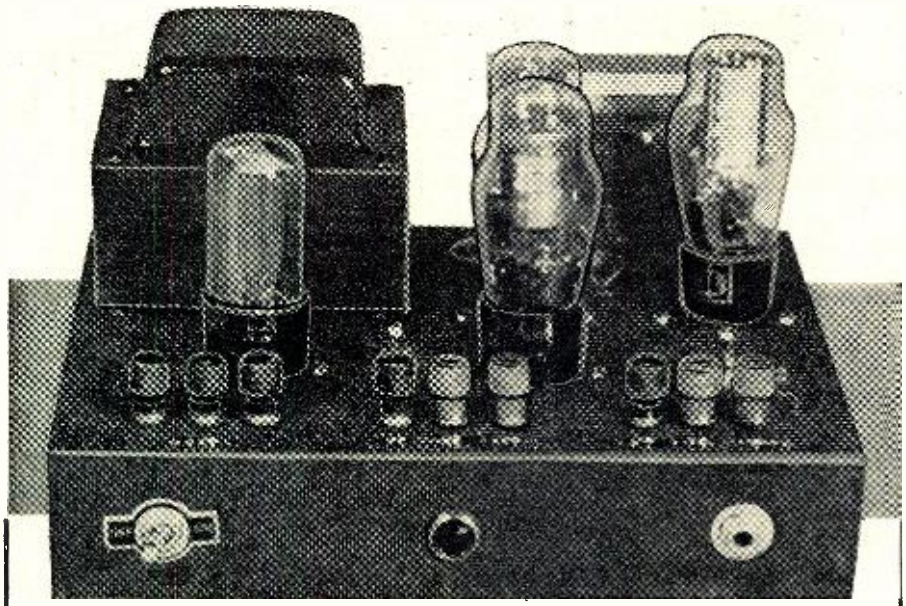


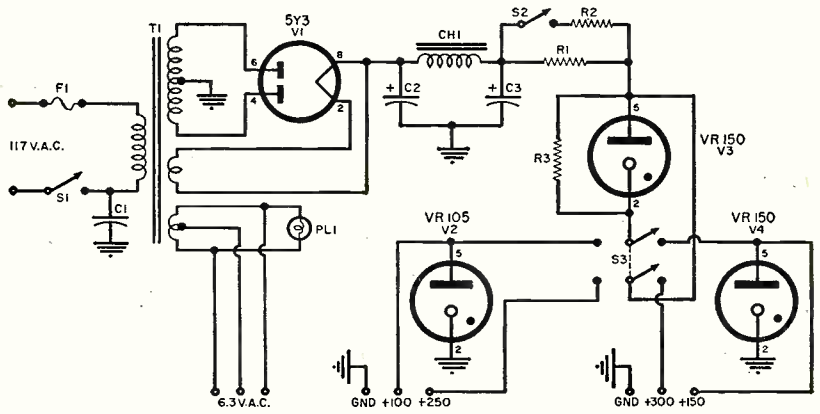
Fig. 1. Completed power supply furnishing four accurate, stable d.c. voltages and 6.3 volts a.c. The jack on the front panel is one source for 250 volts d.c. and 6.3 volts a.c.

■ ■ ■

Indispensable for servicing radios, TV sets, and other electronic equipment, it is easily built and inexpensive.

■ ■ ■

Fig. 2. Complete schematic diagram and parts list for the versatile power supply. The use of voltage regulator tubes assures stability for various load conditions.



R_1—5000 ohm, 20-watt wirewound res.
R_2—4000 ohm, 20-watt wirewound res.
R_3—15,000 ohm, 10-watt wirewound res.
C_1—.05 μfd., 600 v. capacitor
C_2-C_3—16/16 μfd., 450 v. elec. capacitor
S_1—S.p.s.t. toggle switch (Power "on-off")
S_2—S.p.s.t. toggle switch ("Normal-load—Heavy-load" control)
S_3—D.p.d.t. toggle switch ("VR105-VR150" switch)
PL_1—#46 pilot lamp
F_1—5 amp fuse
CH_1—10.5 hy., 110 ma. filter choke (Stancor C-1001 or equiv.)
T_1—Power trans. 375-0-375 volts @ 150 ma.; 5 v. @ 3 amps; 6.3 v. c.t. @ 4.5 amps. (Stancor PM-8411 or equiv., see text)
V_1—5Y3 tube
V_2—VR105 tube
V_3, V_4—VR150 tube

ANY radio shop needs a supply that can give commonly used voltages at light or heavy loads. The ordinary power supply's output voltage is dependent upon the load. The lighter the load, the higher the voltage; the heavier the load, the lower the voltage. The power supply to be described in this article and shown in Fig. 1 uses voltage regulator tubes in a circuit where various d.c. voltages (+100, +150, +250, and +300) can be obtained whether one or several tubes are connected to the output.

The purpose of using voltage regulator tubes is not so much to obtain a regulated supply as to obtain different output voltages ranging from +100 to +300 volts. Should an oscillator be connected to this power supply, the secondary advantage will be obtained —a regulated source of voltage to help maintain oscillator stability.

To give an idea of how well this power supply works, the +250- and +300-volt terminals can be used to supply a complete a.c. superheterodyne receiver with only a slight drop in voltage. Also, the +100- and +150-volt outputs can be used to supply an a.c./d.c. superhet with just a slight drop in voltage. On the other hand, this same power supply can be used for a one-tube amplifier or oscillator and the voltage will remain as indicated.

Referring to the schematic in Fig. 2, notice that the power supply is conventional up to and including the filter network. Beyond this point a network of resistors, switches, and voltage regulator tubes is so arranged as to obtain the desired flexibility for various loads and voltages. The d.c. voltage outputs will depend upon the position of switch S_3. If the VR105 is thrown into the circuit, +100 volts and +250 volts (the sum of the outputs of V_2 and V_3) become available. If V_4 is thrown into the circuit, +150 volts and +300 volts become available. Heater voltage of 6.3 volts a.c. is available at all times. The 6.3-volt winding with its center tap is brought out to three terminal posts, none of which is grounded in this particular application.

R_1 has been selected so that the maximum rated current is allowed to flow through the regulator tubes when no load is connected. R_3 is shunted across V_3 as a protective measure to carry the additional current should a load heavier than 40 milliamperes be connected to either the +100- or +150-volt outputs. Switch S_2 is closed only when a heavy load is connected at either the +250- or +300-volt outputs. At all other times S_2 must be in the normal load or open position to prevent excessive current from flowing through the regulator tubes.

It might be wise at this time to review the operation of the VR tube in this particular setup so that the reader may use a different power transformer than the one specified. Referring to Fig. 3, the purpose of the series resistor R is to limit the maximum

(*Continued on page* 158)

A Portable GEIGER COUNTER

By RONALD L. IVES

Details on a sensitive unit designed to "take it" under adverse field conditions.

Fig. 1. The counter in use. Note the bone-conduction headset, carrying strap, and the position of the unit's carrying handle.

DURING the last decade, several hundred thousand amateur and professional prospectors have purchased, rented, or borrowed Geiger counters; and several hundred of these users have discovered commercially-valuable deposits of radioactive materials. Need for radioactive materials, particularly uranium, continues and interest in uranium prospecting is not only increasing, but is spreading into areas once incorrectly thought completely barren of radioactive minerals.

Although several hundred Geiger counter circuits have been published, and more than fifty designs have been put on the market, most Geiger counters are qualitative instruments. capable of telling whether or not a mineral specimen is strongly radioactive, but not certainly capable of indicating "how radioactive."

By making some relatively simple changes in an already good design,[1] it is possible to make a Geiger counter in which the rate meter readings are both significant and consistent. Minor changes in conventional design increase both the ease of operation of the counter, and its ease of repairability.

Circuit

The circuit of this improved counter, which is shown in Fig. 5, is fairly conventional as regards the functions performed, but has a number of added features which improve the over-all performance.

The input to the counter is a standard Geiger-Muller tube, a *Victoreen* 1B85 being used here. This feeds an amplifier, the first stage of which is entirely conventional, and is operated semi-starved, with a high plate and screen resistance, to increase the voltage swing at the output. Each discharge of the Geiger tube causes a negative-going pulse on the grid of the first amplifier tube (V_2), and this appears as a strong positive-going pulse on the plate.

The second stage of the amplifier is normally cut off, with a battery bias of —22.5 volts on its grid. In consequence, only a very strong positive-going pulse applied to the grid will affect the tube. With this arrangement, amplified pulses from the Geiger tube are further amplified in the second stage (V_3), but "sneak through" a.f. from the high voltage supply, and microphonics originating in the input circuit, being of lesser amplitude, do not appear in the ouput of this stage. This means that all signals heard are pertinent, and that the rate meter measures actual counts, with no spurious background from the high-voltage supply.

Nine-hundred regulated volts for the Geiger tube are generated by the neon oscillator, amplifier, cold-cathode rectifier, and voltage regulator tube (V_4, V_5, and V_6) in the lower part of the circuit diagram. Circuit and performance of this high-voltage supply are entirely conventional except for the output. Here, a .01 μfd. capacitor (C_{17}) is used as a voltage reservoir, and this

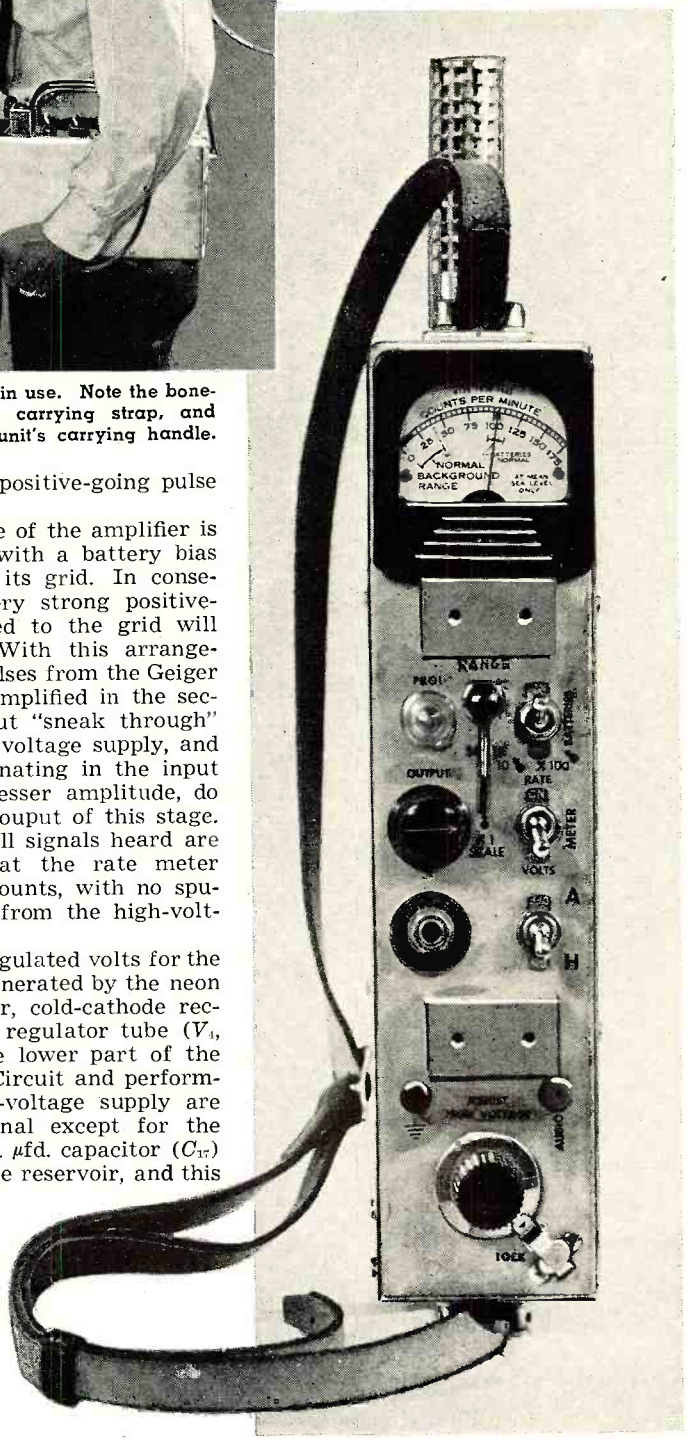


Fig. 2. Top view of counter with the carrying handle removed to show placement of the controls and how rate meter is set up.

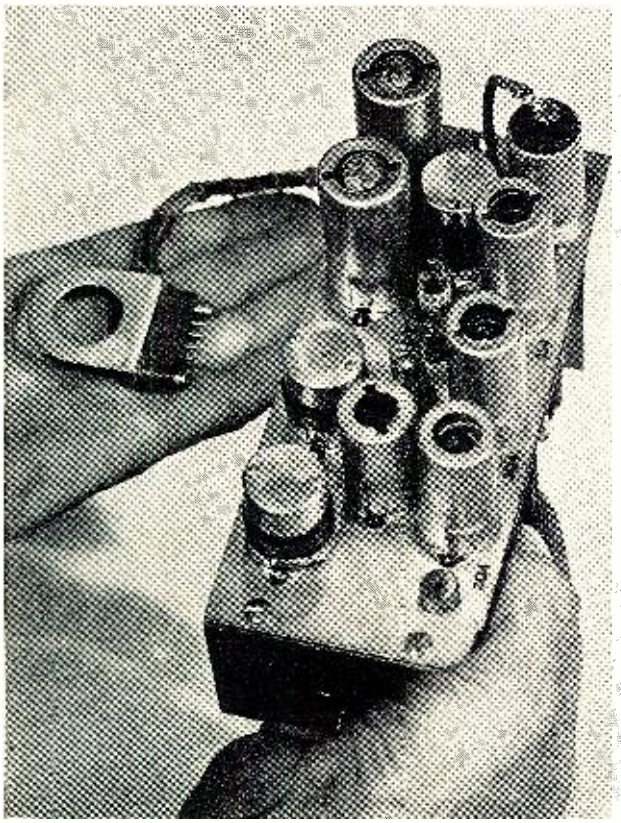


Fig. 3. Bottom view of amplifier chassis showing use of tube shields. Tip jack in lower right is the Geiger tube input. A Winchester plug with attached handle makes electrical connection to case-mounted parts. See text on construction hints.

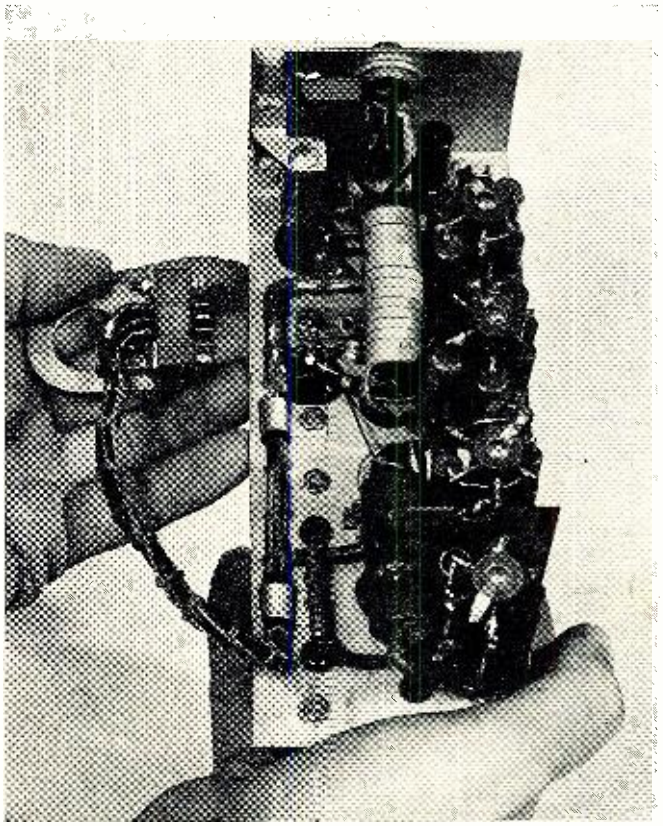


Fig. 4. Arrangement of components on the top of the amplifier chassis. Note the shield between the oscillator amplifier and the rectifier components (lower right) and the use of brackets, cable clamps, grommets, and sleeving for increased ruggedness

is isolated from the 5841 voltage regulator tube by a 500,000 ohm resistor (R_{15}) to prevent *RC* oscillation. This output filter prevents extinction of the *VR* tube when rapid counts occur.

Outputs consist of a neon flasher, always in circuit; a headset, with manually variable volume; and a rate meter. A dummy load is connected across the audio output when the phone plug is pulled, to stabilize the calibration. The rate meter is connected so that it can also be used to monitor the "A" battery voltage and the output of the high-voltage supply. Three ranges are provided on the rate meter, so that normal background can be read on the lower quarter of the low range, while top mark of the high range corresponds to the count rate produced by one ounce of uranium at one foot from the Geiger tube.

Construction

Insofar as possible, mechanical and electrical construction of this counter follows aeronautical procedure, as it was developed for field use, where it would undergo considerable rough treatment.

Electrical components were chosen with an ample margin of safety, both mechanical and electrical, and mechanical construction was done with easy servicing in mind.

The case, which consists of two pieces of 1/16" steel, is 3" by 5½" by 12½". This was cut from a heavy duty 13" by 17" by 3" chassis base. A piece of ½" by ½" by 2¾" angle was spot welded to the back of the top and the front of the bottom, to make a tight and strong case closure. A box-like battery holder, bent up from sheet .040 steel, was spot welded to the back bottom of the left case half, as in Fig. 8, and the entire case heavily cadmium plated to prevent rust. Appearance of the case with the amplifier chassis removed is shown in Fig. 6. Most of the case-mounted parts are fastened to a small right-angled sheet of steel, which is held to the case by the screws of the top-mounted controls.

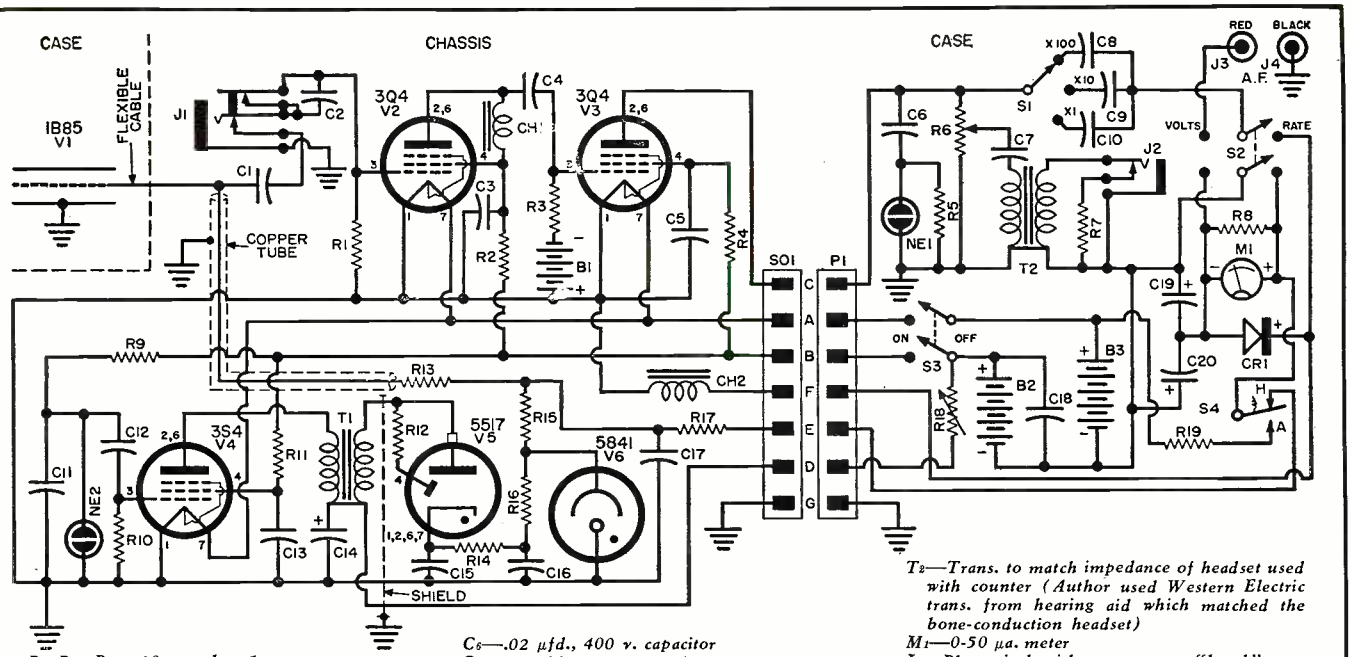
All components marked "Chassis" in Fig. 5 are mounted on a small steel subchassis, held to the case by J_1 at the front, and by a screw to a small angle on the battery holder in the back. Electrical connection between the chassis and the case-mounted components is furnished by a *Winchester* connector and cord. By running a ground connection through the cord and connector, the instrument can be used with the chassis out of the case.

A general view of the bottom of this chassis is shown in Fig. 3. All tubes, which operate "base up," are held in place by use of tube shields. Transformer and chokes are held in place by use of split tube shield bases, reenforced with tape. The larger capacitors are mounted vertically in tube shields, the grounded side of each being connected to a metal disc which is held in place by the tube shield spring. To facilitate replacement, the 5841 voltage regulator is mounted in a three-prong *Amphenol* type connector.

For mechanical rigidity and to facilitate servicing, *Vector* turret sockets were used for the amplifier, oscillator, and rectifier tubes. No special or tricky arrangement of parts was found necessary, but a shield between the oscillator, amplifier, and the high-voltage rectifier was found desirable to prevent circuit interaction, and a copper tube around the high-voltage lead reduced audio pickup from the neon oscillator circuit appreciably. To insure mechanical rigidity and ample insulation, liberal use was made of cable clamps, brackets, rubber grommets, and sleeving, as is apparent in Fig. 4. Care must be taken, in laying out the chassis, to allow clearance between chassis-mounted and case-mounted parts, otherwise the chassis cannot be fitted into the case.

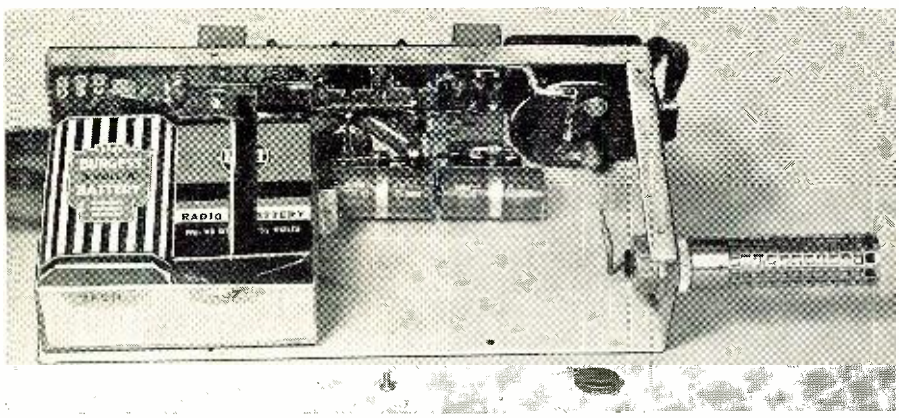
Case-mounted components include the Geiger tube (Fig. 10), the rate meter, the controls, the carrying handle, and the carrying strap. Arrangement of the controls is shown in Fig. 2. The range switch is equipped with a paddle handle, and so placed that snapping the battery switch to "off" position automatically puts the rate meter on low range. The high-voltage adjusting rheostat (R_{18}) is equipped with a dial lock to prevent accidental readjustment in the field. The other controls are protected from accidental operation by the carrying handle, which covers them, but which is elevated above the case top by 1" alu-

(*Continued on page* 60)



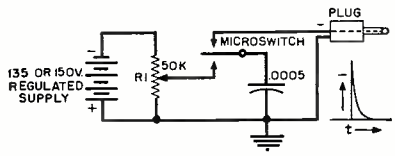
R1, R12, R13—10 megohm, 1 w. res.
R2, R19—100,000 ohm, 1 w. res.
R3—4.7 megohm, ½ w. res.
R4—10,000 ohm, 1 w. res.
R5, R10—1 megohm, 1 w. res.
R6—25,000 ohm pot ("Volume")
R7—150 ohm, 1 w. res. (Select a value to match impedance of headset used)
R8—33,000 ohm, 1 w. res. (see text)
R9—6.8 megohm, 1 w. res.
R11—47,000 ohm, 1 w. res.
R14, R16—5 megohm, 1 w. res.
R15—500,000 ohm, 1 w. res.
R17—30 megohm, 1 w. res.
R18—10,000 ohm wirewound pot with dial lock ("High-Voltage Adjust.")
C1—250 μμfd., 1500 v. mica capacitor
C2—.01 μfd., 600 v. capacitor
C3, C4, C5, C10—.005 μfd., 400 v. capacitor
C6—.02 μfd., 400 v. capacitor
C7—.05 μfd., 400 v. capacitor
C8—50 μμfd. mica capacitor
C9—500 μμfd. mica capacitor
C11—400 μμfd., 600 v. ceramic capacitor
C12—.001 μfd., 400 v. capacitor
C13—.1 μfd., 400 v. capacitor
C14—8 μfd., 400 v. elec. capacitor
C15, C16—.1 μfd., 1500 v. capacitor
C17—.01 μfd., 1500 v. capacitor
C18—50 μfd., 400 v. elec. capacitor
C19, C20—1000 μfd., 15 v. elec. capacitor
NE1, NE2—NE51 neon bulb
CH1, CH2—50 hy., 3 ma. reactor, 6000 ohms (UTC O-13)
CR1—1N72 crystal diode
T1—"Ouncer" trans., UTC O-7. 15,000-ohm pri. to plate of 3S4, 95,000-ohm sec. to plate of 5517. Sec. center-tap not used
T2—Trans. to match impedance of headset used with counter (Author used Western Electric trans. from hearing aid which matched the bone-conduction headset)
M1—0-50 μa. meter
J1—Phone jack with two separate "break" contacts (Carter AJ-161 or Mallory Type 705)
J2—Closed-circuit phone jack
J3, J4—Pin jack (color coded, one black and one red)
B1—22½ v. battery (Eveready 412)
B2—135 v. battery (two Burgess XX-45 67½-volt units in series)
B3—3 v. battery (Burgess 2F2H)
S1—S.p. 3-pos. switch with paddle handle (see text)
S2—D.p.d.t. toggle switch
S3—D.p.s.t. toggle switch
S4—S.p.d.t. spring-return toggle switch
V1—1B85 Geiger tube (Victoreen)
V2, V3—3Q4 tube
V4—3S4 tube
V5—5517 tube
V6—5841 tube

Fig. 5. Schematic of the Geiger counter. All parts are standard. The section marked "Chassis" is built on a separate sub-chassis.



← **Fig. 6.** Geiger counter with right case and amplifier chassis removed, showing case-mounted parts and chassis mounting bracket on right side of battery holder.

↓ **Fig. 7.** Simple electrical circuit for calibrating rate meter used in the Geiger counter. A standard three-speed turntable is heart of this "tester."



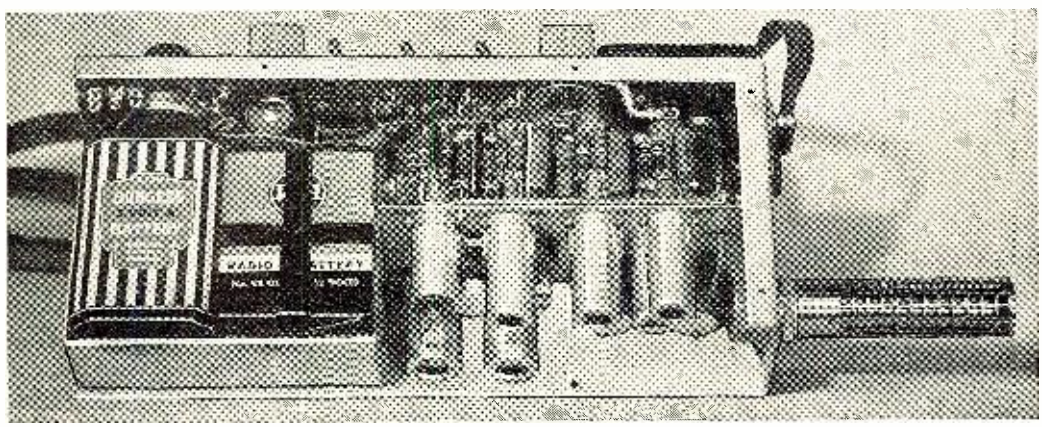


Fig. 8. Interior view of left case half. It shows battery holder in lower left, amplifier chassis in place, and the Geiger tube mounted at the right.

SPEED (rpm)	CONTACTS PER REVOLUTION 1	2	3	4
	(in counts per minute)			
33⅓	33⅓	66⅔	100	133⅓
45	45	90	135	180
78	78	156	234	312

Table 1. Pulse output in counts per minute from three-speed turntable with contacting arrangement. Used with circuit, Fig. 7.

minum blocks to allow ample hand clearance.

Components mounted on the interior of the case are firmly held in place by use of clamps and brackets, and connections are made with emphasis on rigidity and permanence (Fig. 6). Battery leads are of heavy flexible wire, and are brought out to a triple tie point bolted to the top of the case.

Special Features

Although this Geiger counter design apparently differs only slightly from conventional designs, the mechanical and electrical modifications substantially double its field utility and convenience.

Use of a regulated and adjustable high-voltage supply, in conjunction with an "all or nothing" amplifier makes for consistent performance throughout the life of the batteries. Switching permits use of the rate meter for checking batteries. When the meter switch is thrown to "volts" position (Figs. 2 and 5) the instrument is connected across the high voltage through a 30-megohm resistor (R_{17}), so that the meter reading is an indication of the high voltage. By moving the spring return voltage switch from *H* to *A*, with the meter switch at "volts" position, the filament battery is monitored. When the meter switch is moved to "rate" position, the 30-megohm resistor functions as a bleeder, to stabilize the system, and to drain off the capacitor charge when the counter is turned off.

Provision is made for an independent a.f. output (red a.f. tip jack) to permit checking of the rate meter or connection to other rate indicating or recording devices; and a jack input is provided (J_1, Fig. 5) for calibration check purposes. This is fitted with a jack cover (see Fig. 10) to keep dirt and moisture out.

Field and shop servicing are facilitated by use of the removable amplifier chassis with cord connector. To permit observation of the neon high-voltage oscillator, a small circular viewing window is inserted in the bottom of the case, opposite the NE-51, as in Fig. 9.

A bone-conduction headset is recommended for field use with this and other Geiger counters, as in Fig. 1. With ordinary headsets, one or both ears are covered, making it difficult for the operator to hear and localize field sounds, such as shouted instructions, or the warning buzz of rattlesnakes. Some people also find that wearing a headset impairs their sense of balance. With a bone-conduction receiver, both ears function normally, yet the click output of the counter is clearly detectable.

For hand carrying in the field, a strong metal handle is provided. This, a *Stanley* #3 door pull, is large enough for the average man's hand, and is raised from the top of the case by two aluminum blocks to provide adequate clearance between the controls and the operator's fingers. The handle also protects the controls against accidental operation in the field.

For most field use, a shoulder strap is found desirable, and is attached to the case by use of suitcase handle fittings, which are bolted to the sheet metal. The carrying strap should be about 1" wide. A narrower strap is more elegant, but produces sore shoulders after long days in the field.

All screws used in this counter are standard machine screws, most of them 6-32 binding head. Self-tapping sheet metal screws make for more rapid assembly, but are self-stripping in the field, and should not be used. Large rubber feet (¾" in diameter) are bolted to the bottom corners of the case, to protect against shocks and abrasion, and to prevent skidding in the field.

All major controls are indicated with decals, applied in the usual manner, and then protected against wear by several coats of clear lacquer (Figs. 2, 4, and 10). A descriptive label, stating ownership, is bolted to the back of the case, with a small chart frame for protection. This saves a lot of arguments in going through customs inspection.

Calibration

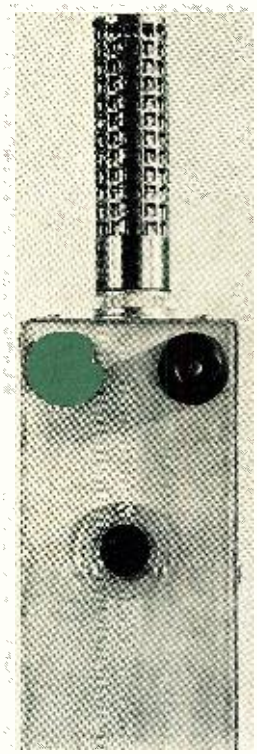
A 50-microampere movement is used in the rate meter of this Geiger counter. Because the integrating circuit of the rate meter is not linear, the instrument must be calibrated. This is accomplished by feeding the counter with evenly-spaced pulses, of uniform amplitude, at various known rates.

Although several rate meter calibration devices are known,[2] a very convenient calibrator can be improvised in a few minutes from a standard three-speed turntable and a *Microswitch*. Uniformly-spaced bumps are placed on the rim of the turntable, and each of these operates the *Microswitch* once per revolution. Output count rates produced at various numbers of operations per revolution and various speeds are shown in Table 1. The electrical circuit is shown in Fig. 7.

To calibrate the counter, after operation has been checked and found normal, connect an oscilloscope across the output tip jacks, and note the amplitude and shape of the pulses produced by normal counts. Put the range switch (S_1) on "X 1," and the meter switch on "rate." Arrange the calibrator for 180 counts per minute output, plug it into jack J_1 (the calibrate jack) on the front of the counter, and adjust R_1 (Fig. 7) until the pulse seen on the oscilloscope has the same amplitude as that produced by the Geiger tube input. The rate meter will slowly climb, going off scale gently after about 100 seconds of operation.

Shunt the meter with a variable high resistor, and adjust it until the pointer is steady at 50 microamperes when the input is 180 counts per minute. When this value has been checked, replace the variable resistor with a fixed resistor (R_5) of the same value (20,000 to 50,000 ohms). Proceed to record the scale reading for the other nine calibration points (Table 1), be-

(*Continued on page* 156)



←**Fig. 9. A bottom view of case, showing circular inspection window, opposite NE-51 oscillator. Note heavy rubber feet bolted to case. Upper projection is Geiger tube in its protective shield.**

Fig. 10.→ Front view of counter with shielded Geiger tube removed from socket to show arrangement of parts. Note elevation of handle above top surface and controls by use of aluminum spacing blocks.

A Complete Control Unit for the Ham Station

Front view of the complete control unit, showing layout of panel controls. Standard panel measures 3½" x 19". Power supply and the relays are visible at the rear of the open frame chassis.

By **MAURICE P. JOHNSON, W3TRR**
Engr. Dept., Station WAAM-TV

A centralized control assembly for use with amateur rigs in the 100-150 watt power class. The design permits primary power distribution and power switching as well as transfer from "send" to "receive" with a single control switch. Also incorporated are operational accessories such as 100 kc. standard and additional marker oscillators, an r.f. carrier and a.f. modulation monitor with meter-type indicator, as well as "Monitone" CW and AM monitoring facilities.

TRANSMITTERS of the hundred-watt power class are tremendously popular with amateurs, and an examination of modern designs of such equipment indicates that this popularity is well deserved. It will be noted that certain criteria are evident in the designs, irrespective of whether they are commercial units, kits intended for home assembly, or "home brew" designs, such as have appeared in various publications. Invariably, such equipment tends toward a neat, compact, self-contained assembly. Dependable circuits featuring modern tube types are used, with TVI reduction measures incorporated in the design. Such rigs, in their compact form, are able to be nestled beside a receiver to provide a true "desk-top" station.

Equally obvious, and most important, is the attention being directed toward ease of operation. Operational convenience, in fact, is of prime importance to any amateur station. Naturally, such features as bandswitching for both transmitter and receiver, complete front panel control, pie-tank tuning circuits for final r.f. stages, and the like, all contribute to operating ease.

Additionally, when discussing station operating convenience, it is worthwhile to consider the role played by accessories such as monitoring and measuring equipment, for both transmitting and receiving. Likewise, no station can be conveniently operated unless the transfer from receive to transmit can be made with a single switch.

It was with these particular needs in mind, that a complete control unit was designed and assembled, in order to coordinate the operational activities of the station and thereby make operating a decided pleasure.

Design Considerations

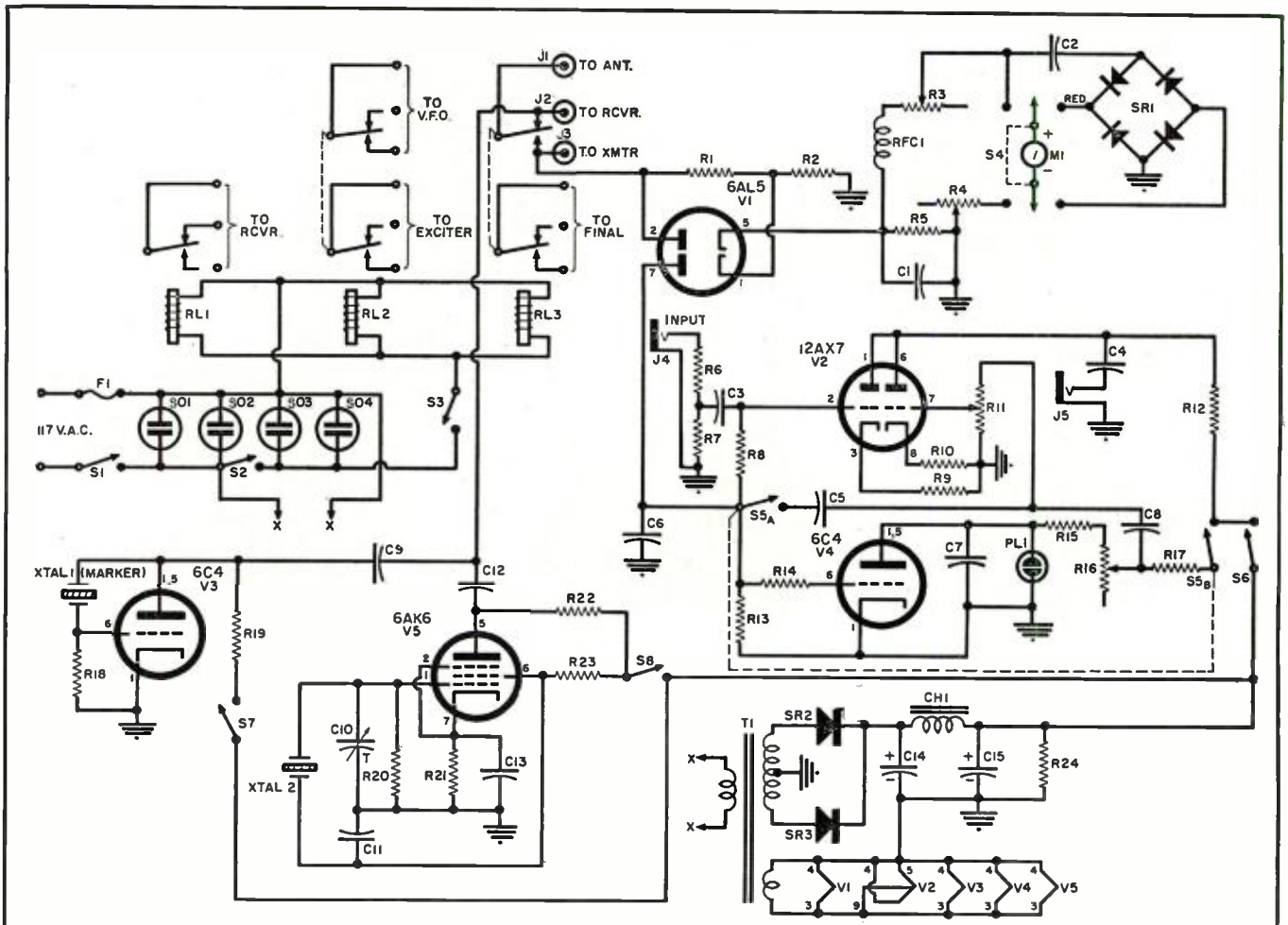
The control unit to be described is intended to consolidate the switching requirements of the transmitter and receiver in the normal procedures of send-receive operation. In addition, included within the unit are certain accessories which were considered essential or desirable in the operation of the ham station.

In considering the design, it was initially decided that the most logical placement for the control unit would be directly below the receiver. It is usually necessary to elevate the receiver over the operating desk in order to position the tuning knobs at the most comfortable height of six to eight inches above the table. This indicated that a 3½" panel could be fitted below the usual receiver, and the design of the control unit was undertaken with this stipulation in mind. It was found practical, nevertheless, to include all features desired in the unit within this limitation of space.

The first requirement of the design to receive consideration was for the primary power demands of the transmitter, receiver, and the accessories. Power needs of a ham station of the 100-watt class are such that the usual home a.c. circuits may be used without undue loading. It was thus decided that the primary power distribution and switching could be included within the assembly, resulting in a single neat power cord to connect the complete ham station to the home a.c. source.

For switching and distribution purposes, power needs can be split into two categories; namely, that needed for receiving equipment, and that used for transmission. Reference to the schematic will show that four power connectors are available, all supplied through the main switch S_1, and fused in the return leg of the circuit. Two outlets are directly energized by S_1, to supply receiver and a desk lamp or other external accessory if desired. It will be noted that an internal power pack is also activated by S_1 in order to power the accessories used in reception and transmission, as will be discussed later.

An additional switch, S_2, powers the remaining two outlets for the v.f.o. and transmitter. In addition, power is thus made available to the send-receive relay circuits, which may now be activated by a key type send-receive switch, S_3. To accomplish complete changeover from receive to transmit, three relays were used in this circuit. Naturally, the exact switching requirements are governed by the receiver, v.f.o., and transmitter being used, as well as the antenna system. It should be pointed out that the system being described was designed to be used with the 100-watt bandswitching rig discussed by the author in the December, 1954 issue



R1—33,000 ohm, 1 w. res.
R2—15,000 ohm, 1 w. res.
R3—25,000 ohm linear taper pot (Ohmite AB)
R4—250,000 ohm linear taper pot (Ohmite AB)
R5—47,000 ohm, 1 w. res.
R6—6800 ohm, ½ w. res.
R7—1000 ohm, ½ w. res.
R8—560,000 ohm, ½ w. res.
R9, R10—1200 ohm, ½ w. res.
R11—1 megohm pot ("Volume Control")
R12—22,000 ohm, 1 w. res.
R13, R15—1 megohm, ½ w. res.
R14—68,000 ohm, ½ w. res.
R16—3 megohm pot ("Tone Control")
R17—2.2 megohm, ½ w. res.
R18, R20—470,000 ohm, ½ w. res.
R19, R21—100,000 ohm, ½ w. res.
R22—2700 ohm, ½ w. res.
R23—180,000 ohm, ½ w. res.
R24—33,000 ohm, 2 w. res.

C1—100 μμfd. ceramic capacitor
C2—1 μfd., 400 v. capacitor
C3, C13—.005 μfd. disc ceramic capacitor
C4, C5—.1 μfd., 400 v. capacitor
C6—100 μμfd. ceramic capacitor
C7—.001 μfd. disc ceramic capacitor
C8—250 μμfd. ceramic capacitor
C9, C12—5 μμfd. ceramic capacitor
C10—10-50 μfd. trimmer (N-750, CRL 823-BZ)
C11—150 μμfd. ceramic capacitor
C14-C15—20/20 μfd., 450 v. elec. capacitor
M1—0-1 ma. meter (Simpson 127)
SR1—Full-wave meter rectifier (bridge)
SR2, SR3—65 ma., 130 v. selenium rectifier
CH1—30 ma. filter choke
RFC1—2.5 mhy. r.f. choke, single pi
Xtal.1—See text
Xtal.2—100 kc. crystal (Bliley KV3)
RL1—S.p.d.t. relay, 117 v. coil (Advance K-1503S)

RL2—D.p.d.t. relay, 117 v. coil (Advance K-1504)
RL3—D.p.d.t. antenna relay, 117 v. coil (Advance AM type)
S1, S2—S.p.s.t. heavy-duty toggle sw., (15 amps @ 125 v.)
S3—Switchcraft "Lev-R" switch (Locking type 3001-L)
S4, S5—D.p.d.t. bat-handle toggle switch
S6, S7, S8—S.p.s.t. bat-handle toggle switch
F1—10 amp line fuse
SO1, SO2, SO3, SO4—117 volt power line socket
J1, J2, J3—Shielded input jack
J4, J5—Single-circuit phono jack
PL1—NE-2 neon lamp
T1—125-0-125 v. @ 25 ma.; 6.3 v. @ 1 amp. (Stancor PS-8416)
V1—6AL5 tube *V3—6AK6 tube*
V2—12AX7 tube
V3, V4—6C4 tube

Complete schematic of the control unit. The circuit design is adaptable to most amateur transmitters in the 100-150 watt power class.

of this magazine. When used with other rigs, individual requirements may dictate minor changes.

One relay is used for the antenna switching, transferring a single coax-fed antenna from receiver to transmitter. Additionally, three sets of normally-open, and one set of normally-closed relay contacts are used to complete transfer functions. Because of availability, a d.p.d.t. antenna relay was used, together with two miniature d.p.d.t. relays.

The receiver makes use of the normally-closed set of contacts to tie to the standby circuit of the set, disabling the receiver during periods of transmission. If, for any reason, it is desired to operate the receiver during transmitting periods, the usual receiver standby switch can be used to shunt the relay contacts as needed.

The separate v.f.o. is controlled in the "B-" return with one set of the normally-open contacts. The transmitter requires the two remaining pairs of normally-open contacts. One set completes the oscillator cathode-to-ground path during transmission. The heavy-duty contacts remaining on the antenna relay are used to complete the high-voltage power transformer primary circuit, to operate the final.

Connections are made to the antenna relay by means of chassis mounted coax fittings so that receiver, transmitter, and antenna may be fed with coax cable. Needless to say, the antenna feedline should be flat, with minimum standing wave ratio. This necessitates a well designed resonant antenna system.

The other relay contacts are attached to associated pieces of gear through cables and plugs of the *Jones* 300 series. A four-wire circuit feeds the transmitter, to control final and exciter. With reference to the schematic of the 100-watt transmitter, on page 68 of the December, 1954 issue of RADIO & TELEVISION NEWS, leads were connected paralleling the d.p.s.t. switch S_3, and brought out to the rear chassis lip to a suitable *Jones* connector. This is the only addition made to the transmitter.

The control unit circuitry discussed thus far completes the a.c. power control and distribution, as well as send-receive transfer functions. The remaining parts of the control unit are de-

voted to operational accessories which contribute to station operating ease.

A valuable receiving aid is a crystal-controlled frequency standard for receiver calibration and other frequency measurements. A 100 kc. crystal standard is included, with a 6AK6 tube in a conventional circuit. A *Bliley* KV3 crystal is used, and can be set to exact frequency by adjustment of C_{10}. Switch S_8 applies plate voltage to this oscillator when in use.

An additional oscillator has been included, which serves as a convenient marker oscillator. The crystal socket is mounted to the front panel so that crystals may be readily plugged in. The oscillator uses a 6C4 in a simple Pierce circuit, with S_7 as plate voltage switch to turn the marker on. This makes a convenient marker for checking transmitter frequency or band edges by plugging in appropriate crystals.

The two oscillators are coupled to the receiver side of the antenna relay to permit injection into the receiver front end.

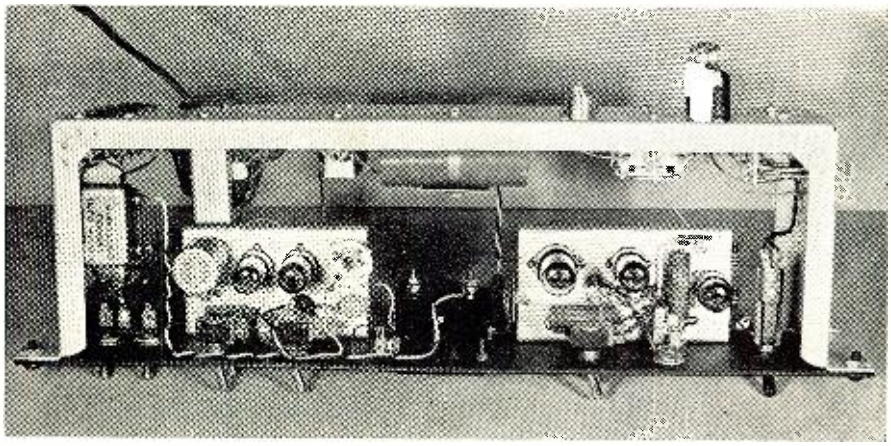
Several additional accessories are included for the transmitter. A modulation monitor is incorporated, with provision for r.f. carrier indication as well. This is based on a test monitor circuit covered by Arthur Franklin Mill in the April, 1954 issue of *"CQ"* magazine. The circuit has been modified to eliminate tuned circuits in the pickup.

Referring to the schematic, it will be seen that one half of a 6AL5 is coupled to the transmit side of the antenna relay. Rectified carrier appears across R_5, and is fed to the indicating milliammeter by means of switch S_4. One position of the switch selects the rectified carrier only, the meter then serving as an r.f. output indicator. The other switch position applies the meter to the instrument rectifier which recovers the audio from the carrier, giving a modulation indication.

It should be stated that the monitoring circuit is intended for use with 72-ohm antenna feeds, with low standing wave ratios, and powers of approximately 100-150 watts. These conditions determined the design conditions for the 6AL5 circuitry.

A note should be made in passing concerning the calibration of the r.f.-a.f. modulation monitor circuit. The audio voltage recovered will be less than the rectified carrier indication. Therefore, R_3 should be adjusted first for the audio level representing 100% carrier modulation, by comparison with the oscilloscope pattern in a conventional oscilloscope modulation measurement. The oscilloscope is needed only for the initial calibration, of course. A convenient indication can be had by setting the resistance of R_3 so that 100% modulation at the proper power level causes full scale deflection of the meter.

With S_4 thrown next to the r.f. carrier output position, R_4, should be set for the same full scale reading with carrier only applied. In future operation, it then becomes necessary only to tune and load the transmitter for full scale indication in the r.f. position, switch S_4 to the a.f. position, and modulate for 100% peaks at full scale. Because of the meter ballistics, an indication of approximately 70% of full scale will correspond to 100% modulation with voice frequencies. Additional data on the circuit adjustment can be found in the original *"CQ"* article.



Top view of control unit. Open frame chassis construction gives easy access to all components. Note layout of chassis bases, relays, and power supply, as well as the locations of the various switches. Power distribution is at left end of the unit.

The remaining accessory is similar to the familiar "Monitone" of *"ARRL Handbook"* fame. This is a most useful circuit which permits the monitoring of c.w. and phone transmissions, as well as blocking receiver audio during transmission. The only connection to the receiver is to tie the headphone output of the receiver to the input jack with a "patch cord." Phones are then plugged into the "Monitone" output jack at C_4.

The circuit is carrier-controlled by the transmitter r.f. output. Resistors R_1 and R_2 form a voltage divider feeding carrier to the remaining half of the 6AL5 for rectification. The resultant output voltage is used to key the "Monitone." Complete circuit information is to be found in any edition of the *"ARRL Handbook."* Suffice it to say that S_{3A} and S_{3B} switch the circuit from phone to c.w. monitoring positions, energizing the neon-bulb side-tone oscillator. R_{16} is the associated side-tone pitch control. R_{11} adjusts the audio level of the transmitter signal in the phones. The receiver volume control determines the audio level heard in the phones during reception. Thus the same phones position is used to monitor the transmitter as well as for normal reception. The switch S_6 applies plate voltage to the entire "Monitone" for use.

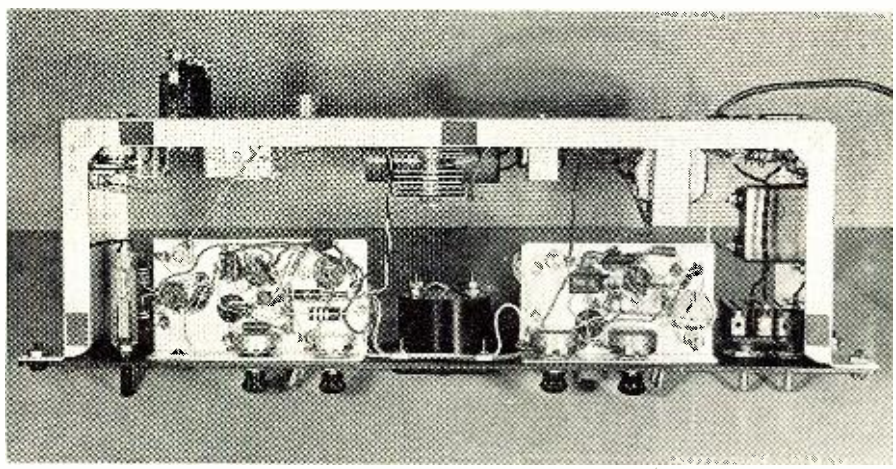
Construction

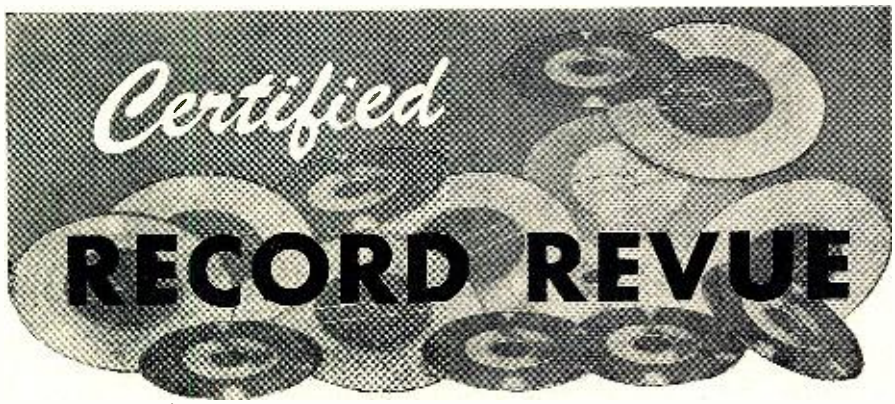
As previously mentioned, a panel space of 3½" was available, so a standard rack panel of this size was used for construction. A *Bud* CB-1371 dish type chassis is attached to the rear of the panel to form the basic chassis assembly, of open frame construction. Two small aluminum bases measuring 4½" x 2½" in size, with a 1" lip folded along the longer dimension, attach to the front panel as support shelves for the tubes and associated components. One shelf accommodates the two oscillators as well as parts of the modulation monitor. The other shelf is used for the "Monitone" circuit.

Reference to the accompanying photographs will indicate the parts layout and method used for construction to those interested in making a similar control unit. Viewed from the front,

(*Continued on page* 177)

Bottom view of control unit, showing two small chassis bases attached to the front panel, as well as general component placement. Jones plugs are used to connect the relays to the transmitter, v.f.o., and receiver comprising entire ham station.





By **BERT WHYTE**

IT HAS been a long time since I aired one of my pet gripes in this column . . . the subject of hi-fi advertising. Or I should more properly say the advertising of equipment which purports to be hi-fi in quality and which, of course, is nothing of the sort. It is downright amazing how the manufacturers of these cheap, gimcrack commercial phonos, that make a mockery of music, get away with the stunts they pull! The Federal Trade Commission has done a laudable job in protecting the public from fraudulent advertising, especially through sub-agencies like the Food and Drug Administration.

Evidently the segment of the electronics industry that produces these phonographic abortions is somehow free from any Federal restraints in their advertising. In practically any other field of manufacture, no one would dare to make such outrageous and flagrantly misleading advertising claims for their products. But just pick up any newspaper, especially a Sunday edition, and you will be inundated with purple propaganda from the merchants of phony-fi . . . "Hi-Fi Phono" . . . "response from 20 to 50,000 cycles" . . . has "permanent needle" . . . "full fidelity tone" . . . "has *powerful* 10" speaker for bass tones" . . . "has *three* speakers for stereophonic sound," etc., etc., *ad nauseam*. Imagine! All those hi-fi miracles in a table model selling for $99.50! Yessirreee Bob, it's a wonderful world we live in. Wonder what they'll think up next? Believe me, friends, the foregoing is but a mild example of the advertising that is constantly bombarding the public.

One of the choice ones, that really makes me see red is the ad for the so-called "roving" speaker which can be added to your Jim Dandy table model "to bring the glories of stereophonic sound into your home." The horrible part of this whole mess is that this deceitful advertising is bearing fruit! Being so close to the legitimate hi-fi business it is hard to realize that people could actually believe such printed bilge. But they have and in increasing numbers they are buying these miserable machines, happy in the delusion that they own hi-fi equipment. Happy that is, until somewhere, somehow, they are exposed to the real thing, to honest hi-fi sound. Then they know their moment of truth and with much chagrin realize that some sharpie has "taken them on a sleigh ride."

At the moment there seems to be no legal means of forcing the whoopla merchants to tell the truth in their advertising. In fact there may never be any means of restraint and the best thing we can do is to wage individual crusades with friends and people with whom we come into contact . . . tell them the basic facts, tell them where they can get genuine hi-fi equipment and honest advice.

The question has probably formed in your mind, "Why should I care if these manufacturers are untruthful in their ads and some joker gets clipped." Well, outside of the normal desire of any decent person to "give the other guy a helping hand," you have a perfectly selfish reason . . . the preservation of the hi-fi movement! After all, if great numbers of people become disillusioned with phony hi-fi, this will have an ultimate reflection on all aspects of the legitimate hi-fi business. The mighty flow of recordings we are enjoying from the record manufacturers will become a trickle, the *bona fide* hi-fi manufacturer, now enjoying an expanding market could not very well exist in a static, saturated hi-fi economy. The present hi-fi market would have to be much greater than it is to sustain even the most financially secure manufacturer on equipment replacement business alone. For you, the enthusiast, there would no longer be the Audio Fairs and the bright and shiny new models. If this seems a grim picture I have painted, remember that such a frightful situation is entirely possible . . . it has happened to other industries before. So you see, you do have a very personal stake in this affair.

The beauty and boons of genuine hi-fi sound should be available to everyone and it is up to the knowledgeable hi-fi enthusiast to help in as many ways as possible, the dissemination of accurate hi-fi information. The best defense against "phony-fi" is an informed and therefore discriminating public. Of course, there is already in existence an organization which if properly supported and adequately financed could wield a tremendous influence in the hi-fi market. I am referring to the "Institute of High Fidelity Manufacturers." A majority of the legitimate hi-fi companies belong to this organization, but if it is to succeed, the group must have full support of all companies. Some companies are foolishly allowing personality problems and other minor differences and petty bickering between themselves and the Institute to keep them from joining the Institute. This is short-sighted thinking at best. Properly administered, the Institute is the best weapon the companies have in the fight against phony-fi. A rigid code could be set up which would allow admission to membership in the Institute only to those companies whose manufactured products passed a rigorous test of an acceptable minimum of hi-fi performance.

An Institute Seal (similar to the familiar "*Good Housekeeping*" seal) on a piece of equipment, would guarantee to the public that they were buying a tested quality product. Naturally, to achieve general acceptance of this seal, a vigorous promotional and educational program would have to be brought to the public. Careful selection of the various media . . . newspapers, magazines, radio, and TV would be necessary because, in a program of this nature, money is the limiting factor. In fact, it is really the availability of money which will determine the ultimate success of the Institute. This is the uphill battle because the "phony-fi" boys have plenty of money and know how to use it. Even though many hi-fi companies are small in terms of corporate wealth, and even though they are beset enough with taxes, etc. in the normal operation of their businesses, membership in the Institute should call for a certain financial contribution in order to carry out the proposed programs. The benefits to be derived more than outweigh the expenditure and a percentage system could be set up so that a given company's contribution would be commensurate with their means. This would seem to be the only intelligent approach to the problem, and it is to be hoped that those companies which are still holdouts will bury the hatchet and join the Institute. With a solid front, the Institute can swing into action and then boys . . . watch the fur fly!

Equipment used this month: *Weathers*, arm, cartridge, and oscillator, *Components Corp.* turntable, *Marantz* preamp, *H. H. Scott* 70-watt amplifier, *McIntosh* 60-watt amplifier, *Pickering* electrostatic speaker combined with two *Bozak* woofers, and *Jensen* "Imperial" speaker.

The opinions expressed in this column are those of the reviewer and do not necessarily reflect the views or opinions of the editors or the publishers of this magazine.

MOZART

THE MAGIC FLUTE (COMPLETE) Soloists and chorus of Vienna State Opera with Vienna Philharmonic Orchestra conducted by Karl Bohm. London XLLA 33. RIAA curve. Price $14. 94. Three discs.

It is almost mandatory that a review column start off with a Mozart work these days. The Mozart Bicentennnial celebration is under a full head of steam now, and the flood of new releases continues. I suppose everyone is trying to put his best foot forward, but one is inclined to think that through sheer weight of numbers, many a Mozart work will be turned out in haste and not too well, when in more normal years the less hurried approach would have aided the chances of success. However, this new *London* recording of the "Magic Flute" is definitely not of the slip-shod, "hurry-up" variety. As with the earlier *London* Mozart offerings, this is first rate in all aspects.

The casting is as good as could be managed within the bounds of artists' time and contractual commitments, the engineering is to the highest *London* standards, and the packaging is not only deluxe but highly utilitarian. The principals in the cast . . . Hilde Gueden as Pamina, Leopold Simoneau as Tamino, Walter Berry as Papageno, Wilma Lipp as the Queen of the Night, Kurt Baum as Sarastro, and Emmy Loose as Papagena are all in splendid voice, although Wilma Lipp seems to be straining at times. The most remarkable thing about this performance is the projection of the voices. This is partly the artistry of the cast but they are aided by the fabulous engineering. Every note, every word, is heard cleanly and completely articulate, yet with this high degree of intelligibility, the acoustic perspective is still spacious enough to maintain the illusion of "liveness" and "presence." And this performance is also characterized by minute attention to detail, for instance, even the subsidiary roles are sung by artists of considerable stature.

Perhaps conductor Karl Bohm could be criticized for a certain degree of over-fussiness, but few can deny that this is the most cohesive and best integrated reading available. Bohm may not have the rhapsodic grace that the old Beecham recording displayed, but certainly this is not a "dry"

(*Continued on page* 146)

TVI from Power Lines

Is your area plagued by this trouble? If so, here are some good, practical methods for combating it.

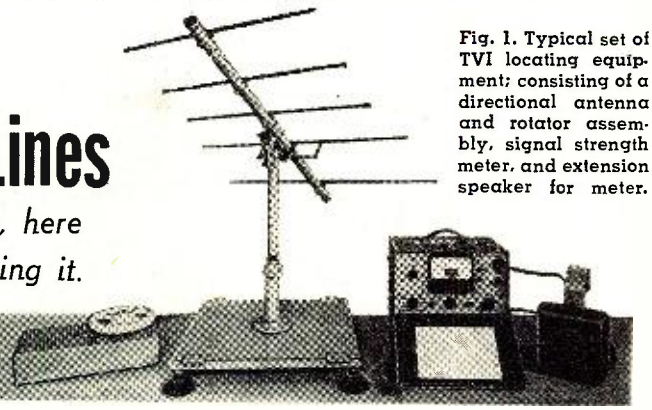


Fig. 1. Typical set of TVI locating equipment; consisting of a directional antenna and rotator assembly, signal strength meter, and extension speaker for meter.

By **NICHOLAS ALCHUK**

IN MANY areas, television viewers experience power-line interference. Service technicians could probably do a better job of eliminating such interference if they knew its source. Before attempting to describe the effects and detection of power-line noise, a brief explanation of how electric power is distributed to communities is essential.

Power is normally transmitted from generating stations at from about 100 up to 300 kilovolts, and may be conducted for distances of 300 miles or more. These high voltages are reduced at transformer stations to lower levels, and are then transmitted on local distribution systems. It is evident that noise or interference generated anywhere in the electric system can be radiated or conducted for miles.

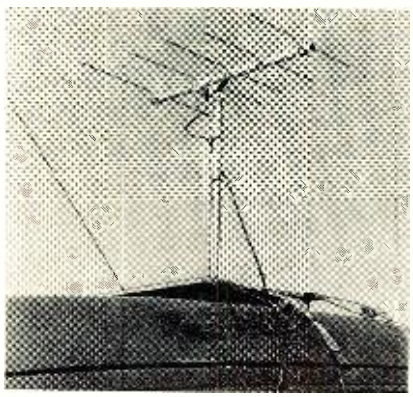
The noise generated by power lines is usually an electromagnetic disturbance of an erratic sort. It consists of a series of recurring bursts or pulses of energy containing a large number of random frequencies spread over a wide portion of the radio spectrum. Common sources are loose contacts, poor joints, old insulators, and contaminated insulators in industrial areas.

Interference from power lines can enter the TV receiver by several paths. Interference within the receiver r.f. passband will obviously be reproduced. The amount will depend entirely on the relative amplitudes of the picture and sound carriers and the interfering signal. Direct interference is also possible at any frequency within the passband of the picture or sound i.f. amplifiers of the receiver. Signals may be picked up by the i.f. wiring in the chassis. With extremely strong interference, it is possible for some signals to pass directly through the r.f. and mixer stages, particularly when the set is tuned to a lower channel.

If the interference is entering by direct pickup on the i.f. wiring, switching to another channel may change the relative intensity of the interference. The number of interference lines seen on the CRT screen will not be altered, however, unless the frequency of the interfering signal changes. The number of lines depends upon the frequency relationship between the interference and the horizontal sweep frequency, which is the same for each channel.

In certain instances, interference outside the passband of a receiver may cause annoying effects. Disturbances such as corona discharges from an insulator, originating close to the receiver and of sufficient amplitude, may generate new frequencies in the receiver input that are within the receiver bandpass. Such new frequencies are usually produced by the nonlinear action of the r.f. mixer.

Fig. 2. Directional antenna mounted on the roof of interference-seeking auto.



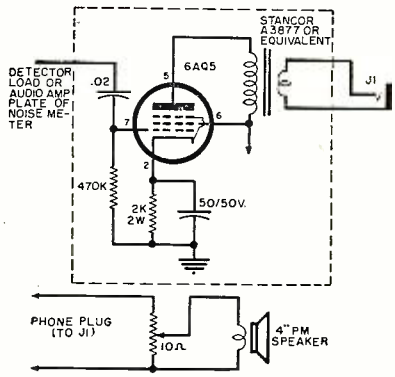


Fig. 3. Schematic diagram of amplifier circuit which may be added to a signal strength meter to enable it to accept an extension speaker and volume control.

Fig. 1 illustrates a typical set of TVI-locating equipment, while Fig. 2 shows the antenna mounted on the roof of a car. The equipment consists of a noise meter, external speaker, and a directional antenna. An external loudspeaker was added to the noise meter to enable the operator to hear the increase or decrease in noise intensity without having to watch the meter. Fig. 3 is a schematic diagram of the modifications made to the noise meter to accept the external speaker.

Interference from the vibrator of the noise meter was reduced by running the battery leads through the bottom plate of the power pack. In addition, a simple filter, consisting of a coil of 10 turns, paralleled by two .001 μfd. mica capacitors, was connected in the ungrounded battery lead.

A directional antenna is necessary for noise location. An inexpensive commercial television antenna may be employed and installed as shown. A manual rotating system consisting of a handwheel and a simple pulley arrangement can be used; the details will depend on the type of vehicle used.

Operation of the antenna at two frequencies is necessary, because power-line noise may be strong at only one end of the v.h.f. spectrum. A two-element, low-band unit may be utilized at an unused channel between 50 and 90 mc., while a 5-element yagi designed for a vacant channel between 174 and 216 mc. will do for the upper end of the TV band. The ignition system of the car must be suppressed to prevent undue noise pickup by the antenna.

After installation in a car or truck, the equipment is turned on and allowed to warm up. The vehicle is slowly driven along the street where power lines are suspected of generating noise. The antenna is rotated slowly until maximum noise is heard in the external loudspeaker. As the noise increases in intensity, switching in one or more of the attenuators (if present on the noise meter), will allow pinpointing the source producing the noise.

Noise Sources

Noise usually occurs on the stepped-down distribution lines and can be normally traced to pin-type insulators. The effect of this type of noise is very noticeable in rural and suburban areas.

The pattern produced on the CRT is readily identified. Noise consisting of a rapid succession of short, sharp pulses of r.f. energy, produces short light or dark streaks along individual lines of a picture. Leakage across the top skirt of an insulator, due to voltage stresses or contamination, may generate noise of a steady nature. In such a case, the dark streaks will appear in two broad horizontal bands on the CRT screen as

(*Continued on page* 171)

High Fidelity Performance with Mullard's 520 Circuit

Over-all view of power amplifier. The three fuses are mounted on the left flange while the "on-off" switch appears on the right flange. The large housing (which is vented at top and bottom) directly behind the tubes covers the output and power transformers and filter choke. The other components are mounted below the chassis.

The original British-designed power amplifier was conservatively rated at 20 watts. Actual tests showed an output of 36 watts with .2% harmonic distortion. Maximum output is with .3 volt input.

By **E. J. PORTO***

CONSIDERABLE international attention has been focused on a new audio output pentode, the EL34, recently introduced in England by *Mullard Ltd.,* in view of the many American power amplifier designs based around this new tube. The circuit described in this article is basically an "Ultra-Linear" design that was originally worked up by *Mullard Ltd.* and published in *"Wireless World."* According to published data, it was rated at 20 watts with a total harmonic distortion of .05% at rated output. Actual tests by American standards resulted in a rather surprising performance in that, instead of 20 watts output, we were able to obtain up to 36 watts with a total harmonic distortion of .2%.

Before going into the actual details of this power amplifier, let us review the basic requirements of amplifier designs that are important considerations for high-fidelity reproduction. Briefly, they are as follows:

1. Low harmonic and intermodulation distortion
2. Linear frequency response throughout the audible range
3. Good response to transient signals
4. Low phase shift
5. Low hum and noise level
6. Enough power output to allow peaks to be reproduced without overloading
7. Low output resistance to provide electrical damping for the loudspeaker system
8. Stability under feedback conditions

TABLE 1.
THE MULLARD EL34 TUBE UNDER VARIOUS OPERATING CONDITIONS

MODE OF OPERATION	OPERATING CONDITIONS					IM DISTORTION (in per-cent at)		
	E_p (volts)	E_{g2} (volts)	R_k (ohms)	Impedance (P-P, ohms)	R_{g2} (ohms)	10 w.	14 w.	36 w.
Triode-connected	400		470 (each)	10K		.4	.6	....
Distributed-load ("Ultra-Linear")	400	400	470 (each)	6.6K	1000 (each)	.5	.6	.8
Pentode-connected (push-pull)	330	330	130 (common)	3.4K	470 (common)	1.5	2.0	4.0

Amplifier Designs

A low level of inherent distortion can be obtained in a push-pull triode output stage operating under virtually Class A conditions. It is found that with 25-watt pentodes or tetrodes, wired as triodes, a power output of from 12-15 watts can be easily obtained with harmonic distortion levels below 1%, using a supply voltage of from 430-450 volts.

The maximum power output and the corresponding distortion vary appreciably with the value of load impedance. Fig. 2 illustrates typical performance of the *Mullard* EL34 high slope output pentode, triode-connected, in a push-pull stage operating slightly below its rated plate dissipation of 25 watts.

Increasing interest is being shown in circuits employing distributed loading ("Ultra-Linear" operation) of the output stage (Fig. 1). These circuits apply negative feedback in the output stage itself. In the simplest form, the screen grids of the output tubes are fed from taps on the primary of the output transformer. The stage can be considered as one in which negative feedback is applied in a non-linear manner *via* the screen grids. The characteristics of the distributed load stage are intermediate between those for pentode and triode operation, approaching triode operation as the per-

*International Electronics Corporation, 81 Spring Street, New York, New York.

centage of the primary winding common to plate and screen-grid circuits increases. It is found that under optimum conditions about two-thirds of the power-handling capacity of the corresponding pentode stage can be used with greatly reduced distortion, while at power levels corresponding to triode operation, a similar order of distortion is obtained. At the same time, the output impedance is reduced to a level approaching that obtained when a conventional push-pull triode stage is used. Such a stage can, therefore, be used with pentodes of the 25-watt class in high-quality amplifiers designed for power outputs well in excess of 30 watts, the over-all power efficiency being much greater than with triode operation.

Table 1 is a comparison of triode, pentode, and distributed-load operation for the EL34. For tubes of the EL34 type, comparison with triode operation is of most interest. It will be seen that distributed-load operation enables the power-handling capacity to be more than double that possible with triode operation while, at the same time, distortion in the stage can be held to a very low level. Although with a common winding ratio of 0.2 to 1 the distortion level is comparable to triode conditions, it has been found that appreciable improvement is obtained at higher power outputs if the common winding ratio is further increased.

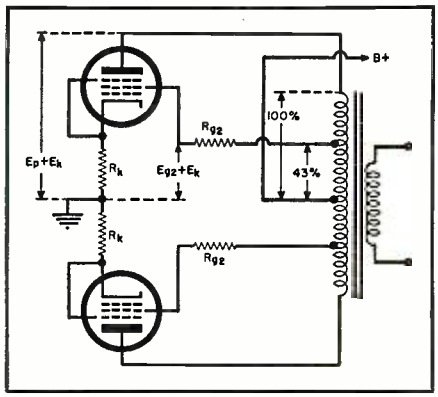


Fig. 1. Theoretical design for "Ultra-Linear" circuitry used in amplifier. The percentage figure is turns ratio.

From the figures of Table 1, little advantage would appear to be gained by further approaching triode conditions. There are, however, at least two advantages in using a tap at about 40% of primary turns, particularly with the EL34 where a high power output is still available. In the first place, almost identical performance is obtained under cathode and fixed bias conditions since with a closer approach to Class A triode operation, variations in plate and screen grid currents are reduced when the stage is driven. Secondly, as with normal triode operation, power output and distortion are less dependent on the precise value of the load impedance. With a primary tap

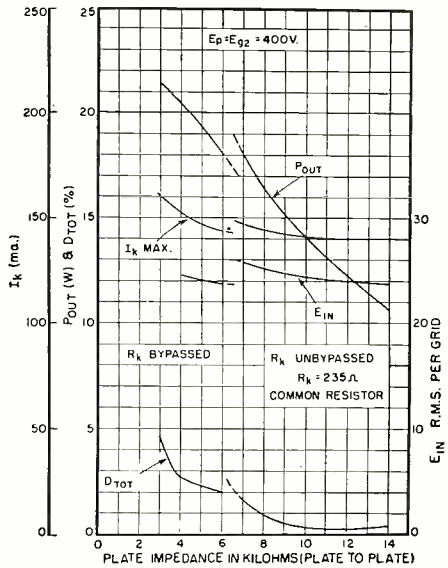


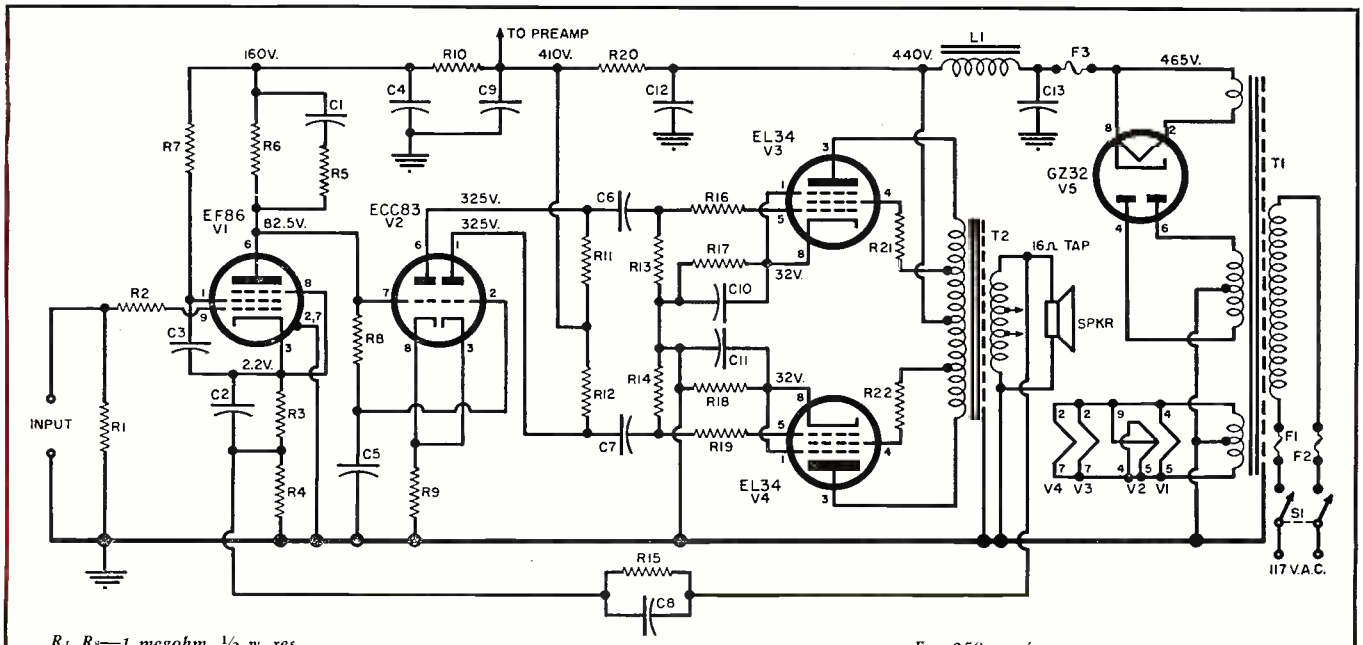
Fig. 2. Performance curves of two triode-connected EL34 tubes in push-pull. Refer to text for complete discussion.

of about 40% of the turns, little change in performance is produced by a change in the plate-to-plate load impedance of 6000 to 9000 ohms. In addition the output impedance of the stage is still further reduced by the use of the larger common winding ratio.

Circuit Arrangements

The next-to-the-last-stage of the amplifier must be capable of providing a

Fig. 3. Schematic of Mullard 520 amplifier. All parts are available at local parts jobbers. Maximum current drain for preamp is 40 ma.



R_1, R_8—1 megohm, ½ w. res.
R_2, R_5—4700 ohm, ½ w. res.
R_3, R_{16}, R_{19}—2200 ohm, ½ w. res.
R_4—100 ohm, ½ w. res.
R_6—100,000 ohm, ½ w. res.
R_7—390,000 ohm, ½ w. res.
R_9—8200 ohm, ½ w. res.
R_{10}—270,000 ohm, ½ w. res.
R_{11}, R_{12}—180,000 ohm, ½ w. res. (Matched ±5%, R_{12} to be greater than R_{11})
R_{13}, R_{14}—470,000 ohm, ½ w. res. (Matched ±5%)
R_{15}—8200 ohm, ½ w. res. ±5% (for 16-ohm load)
R_{17}, R_{18}—470 ohm, 5 w. wirewound res. ±5% (critical value)
R_{20}—15,000 ohm, ½ w. res.
R_{21}, R_{22}—1000 ohm, ½ w. res.
C_1—47 μμfd. disc ceramic capacitor
C_2—50 μfd., 12 v. elec. capacitor
C_3—.05 μfd., 400 v. capacitor
C_4, C_9—8 μfd., 450 v. elec. capacitor
C_5—.25 μfd., 400 v. capacitor
C_6, C_7—.05 μfd., 400 v. capacitor
C_8—220 μμfd. ceramic capacitor (for 16-ohm load)
C_{10}, C_{11}—50 μfd., 50 v. elec. capacitor
C_{12}, C_{13}—8 μfd., 500 v. elec. capacitor
L_1—8 hy, 180 ma., 145 ohm filter choke (Thordarson T-20-C-54 or UTC H-62)
F_1, F_2—2 amp fuse
F_3—250 ma. fuse
S_1—D.p.s.t. switch (Power "on-off")
T_1—Power trans. 400-0-400 v. @ 200 ma.; 5 v. @ 3 amps.; 6.3 v. c.t. @ 5 amps. (Stancor PM-8412 or equiv.)
T_2—Output trans. (Any of the following may be used: Acro Products Company TO-300, 6600 ohms p-to-p, 4-8-16 ohms; Chicago-Standard Transformer Corp. A-8072, 7600 ohms p-to-p, 4-8-16 ohms; Dyna Company A-420. 6600 ohms p-to-p, 8-16 ohms; Partridge P3878, 6600 ohms p-to-p, 4-16 ohms)
V_1—EF86 tube (Mullard)
V_2—ECC83 tube (Mullard)
V_3, V_4—EL34 tube (Mullard)
V_5—GZ32 or GZ34 tube (Mullard)

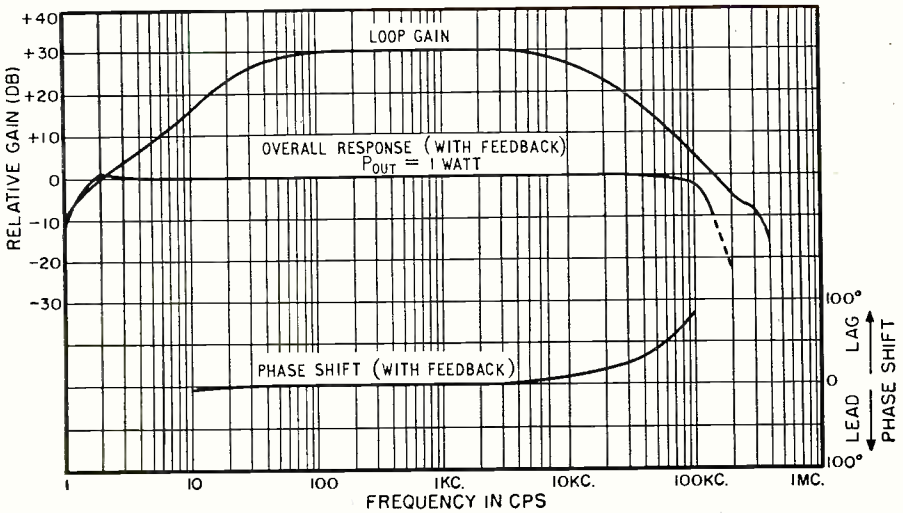


Fig. 4. Loop gain, frequency response, and phase characteristics. Over-all frequency response at 36 watt operation is flat, 30 to 20,000 cycles-per-second.

TABLE 2.
SUMMARY OF PERFORMANCE CHARACTERISTICS OF THE POWER AMPLIFIER

Power output:	36 watts; 30 to 20,000 cps
Frequency response: (at 36 watts)	within 1 db from 20 to 20,000 cps
Harmonic distortion: (at 400 cps)	.05% at 20 watts, .2% at 36 watts
IM distortion: (40 to 10,000 cps, 4:1 ratio)	.8% with peak corresponding to 36 watts sine-wave power
Hum and noise:	−89 db (relative to 36 watts)
Sensitivity:	.3 volt for 36 watt output
Damping factor:	50

well balanced push-pull drive of adequate amplitude and low distortion content. With the EL34 the maximum drive voltage required is approximately 2 x 25 volts r.m.s. Input voltage requirements are similar for triode, pentode, or distributed-load operation.

Bearing in mind the need to insure stability when feedback is applied over the whole amplifier, the circuit should contain the minimum number of stages in order to reduce phase shifts. If the function of phase splitting and amplification can be combined in the next-to-the-last-stage, so much the better. This can be conveniently achieved by using a cathode-coupled form of phase splitter. A high degree of balance is possible with this circuit, combined with a low distortion level at maximum drive to the output stage. By using a high-impedance double triode, an effective gain of about 25 times can be obtained simultaneously. This, combined with a preceding high-gain stage, enables a high over-all sensitivity to be obtained, even when a large amount of negative feedback is used. A high sensitivity in the main amplifier enables the output voltage requirements of preamplifier and tone control circuits to be reduced, thereby enabling low distortion to be more easily achieved in these circuits. It should be remembered that circuits preceding the main amplifier must be capable of handling, without appreciable distortion, voltages which are much greater than those necessary to load the amplifier fully.

With the use of such tubes as the EF86, which is particularly suited for use in a high-sensitivity input stage due to its low hum and noise levels, it is found that when feedback is applied, input sensitivities of 100 to 300 millivolts for 36-watt output can be achieved while keeping hum and noise levels extremely low.

In an amplifier employing single-loop feedback from output/input, instability will occur if the loop gain exceeds unity at frequencies for which the total phase shift around the loop becomes either 0° or 360° and so renders the feedback signal in-phase with the input. The conditions for negative feedback imply a phase change of 180° so that instability is approached as the additional phase shift in the amplifier and feedback network approaches 180°.

It is, therefore, necessary to control the amplifier characteristics over a frequency range greatly in excess of the designed working band. As the degree of feedback increases, control becomes more difficult and is usually limited by the leakage inductance, self-capacitance, and primary inductance of the output transformer. It is quite difficult in practice to provide a constant and high level of feedback over the whole audible range in a 3- or 4-stage amplifier where the main feedback loop includes the whole circuit and the output transformer. An adequate margin of stability in such circumstances is very difficult to obtain. Thus it is more usual to find that the effective feedback decreases towards the upper and lower audible frequencies. The *Mullard* 520 circuit is especially designed and engineered to maintain a constant degree of feedback throughout the audible range.

The performance of any high-quality amplifier is, ultimately, dependent on the quality of the output transformer. The use of distributed-load conditions does not modify the essential requirement of a first-class component; on the contrary, the output transformer may be a more critical component since precise balance of primary windings must be maintained.

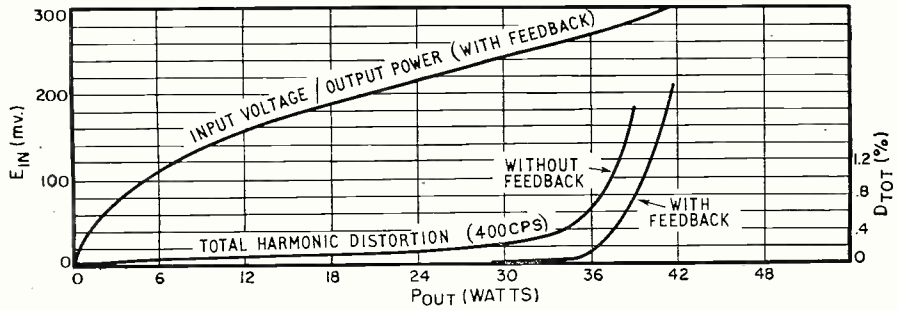
We can summarize by stating that with the introduction of distributed-load operation using the *Mullard* EL34 output pentode we can design efficient high-quality amplifiers with very high power handling capacities to reproduce the widest dynamic range of modern program sources.

Construction Details

The plate-to-plate loading of the output stage is 6600 ohms and with a feed voltage of approximately 440 at the center-tap of the output transformer primary the combined anode and screen-grid dissipation of the output tubes is 28 watts per tube. With the particular screen-grid-to-plate-turns ratio used, it has been found that improved linearity is obtained at power levels above 15 watts when resistors on the order of 1000 ohms are inserted in the screen-grid feeds. The slight reduction in peak power-handling capacity which results is not significant in practice. Separate cathode-bias resistors are used to limit the out-of-balance d.c. current in the output transformer primary; the use of further d.c. balancing arrangements in the output stage has not been considered necessary primarily because of the uniform characteristics of the

(*Continued on page* 139)

Fig. 5. Harmonic distortion and input/output characteristics of the amplifier.



Trans stor'zed Intercom

Over-all view of the transistorized intercom. It is housed in small plastic box and uses six "penlite" cells and two 2N104 transistors. The battery life is about 100 hours.

By **A. L. CLELAND**
Tube Div., Radio Corporation of America

Although specifically designed for use in the cabin of a light aircraft, it can be used in many other applications.

THE ambient noise level in the cabin of a light aircraft is usually so high that conversation is quite difficult. Although several commercial transmitter-receivers are equipped with intercoms to aid in conversation between pilot and passenger, the majority of light aircraft, especially those used for training, are not equipped for two-way communication. Many of these planes do not even carry a radio receiver. This article describes a small, lightweight, experimental intercom using the *RCA*-2N104 junction transistor and featuring a self-contained, long-life battery supply designed for such aircraft.

Design Considerations

The mounting of communication equipment in small aircraft is often a problem because of lack of space and available structural members. It is desirable, therefore, that an amplifier for such applications be portable and small enough to be carried in a shirt pocket. These features require maximum reduction of the size and weight of the equipment, and the use of a small, low-current battery supply to provide adequate battery life. The input impedance to the amplifier should be relatively low to match the impedance of a carbon microphone. The output impedance should also be low to match a set of low-impedance headphones. The matching of impedances, as described, makes it possible to eliminate matching transformers from the circuit, thus achieving a major reduction in space and weight.

Transistor Amplifier

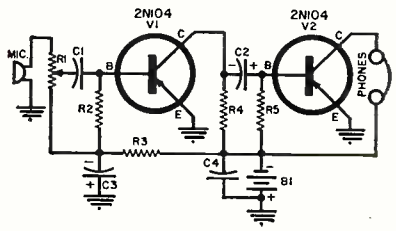
In view of the requirements just given for a satisfactory intercom, it appears that transistors afford many advantages in such service. A circuit diagram of a complete transistor amplifier is shown in Fig. 1. The input impedance of this circuit, which is approximately 350 ohms, matches the impedance of a carbon microphone having a nominal impedance between 300 and 700 ohms. The output of the circuit is terminated in an impedance of approximately 600 ohms, which provides adequate power output, even though a slight mismatch exists. This impedance can be conveniently supplied by headphones having an a.c. impedance of approximately 625 ohms at a frequency of 1000 cycles per second. Headphones of this type, which are readily available on the "surplus" market, have a d.c. resistance of approximately 240 ohms. Conventional 2000-ohm headphones may be used, but the resulting mismatch will decrease the audio power available. Similarly, a standard 200-ohm carbon mike may be employed but with some degradation in performance.

The circuit shown in Fig. 1 has a power gain of approximately 51 db and a power output of 10 milliwatts with less than 10 per-cent distortion. The microphone circuit draws a current of approximately 6 milliamperes, the first stage about 3 milliamperes, and the second or output stage approximately 5 milliamperes. The total battery drain, therefore, is approximately 14 milliamperes from a supply of 9 volts.

The low-frequency response of the amplifier circuit is limited primarily by the coupling capacitors. A large value of coupling capacitance must be used to avoid attenuation of the low frequencies because of the low input impedance of the transistor in the following stage. The response of the amplifier terminated in the 600-ohm a.c. load of a power-output meter is shown in Fig. 2. The relative response of the amplifier terminated in headphones is shown in Fig. 3. The difference between the response curves shown in Figs. 2 and 3 is attributed to the fact that the headphone impedance changes

(*Continued on page* 114)

Fig. 1. Complete schematic of the transistorized intercom, which uses two of RCA's 2N104 transistors. It is self-contained.



R1—1000 ohm pot
R2—120,000 ohm, ½ w. res.
R3—2000 ohm, ½ w. res.
R4—3000 ohm, ½ w. res.
R5—68,000 ohm, ½ w. res.
C1—.5 μfd., 200 v. capacitor
C2, C4—10 μfd., 12 v. elec. capacitor
C3—50 μfd., 12 v. elec. capacitor
B1—9 volt battery (six RCA-VS034 "penlite" cells in series)
Mike—300-700 ohm carbon mike with press-to-talk switch (surplus unit, see text)
Headphones—Low impedance phones, 240 ohms d.c. res., 625 ohms a.c. impedance @ 1000 cps (see text)
V1, V2—"p-n-p" junction transistor (RCA Type 2N104)

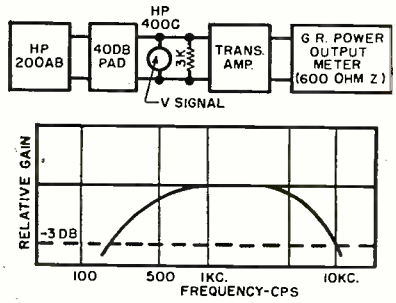
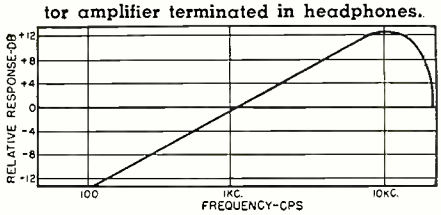


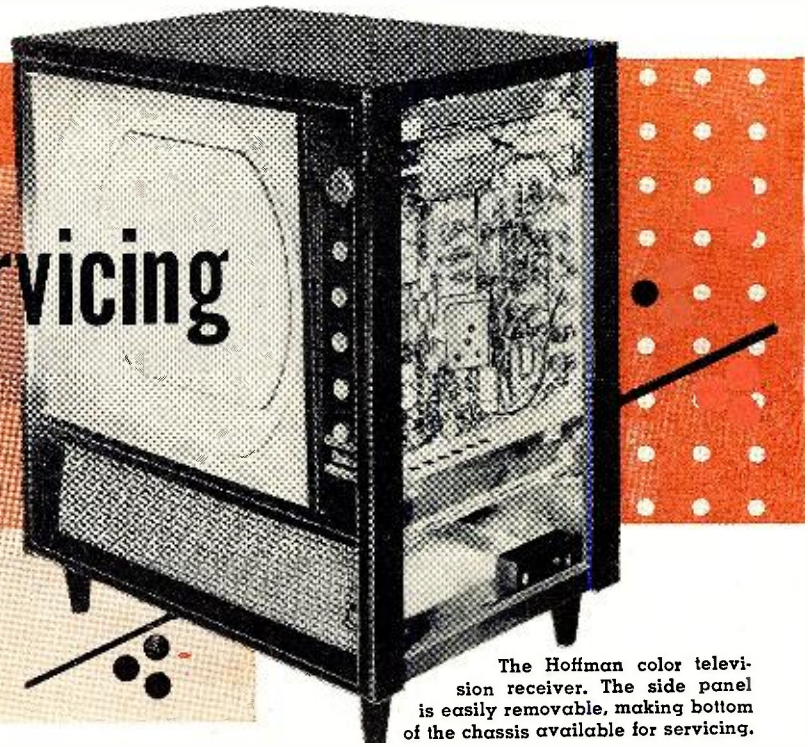
Fig. 2. Relative response of transistor amplifier terminated in 600-ohm impedance of power-output meter. Refer to article.

Fig. 3. Relative response of the transistor amplifier terminated in headphones.



Color TV Servicing in the Field

By WALTER H. BUCHSBAUM
Television Consultant
RADIO & TELEVISION NEWS



The Hoffman color television receiver. The side panel is easily removable, making bottom of the chassis available for servicing.

Do you know what the most common color TV troubles are? Do you know how to deal with them? Read on.

THIS article is the result of a survey among service technicians and dealers who have already begun to install and service color TV sets in quantity. Only the most recent color TV receivers and the most frequently encountered difficulties are considered here.

Every service technician is familiar with the need for fully instructing the customer in the use of the various controls of his TV set. This need is even greater with color TV sets because of the increased complexity of the front panel adjustments. The problems of antenna selection and location are also more acute with color receivers because of the increased bandwidth requirements.

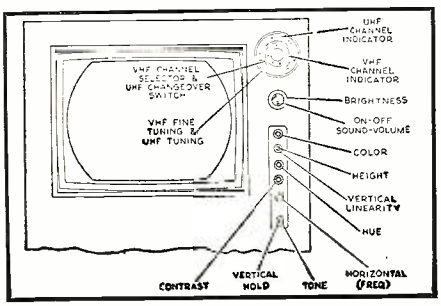
Customer Misadjustments

Just as in the early days of black-and-white TV, the customer's lack of understanding is the cause of a large number of service calls, especially during the first few weeks after a color set has been installed. Shown in Fig. 1 are the operating controls of the *RCA* 21-CT-660 to 664 series receivers, the latest 21-inch color sets. The station selector is not too complex, providing only v.h.f. and u.h.f. channel tuning with which many monochrome TV set owners are reasonably familiar. The brightness, "on-off," and volume control are likewise familiar and rarely prove troublesome. Under a small panel is a total of six controls, two of them duals, which are all capable of confounding the non-technical operator.

The color, hue, and contrast controls might, in theory, not need adjustment by the customer, but the general consensus among service technicians is that their temptation seems to be too great. All set owners desire to "improve" any or all of these vital parameters. After the set owner discovers that the contrast control operates the same for a black-and-white picture as it does on a monochrome set, he feels justified in setting this knob for color TV as well. The knob marked "Color" affects the amount of saturation or the color strength and few viewers can resist a little touchup. Similarly, the "Hue" control provides quite a humorous color spectacle if properly misadjusted. Needless to say, proper balance of contrast, brightness, saturation, and correct hues are lost until the service technician's next appearance.

The following routine is recommended for re-adjusting the front controls when customer misadjustment is suspected: First, for black-and-white reception, turn the color or chroma control fully counterclockwise and turn the receiver on. Then, tune in the weakest channel and adjust brightness and contrast to get a good picture. Check the operation of the vertical and horizontal hold controls by switching channels. The picture should lock in without further adjustments. In addition, check vertical linearity. Finally, tune in every available station, adjusting the fine tuning control for good pictures.

Fig. 1. Function and position of the various front-panel controls on the RCA 21-CT-660 series color television receivers.



To set up the receiver for color reception when no color telecast is available, use a color bar generator connected to the antenna terminals. Tune in the correct channel and set the fine tuning control to get the greatest amount of detail. Be sure that the control has sufficient range to pass through the maximum detail position. Advance the color or chroma gain control to about one quarter turn from its maximum counterclockwise position. Then advance the fine tuning control until the picture just begins to disappear; return the control to the point where the sound bars just disappear and color invades the picture. Re-adjust the color or chroma control for satisfactory saturation; white should be white and not some other color. Adjust the hue or color phase control for the correct setting; with the color bar generator this is rather simple since each bar is a pure color (red, green, or blue) and in a known position. When using a color telecast for setting up these controls, the flesh coloring is usually a good indication of correct hue setting. If possible, check color reception on all available channels.

If the color set is uncrated and tested at the shop before it is delivered, many troubles can be noticed and cor-

rected before the customer starts complaining. When the set is uncrated in the home, some of the adjustments will probably require a touchup.

One manufacturer's service department reports that about 50% of all color sets installed require some purity adjustment. Others find that d.c. convergence adjustments are most frequently required. The purity adjustments are required for a receiver which is shipped with the picture tube in place, while the convergence alignment is usually required with a set whose picture tube assembly is shipped on a special pallet. Actually, both these adjustments are often needed after delivery of the set. Other adjustments such as color balance, color synchronization, decoding, matrixing, or i.f. alignment are only rarely needed, unless some component arrives damaged and must be replaced.

Whether all or only some convergence controls need readjustment, the simplest and most positive means of checking is to use the dot generator. To make certain that this generator is operating at the exact horizontal and vertical scanning frequency of the set, tune in a monochrome station picture and synchronize the dot generator to the TV receiver. It is usually sufficient to clip a lead from the generator to the "hot" side (usually red wire) of the horizontal deflection coils. After a stable dot pattern is obtained, check the dots in the center of the screen. Converge them by adjusting the permanent magnet slugs in the convergence coil assembly, shown in Fig. 2. If only the blue beam appears out, adjust the blue beam positioning magnet assembly (see Fig. 4). Concentrate these adjustments only on the dots at the center of the screen.

Now check the convergence at the top and bottom of the center line. If this requires touching up, the dynamic convergence controls must be adjusted. Fig. 3 shows that part of an *RCA* model 21-CT-662U chassis which provides the various dynamic convergence signals. If the convergence at the sides of the picture tube is unsatisfactory, adjust the horizontal dynamic convergence controls. In most TV receivers the convergence controls are all located together at a convenient point accessible from the rear of the chassis.

More detailed convergence instructions are included in the manufacturer's service notes for the receiver. Color purity is best observed without a picture of any kind and adjustments for purity should be made prior to the final convergence set-up, if this step is needed. In many receivers a slight color impurity is observed after installation although the convergence may be perfectly adjusted. Only a slight adjustment of the field equalizer magnets or the purity coil or magnet assemblies may be needed. These are shown in Fig. 4. Follow the manufacturer's data for purity adjustments.

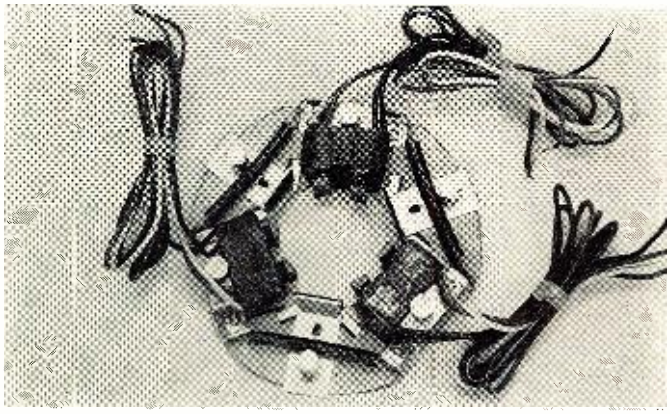


Fig. 2. Convergence magnet assembly. The knurled nuts are rotated for adjustment.

Magnetic Effects

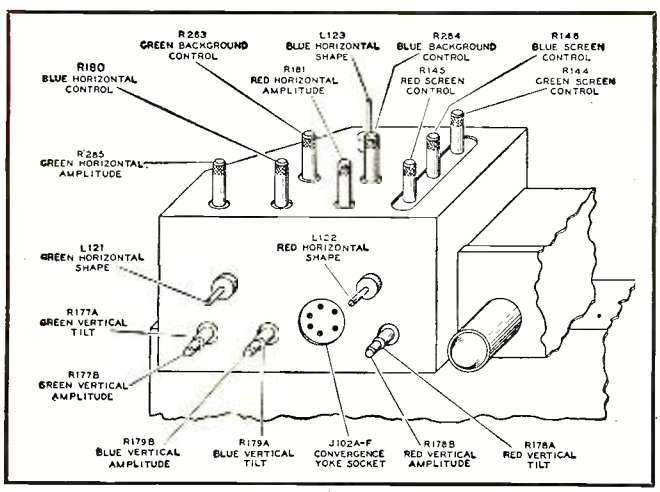
The current color picture tubes are furnished with a special magnetic shield over the electron beam area. Nevertheless, magnetic effects due to fields surrounding the tube can cause considerable color impurity. Such magnetic fields can be due to the chance magnetization of some of the iron brackets in the cabinet or chassis parts. During transportation or storage, receivers may be located under fairly strong a.c. or d.c. fields from power equipment, transformers, etc.

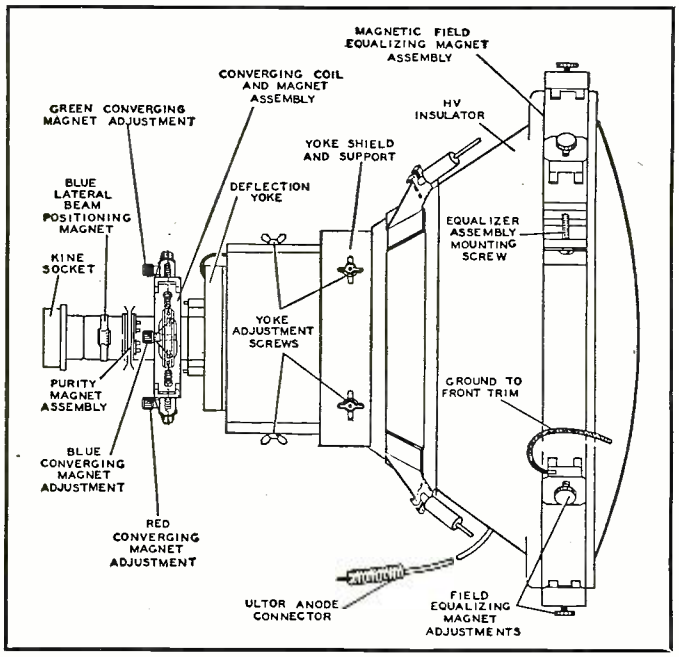
The magnetized parts can be neutralized by introducing a strong a.c. field and then gradually reducing the strength of the field. To accomplish this without using special magnetizing devices, the *RCA Service Company* recommends the construction of a coil which can be connected directly to the 117-volt a.c. line. A winding diameter of about 12 inches is used; an old 10- or 12-inch picture tube can be used as a mandrel with insulating tape serving to hold the wire in place. Approximately 425 turns of No. 20 enamelled wire are sufficient. The entire loop should be well taped and the two ends of the wire connected to a regular a.c. line cord. At least 8 feet of cord will be needed.

The actual demagnetizing is performed with the receiver in the cabinet, but with power off. At the start, the demagnetizing coil is kept at least 6 feet away from the color TV receiver and then is slowly moved over

Fig. 4. A standard color picture tube with the various external deflection and convergence components indicated, along with the magnetic field equalizer. See text. ⟶

Fig. 3. Shown here are the various controls for dynamic convergence adjustments on the RCA Model 21-CT-662U TV chassis. Operation of controls is discussed in the text.





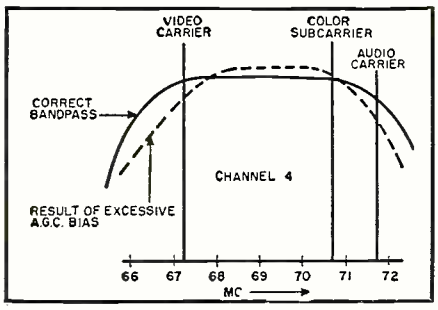


Fig. 5. The decrease in bandwidth of the r.f. amplifier of a color TV set due to high a.g.c. bias, as shown here, results in a deterioration of the color picture.

the sides, front, and rear of the cabinet. With the receiver back cover removed, place the coil inside the cabinet at the top and sides of the picture tube assembly.

It is important in demagnetizing to apply the coil with its magnetic field gradually. The demagnetizing should last about 2 minutes, then the coil is gradually withdrawn to at least 6 feet from the color TV set and the a.c. line plug disconnected.

The various convergence magnets and field neutralizing magnets should be withdrawn from their maximum effective position during the demagnetizing procedure. After a set has been demagnetized the entire purity and convergence set-up procedure will have to be repeated.

Local Color Troubles

As anticipated, local reception conditions have a very pronounced effect on the color picture. Minor reflections which could be tolerated on a monochrome picture cannot in color. One of the prime requisites of a good color installation is an antenna system that brings in ghost-free signals.

The strength of the signal is also important and installation troubles on color TV receivers have been noted both on weak and excessively strong pictures.

For black-and-white signal reception, adjustment of the contrast, a.g.c., and fine-tuning controls usually takes care of excessive signal strength. On really strong signals, the a.g.c. bias increases considerably and this increases the input impedance of the r.f. amplifier. This increased impedance has two serious effects: it changes the r.f. bandpass and it increases the mismatch with the antenna transmission line, setting up reflections on the line. These reflections appear as ghosts, insignificant on monochrome, but distracting in a color picture. Further, the change in r.f. bandpass reduces the gain of the color subcarrier sidebands, reducing the color information. Fine-tuning control adjustment in this instance either moves the video carrier down on the response curve slope or else the color components are moved towards the sound-trap frequency and color is completely lost. This detuning due to excessive signal strength is illustrated in Fig. 5.

The remedy for excessive signal strength is simply to insert a suitable attenuator pad between the transmission line and the receiver antenna terminals. Such 300-ohm attenuators, consisting of printed ceramic circuitry, are available in 6, 10, and 20 db values.

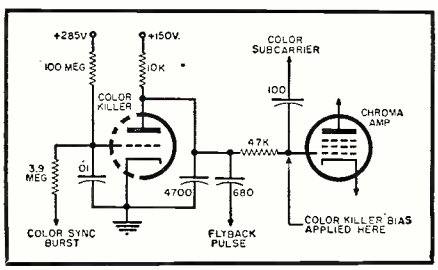
Weak or fading signals present a much more difficult problem. The effects of weak or fading signals on the color TV receiver are varied. The color content and contrast changes. Although this may be annoying, the viewer used to fringe reception on monochrome will understand this fault. Far worse is the effect on color-killer biasing due to weak or fading color bursts.

A typical color-killer circuit is shown in Fig. 6, and illustrates how the killer bias depends on the presence or absence of color sync bursts. If, in a certain location or on some retransmitted programs, the color sync burst is attenuated and appears at the color-killer circuit too weak to deactivate the killer bias, the receiver will not pass any color information at all. In other words, although color signals are received, the picture on the screen will be black-and-white because the burst is too weak. Defects in the color-killer circuit, misadjustment of the burst amplitude control, or misadjustment of the fine-tuning control could all cause excessive killer bias and loss of color reception.

Aside from misadjustment of controls and circuit defects, the problem of poor color-killer action has been encountered frequently in weak-signal areas. It is particularly troublesome if the technician does not realize the cause for loss of color. During a particular telecast the set owner may lose the color picture. When the technician arrives, he finds that on instruments and on fairly strong signals, good color reception is obtained. Either misadjustment by the customer or some intermittent defect might be suspected unless the action of the color-killer circuit is appreciated.

High-gain antennas are commonly used in weak signal areas and many of them have a rather narrow bandwidth, especially the earlier types. Stacked yagi antennas cut for one channel often have less than 5 mc. bandwidth and may not be suited for color reception. All antenna manufacturers have lately announced fringe area models which are better suited for color reception because of their broadband features.

Fig. 6. Color-killer circuit of a color TV set. Note how the bias from the killer tube feeds the control grid of the chroma or bandpass amplifier. Excessive negative bias will cut off set's color.



Service Tips

When the vertical or horizontal linearity seems to be off on color reception, check the centering control action before adjusting linearity controls. Unless the picture is centered quite accurately, nonlinearity may appear. To check vertical linearity quickly without a test pattern or dot-bar generator, adjust the vertical hold control so that the picture rolls slowly through the screen. Observe the width of the vertical blanking section as it moves from bottom to top. The width of that bar should be constant as it moves over the screen.

Most color TV receivers have special high-voltage plug and connector assemblies. Breaks or inadvertent disconnection of these high-voltage cables may cause loss of raster.

The latest *RCA* and similar color sets have special high-voltage interlocks which short the high voltage to chassis when the back cover is removed. When the service technician removes the back cover and plugs in an a.c. cheater cord in the customary manner without removing the high-voltage short, the high-voltage supply can be seriously damaged. The high-voltage safety interlock simply consists of two spring clips, one connected to the high voltage and the other to ground, held apart by an insulating rod mounted on the rear cover. When this rod is removed, the two clips make contact. In order to operate the set without the back cover it is necessary to separate the interlocking spring clips again by inserting a suitable plug. Such a plug can be made of lucite or similar tubing cut to size.

Color balance is usually preset at the factory and should not need touching up in ordinary installation procedure. Customer complaints of colors being too much of one shade are sometimes due to room lighting conditions. For example, the presence of a lamp with a red shade, dominantly green curtains, blue fluorescent light, yellow insect-repelling lamps, etc., will tend to give the impression of improper color balance. The service technician should point out these circumstances to the customer before adjusting color matrixing controls.

Customer misadjustments, purity and convergence changes due to shipping, or local magnetic fields, are the principal troubles the service technician can expect in installing the new color TV receiver models. Demagnetizing of the entire set might occasionally be required to assure good color purity and a special demagnetizing coil should be constructed for this purpose. Extremely strong or weak signal conditions are also frequent causes for service calls. Antenna requirements for color TV reception prove to be more stringent than for black-and-white TV, especially concerning bandwidth. Many of these problems were expected and their cures are becoming known with the increase in installations. —30—

FROM DELCO RADIO come the speakers with highest performance. You trust them...so do your customers!

Engineering skills of Delco Radio and General Motors combine to offer a full line of speakers for home and auto radios, phonographs, TV, and Hi-Fi. National advertising behind the Delco Wonder Bar Radio develops a bigger service market for you! For fast service call your UMS-Delco Electronics Parts Distributor.

14 Standard Models: Designed and built to R.E.T.M.A. standards with heavily plated metal parts and Alnico-V magnets. Precision felted cones give uniform response over full operating frequency range. All are fully dustproof and dependable.

Dual-Purpose Hi-Fi Model 8007: A superior speaker for custom-built audio systems and for replacements in AM, FM, TV and phonograph sets. Size 8″, 50 to 12,500 CPS frequency range; Alnico-V magnet; 10-watt power rating; 4.1 v.c. impedance; $1\frac{3}{16}$″ voice coil.

DELCO

WONDER BAR

RADIO

DIVISION OF GENERAL MOTORS, KOKOMO, INDIANA

GM GENERAL MOTORS PARTS SALES

A GENERAL MOTORS PRODUCT — A UNITED MOTORS LINE

Distributed by Electronics Distributors Everywhere

A complete line of original equipment service parts from the

WORLD LEADER IN AUTO RADIO

By JOHN T. FRYE

DUST OFF THAT RECORDER

MISS PERKINS, the "office force" of Mac's Service Shop, was so busy arranging the little bouquet of spring violets in a vase on her desk that she did not hear Barney come through the door behind her that was opened wide to the wonderful warm April day out of doors. One reason she did not hear him was that she was nodding her head to the strains of a gay Viennese waltz that wafted through the closed door of the service department.

Barney stopped in the doorway a minute to listen to the lilting melody of the violins; then he quickly strode to Amanda, spun her around into his arms, and waltzed her vigorously about the office. At first she made a laughing, startled protest; but then she entered into the spirit of the youth, the music, and the spring day and followed Barney's lead with a timing and deftness of foot that astonished him. For two or three minutes the two dipped and whirled about the office in time with the enchanting melody, stopping only when the music ceased.

"Hey, Mandy, you're good!" Barney exclaimed. "Where did you learn to dance like that? Not in business school, I'll bet!"

"You'd be surprised what a girl can learn in business school; and don't call me 'Mandy,'" Miss Perkins retorted as, flushed and a little breathless. she seated herself at her desk.

"Well, all right, Ginger," Barney called over his shoulder as he headed for the service department; "but you haven't heard the last of this. I'll be back in a bit and check you out on your rhumba. If it's as good as your waltz, you and I are going over to Ideal Beach some night and show those clodhoppers how the light fantastic toe is really tripped."

As the boy opened the door of the service shop, another waltz started unreeling from the tape recorder resting on top of a TV console. Mac, Barney's employer, was seated on the service bench frankly enjoying the music.

"Hey, Boss," Barney exclaimed, "where did you get the fine business schmaltzy music?"

"That's a new recorded tape put out by *Berkshire Recording Corporation* of New York called *'Waltzes From Old Vienna and Potpourri of Viennese Melodies,'*" Mac answered. "While it probably sounds pretty corny to a rock-and-roll cat like yourself, it's a mighty pleasant noise to an old duffer like me."

"I like it too," Barney admitted. "Hey," he suddenly exclaimed as he shot a practiced glance at the slowly revolving reels, "that's playing at 3¾ inches-per-second, isn't it?"

"Surprised?" Mac asked as he nodded affirmatively. "I'll admit I was. What both of us are probably forgetting is that rapid strides have been made recently in achieving better frequency response at slower tape speeds. To prove this is so, all you have to do is compare the characteristics of a modern tape recorder with those of a good recorder of five or six years ago. When you do this, you soon find that the modern job achieves better frequency response at 3¾ ips than the older one managed at 7½ ips. These new recorded tapes sound mighty good at the slower speed even when they are played on recorders two or three years old. This is especially true if the recorder has a tone control on playback that permits you to boost the highs, as this one does."

"Are all the tapes put out by *Berkshire* recorded at this slow speed?"

"Oh no. You can get them at either 7½ or 3¾. And that reminds me of a little demonstration we can make right now. Here is a tape of theirs called 'Highlights Series H-1.' It is actually a catalogue of generous excerpts from several of their tapes. As you can see, it is a five-inch reel of tape and is sold for a buck and a half. This, of course, is less than the cost of the raw tape and the reel; but it permits the buyer to see exactly how his recorder will sound when playing a wide range of vocal and instrumental music on recorded tape. He is not forced to buy a pig in a poke. If he wants to buy a regular recorded tape, he will know in advance exactly how it will sound when played on his recorder."

"That's all very nice," Barney said impatiently, "but how about that demonstration you mentioned?"

"Oh, yes; this 'H-1' tape is recorded at 7½ ips and it contains the same waltz we were just hearing. Let's play it and see how much difference we notice in the same music heard at the two different speeds."

Mac put the reel on the take-up spindle of the machine and rewound about one-fourth its length and then started it playing. As the waltz issued from the speaker of the TV console, the two walked about the service department listening critically.

"I can hear a few more highs on this one," Barney concluded, "but you certainly have to listen closely to tell the difference. That slow speed would be more than adequate for anything except the most critical listening."

"Yes, and on a modern hi-fi recorder with really extended frequency response at the slower speed, the gap between the two speeds would be much narrower," Mac pointed out.

"You got to remember, though, that you're playing the recorder through the speaker on that TV console," Barney mentioned. "The bigger speaker and the increased baffle makes the music sound a whale of a lot better than it would if only the small recorder speaker was being used."

"True, but anyone who has a TV console or a radio console can do what we are doing here: connect the console speaker to the external speaker jack of the recorder."

"How you got that arranged?"

"The secondary leads from the output transformer go to the center connections of a d.p.d.t. toggle switch. The speaker voice coil is connected across one of the remaining sets of contacts, and a one-watt carbon resistor with an ohmage equal to the voice coil impedance—eight ohms in this case—is connected across the other set. Finally, the patchcord of the tape recorder is clipped directly to the voice coil leads."

"Sounds pretty complicated."

"It's really not, especially if you draw it out on paper. When the switch is thrown so that the output transformer is connected to the voice coil, the patchcord is simply inserted in the radio-phono-recording jack of the tape recorder to record any program being heard through the console speaker.

"Then, when you want to play the tape recorder through the console speaker, you simply remove the patchcord plug from the input jack and transfer it to the external speaker jack; and the toggle switch is thrown to its other position which disconnects the output transformer secondary from the voice coil and connects it to the one-watt resistor."

(*Continued on page* 158)

Heathkits

FOR THE ENTIRE ELECTRONICS INDUSTRY

AMATEUR RADIO

RADIO & TV SERVICEMEN

THE WORLD'S LEADING MANUFACTURER OF ELECTRONIC KITS . . .

INDUSTRIAL LABORATORIES

TRAINING SCHOOLS

HI-FI ENTHUSIASTS

more than 65 top-quality models to choose from, including such outstanding kit designs as . . .

V-7A VACUUM TUBE VOLTMETER: Easily the world's largest selling VTVM. Features peak-to-peak scales—etched metal circuit board—1% precision resistors—full wave rectifier and AC input circuit—reads rms and peak-to-peak AC, DC, and ohms.

O-10 LABORATORY TYPE OSCILLOSCOPE: The world's largest selling oscilloscope kit, and the most successful oscilloscope in history. Designed especially for color and black-and-white TV service work. Its 5 megacycle bandwidth and new 500 Kc sweep generator readily qualify it for laboratory applications. Features easy-to-assemble etched metal circuit board construction.

WA-P2 HIGH FIDELITY PREAMPLIFIER: This is the world's largest selling hi fi preamplifier kit. Features complete equalization, 5 separate switch-selected inputs with individual pre-set level controls, beautiful modern appearance, high-quality components.

HIGH FIDELITY AMPLIFIERS: Five Heathkit Models to choose from at prices ranging from $16.95 to $59.75. Power output range from 7 to 25 watts.

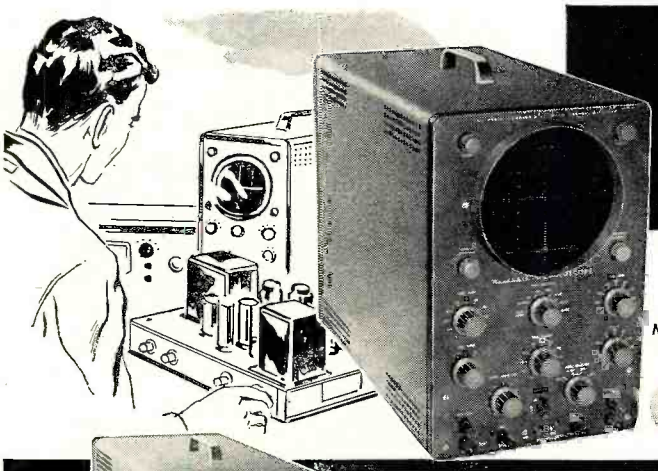
DX-100 TRANSMITTER: A 100 watt phone and CW ham transmitter, offering the greatest dollar value available in the ham radio field today.

Greatest Dollar Value Through Factory-To-You Selling!

ONLY Heathkits CAN GIVE YOU ALL OF THESE DISTINCTIVE ADVANTAGES!

- *The Most Complete Construction Manuals for Easy Assembly.*
- *Originality of Design—Developed Through Pioneering in the Kit Instrument Field.*
- *Greatest Dollar Value—Finest Quality with Real Economy.*
- *Direct Contact with Manufacturer—Lower Price, Guaranteed Performance.*
- *Etched Metal, Prewired Circuit Boards—Save Construction Time, Improve Performance.*
- *High Quality Standard Components for Long-Life Service.*

HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICHIGAN**

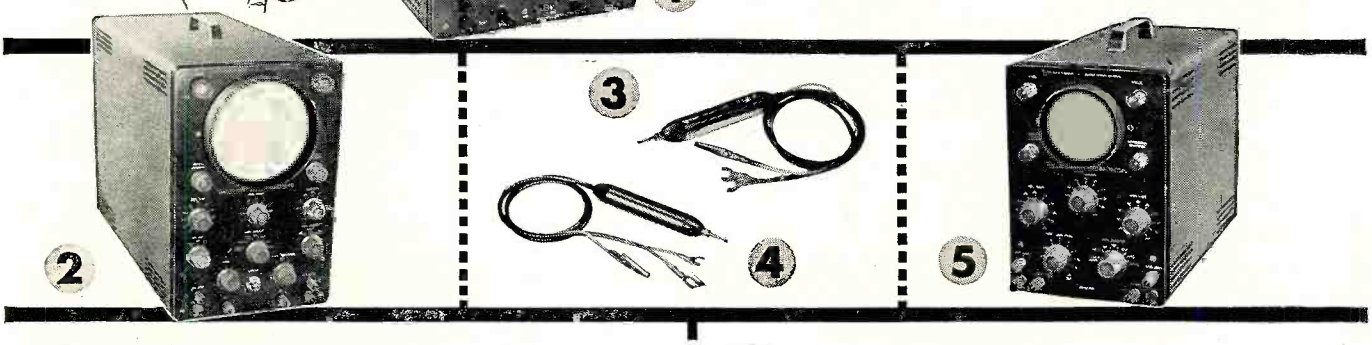


there is no substitute for

HEATHKIT QUALITY

YOU GET MORE: *All first-run, top quality parts —the latest in electronic design—complete and comprehensive step-by-step assembly instructions with large pictorial diagrams and assembly drawings. Proven performance through the production of thousands of kits.*

MODEL O-10



1 Heathkit ETCHED CIRCUIT COLOR-TV 5" OSCILLOSCOPE KIT

This deluxe quality oscilloscope has proven itself through thousands of operating hours in service shops and laboratories. Features the best in components—and the best in circuit design.

Features amplifier response to 5 Mc for color TV work, and employs the radically new sweep circuit to provide stable operation up to 500,000 cps. In addition, etched metal, pre-wired circuit boards cut assembly time almost in half, and permit a level of circuit stability never before achieved in an oscilloscope of this type.

Vertical amplifiers flat within +2 db −5 db from 2 cps to 5 Mc, down only 1½ db at 3.58 Mc. Vertical sensitivity is 0.025 volts, (rms) per inch at 1 Kc. 11 tube circuit employs a 5UP1 CRT.

Plastic molded capacitors used for coupling and bypass—preformed and cabled wiring harness provided.

Features built-in peak-to-peak calibrating source—retrace blanking amplifier—push-pull amplifiers and step-attenuated input.

MODEL O-10
$69.50
Shpg. Wt. 21 Lbs.

2 Heathkit ETCHED CIRCUIT 5" OSCILLOSCOPE KIT

This is a general purpose oscilloscope for the more usual applications in the service shop or lab, yet is comparable to scopes costing many dollars more.

Features full size 5" CRT (5BP1), built-in peak-to-peak voltage calibration—3 step input attenuator—phasing control—push-pull deflection amplifiers—and etched metal prewired circuit boards.

Vertical channel flat within ±3 db from 2 cps to 200 Kc, with 0.09 V. rms/inch, peak-to-peak sensitivity at 1 Kc. Sweep circuit from 20 cps to 100,000 cps. A scope you will be proud to own and use.

MODEL OM-1
$49.50
Shpg. Wt. 21 Lbs.

3 Heathkit LOW CAPACITY PROBE KIT

Scope investigation of circuits encountered in TV requires the use of special low capacity probe to prevent loss of gain, circuit loading, or distortion. This probe features a variable capacitor to provide correct instrument impedance matching. Also the ratio of attenuation can be controlled.

NO. 342
$3.50
Shpg. Wt. 1 Lb.

4 Heathkit ETCHED CIRCUIT SCOPE DEMODULATOR PROBE KIT

Extend the usefulness of your Oscilloscope by observing modulation envelope of R.F. or I.F. carriers found in TV and radio receivers. Functions like AM detector to pass only modulation of signal and not signal itself. Applied voltage limits are 30 V. RMS and 500 V. DC.

NO. 337-C
$3.50
Shpg. Wt. 1 Lb.

5 Heathkit ETCHED CIRCUIT 3" OSCILLOSCOPE KIT

This compact little oscilloscope measures only 9½" H. x 6½" W. x 11¾" D., and weighs only 11 lbs! Easily employed for home service calls, for work in the field or is just the ticket for use in the ham shack or home workshop. Incorporates many of the features of the Model OM-1, but yet is smaller in physical size for portability.

Employing etched circuit boards, the Model OL-1 features vertical response within ± 3 db from 2 cps to 200 Kc. Vertical sensitivity is 0.25 V. RMS/inch peak-to-peak, and sweep generator operates from 20 cps to 100,000 cps. Provision for r.f. connection to deflection plates for modulation monitoring, and incorporates many features not expected at this price level. 8-tube circuit features a type 3GP1 Cathode Ray Tube.

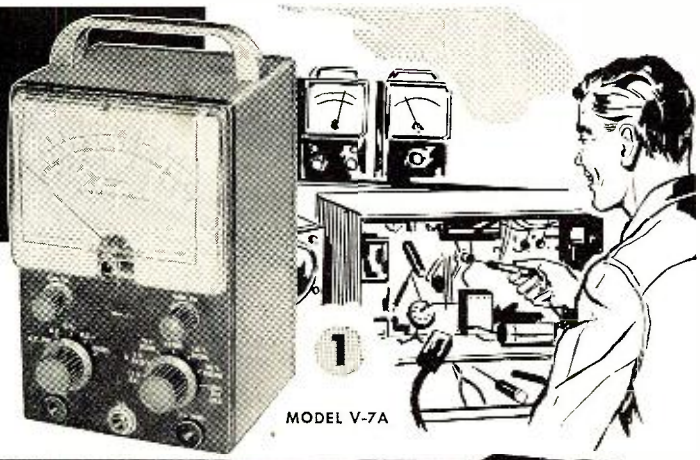
MODEL OL-1
$29.50
Shpg. Wt. 14 Lbs.

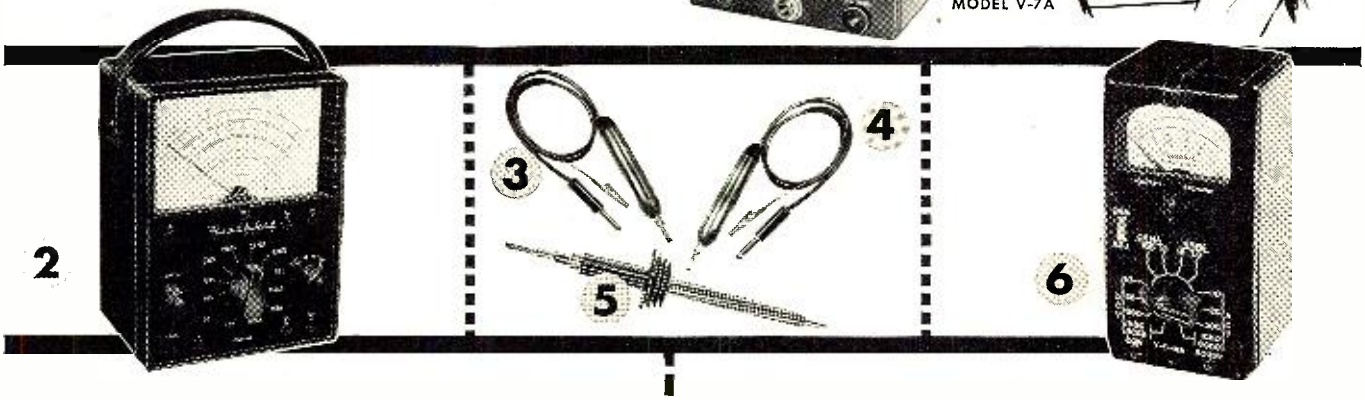
HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICHIGAN**

fill your test requirements

WITH HEATHKITS

DESIGNED FOR YOU: *Heath Company test equipment is designed for the maximum in convenience. Besides being functional, Heathkits represent the very latest in modern physical appearance, and incorporate all the latest circuit design features for comprehensive test coverage.*





1 *Heathkit* ETCHED CIRCUIT VACUUM TUBE VOLTMETER KIT

Besides measuring AC (rms), DC and resistance, the modern-design V-7A incorporates peak-to-peak measurement for FM and television servicing.

AC (rms) and DC voltage ranges are 1.5, 5, 15, 50, 150, 500, and 1500. Peak-to-peak AC voltage ranges are 4, 14, 40, 140, 400, 1400, and 4000. Ohmmeter ranges are X1, X10, X100, X1000, X10K, X100K, and X1 megohm. Also a db scale is provided. A polarity reversing switch provided for DC measurements, and zero center operation within range of front panel controls. Employs a 200 μa meter for indication. Input impedance is 11 megohms.

Etched metal, pre-wired circuit board for fast, easy assembly and reliable operation is 50% thicker for more rugged physical construction. 1% precision resistors for utmost accuracy.

MODEL V-7A
$24.50
Shpg. Wt. 7 Lbs.

2 *Heathkit* 20,000 OHMS/VOLT MULTIMETER KIT

The MM-1 is a portable instrument for outside servicing, for field testing, or for quick portability in the service shop. Combines attractive physical appearance with functional design. 20,000 ohms/v. DC, and 5000 ohms/v. AC. AC and DC voltage ranges are 0-1.5, 5, 50, 150, 500, 1500 and 5000 volts. Direct current ranges are 0-150 μa., 15 ma., 150 ma., 500 ma., and 15 amperes. Resistance ranges are X1, X100, X10,000 providing center scale readings of 15, 1500 and 150,000 ohms. DB ranges cover −10 db to +65 db.

Features a 4½" 50 μa. meter. Provides polarity reversal on DC measurements. 1% precision resistors used in multiplier circuits. Not affected by RF fields.

MODEL MM-1
$29.50
Shpg. Wt. 6 Lbs.

3 *Heathkit* ETCHED CIRCUIT RF PROBE KIT

The Heathkit RF Probe used in conjunction with any 11 megohm VTVM will permit RF measurements up to 250 Mc with ± 10% accuracy. Uses etched circuits for increased circuit stability and ease of assembly.

NO. 309-C
$3.50
Shpg. Wt. 1 Lb.

4 *Heathkit* ETCHED CIRCUIT PEAK-TO-PEAK PROBE KIT

Now read peak-to-peak voltages on the DC scale of any 11 megohm VTVM with this new probe, employing etched circuit for stability and low loss. Readings made directly from VTVM scales, from 5 Kc to 5 Mc. Not required for Heathkit Model V-7A VTVM.

NO. 338-C
$5.50
Shpg. Wt. 2 Lbs.

5 *Heathkit* 30,000 VOLT D.C. HIGH VOLTAGE PROBE KIT

For TV service work or similar application for measurement of high DC voltage. Precision multiplier resistor mounted inside plastic probe. Multiplication factor of 100 on the ranges of Heathkit 11 megohm VTVM.

NO. 336
$4.50
Shpg. Wt. 2 Lbs.

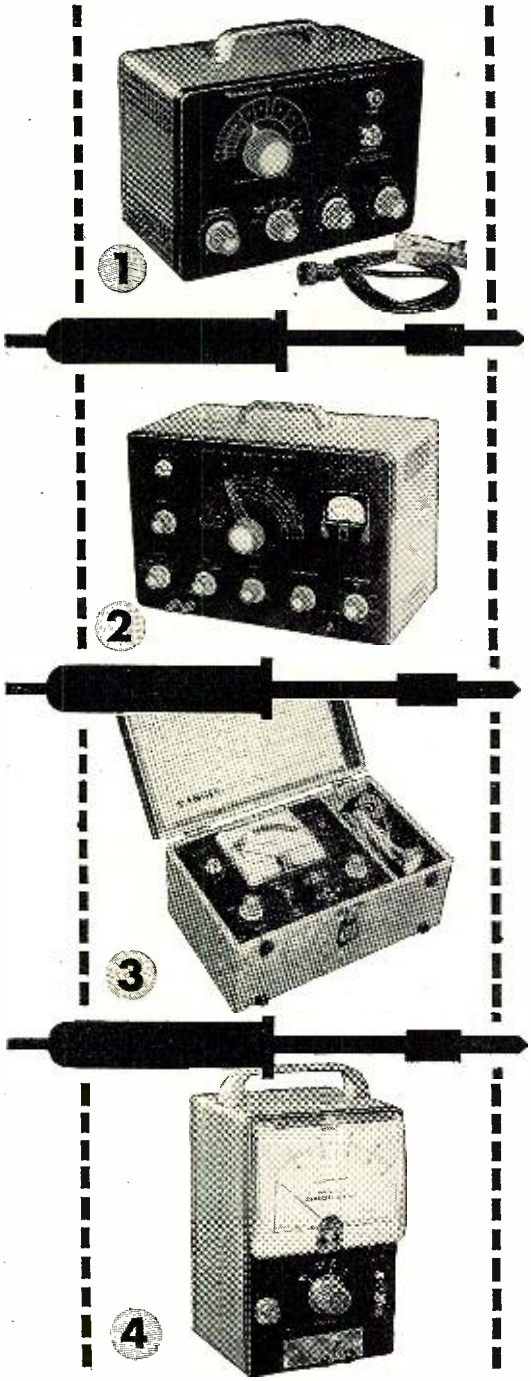
6 *Heathkit* HANDITESTER KIT

The Model M-1 measures AC or DC voltage at 0-10, 30, 300, 1000, and 5000 volts. Measures direct current at 0-10 ma. and 0-100 ma. Provides ohmmeter ranges of 0-3000 (30 ohm center scale) and 0-300,000 ohms (3000 ohms center scale). Features a 400 μa. meter for sensitivity of 1000 ohms/volt. Because of its size, the M-1 is a very handy portable instrument that will fit in your coat pocket, tool box, glove compartment, or desk drawer. Makes a fine standby unit in the service shop when the main instruments are in use, or is ideal for the hobbyist or beginner. An unusual dollar value.

MODEL M-1
$14.50
Shpg. Wt. 3 Lbs.

HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICHIGAN**

Heathkit
TV ALIGNMENT
GENERATOR KIT



The Model TS-4 features a controllable inductor for all-electronic sweep, improved oscillator and automatic gain circuitry, high RF output, center sweep operation, and improved linearity. It sets a new high standard for sweep generator operation, and is absolutely essential for the up-to-date service shop doing FM, black-and-white TV, and color TV work.

Voltage regulation and effective AGC action insure flat output over a wide frequency range. Electronic sweep insures complete absence of mechanical vibration. Sweep deviation controllable from 0 up to 40 Mc, depending upon base frequency. Effective two-way blanking.

Fundamental output from 3.6 Mc to 220 Mc in 4 bands. Crystal marker provides markers at 4.5 Mc and multiples thereof. Crystal included with kit. Variable marker covers from 19 Mc to 60 Mc on fundamentals, and up to 180 Mc on harmonics. Provision for external marker.

MODEL TS-4
$49.50
Shpg. Wt. 16 lbs.

1 *Heathkit* LINEARITY PATTERN
GENERATOR KIT

The new-design Model LP-1 produces vertical or horizontal bar patterns, a cross-hatch pattern, or white dots on the screen of the TV set under test. No internal connections required. Special clip is attached to the TV antenna terminals. Instant selection of the pattern desired for adjustment of vertical and horizontal linearity, picture size, aspect ratio, and focus. Dot pattern presentation is a *must* for color convergence adjustments on color TV sets.

Extended operating range covers all television channels from 2 to 13. Produces 6 to 12 vertical bars or 4 to 7 horizontal bars.

MODEL LP-1
$22.50
Shpg. Wt. 7 lbs.

2 *Heathkit* LABORATORY
GENERATOR KIT

The Heathkit Model LG-1 Laboratory Generator is a high-accuracy signal source for applications where metered performance is essential It covers from 100 Kc to 30 Mc on fundamentals in 5 bands. Modulation is at 400 cycles, and modulation is variable from 0-50%. RF output from 100,000 μv. to 1 μv. 200 μa. meter reads the RF output in microvolts, or percentage of modulation. Fixed step and variable output attenuation provided.

Features voltage regulation, and double copper plated shielding for stability. Provision for external modulation. Coaxial output cable (50 ohms).

MODEL LG-1
$39.50
Shpg. Wt. 16 lbs.

3 *Heathkit* CATHODE RAY
TUBE CHECKER KIT

This new-design instrument holds the key to rapid and complete picture tube testing, either in the set, on the work-bench, or in the carton. Tests for shorts, leakage, and emission. Features Shadowgraph test (a spot of light on the screen) to indicate whether the tube is capable of functioning.

The Model CC-1 tests all electromagnetic deflection picture tubes normally encountered in television servicing. Supplies all operating voltages to the tube under test, and indicates the condition of the tube on a large "GOOD-BAD" scale. Features spring loaded test switches for operator protection.

The CC-1 is housed in an attractive portable case and is light in weight — ideal for outside service calls.

MODEL CC-1
$22.50
Shpg. Wt. 10 lbs.

4 *Heathkit* DIRECT READING
CAPACITY METER KIT

Not only is this instrument popular in the service shop, but it has found extensive application in industrial situations. Ideal for quality control work, production line checking, or for matching pairs.

Features direct reading linear scales from 100 mmf to .1 mfd full scale. Necessary only to connect a capacitor of unknown value to the insulated binding posts, select the correct range, and read the meter. The CM-1 is not susceptible to hand capacity, and has a residual capacity of less than 1 mmf.

MODEL CM-1
$29.50
Shpg. Wt. 7 lbs.

HEATH COMPANY
A SUBSIDIARY OF DAYSTROM INC.

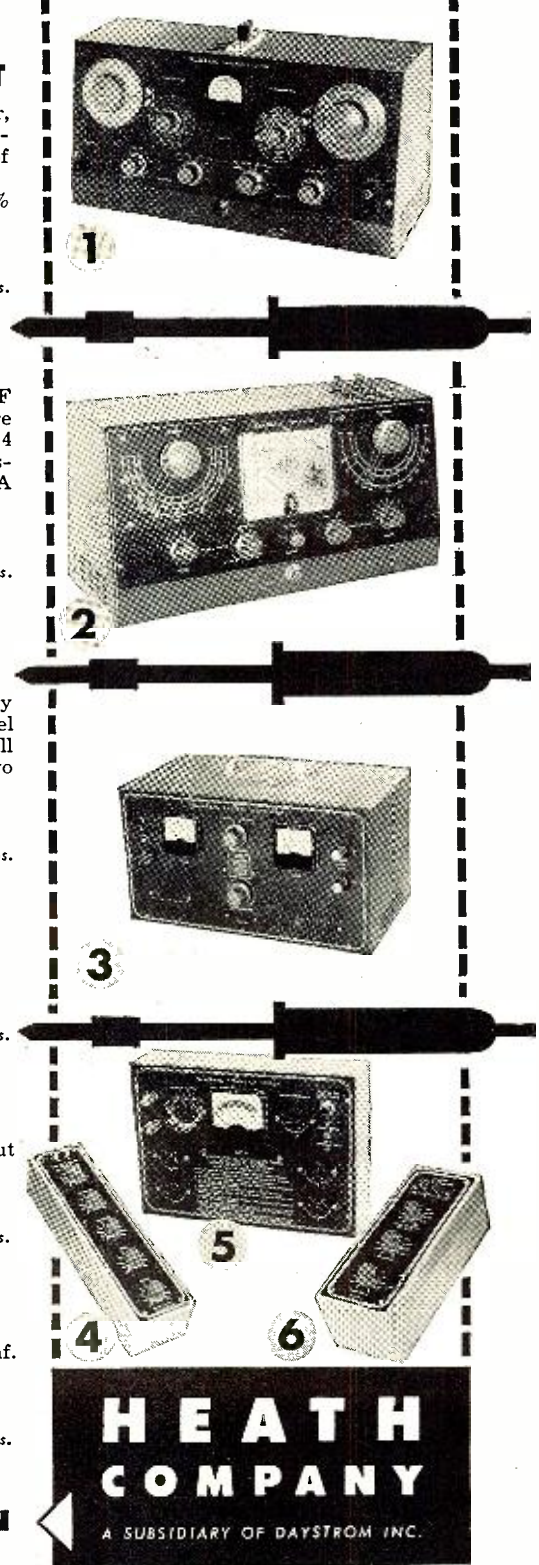
BENTON HARBOR 15, MICHIGAN

Heathkit SIGNAL GENERATOR KIT

MODEL SG-8
Shpg. Wt. 8 Lbs.
$19.50

This is one of the biggest signal generator bargains available today. The tried and proven Model SG-8 offers all of the outstanding features required for a basic service instrument. High quality components and outstanding performance.

The SG-8 covers 160 Kc to 110 Mc on fundamentals in 5 bands, and calibrated harmonics extend its usefulness up to 220 Mc. The output signal is modulated at 400 cps, and the RF output is in excess of 100,000 uv. Output controlled by both a continuously variable and a fixed step attenuator. Also, audio output may be obtained for amplifier testing. Don't let the low price deceive you. This is a professional type service instrument to fulfill the signal source requirements in the service lab.



1 Heathkit . . . IMPEDANCE BRIDGE KIT

The IB-2 features built-in adjustable phase shift oscillator and amplifier, and has panel provisions for external generator. Measures resistance, capacitance, inductance, dissipation factors of condensers, and storage factor of inductance.

D, Q, and DQ functions combined in one control. ½% resistors and ½% silver-mica capacitors especially selected for this instrument. A 100-0-100 microammeter provides null indications. Two-section CRL dial provides 10 separate "units" with an accuracy of .5%. Fractions of units read on variable control.

MODEL IB-2
$59.50
Shpg. Wt. 12 Lbs.

2 Heathkit "Q" METER KIT

The Heathkit Model QM-1 will measure the Q of inductances and the RF resistance and distributed capacity of coils. Employs a 4½" 50 microampere meter for direct indication. Will test at frequencies of 150 Kc to 18 Mc in 4 ranges. Measures capacity from 40 mmf to 450 mmf within ± 3 mmf. Indispensible for coil winding and determining unknown condenser values. A worthwhile addition to your laboratory at an outstandingly low price. Useful for checking wave traps, chokes, peaking coils, etc. Laboratory facilities are now available to the service shop and home lab.

MODEL QM-1
$44.50
Shpg. Wt. 14 Lbs.

3 Heathkit 6–12 VOLT BATTERY ELIMINATOR KIT

This modern battery eliminator will supply 6 or 12 volt output for ordinary automobile radios as well as 12 volts for the new models in the latest model cars. Output voltage is variable from 0-8 volts DC, or 0-16 volts DC. Will deliver up to 15 amperes at 6 volts, or up to 7 amperes at 12 volts. Two 10,000 microfarad filter capacitors insure smooth DC output. Two panel meters monitor output voltage and current. Will double as a battery charger. Definitely required for automobile radio service work.

MODEL BE-4
$31.50
Shpg. Wt. 17 Lbs.

4 Heathkit DECADE RESISTANCE KIT

Twenty 1% precision resistors provide resistance from 1 to 99,999 ohms in 1 ohm steps. Indispensible around service shop laboratory, ham shack, or home workshop. Well worth the extremely low Heathkit price.

MODEL DR-1
$19.50
Shpg. Wt. 4 Lbs.

5 Heathkit VIBRATOR TESTER KIT

Tests vibrators for proper starting and indicates the quality of the output on a large "GOOD-BAD" scale. Checks both interrupter and self-rectifier types in 5 different sockets. Operates from any battery eliminator delivering variable voltage from 4 to 6 volts DC at 4 amps. Ideal companion to the Model BE-4.

MODEL VT-1
$14.50
Shpg. Wt. 6 Lbs.

6 Heathkit DECADE CONDENSER KIT

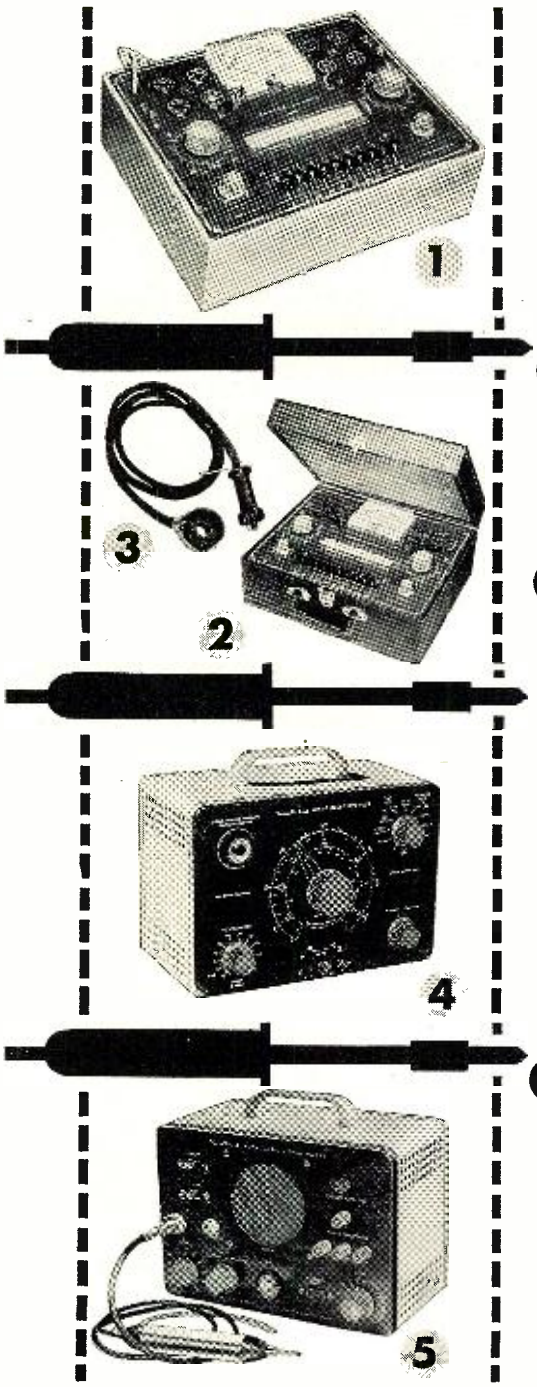
Provides capacity values from 100 mmf to 0.111 mfd in steps of 100 mmf. ± 1% precision silver-mica condensers used. High quality ceramic switches for reduced leakage. Polished birch cabinet. Extremely valuable in all electronic activity.

MODEL DC-1
$16.50
Shpg. Wt. 3 Lbs.

HEATH COMPANY
A SUBSIDIARY OF DAYSTROM INC.

BENTON HARBOR 15, MICHIGAN

Heathkit TUBE CHECKER KIT



1 The Heathkit Model TC-2 is an emission type tube tester that represents a tremendous saving over the price of a comparable unit from any other source. At only $29.50, you can have a tube tester of your own, even if you are an experimenter, or only do part time service work. Extremely popular with radio servicemen, it uses a 4½" meter with 3-color meter face for simple "GOOD-BAD" indications that the customer can understand. Will test all tubes commonly encountered in radio and TV service work.

Ten 3-position lever switches for "open" or "short" tests on each tube element. Neon bulb indicates filament continuity or short between tube elements. Line adjust control provided. The roll chart is illuminated.

Sockets provided for 4, 5, 6, and 7-pin, octal, and loctal tubes, 7 and 9 pin miniature tubes, and the 5 pin Hytron tubes. Blank space provided for future socket addition. Tests tubes for opens, and shorts, and for quality on the basis of total emission. 14 different filament voltage values provided.

MODEL TC-2
$29.50
Shpg. Wt. 12 Lbs.

2 Heathkit **PORTABLE TUBE CHECKER KIT**

The Model TC-2P is identical to the Model TC-2 except that it is housed in a rugged carrying case. This strikingly attractive and practical two-tone case is finished in proxylin impregnated fabric. The cover is detachable, and the hardware is brass plated. This case imparts a real professional appearance to the instrument. Ideal for home service calls, or any portable application.

MODEL TC-2P
$34.50
Shpg. Wt. 15 Lbs.

3 Heathkit **TV PICTURE TUBE TEST ADAPTER**

The Heathkit TV picture tube test adapter is designed for use with the Model TC-2 Tube Checker. Test picture tubes for emission, shorts, and thereby determine tube quality. Consists of 12-pin TV tube socket, 4 ft. cable, octal connector, and necessary technical data. (Not a kit.)

MODEL 355
$4.50
Shpg. Wt. 1 Lb.

4 Heathkit . . .

CONDENSER CHECKER KIT

Use this Condenser Checker to quickly and accurately measure those unknown condenser and resistor values. All readings taken directly from the calibrated panel scales without any involved calculation. Capacity measurements in four ranges from .00001 to 1000 mfds. Checks paper, mica, ceramic and electrolytic condensers. A power factor control is available for accurate indication of electrolytic condenser efficiency. Leakage test switch—selection of five polarizing voltages, 25 volts to 450 volts DC to indicate condenser operating quality under actual load conditions. Spring-return test switch automatically discharges condenser under test and eliminates shock hazard to the operator.

Resistance measurements can be made in the range from 100 ohms to 5 megohms. Here again, all values are read directly on the calibrated scales. Increased sensitivity coupled with an electron beam null indicator increases overall instrument usefulness.

For safety of operation, the circuit is entirely transformer operated. An outstanding low kit price for this surprisingly accurate instrument.

MODEL C-3
$19.50
Shpg. Wt. 7 Lbs.

5 Heathkit VISUAL-AURAL

SIGNAL TRACER KIT

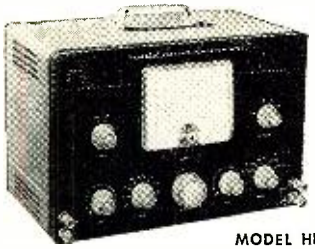
This signal tracer is extremely valuable in servicing AM, FM, and TV receivers, especially when it comes to isolating trouble to a particular stage of the circuit under test.

This visual-aural tracer features a high gain RF input channel to permit signal tracing from the receiver antenna input clear through all RF, IF, detector, and audio stages to the speaker. Separate low-gain channel provided for audio circuit exploration. Both visual and aural indication by means of a speaker or headphone, and electron beam "eye" tube as a level indicator. Also incorporates a noise locater circuit for DC noise checks, and a built-in calibrated wattmeter (30-500 watts). Panel terminals provided for "patching" output transformer or speaker into external circuit for test purposes. Designed especially for the radio and TV serviceman. Cabinet size: 9½" wide x 6½" high x 5" deep. A real test equipment bargain.

MODEL T-3
$23.50
Shpg. Wt. 9 Lbs.

HEATH COMPANY
A SUBSIDIARY OF DAYSTROM INC

BENTON HARBOR 15, MICHIGAN



MODEL HD-1

Shpg. Wt. 13 Lbs. **$49.50**

Used with a sine wave generator, the Model HD-1 will check the harmonic distortion output of audio amplifiers under a variety of conditions. Reads distortion directly on the meter as a percentage of the input signal. Operates between 20 and 20,000 cps. High impedance VTVM circuit for initial reference settings and final distortion readings. Ranges are 0-1, 3, 10, and 30 volts full scale. 1% precision resistors. Distortion scales are 0-1, 3, 10, 30 and 100% full scale. Requires only .3 volt input for distortion test.

Heathkit HARMONIC DISTORTION METER KIT

1 Heathkit AUDIO ANALYZER KIT

This instrument consists of an audio wattmeter, an AC VTVM, and a complete IM analyzer, all in one compact unit.

Use the VTVM to measure noise, frequency response, output gain, power supply ripple, etc. Use the wattmeter for measurement of power output. Internal loads provided for 4, 8, 16, or 600 ohms. VTVM also calibrated for DBM units. High or low impedance IM measurements made with built-in 6KC and 60 cps generators. VTVM ranges are .01, to 300 volts in 10 steps. Wattmeter ranges are .15 mw. to 150 w. in 7 steps. IM scales are 1% to 100% in 5 steps.

MODEL AA-1 **$59.50** Shpg. Wt. 13 Lbs.

2 Heathkit AUDIO GENERATOR KIT

This new Heathkit Model features step-tuning from 10 cps to 100 Kc with three rotary switches that provide two significant figures and multiplier. Less than .1% distortion. Frequency accurate to within ± 5%.

Output monitored on a large 4½" meter that reads voltage or db. Both variable and step-type attenuation provided. Meter reads zero-to-maximum at each attenuator position. Output ranges (and therefore meter ranges) are 0-.003, .01, .03, .1, .3, 1, 3, 10 volts. Step-tuning provides rapid positive selection of the desired frequency, and allows accurate return to any given frequency.

MODEL AG-9 **$34.50** Shpg. Wt. 8 Lbs.

3 Heathkit AUDIO OSCILLATOR KIT

(SINE WAVE — SQUARE WAVE)

The Model AO-1 features sine wave or square wave coverage from 20-20,000 cps in 3 ranges. It is an instrument specifically designed to completely fulfill the needs of the serviceman and high fidelity enthusiast. Offers high level output across the entire frequency range, low distortion and low impedance output. Features a thermistor in the second amplifier stage to maintain essentially flat output through the entire frequency range. Produces an excellent sine wave for audio testing, or will produce good, clean, square waves with a rise time of only 2 microseconds.

MODEL AO-1 **$24.50** Shpg. Wt. 10 Lbs.

4 Heathkit RESISTANCE SUBSTITUTION BOX KIT...

Provides switch selection of 36 RTMA 1 watt standard 1% resistors ranging from 15 ohms to 10 megohms. Numerous applications in radio and TV work, and essential in the developmental laboratory.

MODEL RS-1 **$5.50** Shpg. Wt. 2 Lbs.

5 Heathkit AC VACUUM TUBE VOLTMETER KIT...

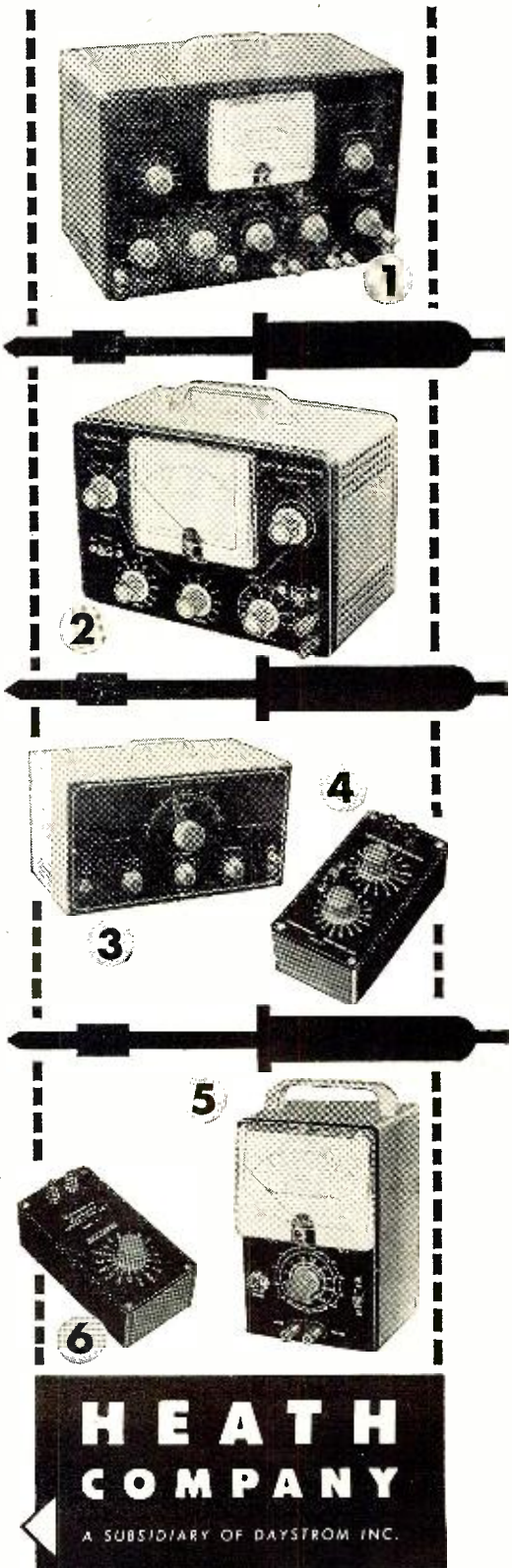
The Heathkit AC VTVM features high impedance, wide frequency range, very high sensitivity, and extremely wide voltage range. Will accurately measure a voltage as small as 1 mv. at high impedance. Excellent for sensitive AC measurements required by laboratories, audio enthusiasts and experimenters. Frequency response is substantially flat from 10 cps to 50 Kc. Ranges are .01, .03, .1, .3, 1, 3, 10, 30, 100, and 300 v. RMS. Total db range −52 to + 52 db. Input impedance 1 megohm at 1 Kc.

MODEL AV-2 **$29.50** Shpg. Wt. 5 Lbs.

6 Heathkit CONDENSER SUBSTITUTION BOX KIT...

Very popular companion to Heathkit RS-1. Individual selection of 18 RTMA standard condenser values from .0001 mfd to .22 mfd. Includes 18" flexible leads with alligator clips.

MODEL CS-1 **$5.50** Shpg. Wt. 2 Lbs.



HEATH COMPANY

A SUBSIDIARY OF DAYSTROM INC.

BENTON HARBOR 15, MICHIGAN

HEATHKIT HAM GEAR

for high quality at moderate cost

MODEL DX-100

DOLLAR VALUE: *You get more for your Heathkit dollar because your labor is used to build the kit instead of paying for someone else's. Also, the middleman's margin of profit is eliminated when you deal directly with the manufacturer.*

1 *Heathkit* DX-100 PHONE & CW TRANSMITTER KIT

The reception given this amateur transmitter has been tremendous. Reports from radio amateurs using the DX-100 are enthusiastic in praising its performance and the high quality of the components used in its assembly. Actual "on the air" results reflect the careful design that went into its development.

The DX-100 features a built-in VFO, modulator, and power supplies, and is completely bandswitching for phone or CW operation on 160, 80, 40, 20, 15, 11, and 10 meters. All parts necessary for construction are supplied in the kit, including tubes, cabinet, and detailed step-by-step instructions. Easy to build, and a genuine pleasure to operate.

Employs push-pull 1625's modulating parallel 6146's for RF output in excess of 100 watts on phone and 120 watts on CW. May be excited from the built-in VFO or from crystals (crystals not included with kit). Features five-point TVI suppression: (1) pi network interstage coupling to reduce harmonic transfer to the final stage; (2) pi network output coupling; (3) extensive shielding; (4) all incoming and outgoing circuits filtered; (5) inter-locking cabinet seams to eliminate radiation except through the coaxial output connector. Pi network output coupling will match 50 to 600 ohm non-reactive load. Illuminated VFO dial and meter face. Remote control socket provided.

The chassis is made of extra-strong #16 gauge copper-plated steel. It employs potted transformers, ceramic switch and variable capacitor insulation, solid silver loading switch terminals, and high-grade well-rated components throughout. Features a pre-formed wiring harness, and all coils are pre-wound.

High-gain speech amplifier for dynamic or crystal microphones, and restricted speech range for increased intelligence. Plenty of audio power reserve. Measures 20⅞" W. x 13¾" H. x 16" D. Schematic diagram and complete technical specifications on request.

MODEL DX-100
$189.50
Shpg. Wt. 120 Lbs.

Shipped Motor Freight Unless Otherwise Specified
$50.00 Deposit Required on C.O.D. Orders

2 *Heathkit* VFO KIT

The Model VF-1 covers 160-80-40-20-15-11 and 10 meters with three basic oscillator frequencies. Better than 10-volt average RF output on fundamentals. Features illuminated and pre-calibrated dial scale. Cable and plug provided to fit crystal socket of any modern transmitter.

Enjoy the convenience and flexibility of VFO operation at no more than the price of crystals. May be powered from plug on the Heathkit Model AT-1 transmitter, or supplied with power from most transmitters. Measures: 7" H. x 6½" W. x 7" D.

MODEL VF-1
$19.50
Shpg. Wt. 7 Lbs.

3 *Heathkit* CW AMATEUR TRANSMITTER KIT

The Model AT-1 is an ideal novice transmitter, and may be used to excite a higher power rig later on.

This CW transmitter is complete with its own power supply, and covers 80, 40, 20, 15, 11, and 10 meters. Features single-knob bandswitching, and panel meter indicates grid or plate current for the final amplifier. Designed for crystal operation or external VFO. Crystal not included in kit. Incorporates such features as key click filter, line filter, copper-plated chassis, pre-wound coils, 52 ohm coaxial output, and high quality components throughout. Instruction book simplifies assembly. Employs a 6AG7 oscillator, 6L6 final amplifier. Operates up to 35 watts plate power input.

MODEL AT-1
$29.50
Shpg. Wt. 15 Lbs.

4 *Heathkit* . . . ANTENNA COUPLER KIT

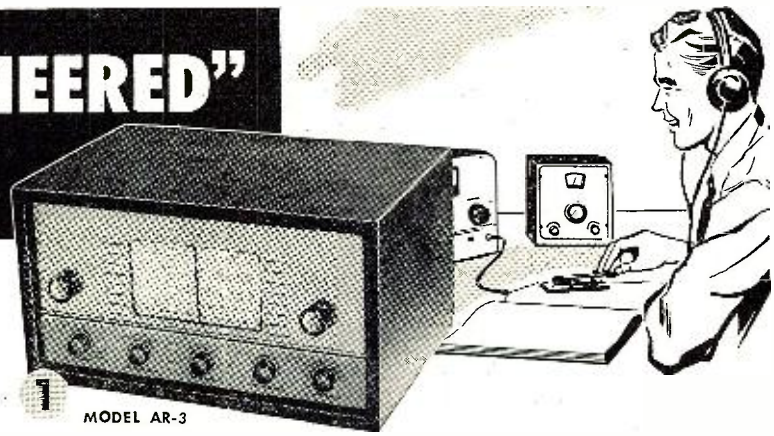
The Model AC-1 will properly match your low power transmitter to an end-fed long wire antenna. Also attenuates signals above 36 Mc, reducing TVI. 52 ohm coax. input—power up to 75 watts—10 through 80 meters—tapped inductor and variable condenser—neon RF indicator—copper plated chassis and high quality components. Ideal for use with Heathkit AT-1 Transmitter.

MODEL AC-1
$14.50
Shpg. Wt. 4 Lbs.

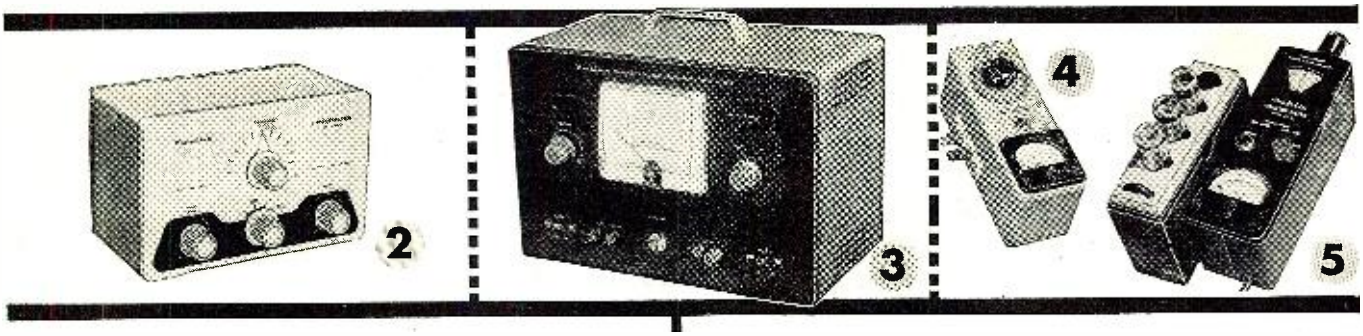
HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICHIGAN**

"AMATEUR-ENGINEERED"

Equipment For The Ham



MODERN DESIGN: *You can be sure of getting all the latest and most desirable design features when you buy Heathkits. Advanced-design is a minimum standard for new Heathkit models.*



1 *Heathkit* COMMUNICATIONS-TYPE ALL BAND RECEIVER KIT

The new Model AR-3 features improved IF and RF performance, along with better image rejection on all bands. Completely new chassis layout for easier assembly, even for the beginner

Covers 550 Kc to 30 Mc in four bands. Provides sharp tuning and good sensitivity over the entire range. Features a transformer-type power supply—electrical bandspread—separate RF and AF gain controls—antenna trimmer—noise limiter—AGC—BFO—headphone jacks—5½" PM speaker and illuminated tuning dial.

CABINET: Fabric covered cabinet with aluminum panel as shown. Part No. 91- shipping weight 5 lbs. $4.50.

MODEL AR-3
$27.95
Shpg. Wt. 12 Lbs.
(Less Cabinet)

2 *Heathkit* "Q" MULTIPLIER KIT

Here is the Heathkit Q Multiplier you hams have been asking for. A tremendous help on the phone and CW bands when the QRM is heavy. Provides an effective Q of approximately 4,000 for extremely sharp "peak" or "null." Use it to "peak" the desired signal or to "null" an undesired signal, or heterodyne. Tunes to any signal within the IF band-pass of your receiver. Also provides "broad peak" for conditions where extreme selectivity is not required.

Operates with any receiver having an IF frequency between 450 and 460 Kc. Will not function with AC-DC type receivers. Requires 6.3 volts AC at 300 ma. and 150 to 250 VDC at 2 ma. Derives operating power from your receiver. Uses a 12AX7 tube, and special High-Q shielded coils. Simple to connect with the cable and plugs supplied. Measures only 4-11/16"H.x7⅜"W.x4⅛"D. A really valuable addition to the receiving equipment in your ham shack.

MODEL QF-1
$9.95
Shpg. Wt. 3 Lbs.

3 *Heathkit* VARIABLE VOLTAGE REGULATED POWER SUPPY KIT

Provides well filtered DC output, variable from zero to 500 volts at no load and *regulated* for stability. Will supply up to 10 ma. at 450 VDC, and up to 130 ma. at 200 VDC. Voltage or current monitored on front panel meter. Also provides 6.3 VAC at 4A. for filament. Filament voltage isolated from B+, and both isolated from ground. Invaluable around the ham shack for supplying operating potentials to experimental circuits. Use in all types of research and development laboratories as a temporary power supply, and to determine design requirements for ultimate power supply.

MODEL PS-3
$35.50
Shpg. Wt. 17 lbs.

4 *Heathkit* ANTENNA IMPEDANCE METER KIT

Use in conjunction with a signal source for measuring antenna impedance, line matching, adjustment of beam and mobile antennas, etc. Will double as a phone monitor or relative field strength indicator. 100 μa. meter employed. Covers the range from 0-600 ohms. An instrument of many uses for the amateur.

MODEL AM-1
$14.50
Shpg. Wt. 2 lb.

5 *Heathkit* GRID DIP METER KIT

This is an extremely valuable tool for accomplishing literally hundreds of jobs on all types of equipment. Covering from 2 Mc to 250 Mc, the GD-1B is compact and can be operated with one hand. Uses a 500 μa. meter for indication, with a sensitivity control and headphone jack. Includes prewound coils and rack. Indispensable instrument for hams, engineers, or servicemen.

MODEL GD-1B
$19.50
Shpg. Wt. 4 lbs.

HEATH COMPANY *A Subsidiary of Daystrom, Inc.* BENTON HARBOR 15, MICHIGAN

Heathkits PROVIDE THE "CONSTRUCTIVE" APPROACH TO HIGH-FIDELITY

EASY TO BUILD: *The assembly instructions supplied with Heathkits are so complete and detailed that anyone can assemble the kits without difficulty. Plenty of pictorial diagrams and step-by-step instructions. Information on resistor color codes, soldering, use of tools, etc. Build-it-yourself with confidence!*

1

1 Heathkit ADVANCED-DESIGN HIGH FIDELITY AMPLIFIER KIT

The 25 Watt Model W-5 is one of the most outstanding high fidelity amplifiers available today—at any price. Incorporates the very latest design features to achieve true "presence" for the super-critical listener.

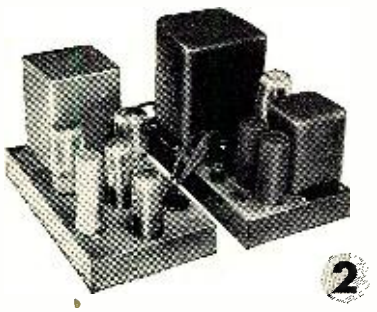
Features a new-design Peerless output transformer, and KT66 output tubes handle power peaks up to 42 watts. The unique "tweeter-saver" suppresses high frequency oscillation. A new type balancing circuit results in closer "dynamic" balance between output tubes. Features improved phase shift characteristics and frequency response, with reduced IM and harmonic distortion. Color styling harmonizes with the Heathkit WA-P2 Preamplifier and the FM-3 Tuner.

Frequency response—within ± 1 db from 5 cps to 160 Kc at 1 watt. Harmonic distortion only 1% at 25 watts, 20-20,000 cps. IM distortion only 1% at 20 watts, using 60 and 3,000 cps. Output impedance 4, 8, or 16 ohms. Hum and noise—99 db below rated output. Uses two 12AU7's, two KT66's and a 5R4GY.

KIT COMBINATIONS:

W-5M Amplifier Kit: Consists of main amplifier and power supply, all on one chassis. Complete with all necessary parts, tubes, and comprehensive manual. Shpg. Wt. 31 lbs. Express only. **$59.75**

W-5 Combination Amplifier Kit: Consists of W-5M Amplifier Kit listed above *plus* Heathkit Model WA-P2 Preamplifier Kit. Complete with all necessary parts, tubes, and construction manuals. Shpg. Wt. 38 lbs. Express only. **$79.50**



2

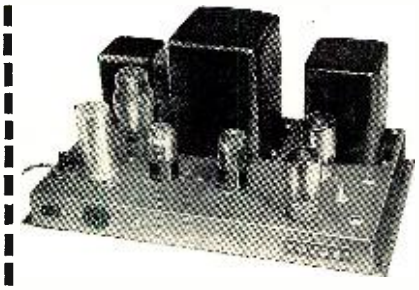
2 Heathkit DUAL-CHASSIS WILLIAMSON TYPE HIGH FIDELITY AMPLIFIER KIT

This is a very popular high fidelity amplifier kit that features dual-chassis type construction. The resulting physical dimensions offer an additional margin of flexibility in installation. It features the famous Acrosound TO-300 "ultra-linear" output transformer, and has a frequency response within ± 1 db from 6 cps to 150 Kc at 1 watt. Harmonic distortion only 1% at 21 watts. IM distortion at 20 watts only 1.3% at 60 and 3,000 cps. Rated power output is 20 watts. Output impedance 4, 8, or 16 ohms. Hum and noise—88 db below 20 watts. Uses two 6SN7's, two 5881's, and a 5V4G.

KIT COMBINATIONS:

W-3M: Consists of main amplifier and power supply for separate chassis construction. Includes all tubes and components necessary for assembly. Shpg. Wt. 29 lbs., Express only. **$49.75**

W-3: Consists of W-3M Kit listed above *plus* Heathkit Model WA-P2 Preamplifier described on opposite page. Shpg. Wt. 37 lbs., Express only. **$69.50**



3

3 Heathkit SINGLE-CHASSIS WILLIAMSON TYPE HIGH FIDELITY AMPLIFIER KIT

This is the lowest priced Williamson type amplifier ever offered in kit form, and yet it retains all the usual features of the Williamson type circuit. Main amplifier and power supply combined on one chassis, and uses a new-design Chicago output transformer. Frequency response—within ± 1 db from 10 cps to 100 Kc at 1 watt. Harmonic distortion only 1.5% at 20 watts. IM distortion at rated output, 2.7% at 60 and 3,000 cps. Rated power output is 20 watts. Output impedance 4, 8, or 16 ohms. Hum and noise—95 db below 20 watts. Uses two 6SN7's, two 5881's, and one 5V4G.

Instructions are so complete that the kit may be assembled successfully even by a beginner in electronics.

KIT COMBINATIONS:

W-4AM: Consists of main amplifier and power supply for single chassis construction. Includes all tubes and components necessary for assembly. Shpg. Wt. 28 lbs. Express only. **$39.75**

W-4A: Consists of W-4AM Kit listed above *plus* Heathkit Model WA-P2 Preamplifier described on opposite page. Shpg. Wt. 35 lbs. Express only. **$59.50**

HEATH COMPANY

A SUBSIDIARY OF DAYSTROM INC.

BENTON HARBOR 15, MICHIGAN

ATTRACTIVELY STYLED: *Heathkit high fidelity instruments are not only functional, but are most attractive in physical design. Such units as the preamplifier and the W-5 main amplifier are designed for beauty as well as performance. They blend with any room decor and are the kind of instruments you will be proud to own.*

enjoy.... THE VERY BEST IN AUDIO WITH "BUILD-IT-YOURSELF" HEATHKITS

1 *Heathkit* HIGH FIDELITY PREAMPLIFIER KIT

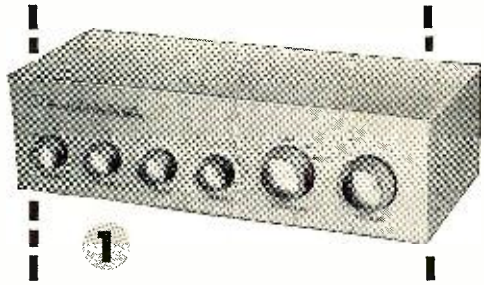
This outstanding preamplifier is designed specifically for use with the Heathkit Williamson type amplifiers. It completely fulfills the requirements for remote control, compensation and preamplification, and exceeds even the most rigorous specifications for high fidelity performance.

Features five separate switch-selected input channels (2 low level and 3 high level), each with its own input control. Full record equalization with four-position turnover control and four-position rolloff control.

Output jack for tape recorder — separate bass control with 18 db boost and 12 db cut at 50 cps. — treble control offering 15 db boost and 20 db cut at 15,000 cps — special hum control to insure minimum hum level — and many other desirable features. Overall frequency response (with controls set to "flat" position) is within 1 db from 25 cps to 30,000 cps. Will do justice to the finest available program sources. Beautiful satin-gold finish.

Power requirements from the Heathkit Williamson type high fidelity amplifier — 6.3 VAC at 1 amp., and 300 VDC at 10 Ma. Uses two 12AX7's and one 12AU7.

MODEL WA-P2
$19.75
Shpg. Wt. 7 Lbs.



2 *Heathkit* 20-WATT HIGH FIDELITY AMPLIFIER KIT

This Heathkit Model offers you the least expensive route to high fidelity performance. Frequency response is ± 1 db from 20-20,000 cps. Features full 20 watt output using push-pull 6L6's, and incorporates separate bass and treble tone controls. Preamplifier and main amplifier are built on the same chassis. Four switch-selected compensated inputs and separate bass and treble tone controls provide all necessary functions at minimum investment. Features miniature tube types for low hum and noise.

Uses 12AX7, two 12AU7's, two 6L6G's and a 5V4G. A most interesting "build-it-yourself" project, and an excellent hi-fi amplifier for home use. Well suited, also, for public address applications because of its high power output and high quality audio reproduction. Another Heathkit "best-buy" for you!

MODEL A-9B
$35.50
Shpg. Wt. 23 Lbs.

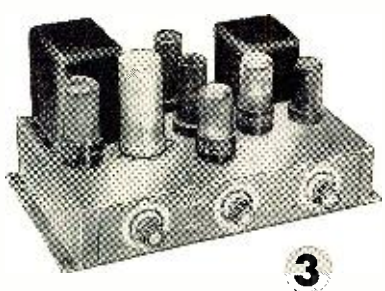
3 *Heathkit* 7-WATT AMPLIFIER KIT

The redesigned Model A-7D features a new type output transformer for tapped screen operation, and provides improved sensitivity, reduced distortion, and increased power output.

The full 7-watt output of the Model A-7D is more than adequate for normal home installations. Frequency characteristics are ± 1½ db from 20 to 20,000 cps. Potted output and power transformers employed. Push-pull output — detailed construction manual — top quality parts — high quality audio without great expense. Output transformer tapped at 4, 8, and 16 ohms. Bass and treble tone controls provided on the front chassis apron.

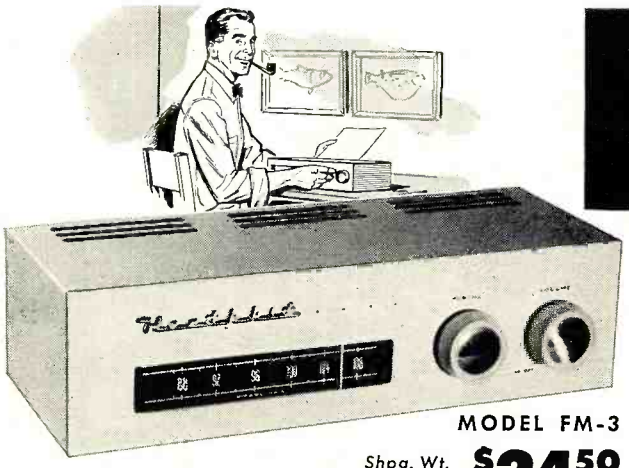
MODEL A-7D
$16.95
Shpg. Wt. 10 Lbs.

Model A-7E: Provides a preamplifier stage with two switch-selected inputs and RIAA compensation for variable reluctance or low level cartridges. Preamplifier built on same chassis as main amplifier. Model A-7E. Shipping weight 10 lbs. $18.50.



HEATH COMPANY
A SUBSIDIARY OF DAYSTROM INC.

BENTON HARBOR 15, MICHIGAN



MODEL FM-3

Shpg. Wt. 7 lbs. **$24.50** (with cabinet)

Brand New HEATHKIT HIGH-FIDELITY FM TUNER KIT

The new Heathkit Model FM-3 features tremendous circuit improvements and brand new physical design. Sensitivity is better than 10 μv, for 20 db of quieting, and it employs a completely modern tube line-up for high gain and stable operation. Incorporates its own power supply, and has provision for low-level or high-level output at low impedance.

The attractive Model FM-3 matches the WA-P2 Preamplifier in color, styling, and physical size.

Incorporates automatic gain control, a highly stabilized oscillator, and illuminated tuning dial. Educational treatment of construction manual simplifies assembly for the newcomer to electronics. *IF* and *ratio* transformers are *prealigned*, and the front-end tuning unit is pre-assembled and aligned. Uses 6BQ7A as a cascode type RF stage, 6U8 oscillator-mixer, two 6CB6's as IF amplifiers, a 6AL5 ratio detector, a 6C4 audio amplifier, and 6X4 rectifier.

Features

- *Brand New, Modern FM Circuit Using Latest Type Miniature Tubes.*
- *Low-Noise Cascode RF Stage—Two IF's—Ratio Detector —Stage of Audio.*
- *Extremely Good Sensitivity and Band-Pass for Outstanding Performance.*
- *Strikingly Attractive Satin-Gold Finish to Match Heathkit Model WA-P2 Preamplifier.*
- *Compact Physical Dimensions for Most Pleasing Appearance and Increased Circuit Efficiency.*

HEATHKIT BROADCAST-BAND RECEIVER KIT

Build your own radio receiver with confidence, even if you are a beginner. Complete instructions supplied.

Features transformer-type power supply, high-gain miniature tubes, built-in antenna, 5½" speaker, and planetary tuning from 550 Kc to 1500 Kc. Adaptable for use as AM Tuner and phono amplifier. Educational treatment of the construction manual helps the beginner learn about radio circuits and parts as he builds.

CABINET: Fabric covered plywood cabinet with aluminum panel as shown. Part 91-9, Shpg. Wt. 5 lbs., $4.50.

MODEL BR-2

$17.50 *Less Cabinet*

Shpg. Wt. 10 lbs.

Are you on our mailing list? If not—how about sending us your name?

ORDER BLANK

from _____

_____

_____

(PLEASE PRINT)

SHIP VIA
- ☐ Parcel Post
- ☐ Express
- ☐ Freight
- ☐ Best Way

QUANTITY	ITEM	MODEL NO.	PRICE

NOTE: ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

Enclosed find ( ) check ( ) money order for_____. Please ship C.O.D. ( ) postage enclosed for_____pounds.

On Express orders do not include transportation charges— they will be collected by the express agency at time of delivery.

ON PARCEL POST ORDERS include postage for weight shown. ORDERS FROM CANADA and APO's must include full remittance.

HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICHIGAN**

Richard H. Lindeberg, Sylvania engineer (left) explains details of the new r.f. lamp to Dani Crayne, an actress whose work may involve this new light source.

New R. F. Incandescent Lamp

Powered by r.f. energy, the world's brightest incandescent lamp has many TV, radar, control, and movie applications.

SYLVANIA Electric Products Inc. has developed a new multi-purpose lamp which is powered inductively from an r.f. power source.

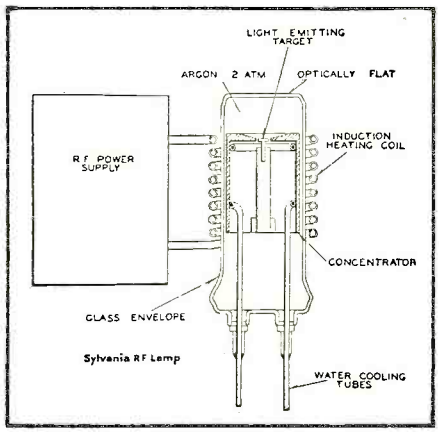
The new lamp was developed in cooperation with the Motion Picture Research Council of Hollywood and is expected to have its widest application in overcoming motion picture printing problems. The r.f. lamp can also be used in color TV tube processing, medical research, radar and air traffic control, computers, film projectors, and many other fields.

One of the major advantages of this new light source is its maximum utilization of power. Almost all of the light produced by the lamp is usable.

The r.f. energy used to power this lamp is concentrated in a small disc about 5/16" diameter, causing it to incandesce brilliantly. Because the refractory material of the disc can be heated to a much higher temperature than the tungsten filaments of incandescent lamps, a great increase in light output is obtained. Also, because of the higher temperature, the light has a higher blue content and provides more light emission in the visible range. The disc also permits the focusing of the light without using complicated optical systems of various types.

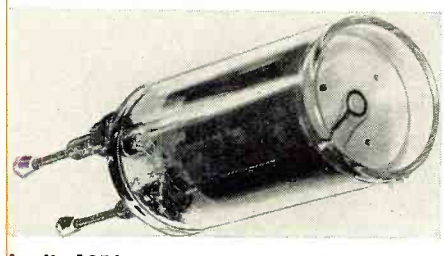
The r.f. energy is carried to the lamp by means of a copper coil wound around the outside of the lamp. Lamp brightness is controlled by varying the d.c. voltage fed to the r.f. oscillator. A water line can be connected to the oscillator to cool both the lamp and coil should sustained operation of the device make this necessary.

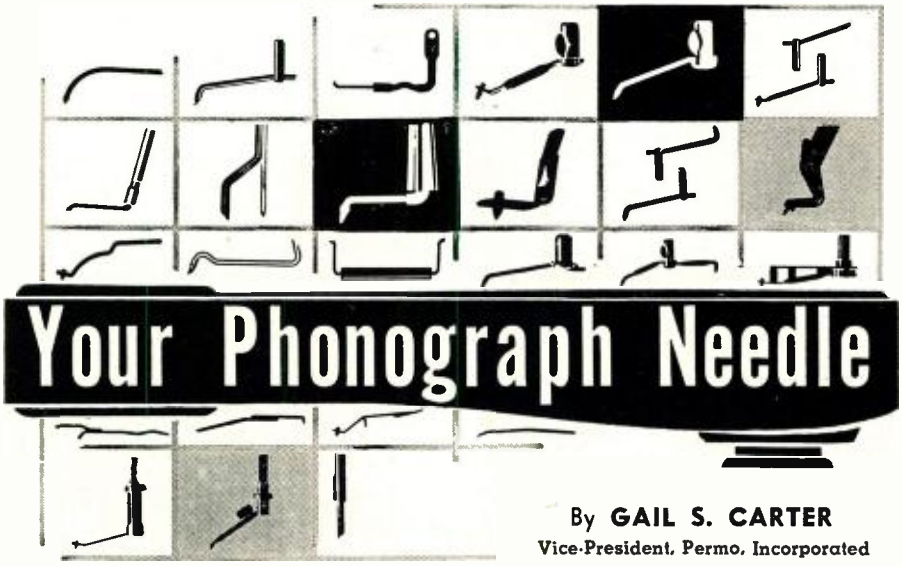
The company's photolamp division is handling the new unit. —30—



Cross-sectional view of the new Sylvania r.f. lamp. It uses no direct electrical connections but is powered inductively from the r.f. power supply shown at left.

Close-up of the new incandescent lamp. It is being used in a variety of industrial and commercial applications. See text.





Your Phonograph Needle

By **GAIL S. CARTER**
Vice-President, Permo, Incorporated

A small but very important part of your record player which can either enhance or ruin phono reproduction.

THE modest little phonograph needle, like the heart in a human being, is an essential part of a record player. It must be manufactured correctly, installed properly, and used wisely to perform its required function in the playing of phonograph records.

The advent of radically reduced tone arm pressures, lightweight pickups, and LP, 45 rpm, and extended-play records has radically altered the design and function of phonograph needles. Prior to 1946 most phonograph records were of the shellac type and were manufactured for use on record players revolving at 78 rpm. Needles for most 78 rpm records fit a common hole, or chuck, in the cartridge or pickup, conforming to a standard industry size for those openings. The engineering of conventional-type needles for use on 78 rpm records and having a 3-mil point is largely the responsibility of needle manufacturers.

On the other hand, needles for use on LP, extended-play, and 45 rpm records are, for the most part, not designed by the needle manufacturers but by the cartridge or set manufacturer since they are part of the overall engineering of the record player.

The marked improvement of sound reproduction from phono records accounted for by the technological advancement made in the manufacture of vinyl or plastic records requiring a 1 mil needle point, made it necessary that cartridge designs be radically changed. Improvement in the manufacture of records would have been lost to the public had not sound, electronic, and mechanical engineers created cartridges and needles designed to obtain maximum benefit from these record developments.

Owners of LP, extended-play, and 45 rpm records are confronted with several problems when the matter of needle replacement comes up. It is not the simple act of merely asking a record clerk for a phonograph needle. Record players designed to handle LP, 45 rpm, and/or extended-play discs are equipped, for the most part, with special type cartridges which require specific phonograph needles. There are also some special type needles for 78 rpm records. There is no one "hole" that all of these special type needles fit. There are more than a score of different-type cartridges that require approximately 125 special type needles. The consumer does not just ask for an "LP," "EP," or "45 rpm" needle. He must be able, sooner or later, to give the record clerk the name and number of the cartridge installed in his record player. That is the one step which differs from the procedure followed with record players using conventional-type needles. This bit of inconvenience, however, is more than offset by the greater listening pleasure obtainable from the newer records.

Among the many "special type" needles illustrated in the photograph at the top of the page are those designed for use on LP, extended-play, 45, and 78 rpm discs. Each needle represents the answer to a specific requirement to meet the needs of some special cartridge or record player. For example, there are 82 basic designs in our company's "Fidelitone" line which account for some 283 individual units made to meet specific requirements.

The oft-asked question regarding needle point material is not an easy one for the engineer to answer although there are certain basic factors which can be used as a guide in making a replacement purchase. For long service a needle must resist oxidation and must have the right degree of hardness. The osmium alloys, the sapphire or jewel, or diamond each possess these qualities and are the best phono needle tip materials available.

The consumer's interest generally lies in the manner in which these different materials affect phono records. The osmium alloy tip wears in rapidly and wears out slowly. The sapphire or jewel tip wears in slowly and wears out slowly, while the diamond tip wears in very, very slowly and wears out at an equally decelerated rate. The important point is that *all of these materials eventually wear out and, needless to say, they must someday be replaced.*

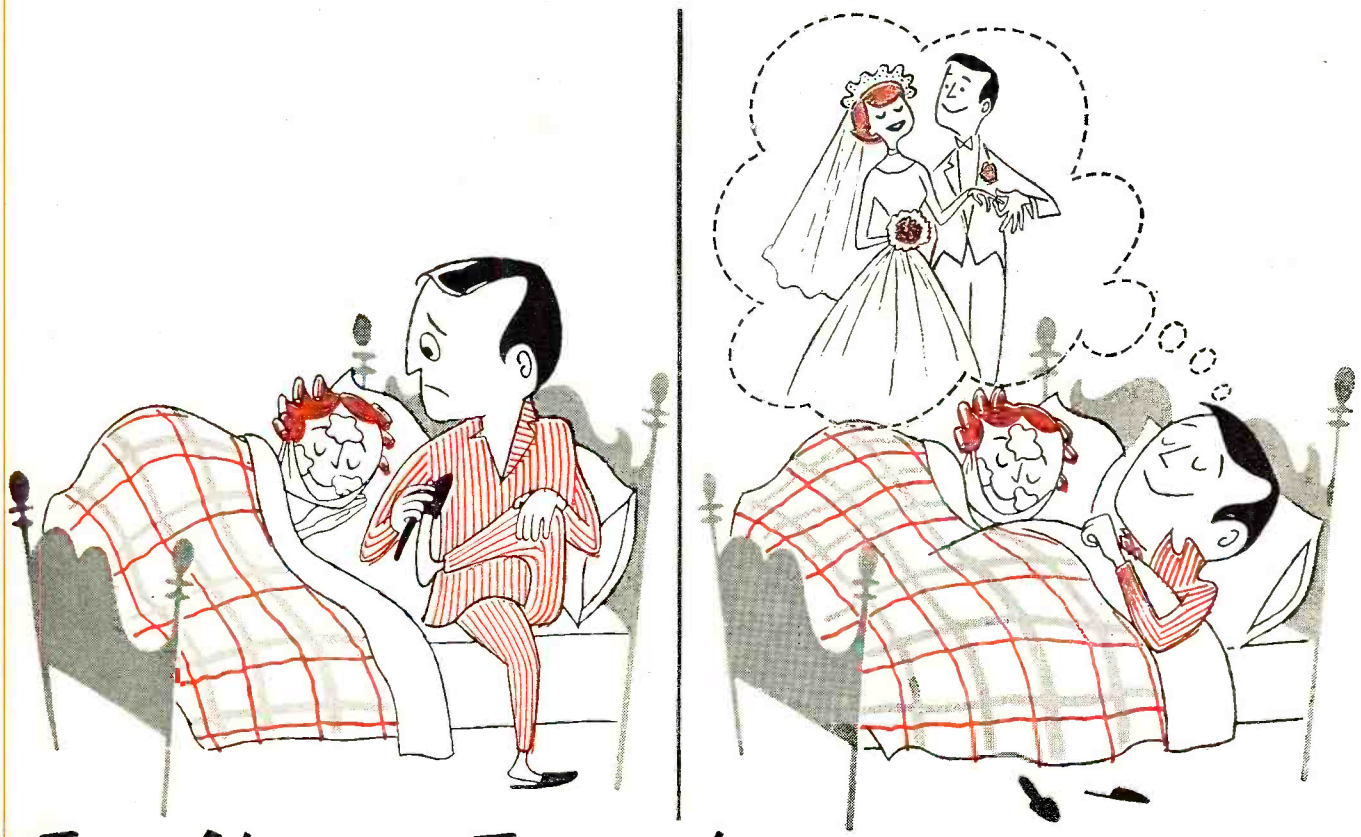
Choice of a needle depends on what the user expects from his point. Excellent reproduction can be expected and obtained from any one of these materials. The user who doesn't want to have to change his needle regularly should select the diamond point. Financial considerations also dictate selection of a needle since there is a wide spread between the average price of $1.50 for osmium tipped needles, $2.50 for sapphire, and $25.00 for diamond tipped needles. It should always be remembered that something has to "give" when high temperature and dry friction are present simultaneously. The unit pressure is on the order of 25,000 pounds per square inch and temperatures are around 1500° F. Under such conditions, the needle point or the disc will wear out. The question is, which one will wear out first. The user, therefore, must take into consideration his choice between buying more records or changing his phonograph needle more frequently.

An interesting phenomenon, not always appreciated, is that phono discs are manufactured for universal usage. It matters not whether these discs are played on a $20.00 player or a $1000.00 set—reproduction of sound is accomplished. The modern phono needle point, like the record, must do a universal job on every type of shank, record, record player, tone arm, and cartridge. Thus the relative quality of reproduction depends on the player and the needle rather than the record itself.

Users should not make the mistake of blaming their record players for scratchy, noisy sounds, and distortion that develops after a phonograph needle has been used over an extended period of time. That noise can mean that the record or records have been ruined by playing them with a worn-out needle. It is wise to remember that the phono needle is the "heart" of the record player and use it accordingly.

There are no truer statements than: "There is no permanent phonograph needle" and "Worn-out needles wear out phonograph records."

Keep both of these truisms in mind when next your record player shows signs of balkiness and refuses to play your favorite discs the way you want, or are accustomed, to hear them reproduced. —30—



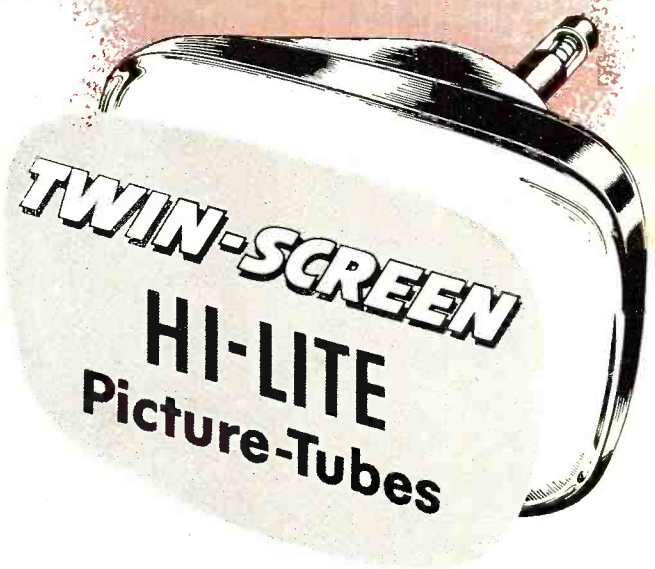
For Almost Everything...

there is the

PERFECT REPLACEMENT

Some things can't be revitalized, no matter how many "boosters" are used—you have to face it, you can't get that original quality back again. However, a worn out, faded television picture can be done away with—because Du Mont has a *Perfect Replacement* for an old picture tube. To go even further, a Twin-Screen Hi-Lite* picture tube will give a brighter, sharper, sparkling new picture—for a cost no greater than that of ordinary aluminized picture tubes. For picture perfection, for the *perfect replacement,* insist on Du Mont.

**The ultimate in aluminized picture tubes.*



DU MONT®

CATHODE-RAY TUBE DIVISION, ALLEN B. DU MONT LABORATORIES, INC., CLIFTON, N. J.

Over-all view of the "Knight" 25-watt linear amplifier. It is offered in kit form for assembly by home audio builder.

New 25-WATT POWER AMPLIFIER

By
NORMAN KRAMER
Project Engr., Allied Radio Corporation

Circuit details on a new linear amplifier kit which uses two 5881 beam power tubes and a special output transformer.

AUDIO amplifiers in recent years have reached a practical limit of perfection. The present trend in amplifier design is to reduce the cost of such units while retaining the high standards of frequency response and undistorted output power.

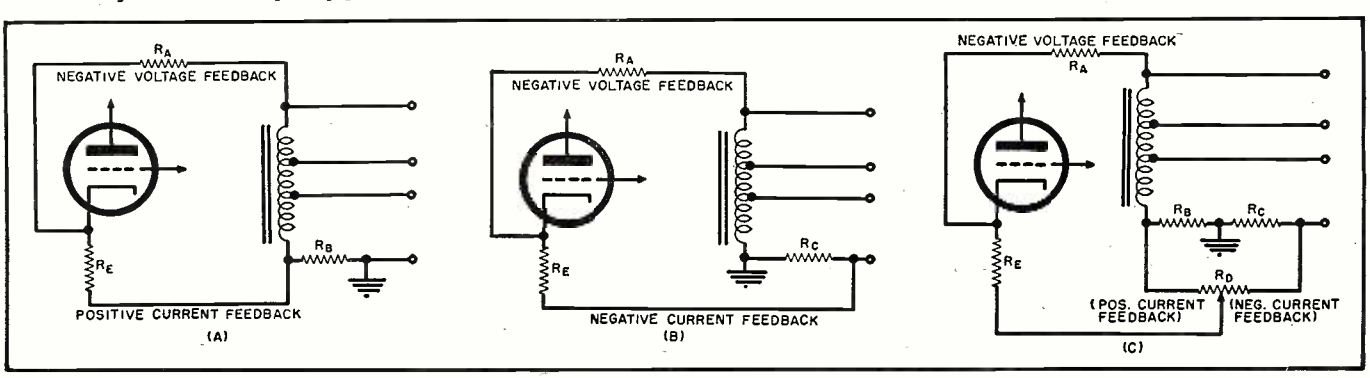
The new "Knight" linear-deluxe basic amplifier is one such unit since the cost has been reduced by offering the unit in kit form. The design of this amplifier is centered around the following requirements: (1) Negligible harmonic and frequency distortion as well as negligible IM and phase distortion; (2) Maximum output power rating far in excess of that required to reproduce the transient peaks found in music; (3) No tendencies toward low-frequency instability or ultrasonic oscillations; (4) Negligible incremental output impedance and a method for making this a variable in both the positive and negative directions. In other words, variable damping which enables the listener to optimize the source for any loudspeaker; (5) Linear frequency response throughout the entire range from 10 to 20,000 cps; and (6) Complete freedom from hum and microphonics.

There are numerous factors and design features which have to be considered in meeting these requirements. Choice of circuitry influences distortion and output power as well as stability at both the high and low ends of the amplifier bandpass. The output transformer, which is actually the heart of the amplifier, governs the IM and phase distortion as well as frequency response and the power handling capacity. Freedom from hum is most dependent on circuitry and component layout. Actually, all of these factors must be considered together since many of them are interdependent.

The underlying design concept was to keep the distortion in the amplifier as low as possible before the addition of the negative feedback, the thought behind this being that upon the addition of the single loop of negative feedback the inherent distortion would virtually vanish. The input circuitry was made as simple as possible with the signal level kept at a minimum to keep the distortion low. Two 12AU7 dual triodes are used as input, phase-inverter, and driver stages and all of this circuitry is combined on an etched circuit board. This insures that each unit is a photographic reproduction of the engineering prototype and that there is no possibility of additional feedback loops which could degrade the amplifier through undesirable increases or decreases of signal levels in these stages. Furthermore, the printed circuit board makes for ease of wiring and a layout of components critical to hum minimization which cannot readily be achieved by conventional wiring methods. Circuit parameters and operating voltages are carefully adjusted to minimize IM and harmonic distortion.

A great deal of care went into the design and selection of the output transformer used in this amplifier. Low distortion and wide bandpass in an output transformer are not enough to insure optimum performance. This bandpass must be free from any resonances, must be smooth, and must have a minimum phase shift over a very wide band. Therefore, such transformer parameters as shunt inductance, leakage inductance, and capac-

Fig. 1. Method of getting positive (A) and negative (B) current feedback. (C) Simplified diagram of the feedback circuit.

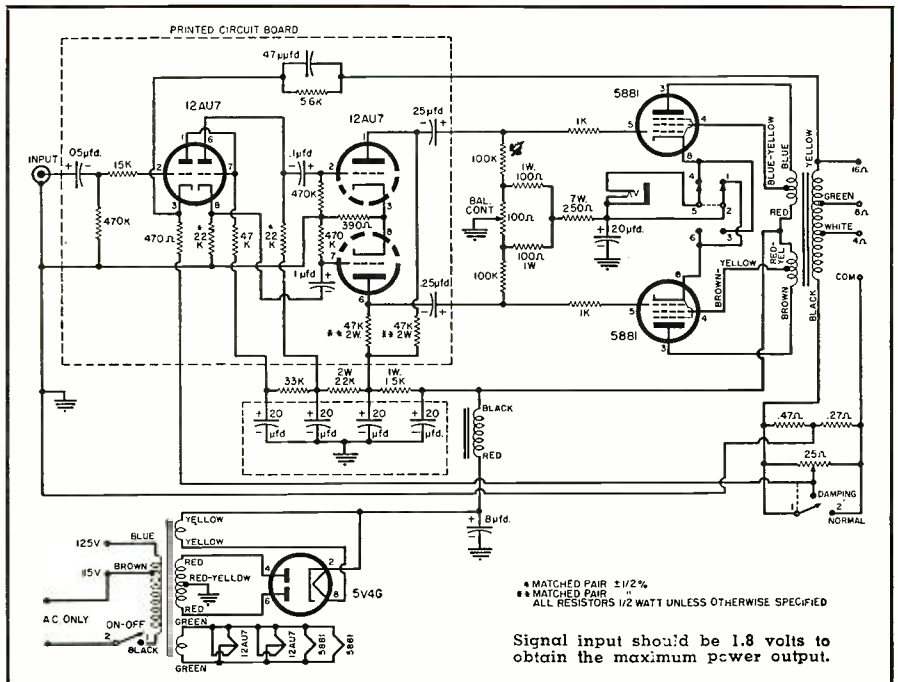


itance, and even tube types to be used become factors to be considered in the choice of an output transformer for a given amplifier circuit.

The power output stage consists of two 5881 beam tetrodes and the output transformer just described. The 5881 tubes were selected because of their special grid construction and their excellent characteristics of higher permissible plate dissipation and ruggedized construction. These factors make for very stable operation. The output transformer has taps provided on the plate windings to which the screens of the 5881 tubes are connected. Thus, the screens as well as the plates are energized with both a.c. and d.c. and their currents are combined in such a way as to "linearize" the dynamic plate characteristics of the tube. In this way the efficiency and power sensitivity of the tetrode are preserved and the low internal impedance of the triode is maintained.

The secondary of the output transformer not only supplies the single loop of 20 db negative voltage feedback to the input cathode, but is also brought to ground through a resistive network which includes the variable damping control. Amplifier damping factor is defined as the ratio of nominal load impedance to actual output impedance. It is apparent that amplifier damping factor can best be controlled by changing the actual output impedance since the load impedance is fixed by the speaker system used.

The most effective method of changing the output impedance is by a combination of voltage and current feedback. Fig. 1A shows a simplified diagram of one method of achieving positive current feedback. R_A is the voltage feedback resistor and R_E is the cathode resistance of the stage receiving the feedback. R_B is the current feedback resistor and is in series with the load. Current through R_B produces a feedback, proportional to a positive current, which decreases amplifier output impedance. Fig. 1B shows a somewhat different arrangement whereby the phase of the feedback through R_C, the current feedback resistor, is opposite and is now proportional to a negative current. In this way, amplifier output impedance is increased. Fig. 1C is a simplified schematic of the feedback circuit actually used in this amplifier. The two current feedback resistors, R_B and R_C, are shunted by R_D, the damping factor control potentiometer, which permits a continuous control over both negative and positive feedback. Furthermore, there is a point where amplifier output impedance approaches zero and the damping factor approaches infinity. This control is capable of adjusting the damping factor between fairly wide limits at the lower frequencies to assure optimum damping of virtually any speaker and enclosure resonances. In this way, the listener may adjust the amplifier damping factor to achieve optimum damping for his own system.



Output trans.—7000 ohms to 4, 8, 16 ohms. For 5881 operation, pri. taps for screens, max. undistorted power output 30 watts, frequency response ±½ db, 10-120,000 cps.
Power trans.—500-0-500 v. @ 160 ma.; 5 v. @ 3 amps.; 6.3 v. @ 4 amps.
Filter choke—6 hy. @ 160 ma., d.c. resistance 160-170 ohms

Fig. 2. Schematic of "Knight" 25-watt amplifier which is available in kit form. Parts values are shown on diagram, except for special parts whose specifications are given above.

The damping factor is continuously variable from +35 to −4 with a normal damping factor (network shorted out of the circuit) of +16.

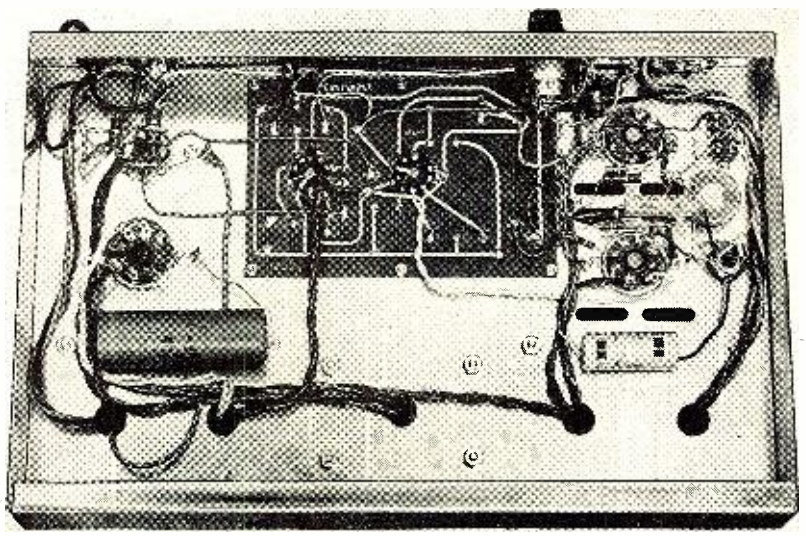
Fig. 2 shows the complete schematic diagram of the amplifier. A 5V4G is used as a full-wave rectifier with a pie-type *LC* filter to supply the output stages. Additional *RC* filtering and decoupling are used in each of the previous input stages. All the power supply ratings are sufficiently high so that power may be taken from the amplifier to supply a remote preamp if necessary.

Optimum performance requires that the output tubes operate in a balanced condition. Therefore, a switch and jack arrangement is provided for the metering of cathode currents and a bias adjustment can be made for balance.

Frequency response is ±½ db from 10 to 120,000 cps. Harmonic distortion is .15% at 25 watts output. IM distortion (60 and 7000 cps, mixed 1:4) measures 1% at 20 watts and is less than .25% below the 18 watt output level. Output taps are provided at 4, 8, and 16 ohms.

This amplifier is being marketed in kit form by *Allied Radio Corporation*, 100 N. Western Ave., Chicago 80, Ill., for $41.50. It comes complete with full instructions for assembling the unit. -30-

Under chassis view of assembled amplifier. Note use of printed circuit board (top).



New Hi-Fi-Audio Equipment

30-WATT AMPLIFIER

McIntosh Laboratory, Inc., 320 Water Street, Binghamton, New York has added a 30-watt power amplifier to its line of audio components.

The MC-30 is specifically designed for custom installations. It incorporates the company's special circuitry which employs unity coupling in the

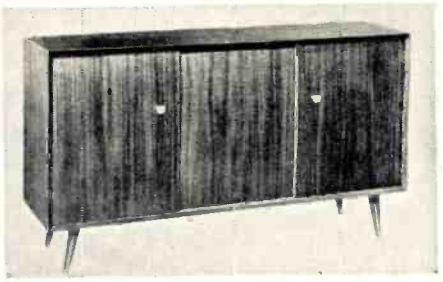
output. This feature permits great power output without introducing distortion.

Frequency response is from 20 to 30,000 cps ±.1 db at 30 watts. Harmonic distortion is less than ⅓% at full 30 watts, all frequencies. IM distortion is less than ½% at full 30 watts, all frequencies. The company will supply additional details on this unit upon request.

EQUIPMENT CABINET

Cabinart, a division of *G & H Wood Products Co., Inc.,* 99 North 11th St., Brooklyn 11, N. Y. has added the Model 65 to its line of furniture and speaker enclosures for high-fidelity installations.

A full 60" wide, the new unit will accommodate a radio tuner, amplifier, record changer or player, manual player or professional turntable, tape recorder, and speaker or speaker system. A companion unit, the Model 65D, offers phono record or tape storage space in lieu of a speaker com-



partment. This storage section is finished inside and fitted with an adjustable shelf.

The right and left doors hinge outward while the center panel slides left or right. Details include only a slight

bevel molding, tiny brass door pulls, and wood or brass legs. Finishes are hand-rubbed mahogany, walnut, or korina veneers. Black lacquer finish is available on request.

DOUBLE-TRIODE FOR AUDIO

The Radio Tube Division of *Sylvania Electric Products Inc.*, Emporium, Pa. has recently developed the 12AD7 double-triode, a 9-pin miniature tube that meets the need for a low-hum preamplifier in audio applications.

Hum level is less than 3 mv. (r.m.s.) on the plate of each triode when the tube is operated in a typical resistance-coupled amplifier circuit. This has been achieved by design features which include a reverse coil heater that helps cancel magnetic coupling.

The 12AD7 is a "premium" tube to the extent that it is so constructed and tested that hum specifications are guaranteed by the manufacturer.

CRESCENT RECORD CHANGER

Crescent Industries, Inc., 5900 W. Touhy Ave., Chicago 31, Illinois is currently marketing a new record changer, the "Corsair" C-607.

According to the company, the new changer is the only American changer

which plays and intermixes all record sizes in any sequence without selective stacking and automatic tone arm positioning.

Other innovations include an exclusive double-angle isolation drive which is said to make the unit virtually rumble-free, professional stylus pressure adjustments which help prolong record life by correcting stylus weight and position, and a silent change cycle with the firm's exclusive rubber cam design. A para rubber turntable mat keeps records clean, prevents static, and provides positive traction.

RCA TAPE RECORDER

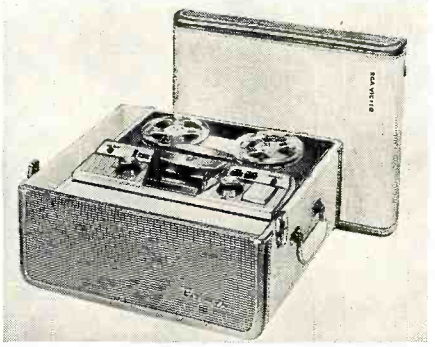
Production of a new high-fidelity tape recorder has begun at the Cambridge, Ohio plant of the *RCA Victor* radio and "Victrola" division.

The unit currently in production has been tradenamed the "Judicial" (Model 7TR3). It is a three-speaker, push-button portable that incorporates a number of new *RCA* engineering advances.

The recorder features a newly-designed amplifier that is perfectly matched to the magnetic head of the tape transport and the exclusive "voice-music" switch. This feature permits the selection of the best sound

characteristics for either voice or music recording. The amplifier has an undistorted output of two watts. Its three speakers include a 6½" woofer, and two 3½" tweeters.

The "Judicial" records and plays back at either 7.5 or 3.75 ips. It represents the first unit in what the company advises will be a complete line of tape recorders.



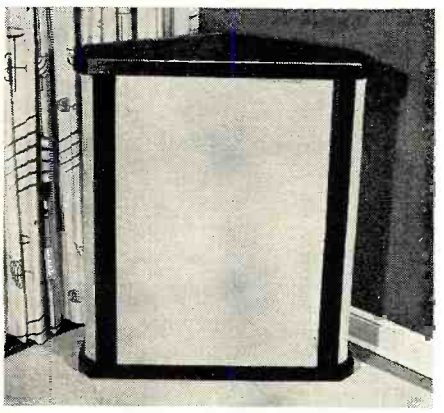
CORNER HORN SYSTEM

United Speaker Systems, 58 Schuyler Street, Belleville 9, New Jersey has just introduced a new corner horn speaker system which is being marketed as the "Premiere."

Frequencies between 30 and 800 cycles are reproduced by the rugged 15" low-frequency driver coupled to a dual-throat, 9 cubic-foot folded horn. Frequencies between 800 and 22,000 cps are handled by a heavy compression driver mounted to a rigid sectoral horn. Both speakers used in the enclosure were originally designed for theater use.

Crossover at 800 cycles is accomplished by a specially designed 12 db constant resistance parallel-type network using air-core coils and oil-filled capacitors.

The enclosure is 39" high, 33" wide, and 28¼" deep. It comes in genuine



walnut, mahogany, and korina woods. The grille cloth is made from loosely woven decorator fabrics which are available in a variety of shades. Write the company for a data sheet giving full details.

NEW TURNTABLE ARMS

Rek-O-Kut Company, 38-01 Queens Blvd., Long Island City 1, New York has announced a new pickup arm which is currently available in two versions for records up to 12" in di-

ameter (Model 120) and for 16" discs (Model 160).

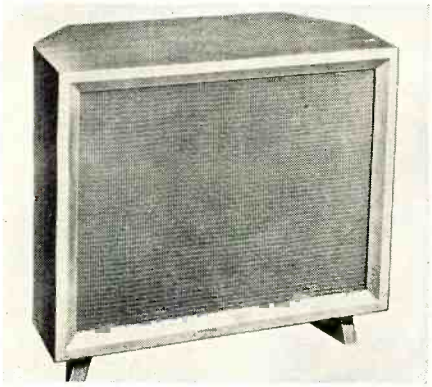
The arm proper is of tubular construction. The cartridge shell, made of die-cast aluminum, is attached to the arm by means of a bayonet-lock arrangement. A slight twist in one direction secures the shell to the arm while a twist in the other direction permits quick removal. This feature of rapid interchangeability was developed especially for users who prefer individual cartridges for standard and microgroove records. Cartridge shells are available separately as an accessory item.

E-V "EMPIRE" ENCLOSURE

Electro-Voice, Inc., Buchanan, Michigan now has an economy-type lowboy speaker enclosure available which will accommodate 15" single and two- and three-way systems.

Acoustically designed with built-in corner for use in a corner or flat against one wall, the "Empire" is designed to enhance the efficiency of 15" speaker systems (either coaxial or triaxial) or separate 15" two- or three-way systems. The enclosure employs two vertical parallel porting slots to extend and augment the lower bass range and improve musical balance.

The cabinet, which measures 29⅝" high, 32" wide, and 16" deep, is made



of hardwood veneers which are hand-rubbed on all exposed surfaces. The "Empire" is currently available in kit form, as a cabinet only, and complete with the speaker systems factory installed.

DISCS AND TAPE

Affton Industries, 8300 Flex-O-Lite Drive, St. Louis 23, Mo. has entered the field of recording media manufacturing with a complete line of discs and tapes.

The tape is available in either acetate or Mylar bases in all standard thicknesses and widths. Special tapes are available on a custom basis. A special insulating barrier between the base and oxide eliminates print-through from one layer of tape to another. This same barrier is said to make possible a more flat and curl-free tape.

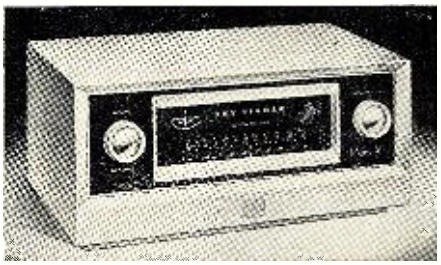
The full line of professional recording blanks includes sizes from 6½ through 17¼ inches. All popular thick-

nesses are offered and all discs are on aluminum bases. A new 7" 45 rpm instantaneous size comes complete with pressure labels and inserts.

Descriptive literature is available from Dept. A of the company.

FISHER FM TUNER

Fisher Radio Corporation, 21-21 44th Drive, Long Island City 1, New York



is now offering a new FM tuner, the Model FM-40.

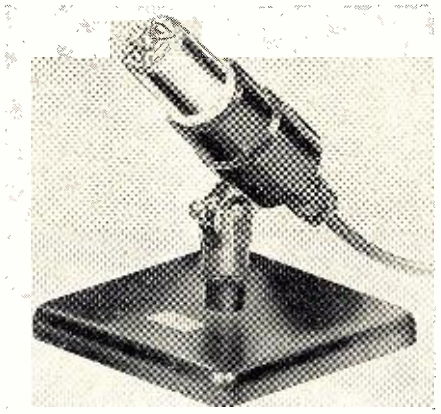
Among the features of this new unit are a tuning meter; sensitivity of 3 μv. for 20 db of quieting; uniform response ±1 db from 20 to 20,000 cps; two outputs (detector-multiplex and main audio); shielded and shock-mounted chassis; eight tubes; folded dipole antenna; flywheel tuning mechanism; and edge-lighted glass dial scale.

The chassis measures 12¾" wide, 4" high, and 8⅜" deep, including knobs. Cabinets for this unit are available (mahogany or blonde finishes) at additional cost.

HAND-SIZE MIKE

American Microphone Company, 370 S. Fair Oaks Ave., Pasadena, California is currently in production on a new hand-sized microphone which has been developed especially for audiophiles.

The microphone, D-300, has a frequency range of 40 to 15,000 cps, which makes it suitable for either high-quality recording or studio operations. The unit weighs six ounces and measures just 4⅜". It comes equipped with a *Cannon* XLR "quiet"



connector which eliminates annoying clicks and crackles when the microphone is carried.

QUAM WOOFERS

Quam-Nichols Co., Chicago speaker manufacturer, has announced the addition of two new low-frequency woofers to its line.

The 12A10L is especially designed to provide full-bodied, distortion-free reproduction of low tones. It can be used with the company's Model 3A15T or 5A15T tweeters. Frequency response is 40 to 5000 cps, ±5 db. Resonance point is 60 cps and voice coil impedance is 6-8 ohms. It will handle 10 watts.

The 15A104L has a frequency response of 30-5000 cps, ±5 db, resonance at 45 cps, voice coil impedance of 8 ohms, and power handling capacity of 10 watts.

RIBBON TWEETER

Ercona Corporation's Electronic Division, 551 Fifth Avenue, New York 17, New York is handling the U. S. distribution of a new British tweeter which provides good high-frequency response when used with a low- or medium-frequency speaker.

The "Kelly" ribbon unit features a diaphragm which consists of a special .0003" duralumin foil operating in an intense magnetic field. The a.c. current flowing through the foil causes a magnetic field to be generated which interacts with the permanent field, the resulting magnetic force being applied uniformly over the entire ribbon.

The tweeter has a power-handling capacity of better than 10 watts. High efficiency is assured between 3000 and 20,000 cps with considerable attenuation below 1000 cps. Dimensions are 8½" x 5½" x 4½" and the unit weighs 8 pounds.

SMALL TAPE SPLICER

Robins Industries Corp., 214-26 41st Avenue, Bayside 61, New York is now offering a smaller, lighter, and less expensive model of its tape splicer, known as the "Gibson Girl Junior."

Designed for carrying in pocket, purse, or equipment bag, the splicer cuts tape ends diagonally and trims the tape edges without use of scissors or razor blades. It produces a slightly narrow waist at the splice which prevents contact of the adhesive with recorder parts.

NEW TURNTABLE

Metzner Engineering Corporation, 1041 N. Sycamore Street, Hollywood 38, California has announced the development of a new center-drive turntable which retails in the moderate price class.

Tradenamed the "Starlight," the new turntable will handle all size records from the smallest home recordings to full size professional transcriptions. A built-in "pop-up" hub provides for standard 45 rpm records.

The drive motor is the conventional 4-pole type and is fully shielded to as-

(*Continued on page* 143)

ALLIED knight-kits

FINEST ELECTRONIC EQUIPMENT IN LOW-COST KIT FORM

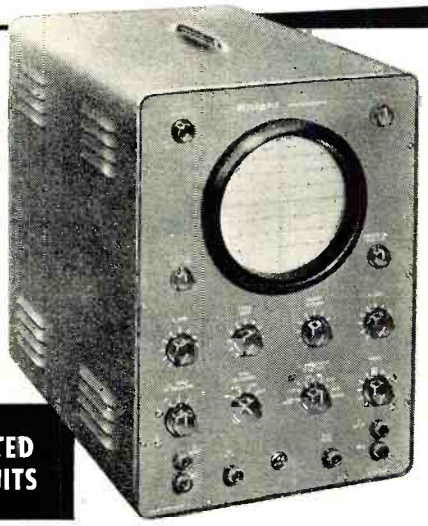
YOU SAVE MORE BECAUSE YOU BUY DIRECT

LOW COST—huge buying power and DIRECT SALE pass biggest savings on to you. You do the easy assembly and your built-up instrument is equal in appearance and performance to equipment selling for several times the KNIGHT-KIT price.

ADVANCED DESIGN—months of research, development and field testing go into each KNIGHT-KIT. And to assure top performance, premium quality parts are supplied throughout.

EASIEST ASSEMBLY—all chassis and panels are punched for accurate assembly; all parts are fully identified. Instruction manuals are a marvel of simplicity and clarity, featuring "Step-and-Chek" assembly, "King-Size" diagrams and "Spotlight" pictorials. For easy assembly you need only a soldering iron, pliers and screwdriver.

ALLIED—the reliable name in Electronics—gives you the greatest value in KNIGHT-KITS through the economies of DIRECT SELLING



PRINTED CIRCUITS

knight-kit PRINTED CIRCUIT VTVM KIT

Model F-125

$24.95

New, extremely stable, highly accurate VTVM. Greatly simplified wiring—entire chassis is a printed circuit board. Features maximum convenience in arrangement of scales and controls. With peak-to-peak scale for FM and TV work. Ranges: AC peak-to-peak volts, 0-4-14-40-140-400-1400-4000; AC rms volts and DC volts, 0-1.5-5-15-50-150-500-1500; ohms, 0-1000, 10K, 100K; 1-10-100-1000 megs; db scale, —10 to +5. Response, 30 cps to 3 mc. Uses low-leakage switches and 1% precision resistors. Balanced-bridge, push-pull circuit permits switching to any range without adjusting zero set. 4½" meter, 200 microamp movement. Polarity reversing switch. Input resistance, 11 megs. Complete kit, ready to assemble. Shpg. wt., 6 lbs.

Model F-125. Printed Circuit VTVM Kit. Net only..... **$24.95**
Model F-126. Hi-Voltage Probe; extends DC range to 50,000 Volts. Net..... **$4.75**
Model F-127. Hi-Frequency Probe; extends AC range to 250 mc. Net..... **$3.45**

Model F-144

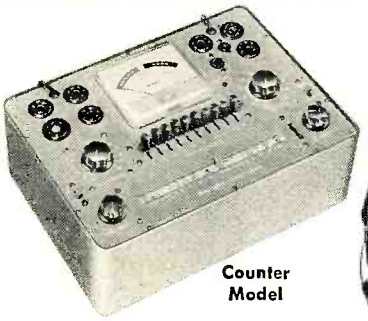
$69.00

$6.90 down, 12 months to pay balance

knight-kit WIDE-BAND 5" OSCILLOSCOPE KIT

Wide-band 5" Oscilloscope equal or superior to commercially-wired 'scopes costing several times the price. Vertical response from 5 cycles to 5 mc—ideal for the professional laboratory, for color TV servicing, and high frequency applications. Response —1 db at 3.58 mc; —3 db at 5 mc. Two printed circuit boards and laced wiring harness reduce assembly time. Has very wide sweep range—from 15 to 600,000 cps. Locks in frequencies as high as 9 mc. High vertical sensitivity of 25 rms millivolts/inch. Input capacitance 36 mmf. Outstanding features: cathode-follower vertical and horizontal inputs; 1400 volts at 2nd anode provides high-intensity trace; push-pull vertical and horizontal amplifiers; positive and negative locking; faithful square wave response; frequency-compensated input attenuator; Z-axis input for intensity modulation; one volt peak-to-peak calibrating voltage; internal astigmatism control; blanking circuit to eliminate retrace lines; DC positioning control. Complete with all tubes and parts, ready for easy assembly. Handsome professional case finished in blue, with gray control panel. Shpg. wt., 40 lbs.

Model F-144. 5" Oscilloscope Kit. Net only..... **$69.00**
Model F-148. Demodulator Probe. Net..... **$3.45**
Model F-147. Low Capacity Probe. 12 mmf. Net..... **$3.45**



Counter Model

Portable Model

knight-kit TUBE TESTER KIT

An Outstanding Value

Model F-143

$29.75

Expertly designed, up-to-date, ideal for the laboratory or service shop. Remarkably low priced, yet it offers high accuracy, top versatility and convenience. Illuminated roll chart lists over 700 tube types. Features provision for testing 600-ma tubes; roll-chart includes data for all popular series-string types. Tests 4, 5, 6 and 7-pin large, regular and miniature types, octals, loctals, 9-pin miniatures and pilot lamps. Tests for open, short, leakage, heater continuity and quality (by amount of cathode emission). 4½" square meter with clear "GOOD—?—REPLACE" scale. With line-voltage indicator and line-adjust control. Choice of 14 filament voltages from .63 to 117 volts. Blank socket for future type tubes. Universal-type selector switches for any combination of pin connections. Single-unit, 10-lever function switch simplifies assembly. Complete kit, ready for easy assembly. Shpg. wt., 14 lbs.

Model F-143. Counter Model Tube Tester Kit. Net only..... **$29.75**
Model F-142. As above, but with carrying case. Net only... **$34.75**
Model F-141. TV Picture Tube Adapter for above. Net only. **$3.75**

ALSO AVAILABLE: Refer to your 324-page 1956 Allied Catalog for dozens of other KNIGHT-KIT values, including 20,000 Ohms/Volt VOM, Signal Generator, Audio Generator, Resistor-Capacitor Tester, Signal Tracer, Resistance and Capacitance Substitution Boxes. Additional test instrument kits appear on the next page, followed by famous Hobbyist, Ham and Hi-Fi KNIGHT-KITS.

EASY PAYMENT TERMS: If your total kit order comes to over $45, take advantage of our liberal Time Payment Plan—only 10% down, 12 full months to pay. Write for application form.

Order from ALLIED RADIO
100 N. WESTERN AVE., CHICAGO 80, ILLINOIS

SEE FOLLOWING PAGES

ALLIED knight-kits...Top Quality

knight-kit IN-CIRCUIT CAPACITOR CHECKER KIT

SAVE UP TO 70%

Model F-119

$11.65

SUPER-VALUE

Tests capacitors while they are still wired in the circuit! Saves time and trouble. Just press a button and the "magic eye" instantly shows opens and shorts. Checks practically any bypass, blocking, coupling and filter capacitors for opens or shorts. Tests for opens can be made on any capacitor of 20 mmf or greater, even when capacitor is in parallel with resistance as low as 50 ohms. Tests for opens on any capacitor up to 2000 mfd, even when shunted by as low as 20 ohms. Housed in professionally styled case, sturdy steel in blue wrinkle finish with gray control panel. Complete kit, ready for easy assembly. Shpg. wt., 5 lbs.

Model F-119. Capacitor Checker Kit. Net only **$11.65**

knight-kit VOM KIT

1000 Ohms/Volt

Model F-128

$15.95

Exceptional accuracy and versatility at amazing low cost. Ideal for service shop, lab and Amateur use. Uses 4½" meter (400 microamp movement) with separate scales for AC voltage and current, DC voltage and current, decibels and resistance. 38 ranges include: AC, DC and Output volts, 0-1-5-10-50-100-500-5000 (1000 ohms/volt sensitivity); Resistance, 0-1000-100,000 ohms and 0-1 meg.; Current, AC or DC, 0-1-10-100 ma and 0-1 amps; Decibels, —20 to +69 in 6 ranges. Uses 1% precision resistors. 3-position function switch and 12-position range switch. Complete kit with bakelite case, battery and test leads. Shpg. wt., 2½ lbs.

Model F-128. 1,000 ohms/volt VOM Kit. Net only **$15.95**

EASY PAYMENT TERMS:

If your total kit order comes to over $45, take advantage of our liberal Time Payment Plan —only 10% down, 12 full months to pay. Write for application form.

FAMOUS knight-kits FOR HOBBYISTS

"SPACE-SPANNER" RECEIVER KIT

Model S-243 Featuring Bandswitching for Thrilling Short Wave and Broadcast Reception. All-new 2-band receiver—easy to build—a great value! Pulls in thrilling short wave including amateur, aircraft, police and marine radio (6 to 17 mc), and standard broadcast. Features special highly sensitive regenerative circuit. Has 4" PM speaker and beam-power output tube for plenty of volume. Kit includes calibrated panel, punched chassis, all parts and tubes, detailed instructions (less wire and solder). 7 x 10½ x 6"; for 110-120 v. 50-60 cycles AC or DC. Shpg. wt., 4½ lbs.

$13.95

Model S-243. "Space-Spanner" Kit. Net Only (less cabinet) **$13.95**

S-247. Matching cabinet for above **$2.85**

GEIGER COUNTER KIT

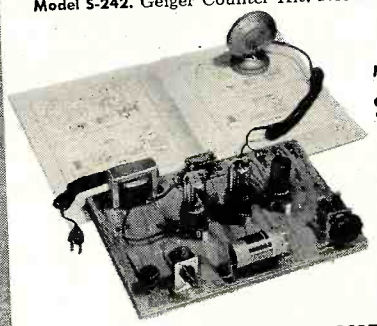
Super-sensitive Uranium Locator and Radioactivity Detector. Get started in uranium prospecting now with this extremely sensitive instrument—comparable to costly equipment, yet easy to build at only a fraction of the price. Just turn it on, flip the high-voltage switch and listen to the clicks in the headphone when you hit a radioactive source. Uses low-cost long-life batteries. Kit includes all parts, tubes, carrying case with shoulder strap, 22½ and 1½ v. batteries, headphone, AEC prospecting booklet, radioactive sample and complete assembly instructions. Shpg. wt., 2½ lbs.

Model S-242

$15.95

Model S-242. Geiger Counter Kit. Net only... **$15.95**

FAMOUS 10-IN-1 LAB KIT

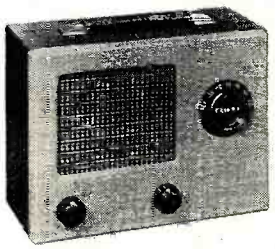


Model S-265 Build Any One of 10 Fascinating Projects. Instructive and fun to build. Construct a sensitive Broadcast Receiver; Amplifier (for phono or mike); Wireless Phono Oscillator; Home "Broadcast Station"; Code Practice Oscillator; Capacity-Operated Relay or any one of four other fascinating projects. Kit includes mounting board, special "safety designed" low voltage power transformer, tubes, all parts, microphone, 12-page builder's manual (less wire and solder). For 110-120 v. 50-60 cycles AC. Shpg. wt., 10 lbs.

$12.45

Model S-265. "10-in-1" Kit. Net only..... **$12.45**

PORTABLE RADIO KIT



Powerful 3-Way Operation. Top-quality, portable AM receiver for AC, DC or battery operation. Tunes full broadcast band, 535-1650 kc. Features sensitive superhet circuit; 5" PM dynamic speaker; built-in loop-stick antenna; automatic volume control; handsome carrying case. Complete with all parts, tubes and easy-to-follow instructions (less wire, solder and batteries). For 110-120 v., 50-60 cycle AC, DC, or batteries. Shpg. wt., 6 lbs.

Model S-730

$19.95

Model S-730. Portable Radio Kit. Net only . **$19.95**

S-651. Battery Kit for above. Net..... **$2.40**

TRANSISTOR RADIO KIT

Model S-765

$3.95

Printed Wiring—Works From Flashlight Cell. Experiment with the marvel of transistors in this printed-circuit radio. No tubes—no crystal! Small enough to fit in the palm of the hand—yet it provides powerful reception over the complete AM broadcast band. Operates from single flashlight cell. For use with headphones. Printed circuit eliminates wiring—just assemble and solder a few connections! Supplied complete with all parts, hardware, battery, and easy-to-follow instructions. Less solder, antenna and headphone. Shpg. wt., 8 oz.

$3.95

Model S-765. Transistor Radio Kit. Net only **$3.95**

RECEIVER KIT ACCESSORIES

J-149. 4000 ohm extra-sensitive double headset. Net..... **$1.98**

C-100. Antenna kit for use with all Knight-Kit receivers. Net..... **$1.05**

BUY WITH CONFIDENCE • BUILD WITH CONFIDENCE

- Advanced Electronic Design
- Precision Quality Performance
- Professional Streamlined Styling
- Premium Quality Components
- Crystal-Clear Instruction Manuals
- "Step-and-Chek" Building Method

BUY DIRECT • YOU SAVE MORE • YOU GET MORE FOR YOUR KIT DOLLAR

All Prices Net F.O.B. Chicago

Order from ALLIED RADIO 100 N. WESTERN AVE., CHICAGO 80, ILL.

Easiest-to-Build Electronic Equipment in Kit Form

BUY DIRECT AND SAVE!

LOW-COST HAM GEAR

knight-kit

50 WATT CW TRANSMITTER KIT

Model SX-255

$42.50

Built-in Pi-Type Antenna Coupler

Check the features packed into this new transmitter kit and you'll see why it's one of the greatest Amateur values ever offered. Compact and versatile, it is the perfect low-power rig for the beginning Novice or seasoned veteran. Features: 50 watts input to 807 final; high-efficiency 6AG7 modified-Pierce oscillator takes crystal or VFO without circuit changes; bandswitching coverage of 80, 40, 20, 15, 11-10 meters; pi-section antenna output matches line impedances from 50 to 1200 ohms—permits use with any type of antenna. Crisp, clean, cathode keying of oscillator and final. Power take-off plug supplies filament and B-plus voltages for other equipment. Copper-finished chassis and cabinet interior, filtering, shielding, bypassing, and coaxial SO-239 antenna connector provide excellent TVI suppression. Meter reads either plate or grid current of final. Jacks for VFO, crystal, and key. Supplied with all parts, tubes and step-by-step instructions. Less crystal and key. Size, 8 1/16 x 11 1/16 x 8 3/4". For 110-120 volts, 50-60 cycle AC. Shpg. wt., 18 lbs.

SX-255. 50-Watt Transmitter Kit. Net..... **$42.50**

knight-kit

SELF-POWERED VFO KIT

Model S-725

$27.50

Complete with built-in power supply! Careful design and voltage regulation assure high stability. Excellent oscillator keying characteristic for fast break-in without clicks or chirps. Full TVI suppression. Has plenty of bandspread: separate calibrated scales for 80, 40, 20, 15, 11 and 10 meters; vernier drive mechanism. 2-chassis construction keeps heat from frequency determining circuits. Output cable plugs into crystal socket of transmitter. Output on 80 and 40 meters. With Spot-Off-Transmit switch for "no swish" tuning. Extra switch contacts for operating relays and other equipment. Complete kit for easy assembly. Shpg. wt., 8 lbs.

Model S-725. Self-Powered VFO Kit. Net.. . **$27.50**

knight-kit

CODE PRACTICE OSCILLATOR KIT

Model S-239

$3.95

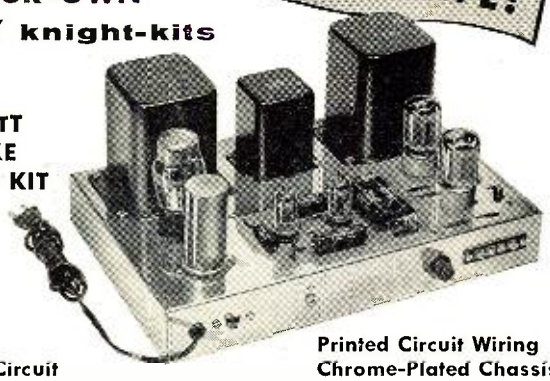
Transistorized—Powered by Flashlight Battery

An ideal new code practice oscillator. Uses transistor circuit. Extremely low current consumption—powered by single penlight battery. Provides crisp, clear tone (400 to 600 cps). Has input jack for earphone; screw-type terminal strip for key. In compact bakelite case (2 3/8 x 3 3/4 x 1 1/2") with anodized aluminum panel. Complete with all parts, battery and easy-to-follow instructions. Shpg. wt., 1 lb.

Model S-239. Code Practice Oscillator Kit ... **$3.95**

ORDER TODAY →

BUILD-YOUR-OWN HIGH FIDELITY knight-kits



knight-kit

BASIC 25-WATT LINEAR-DELUXE HI-FI AMPLIFIER KIT

Model S-755

$41.50

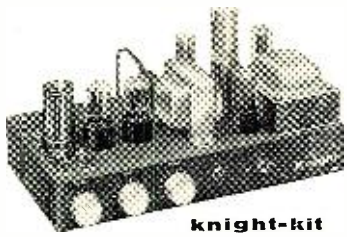
Custom Quality Williamson-type Circuit

Printed Circuit Wiring Chrome-Plated Chassis

Designed to satisfy the most critical listener. Intended for use with tuners incorporating built-in preamp or with separate preamp. Uses latest Williamson-type circuit. Has potted, matched transformers. Output: Maximum, 45 watts; rated, 25 watts. Frequency response: ±0.5 db, 10 to 120,000 cps, *measured at 20 watts*. Harmonic distortion is only 0.15% right up to 30 watts. Intermodulation is only 0.27% at 17 watts and only 1% at 20 watts, using 60 cps and 7 kc, 1:4 ratio. Hum level is 85 db below rated output. Output impedance, 4, 8, 16 ohms. Uses two 12AU7's, two 5881's, and a 5V4. Printed circuit is utilized in voltage amplifier and phase inverter stages. Has output tube balancing control, variable damping control, and on-off switch. Handsome chrome-plated chassis, 14" x 9" x 2". Overall height, 7". Complete with all parts, tubes and construction manual (less wire and solder). Shpg. wt., 27 lbs.

Model S-755. Basic 25 watt Hi-Fi Linear-Deluxe Amplifier Kit. Net..... **$41.50**

Model S-706. Knight Preamplifier-Equalizer. Ideal for use with above amplifier. Provides 5 selectable inputs. Completely wired—ready to use. Net..... **$36.95**



knight-kit

10-WATT HI-FI AMPLIFIER KIT

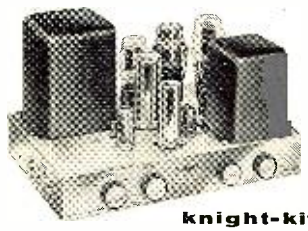
Model S-234

$22.95

Famous for wide response and smooth reproduction at low cost. Only 0.5 volt drives amplifier to full output. Response: ±1 db, 30-20,000 cps at 10 watts. Harmonic distortion less than 0.5% at 10 watts. Intermodulation is less than 1.5% at full output. Controls: On-off-volume, bass, treble. Input for crystal phono or tuner. Chassis punched to take preamp kit for magnetic cartridges. Matches 8 ohm speakers. Shpg. wt., 14 lbs. Complete kit (less wire and solder).

Model S-234. Amplifier Kit. Net. **$22.95**

Model S-235. Preamp Kit for above. Net..... **$2.75**



knight-kit

20-WATT HI-FI AMPLIFIER KIT

Model S-750

$35.75

True hi-fi for less! Response, ±1 db, 20 to 20,000 cps at 20 watts. Distortion, 1% at 20 watts. Hum and noise level: Tuner input, 90 db below 20 watts; magnetic phono, 72 db below 20 watts. Sensitivity: Tuner input, 0.6 volt for 20 watts output; magnetic phono, .007 volts. 4 inputs: Magnetic phono, microphone, crystal phono or recorder, and tuner. Controls: Bass, Treble, Volume, Selector with compensation positions for 78 and LP records. Chrome-plated chassis. Wt., 23 lbs. Complete kit (less wire and solder).

Model S-750. 20-Watt Hi-Fi Amplifier Kit. Net..... **$35.75**

ALLIED RADIO

Everything in Electronics from One Reliable Source

OUR 35TH YEAR

Allied Radio Corp., Dept. 1-D-6
100 N. Western Ave., Chicago 80, Ill.

Ship me the following KNIGHT-KITS:

Quantity	Description	Model No.	Price

$..... enclosed. For parcel post include postage (express is shipped collect).

☐ Send FREE 324-Page ALLIED Catalog listing the complete Knight-Kit line.

Name_____

Address_____

City_____ Zone____ State_____

Eavesdropping on the O P S

By **R. W. JONES**

There are as many "tall ones" in the radio operating game as ever came out of Texas. Here are a few that may be new!

PERHAPS it is the mid-watches of radio operating that brings out the stories. That's where I heard most of these: during those early morning hours when the traffic is thin but the coffee and conversation are thick. I can't vouch for the veracity of these stories, but I won't disbelieve them because in every case each of these stories was related in my presence by a radio operator who was there, or knew someone who was there, or knew someone who knew someone who was there. And you can't dispute such positive evidence.

Some say that copying code drives people crazy. Perhaps it does. St. Elizabeth's has one case who sits all day wearing earphones that are plugged into an empty cigar box. The doctors and attendants humored the "on watch" radioman and thought that it was one way to placate him. He was quiet—in fact he insisted on quiet in the radio shack—but he wouldn't leave for chow unless someone else took over the watch: earphones, cigar box, and log.

I have heard of men throwing typewriters against walls and any operator with any time in front of a mill has seen operators talking to themselves and banging fists on table tops.

When conversing with radiomen it is best not to point your story with reference to the "Message to Garcia." Such a reference will bring a chorus of "Who sent it? What's the number on it? If it's lost it didn't come in on my watch."

The story of the cut zero and the 100,000 loaves of bread must be true. I have heard it so often in so many different places. Operators use short cuts to shorten transmission time and one of these dodges—as we all know—is to send one dash instead of five dashes for a zero. One Army operator who habitually used one dash for a zero reported for duty at a large radio station in Alaska. His first operating assignment was on a circuit that held schedules with small weather stations in the back country. His first message was from a one-man station: a message requesting a shipment of food and supplies for the coming winter. The message requested, among other things, 10 loaves of bread. The transmitting operator sent five dashes for his zero. The receiving operator copied it as five separate zeros and soon 100,000 loaves of bread—a 500 year supply—were on their way to the one-man station.

At least four times during the past twenty years someone has proposed a "new" method of thwarting intercept stations. This method utilizes two transmitters: one for dots, one for dashes. The dot contact of the bug is connected to one transmitter, the dash contact connected to the other. Dots on one frequency, dashes on another. Tune it in on two receivers. I have heard people claim they have operated such devices; I have heard others claim they copied such circuits. I have never seen nor heard such a system and don't believe it's practical.

I knew one Navy radioman who told me of his telegraphing days with Western Union when he copied most of his traffic on the speakeasy wall above the telephone. This thirsty telegrapher was in charge of a one-man telegraph office and his messenger boy—in addition to his bicycling duties—knew when to hold the telephone near the sounder so the boss, in the neighborhood speakeasy, could hear and copy messages addressed to his office. The telegrapher, comfortably ensconced in the "speak," would then read the message over the phone to the messenger boy who typed it on a blank and delivered it. I personally know this operator. I have seen him operate and I have seen him drink. I believe this story.

Before the days of radar, shore-based radio direction finder stations guided ships into fog shrouded harbors. Two or three D/F stations would take bearings on a radio signal from a ship and plot the ship's position. A series of positions, or fixes, could be used to guide a ship into the harbor.

No special equipment was required by the ship. Any ship with a transmitter and receiver could use the U. S. Navy-operated service. A ship, after requesting a fix, would be directed to send a series of MO's and the shore stations would take the bearings necessary for plotting a position. The letters MO were used because they made a total dash combination (— — — — —) and, hence, better bearings.

One merchant ship captain, trying to make San Francisco in a dense fog, had his radio operator call the shore D/F stations for a fix. The shore station told him to send MO's. The shore stations took their bearings, calculated the merchant ship's position, and transmitted the information back to the ship. The ship's operator yelled the position up the voice tube to a worried captain on the bridge.

The captain consulted his charts, grumbled to himself, and yelled back to the ship's operator. "Call that idiot on the beach and tell him his fix puts us in the Mark Hopkins Hotel."

The voice tube answered, "Aye, aye, Captain."

Sparks translated his captain's words into dots and dashes and sent them to the shore Navy operator.

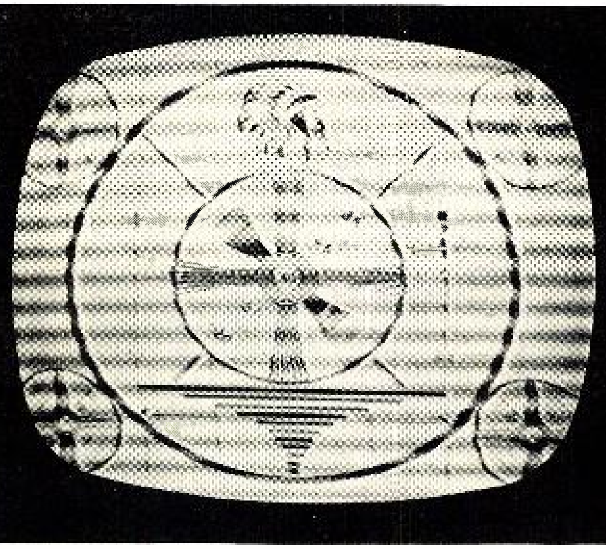
The captain paced his bridge like a caged tiger, ground his teeth, and nibbled his fingernails, all the while fruitlessly peering into the all-enveloping fog.

The frequency was quiet. Then the Navy operator answered.

"Send some more MO's and I'll give you a room number." —30—

how long would it take you to solve this service problem?

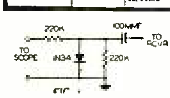
SYMPTOM: Sound bars in the picture. Bars vary in intensity and position according to the audio being transmitted. Need for alignment has been established.

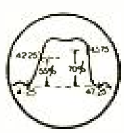


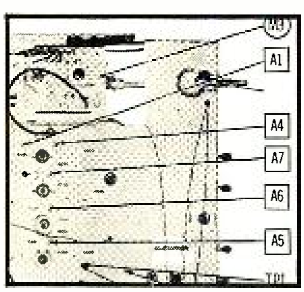
Valuable time can be spent searching for alignment points, adjustments and frequencies if you are relying on hit-or-miss methods or incomplete service data. With a PHOTOFACT Folder by your side you have all the information in just minutes. Here's why:

ALIGNMENT INSTRUCTIONS

SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
to loose end from grid of tube. Low chassis.	43.5MC (10MC Swp.)	41.25MC 42.25MC 45.75MC 47.25MC	Between any two channels	Vert. amp. thru detector (Fig. 1) to pin 5 (plate) of 6CB6 (V3). Low side to chassis	A1, A2, A3, A4	Adjust for response curve similar to Fig. Adjust A1 to place 41.25MC marker in trap notch. Adjust A2 to place 47.25MC in trap notch. A3 to place 42.25MC marker on frequency side of curve. A4 to place 45.75 at 70% on high frequency side of response curve
"	Not used	44.0MC Unmod.	"	Use VTVM DC probe to point (A). Common to chassis.	A5	Adjust for maximum deflection.
"	"	42.35MC	"	" "	A6	•







In just seconds, you find the complete Alignment Instructions. It's in *every* PHOTOFACT Folder, in the form of an easy-to-use chart*, with step-by-step instructions. It gives frequencies, adjustments, connection points for oscilloscope or VTVM, dummy antenna and detectors required, and oscilloscope response curves with marker frequencies and placement. Whenever possible, instructions are given for using either an oscilloscope or a VTVM.

Adjustments called for in the alignment chart are readily located by reference to chassis photographs* with call-outs keyed to alignment chart and Standard Notation Schematic*. In minutes, you make the video IF alignment and eliminate the sound bars.

SERVICING IN THE FIELD

SOUND IF DETECTOR BUZZ ADJUSTMENT

To eliminate sound IF detector buzz, adjust the ratio detector secondary slug (A11) located on top of chassis. (See tube placement chart).

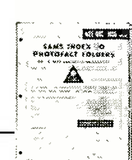
To eliminate the buzz, you can either follow the alignment chart for a complete sound IF alignment or, as advised in the Field Servicing notes on this model, merely adjust the ratio detector, A-11. For speedy reference to this adjustment as well as to other service adjustments and picture tube removal or safety glass cleaning, see the Servicing In the Field* notes. They save you even more time.

From start to finish, you solve your service problems in just minutes... you service more sets and earn more daily with PHOTOFACT by your side!

MONEY BACK GUARANTEE!

Got a tough repair? Try this—at Howard W. Sams' own risk: see your Parts Distributor and buy the proper PHOTOFACT Folder Set covering the receiver. Then use it on the actual repair. If PHOTOFACT doesn't save you time, doesn't make the job easier and more profitable for you, Howard W. Sams wants you to return the complete Folder Set direct to him and he'll refund your purchase price promptly. GET THE PROOF FOR YOURSELF—TRY PHOTOFACT NOW!

free



Send for Sams' INDEX TO PHOTOFACT FOLDERS—your guide to virtually any receiver model ever to come into your shop; helps you locate the proper PHOTOFACT Folder you need to solve any service problem on any model. You'll want this valuable reference guide. Send coupon now.

*One of 32 features found exclusively in PHOTOFACT—the world's finest service data covering over 20,000 TV and radio models

HOWARD W. SAMS & CO., INC.

Howard W. Sams & Co., Inc.
2203 E. 46th St., Indianapolis 5, Ind.

☐ Send FREE Index to PHOTOFACT Folders
☐ I am a Service Technician

Name ____________________

Address ____________________

City ____________ Zone ____ State ____

New Tube Tester Data

LISTED here are the settings for the Weston tube tester model 981 type 3, for the new tubes that have been made available by tube manufacturers since the Weston Electrical Instrument Corp. of Newark 5, N. J. issued its last roll chart for this tester. This information will allow you to test these new tubes on your Weston.

A completely revised roll chart including most of the new tubes is available from Weston. In addition, the company is releasing supplementary data in the form of looseleaf pages to its registered customers without charge.

The Accessory Division of the Philco Corp., A Street and Allegheny Avenue, Philadelphia 34, Pa., regularly prepares technical bulletins listing the new tube settings for its models 7052 and 9100 dynamic mutual-conductance tube testers. These are available to customers free of charge. The most-recent completely revised roll chart for these testers was issued in August 1955, and may be obtained from Philco for a nominal charge.

WESTON MODEL 981, TYPE 3

Tube Type	Fil.	Mult.	Bias	Selectors	Sens.	Ep	Rej. Pt.	Remarks
0G3	13	VR	....	31313-0100	..	G	....	Firing lim 83 to 125v.; 2.0v. Reg, fil. 13 to 27.5v.
4K6	5	2	46H	07345-0610	44	F	1360	
5AM8	5	8	17L	15476-3002	37	F	1140	X4.
	5	D	....	00076-0130	36	A	....	
6AM8	5	8	17L	15476-3002	37	F	1140	X4.
	5	D	....	00076-0130	36	A	....	
6AU8	6.3	4	10L	15376-1000	32	D	1050	Tr; X3.
6AX7	6.3	2	20L	35177-PG'K6	47	F	1050	P, G, K, & P2 G2 K2
6CG7	6.3	4	18H	531G'P-K760	44	F	810	P, G, K, & P2, G2 K2; X2
6CH7	6.3	8	20L	35176-PG'K0	47	D	1300	P, G, K, & P2 G2 K2; X3.
6CN7	6.3	2	26L	00076-1530	44	F	780	
	6.3	D	....	3P176-0000	37	A	....	P, & P2
6DE6	6.3	8	21L	51763-4200	45	D	1000	X4.
6K4	6.3	4	35L	35761-0000	40	D	1100	X2.
19AU4	19	R	....	00103-0760	24	E	....	
5763	6.3	4	20H	30276-415G	34	F	1150	G, 862; X4.
5897	6.3	8	12L	50701-6030	44	C	950	X4.
6095	6.3	2	29H	51763-4G00	28	F	1330	G, & 62; X2.
6660	6.3	4	10L	52763-4100	33	C	960	X3.
6661	6.3	4	11L	51763-4200	40	C	1100	X2.
6663	6.3	D	....	K3761-2P00	36	A	....	P, K, & P2 K2.
1X2A/B		D			38			
6D6	6.3	2	30L	73421-6000	44	C	1050	Grid Cap.

PHILCO MODEL 7052 and 9100

Tube Type	Fil.	R-G	Bias	Fil.	Fil.	G.	P.	Sc.	C.	Su.	Press	Gm	Notes
1AG5	1.1	39	0	E	W	0	3	0	0	0	P1	....	Diode Sect.
1AG5	1.1	0	19	E	W	5	1	2	0	0	P1 with P4	250	Pentode Sect.
1AH4	1.1	18	12	D	V	4	1	2	0	0	P1 with P4	375	
1AJ5	1.1	0	10	E	W	5	1	2	0	0	P1 with P4	375	Pentode Sect.
1AJ5	1.1	45	0	E	W	0	3	0	0	0	P1	....	Diode Sect.
5BE8	5.0	82	5	E	V	9	6	7	8	0	P4	2200	Pentode Sect.
5BE8	5.0	91	15	E	V	1	2	0	3	0	P4	5000	Triode Sect.
5Y3*	5.0	15	0	H	R	0	6	0	0	0	P3	....	Plate No. 1
5Y3	5.0	15	0	H	R	0	4	0	0	0	P3	....	Plate No. 2
6AS7	6.3	79	100	J	X	4	5	0	6	1	P4	2080	Triode No. 1
6AS7	6.3	79	100	J	X	2	1	0	3	5	P4	2080	Triode No. 2
6AZ5	6.3	80	0	D	W	0	8	0	7	0	P1	....	Diode No. 1
6AZ5	6.3	80	0	D	W	0	1	0	2	0	P1	....	Diode No. 2
6CM7	6.3	81	20	E	V	7	6	0	3	0	P4	2300	Triode No. 1
6CM7	6.3	82	29	E	V	8	1	0	9	0	P4	2400	Triode No. 2
6DG6	6.3	89	41	J	R	5	3	4	7	0	P4	3450	
6DQ6	6.3	87	52	J	R	5	0	4	7	0	P4	3100	Cap=P
12AB5	12.6	75	39	E	V	3	9	1	7	0	P4	1760	
12CR6	12.6	71	9	J	R	7	5	6	3	0	P4	1600	Pentode Sect.
12CR6	12.6	51	0	J	R	0	2	0	3	0	P1	....	Diode Sect.
12DQ6	12.6	87	52	J	R	5	0	4	7	0	P4	3100	Cap=P
25DN6	25.0	82	67	J	R	5	0	7	3	0	P4	2480	Cap=P
25DQ6	25.0	87	52	J	R	5	0	4	7	0	P4	3100	Cap=P
50BK5	50.0	91	0	E	V	3	1	8	6	0	P4	5600	
X-155	6.3	88	18	E	V	7	6	0	8	9	P4	3000	Triode No. 1
X-155	6.3	88	18	E	V	2	1	0	3	9	P4	3000	Triode No. 2

*Revised data

The book that Launched Thousands of Careers is yours FREE

TELLS HOW YOU CAN BE SUCCESSFUL IN RADIO-TV-ELECTRONICS

Send for Your Free Copy Today!

YOU CAN PLOD ALONG for years, getting a paltry increase now and then, enjoying little security, finding your work dull and drab.

Then something happens. Things look up. You become more confident. Your earnings rise. You feel more important.

"Luck," some may say.

"Contacts," others may suggest.

But in your heart, you will know the answer: "Training." And it all may have started the moment you filled out a coupon requesting a copy of a free booklet named "Your Future in the New World of Electronics." From this data you get knowledge of where you stand in Electronics. Tremendous expansion leaves this gigantic industry pleading for trained men. Top manufacturers sold billions of dollars worth of electronic merchandise in 1955. By 1960, the radio-electronics industry should do no less than 15 billion dollars per year, not counting military orders.

Today, there are over 118,000 radio-equipped police cars; over 92,000 radio-equipped taxis; over 30,000 civilian planes have radio; nearly 50,000 American ships have radio.

Today, there are over 132,000,000 radios in use. There are 38,000,000 TV sets and 477 TV stations in operation. Color TV is coming into high gear. Countless positions must be filled—in development, research, design, production, testing and inspection, manufacture, broadcasting, telecasting and servicing. To fill these posts, trained men are needed—men who somewhere along the line take time to improve their knowledge, their skills. Men who, today, perhaps, take two minutes to send for a booklet.

"Your Future in the New World of Electronics" shows you how CREI Home Study leads the way to greater earnings through the inviting opportunities described above.

However, CREI does not promise you a "snap." With an accredited technical school such as this, you must *study* to convert your ambition into technical knowledge you can sell in the fabulous Electronics market.

Since its founding in 1927, CREI has provided thousands of professional radio men with technical educations. During World War II CREI trained thousands for the Armed Services. Leading firms choose CREI courses for group training in electronics, at company expense, among them United Air Lines, Canadian Broadcasting Corporation, Trans-Canada Airlines, Douglas Aircraft Co., Columbia Broadcasting System, All-American Cables and Radio, Inc., and Radio Corporation of America.

CREI courses are prepared by recognized experts, in a practical, easily understood manner. You get the benefit of time-tested materials, under the personal supervision of a CREI Staff Instructor, who *knows* and *teaches* you what industry wants. This is accomplished on your own time, during hours selected by you, and controlled by your own will power. This complete training is the reason that graduates find their CREI diplomas keys-to-success in Radio, TV and Electronics. CREI alumni hold top positions in America's leading firms. At your service is the CREI Placement Bureau, which finds positions for advanced students and graduates. Although CREI does not guarantee jobs, requests for personnel far exceed current supply.

Now is the time of decision for you. Luck will not propel you forward unless it finds you trained. Contacts won't budge you an inch unless you have the skill to back them up. The answer is: Technical Training . . . and willingness to learn. Together they will bring you increased earnings in this new Age of Electronics. Fill out the postage-free reply card and mail it now. We'll promptly send you your free copy of "Your Future in the New World of Electronics." The rest—your future—is up to you.

MAIL THIS POSTAGE-FREE POSTCARD TODAY

CAPITOL RADIO ENGINEERING INSTITUTE

Accredited Technical Institute Curricula

3224 16th St., N.W., Washington 10, D. C.

(R. N. Apr. 1956) **BA**

Please send me your course outline and **FREE** Illustrated Booklet "Your Future in the New World of Electronics" . . . describing opportunities and CREI home study courses in Practical Electronics Engineering.

CHECK FIELD OF GREATEST INTEREST
- ☐ Practical Radio Electronics Engineering
- ☐ Broadcast Radio Engineering (AM, FM, TV)
- ☐ Practical Television Engineering
- ☐ Practical Aeronautical Electronics Engineering

Name_____ Age_____

Street_____

City_____ Zone____ State_____

To help us answer your request intelligently, please give the following information:

EMPLOYED BY_____

TYPE OF PRESENT WORK_____

SCHOOL BACKGROUND_____

ELECTRONICS EXPERIENCE_____

IN WHAT BRANCH OF ELECTRONICS ARE YOU MOST INTERESTED?_____

MAIL THIS POSTAGE-FREE POSTCARD TODAY

See Our Ad On The Next Page

CREI prepares you quickly for Success

in

- ☑ BROADCASTING
- ☑ TELEVISION
- ☑ MANUFACTURING
- ☑ COMMUNICATIONS
- ☑ SERVICING
- ☑ AERONAUTICAL ELECTRONICS

The future is in your hands!

The signs are plain as to the future of the trained men in the electronics industry. It is a tremendous industry, and—at the *present time* there are more jobs than there are trained men to fill them. But—when there's a choice between a trained and untrained applicant, the trained man will get the job. Your biggest problem is to decide on—and begin the best possible training program.

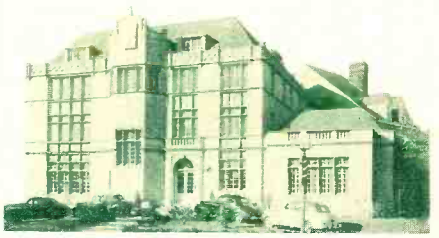
CREI Home Study . . . The Quick Way to Get There.

Since 1927, CREI has given thousands of ambitious young men the technical knowledge that leads to more money and security. The time-tested CREI procedure can help *you*, too—if you really want to be helped. CREI lessons are prepared by experts in easy-to-understand form. There is a course of instruction geared to the field in which you want to specialize. You study at *your* convenience, at *your* rate of speed. Your CREI instructors guide you carefully through the material, and grade your written work personally (not by machine).

Industry Recognizes CREI Training.

CREI courses are prepared, and taught with an eye to the needs and demands of industry, so your CREI diploma can open many doors for you. Countless CREI graduates now enjoy important, good-paying positions with America's most important companies. Many famous organizations have arranged CREI group training for their radio-electronics-television personnel. To name a few: All America Cables and Radio, Inc.; Canadian Aviation Electronics, Ltd.; Canadian Broadcasting Corporation; Columbia Broadcasting System; Canadian Marconi Company; Hoffman Radio Corporation; Machlett Laboratories; Glenn L. Martin Company; Magnavox Company; Pan American Airways, Atlantic Division; Radio Corporation of America; Technical Appliance Corporation; Trans-Canada Air Lines; United Air Lines. Their choice for training of their own personnel is a good cue for *your* choice of a school.

Almost immediately you feel the benefits of CREI training. Your employer, when informed of your step toward advancement (only at your request), is certain to take new interest in you and in your future. What you learn in CREI Home Study can start helping you do a better job immediately.



CREI also offers Resident Instruction

at the same high technical level—day or night, in Washington, D. C. New classes start once a month. If this instruction meets your requirements, check the coupon for Residence School catalog.

PAYS FOR ITSELF QUICKLY. Your very first raise could repay your investment in CREI training, and leave you a profit the very first year. Your increases in pay thereafter are all pure profit, and you'll be prepared for many more promotions and pay raises in the future years of your life.

KOREAN VETERANS

If you were discharged after June 27, 1950, let the new G.I. Bill of Rights help you obtain resident instruction. Check the coupon for full information.

Get this fact-packed booklet. It's free.

Called "Your Future in the New World of Electronics," this free illustrated booklet gives you the latest picture of the growth and future of the gigantic electronics world. It includes a complete outline of the courses CREI offers together with all the facts you need to judge and compare. Take 2 minutes to send for this booklet right now. We'll promptly send your copy. The rest—your future—is up to you.

1st Class
Permit No. 288-R
Sec. 34.9 P.L.R.
Washington, D. C.

BUSINESS REPLY CARD
No Postage Stamp Necessary If Mailed in United States

3c Postage Will Be Paid By

CAPITOL RADIO ENGINEERING INSTITUTE

3224 16th Street, N.W.

Washington 10, D. C.

Light Amplification Up to 40,000 Times Now Possible

Based on circuitry similar to closed-circuit TV, "Lumicon" is new boon to medicine, science.

A NEW light amplifying device which is capable of increasing brightness on the order of 40,000 times is being manufactured by the Friez Instrument Division of Bendix under the tradename "Lumicon."

The new device consists of a closed-circuit TV system coupled directly to a monitor or viewing unit which includes a kinescope or TV display tube of the same type as used in home sets. Unlike standard TV practice, however, in order to get better resolution, the "Lumicon" uses 1029 lines instead of the standard 525 lines in TV-casting. The detector unit consists of a standard TV pickup tube together with an appropriate optical lens.

At the press preview of this device all of the room lighting except the "exit" sign was extinguished and the subject placed in front of the camera. Although the subject was not visible to the naked eye except as an outline, all details of features and dress became clearly distinguishable on the monitor screens connected with the "Lumicon."

In addition to the medical applications for this device, it may also be used in television astronomy, meteorology, nondestructive inspection and testing, safety and protection work, telecasting in black-and-white and color. —30—

One application of the new "Lumicon" light amplifier is in connection with x-ray diagnosis and radiation therapy. Because of the device's ability to amplify light energy, doctors can examine patients using a very low-level of x-ray, reducing radiation hazards to patients and doctors alike.

New Hi-Fi Amplifier Uses Printed Circuit

Front panel view of the new Harman-Kardon printed circuit amplifier, Model PC-200. The brushed copper panel is enclosed in a black finished cage.

Details on a 10-watt commercial amplifier-preamp which uses printed circuitry for simplicity and servicing ease.

By **ROBERT G. BACH**
Harman-Kardon, Inc.

THE use of printed circuitry in the high-fidelity and audio fields has thus far been extremely limited with few manufacturers taking advantage of this production technique. Those who have adopted such circuitry have, in general, used it sparingly in only certain parts of the unit.

For this reason, the "Prelude" amplifier, recently introduced by *Harman-Kardon*, is of special interest because this 10-watt amplifier-preamp uses dip soldered, copper-clad laminated phenolic plastic board for the entire circuit.

The production techniques employed with the PC-200 result in uniformity of performance and ease in servicing.

The manufacturing procedure is basically a simple one—the components are first mounted on the top of the printed circuit board with the wires crimped on the underside to assure perfect soldered connections during the dip soldering process. All tube sockets, filter capacitors, and potentiometers used in the construction have been specifically designed for printed circuit wiring and are easily snapped into place on the board during the assembly operation. All connections are then carefully inspected and, after mounting on the chassis, the amplifier is ready for test. A bottom view of the assembled unit is shown in Fig. 4.

Controls and Circuit Features

Unique in construction, the "Prelude" also incorporates a number of interesting circuit and operating features normally found in more elaborate high-fidelity amplifiers. A total of seven controls is provided. They include a four-position loudness contour control, loudness, treble, bass, function/turnover (tuner, tape, and three phono turnover positions). rolloff, and rumble filter. Inputs include a high-level tuner input, a low-level phono input for magnetic cartridges, and a tape input.

The tape input provides correct low-frequency equalization for the output from tape playback heads, thereby eliminating the need for an extra tape playback preamplifier. A tape output jack located at the rear of the chassis is unmodified by the tone or loudness controls and makes it possible to simultaneously record material as it is being audited.

The phono input accommodates all types of magnetic cartridges and the terminating resistor, R_{20}, of 47,000 ohms provides a perfect match for most of the cartridges in general use today. An input signal of only 8 millivolts is necessary to drive the amplifier to full output. The phono amplifier, V_1, a 12AX7, drives V_1 (12AX7), which is operated as a phase inverter to drive the push-pull output stage.

A full ten-watts output (15-watts peak) is obtained from a pair of 6V6GT's (V_2, V_3) operating as pentodes. Wide range frequency response is ±1 db from 20 to 20,000 cps at 5 watts. The two output impedances, 8 and 16 ohms, accommodate speakers with impedances from 4 to 20 ohms due to the use of generous amounts of inverse feedback between the output and input stages. Speakers with rated impedances between 4 and 12 ohms should be connected to "G" and "8." Those with rated impedances between 12 and 24 ohms should be connected to "G" and "16" terminals.

Heavy filtering by C_{13C}, R_{28}, and C_{13D}, and the decoupling of R_{27} and C_{13B} plus balanced filaments (R_{30}, R_{31}) result in exceptionally low hum—min-

Fig. 1. Equalization characteristics of the PC-200 covers all current as well as many of the older phono recording curves.

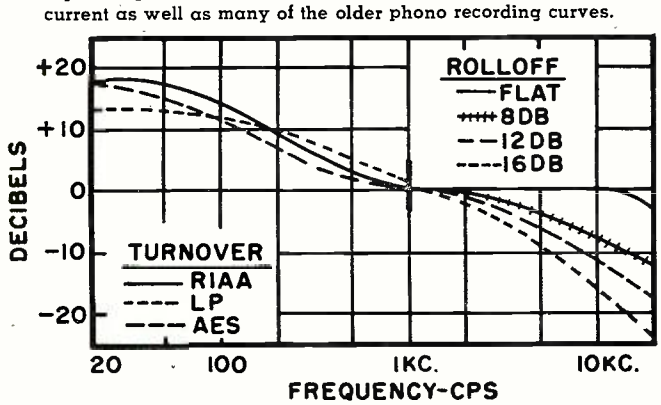
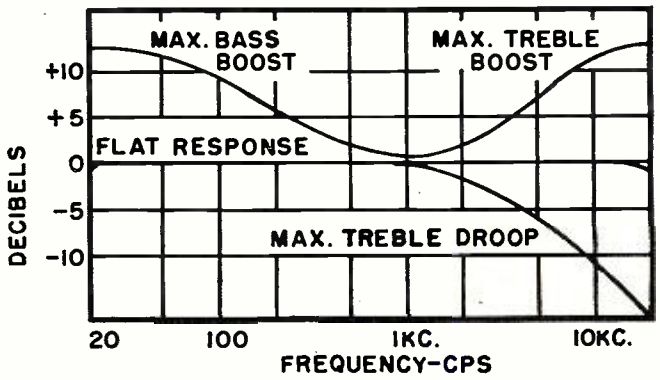


Fig. 2. Tone control characteristics of the "Prelude" (Model PC-200). See the discussion of these controls in the article.



imum volume of 80 db below 10 watts. "Phono" hum is rated at 50 db below 10 watts and "tuner" hum is rated at 60 db below 10 watts.

The separate roll-off switch, S_2, has four positions as indicated in the schematic diagram of Fig. 3—flat, 8, 12, and 16. The three turnover positions, RIAA, AES, and LP, are part of the function switch, S_{3a} and S_{3b}. This means that twelve different equalization curves (see Fig. 1) are obtainable by combining the various settings of these two controls—an adequate number of equalization positions for practically any record library.

In order to minimize rumble that may be introduced through the turntable or recordings, an annoying trait when listening to a wide-range system, a rumble filter has been incorporated to introduce a 6 db-per-octave cut below 50 cycles. This is accomplished by means of slide switch S_1 and the RC filter comprised of C_7, C_8, and R_3, which eliminates this nuisance without adversely affecting the quality of the reproduced material.

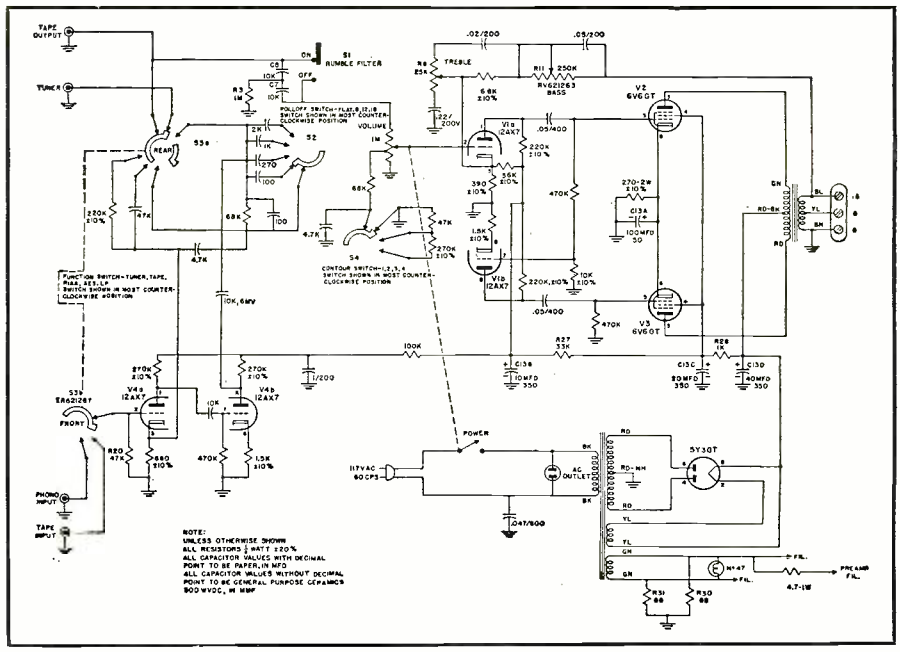


Fig. 3. Schematic diagram of "Prelude." Numbered parts are referred to in text.

Loudness Contour Control

One of the limitations of human hearing is its tendency to lose sensitivity to the very low and very high pitched sounds, as the sound level is reduced. It is this characteristic (known as the Fletcher-Munson effect) which causes one to play music programs at high level in order to experience the fullness of tone available from modern recordings and identified with "live" listening.

The dynamic loudness contour control incorporated in this unit compensates for the Fletcher-Munson effect, eliminating high reproduction level as a requisite for full enjoyment of reproduced music. Four positions of compensation are provided to allow the selection of the one most suited to the individual's hearing.

Each position causes the loudness ("volume") control to perform with a different degree of compensation, the amount increasing with each clockwise setting. Position 1 is uncompensated. Position 2 provides somewhat less compensation than that required to match the Fletcher-Munson loudness contour curves. Position 3 matches the Fletcher-Munson curves while position 4 provides greater amounts of compensation than the curves suggest. Since hearing characteristics vary from person to person, the flexibility offered by these controls is worthwhile.

In operation, the choice of the proper contour is easily made by switching through the several loudness contour positions and selecting the one which sounds best to the listener. It is characteristic of this circuit that as one switches through the various contour positions (the loudness control remaining unchanged) no significant change in output level occurs, although a very significant and noticeable change in response occurs in each position.

Treble boost of 12 db and cut of 15 db at 10,000 cps is provided by action of R_6, the treble control. The bass control, R_{11}, provides 12 db boost at 50 cycles but no bass cut. These tone control characteristics are plotted in Fig. 2.

The red "marking" dot found next to each control is the suggested position for "flat" over-all response. Variations are recommended, of course, to compensate for individual requirements. However, it should be noted that even the uninitiated user can set the controls to the marker dots for normal program material and be certain that the resulting sound will be correctly balanced. This is a technique which has been borrowed from the camera field where it has been common practice for some years to make "average" settings for the user.

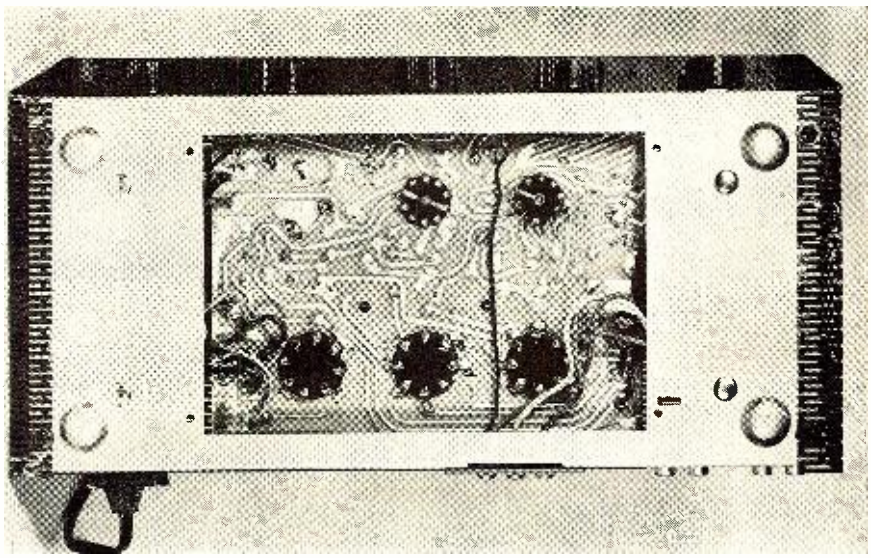
Servicing

Accessibility to the underside of the printed circuit board is provided by a removable bottom plate which exposes the entire board. The metal cage which houses the unit can be quickly removed by merely unscrewing the four screws holding it to the chassis frame. The a.c. connection is made through a safety interlock power cord, of the type found on TV sets, which disconnects power as the cage is removed, thus assuring the technician of complete safety both to himself and to his test equipment.

Whenever it is found necessary to use a soldering iron on the printed circuit board, a 40-watt iron should be used since higher wattages might damage the laminated board.

The PC-200 amplifier-preamp unit is now being marketed by the company for $55.00 retail, a price made possible, for the most part, by economies inherent in printed circuit construction. —30—

Fig. 4. Under chassis view with bottom cover plate removed to expose the printed wiring board. Wires connect to various jacks as well as the transformers.



Transistorized Phase-Shift Oscillator

By **RUFUS P. TURNER**

Junction types oscillate without transformer feedback in this circuit.

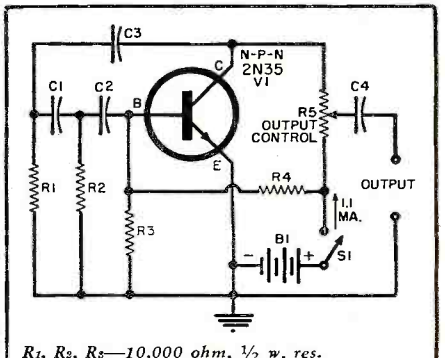
IT IS relatively simple to find RC oscillator circuits using point-contact transistors but the junction transistor units all seem to require one or more transformers. The reason for this is that point-contact types possess a peculiar negative resistance property that permits oscillation in extremely simple RC circuitry. Junction transistors, not having this property, will not oscillate in the same type of circuit. Because of this, many people think junction transistors will not oscillate without transformer feedback.

This is not true. Junction types will oscillate in many familiar RC circuits, provided the circuit is designed for sufficient gain and that the d.c. bias is high enough to insure good output-circuit power. The transistor must be connected as a common-emitter for input-output phase reversal.

Fig. 1 shows such a circuit. The phase-shift network consists of R_1, R_2, R_3, C_1, C_2, and C_3. In addition, R_3 acts with R_1 to form a base-bias stabilization circuit.

The oscillator frequency may be altered by changing the value of each network capacitor by the same amount. Increasing the capacitance lowers the frequency and vice versa. Maximum output into a high-impedance load is 3.5 volts r.m.s. Total harmonic distortion is .26%. Current drain is only 1.1 ma. —30—

Fig. 1. Circuit of a 2000-cycle audio oscillator using an "n-p-n" type transistor.



R_1, R_2, R_3—10,000 ohm, ½ w. res.
R_4—820,000 ohm, ½ w. res.
R_5—10,000 ohm wirewound pot
C_1, C_2, C_3—.002 μfd., 100 v. capacitor
C_4—.1 μfd., 400 v. capacitor
S_1—S.p.s.t. switch
B_1—22½ volt battery
V_1—"n-p-n" transistor (Sylvania 2N35)

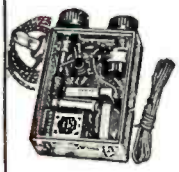
FREE! LAFAYETTE CATALOG

132 PAGE ELECTRONIC CATALOG

Packed with the largest selection of Electronic, Radio and T.V. Parts, and equipment, PA, Hi-Fi systems, tubes, antennas, Transistor Kits, parts and components, Test Equipment, new build your own kits, tools, books, Microscope, drafting equipment, Binoculars, Telescopes, All Radio, TV and Ham supplies — ALL AT GREAT SAVINGS — For the economy minded servicemen, dealer, engineer and technician. CHUCK FULL OF BUYS! SEND FOR YOUR FREE COPY TO-DAY.

Just a few of Lafayette's Values

2 TRANSISTOR POCKET RADIO KIT



Packed into a 2½"x3½"x1¼" plastic case. This Two Transistor plus crystal diode radio kit offers many surprises, utilizing a regenerative detector circuit with transformer coupled audio stage, gives you high gain and excellent selectivity. Pulls in distant stations with ease with more than ample earphone volume. Kit comes complete with two transistors, crystal diode, loopstick, Argonne transistor audio transformer, resistors, condensers, plastic case, etc. Including schematic and instructions.

KT-68A Complete Kit less earphones. Net **11.80**

MS-260 New Super Power Dynamic Earphone, ideal for Transistor Circuit Imp. 8000 ohm, D.C. 2000 ohm **3.95**

HIGH-FIDELITY TURNOVER CARTRIDGE

NEW!

2.75

Reg. Price ~~3.50~~

- 40-14000 CYCLE
- NEVER BEFORE AT SUCH A PRICE!

Lafayette brings you one of the finest high-fidelity turnover cartridges, AT AN UNBELIEVABLE PRICE! Frequency response from 40-14000 cycles + 2 db. Has 2 sapphire styli to play all speeds. Needle pressure only 5 grams on LP cond 12-15 grams on 78. Output is .5 volts. Complete with turnover mechanism and knob, fits Webster, Garrad, VM, Collaro and tone arms of leading manufacturers of record changers and players.

PK-79 ..... Singly, Each **2.75**
In lots of 3, Each **2.50**

TRANSISTOR CHECKER KIT

- Checks Shorts, Leakage, and Gain

A "must" for servicemen, experimenters and engineers. Tests both PNP and NPN type transistors. Gives 2 separate checks; first GOOD-BAD check for shorts and leakage, and second for GAIN. Gray hammertone case 5¾" x 3" x 2¼". Kit includes case, meter, all parts with full assembly and operating instructions. Simple to build. Fast, accurate. Shpg. wt. 3 lbs.

KT-86 Kit **7.95**

NEW POCKET AC-DC VOM MULTITESTER
2,000 ohm per Volt on AC & DC

7.95

- Completely wired — Not a kit

Accurate VOM with a sensitivity of 2000 ohms per volt on both AC and DC. Single selector switch. 3" 160 amp. meter. Scales: DC Volts: 0-10-50-500-1000; AC Volts: 0-10-50-500-1000; Ohms: 0-10K, 0-1 Meg; DC Current: 500 ua and 500 ma; Decibel: —20 to +22, +20 to 36; Capacity: 250 mmf to .2 mfd and .005 to 1 mfd. Heavy plastic panel, metal bottom. 4¼" x 3½" x 1⅝". With batteries and test leads. Shpg. wt. 4 lbs.

RW-27A **7.95**

NEW! ALL-PURPOSE DYNAMIC EARPHONE

- FOR RADIO AND TV LISTENING
- FOR SUBMINIATURE, MINIATURE AND TRANSISTOR RECEIVERS

A sensitive all-purpose earphone designed for your listening pleasure. Combines the range of a dynamic earphone with the performance of its special magnet to give you excellent reproduction. Lightweight and equipped with ear support that slips comfortably over your ear. You can relax! The support is practically invisible — the earphone can't slip out — it can't fall off. Ideal for use with TV and radio sets, amplifiers, miniature and transistor receivers etc. Complete with 3 ft cord. A super value for the price!

MS-278 — 3000 ohm impedance, 1000 ohm DC resistance, with phone tip plugs ..... Net **1.95**

MS-277 — 6 ohm impedance, with phone tip plugs. For Silent Radio and TV Listening or Viewing Net **1.95**

MS-273 — 3000 ohm impedance, 1000 ohm DC resistance, with subminiature phone plug and matching phone jack ..... Net **2.39**

MS-279 — 6 ohm impedance, with subminiature phone plug and matching phone jack. For Silent Radio and TV Listening or Viewing Net **2.39**

HIGH SENSITIVITY 20,000 OHM PER VOLT DC 10,000 OHM PER VOLT AC MULTITESTER

35 ua 3" METER SILVER CONTACT SELECTOR SWITCH 1% PRECISION RESISTOR

LOOK AT THESE FULL SCALE RANGES!
D.C. VOLTS: 0-6; 0-30; 0-120; 0-600; 0-1200; 0-6000 Volts—A.C. VOLTS: 0-6; 0-30; 0-120; 0-600; 0-1200 Volts—RESISTANCE: 0-10K; 0-100K; 0-1 Meg; 0-10 Megohms—D.C. CURRENT: 0-60 Microamp; 0-6; 0-60; 0-600 Milliamps—DECIBEL: —20 to +17 db (0 db — 0.774V)—CAPACITY: .0001 - .01; .005 - .15 mfd—INDUCTANCE: 20-2000 millihenry—OUTPUT RANGES: 0-6; 0-30; 0-120; 0-600; 0-1200 Volts

The new Lafayette high sensitivity Multitester is a complete instrument (not a kit). In addition to its unusual sensitivity of 20,000 OHMS PER VOLT ON D.C. AND 10,000 OHMS PER VOLT ON A.C., and the extraordinary number and scope of its ranges. It is packed with features that would make it cost at least twice as much if made in this country. Uses 1% precision resistors, silver contacts on selector switch, 35 ua 3" meter. Size: 6¼" x 4¼" x 2½". Complete with batteries and leads. Shipping weight 4½ lbs.

RW-30A ..... Singly, Each **19.95**
In lots of 3, each **19.25**

NEW! EXCLUSIVE — REVOLUTIONARY DESIGN!
TRANSISTOR 2 GANG VARIABLE SUPER-HET CONDENSER — ½" x 1" x 1"
THE SMALLEST SUPER-HET VARIABLE CONDENSER IN THE WORLD!

Lafayette does it again with this new super 2 gang midget variable condenser. An exciting and proven innovation in the transistor parts field! Manufactured for top performance in transistor super-het circuitry, it measures only ½" x 1" x 1". Has 2 gangs specifically designed for transistor super-hets — 10 to 208 mmf capacitance on the antenna section, and 10 to 100 mmf on the cut oscillator section. Self contained trimmers. Tunes through 180°. Entirely enclosed in a transparent plastic case! The smallest complete 2 gang variable for super-hets in the world! Offers unlimited possibilities to the experimenter.

MS-270 ..... Net **1.95**

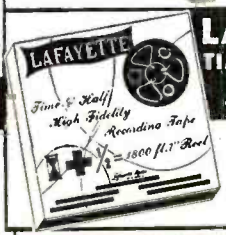
MATCHED COIL SET
MS-265—Osc. Coil ..... Net .79 Ea.
MS-272—Ant. Coil ..... Net .95 Ea.

365 MMF SINGLE GANG SUPER MIDGET VARIABLE CONDENSER

For exceptional performance in TRF and experimental transistor and subminiature circuitry. 10 to 365 mmf single gang. Enclosed in transparent plastic case. ½" x 1" x 1".

MS-274 ..... Net **1.25**

LAFAYETTE TIME + ½ TAPE 1800 FT. - 7 INCH REEL



$2.59 Each, Singly

$2.45 Each, Lots of 10

AN ENTIRE SYMPHONY ON ONE REEL OF TAPE! NO MORE ANNOYING INTERRUPTIONS!

Lafayette did it again! New plastic base. TIME + ½ High Fidelity Recording Tape at an amazingly low price! Over 1½ hrs. of playing time on a single reel at 7½" per second on dual track recording. At 3¾" per second you get 3 hours and 12 minutes. The same quality that has made the Lafayette Standard Tape the nation's outstanding value. 40-15,000 cycle response at 7½" per second assures you of the finest professional quality high fidelity recordings. A true Lafayette value backed up with our Money Back Guarantee. You be the judge—try it!

LAFAYETTE TIME + ½ TAPE 1800 FT. - 7 INCH REEL
Lots of 10, Each **$2.45**
Singly, Each **$2.59**

CRYSTAL MICROPHONE

COMPARE IT WITH ANY MIKE AT 2 to 3 TIMES THE PRICE

A quality crystal Microphone for PA systems, house recorders, etc. Frequency response 30 to 10,000 cycles. Output level —52 db. Provides ample output for use with low gain amplifiers. Complete with 5 ft. of shielded cable. Shpg. wt., 3½ lbs.

PA-24— In lots of 3, each **3.95**
singly, each **4.25**

REMOTE CONTROL FOR SILENT TV VIEWING

- For Hard-of-Hearing
- For Late Listening

One or two people can both see or hear the program with the loud speaker cut-off. The hard-of-hearing can listen to radio or TV without turning the volume so high that others can't stand the noise. Comes complete with miniature phone and 20 ft. of cable. Shpg. wt. 3 lbs.

MS-125 ..... Net **6.50**

FREE! BUILD YOUR OWN TRANSISTOR RADIOS

COMPLETE 8 PAGE BROCHURE

Lafayette Radio DEPT. RD

100 SIXTH AVE. NEW YORK, N.Y.
BRONX, N.Y. | 542 E. Fordham Rd
NEWARK, N.J. | 24 Central Ave.
PLAINFIELD, N.J. | 139 West 2nd St.
BOSTON, MASS. | 110 Federal St.

Include postage with order.

■ Send FREE 132-Page Lafayette Catalog

Name _____

Address _____

City _____ Zone _____ State _____

LAFAYETTE

Easy o Build

New! Model 625K 34.95

TUBE TESTER KIT MODEL 625K

- LARGE 4½" RUGGED METER WITH 3-COLOR REPLACE-WEAK-GOOD SCALE SHOWS TUBE CONDITION AT A GLANCE.
- TESTS NEW 600 MIL SERIES STRING TYPE TUBES
- ILLUMINATED GEAR DRIVEN "SPEEDWELL" ROLL CHART WITH SPECIAL ANTI-BACK-LASH DESIGN.

Highly dependable Cathode Conductance tube tester with simple test set-up procedure for checking emission, shorted elements, open elements, and continuity. Features 10 individual lever-type element switches for complete flexibility. Tests all standard AM, FM and TV tubes such as 4, 5, 6, large and small 7, octal, loctal, noval, hytron, VR, magic eye, and pilot lamps. Has blank spare socket for future tube types. Protective overload bulb shows transformer overloads and acts as fuse. Simple and reliable line adjust control. Has two grid caps for extra convenience. Filament voltages available: 0, .75, 1.4, 2.0, 2.5, 3.3, 5.0, 6.3, 7.5, 12.6, 25, 32, 50, 70, 110. Roll charts kept up-to-date periodically. Requires 105-125 volts AC, 50/60 cps, 6 watts. Dimensions: 9½" high, 12½" wide, 4¼" deep. Shpg. wt., 13 lbs.

EICO MODEL 625K — KIT, Complete ..... Net **34.95**
MODEL 625 — Factory Wired ..... Net **49.95**
MODEL CRA TV Picture Tube Test Adapter — Factory Wired ..... Net **4.50**

PEAK-TO-PEAK VTVM KIT MODEL 232K

- THE NEW LEADER IN PROFESSIONAL PEAK-TO-PEAK VTVM'S!
- WITH THE SENSATIONAL AC/DC UNI-PROBE!
- FOR COLOR AND MONOCHROME TV/FM/AM/ ELECTRONIC SERVICING WITH HIGHEST ACCURACY!

Model 232K $29.95

By far the best professional VTVM value in electronics! Features a large 4½" meter in a can't burn-out circuit, zero-center for TV-FM discriminator alignment, dual-purpose AC/DC UNI-PROBE — a half-turn of probe-tip selects DC or AC-ohms, new balanced bridge circuit for exceptional stability and accuracy, calibration without removing from cabinet, high impedance input for negligible circuit loading, 1% precision ceramic multiplier resistors, transformer operated for isolation and safety.

Measures directly Peak-to-Peak AC Volts . . . 0-4, 14, 42, 140, 420, 1400, 4200; DC/RMS Sine Volts . . . 0-1.5, 5, 15, 50, 150, 500, 1500 (DC up to 30,000 volts with HVP probe); Frequency response . . . 30 cps to 3mc (up to 250mc with PRF probe). Ohmmeter . . . 0.2 ohms to 1000 megs in 7 ranges. Uses 12AU7, 6AL5, selenium rectifier and 1.5 volt battery. For 105-125 VAC, 50/60 cps, 5 W. Smart professional styling-satin finish etched aluminum panel, grey wrinkle steel case. Size: 8½" H, 5" W, 5" D. Shpg. wt., 7 lbs.

EICO MODEL 232K — KIT, Complete ..... Net **29.95**
MODEL 232 — Factory Wired ..... Net **49.95**
DELUXE PEAK-TO-PEAK VTVM with 7½" Meter and **UNI-PROBE**
MODEL 249K — KIT, Complete ..... Net **39.95**
Model 249 — Factory Wired ..... Net **59.95**

RESISTANCE-CAPACITANCE BRIDGE AND R-C-L COMPARATOR KIT MODEL 950BK

- 4 SEPARATE CAPACITY AND RESISTANCE RANGES!
- DIRECT READINGS ON CALIBRATED FRONT PANEL!

Model 950BK $19.95

The only instrument of its kind with a Comparator Range for measurement of capacitance, resistance and inductance with a complementary component as a standard. Features direct reading scales for measurement of capacitance and resistance, direct reading ratio scale for comparison measurement of capacitance, inductance and resistance, extremely sensitive leakage indication directly in eye tube, sensitive magic eye tube null indicator, and continuously variable polarizing leakage test voltage 0 to 500 volts DC. Directly reads 0.5 ohms to 500 megohms (4 ranges), 10 mmf to 500 mf (4 ranges), and electrolytic power factor. Has Comparator ratio from .05 to 20 (400 to 1), and 0 to 500 volts DC polarizing voltage. For 105-125 volts AC, 50/60 cps. Smart professional styling — satin finish deep-etched aluminum panel, grey wrinkled case. Size: 8" H, 10" W, 4¾" D. Shpg. wt., 8 lbs.

EICO MODEL — 950BK —
Kit Complete ..... Net **19.95**
MODEL 950B — Factory Wired ..... Net **29.95**

THE ONLY LINE OF KITS WITH ALL THESE FEATURES

EASY TO BUILD . . . Every Kit is complete with an easy to follow instruction manual, replete with pictorial and schematic diagrams and step-by-step instructions for building and operation. Any one can do it.

QUALITY . . . Deep etched panels are used throughout the kits giving a fine professional appearance. Only first quality brand new parts of leading manufacturers are used.

ECONOMY . . . Building is not only fun and educational; it saves you a substantial amount of money. Compare the price of the wired unit with the price you pay for the kit.

LIFETIME SERVICE GUARANTEE

RF SIGNAL GENERATOR KIT MODEL 324K

Model 324K $26.95

- ONE GENERATOR COVERS THE WHOLE RANGE OF 150kc to 435mc!
- HAILED AS THE BEST GENERATOR BUY IN THE WORLD!
- FOR COLOR & MONOCHROME TV SERVICING!

A superb instrument for IF-RF alignment, signal tracing and trouble-shooting of TV, FM and AM sets, all on fundamentals; marker generator for alignment of new high-frequency as well as older low-frequency TV IF's; 400 cps sine wave audio testing; laboratory and experimental work. Features Colpitts RF oscillator directly plate modulated by cathode follower for improved modulation; ± 1.5% frequency accuracy; variable gain external modulation amplifier — only 3.0 volts needed for 30% modulation; 6:1 vernier tuning knob and excellent spread at most important alignment frequencies; etched turning dial, plexiglass windows, edge-lit hairlines, for utmost accuracy, convenience and professional appearance. Covers 6 fundamental bands: 150-400kc, 400-1200kc, 1.2-3.5mc, 3.5-11mc, 11-37mc, 37-145mc; one harmonic band, 111mc-435mc; RF output 100,000 microvolts; AF output to 10 volts; Tube complement — 12AU7, 12AV7, selenium rectifier, transformer operated. Handsome satin aluminum front panel and grey wrinkle steel case. For 105-125 volts AC, 50/60 cps. Size: 8"H, 10"W, 4¾"D. Shpg. wt., 10 lbs.

EICO MODEL 324K — KIT Complete .... Net **26.95**
MODEL 324 — Factory Wired ..... Net **39.95**

DeLUXE MULTI-SIGNAL TRACER KIT MODEL 147K

- A DeLuxe Signal Tracer — Invaluable for TV, FM, AM, Audio, Electronic Servicing!
- See and Hear the Signal Level in Each Stage!

Model 147K $24.95

For signal tracing and trouble-shooting in RF, IF and audio stages in AM, FM and TV sets . . . locating noisy components . . . checking equipment power consumption.

Features high-gain RF and low-gain audio with RF gain more than adequate for tracing up to receiver input; Visual and aural signal monitors (eye tube and speaker) — facilitates estimation of signal strength and gain per stage. Shielded RF crystal demodulator and direct probes; Noise locator ferrets out noisy controls, resistors, capacitors, coils, transformers, cold solder joints, etc.; Calibrated wattmeter reveals abnormal power consumption and detects B+ short, intermittent filament circuit, defective filter, etc. Fused for safety; Transformer operated for isolation and safety. Has 1-6SQ7, 1-6SJ7, 1-6K6, 1-1629 and 1-6X5 tubes. For 105-125 volts AC, 50/60 cps, 40 watts. Satin finish deep-etched aluminum panel and gray wrinkle steel case. Size: 8"H, 10"W, 4¾"D. Shpg. wt., 12 lbs.

EICO MODEL 147K — Kit, Complete .... Net **24.95**
MODEL 147 — Factory Wired ..... Net **39.95**

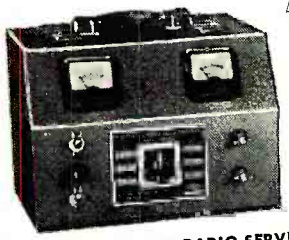
LAFAYETTE RADIO

100 SIXTH AVE., NEW YORK, N. Y.

BOSTON, MASS., 110 Federal St.
PLAINFIELD, N. J., 139 West 2nd St.
NEWARK, N. J., 24 Central Ave.
BRONX, N. Y., 542 E. Fordham Rd.

EICO Kits — The Only Line Of Kits With A EICO Lifetime Service Guarantee

6V & 12V BATTERY ELIMINATOR & CHARGER KIT MODEL 1050K



EICO Model 1050K $29.95

- A MUST FOR CAR RADIO SERVICING!
- A BOON TO THE MOTORIST FOR BATTERY CHARGING!

A convenient and reliable source of DC voltage, model 1050 has many more applications in addition to car radio servicing and battery charging. It runs many small electric appliances such as shavers, trains, etc. For marine use, it operates boat lights, radio-phone, bilge blower, bilge pump, etc. Model 1050 features two DC voltage ranges. 0-8 volts and 0-16 volts. Continuous voltage adjustment with variac-type transformer; Separate voltmeter and ammeter for simultaneous readings of both voltage and current; Heavy duty selenium rectifiers; Fused primary — automatic reset overload relay for secondary. 10 amps continuous and 20 amps intermittent current rating for 0-8 volt range; 6 amps continuous, 12 amps intermittent for 0-16 volt range. Voltmeter scale 0-20 volts: Ammeter scale 0-20 amps. For 105-125 volts AC, 50/60 cps, 150 watts. Size: 8¾"H, 10½"W, 7¾"D. Shpg. wt., 15 lbs.

EICO MODEL 1050K — Kit, Complete Net **29.95**
MODEL 1050 — Factory Wired .....Net **38.95**

5" PUSH-PULL OSCILLOSCOPE KIT MODEL 425K

EICO

THE LOWEST-PRICED 5" SCOPE IN THE WORLD!

- A SUPER WORKING TOOL FOR TV-RADIO SERVICING, LABORATORY, PRODUCTION-LINE, AND HAM

Model 425K $44.95

Features push-pull output stages in both V & H amplifiers for balanced V & H deflection; wide band TV servicing; wide frequency range, linear, stable sweep; dual potentiometer controls for full screen V & H centering; intensity (Z-axis) modulation input for sweep blanking or insertion of timing markers on the trace; direct connections to deflection plates available at rear of cabinet; provision for internal and external synchronization; shielded transformer operated circuit; calibrated graph screen.
Specifications: Vertical — 5 cps to 500 kc usable to 2.5mc response, .05 to .1 volts RMS/inch sensitivity, 1 megohm input impedance. Horizontal — 5 cps to 500 kc frequency response, .05 to .15 volts RMS/inch sensitivity, 1 megohm input impedance. Multi-vibrator with range of 15cps to 75kc for sweep. Uses 2-5Y3, 2-6J5, 3-6SN7, 1-5BP. For 105-125 volts AC, 50/60 cps, 68 watts. Lifetime satin finish deep-etched aluminum panel, rugged grey steel case. Size: 15"H, 8⅞"W, 17¾"D. Shpg. wt., 30 lbs.

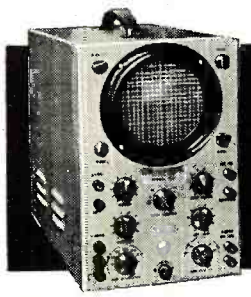
EICO MODEL 425K — Kit, Complete ....Net **44.95**
MODEL 425 — Factory Wired .....Net **79.95**

order now! ------>

Lifetime Service Guarantee

IN ADDITION TO THE REGULAR RMA GUARANTEE ON PARTS, ANY EICO INSTRUMENT MAY BE RETURNED TO THE FACTORY ANY TIME DURING ITS LIFETIME FOR REPAIR AND CALIBRATION AT A NOMINAL CHARGE.

DC WIDE BAND 5" OSCILLOSCOPE KIT MODEL 460K



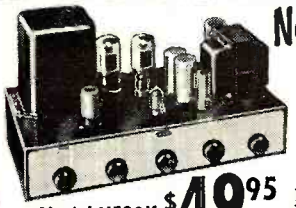
New! Model 460K $79.95 EICO

- COLOR AND BLACK & WHITE LAB AND TV SERVICE SCOPE
- 5 MC BANDWIDTH AND DC AMPLIFIERS!
- ENGINEERED FOR THE PROFESSIONAL WITH A LIFETIME GUARANTEE!

Flat from DC to 4.5 mc for reproduction of 3.58 mc sync burst and oscillator signals in color sets. Vertical amplifier direct coupled, and push-pull throughout. High vertical sensitivity, 25 millivolts per inch. Direct or capacitive coupling. Balanced or unbalanced inputs. Accurate and direct peak-to-peak voltage measurement. Automatic sync limiter and amplifier — anything visible on screen is synchronized automatically. Pre-set TV V and H sweep positions (30 cps and 7875 cps). Edgelit filter lucite graph screen with dimmer control. Vertical Amplifier has frequency-compensated attenuation by factors of 1, 10, 100, and 1000; 0.06 microseconds rise time; 8% or less overshoot; 3 megs shunted by 35mmf input impedance; instantaneous, drift-free positioning.
Horizontal Amplifier has 1 cps to 400 kc response; 0.6 millivolts per inch sensitivity; approx. 5 megs shunted by 35 mmf (at 1KC) input impedance; attenuator low impedance type in cathode follower output. Sweep Frequency — 10 cps to 100 kc, plus low frequency sweep with external capacitor.
Uses 5UP1 CRT, 2-6AU8, 2-6CB6, 1-12AU7A, 2-6J6, 1-6AX5, 1-1V2 tubes.
Excellent mechanical construction and layout so that it can be built at home without special equipment or special knowledge. For 105-125 volts AC 50/60 cps. Deep-etched satin aluminum panel, grey wrinkle steel cabinet. Sizes: 13"W, 8½"H, 16"D. Shpg. wt., 30 lbs.

EICO MODEL 460K — KIT, complete .....Net **79.95**
MODEL 460 — Factory Wired .....Net **129.50**

New! 20 WATT HIGH FIDELITY AMPLIFIER KIT MODEL HF20K



EICO

- ±0.5 db 13 to 35,000 cps; ±1.5 db, 7 to 50,000 cps
- COMPARES WITH MOST EXPENSIVE AMPLIFIER MADE!
- BEST BUY IN SUPERLATIVE HIGH FIDELITY AMPLIFIERS!

Model HF20K $49.95

High quality equalizer and control section plus 20 watt Ultra-Linear Williamson-type power amplifier. Low distortion feed-back equalization; 5 equalizations provided for LP's and 78's including RIAA. Variable turnover, low distortion feed-back tone controls. "Flat" positions at center settings of control knobs. Loudness control and separate level set control both on front panel. Provides adjustable Fletcher-Munson compensation or no compensation when desired. Loudness control can be adjusted to give desired listening level without affecting tape output. Permits use of up to 30 ft. of cable.
Six inputs: 4 high level switched inputs — Tuner, TV, Tape, Auxiliary (crystal/ceramic phono or second tuner): 2 low level inputs (not switched) — provides proper pick-up loading and attenuation for all leading magnetic, FM and high quality crystal cartridges without changing resistors. Hum balance control for balancing out 60 cycle residual hum.
Power Consumption: 110-120 volts, 60 cps, 100 watts. Tubes: 2-12AX7, 2-12AU7A, 2-6L6GB, 1-5U4GB. Handsomely styled to eliminate the necessity for cabinety. Size: 8½"H, 15"W, 10"D. Shpg. wt., 24 lbs.

EICO MODEL HF20K — KIT, Complete .....Net **49.95**
MODEL HF20 — Factory Wired .....Net **79.95**
ENCLOSURE FOR HF20 .....Net **4.50**

Lafayette Radio — Write for FREE EICO CATALOG

THE WORLD'S GREATEST RADIO, TV and HI-FI CENTER

LAFAYETTE RADIO, Dept. R-1-4, 100 SIXTH AVE., NEW YORK, N. Y.

Ship me the following

Quantity	Description	Model No.	Price

$..... enclosed. For parcel post include postage (express is shipped collect).

Name_____

Address_____

City_____ Zone____ State_____

Radio Australia Tops with SWL's

By **KEN BOORD**

"Down Under" station wins latest International Short Wave Club poll, with Swiss second and the BBC coming in third.

CLIMBING up one more rung in the popularity ladder, Radio Australia and the Swiss Short Wave Service took first and second spots, respectively, in the 1956 favorite short-wave radio station poll just conducted by the International Short Wave Club, London. The BBC, which stood 5th in the 1950 poll, and first in 1953, dropped to 3rd place in 1956. In both 1950 and 1953, Radio Australia took second place, while the Swiss Short Wave Service held third spot in both these earlier polls.

Radio Canada this year stood 4th; Radio Nederland was 5th, while the Voice of America placed 6th.

Voting was open to all short-wave listeners, whether members of ISWC or not. Votes were made up on a point basis—3 being given to the No. 1 choice listed by the SWL; 2 to the No. 2 favorite, and 1 to the No. 3 station.

Arthur E. Bear, secretary of ISWC, points out that "almost all listeners stressed the fact that they did not listen to the broadcasters of propaganda. The sooner that the stations who do this kind of thing (from whatever side it may come) realize this, then they will be saving their time, breath, and their kilowatts and the air will be a cleaner place, with the absence of the jamming stations. It will be noted that the most popular stations are those which have stood at the top for past years. It is regretted that the Belgian Short Wave Service is not there. For when they had their 'International Goodwill' programs, they were without doubt, favorite among listeners." (In the 1950 polling, the Belgian Short Wave Service led all others, and was in fourth spot in 1953; with the dropping of its "International Goodwill" broadcasts, in the 1956 poll, it stood 34th.)

"Votes came to us from almost all countries, but from none of those behind the Iron Curtain," Mr. Bear comments. "Radio Prague gave this poll a lot of advance publicity over the air, but not one vote was recorded for Prague." Moscow stood in 21st place, and the only other Iron Curtain broadcaster to receive votes was Radio Budapest, which stood 23rd.

The individual station results of the 1956 poll clearly indicate which ones command the audiences:

1. Radio Australia, 1156; 2. Swiss Short Wave Service, 1013; 3. BBC, 905; 4. Radio Canada, 672; 5. Radio Nederland, 663; 6. Voice of America, 421; 7. Radio Brazzaville, French Equatorial Africa, 198; 8. Radio Ankara, 143; 9. Radio Cairo, 120; 10. Radio Sweden, 104; 11. WRUL (Radio Boston), 102; 12. Radio Rome, 96; 13. RDTF, Paris, 81; 14. Radio New Zealand, 67; 15. IBRA Radio (*via* Radio-Africa), Tangier, 63; 16. HVJ, Vatican, 61; 17. HCJB, Quito, Ecuador (missionary broadcaster), 59; 18. Radio Indonesia, 57; 19. Danish State Radio, 55; 20. All India Radio, 50; 21. Radio Moscow, 48;22. Radio de Espana, Madrid, 44; 23. Radio Budapest, 39; 24. Radio Nacional del Peru, 36; 25. Emissora Nacional, Lisbon, 32; 26. Radio Japan, 30; 27. Radio Pakistan, 27; 28. Radio Ceylon and Radio Free Europe, 25 (tie); 29. TGNA, Guatemala (missionary broadcaster), 22; 30. Radio Wien, Austria, 21; 31. Radio Accion Popular, Sutatenza, Colombia, 19; 32. Radio Norway, 18; 33. Kol-Zion, Israel, 16; 34. Belgian Short Wave Service (ORU, Brussels, and OTO, Leopoldville, Belgian Congo), 15; 35. Radio Commerce, Haiti, 12; and 36. Radio Clube de Mozambique, 10.

For comparative purposes, here are the first five placings in the 1950 and 1953 polls:

In 1950—Belgian Short Wave Service, 609; Radio Australia, 446; Swiss Short Wave Service, 435; Radio Canada, 419; BBC, 388.

In 1953—BBC, 847; Radio Australia, 751; Swiss Short Wave Service, 615; Belgian Short Wave Service, 531; Radio Canada, 471.

From letters picked at random, here are some of the voters' comments:

R. D. Long, Blenheim, New Zealand, said: "My No. 1 station is Radio Australia. Excellent news coverage of world-wide events without the large doses of obvious propaganda and political advertisements. Excellent musical programs with variety. The 'Mail Bag.' A word from the 'Children's Australian Diary,' and, above all, the cheerful friendliness of their announcers, in place of the formal and (to a listener) 'stand-offishness' of the announcers at so many British stations. My No. 3 station is the BBC. My people belong to 'Where the Zuyder Apples Grow' and England is home."

Sidney Pearce, Berkhamsted, Herts., England, one of the world's best-known SWL's, commented: "No. 1, Radio Australia. They cater for all tastes. They give encouragement to both new and old DX-ers alike, and the programs are free from propaganda."

A Canadian DX-er, John J. Griffiths, Montreal, said: "My No. 1 is Radio Moscow. Many frequencies to choose from. News items are interesting, to

verify what newspapers have to say about the daily doings and affairs of the USSR and to hear what people who are visiting Moscow say over the Moscow Radio. It is interesting to hear both versions of a story, these events interest me more than mere varieties of singing and others acting."

D. Church, London, England, said: "My No. 1 is the Swiss Short Wave Service. I would place the Swiss Radio as the outstanding broadcaster of all. Programs are always interesting, instructive, and perfectly reflect the way of life, people, and the country of Switzerland."

Arthur T. Cushen, veteran DX-er of Invercargill, New Zealand, had this praise for the BBC: "I vote for the BBC for fine entertaining programs, presenting the news and with a high degree of fine reception. Brings us the best in radio entertainment over 12,000 miles, impartially presented, with a sense that short-wave broadcasting can be made to make friends with everyone."

On the other hand, William N. Roemer, Bowling Green, Kentucky, USA, had this to say: "I vote for Radio Australia. Sorry, but the BBC is last on my list, as to news, variety, and programs of interest to the SWL. The BBC has been giving the same talks, but by different people, since 1939. They are not worth listening to any longer after listening to Radio Australia. People get tired of the long-hair music, semi-operas are just fine but not for more than 30 minutes. During World War II, the BBC was tops with the news, along with Radio Australia from the Pacific, but Australia has gone forward, while the BBC has slid backward, to where it was in 1939 or 1940."

Jack Lippold, London, England, said of Radio Nederland: "I vote for the 'Happy Station,' Hilversum, because it is so pleasant to listen to, has a style and a presentation all its own, broadcasts something for everyone, and a wonderful friendly atmosphere prevails throughout."

"Congratulations to the stations," says Mr. Bear of ISWC, "and may this be a pointer to all stations to maintain their popularity and to improve their transmissions so that short-wave listening may continue as a popular hobby among listeners."

The ISWC was founded in the USA on October 4, 1929, by Arthur J. Green, Joseph Sessions, Charles Schroeder, Jacob Kleinmans, and George F. Brooks, with headquarters first in Klondyke, Ohio, later at East Liverpool, Ohio. Headquarters was transferred in 1946 to 100 Adams Gardens Estate, London, S.E. 16, England.

Aims and objectives of ISWC are "to foster and promote world friendship among short-wave listeners and the exchange of short-wave station information." The short-wave radio station popularity polls—conducted by ISWC for members and non-members alike—clearly indicate that ISWC is carrying out its pledge. —30—

Transistorized Intercom

(*Continued from page* 69)

with frequency. A curve of headphone impedance *versus* frequency is shown in Fig. 4.

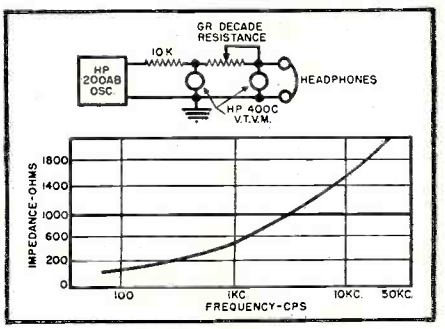
It should be pointed out that the frequency response and distortion of headphones usually is much poorer than that of the amplifier. The over-all response of the system, therefore, probably will be limited by the headphones used.

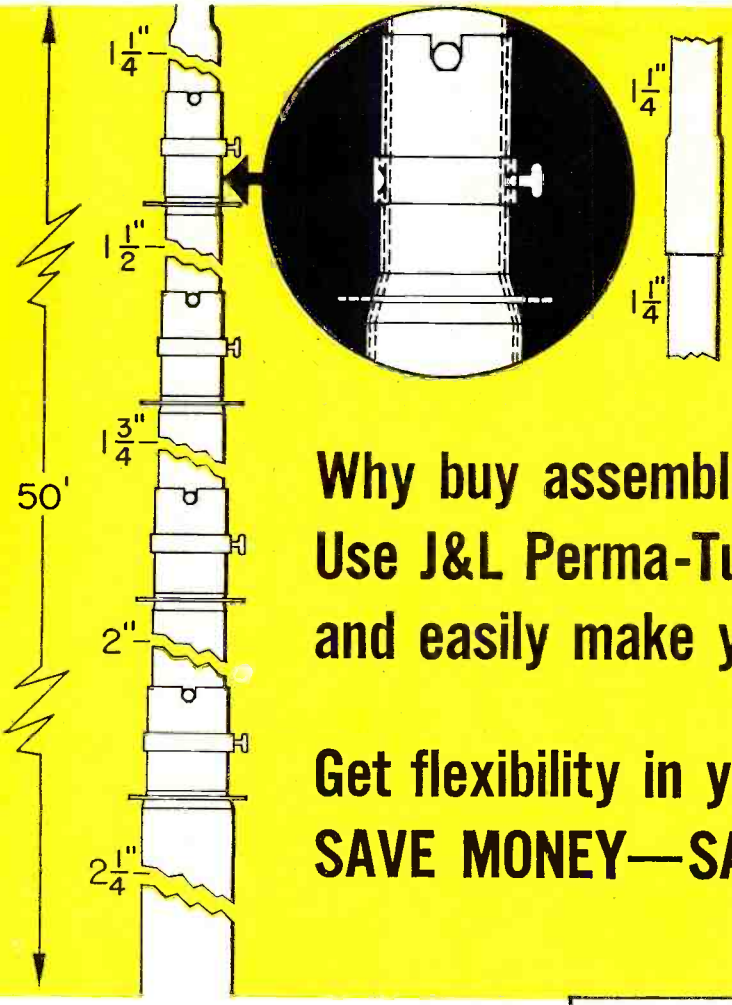
The decoupling network R_3C_3 shown in Fig. 1 is used to prevent circuit oscillation due to positive feedback. If the values of capacitors C_1 and C_2 differ from those specified in the parts list, it may be necessary to vary this decoupling network if oscillation exists. The operating point of transistor V_1 is determined by the value of resistor R_5. The operating point of transistor V_1, however, depends upon the values of resistors R_1, R_2, and R_3, and the d.c. impedance of the microphone. The d.c. microphone current must be blocked from the input of transistor V_1 by means of capacitor C_1 to avoid a shift in the operating point of V_1. The operating point of the output stage was adjusted to give optimum output for headphones having a d.c. resistance of 240 ohms. Some alteration may be necessary if headphones having a d.c. resistance considerably different from this value are employed. If the difference in resistance is too great, however, it may not be possible to obtain the required power output.

The over-all amplifier is housed in a small plastic box which fits into a shirt pocket. In order to avoid oscillation, the input and output leads must be shielded or well separated so that stray capacitive feedback is minimized.

Fig. 5A is a schematic representation of a conventional carbon microphone having a "push-to-talk" switch. The function of this switch is merely to make or break the connection from the tip of the jack to the shank. In normal applications, this switch closes a relay which, in turn, operates the transmitter. This type of microphone can be adapted quite readily to the transistor intercom, as is shown in Fig. 5B. Two microphone jacks are connected in parallel so that either microphone can be used with the amplifier. The carbon microphone is con-

Fig. 4. Impedance of the headphones as function of frequency. See discussion.





Same 1¼-inch piece of Perma-Tube can be used for telescoping masts or with another 1¼-inch piece to make smaller 2-piece masts.

Why buy assembled telescoping masts? Use J&L Perma-Tube in 10-foot lengths and easily make your own

Get flexibility in your stock SAVE MONEY—SAVE SPACE

Only J&L Perma-Tube offers:

- Joint design which provides instant field assembly.
- Machine-fitted joints that insure close tolerance for high strength and rigidity.
- Guy wire ring position that eliminates all binding and guy wire interference.

Buy only a carton each of five different sizes of Perma-Tube (1¼ to 2¼-inch) and make any telescoping TV mast up to 50 feet in height. Hardware —cotter keys or bolts, clamps and guy rings—may also be secured from your distributor.

You can now "tailor-make" your own TV masts up to 50 feet high by using standard 10-foot lengths of 16-gage Perma-Tube—and save money. Five diameters are available in easily-handled cartons from your local distributor. Largest base section OD is 2¼ inches and each telescoping section is ¼-inch smaller, the smallest section having an OD of 1¼ inches.

Corrosion-resistant Perma-Tube is treated with Vinsynite—then coated both inside and outside with a metallic vinyl resin base. It's made of a special, high-strength, J&L steel tubing. A 10-foot section of 1¼ inch diameter by 16 gage is capable of supporting a weight at its center point of 200 pounds with a minimum of deflection and permanent set.

J&L Perma-Tube—best for strength and rust protection

Jones & Laughlin
STEEL CORPORATION · PITTSBURGH

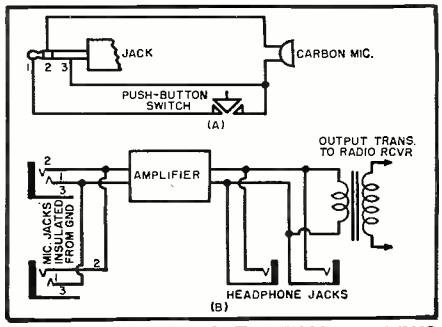
J&L STEEL

nected between points 2 and 3. Point 3 is left floating, however, and point 1 is grounded in the amplifier. When the switch is closed, point 3 is connected to point 1 and the circuit is completed. When two microphones are used as shown, the operating point of transistor V_1 in Fig. 1 may be changed appreciably due to excessive current in resistor R_3 if the push-buttons for both microphones are depressed simultaneously. For this reason, it is recommended that only one microphone switch be depressed at any one time.

In this intercom, two headphone jacks are connected in parallel with the output of an aircraft receiver, as shown at the right of Fig. 5B. This arrangement provides complete two-way communication between pilot and passenger, and also permits both to listen to the radio. Since the power required for one set of headphones is only three milliwatts, the amplifier has sufficient output to drive more than one headset.

This transistorized aircraft intercom uses a supply voltage of 9 volts (six "penlite" *RCA*-VS034 cells), and has a battery life of approximately 100 hours with intermittent use. Because the intercom is also small and light, it should be very useful for flight instruction. During certain periods of a student pilot's training, it is necessary for the flight instructor to talk to his student almost continuously. Flight instructors often find that their time in the air is limited by the length of time that their voices will hold out. In most cases, it is also necessary for the student to forego the use of headphones during this stage of his training so that he can hear the instructor. This may be a disadvantage to the student if a radio receiver is required for flight out of his local airport, for when he is ready for solo flights he is not accustomed to receiving voice communications by headphones. The use of an intercom such as the one described in this article improves communication between the instructor and the student, and also accustoms the student to voice reception from earphones. Although the use of headphones seems like a minor item to the average individual, it is very important to the student pilot flying alone for the first time to be able to hear what the control tower is telling him to do. —30—

Fig. 5. (A) Schematic of carbon mike having a push-to-talk switch. (B) Connection of mike and headphones to amplifier and the aircraft's receiver, if one is available.



FREE

MONEY MAKING

FCC

Commercial·Radio Operator

LICENSE

INFORMATION

TELLS HOW—

WE GUARANTEE

TO TRAIN AND COACH YOU AT HOME IN SPARE TIME UNTIL YOU GET

YOUR FCC LICENSE

If you have any practical experience—Amateur, Army, Navy, radio, repair, or experimenting.

HERE IS YOUR GUARANTEE

If you fail to pass your Commercial License exam after completing our course, we guarantee to continue your training, without additional cost of any kind, until you successfully obtain your Commercial license.

TV Engineering INCLUDED IN OUR TRAINING AND COACHING

TELLS HOW—

EFFECTIVE JOB-FINDING SERVICE HELPS CIRE TRAINEES GET BETTER JOBS. HERE ARE JUST A FEW RECENT EXAMPLES OF JOB-FINDING RESULTS:

ELECTRONICS TECHNICIAN

"I am now employed by the Collins Radio Company as a Lab Technician. (This job was listed in your bulletin). I have used the information gathered from your course in so many ways and I know that my training with CIRE helped me a great deal to obtain this job."

Charles D. Sindelar, Cedar Rapids, Iowa

AIRLINES

"I replied to the Job Opportunities you sent me and I am now a radio operator with American Airlines. You have my hearty recommendation for your training and your Job-Finding Service."

James A. Wright, Beltsville, Md.

INDUSTRIAL ELECTRONICS

"Upon my discharge from the Navy I used your Job-Finding Service and as a result I was employed by North American Aviation in electronic assembly (final checkout)."

Glen A. Furlong, Fresno, Calif.

TELLS HOW—

EMPLOYERS MAKE JOB OFFERS LIKE THESE TO OUR GRADUATES EVERY MONTH!

Broadcast Station in Illinois: "We are in need of an engineer with a first class phone license, preferably a student of CIRE; 40 hour weeks plus 8 hours overtime."

West Coast Manufacturer: "We are currently in need of men with electronics training or experience in radar maintenance, and we would appreciate if you will refer interested persons to us."

Letter from nationally-known Manufacturer: "We have a very great need at the present time for radio-electronics technicians and would appreciate any helpful suggestions that you may be able to offer."

These are just a few of the examples of the job offers that come to our office periodically. Some licensed radioman filled each of these jobs. It might have been you!

OURS IS THE ONLY HOME STUDY COURSE WHICH SUPPLIES FCC-TYPE EXAMINATIONS WITH ALL LESSONS AND FINAL TESTS.

An Approved Member

ACT NOW! Get ALL 3 FREE

Your FCC Ticket is recognized by employers as proof of your technical ability.

HERE'S PROOF FCC LICENSES ARE OFTEN SECURED IN A FEW HOURS OF STUDY WITH OUR COACHING AT HOME IN SPARE TIME:

Name and Address	License	Time
A/1C Ronald H. Person St. Louis 20, Mo.	1st Class	25 Weeks
Milton L. Geisler, ET3 FPO, San Francisco, Calif.	1st Class	26 Weeks
Marvin F. Kimball Lafayette, Ind.	2nd Class	21 Weeks
L. M. Bonino Harlingen AFB, Tex.	2nd Class	16 Weeks
John E. Hutchison Bluefield, W. Va.	1st Class	27 Weeks

MAIL COUPON NOW!

Cleveland Institute of Radio Electronics
Desk RN-89—4900 Euclid Bldg.
Cleveland 3, Ohio

(Address to Desk No. to avoid delay)

I want to know how I can get my FCC ticket in a minimum of time. Send me your FREE booklet, "How to Pass FCC License Examinations" (does not cover exams for Amateur License), as well as a sample FCC-type lesson and the amazing booklet, "Money-Making FCC License Information." Be sure to tell me about your Television Engineering Course.

PLEASE PRINT CLEARLY

Name ..... Age .....

Address .....

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

FOR PROMPT RESULTS, SEND AIR MAIL

Special tuition rates to members of the U. S. Armed Forces
Electronic Training also available to Canadian Residents.

CARL E. SMITH, Consulting Engineer, President

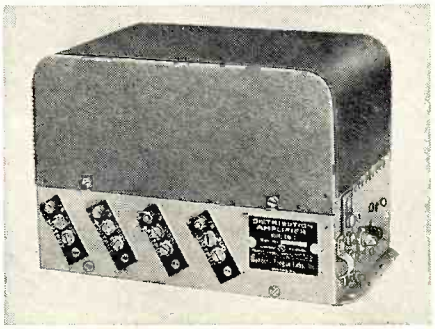
CLEVELAND INSTITUTE OF RADIO ELECTRONICS

Desk RN-89, 4900 Euclid Bldg., Cleveland 3, Ohio

DISTRIBUTION AMPLIFIER

Blonder-Tongue Labs., Inc. of 526-536 North Avenue, Westfield, N. J., has available a new low-noise distribution amplifier for master TV antenna systems. The model DA8-B provides eight isolated outlets, each having over 10 db all-channel gain.

The DA8-B features all-triode circuitry and will accept either 300-ohm twin-lead or 75-ohm coaxial cable. Included with the unit are coaxial grounding clamps, solder lugs, and terminating resistors for unused outlets. More than 8 outlets can be pro-



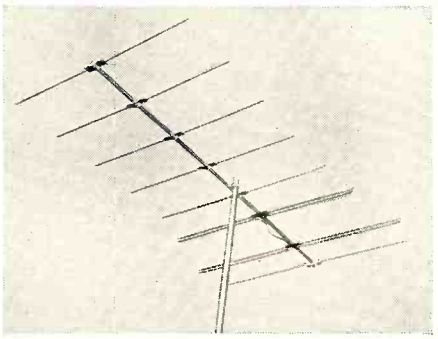
vided by connecting a line splitter to feed several DA8-B units.

Additional specifications and price information are available from the company.

FM FRINGE ANTENNA

Clear Beam Antenna Corp., 100 Prospect Avenue, Burbank, Calif., has just announced a new "Sonic-Tone" FM antenna, model D8FM. This 8-element yagi-type antenna has a gain of 12 db across the FM band, according to the manufacturer.

The antenna is all-aluminum and pre-assembled at the factory. All ele-



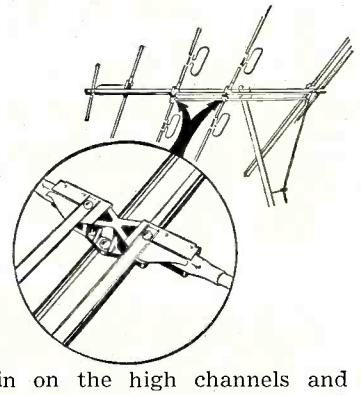
ments utilize the company's "Snap-open" construction wherein elements unfold into opened position.

NEW LOCKING DEVICE

Technical Appliance Corp., Sherburne, N. Y., is now including a new snap lock design in its "Trapper" line of antennas. The original *Taco* "Trapper" and "Super Trapper" with the tension booster design will continue to be sold in addition to the new models 2880, 2885, and 2890 which feature the new "Stay-Lok" assembly.

This new assembly automatically locks the elements of the antenna in place without the use of tools, bolts, etc. It also permits quick disassembly of the antenna.

The new models also feature higher

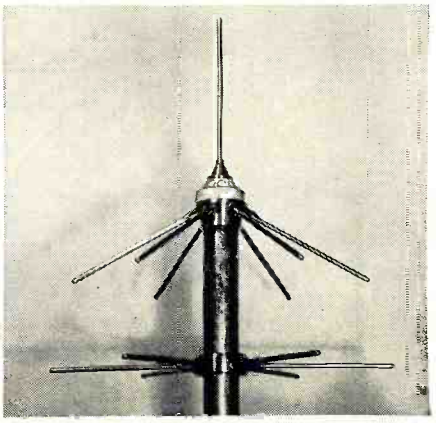


gain on the high channels and are fully tested for color TV reception.

COMMUNICATIONS ANTENNAS

Herb Kreckman Antenna Co., 124 Greenwood Drive, Massapequa, N. Y., announces a new series of "Kreco" communications antennas designed to mount directly on 1¼" support pipe.

Shown here is the DGP-155, an all-brass duo-ground-plane model which has 6 radials. This model is available in different sizes for the frequencies between 108 and 470 mc. Also avail-



able for the 108 to 470 mc. range are coaxial co-plane models and a 4-element stacked coaxial. Other models are made for the 25 to 50 mc. range.

Additional specifications are available from the company.

TV AND FM ACCESSORIES

Dynamic Electronics-New York, Inc., 7339 Woodhaven Blvd., Forest Hills, L. I., N. Y., has three new accessories available in its "Tentenna" series for FM and TV.

The model T115 video-audio signal attenuator removes overload in strong signal areas. It connects at the receiver antenna terminals and contains a variable control.

The model T121 interference suppression high pass TV-FM filter eliminates all noise disturbances below 40 mc. The third item is a three-set coupler, the model T130. It allows three different receivers, FM and/or

TV, to operate from one antenna. According to the manufacturer, there is less than 6 db insertion loss with this device and a rejection ratio of 40 to 50 db.

These units measure 3¾" x 2¾" and the cases are made of transparent polystyrene.

NEW INDOOR ANTENNA

Channel Master Corp., Ellenville, N. Y., has introduced a new indoor TV antenna, the "Glide-o-Matic" series 3700. This antenna features a sliding, six-position, low-loss switch

which is used to set up the various antenna parameters for the best ghost- and snow-free picture reception.

Both aluminum and brass models are available; the brass models have bases of ivory, mahogany, or ebony. The aluminum model is furnished with an ebony base. —30—

TRANSISTOR TONE DEVICE

BELL LABS is experimenting with a new musical tone device which may someday replace the telephone bell if it meets technical standards and customers' approval.

The musical tone equipment uses transistors. The ordinary telephone bell requires 85 volts while the transistorized device operates on less than 1 volt.

The experimental sets look like a regular telephone except for the louvered section at the side of the base for radiating the sound. Tests indicate the tone has high audibility over great distances. —30—

Marion Lageda of Bell Labs holds one of the new experimental handsets. Grillework in base allows musical tone from transistorized "ringer" to radiate. It is said to be especially effective for the partially deaf since it operates at mid-frequencies.

AMERICA'S FINEST VALUES IN "LOW COST" HIGH FIDELITY

CONSOLE HI-FI SPEAKER SYSTEM $49.95

12" G.E. PM WOOFER—10" PM MID-RANGE—8" G.E. MODEL 850 MID-HIGH RANGE SPEAKER AND 600 CYCLE L-C CROSSOVER NETWORK.

Have Juke Box tone quality in your own home. Strictly High fidelity. Three speakers all connected to a 600 cycle frequency dividing network, so that only 2 wires feed the system from any 4 or 8 ohm radio or amplifier. A variable tone compensating control incorporated in the circuit makes brilliant highs or boomy lows to your own taste. Any amplifier that you now have will give you a much wider selection of acoustical arrangements with this speaker system. The 3-way system is shipped ready to connect to your amplifier or hi-fi radio. Equipped with a General Electric 12" woofer, an 8" famous G.E. 850 plus a 10" middle range speaker. Frequency response 30 to 15,000 cps. Take your choice of cabinets; blonde oak, walnut or mahogany. (Specify finish desired when ordering) 37" high, 24" wide and 20" deep. Ship. wt. 75 lbs. Stock No. HF-33GE, Sale price, $49.95.

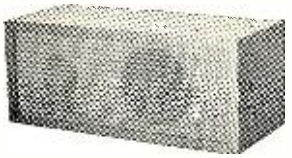
DELUXE CONSOLE SPEAKER SYSTEM $89.50

15" UTAH WOOFER—8" GE—2 - 5" TWEETERS—CROSSOVER

New, deluxe quality High-Fidelity console speaker system. Has 15" Utah woofer with 21 oz. Alnico V magnet, 8" model 850 G.E. mid-range speaker and two Utah 5" tweeters. This is the finest console speaker system that we offer. Available in blond oak or natural mahogany finish. Cabinet size, 43" high, 31" wide and 23" deep. Has 3/4" length doors with attractive hardware and ornament on grill below doors. All 4 speakers are connected to a 600 cycle frequency dividing network, so that there are only 2 wires to connect to any 4 or 8 ohm output of your radio or amplifier. Has variable tone compensating control built-in. Model HF-15CR4, deluxe quality Hi-Fi console speaker system. Ship. wt. 150 lbs. (Specify cabinet finish desired.) Sale price, $89.50.

NEW IMPERIAL IV with General Electric

8 in. HIGH FIDELITY SPEAKER $19.95



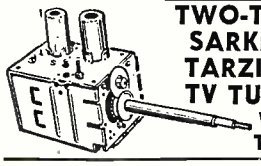
New 1956 Model IMPERIAL IV, High fidelity speaker system with General Electric 8" speaker. Housed in a high quality leatherette covered plywood cabinet 10" x 10" x 24" long. Fully enclosed; covered on all sides except back. Use as an auxiliary speaker or with any high fidelity radio, amplifier or home music system. The IMPERIAL IV contains a General Electric Model 850 extended range high fidelity 8" PM speaker with 6.8 oz. Alnico V magnet and curvilinear cone with 8 ohm voice coil and a 5" tweeter. Response 50 to 15,000 cps. Model IV Imperial $19.95. Ideal for use with IMP-30 amplifier described above.

FAMOUS STANDARD COIL CASCODE TUNERS

TV-2000 series Standard Coil cascode tuners complete with 6J6 and 6BK7 or 6BQ7 tubes. Thousands of TV sets use this famous tuner. Tunes 12 channels (2 thru 13). For 21 mc I.F. circuit. This tuner will give 2 to 1 better reception than the old pentode type. Many servicemen replace all older tuners with this cascode model. Available with either 2 7/8" or 4 1/4" shaft length. A tremendous purchase makes our low $12.95 price possible. Specify shaft length desired. Stock No. TV-2000-3. Sale price $12.95 each, 2 for $25.00.

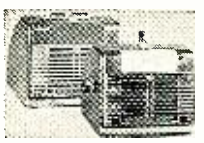
SALE PRICE **$12.95** 2 FOR $25.00

Matching knobs for Standard Coil tuners. Set No. SCK-2 for fine tuning and channel selector. Set VCK-2, matching volume and contrast knobs. Either set only 59¢ a pair.



TWO-TUBE SARKES-TARZIAN TV TUNER WITH TUBES $7.95 EA., 2 FOR $15.00

No. TT-3A, 2 tube Sarkes-Tarzian 12 channel TV tuner. 21-25 mc. Popular in many makes. Ideal for general replacement use too. Has 6J6 and 6BC5 tubes. Used in CBS, Arvin, Crosley, etc. Makes a good replacement for one tube tuners. 3 1/8" shaft. Takes SCK-2 knob set described above. Sale price, $7.95 each, 2 for $15.00 with tubes.



3-STATION MASTER SUB-STATIONS $3.95 EACH $16.95

Powerful 3 station master. Chrome plated metal case 7 1/2" x 6" x 5". 3 tube AC-DC amp. Press-to-talk switch on top. Volume control, switch and station selector on side. Master is quiet except when call switch is pressed at sub. Use with one to 3 subs. Model MPM-A3. Ship. wt. 10 lbs., $16.95. Matching sub-station PM-A5, with 5" PM and call-back switch, $3.95 ea.; 3 for $10.00. Requires 3 wire intercom cable, $1.95 per 100 ft.; 500 ft. for $8.95.

$59.95 TIMEX MAGNETIC RECORDER

SPECIAL SALE PRICE **$29.95** CRYSTAL PICKUP TO PLAY PHONO RECORDS $2.95 EXTRA

MODEL 40 TIMEX RECORDS AND PLAYS BACK

A product of United States Time Corp. (Timex) A multiple purpose machine made to retail for $59.95. McGee buys a solid carload and you save by buying now at only $29.95, plus $2.95 for a 45 RPM record adaptor and crystal head for 16 2/3 or 45 RPM phono records. Records and plays back for 3 1/2 minutes on a wafer thin flexible magnetic disc. Make recordings of your family—use for office dictation—dictate records that may be mailed without breaking. Attractive brown plastic case, 9 1/2 x 11 1/2 x 4 7/8". Turntable speeds 16 2/3 and 45 RPM. Response 100 to 4000 cps. Amplifier has neon level indicator, volume control and selector knob with playback, record and phono positions. Uses 12AX7, 50C5, 6C4 and 35W4 tubes. Built-in 4" speaker. Complete with Shure variable reluctance microphone. Provides faithful reproduction at low volume of voice or music, recorded through the microphone supplied or direct from your radio or TV. As simple to operate as a record player. Stock No. TIM-RI recorder, ship. wt. 13 lbs. Sale price, $29.95.

Recording discs, package of 6 for 99¢. One blank shipped with recorder.

You may purchase a plug-in crystal phono pickup to adapt this recorder for playing 16 2/3 or 45 RPM phono records for only $2.95 extra.

IMPERIAL 30 WATT AMPLIFIER $29.95

NEW 1956 MODEL

Push-Pull 6L6 Output Tubes
Response 15-20,000 CPS
Bass and Treble Tone Controls
Compensated Gain for G.E. Cart.
Input for Xtal or Dynamic Mike

Model IMP-30

With CU-14Y, 12" Coax Speaker .$39.95
With P15-CR, 15" Coax Speaker..$49.95
With Imperial IV Speaker System.$46.95
With SP12125CR .....$51.95 With HF-33GE $76.95

New 1956 model 7 tube Imperial 30 watt High Fidelity audio amplifier. A $100.00 list value for only $29.95. Features a heavy 4 lb., specially wound high fidelity output transformer with 15% inverse feed-back; push-pull 6L6 output tubes and frequency response from 15 to 20,000 cps. Matches 8 or 16 ohm speakers. You can center your entire custom music system around this low cost 30 watt amplifier. This Imperial 30, 30 watt amplifier may be used with any radio tuner or record player. It will drive any speaker system that you may have. Use from one to ten 8" speakers or any 12" or 15" coaxial speaker or any 3-way speaker system. Tone compensated input for either a crystal phono pickup or a General Electric variable reluctance pickup. Also, has input for crystal or high impedance dynamic microphone, 4 controls are mike gain, phono gain, treble tone and bass boost tone control. This amplifier weighs 21 lbs. net. Full size transformer components would cost you up to $15.00 if purchased separately. Gold color chassis is 12 1/4" x 7 3/4" x 7 1/4" high. Complete with tubes: 6AT6, 6AU6, 6C4, 12AU7, 2—6L6GA, plus 5U4G rectifier. Stock No. IMP-30, 30 watt Imperial High-Fidelity amplifier complete with tubes and diagram. Ship. wt. 23 lbs., Sale price only $29.95.

25 WATT HI-FI SPEAKER SYSTEM

2-12" Woofers
2-5" Tweeters
Power Supply and L-C Cross-over Network

SALE PRICE **$24.95**

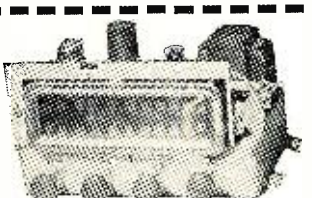
25 watt, High-Fidelity Dynamic Speaker System, complete with 2000 cycle genuine inductance-capacitance cross-over network, two 12" woofer speakers, two 5" high frequency tweeter speakers and separate 110 volt AC power supply for only $24.95. Frequency response 20 to 18,000 cps. Both the woofers and the tweeters are fine quality dynamic speakers with fields excited to saturation by the power supply. Tweeters are specially made with cones designed to respond only to the high frequencies of the audio spectrum. The 2000 cycle cross-over network is of the high quality inductance-capacitance type which prevents frequencies below 2000 cps from entering the tweeters and eliminates frequencies above 2000 cps from the woofer circuit. The cross-over network system is simple to connect to any 4 or 8 ohm output of your high fidelity audio amplifier or radio. No. SP-12125CR, High Fidelity Dynamic Speaker System. Ship. wt. 15 lbs. Sale price, $24.95.

No. SPS-12125, High Fidelity Dynamic Speaker System, as described above, but less the 2000 cycle cross-over network and with a separate attenuator control. Sale price, $14.95. Ideal for use with IMP-30 amplifier described above.

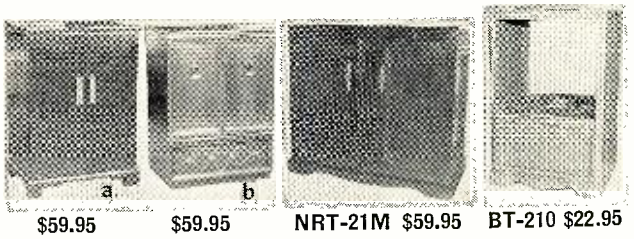
AIR KING FM-AM TUNER

SELF POWERED

Use with any Audio Amplifier SALE PRICE **$24.99**



Air King factory built, 6 tubes self-powered FM-AM radio tuner. Receives broadcast 540 to 1620 kc and FM 88 to 108 mc. Use with any Hi-Fi audio amplifier or connect it to your TV set for FM-AM reception. Selector switch has 4 positions for TV-Phono-FM and AM. 3 other controls are volume-off-on, tone and tuning. With tubes: 12AT7, 2—6AU6, 6AL5, 6SQ7, and 5Y3 rectifier. Chassis size, 11 1/2" x 7 1/2" x 6 1/4" high. Illuminated slide rule dial 7 1/2" x 2 1/2", with escutcheon plate and knobs. Self-powered with its own power transformer. Air King FM-AM tuner chassis No. 703 as used in Air King model 17K1C combination TV-Radio-Phono with power supply added. Note: A separate audio amplifier is required to operate a speaker. Stock No. AIR-K6, self-powered FM-AM tuner, complete with tubes, knobs and diagram. Ship. wt. 10 lbs. Sale price, $24.99.



a $59.95 b $59.95 NRT-21M $59.95 BT-210 $22.95

27" Mahogany Full Door Cab. $59.95

(a) No. 27-MA. Mahogany with full doors for 21", 24" and 27" TV. 43" h. 30 1/4" w. 23" deep. Chassis area 27 3/4" w. 25" h. 18 1/4" deep. Baffle for 10" speaker. A beautiful cabinet that cost the factory over $100. Made for a $600 TV set. Ship. wt. 135 lbs. Sale price, $59.95. Blank panel $5.00 extra. Shipped with 27" mask and safety glass.

27" 3/4 Door Mahogany Cab. $59.95

(b) No. 27-34MA. Mahogany with 3/4 doors for 21", 24" and 27" sets. 43" h. 31 1/4" w. 22 3/4" deep. Chassis area 27 1/2" w. 26 3/4" h. 21" deep. Baffle cut for 2 10" speakers. Made for one of America's largest TV builders. Cost over $100. Ship. wt. 135 lbs. Sale price, $59.95. Blank panel $5.00 extra. Shipped with 27" mask and safety glass.

DELUXE 21" MAHOGANY TV-PHONO CABINET

No. NRT-21M, DeLuxe piano finish mahogany combination radio-phono-TV cabinet for 20" or 21" TV chassis. Beautiful full door style with matching front panels. 37" high, 40 1/2" wide and 22 3/4" deep. Baffle cut for a 12" speaker. TV chassis area 21" high, 23 1/2" wide and 19" deep. Changer shelf 15" x 17" with 9" height clearance. Ship. wt. 165 lbs. No. NRT-21M, mahogany cabinet, sale price, $59.95. 21" mask and safety glass, $6.95 extra.

21" BLONDE $22.95—MAHOGANY OR WALNUT $19.95

No. BT-210, blonde oak 21" TV cabinet. 37 1/2" high, 24" wide and 20 1/2" deep. TV chassis area 20 1/2" high, 23 1/2" wide and 18 1/2" deep. Baffle cut for 10" speaker. Open front, no blank panel furnished. Shipping weight 68 lbs. Sale price, $22.95.

No. WT-210, walnut 21" TV cabinet, same as above. Sale price, $19.95.

No. MT-210, mahogany 21" TV cabinet, same as above, Sale price, $19.95.

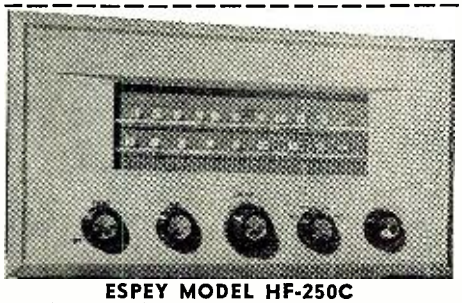
McGEE RADIO COMPANY

PRICES F.O.B. KANSAS CITY
SEND 25% OR FULL REMITTANCE WITH ORDER. BAL. SENT C.O.D.

TELEPHONE VICTOR 2-5092
1903 McGEE ST., KANSAS CITY, MISSOURI

14 TUBE ESPEY HI-FI CUSTOM FM-AM CHASSIS $84.95

LATEST 1956 MODEL WITH RESPONSE FROM 10 TO 22,000 CPS



ESPEY MODEL HF-250C

With 12" Phillips Model 9760M Speaker....$ 99.95

With 12" Phillips Model 9762M Speaker.... 119.95

Buy either of these new Duotone "Norelco" speakers with your Espey chassis. Made by Phillips of Holland. Features Ticonal magnet, improved cone design, built-in mechanical cross-over and copper ring fitted into air gap keeps voice coil impedance independent of frequency.
Model 9760M, $54.95 list 12" Phillips speaker, response 30 to 20,000 cps, rated at 20 watts with Model HF-250C Espey chassis, both for only $99.95.
Model 9762M, $99.95 list 12" Phillips speaker, response 22 to 20,000 cps, rated at 20 watts with Model HF-250C Espey chassis, both for only $119.95.

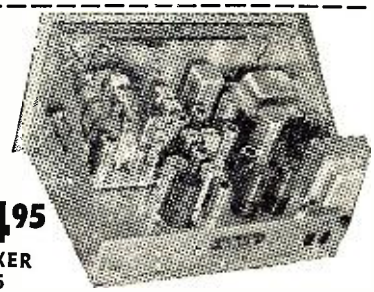
With 15" Utah Coaxial PM Speaker.....$99.95

NEW MODEL HF-250C. A FULL HIGH FIDELITY AUDIO AMPLIFIER AND FM-AM TUNER—ALL ON ONE CHASSIS

- ★ PUSH-PULL 6V6 OUTPUT
- ★ TWIN TONE CONTROLS
- ★ INPUTS FOR CRYSTAL OR V.R. PHONO, TAPE OR TV
- ★ WILLIAMSON TYPE CIRCUIT
- ★ ULTRA-LINEAR RESPONSE

SALE PRICE **$84.95** LESS SPEAKER

WITH MONARCH UA6U CHANGER $112.95



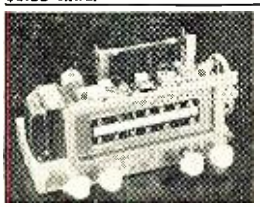
New 1956 model, 14 tube FM-AM chassis. A true Hi-Fidelity receiver built by a nationally famous maker of fine custom chassis. Espey Model HF-250C, 14 tube FM-AM chassis with push-pull 6V6, 10 watt audio. You could spend $200 to $250 for a separate tuner and amplifier and not have the quality of this receiver. Ultra-Linear output used in Williamson type circuit gives frequency response of 10 to 22,000 cps. Output taps of 4, 8 and 16 ohms. Separate RF stages for FM and AM assure high sensitivity. Temperature compensated FM front end for minimum drift. Separate bass and treble tone controls. Pre-amp for all types of magnetic cartridges. 2nd input for crystal phono, tape recorder or TV. 3 position equalizer for accurate reproduction of all records. Built-in antennas for both FM and AM. Response plus or minus 1 db from 10 to 22,000 cps. Harmonic distortion less than 1%. Sensitivity: FM, 8 mv for 30 db quieting; AM, 75 mv for 6 db signal to noise ratio. Off-on-volume and equalizer are combined on a concentric control. Has 2 AC outlets on rear of chassis. Beautiful edge lighted flywheel inertia slide rule dial. Size: 7¾"x13½"x10" deep. Ship. wt. 24 lbs. (not mailable) Model HF-250C, Sale price, $84.95. With heavy duty Utah 15" coaxial PM speaker, both for only $99.95.

NEW IMPORTED MONARCH HIGH FIDELITY AUTOMATIC CHANGER

WITH GOLDRING #500 VAR. REL. CARTRIDGE

SALE PRICE **$29.95**

Monarch Model UA6U—new, imported high fidelity 3 speed automatic record changer. Plays 7", 10" and 12" records automatically. Intermixes records of the same speed in any order. Features a 4 pole high fidelity motor eliminating rumble and wow. Pickup automatically returns to rest and motor turns off after last record has played. Full size 10" turntable has molded rubber pallet for better record cushioning. Base size, 10⅞"x12¾". Tone arm is counter balanced to assure minimum record wear. The changer features, at no added cost the regular $9.90 net value Goldring #500 variable reluctance cartridge for the finest high fidelity record reproduction. Output 10 millivolts. Response, 20 to 16,500 cps. It requires the same input gain as popular American made variable reluctance cartridges. Model UA6U, Monarch automatic changer with Goldring cartridge, ship. wt. 15 lbs. Sale price, $29.95: Large spindle for 45 RPM records, $1.88 extra.



HI-FI FM-AM TUNER

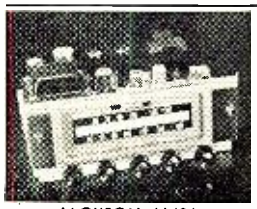
AND 10 WATT P.P. 6V6 AMPLIFIER

10 W. AMP.

BOTH FOR **$44.95**

9 TUBES-PLUS 2 RECTIFIERS PHONO INPUT

New Hi-Fi self-powered FM-AM tuner with 10 watt amplifier (push-pull 6V6's) on separate chassis. All you need is a record changer and speaker to have a complete home music system. 3 ft. cable connects tuner to amp. Tuner has input for crystal phono. (If changer with v.r. cartridge is purchased, we will include the necessary pre-amp, no charge.) Tuner has 6 tubes: 12AT7, 6BE6, 2—6BA6, 6AT6, 6AL5 and 6X4 rectifier. Amp has 2—6V6's, 6SN7 and rectifier. Full supertet circuit with AVC, 3 position tone control, 9" illuminated slide rule dial, escutcheon and knobs. Stick loop antenna for AM. Radio-FM-AM, phono selector switch, tone control, volume control on tuner. Response 50 to 17,500 cps. Receives broadcast 540 to 1600 kc and FM 88 to 108 mc. Output matches any of the speakers shown above. No. FA9-2CR tuner and amplifier complete. Ship. wt. 22 lbs. Sale price, $44.95. CU-14Y 12" coax speaker, $10.00 extra; 15" coax speaker, $20.00 extra.



JACKSON AM9A

9-TUBE HI-FIDELITY

12 Watts Audio
Dual Tone Controls

$39.95 LESS SPEAKER

RECEIVES BROADCAST 550 TO 1650 K.C.

Jackson AM9A, 12 watt hi-fi audio amplifier and broadcast tuner combined. Less than you would pay for the amp alone. Push-pull 6V6's. Response 30 to 15,000 cps. Inputs for crystal or v.r. phono and crystal or dynamic mike. Separate bass boost and treble tone controls, radio-phono switch. Shielded output matches 3.2 or 8 ohm speaker. Heavy duty 150 mil power trans. 9½" illuminated slide rule dial. 3 gang condenser with tuned R.F. and loop ant. Receives 550 to 1650 kc. Size, 13" x 9½" x 6" high. With tubes: 2—6BA6, 6AU6, 6BE6, 6SN7, 6AT6, 2—6V6 and 5Y3. Knobs, escutcheon, diagram and instructions included. Model AM9A. Ship. wt. 19 lbs. Sale price, $39.95. CU-14Y 12" coax speaker, $10.00 extra; 15" coax speaker, $20.00 extra.

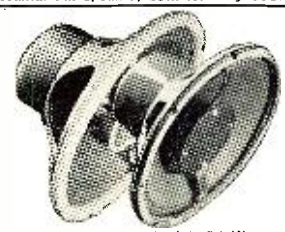
NEW—SMALL VOLT-OHM METER

2000 OHMS PER VOLT
AC-DC
WITH TEST LEADS

2 FOR $19.50—4 FOR $37.00

McGEE SCOOP SALE PRICE **$9.95**

New, small Volt-Ohm meter 5¼" tall, 3⅝" wide and 1½" thick. 3¼" meter. Sensitivity 2000 ohms per volt. DC volts 0 to 1000 in 5 ranges; AC volts 0 to 1000 in 5 ranges; DC current 0 to 500 ma. in 3 ranges; Resistance 0 to 1.5 megohms in 2 ranges; Decibels minus 20 to plus 16 (0db .774 volts). A thin, compact instrument small enough to fit in your service kit. A fine imported meter specially priced at $9.95 for this Radio & TV News ad. Never before have we offered an instrument value like this. Model TP-5, complete with test leads. Sale price, only $9.95. Ship. wt. 2 lbs. Special quantity price, 2 for $19.50, or buy 4 for only $37.00.
New, larger size Volt-ohm meter Model MT-1A, 6¼" tall, 4¼" wide and 2⅝" thick. 2000 ohms per volt. Similar in appearance to Model TP-5, except that it is larger, has 3½" meter and 4 resistance ranges instead of 2. Model MT-1A. Ship. wt. 2 lbs. Sale price, $12.95 each, 2 for $25.00.



McGee's Famous 12 AND 15 INCH COAXIAL P.M. HIGH FIDELITY SPEAKERS

$12.95 12-Inch Model CU-14Y

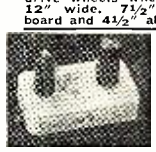
$23.95 15-Inch Model P15-CR

Model CU-14Y, 12" high fidelity coaxial PM speaker. Response from 30 to 17,500 cps. Full 6.8 oz. Alnico V magnet in the 12" woofer. Special coaxially suspended high frequency tweeter. Built-in crossover network. Only two wires to connect to your radio or amplifier. Matches 3.2 to 8 ohm output. Don't confuse this speaker with many cheap speakers that are offered. This is a fine quality speaker. Stock No. CU-14Y. Sale price $12.95 each, two for $25.00.
Model P15-CR, 15" high fidelity coaxial PM speaker. Response down to 20 cps. and up to 17,500 cps. Full 21½ oz. Alnico V magnet in the 15" woofer. Specially made, coaxially suspended 5" high frequency tweeter. Built-in crossover network. Only two wires to connect. Matches 3.2 to 8 ohm output transformer. A regular $62.50 list speaker. Model P15-CR, McGee's Sale Price, $23.95.

WEBCOR 3 SPEED CHANGER

MODEL 140-16 WITH 2 NEEDLE FLIPOVER CARTRIDGE **$24.95**

New Model 140-16, Webster-Chicago 3 speed automatic record changer with Astatic 66-TMY, 2 needle flipover crystal cartridge. Plays all 3 speeds and all 3 size records. Shuts off automatically after last record. Has neutral position to prevent damaging drive wheels when changer is not in use. 13⅜" x 12" wide. 7½" high overall. 2½" below motor board and 4½" above. Model 140-16. Ship. wt. 12 lbs. Sales price, $24.95.



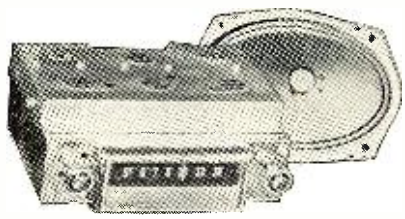
MINIATURE BROADCASTING STATION FOR MICROPHONE AND PHONO WITH CRYSTAL MICROPHONE

SALE PRICE $9.95

Sensational new model MCL-E3 miniature broadcasting station for microphone and phonograph. Can be received on any broadcast radio in the home. No wires to connect, tunes in just like a radio station. Has input jacks for crystal mike or record player. Complete with 12K8 and 70L7 tubes and instructions. Operates on 110 volts AC. Simple to operate; one control fades from microphone to record. Frequency can be adjusted so as not to interfere with local radio stations. Miniature broadcasting station, complete with crystal hand mike and instructions. Ship. wt. 4 lbs. Net price $9.95.

NEW 6-TUBE, 12-VOLT UNIVERSAL MOUNTING AUTO RADIO WITH 5" x 7" OR 6" x 9" SPEAKER

SALE PRICE **$29.99**



6-TUBE, 6-VOLT WITH SPEAKER **$19.99**

McGee makes another tremendous purchase and passes the saving on to you. This universal mounting, 6 tube, 6 volt auto radio is a full superhet with fully tuned R.F. stage. Made to sell at a much higher price, by one of America's best known manufacturers. Its very thin and compact construction lends it to a neat underdash installation in most any car or truck. Or, you can arrange a place in the dash for custom installation. (Dial requires a cut-out 5½" long x 2½" high; two control holes on 7" centers. A minimum of 6¾" depth behind dash.) When mounted underdash it extends only 2⅛" below. Overall size; 9" wide, 4¼" high and 7¼" deep. Requires no more room under your dash than an ordinary auto radio remote control head. Not intended for an exact custom panel fit, but it lends itself very well for your custom installation ideas. Can be custom fit in most late model cars and trucks. Has no built-in speaker, but is furnished with a heavy duty 6x9" speaker. This is the most popular size auto radio speaker. Tubes: 6BE6, 2—6BD6, 6AV6, 6AQ5 and 6X4. Ship. wt. 12 lbs. Stock No. AH-759. McGee's sale price, $19.99 for the radio complete with 6x9" speaker. 3 section top cowl antenna, $2.29 extra.

NEW 12-VOLT MODEL WITH SPEAKER $29.99

Model AH-1259, 12 volt universal mounting auto radio. This is the same set as pictured above (AH-759), except made for 12 volt model 1955 and 1956 cars. Stock No. AH-1259 with 6x9" or 5x7" speaker, $29.99. Stock No. RP-232X, 6x9" rear seat speaker kit for 12 volt cars, $4.99 extra.

McGEE RADIO COMPANY

PRICES F.O.B. KANSAS CITY
SEND 25% OR FULL REMITTANCE WITH ORDER. BAL. SENT C.O.D.

TELEPHONE VICTOR 2-5092
1903 McGEE ST., KANSAS CITY, MISSOURI

Record-Playback Preamp

(*Continued from page 49*)

any point, since this would nullify the effectiveness of the single ground point. This ground is completed at a silver-plated screw midway between the two input connectors. The silver-plated screw is not an essential. It is mentioned only to point up the necessity for thorough and careful handling of the ground circuits. Cutouts at the corners of the end chassis permit wires to be run from the center section to the end chassis.

The erase head and record-playback head leads are rubber covered shielded wires, terminated with plugs which fit the phono jacks used for head connections at the back of the deck. These, incidentally, present a troublesome soldering job for the home builder. The issue is circumvented by buying a 36-inch patch cord, complete with molded-on plugs and cutting it near-center to provide two leads of proper length. With 70 kc. bias this length should be not more than 18 inches. The shielded leads are anchored at the back of the preamp chassis with a flat cable retaining clip.

Keep resistor and capacitor leads short. Use sleeving wherever danger of shorting exists. Don't use tie-points with ground lugs. Instead run grounds to an insulated tie-point and thence to the common ground. During construction, note the location of signal and oscillator leads. You may have to redress them slightly during the final checkout.

Testing of the unit after wiring should logically begin with a check of voltages appearing at the test points indicated on the schematic diagram. Note that readings marked "A" are obtained in the *record* condition and readings marked "B" are taken in the *playback* condition.

Using an oscilloscope, check to see that the erase-bias oscillator is operating. The frequency, using the D501 transformer, should be between 60 kc. and 70 kc.

The 6E5 indicator tube should be operative, but fully open when the switch is in the record position and the gain control at maximum. If the eye is partially or fully closed, oscillation in the amplifier stages is indicated.

Plug in the erase and record head shielded leads at the proper jacks on the deck and clip a ground lead from the preamp chassis to the deck. The erase head jack should be grounded to the deck. The record head jack should not be grounded. During this adjustment procedure the cover should be removed from the deck permitting access to the head connections.

To determine the erase head current, insert a 100-ohm resistor in series with the head at the deck. With the preamp in the *record* condition, an a.c. voltage reading of 1.2 to 1.4 volts should be obtained across this resistor. Too low a reading indicates that the bias frequency is too high. Change capacitors C_{17} and C_{18}, if necessary.

Place the same 100-ohm resistor in series with the record-playback head. Adjust R_{13} to provide a reading of 0.8 volt. Change the value of series resistor R_9 if necessary to obtain this exact value.

Now, place the *record-playback* switch in the *play* position and put on a music tape or other recorded tape. Adequate listening volume should be provided, with high impedance phones plugged in at the output jack or with this jack connected to the music system.

No azimuth adjustment of the record-playback head is required unless it has been loosened at any time, or removed from the bracket. In that case, loosen the head retaining nut slightly and alternately adjust the two azimuth alignment screws until maximum output is obtained. Actually, azimuth alignment should be done using a very-high-frequency continuous-tone tape and an oscilloscope.

The erase head is not critical as to alignment. If it has just been installed, align it by plugging in the record-playback lead at the erase head jack, use a continuous tone or music tape and merely rotate the head for maximum volume. Since the erase head has a very wide gap, very little high-frequency response will be obtained.

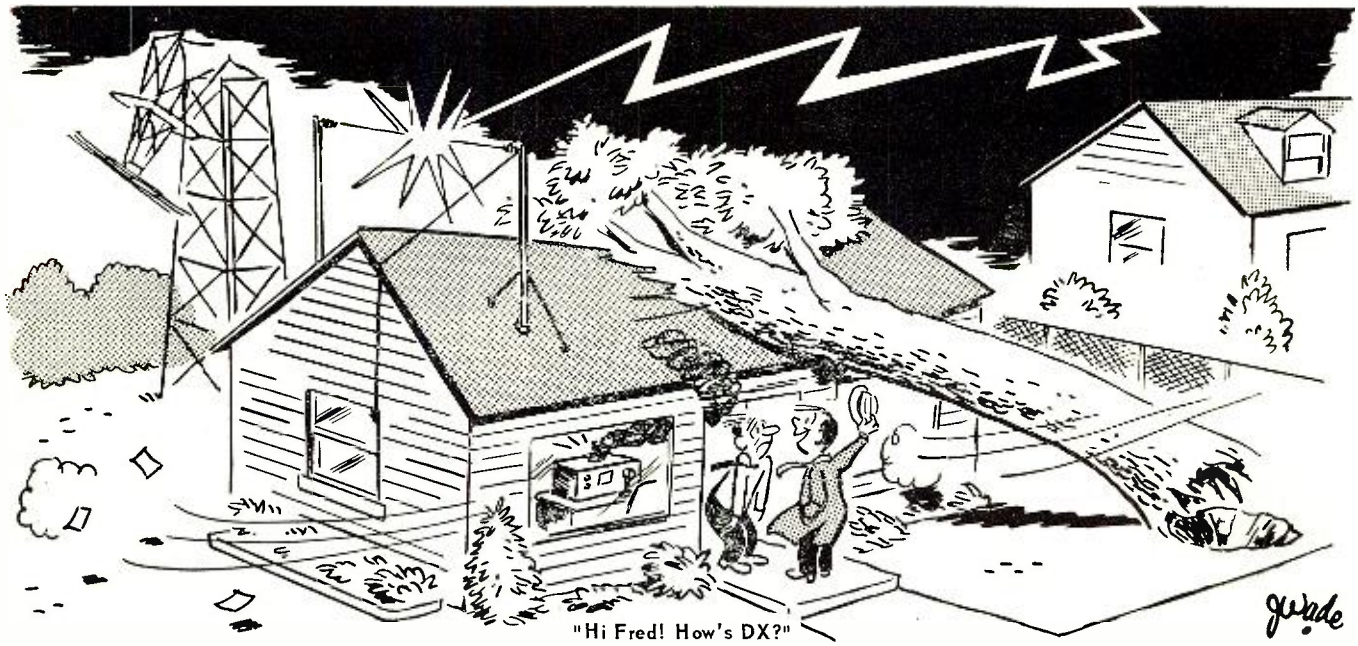
The equipment is then ready for use as a recorder. With phono, radio, or mike inputs the eye indicator should close entirely as the gain is advanced. The best fidelity and dynamic range is provided at a setting that causes the eye to close not more than half way on peaks. Distortion will occur if the eye closes entirely.

If noticeable hum is encountered, check all ground leads carefully. Check to be certain that the record head jack is not grounded at the deck, and that the erase head is grounded. With a short clip lead, momentarily ground the cable shields and ground tie-points throughout the preamp. For minimum hum, the level control should be set fully clockwise during playback.

One more precaution, be sure to place the *record-playback* switch in the *play* position after finishing a recording. An erase head has neither conscience nor judgment about what it erases.

As pointed out in the article, the unit described is a commercial product. For those who would rather purchase an assembled instrument, it is available from *Viking*. It is known as the RP61 and is priced at $74.50. For those who need an erase head for conversion to the two-head unit (Fig. 1B) it is available for $7.50. The three-head unit (Fig. 1C) is priced at $26.75 complete.

In next month's article the mechanical problems involved in changing or adding heads for stereophonic playback will be covered along with a discussion of in-line *versus* staggered heads. (*To be continued*)



"Hi Fred! How's DX?"

NEW HAM GEAR

It's your misfortune if you have never taken advantage of a Walter Ashe "Surprise" trade-in allowance. Get that new ham gear the easy way as thousands of thrifty hams have done. Tell us what new equipment you want and the used (factory-built) test or communications equipment you have to trade. By return mail will come our liberal, money-saving trade-in allowance. We know you will be more than satisfied. Wire, write, phone or use the handy coupon.

HALLICRAFTERS SX-100.
Less speaker. Net $295.00

NATIONAL NC-98. Less speaker. Net.....$ 149.95

PRICES SLASHED AGAIN

We've been making so many wild deals with our "Surprise" Trade-In Allowances that we finally discovered that we're up up to our necks in used ham gear. We're loaded with the units listed below. In order to move them in a hurry, we're cutting prices to the point where it really hurts. These units must go NOW – and they will at these prices. Don't put it off – send your order today. Give a first and second choice if possible. 20% deposit required on C.O.D. orders. No equipment held without a deposit. These special prices in effect only until May 31, 1956.

CENTRAL ELECTRONICS 10B Wired and tested	$109.50
CENTRAL ELECTRONICS 20A Wired and tested	169.50
CENTRAL ELECTRONICS Model "A" with AP-1	39.50
ELMAC A-54 Mobile Transmitter	62.50
ELMAC A-54H Mobile Transmitter	74.50
ELMAC AF-67 Mobile Transmitter	119.50
GONSET Deluxe 2 Meter Communicator II	149.50
HALLICRAFTERS S-40A Receiver	49.50
HALLICRAFTERS S-40B Receiver	69.50
HALLICRAFTERS SX-71 Receiver, less speaker	124.50
HALLICRAFTERS SX-71 Latest Model, less spkr.	149.50
HALLICRAFTERS SX-96 Receiver, less speaker	179.50
JOHNSON VIKING RANGER Wired and tested	179.50

ASK ABOUT OUR TIME PAYMENT PLAN

JOHNSON VIKING RANGER
TRANSMITTER-EXCITER KIT
Net.....$ 214.50
Wired and tested. Net..$ 293.00

NC-300 PRICE INCREASE – SAVE TWO WAYS

The price of the National NC-300 has now increased to $369.95. HOWEVER, Walter Ashe beat the price increase by purchasing a large stock of these receivers while they were still available at the old price. Until our present stock runs out, we are offering these fine receivers at the original price of $349.95. This outright saving of $20.00 is in addition to the money you will save when you get a "Surprise" trade-in allowance on your used (factory-built) test and communications equipment. Don't delay. Get your trade-in deal working today.

NC-300

WRITE FOR FULL INFORMATION ABOUT OUR TIME PAYMENT PLAN

All prices f. o. b. St. Louis • Phone CHestnut 1-1125

Walter Ashe RADIO CO.
1125 PINE ST. • ST. LOUIS 1, MO.

WALTER ASHE RADIO COMPANY
1125 Pine Street, St. Louis 1, Mo.

RN-4-56

Rush my order for used equipment as follows:
(1st Choice).....
(2nd Choice).....
Remittance for $.....is enclosed.
☐ Send free list of additional used equipment bargains.
☐ Send new free 1956 Walter Ashe catalog.

☐ Rush "Surprise" Trade-In offer on my.....
for.....
(show make and model of new equipment desired)
Name.....
Address.....
City.....Zone.....State.....

Bell Labs Designs New V.H.F. Transistor

According to reports, this new design surpasses all others in high-frequency performance.

THE development of new transistor fabricating techniques by Bell Telephone Laboratories has opened the way for the production of an entirely new kind of transistor.

Key to the new fabricating technique is the development of controls over microscopic chemical layers. The "heart" of the new transistor is a layer 50 millionths of an inch thick.

The new techniques involve the adaptation of the chemical process of "diffusion" used in treating silicon for the Labs' solar battery. Since the narrower the base layer, the higher the frequency, this diffusion process provides a high degree of control over such microscopic dimensions.

Because of its v.h.f. characteristics, the new transistor appears to be ideally suited for applications in guided missiles and electronic "brains" for military and computer uses.

The new transistor could amplify 2500 telephone conversations simultaneously on a telephone line. This is three times as many as could be handled by the best previous transistor.

It is also expected to be useful in television transmission which requires a much wider communication channel than a telephone conversation.

The new transistors have been found to reach a cut-off between 500 and 600 mc. Currently available transistors have a frequency cut-off of 1-10 mc. and several recently announced units have a cut-off between 100 and 200 mc. The new higher cut-off would provide more channels or greater amplification. -30-

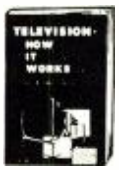
A Bell Labs' technician performing one of the operations in the fabrication of the new germanium transistor. Here, electrical contacts are made to germanium by vaporizing a metal onto the surface of the material. Later wire leads are attached. Bar of germanium is held in vise under vacuum in the jar, as shown in the photo.

TENS OF THOUSANDS
OF ELECTRONICS TECHNICIANS NEEDED BY INDUSTRY!

Let Rider Books Teach You Electronics Know-How!

FUNDAMENTALS OF TRANSISTORS
by Leonard Krugman
Explains the BIG thing in electronics, today—the transistor! Written by one of the pioneers in transistor development, this book tells you all you need to know about this electronic miracle: basic operation, characteristics, performance, and application. Soft Cover, 144 pp., 5½ x 8½", illus.
#160.....Only $2.70

ENCYCLOPEDIA ON CATHODE-RAY OSCILLOSCOPES & THEIR USES
by Rider & Uslan
Fully and clearly describes the oscilloscope, its construction and capabilities. Covers a wide variety of scopes, including present day models. Profusely (3,000) illustrated. Cloth Bound, 1008 pp., 8½ x 11".
#133.....Only $11.50



TELEVISION—HOW IT WORKS (2nd Edition)
by J. Richard Johnson

A completely rewritten, up-to-the-minute edition of an authoritative and informative book. It is the newest and most comprehensive text on the subject, and follows the progress of the received signal from the antenna to the picture tube and loudspeaker. Leather Finish MARCO Cover, 352 pp., 5½ x 8½", illus.
#101.....Only $4.60

COLOR TELEVISION RECEIVER PRACTICES
by Hazeltine Corp. Lab. Staff
Prepared by experts, this book covers every major aspect of color TV receivers, including the latest 21" picture tube and its required circuitry. For anyone who wishes a solid grounding in color television, this volume is ideal. Destined to become a standard reference work on the subject. Soft Cover, 208 pp., 5½ x 8½", illus.
#162.....Only $4.50

RADIO OPERATOR'S LICENSE Q & A MANUAL (5th Edition)
by M. Kaufman
Revised and enlarged 5th edition contains the latest revisions in Elements 1 and 2 (Basic Law, and Basic Operating Practice). Lists questions and answers of past FCC exams, plus discussions of each answer. An indispensable reference volume for the student and operator. Cloth Bound, 766 pp., 5½ x 8½", illus.
#130.....Only $6.60

OBTAINING & INTERPRETING TEST SCOPE TRACES
by John F. Rider
Explains oscilloscope screen traces in clear, non-mathematical language. Contains over 800 scope traces, and complete instructions on the use of scopes and interpretation of traces. Soft Cover, 190 pp., 5½ x 8½", illus.
#146.....Only $2.40

INTRODUCTION TO COLOR TV (2nd Edition)
by Kaufman & Thomas

A revised, up-to-date edition of a best seller in books on TV. New edition contains full information on the latest and larger screen picture tubes, simplified receiver circuitry, etc. Most up-to-date introduction to color television available. Soft Cover, 160 pp., 5½ x 8½", illus.
#156.....Only $2.70

FM TRANSMISSION & RECEPTION (2nd Edition)
by Rider & Uslan
Covers FM broadcasting of all kinds, and explains the theory, functioning and servicing of various types of FM receivers, including TV receivers. Cloth Bound, 460 pp., 5½ x 8½", illus.
#102.....Only $4.95

UNDERSTANDING VECTORS & PHASE
by Rider & Uslan
A book which makes for quick and easy understanding of radio theory, written for anyone in radio and electronics who has not had the advantage of technical training. Soft Cover, 160 pp., 5¼ x 7¼", illus.
#103.....Only $ .99

BASIC VACUUM TUBES & THEIR USES
by Rider & Jacobowitz
Basic information relating to vacuum tubes, with a minimum of mathematics, from the behavior of the elementary electron to the specialized types of tubes. A must book for technicians, engineers, students. 208 pp., 5½ x 8½", illus.
#171, Soft Cover.....Only $3.00
#171-H, Cloth Bound.....Only $4.50

HOW TO TROUBLESHOOT A TV RECEIVER
by J. Richard Johnson
A book written for the newcomer, to aid in a systematic procedure for troubleshooting. An easily understandable, step-by-step guide. Soft Cover, 128 pp., 5½ x 8½", illus.
#152.....Only $1.80

BASIC ELECTRICITY
BASIC ELECTRONICS
BASIC SYNCHROS & SERVOMECHANISMS
by Van Valkenburgh, Nooger & Neville, Inc.
The fabulous picture-text books that teach faster and easier! The theory, principals and practice of electricity, electronics, synchros and servos, are here presented in a manner which permits a rapid grasp of the fundamentals of these vitally important subjects. Over 2,000 specially prepared illustrations present, explain and make every topic discussed picture clear.
#169 BASIC ELECTRICITY
Soft Cover: 5 volumes, 624 pp., 6 x 9", illus. Only $9.00 per set
Cloth Bound: all 5 volumes in a single binding Only $10.50
#170 BASIC ELECTRONICS
Soft Cover: 5 volumes, 550 pp., 6 x 9", illus. Only $9.00 per set
Cloth Bound: all 5 volumes in a single binding Only $10.50
#180 BASIC SYNCHROS & SERVOMECHANISMS
Soft Cover: 2 volumes, 270 pp., 6 x 9", illus. Only $5.50 per set
Cloth Bound: both volumes in a single binding Only $6.95

HOW TO USE TEST PROBES
by A. Ghirardi & R. Middleton
The only book of its kind, it covers all types of test probes used with VOM's, VTVM's, and scopes. Complete step-by-step explanations, with practical examples of results and effects. Soft Cover, 176 pp., 5½ x 8½", illus.
#165.....Only $2.90

HOW TO USE METERS
by John F. Rider
For the technician, hobbyist, TV or radio student. Explains everything about using meters of all kinds. Tells and shows what to use and what to measure. If you use meters, this is a book you cannot afford to pass by! Soft Cover, 144 pp., 5½ x 8½", illus.
#144.....Only $2.40

HOW TO USE SIGNAL & SWEEP GENERATORS
by J. Richard Johnson
Discusses all types of signal and sweep generators, and their applications in AM, FM radio, and TV servicing. Soft Cover, 144 pp., 5½ x 8½", illus.
#147.....Only $2.10

The "Classic" in hi-fi literature

HI-FI LOUDSPEAKERS and ENCLOSURES by Abraham B. Cohen

Really an education . . . A book which explains hi-fi loudspeakers and enclosures in a way that is easy to absorb — does not require any special background!

The book is *supremely authoritative* and *brilliantly written*. Among its 368 pages are many hundreds of illustrations which whet your appetite . . . not to stop reading until you have finished it.

Its coverage is tremendous! EVERYTHING about ALL kinds of loudspeakers — about ALL kinds of enclosures . . . inexpensive ones and costly ones. Not only does this book tell you all about them — but it will enable you to make wise decisions when you want to buy. Includes 18 blueprints of enclosures for home construction.

368 pages 5½ x 8½" Leather Finish MARCO Cover $4.60

THESE AND MANY OTHER RIDER BOOKS ARE AVAILABLE AT YOUR BOOKSTORE OR PARTS JOBBER—LOOK FOR THE RIDER DISPLAY RACK!

JOHN F. RIDER PUBLISHER, INC.
480 Canal Street, New York 13, N. Y.

In Canada:
Charles W. Pointon, Ltd.
6 Alcina Ave., Toronto, Ontario
In Canada, all prices approximately 5% higher.

TRANSISTORIZED CODE-PRACTICE OSCILLATOR

By GUY DEXTER

Using a power transistor, unit will deliver one-half watt of audio to speaker.

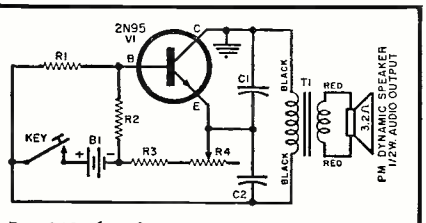
CONVENTIONAL transistorized code-practice oscillators are unsuitable for group instruction, since they deliver only headphone-volume signals.

The diagram shows an oscillator circuit employing a single *Sylvania* Type 2N95 *n-p-n* power transistor. This oscillator delivers ½ watt of audio to a loudspeaker. At the lowest-resistance setting of the 1000-ohm potentiometer, R_4, the signal frequency is 3500 cycles. When R_4 is set to 1000 ohms, the frequency is 360 cycles. Thus, a frequency range of almost 10 to 1 available.

With the key down, the battery drain is 170 milliamperes. While this amount of current might seem excessive for a small battery, the reader is reminded that the drain is very intermittent—there being no current flow whatsoever when the key is up, which is a great deal of the time. Under such conditions of use, even Size D flashlight cells (eight in series for the required 12 volts) will have long life. Eight of these cells can be fitted neatly into a space 2⅝" x 2⅝" x 5". Two midget series-connected 6-volt batteries (such as *Burgess* F4BP or *RCA* VS009) also may be used.

The 2N95 transistor has a threaded mounting hole in one end. This hole is ¼ inch deep. Using this hole, the

Schematic of the loudspeaker-operating, transistorized code-practice oscillator.



R1—910 ohm, 2 w. res.
R2, R3—100 ohm, 2 w. res.
R4—1000 ohm, 4 w. wirewound pot (IRC Type 4WK)
C1—4 μfd., 200 v. metallized paper capacitor (see text)
C2—.1 μfd., 200 v. capacitor
T1—Special Class A output trans. for power transistor, pri. 100 ohms, 150 ma. d.c.; sec. 3.2 ohms; 6 watt (Acme T-24041 available from Acme Electric Corp., 1375 W. Jefferson Blvd., Los Angeles)
B1—12-volt battery (two 6-volt batteries or eight 1½-volt batteries in series)
V1—2N95 transistor (Sylvania. Although the 2N95 transistor is not too readily available, it can be ordered through your local parts distributor).

TRANSCEIVER 20—80 MC.

NAVY TBY WALKIE-TALKIE TRANSCEIVER—20 to 80 MC. in 4 Bands, providing Voice or MCW. For short range operation with Crystal Calibrator for checking Freq. Trans. Oscillator Modulation & 958, 1E7, & #30 Tubes. Rec. is super-regenerative, using 958 & 959 Tubes. Voltage required for operation: 150 V "B" 3 V "A" tapped 1.5 V & 7.5 V "C." Complete with Tubes, Schematic, & Conversion Info. Good Condition **$19.95**

TOWERS And ANTENNA EQUIPMENT

TRIANGLE TOWER

(Illustrated) Galvanized Steel Tower, 12½" Base, 30 Ft. High—in 10 Ft. Sections. Knocked down. Complete with Hardware, two 50 Ft., one 80 Ft. Guys; three 5 Ft. Anchors, and Base Plate. Each section weighs 45 lbs. Complete with Erection Manual. Shipping Weight: Approx. 350 lbs. F.O.B. Ky.—Price..... **$31.95**
NOTE: Two of these Towers may be joined together to make one 60 Ft. Tower.

MAST BASES—INSULATED:

MP-22 BASE—Ins. spring action, direction of bracket can be raised or lowered easily $2.95
MP-S-33 BASE—Ins. type with heavy coil spring and 5" dia. Ins. Requires 2" hole for mounting. Weight: 9 lbs. $5.95
MP-48 BASE—Insulated type base with heavy coil spring. Requires 1⅜" mounting hole. Weight: 11 lbs. $4.95

MAST SECTIONS FOR ABOVE BASES:

Tubular steel, copper coated, painted—in 3 ft. sections, screw-in type. MS-53 can be used to make any length with MS-52-51-50-49 for taper. Any Section. @ 50¢ Ea.
Larger Diameter Section—MS-54 ..... 75¢

115 VOLT 60 CYCLE BLOWERS:

Pictured at Right—115 VAC 60 Cycle SINGLE TYPE—100 CFM —2¼" intake; 2" outlet. Complete size: 5"x6"— **$8.95**
No. 1C939 .....
115VAC 60 Cycle DUAL TYPE—100 CFM—4" intake; 2" Dis. Each Side. Complete Size: 8"x 6"— **$13.95**
No. 1C880 .....
115 VAC 60 cycle COMPACT TYPE—108 CFM; Motor built inside squirrel cage; 4½" intake; 3⅝"x3" Dis. Complete size: 4½" W x 8⅜" H x 8⅛" D —No. 2C067 ..... **$14.95**
115VAC 60 Cycle FLANGE TYPE—140 CFM; 3½" intake; 2½" Dis. Complete size: 7½" W x 7¼" H x 6¾" D—No. 1C807 ..... **$13.95**
115 VAC 60 cycle FLANGE TWIN—275 CFM; 4½" intake; 3¼"x3" Dis. Complete size: 11¾" W x 3⅜" H x 8-1/16" D—No. 2C069 ..... **$21.95**
115 VAC 60 Cycle BLOWER—200 CFM; 4" intake; 3"x5" outlet. Overall size: 8"x7"x6". Bodine Motor NSI-33. Removed from New Equipment. #BOD-200 ..... **$14.95**
115 VAC 60 Cycle BLOWER—100 CFM; 3¾" intake; 2" outlet; Rd. Flange with Flap Director. Overall size with bracket: 8" L x 6½" W x 7" H. Removed from New Equipment. Diehl Motor FB-2106-6 No. FDBL-2106 ..... **$6.95**
Same as above, but with 12-Curved Director. No. CDBL-2106 ..... **$7.95**

OTHER TYPE BLOWERS:

12/24 VDC—AC CAST ALUMINUM BLOWER—100 CFM—3" intake; 2" outlet. Shunt Motor 4"x2", 3000 RPM @ 24 VDC **$5.95**
6 VDC SINGLE—100 CFM—No. 6100—Used $4.95
24 VDC DUAL—20 CFM—Min.—No. 2420 .....$7.95
10 CFM BLOWER—27.5 VDC—1/100 HP.; 7000 RPM; Oster Motor C2BP-1A; L-R Mfg. Co. Bakelite Blower #2; Overall size: 3½"x4½"... **$5.95**
115 V. 400 Cycle—10 CFM—Eastern Air Devices Motor J31A—7200 RPM, 1/100 HP. L-R #2 Blower Assy. Overall size: 4½"x3½". No. 3110... **$5.95**
10 CFM BLOWER—28 VDC—.6 A.; 5000 RPM Pioneer Motor SS-2345. Aluminum Blower Housing. Overall size: 4½"x3¼"..... **$5.95**

FM TRANSMITTER—27 to 38.9 MC

BC-924—TRANSMITTER: Four preselected Channels, M.O. Control, 30 Watt slug tuned Coils, high & low Switch. Uses 2/815 tubes, 2/6SJ7, 1/6SL7, 1/6V6, 1/6J5, 1/6AG7, 1/VR-150. Voltage required 12 or 24 V. and 400 V. @ 400 MA. Size: 11"x11"x18". With Schematic..... **$24.95**

INVERTERS & GENERATORS

GENERATOR: Motor 3 HP. 115/230 V. 60 cycle single phase; Generator 115 V. 400 cycle single phase 1400 Watt & 28.5 VDC 400 Watt. Belt Drive. Reconditioned..... **$195.00**
GENERATOR: 115 V. 400 cycle 1400 Watt Single phase, 28.5 VDC 400 Watt...Used: **$89.50**

SEND FOR NEW LISTING

CLASSIFIED ITEMS:

BC-212G Amplifier—2/6C5 tubes.....NEW:	$ 1.95
BC-216 Amplifier—6F7 & 39/44.....USED:	1.50
BC-229/429 Receiver—2500-7700 KC w/Coils.U:	6.95
BC-230 Transmitter—2500-7700 KC w/Coils..U:	8.95
BC-347 Amplifier—1/6F8G tube...N: $3.95; U:	1.95
BC-357 Beacon Rec.—75 MC.....N: $4.95; U:	2.95
BC-367 Amplifier—2/6V6 tubes...N: $4.95; U:	2.95
BC-375 Transmitter .....Used:	29.95
Tuning Units f/BC-375; TU-5-6-7-8-9-10-26. U: Ea.	3.95
Cables f/BC-375/BC-191, PL-61, 64 or 59. Each End: Ea.	2.75
BC-442 Antenna Relay Box—w/Cond.....New:	2.95
BC-500 Trans. & Receiver—25 Watt, 20-28 MC.	59.50
BC-603 Receiver—20-28 MC FM..N: $39.95; U:	29.95
BC-604 Transmitter—20-28 MC FM 30 Watt.U:	18.95
BC-617 Receiver only—30-40 MC w/Dyn....U:	24.95
SCR-625 Mine Detector—Reconditioned.....	39.95
BC-654 Transceiver—3800 to 5800 KC....Used:	34.95
RM-21 Remote Control Box F/BC-669.....	4.95
CD-515 Cable F/BC-669.....	2.75
BC-709 Amplifier—Batt. Operated .....New:	1.95
BC-745 Transceiver—3 to 6 MC.....Used:	14.95
BC-966 IFF—160 to 211 MC. 13 tubes...Used:	5.95
BC-1158 Transmitter; 50 Watt; 53.3-95 MC New:	39.95
BC-1206 Receiver——200 to 400 Kc.....New:	9.95
RI/ARR-1 Receiver——Converts to 2 or 6 Meters	2.95
RT-7/APN-1 Altimeter—440 MC.....Used:	9.95
RT-34/APS-13 Transcvr. Comp. less tubes...U:	3.95
R-74/CRW-2 Receiver—53-88 MC—6 Tubes. New:	9.95
BC-463 Trans.—67-74 MC; 20 Watt; 16 Tubes. U:	16.95
ID-60/APA-10 Panoramic Oscilloscope....New:	49.50
T-121 Transmitter—3-4 MC with Coder.....	7.95
Range Beam Filter, Navy Type $1.95; FL-8 Used:	1.49
EE-8 Field Telephones—Checked .....Used:	14.95
RM-12 Radio-Telephone—Remote Control.Used:	19.95
BD-72 Portable 12 Line Switchboard.....Used:	39.95
Sound Powered Head & Chest Set—Checked....	3.95
Sound Powered Head & Handset f/Mark II.Used:	2.95
TS-9 Handset w/Switch—No Plugs.....New:	3.95
TS-15 Handset w/Switch, PL-68 & PL-55.New:	7.95
TS-13 Handset w/Switch, PL-68 & PL-55, Used, Ckd.	5.95
T-17 Microphone—Used, Checked.....	3.95
HS-30 Headset—Hearing Aid Type—L.N.....	1.50
CD-874 Cord—f/HS-30—Low Imp., w/PL-55.U:	.59
CD-605 Cord—f/HS-30—High Imp., w/PL-55.N:	.79
CD-307 Cord—w/PL-55 & JK-26.....U:	.59
CD-318 Cord—2/PL-68, JK-48, & SW-141...U:	.89

METERS:

WESTON AC AMMETER:

(Pictured) In portable leather case, with Test Leads, 2½", 0-15 AC and 0-3 AC Scale..... **$5.95**
DC AMMETER HOYT: In portable metal case, with Test Leads, 4½", Fan Mirrored Scale 0-15 ADC.....$4.95
DB METER—10 to Plus 6, Westinghouse 3", NC-35 Imp. 600 ohms @ 1000 cycle..... 4.95
0-1 MA Weston 506; 2½" Rd..... 3.95
0-3 RF AMMETER IS-128: 2½" Rd.....NEW: 2.95
0-8 Amp RF w/Thermocouple IS-89; 2½" Rd... 4.95
0-15 AC-DC—2½" Rd.; IS-122..... 4.95
0-500 MA DC—2½" Rd.; IS-22..... 4.95
0-150 V. 60 cycle; Simpson; 3½" Rd..... 3.95
0-250 MA DC—DeJur, 3" Sq..... 3.95
OUTPUT—5 Ranges, 4000 ohm Imp.—Used..... 4.95

TRANSFORMERS—115 V. 60 CYCLE PRI.:

600 VCT/100 MA—6.3 V/5 A.; 5 V/3 A. $4.95
350 VCT/40 MA—6.3 V/2.4 A.; 6.3 V/.6..... 1.75
1300 VCT/350 MA—5 inches Sq. 6.95
940 VCT/500 MA—6" x 5" x 5"..... 5.95
700 VCT/150 MA—5 V/3 A.; 6.3 V/4.5 A. CSD.. 3.95
2500 V/.015 A.; 2.5 V/175 A.; 6.3 V/.6 A. 5.95
1890 V/12.6 MA—Tapped 2.5 V 2 A. 5.95
1100 V/80 MA—7.5 VCT/3.25 A. 5.95
720 VCT/50MA—6.3V/2.5 A—5V/2 A..... 2.50
662 VCT/110 MA—6.3V/2 A—5V/2 A..... 3.95
800 VCT/300 MA—12.6V/10 A—5V/3 A..... 6.95
16 Volt 35 Amp. 115/230....$21.95; 24V—1 Amp 1.50
9 Volt CT—35 Amp.—Tapped 4.5 V. 7.95
12 Volt—Two separate windings—4 amp each.... 5.95
28 Volt 8 Amp—Tapped 4 Volt..... 5.95
5 V/2 A.; 5 V/2 A.; 5 V/2 A.; & 5 V/6 A..... 2.95
600-0-600 VAC—200 MA. 12.5 V. 2 A.; 12.5 V. @ 2 A.; 5 V. @ 3 A.—#H-108—Price..... 8.95
250-0-250 VAC—50 MA. 24 V. 1 A.; and 6.3 V. 1 A.—#H-109—Price 4.95

Choke—12.5 Hy/100 MA.....$1.95
Choke—8 Hy/150 MA—200 Ohm—Open Frame.... 1.25
Choke—5 Hy/150 MA—85 Ohm..... 1.50
Choke—10 Hy/250 MA—2⅜" x 2" x 3" Potted.... 4.95
Choke—5 Hy/400 MA—4½" x 4" x 5⅜"..... 4.95
18.4 Hy. 1 Amp 100 Ohm—7⅝" x 5⅝" x 6¾".... 6.95

RANGE BEAM FILTER

NAVY TYPE—Similar to FL-8 & FL-30. 1020 cycle Acceptance or Rejection w/PL-55 Cord & Plug for plugging into output of Rec. Also Two output Phone Jacks .....New: $1.95
FL-8 Filter—Used: $1.40—FL-5 Filter:.....$1.00

100—156 MC TRANSMITTER & RECEIVER—SCR-522 TRANS. &

RECEIVER: 100—156 MC, 4 Channel, Crystal Control, AM Voice Operation. 18 Tubes—Trans.: 2/832, 3/12A6, 1/6SS7, 1/6G6—Rec.: 1/9002, 1/9003, 3/12A6, 2/12AH7, 1/12C6, 1/12H6, & 3/12SG7. Complete with Tubes, Schematic, and Conversion Info. for amateur use—Good Cond. **$34.95**
REC.—Chassis Only, w/Tubes: $19.95—Less Tubes: $9.95
TRANS.—Chassis Only w/Tubes: $22.50—Less Tubes: $9.95
SCHEMATIC and Conversion Info. Only..... $2.50

NOVICE BAND TRANSMITTER

WITH CONVERSION

TRANSMITTER AND AUTOMATIC KEYER

T-121—3.5 to 4 MC; 50 Watt Crystal Control with crystal. MO. P.A. for CW. W/2/1625, 1/25L6 Tubes & Crystal Keyer consists of 24 VDC Keyer Ass'y & Code Wheels. Size: 8½"x6¾"x9½". W/Instruction Book. NEW: **$7.95**

TG-34A KEYER

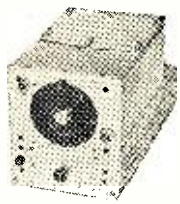
TG-34A KEYER—115 or 230 Volts at 50 to 60 cycles—an automatic unit for reproducing audible code practice signals previously recorded in ink on paper tape. By use of the self contained speaker, the unit will provide code practice signals to one or more persons—or provide a keying oscillator for use with a hand key. Unit is compact in portable carrying case, and complete with Tubes, Photo Cell and Operating Manual. Size: 10⅜" x 10½" x 15⅜". Shipping weight: 45 lbs. .....NEW: **$16.95**

TG-10 KEYER—Same function as TG-34A—only larger—using 2/6N7—2/6L6—2/6SJ7—1/5U4G Tubes and 1/923 Photo Cell. Housed in standard Metal Cabinet, can be removed for 19" rack mtg. Size: 11" H x 24" W x 18½" D. Price—USED, TESTED.....Only **$14.95**

BLANK PAPER TAPES FOR CODE RECORDERS:

⅜" Wide, in 900 Foot Rolls—Prices: 25¢ Each—or 6 Rolls f/$1.00—30 Rolls f/$3.00—60 Rolls f/$5.00

COMM. & ARC-5 REC. & TRANS.:



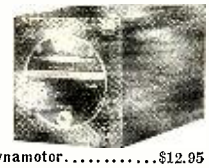
NAVY TYPE—520—1500 KC
New $19.95
Like New 14.95
Q 5'er NAVY TYPE—190—550 KC...New: $12.95
R-28/ARC-5 RECEIVER—100—156 MC .....Used: $10.95
T-23/ARC-5 TRANSMITTER 100—156 MC..Used: $14.95
NAVY TYPE COMM. TRANS. —2.1—3 MC....New: $7.95
NAVY TYPE COMM. TRANS. —3-4 MC .....Used: $6.95
BC-458 TRANS.—5.3—7 MC—New: $5.95..Used: $3.95
Navy type trans.—7—9 MC—New: $7.95...Used: $5.95
BC-1206—200 to 400 KC..... 9.95
Tuning Crank f/274/ARC-5 Receiver..... 75¢

DYNAMOTORS & GENERATORS:

INPUT VOLTS:	OUTPUT: VOLTS:	MA.	STOCK No.	PRICES: USED:	NEW
12 VDC	220	80	DM-34	$2.95	$ 4.95
12	625	225	DM-35	8.95	12.95
12	230	90	PE-133	4.95	6.95
12 or 24	540	450	DA-14		14.95
12 or 24	230	100	DA-12		8.95
14	220	70	DM-24	4.95	7.95
14	1030	260			
	515	215	DM-42	4.95	9.95
14	375	150	BD-83	3.95	4.95
14 VDC	330	150	BD-87	3.95	5.95
14	250	50	DM-25	6.95	3.95
14	1000	350	BD-77	14.95	29.95
24	250	60	PE-86		8.95
28	1000	350	PE-73	8.95	

12 to 24 VDC PM Dynamotor—Supplies 24 VDC 2 A, from 12 VDC. also 500 V 50 MA. @ 6 VDC will supply 12 VDC & 250 V 50 MA. #0515.....New: **$4.95**
GN-45 HAND CRANK GENERATOR—Supplies 6.3 VDC and approx. 250 to 500 VDC. Complete with legs, seat and Hand Cranks which have to be turned 50 to 70 RPM to supply voltage (Used with BC-654).....Complete Set: **$9.95**

NOW—OPERATE BEACON RECEIVER FROM 12 VOLT



BC-1206CM BEACON RECEIVER: 200-400 KC, 5 Tubes, 135 KC IF, operates from 24 VDC— **$9.95**
For 12 Volt operation, use this PM DYNAMOTOR—12 VDC input, output 24 VDC. Size: 2½" x 4" x 7" Dyn.....Only: **$4.95**
Combination: BC-1206 & Dynamotor.....$12.95

Address Dept. RN • $5.00 Order Minimum, & 25% Deposit on C.O.D.'s • Prices are F.O.B. Lima, Ohio

FAIR RADIO SALES 132 SOUTH MAIN ST. LIMA, OHIO

transistor is bolted directly to the chassis by means of a ¼-inch 10-32 screw, the chassis then serving to take heat away from the transistor. Because the metal case of the 2N95 is connected internally to the collector, fastening this transistor to the chassis automatically grounds the collector to chassis, as shown in the diagram. This means *that no other point* of the circuit can be connected to the chassis.

The 4 microfarads of capacitance required for C_1 may be obtained in a small space by paralleling metallized paper tubular capacitors; for example, two 2-μfd. or four 1-μfd. *Aerovox* Type P82 units.

If volume control is desired, the most satisfactory type of control is a 3-to-4-ohm L-pad attenuator (such as *Mallory* L4 or *Jensen* ST-760) inserted between the loudspeaker voice coil and the secondary of the output transformer, T_1. A variable resistor in any other part of the circuit will vary the frequency as well. —30—

PHONO NEEDLE BRUSH

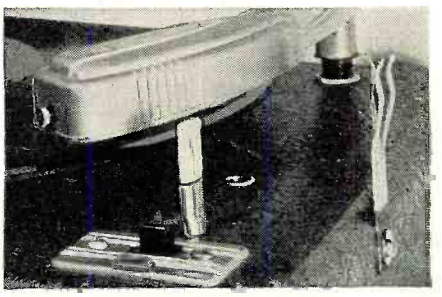
BY ARTHUR TRAUFFER

LIKE many owners of record players, I have been in the habit of rubbing a finger tip over the point of the needle before playing each record in order to remove particles of foreign matter that cling to the point. To simplify this task, I bought a small soft-bristled paint brush, cut off the wood handle, and mounted the brush on the motorboard between the turntable and the tone arm rest, as shown in the photo. The brush was so mounted that when the tone arm is lifted from the record to the arm rest, the point of the needle is carried through the bristles of the brush thus sweeping the point clean of dust and small particles of matter which it picked up from the record.

There are several ways of mounting the brush on the motorboard. I simply put a little Duco cement on the cut end of the brush and stuck it onto the motorboard, as shown in the photo. For a more solid job, drill a small hole of the required size in the motorboard and force the shank of the brush into the hole, using a little Duco cement if desired. Or you can solder a small metal angle bracket onto the metal shank of the brush, and then screw-fasten the angle bracket onto the motorboard.

Small dimestore paint brushes, such as used in children's water color outfits, are ideal for this purpose. —30—

When the tone arm is lifted from the record, and travels to the arm rest, the tip of the needle passes through the soft bristles of the brush, thus sweeping it clean of dust and other foreign material.



LIFETIME GUARANTEED TUBES

BRAND NEW PICTURE TUBES

- RCA Licensed
- One Year Unconditional Guarantee

Type	Price	Type	Price
10BP4	$11.90	17BP4	$20.63
12LP4	$14.38	19AP4	$24.81
14BP4	$16.86	21AP4	$28.79
16RP4	$19.38	21EP4	$28.79
16LP4	$19.38	24AP4	$42.50

Picture Tubes shipped F.O.B. Harrison, N. J.
Above types are most popular. However, you may order any equivalent size at the same price.

NEW INDOOR ANTENNA

Both UHF and VHF. Brings better reception than most outdoor antennas. Use on top of TV.

List Price $9.95

Your Price

Lots of 3 $3.29

$3.99 each

USED TV SETS

Picture Tube Guaranteed To Work!

- Emerson
- RCA
- Philco
- GE
- Motorola
- Zenith
- Capehart
- Others

10" SET		14" SET	
Table Model	$16.95	Table Model	$27.95
Console	$19.95	Console	$31.00
12" SET		16" SET	
Table Model	$22.95	Table Model	$32.00
Console	$24.95	Console	$34.95
17" SET			
Table Model	$37.00		
Console	$39.00		

All prices F.O.B. Harrison, N. J. Prices on request for 19", 20", 21" and 24" sets.

LOOK WHAT YOU GET FREE!

FREE BONUS BOX With Every $25 Order

- 1 RCA Cheater Cord
- 10 Assorted resistors
- 10 Assorted 2 color "blank" tube cartons
- 1 6BQ6GT tube
- 1 6AU6 tube
- 1 6CB6 tube

FREE CLOCK RADIO

With Every $125 Purchase Within 30 Days

Wakemaster clock radio with famous Sessions clock movement wakes you to music or alarm. May be purchased outright from MAJOR BRAND for $17.95. In ivory or rust.

FREE GIFT CERTIFICATE* worth $5 toward the purchase of any of our merchandise on future orders will be sent with any order of $50 or more.

* Free Gift Certificate cannot be used to obtain another certificate unless order is $55 or more.

HERE'S HOW LIFETIME GUARANTEED TUBES SAVE YOU MONEY!

- **We Guarantee to Replace Tubes Labeled MAJOR BRAND Forever**
- **Each Tube Individually Boxed and Guaranteed**
- **Over A Half Million Tubes Always In Stock**
- **Immediate Shipment**
- **Free Postage On All Orders With Full Remittance**
- **There are fewer "call backs"**
- **There are no "out of date" tubes**
- **"Peak Performance" testing in our fully equipped Testing Department before shipment guarantees quality**

0Z4	.43	6A7	.57	6K6GT	.37	12AV6	.35
1A7GT	.43	6A8	.45	6K7	.39	12AV7	.67
1A7G7	.43	6AB4	.43	6K8	.65	12AX4GT	.65
1B3GT	.65	6AC7	.67	6L6	.68	12AX7	.58
1C5GT	.41	6AF4	.79	6L7	.42	12AZ7	.63
1D5GP	.43	6AG5	.50	6N7	.60	12B4	.68
1E7GT	.41	6AG7	.69	6Q7	.40	12BA6	.46
1G6GT	.41	6AH6	.69	6S4	.40	12BD6	.48
1H4G	.43	6AJ5	.70	6SA7	.45	12BE6	.46
1H5GT	.47	6AK5	.54	6SC7	.48	12BH7	.60
1J6GT	.47	6AL5	.39	6SG7	.41	12BY7	.65
1L4	.45	6AQ5	.46	6SH7	.43	12BZ7	.61
1L6	.55	6AR5	.46	6SJ7	.43	12CU6	.95
1LA4	.57	6AS5	.48	6SK7	.45	125A7	.45
1LA6	.47	6AS6	1.70	6SL7GT	.55	125J7	.45
1LB4	.57	6AS7G	2.19	6SN7GT	.55	125K7	.45
1LC5	.49	6AT6	.39	6SQ7	.39	125N7GT	.56
1LC6	.47	6AU4GT	.65	6SR7	.42	125Q7	.37
1LD5	.57	6AU5GT	.59	6SS7	.41	125R7	.45
1LE3	.57	6AU6	.42	6T4	.95	12V6GT	.45
1LG5	.57	6AV5GT	.65	6T8	.68	12X4	.37
1LH4	.64	6AV6	.39	6U8	.75	14A7	.42
1LN5	.47	6AX4GT	.60	6V3	.80	14B6	.38
1N5GT	.50	6AX5GT	.57	6V6GT	.46	14Q7	.50
1R5	.50	6B4G	.52	6W4GT	.39	19BG6G	1.15
1S5	.42	6B8	.69	6W6GT	.53	19T8	.65
1T4	.50	6BA6	.47	6X4	.34	24A	.39
1U4	.47	6BA7	.58	6X5	.34	25AV5GT	.78
1U5	.42	6BC5	.47	6X8	.73	25BQ6GT	.78
1V2	.65	6BC7	.80	6Y6G	.55	25L6GT	.47
1X2	.61	6BE6	.45	7A4	.45	25W4GT	.43
2A3	.55	6BF5	.40	7A5	.53	25Z5	.37
2A5	.57	6BF6	.50	7A6	.45	25Z6	.37
2A7	.55	6BH6	.50	7A7	.43	27	.25
3A4	.51	6BJ6	.47	7A8	.45	35A5	.46
3A5	.50	6BK5	.68	7B5	.39	35B5	.50
3AL5	.45	6BK7	.76	7B6	.42	35C5	.50
3AU6	.46	6BL7GT	.75	7B7	.41	35L6GT	.47
3BC5	.54	6BN6	.58	7B8	.45	35W4	.34
3BN6	.70	6BQ6GT	.78	7C4	.39	35Y4	.34
3CB6	.52	6BQ7	.78	7C5	.42	35Z3	.39
3Q4	.46	6BY5G	.58	7C6	.43	35Z5GT	.34
3Q5GT	.57	6BZ7	.88	7C7	.45	37	.29
3S4	.47	6C4	.37	7E5	.45	50A5	.46
3V4	.47	6C5	.35	7E6	.55	50B5	.50
4BQ7	.89	6CB6	.49	7E7	.70	50C5	.50
4BZ7	.95	6CD6G	1.15	7F7	.59	50L6GT	.43
5AW4	.75	6D6	.48	7F8	.70	75	.42
5BG6G	1.15	6E5	.44	7G7	.75	76	.42
5J6	.63	6F5	.37	7H7	.50	77	.38
5T4	.69	6F6	.38	7J7	.75	78	.38
5U4G	.43	6G6	.40	7K7	.75	80	.34
5U8	.74	6H6	.38	7L7	.75	84/6Z4	.44
5V4G	.59	6J4	1.79	7N7	.50	117L7GT	1.09
5Y3	.31	6J5	.39	12AT6	.37	117N7GT	1.09
5Y4G	.36	6J6	.47	12AT7	.66	117P7GT	1.09
5Z3	.41	6J7	.43	12AU6	.41	117Z3	.35
		6J8G	.85	12AU7	.53	117Z6GT	.63

ALL PARTS SHIPPED F. O. B. FROM HARRISON, N. J.

WE PAY ALL POSTAGE on orders shipped in USA, Territories and APO's. Send only purchase price of merchandise. Please include approximate postage on foreign shipments. All orders subject to prior sale. Add 25c handling on orders under $5.00. Quantity users write for special discount.

Write for FREE Tube List—Order Blank—and FREE Sample Tube Carton. We want Y-O-U on Our Mailing List!

THIS AD IS WORTH M-O-N-E-Y

Clip out this ad and attach it to your order. Three 6SN7GT's will be shipped FREE with any order of $10 or more.

Write Dept. RN-4

MAJOR BRAND TUBE CO.

Romano Bldg. ESsex 4-1106 Harrison, N. J.

What's New in Radio

H.V. RECTIFIER TUBE

The Tube Department of *General Electric Company,* Schenectady, New York has introduced a new high-voltage rectifier tube that promises to cut television set manufacturing costs and give longer life.

Known as the 2B3GT, the tube is intended for design into TV sets in place of the 1B3GT. The 2B3GT has a filament rating of 1.75 volts at .25 ampere as compared with the 1.25 volt and .2 ampere rating of the 1B3GT. The new tube can be operated directly from the flyback transformer without a filament dropping resistor, thus saving the manufacturer the cost of the resistor, associated wiring, and assembly expense.

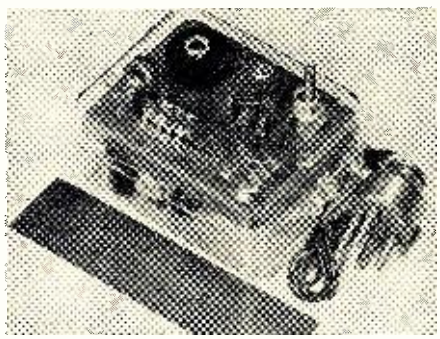
It has a new type of filament construction which promises to give longer life and greater dependability. Other ratings and pin connections are the same as for the 1B3GT.

RADIO-CONTROL RECEIVER

Gyro Electronics Company, 325 Canal Street, New York 13, New York is prepared to make immediate delivery on a new miniature receiver for radio control applications on the 27.255 mc. Citizens band.

The Model DX receiver is housed in a small plastic case that measures 1¼" x 1¾" x 2¼". It uses a high-gain transistor relay current amplifier in conjunction with a thyratron superregenerative detector. Total weight of the receiver is only 2 ounces.

Write the company for full specifications on this receiver and on the company's Model ZT companion transmitter.



COMBINATION TESTER

Radio City Products Co. has announced the availability of a new combination tube and transistor tester, the Model 325.

Designed especially for the servicing field, the instrument will test *n-p-n* and *p-n-p* type transistors as well as all radio and television tubes including magnetically-deflected black and white and color picture tubes and all series-string heater types.

Tubes can be checked for all essential characteristics; grid conductance,

plate conductance, and shorts. The transistors are checked under actual operating conditions.

The entire instrument is housed in a portable case measuring 15⅛" x 14¼" x 5½" and comes complete with probe compartment and built-in straighteners for 7- and 9-pin tubes. A diode limiting circuit protects the 50 μa. meter against burnouts due to shorted transistors.

Full specifications are available from the company's Distributor Division at 26 Rittenhouse Place, Ardmore, Pa.

FLUSH CUT-OFF PLIERS

Xcelite, Incorporated, Orchard Park, New York has brought out a new plier which combines the compactness of needle-nose pliers plus narrow end-nippers for flush or other cut-off work in miniature and subminiature chassis.

The No. 62 transverse cutter features a spring return which permits the unit to be operated by just the thumb and a finger in close quarters too small for the hand. It is of drop-forged steel, induction hardened, with hand-honed cutter blades. The cutter is available in polished or chrome plated finish.

AUTOMATIC TUBE TESTER

American Scientific Development Company, 334-336 South Main, Ft. Atkinson, Wisconsin, is currently marketing a new automatic tube tester, the Model 400A.

The unit completely eliminates selector switches, knobs, load controls, and filament switches. All setup procedures have been eliminated. The necessary contacts, for setup, are made through the holes in a player-piano-type roll chart. The technician merely selects his tube number on the

SENSATIONNEL!

MONEY SAVING

EN STOCK PLUS DE 2,000 TYPES DE LAMPES 1er CHOIX VENDUES AVEC GUARANTIE TOUTES EN BOITES CACHETEES OU EN EMBALLAGE CONSTRUCTEUR

TRANSLATION: We have in stock at all times over 2,000 different types of tubes. All first quality, money-back guarantee, individually boxed

In any language your best buy is Radio Ham Shack for:

QUICK SERVICE • HIGH QUALITY • LOW PRICES

CASH for YOU!

We urgently need for government contracts military electronic equipment, such as: BC312, BC342, BC348, ART13, APR4, ARC1, ARC3, ARN6, ARN7, BC221, BC788, BC610, and many others. State conditions, type and best price.

OTHER SPECIALS

2000 OHM PER VOLT AC-DC VOM MULTITESTER NEW

POCKET SIZE — MODEL RH-42
22 Full Scale Ranges
DC VOLTS: 0-6; 0-12; 0-60; 0-300; 0-1200.
AC VOLTS: 0-6; 0-12; 0-60; 0-300; 0-1200.
DC CURRENT RANGES: 0-300 microamps; 0-3 MA; 0-300 MA.
RESISTANCE RANGES: 0-20K Ohms; 0-2 Megohm.
DECIBEL RANGES: 5 ranges from −20 to +46 db.
Complete, assembled. (Not a kit).
Price per Each (with Test Leads) **$12.95**

HI FI TURNOVER CARTRIDGE
MODEL RH-800
FREQ. RANGE: 40-14,000 CPS + or — 2 DB.
STYLI: 2 sapphire (1 LP and 1 Std.)
OUTPUT: .5 volts.
Price per Each **$2.75**

LAPEL MICROPHONE
MODEL RH-550
WEIGHT: 1⅛ oz. 1⅝" dia.
OUTPUT LEVEL: 55 db. Excellent frequency response. Chrome plated case with **Handy Lapel Clip.** 5 ft. shielded cable.
Price per Each **$2.95**

DYNAMIC EAR PHONE
MODEL RH-14
Lightweight Plastic. Fits right into ear. **SENSITIVITY:** 65 db. DC resistance 2000 ohms.
HIGH IMPEDANCE: 5000 ohms. Complete with 3 ft. cord.
Price per Each **$1.95**
LOW IMPEDANCE: (8 ohms)
Model RH-1S **$1.95**

CRYSTAL MICROPHONE
High Quality
MODEL RH-12
OUTPUT LEVEL: —57 db.
FREQUENCY RESPONSE: 30-10,000 cycles. **CABLE:** 5 ft. shielded. **FITTING:** Standard ⅜", 27 thread. **SIZE:** 4½" H x 4¼" D. Grill Dia. 2¾".
Price per Each **$4.95**
Lots of 3 ..... **$11.85**

Command Equipment (274N-ARC5, ATA)

ALL COMPLETE WITH TUBES

Description	Used	Excellent BRAND NEW
Receiver 190-550 Kc	$11.95	$14.95
Receiver 3-6 Mc	8.29	11.95
Receiver 6-9 Mc	7.95	9.95
Modulator	2.75	4.15
Transmitter 4-5.3 Mc	11.95	12.95
Transmitter 5.3-7 Mc	7.95	8.95
Transmitter 7-9.1 Mc	8.95	11.95
3-Receiver Control Box	1.49	1.95
Transmitter Control Box	1.25	1.49
Transmitter 3-4 Mc	14.75	19.50
Receiver 100-156 Mc	14.95	.....
Transmitter 100-156 Mc	22.50	.....
Tranceiver 420-500 Mc	.....	29.50
Beacon Recvr 195-420 Kc	4.95	.....

All Inquiries Answered Promptly

TUBES! First Quality — Fully Guaranteed — Standard Brands — No Seconds **TUBES!**

RECEIVING TUBES

0Z4	.49	6B4G	.95	7B5	.65
1A3	.68	6B8	.67	7B6	.75
1A7GT	.52	6BA6	.63	7B7	.75
1AE4	.92	6BC5	.68	7C5	.75
1AX2	.95	6BE6	.65	7C6	.75
1B3GT	.79	6BF6	.68	7C7	.79
1C5GT	.55	6BG6G	1.75	7F7	.85
1G4GT	.65	6BH6	.79	7F8	1.10
1G6GT	.49	6BJ6	.69	7N7	.85
1H5GT	.58	6BK7	1.05	7R7	.95
1J6GT	.69	6BL7GT	1.05	7V7	.95
1L4	.74	6BN6	1.10	7Y4	.65
1L6	.79	6BQ6GT	1.15	12A6	.57
1LA4	.79	6BQ7A	1.15	12A8GT	.79
1LA6	.85	6C4	.38	12AH7GT	1.05
1LB4	.85	6C5	.48	12AT6	.48
1LC5	.79	6C5GT	.46	12AT7	.92
1LC6	.79	6C6	.49	12AU6	.62
1LD5	.85	6C8G	.85	12AU7	.75
1LE3	.79	6CB6	.68	12AV7	.95
1LH4	.85	6D6	.59	12AX7	.78
1LN5	.79	6E5	.75	12AY7	1.15
1N5GT	.59	6F5	.59	12BA6	.60
1R4	.65	6F6	.85	12BA7	.89
1R5	.65	6F6GT	.69	12BE6	.65
1S4	.65	6F7	.85	12BH7	.89
1S5	.65	6F8G	.72	12C8	.69
1T4	.65	6G6G	.72	12H6	.59
1T5GT	.69	6H6	.59	12J5GT	.65
1U4	.67	6H6GT	.49	12K7GT	.85
1U5	.59	6J5	.48	12K8	.69
1V	.65	6J5GT	.47	12SA7	.69
1V2	.59	6J6	.68	12SA7GT	.69
1V6	1.49	6J7	.82	12SC7	.75
1X2A	.85	6J7GT	.65	12SG7	.79
2A3	.95	6K6GT	.65	12SH7	.65
2A5	.65	6K7	.74	12SJ7	.65
2A6	.59	6K7GT	.59	12SK7	.69
2X2	.49	6K8	1.10	12SL7	.85
2X2A	1.35	6K8GT	.95	12SN7GT	.75
3A4	.50	6L6	1.69	12SQ7	.59
3A5	.64	6L6G	.98	12SR7	.59
3B7	.39	6L7	.95	12V6GT	.73
3D6	.39	6N7	.89	12W6GT	.87
3LF4	.85	6Q7	.85	14A7	.75
3Q4	.65	6Q7GT	.79	14B6	.69
3Q5GT	.75	6R7	.85	19BG6G	1.89
3S4	.65	6R7GT	.68	19T8	.95
3V4	.69	6S4	.57	25BQ6GT	1.25
5AW4	1.10	6SA7	.79	25L6GT	.65
5R4GY	1.45	7SA7GT	.79	25W4GT	.72
5T4	.90	6SB7Y	.87	25Z5	.75
5U4G	.58	6SC7	.72	25Z6	.62
5V4G	.88	6SF5	.72	30	.65
5W4GT	.65	6SF5GT	.69	32L7GT	.85
5X4G	.75	6SG7	.65	35A5	.68
5Y3GT	.49	6SH7	.74	35B5	.68
5Z3	.69	6SJ7	.69	35L6GT	.65
5Z4	.89	6SJ7GT	.59	35W4	.44
6A3	.95	6SK7	.64	35Y4	.65
6A6	.82	6SK7GT	.59	35Z3	.65
6A7	.89	6SL7GT	.75	35Z5GT	.44
6A8	1.05	6SN7GT	.75	41	.75
6A8GT	.95	6SQ7	.59	42	.69
6AB4	.59	6SQ7GT	.59	43	.79
6AB7	.95	6SR7	.55	50A5	.68
6AC7	.85	6SS7	.75	50B5	.68
6AF6G	.85	6ST7	.95	50C5	.68
6AG5	.72	6T8	.95	50L6GT	.62
6AG7	.98	6U5/6G5	.85	50Y6GT	.78
6AH6	.85	6U8	.95	53	.92
6AJ5	1.49	6V6	1.10	70L7GT	1.15
6AK5	.69	6V6GT	.59	75	.65
6AK6	.75	6W4GT	.65	77	.47
6AL5	.58	6W6GT	.79	78	.57
6AL7	.95	6X4	.48	80	.59
6AQ5	.57	6X5GT	.49	83	.95
6AQ6	.57	6Y6G	.89	83V	.95
6AT6	.52	7A4	.79	84/6Z4	.49
6AU5GT	1.10	7A5	.69	117L/M7GT	1.65
6AU6	.65	7A6	.78	117N/P7GT	1.45
6AV6	.53	7A7	.75	117Z3	.68
6AX4GT	.79	7A8	.75	117Z6GT	.95
6AX5GT	.69	7AG7	.95		

TRANSMITTING AND SPECIAL PURPOSE TUBES

0A3/VR90	.86	250TH	18.95	959	1.32
0B3/VR90	.73	250TL	14.75	991	.29
0C3/VR105	.68	274A	1.40	1603	2.95
0D3/VR150	.68	274B	.85	1616	.50
1B22	1.25	204TH	7.95	1619	.30
1B23	2.68	304TL	9.95	1622	1.45
1B24	4.85	307A	1.10	1624	.95
1B27	12.95	350A	2.65	1625	.29
1B35	3.45	350B	2.35	1626	.19
1B38	33.50	371B	.85	1633	.85
1N21	.39	393A	4.50	1635	1.48
1N21B	1.45	417A	2.95	1641	1.35
1N23	.68	434A	2.95	1654	1.75
1N23B	1.40	450TH	47.50	2050	.93
1N34	.42	450TL	35.00	2051	.65
1N34A	.48	575A	9.95	5516	6.90
2AP1	4.95	705A	.68	5517	1.65
2C39A	12.45	707B	4.25	5637	4.95
2C40	7.45	714AY	35.00	5638	7.95
2C43	7.25	715C	10.95	5639	8.95
2V51	2.95	717A	.35	5642	.95
2D21	.65	721A	.65	5651	1.35
2E22	3.45	726A	6.95	5654	1.25
2E24	1.95	725A	2.95	5670	1.45
2E26	2.95	723A/B	8.45	5675	10.95
2E30	1.95	726B	32.50	5676	1.45
2J32	12.50	726C	32.50	5686	2.45
2J36	14.95	750TL	39.50	5687	2.65
2J51	97.50	801A	.38	5703	.95
2J55	39.50	802	2.45	5763	.95
2J61	12.95	803	1.40	5794	7.50
2J62	4.45	804	8.85	5814	.98
2K25	11.95	805	3.95	5819	34.50
2K28	27.50	806	4.85	5823	1.35
2K33A	56.90	807	1.18	5851	3.45
3AP1	2.90	808	1.25	5876	12.50
3B24	.95	809	2.20	5879	1.25
3BP1	2.45	810	9.50	5881	2.95
3C22	59.50	811	2.75	5886	2.75
3C23	3.45	812	2.45	6146	4.75
3C24	1.48	813	10.50	8005	4.75
3C45	5.95	814	1.50	8008	3.95
3D21A	3.95	815	1.50	8012	.98
3DP1	3.45	816	1.15	8013	2.65
3E29	8.43	826	.65	8014	67.50
4-125A	18.95	828	7.42	8020	1.45
4-250A	29.50	829B	7.95	8025	1.45
4C27	3.25	830B	.65	9001	.82
4C28	17.45	832	5.75	9002	.60
4C35	13.45	832A	7.95	9003	.90
4E27	7.95	833A	37.50	9004	.35
4X150A	22.45	836	1.45	9005	1.39
5BP1	2.35	837	.88	9006	.25
5BP4	1.95	838	.69	C1JA	10.95
5C22	27.50	845	4.85	CGJ	6.45
5CP1	1.95	851	8.95	CK1005	.32
5CP7	7.95	860	2.75	CK1006	3.45
5D21	4.95	861	12.95	CK1007	.65
5FP7	1.37	866A	.98	F-123A	2.75
5JP1	12.45	869B	14.95	F-127A	22.50
5JP2	6.35	872A	1.25	F-128A	14.95
5LP1	7.40	876	.72	FG-17	2.90
5NP1	4.95	878	.48	FG-27	12.95
6AN5	2.75	884	.95	FG-32	3.95
6AS6	1.19	885	.95	FG-95	17.50
6AS7G	2.35	902A	2.95	FG-105	12.95
6C21	14.95	918	1.65	FG-172	17.95
6J4	2.55	823	1.25	HF-100	6.95
7BP7	4.95	927	.95	HF-200	9.95
12DP7	17.50	930	1.19	HF-300	17.50
15E	1.05	931A	2.45	WL-616	47.50
28D7	.75	954	.25	MX408U	.50
100TH	6.25	955	.35	RK-65	7.50
211	.45	956	.35	RK-72	.50
212E	14.95	957	.35	RX-21	5.50
249C	1.95	958	.35	TZ-40	3.50

WRITE FOR OUR FREE FLYER

TERMS: Cash with order or 25% deposit—balance C.O.D. 1% 10 days. Net 30 days to rated accts. All prices net F.O.B. our warehouse.

Special Quantity Discounts

WE SHIP TO ALL THE WORLD. CORRESPONDENCE IN ALL LANGUAGES. CABLE ADDRESS: HAMSHACK NEW YORK

RADIO HAM SHACK, Inc.

370 Greenwich Street, New York 13, N. Y. Telephone CAnal 6-8446

roll chart and plugs the tube into the socket indicated.

Electrical contacts automatically select proper filament voltage, load,

and other settings, when the roll chart is turned to the tube to be tested.

The unit is mounted in a portable case, finished in red leatherette. It provides cathode-conductance testings of some 400 popular tube types as well as detects shorts and gaseous conditions.

ACCURATE POWER SUPPLY

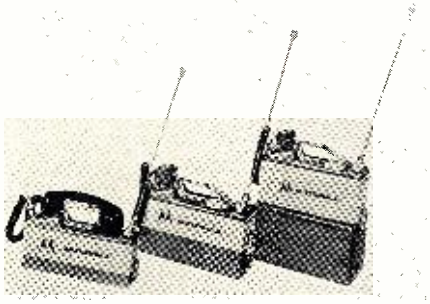
The Field Engineering Division of *A-V Mfg. Corp.*, 100 Indiana Avenue, N.W., Washington 1, D. C. is now offering a precision frequency power supply, the Type 120A.

The new unit is a precision 60-cycle power source with an accuracy of .01% over the temperature range of 0 to 75 degrees C. Although designed for driving 115-volt, 60-cycle hysteresis motors, requiring up to 60 watts, on *A-V* magnetic tape recorders, the unit is also suitable for use as a power source for other instruments such as high-speed cameras, servo systems, turntables, chronographs, etc.

The internal precision frequency source is a hermetically-sealed 480-cycle tuning fork whose frequency is divided by 8 to provide the 60 cycles which drives the unit's power amplifier. Convenience test points and a panel meter are furnished. The unit measures 19" wide, 10½" high, and 13" deep. It weighs 60 pounds. Bulletin 120B, available from the company, provides complete details on the supply.

NEW "HANDIE-TALKIES"

A new line of transistorized portable two-way radiophones, delivering up to 20 times the r.f. power output



conventionally attained in such equipment, has been announced by the Communications and Electronics Division of *Motorola Inc.*, 4545 W. Augusta Blvd., Chicago, Illinois.

Chiefly responsible for the power output capability and trebled receiver audio output are several recent advances in the development of transistors, plated circuitry, and lightweight long-life power packs.

The complete line includes models with r.f. power output ratings from 1 to 8 watts with models in the 25-54 mc. and 144-174 mc. frequency range in both handset type microphone and speaker-palm type microphone versions.

Write the company for full details on this new line of "Handie-Talkies."

REGENCY TRANSISTOR SET

The *Regency Division* of *I.D.E.A., Inc.*, 7900 Pendleton Pike, Indianapolis 26, Indiana has recently unveiled its 1956 line of transistor receivers.

The featured unit in the new series is the TR-1G, a four-transistor receiv-

er that will retail for $39.95. The set uses a new series of graded junction transistors developed by *Texas Instruments, Inc.*

The new pocket set will be offered in one color only, a black and copper motif, featuring an unbreakable plastic case. Other sets in the line range from $49.95 to $59.95 for the deluxe six-transistor unit.

MINIATURE PLUGS-JACKS

Electrocraft, 3739 North Kedzie Ave., Chicago 18, Illinois has just released a new line of plugs and jacks in miniature sizes suitable for hearing aids, pocket radios, meters, and many other industrial applications.

Both plugs and jacks are of the two-conductor type. Jacks are available either open or closed circuit. The miniature plugs contain a one-piece solid brass, nickel-plated rod pressed into the tip terminal and staked to insure positive electrical contact. Terminals, insulation, plug body, and tip rod are mechanically interlocked to prevent turning.

For full details, write the manufacturer direct.

TINY WIREWOUNDS

Waters Manufacturing, Inc., P. O. Box 368, South Sudbury, Mass. is meeting the demand for miniature,

Concord Radio

45 WARREN STREET,
NEW YORK 7, N.Y.
Phone Digby 9-1132

Money-back guarantee.
$5 minimum orders. FOB NYC. 25% deposit on COD's.

STANDARD BRAND TUBES

RAYTHEON · RCA · GE · TUNG-SOL · SYLVANIA

FULL
1 YEAR GUARANTEE

60%-90% OFF LIST!!!

TUBE NO.	LIST PRICE	NET PRICE	TUBE NO.	LIST PRICE	NET PRICE	TUBE NO.	LIST PRICE	NET PRICE	TUBE NO.	LIST PRICE	NET PRICE	TUBE NO.	LIST PRICE	NET PRICE	TUBE NO.	LIST PRICE	NET PRICE	TUBE NO.	LIST PRICE	NET PRICE
0A2	3.20	1.28	2A5	2.30	.92	6AM8	2.75	1.10	6H6GT	2.30	.92	6X5	2.65	1.06	12H5	1.80	.72	35L6GT	1.95	.78
0A3	2.65	1.06	2A6	2.85	1.14	6AN4	4.40	1.76	6J5	1.90	.76	6X5G	1.70	.68	12H6	2.20	.88	35W4	1.25	.50
0A4G	2.90	1.16	2A7	2.85	1.14	6AN5	9.13	3.65	6J5G	1.50	.60	6X8	2.75	1.10	12H7	2.40	.96	35Y4	1.80	.72
0B2	3.55	1.42	2B7	3.55	1.42	6AN8	2.95	1.18	6J5GT	1.90	.76	6Y3G	3.90	1.56	12J5	1.90	.76	35Z3	1.80	.72
0B3	3.35	1.34	2E5	2.75	1.10	6AQ5	1.95	.78	6J6	2.35	.94	6Y5	4.80	1.92	12J5GT	1.85	.74	35Z4GT	1.55	.62
0C3	2.65	1.06	2G5	2.40	.96	6AQ6	1.70	.68	6J7	2.65	1.06	6Y6G	2.60	1.04	12J7G	2.00	.80	35Z5G	2.00	.80
0D3	2.65	1.06	2V3G	5.25	2.10	6AQ7GT	3.05	1.22	6J7G	2.50	1.00	6Y6GT	2.60	1.04	12J7GT	2.80	1.12	35Z5GT	1.45	.58
0Y4	4.80	1.92	2W3	2.00	.80	6AR5	2.20	.88	6J7GT	2.80	1.12	6Y7G	2.45	.98	12K7G	2.00	.80	35Z6G	2.65	1.06
0Z4	1.40	.56	2X2/875	3.90	1.56	6AS5	2.00	.80	6J8G	3.85	1.54	6Z4/84	1.85	.74	12K7GT	2.55	1.02	36	2.90	.49
1A3	2.50	1.00	2X2A	4.25	1.70	6AS6	4.80	1.92	6K5G	1.70	.68	6Z5	3.55	1.42	12K8	3.30	1.32	37	1.85	.49
1A4P	4.25	1.70	3A2	2.90	1.16	6AS7G	7.10	2.84	6K5GT	2.45	.98	6Z7G	4.25	1.70	12K8GT	2.95	1.18	38	2.35	.49
1A4G	2.20	.88	3A3	2.90	1.16	6AS8	3.00	1.20	6K6G	2.40	.96	7A4/XXL	2.05	.82	12Q7G	2.00	.80	39/44	2.85	.39
1A4GT	1.85	.74	3A4	2.50	1.00	6AT6	1.50	.60	6K6GT	1.90	.76	7A5	2.60	1.04	12Q7GT	2.10	.84	40	2.45	.98
1A6	3.60	1.44	3A5	1.50	.60	6AT8	2.75	1.10	6K7	2.55	1.02	7A6	2.15	.86	12S8GT	2.75	1.10	40Z5	1.65	.66
1A5GT	2.10	.84	3A8GT	5.00	2.00	6AU4GT	2.90	1.16	6K7G	2.40	.96	7A7	2.20	.88	12SA7	2.35	.94	41	2.30	.49
1A7GT	2.45	.98	3AU6	1.90	.76	6AU5GT	3.45	1.38	6K7GT	2.55	1.02	7A8	2.35	.74	12SA7GT	1.85	.74	42	1.95	.78
1AB5	5.70	2.28	3B5GT	2.40	.96	6AU6	1.85	.74	6K8	3.35	1.34	7AB7	3.20	1.28	12SC7	2.50	1.00	43	2.05	.82
1AC5	3.00	1.20	3B7	5.70	2.28	6AU7	2.20	.88	6K8G	2.90	1.16	7AD7	4.70	1.88	12SF5	2.15	.86	44/39	2.85	1.14
1AD5	3.00	1.20	3BC5	2.00	.80	6AU8	3.05	1.22	6K8GT	2.75	1.10	7AF7	2.40	.96	12SF5GT	2.15	.86	45	2.20	.88
1AG4	2.85	1.14	3BE6	1.90	.76	6AV5GT	3.30	1.32	6L5G	2.75	1.10	7AG7	2.55	1.02	12SF7	2.75	1.10	45A	1.10	.44
1AH4	2.90	1.16	3BN6	2.75	1.10	6AV6	1.50	.60	6L6	4.70	1.88	7AH7	2.45	.98	12SF7GT	2.00	.80	45Z3	1.80	.72
1AX2	2.45	.98	3BY6	2.05	.82	6AW6	2.65	1.06	6L6G	3.65	1.46	7AJ7	1.80	.72	12SG7	2.60	1.04	45Z5GT	1.80	.72
1B1	1.65	.65	3BZ6	2.00	.80	6AW8	3.20	1.28	6L6GA	3.65	1.46	7AU7	2.25	.90	12SH7	2.75	1.10	46	3.05	1.22
1B3GT	2.45	.98	3C6/XXB	3.75	1.50	6AX4GT	2.35	.94	6L7	2.90	1.16	7B4	2.00	.80	12SH7GT	2.00	.80	47	5.30	.49
1B4P	4.05	1.62	3CB6	2.00	.80	6AX5GT	2.05	.82	6L7G	3.40	1.36	7B5	1.90	.76	12SJ7	2.15	.86	48	4.80	.49
1B7GT	3.35	1.34	3CF6	2.20	.88	6AZ5	3.65	1.46	6N5	3.15	1.26	7B6	2.25	.90	12SJ7GT	1.65	.66	49	2.85	.49
1C5GT	2.60	1.04	3CS6	2.05	.82	6AZ8	3.35	1.34	6N6G	3.90	1.56	7B7	2.05	.82	12SK7	2.15	.86	50	5.40	2.16
1C5	3.35	1.34	3D6	4.80	.50	6B4G	4.50	1.80	6N6GT	3.20	1.28	7B8	2.30	.92	12SK7GT	1.85	.74	50A5	2.25	.90
1C6	3.50	1.40	3E6	2.65	1.06	6B5	3.65	1.46	6N7	3.25	1.30	7C4	3.65	1.46	12SL7GT	2.80	1.12	50B5	2.10	.84
1C7G	3.50	1.40	3LF4	3.10	1.24	6B6G	2.45	.98	6N7G	2.45	.98	7C5	2.15	.86	12SN7GT	2.15	.86	50C5	1.90	.76
1C8	2.40	.96	3Q4	2.20	.88	6B7	3.50	1.40	6N7GT	3.10	1.24	7C6	2.10	.84	12SQ7	1.90	.76	50C6G	3.30	1.32
1D1	1.65	.66	3Q5GT	2.80	1.12	6B8	3.50	1.40	6P5G	2.00	.80	7C7	2.15	.86	12SQ7GT	1.60	.64	50L6GT	1.95	.78
1D5G	2.00	.60	3S4	2.15	86.	6B8G	3.65	1.46	6P5GT	2.45	.98	7C8	2.65	1.06	12SR7	2.15	.86	50X6	2.25	.90
1D5GP	4.25	1.70	3V4	2.15	.86	6B8GT	2.00	.80	6P7G	3.55	1.42	7E5	2.95	1.18	12SR7GT	2.05	.82	50Y6G	1.80	.72
1D5GT	2.00	.50	4BQ7A	3.25	1.30	6BA6	1.80	.72	6Q5G	3.70	1.48	7E6	3.00	1.20	12Z3	2.70	1.08	50Y6GT	2.35	.94
1D7G	3.65	1.46	4BZ7	3.45	1.38	6BA7	2.60	1.04	6Q5	2.90	1.16	7E7	3.35	1.34	14A4	2.75	1.10	50Y7GT	2.25	.90
1D8GT	4.55	1.82	5	2.00	.80	6BC5	2.00	.80	6Q6G	2.90	1.16	7F7	2.55	1.02	14A5	4.10	1.64	50Z7G	2.00	.80
1E4G	2.00	.35	5AM8	2.80	1.12	6BC7	3.20	1.28	6Q7	2.65	1.06	7F8	3.45	1.38	14A7	2.25	.90	52	4.80	.95
1E5G	4.80	.56	5AN8	2.80	1.12	6BC8	3.45	1.38	6Q7G	2.15	.86	7G7/1232	3.00	1.20	14AF7/XXD	2.45	.98	53	2.65	1.06
1E5GP	4.05	.52	5AQ5	1.95	.78	6BD6	1.80	.72	6Q7GT	2.10	.84	7G8	3.90	1.56	14B6	2.25	.90	55	2.35	.94
1E5GT	4.80	.52	5AS4	1.75	.70	6BE6	1.90	.76	6R6G	4.80	1.92	7H7	2.50	1.00	14B8	2.25	.90	56	1.90	.76
1E7G	4.05	.40	5AT8	2.75	1.10	6BF5	2.05	.82	6R7	2.80	1.12	7J7	3.65	1.46	14C5	3.00	1.20	57	2.15	.86
1E7GT	4.25	.40	5AU4	2.90	1.16	6BF6	1.60	.64	6R7G	1.65	.66	7K7	3.20	1.28	14C7	2.45	.98	58	2.15	.86
1E8	3.00	1.20	5AV8	3.00	1.20	6BG6G	5.20	2.08	6R7GT	2.75	1.10	7L7	3.00	1.20	14E6	3.00	1.20	59	3.85	1.54
1F1	1.65	.66	5AW4	2.75	1.10	6BH6	2.30	.92	6S4	1.75	.70	7N7	2.35	.94	14E7	3.35	1.34	70A7GT	3.55	1.42
1F4	2.85	1.14	5AZ4	1.55	.62	6BJ6	2.05	.82	6S4A	1.80	.72	7Q7	2.60	1.04	14F7	2.55	1.02	70L7GT	6.95	2.78
1F5G	2.85	1.14	5BK7A	2.90	1.16	6BJ7	2.35	.94	6S7	3.30	1.32	7R7	3.50	1.40	14F8	3.45	1.38	71A	3.35	.94
1F6	4.25	1.70	5J6	2.35	.94	6BK5	2.75	1.10	6S7G	3.50	1.40	7S7	3.45	1.38	14H7	2.50	1.00	75	2.00	.80
1F7G	4.25	1.70	5R4GY	3.75	1.50	6BK6	1.50	.60	6S8GT	2.75	1.10	7T7	2.75	1.10	14J7	3.65	1.46	76	1.70	.68
1G1	1.65	.66	5T4	5.00	2.00	6BK7A	2.90	1.16	6SA7	2.30	.92	7V7	3.50	1.40	14N7	2.75	1.10	77	2.15	.49
1G4G	2.00	.80	5T8	2.90	1.16	6BL7	2.90	1.16	6SA7GT	1.85	.74	7W7	3.50	1.40	14Q7	2.60	1.04	78	2.40	.49
1G4GT	2.55	.40	5U4G	1.70	.68	6BL7GT	3.45	1.38	6SB7Y	3.45	1.38	7X6	2.20	.88	14R7	3.50	1.40	79	2.85	.49
1G5G	3.15	.40	5U4GB	1.75	.85	6BN6	2.65	1.06	6SC7	2.50	1.00	7X7/XXFM	3.30	1.32	14S7	3.45	1.38	80	1.70	.68
1G6G	2.40	.40	5U8	2.90	1.16	6BQ6GT	3.80	1.56	6SC7GT	2.00	.80	7Y4	1.80	.72	14W7	3.50	1.40	81	4.80	1.92
1G6GT	3.00	.40	5V4G	2.55	1.02	6BQ7A	3.25	1.30	6SD7GT	3.35	1.34	7Z4	1.80	.72	14X7	2.75	1.10	82	2.85	1.14
1H4G	2.30	.40	5W4	1.70	.68	6BU5	5.50	2.20	6SF5	2.05	.82	10	3.90	1.56	14Y4	2.45	.98	83	2.60	1.04
1H5GT	1.95	.40	5W4GT	1.80	.72	6BU6	1.65	.66	6SF5GT	2.00	.80	10Y	4.10	1.64	15	3.20	.39	83V	3.20	1.28
1H6G	3.35	.40	5X3	2.20	.88	6BX7GT	3.35	1.34	6SF7	2.75	1.10	12A5	3.55	1.42	18	2.90	.39	84/6Z4	1.85	.74
1H6GT	3.35	.40	5X4G	2.05	.82	6BY5G	3.30	1.32	6SG7	2.60	1.04	12A6	3.50	.65	19	3.50	.39	85	2.35	.94
1L4	2.10	.84	5X8	2.75	1.10	6B6	2.00	.80	6SH7	2.75	1.10	12A7	3.90	1.56	19BG6G	6.05	2.42	89	2.35	.94
1L5G	3.20	1.28	5Y3G	1.40	.56	6BZ6	2.00	.80	6SH7GT	2.55	1.02	12A8G	2.00	.80	19C8	3.20	1.28	117L7	6.95	2.78
1L6	2.90	1.16	5Y3GT	1.45	.58	6BZ7	3.45	1.38	6SJ7	2.15	.86	12AB5	1.90	.76	19J6	2.50	1.00	117L7GT	6.60	2.64
1LA4	2.95	1.18	5Y4G	1.85	.74	6C4	1.50	.60	6SJ7GT	2.85	1.14	12AH7GT	3.05	1.22	19T8	2.90	1.16	117M7GT	6.95	2.78
1LA6	2.75	1.10	5Y4GT	1.85	.74	6C5	2.00	.80	6SK7	2.15	.86	12AL5	1.65	.66	20	4.80	.49	117N7GT	5.60	2.24
1LB4	2.95	1.18	5Z3	2.40	.96	6C5G	1.65	.66	6SK7GT	2.15	.86	12AQ5	1.90	.76	22	3.35	.49	117P7GT	5.60	2.24
1LC5	2.75	1.10	5Z4	3.30	1.32	6C5GT	2.15	.86	6SL7GT	2.80	1.32	12AT6	1.50	.60	24A	2.75	.49	117Z3	1.85	.74
1LC6	2.75	1.10	5Z4GT	2.00	.80	6C6	2.80	1.12	6SN7GT	2.15	.86	12AT7	2.60	1.04	25A6	3.55	1.42	117Z4GT	3.05	1.22
1LD5	2.75	1.10	6A3	4.10	1.64	6C7	3.55	1.42	6SQ7	1.90	.76	12AU6	1.80	.72	25A6G	2.90	1.16	117Z6GT	3.15	1.26
1LE3	2.75	1.10	6A5G	3.90	1.56	6C8G	3.90	1.56	6SQ7GT	1.90	.76	12AU7	2.20	.88	25A6GT	3.05	1.22	FM1000	3.30	1.32
1LG5	2.75	1.10	6A6	2.90	1.16	6CA5	2.20	.88	6SR7	2.05	.82	12AV6	1.45	.58	25A7G	2.20	.88			
1LH4	2.75	1.10	6A7	3.05	1.22	6CB6	2.00	.80	6SR7GT	1.80	.72	12AV7	3.05	1.22	25A7GT	6.00	2.40			
1LH5	2.75	1.10	6A8	3.10	1.24	6CD6G	4.95	1.98	6SS7	2.75	1.10	12AW6	2.40	.96	25AC5G	4.80	1.92			
1LN5	2.75	1.10	6A8G	2.75	1.10	6CF6	2.15	.86	6SS7GT	1.80	.72	12AX4GT	2.40	.96	25AC5GT	3.05	1.22			
1N5GT	2.60	1.04	6A8GT	2.90	1.16	6CG7	2.20	.88	6ST7	2.80	1.12	12AX7	2.30	.92	25BQ6GT	3.90	1.56			
1P5GT	2.90	1.16	6AB4	1.70	.68	6CL6	3.10	1.24	6SV7	3.35	1.34	12AY7	6.00	2.40	25C5	2.05	.82			
1Q5GT	3.05	1.22	6AB5	3.15	1.26	6CM6	2.30	.92	6SV8GT	2.00	.80	12AZ7	2.60	1.04	25C6G	3.00	1.20			
1Q6	2.20	.88	6AB7	3.20	1.28	6CN7	2.25	.90	6T4	3.45	1.38	12B4	2.40	.96	25D8GT	4.80	1.92			
1R4	2.65	1.06	6AC5GT	3.10	1.24	6CR6	2.05	.82	6T5	3.55	1.42	12B7	2.25	.90	25L6	3.20	1.28			
1R5	2.25	.90	6AC7	3.10	1.24	6CS6	2.00	.80	6T7G	3.50	1.40	12B8GT	5.00	2.00	25L6GT	1.95	.78			
1S4	2.55	1.12	6AD6G	2.40	.96	6CU6	3.80	1.56	6T8	2.90	1.16	12BA6	1.80	.72	25S/1B5	3.50	1.40			
1S5	1.90	.76	6AD7G	4.25	1.70	6D6	2.80	1.12	6U4GT	2.65	1.06	12BA7	2.60	1.04	25W4GT	2.10	.84			
1S6	2.65	1.06	6AE5G	2.45	.98	6D7	3.55	1.42	6U5/6G5	2.05	.82	12BD6	1.80	.72	25W6GT	2.60	1.04			
1SA6GT	2.40	.96	6AE5GT	2.05	.82	6D8G	3.50	1.40	6U6GT	2.45	.98	12BE6	1.90	.76	25Y5	3.10	1.24			
1SB6GT	2.40	.96	6AE6G	2.05	.82	6DE6	2.05	.82	6U7G	2.40	.96	12BF6	1.60	.64	25Z5	2.25	.90			
1T1G	1.65	.66	6AE7GT	2.00	.80	6DQ6	3.75	1.50	6U8	2.85	1.14	12BH6	2.00	.80	25Z6	2.20	.88			
1T4	2.15	.86	6AF4	3.45	1.38	6E5	2.35	.94	6V3	3.90	1.56	12BH7	2.55	1.02	25Z6G	1.50	.60			
1T5GT	2.80	1.12	6AF4A	3.40	1.36	6E6	2.90	1.16	6V3A	3.90	1.56	12BJ6	1.50	.60	25Z6GT	2.15	.86			
1T6	3.00	1.20	6AF5G	2.00	.80	6E7	3.55	1.42	6V5G	3.90	1.56	12BK5	2.75	1.10	26	2.30	.49			
1U4	2.10	.84	6AF6G	3.15	1.26	6F5	2.40	.96	6V5GT	3.90	1.56	12BK6	1.50	.60	27	2.15	.49			
1U5	1.85	.74	6AG5	2.05	.82	6F5GT	2.40	.96	6V6	3.65	1.46	12BN6	2.90	1.16	28D7	3.50	1.40			
1V	2.55	1.02	6AG7	3.65	1.46	6F6	2.45	.98	6V6G	2.00	.80	12BR7	2.25	.90	30	2.35	.94			
1V2	1.55	.62	6AH4GT	2.40	.96	6F6G	2.00	.80	6V6GT	1.80	.72	12BT6	1.50	.60	31	2.90	.49			
1V5	2.20	.88	6AH6	3.90	1.56	6F6GT	2.00	.80	6V7	3.55	1.42	12BU6	1.50	.60	32	3.85	.49			
1V6	3.70	1.48	6AH7GT	2.45	.98	6F7	4.25	1.70	6V7G	2.00	.80	12BU7	2.20	.88	32L7GT	3.35	1.34			
1W4	2.65	1.06	6AJ4	4.45	1.78	6F8G	3.90	1.56	6V8	3.35	1.34	12BV7	2.55	1.02	33	3.50	.49			
1W5	2.20	.88	6AK5	4.25	1.70	6G5/6U5	2.05	.82	6W4GT	1.95	.78	12BY7	2.65	1.06	34	3.65	.49			
1X2A	2.60	1.04	6AK6	2.35	.94	6G6G	3.05	1.22	6W5G	2.90	1.16	12BZ7	2.55	1.02	35/51	2.40	.49			
1X2B	2.60	1.04	6AL5	1.55	.62	6H4GT	2.90	1.16	6W6GT	2.40	.96	12C5	1.90	.76	35A5	2.25	.90			
2A3	4.55	1.82	6AL7GT	3.75	1.50	6H6	2.00	.80	6W7G	2.85	1.14	12C8	3.90	1.56	35B5	2.10	.84			
2A4G	3.20	1.28	6AM4	4.45	1.75	6H6G	1.65	.66	6X4	1.40	.56	12F5GT	2.40	.96	35C5	1.90	.76			

"Portable" KIT #1
1R5, 3S4, 1T4, 1S5
$2.95

"Portable" KIT #2
1R5, 1U4, 1U5, 3S4
$2.95

"Miniature" KIT
12AT6, 12BA6, 12BE6
35W4, 50B5—**$3.15**

All Subways: 6th, 7th, 8th to "Chambers St." • Lexington Ave. to "Brooklyn Bridge" • BMT to "City Hall" • Tubes to "Hudson Terminal" • All Downtown Ferries

precision potentiometers in higher values with the expansion of its AP-½ line to include 50,000 and 100,000 ohm values.

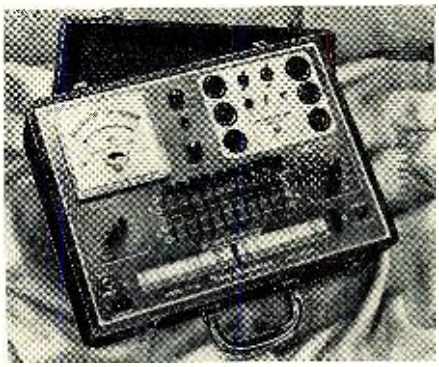
The two new pots embody the basic design features of the earlier units, 2 watt rating at 80 degrees C, all connections spot-welded or soldered, gold-plated fork-type terminals, servo or bush mount, anodized aluminum body, and centerless-ground stainless-steel-alloy shaft.

Two per-cent linearity is standard with the 50,000 and 100,000 ohm units. Catalogue sheets describing these and other units in the AP-½ line are available from the manufacturer on request.

TUBE-TRANSISTOR TESTER

Superior Instrument Co., 2435 White Plains Road, New York 67, New York has designed a new transconductance tube and transistor tester, the Model TV-12. The tester will check tubes under dynamic conditions closely simulating the manner in which they would function in a receiver or amplifier. It also tests all transistors produced to date with provision being made for new transistor types to be designed but not yet in production.

The TV-12 will test all tubes including 4, 5, 6, 7, octal, lock-in, hearing aid, thyratrons, miniatures, subminiatures, noval, and proximity fuse



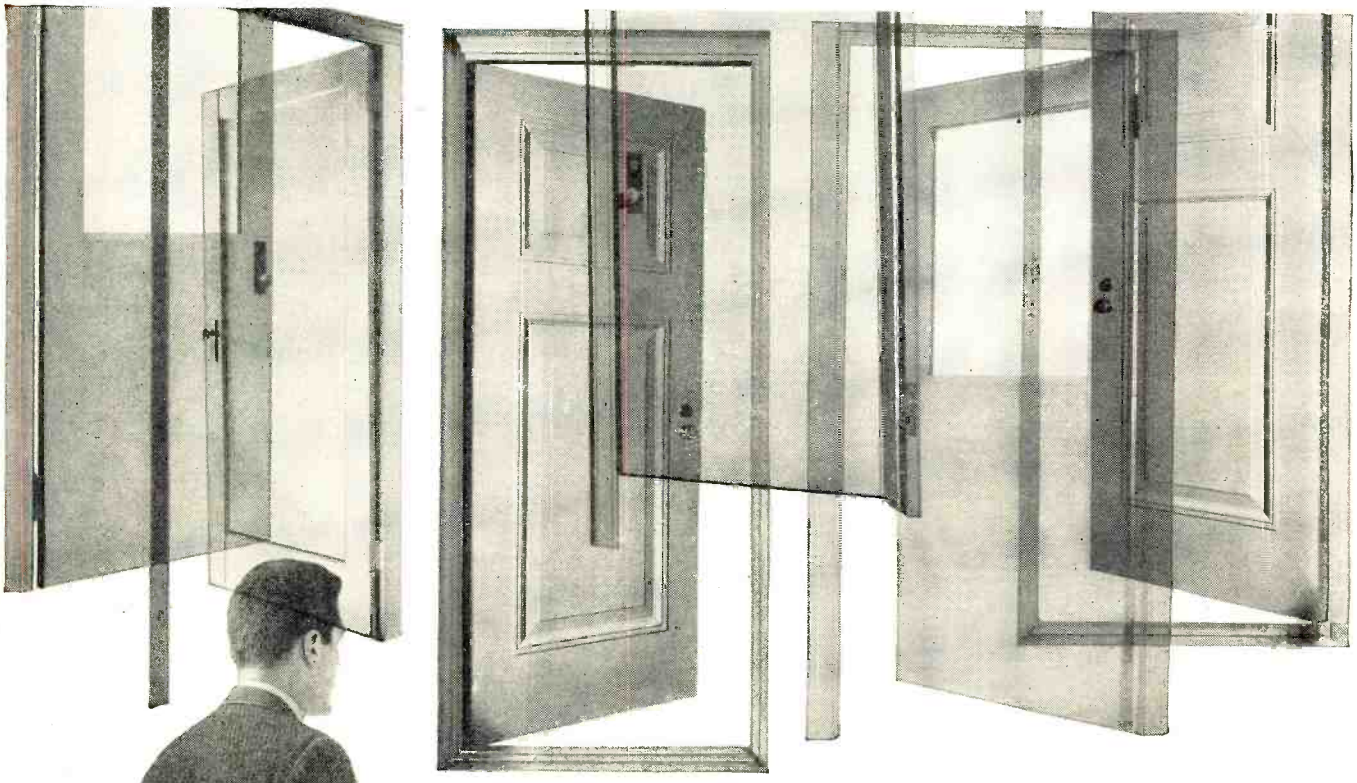
types. An improved roll chart mechanism uses a combination of fiber and brass gears to eliminate backlash and slippage.

NEW "VARIAC"

General Radio Company, 275 Massachusetts Avenue, Cambridge 39, Mass. has developed a new model of its "Variac" autotransformer which offers several improvements over previous models.

The Type W5 carries *UL* approval, military ruggedization, and counterbalanced rotating parts. The basic open unit, Type W5, has an increased rating but sells at a lower price than the model it replaces.

Two case models, both totally enclosed, are included in the line. The Type W5M is intended for wall or panel mounting and is provided with conduit knockouts. The Type W5MT is a bench or portable model with input cord, switch, and output plug. A carrying handle and a resettable thermal overload protector are added conveniences.



DO TECHNICIANS GET JOBS TOO EASILY?

Never before has it been so easy for a technician to get a job. Just because jobs are so abundant—it's harder than ever to choose the right one.

Customer engineering, a rapidly expanding field, which combines the creative with the technical challenge, may hold the right job for you.

At IBM, Customer Engineers maintain computers, accounting machines, electronic time systems and electric typewriters. Following a training period with full pay, you will work in one of these fields. Assignment in one of 190 IBM branch offices . . . your preference considered.

After training, you will work under the guidance of an experienced Customer Engineer. Then, you will advance to the management of an individual territory. Every supervisor and manager in Customer Engineering started just as you will.

Qualifications include: technical training and ability to deal with people. Degree not essential. If you possess these requirements, contact your nearest IBM office or write:

Wayne Hawk, Room 4304,
International Business Machines Corp.,
590 Madison Avenue, New York 22, N. Y.

In Canada write:

George R. Statham,
International Business Machines Corp.,
Don Mills Road, Toronto 6, Ontario

IBM® INTERNATIONAL BUSINESS MACHINES CORPORATION

DATA PROCESSING • ELECTRIC TYPEWRITERS
TIME EQUIPMENT • MILITARY PRODUCTS

Full details on the new line are available from the manufacturer direct.

"VOLTA-CHEK"

Electronic Test Instrument Corporation, 13224 Livernois Ave., Detroit, Michigan is now offering a new in-

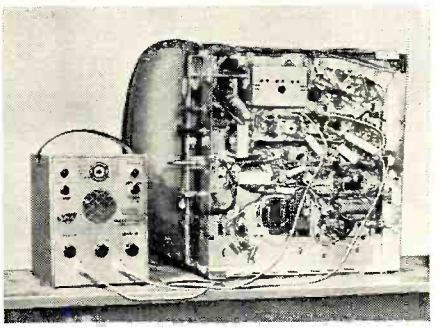
strument, the "Volta-Chek," to the service industry to expedite the checking of cathode-ray tubes.

The instrument provides a simple, accurate, and efficient way to test simultaneously all of the voltages which are applied to the tube elements, checks bias (enabling technicians to check whether brightness or contrast control is working), checks 1st anode and filament, checks sets with low magnitude focus voltages from 400 to 1000 volts, checks sets with high magnitude focus voltages from 1000 to 3000 volts, and localizes the faulty circuit elements and determines whether it is the tube which is at fault or whether the trouble lies in some other components.

INTERMITTENT TRACER

Seco Manufacturing Co., 5015 Penn Ave., South, Minneapolis, Minnesota has developed a new servicing unit which is designed especially for locating intermittents in television receivers.

The "Monitron" is designed to monitor signal paths without requiring the constant attention of the technician. A dual electron-ray indicator tube monitors the signal level independent of the alarm circuits and the indicator lamp also lights in the channel under test in which the failure occurs. An



audio tone indicates a break in the signal path in case the technician is not watching the indicator tube when the interruption occurs.

The unit will monitor a circuit without attention, monitor two different circuits simultaneously, trace signal

hi-fi
ANNUAL
& AUDIO HANDBOOK

NOW ON SALE!

Whatever your interest in Hi-Fi—as a builder of your own rig, or simply as a lover of good music—you'll find a wealth of practical and authoritative information in HI-FI ANNUAL & Audio Handbook, now on sale at newsstands and radio parts stores.

Edited by the staff of RADIO & TELEVISION NEWS, the World's Leading Electronics Magazine, HI-FI ANNUAL & Audio Handbook brings you—between the covers of a single volume—a total of 42 carefully selected articles on everything in Hi-Fi . . .

* SELECTING HI-FI EQUIPMENT
* PREAMPLIFIERS
* EQUALIZERS & TONE CONTROLS
* POWER AMPLIFIERS
* LOUDSPEAKERS & ENCLOSURES
* TAPE TRICKS WITH YOUR HOME RECORDER

. . . plus a complete bibliography of Hi-Fi technical books and a handy product directory.

If you're a Hi-Fi fan—and who isn't today?—HI-FI ANNUAL & Audio Handbook is "must" reading . . . will save you money . . . show you the way to more enjoyment from your hobby. Only $1.00.

BE SURE TO GET YOUR COPY
TODAY

at Newsstands and Radio Parts Stores

HI-FI ANNUAL & Audio Handbook 366 Madison Ave. New York 17, N. Y.

paths, and make point-to-point gain measurements. For full details on this servicing instrument, write the company direct.

AUTOMATIC REGULATOR

Electronic Measurements Company, Inc., Lewis Street, Eatontown. New Jersey has developed an automatic a.c. regulator which operates on either 115 or 230 volt power lines without derating.

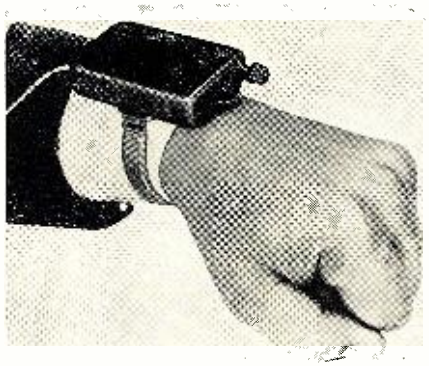
With the Model 260-A the voltage changeover is accomplished in the field by simple switching devices requiring only seconds to operate. Thus, manufacturers need stock only one unit for the two most common voltages. The control tolerance is better than 1%; power rating is 6 kva., and input range is 100 to 130 or 200 to 260 volts at line frequencies from 47 to 63 cycles.

The unit also features a monitor which warns of improper operation plus a "fail-safe" arrangement to prevent over-voltage. The wall or floor mounted unit is 18½" x 13" x 8¾" while a rack model measures 19" x 8¾" x 13".

B.C. TRANSISTOR RADIO

LEL, Inc., 380 Oak Street, Copiague, Long Island, N. Y. has developed a novelty transistor wrist radio which will cover the broadcast band from 550 to 1600 kc.

A special r.f. reflex circuit is incorporated which allows for good selectivity and unusual sensitivity. No antenna is required in moderate signal strength areas. It measures 2¾" long, 1¾" wide, and ¾" thick and weighs 2.5 ounces with batteries, making it ideal for wearing on the wrist or stuck into a shirt pocket.



Three transistors are used, allowing for extreme economy of operation from five button-size mercury cells which will last up to 100 hours. The unit features a two-stage transformer-coupled audio amplifier and a no-whistle regenerative circuit. A hearing-aid earphone allows for private listening. Printed circuitry is used throughout.

TURRET ASSEMBLY KIT

Eby Sales Company, 130 Lafayette Street, New York 13, New York is now offering a "Tinker Turret" kit which has been designed especially for lab technicians, experimenters, engineers, and others faced with the task of turret assembly to fit individual requirements.

Kit No. 1050 comprises individual parts to construct any type of 7-pin turret assembly or 7-pin miniature chassis or in-line cable connectors. Internal drawings illustrate the assembly and usage of each part, all of which are housed in a sturdy plastic box with separate compartments for each item.

The kit can be merchandised as a complete unit or the individual components can be sold separately.

SUBMINIATURE CAPACITORS

Cornell-Dubilier Electric Corporation, South Plainfield. New Jersey has designed a new subminiature series of tantalum capacitors, Type NT, for the unique electrical requirements and dimensional limitations of extremely small equipment.

The capacitors are available in a wide selection of ratings and sizes from .5 to 16 volts d.c. Capacitance ranges from .08 to 30 μfd. are available, depending on the voltage. Case sizes are only 3/32" to 1/8" in diameter and only 5/32" to 1/2" in length.

Among the applications for this new series of units are transistor circuits for hearing aids and miniature radio receivers, printed circuit assemblies, subminiature controls, and other very small, low-voltage devices designed for operation within a temperature range of −20 degrees to +55 degrees C.

NEW RAYTHEON TRANSISTORS

The Semiconductor Division of *Raytheon Manufacturing Company*, Newton 58, Massachusetts has announced the availability of three new *p-n-p* silicon transistors, the CK790, CK791, and CK792.

These three units have been designed to meet the need for high-frequency transistors for operation at high ambient temperatures. They can be used in low-frequency amplifiers, switch circuits, and as replacements for relays in airborne and other electronic equipment which must operate at high ambient temperatures.

All of the new units are hermetically sealed in metal cases and have the advantage of being compact and lightweight with low power requirements and less heat dissipation.

MERCURY "B" BATTERY

P. R. Mallory & Co., Inc.'s Battery Division, North Tarrytown. New York is currently introducing a new long-life mercury "B" battery designed especially for applications in transistor radios, photoflash equipment, etc.

The battery is so designed that a number of them can be stacked together to provide the required voltage in a variety of physical shapes. This new line is currently available in standard miniature sizes for 15, 22½, and 45 volts. The basic individual cell is .490" in diameter, with an over-all height of .280". When cells are nested together, the net height of each cell is .210". —30—

Mullard's 520 Circuit

(*Continued from page 68*)

EL34. It is necessary, in this type of output stage, that the cathodes be bypassed to ground even when a common cathode resistor is used.

The power supply is conventional and uses a *Mullard* GZ32 or GZ34 indirectly-heated, full-wave rectifier with capacitor input filter.

The driver stage uses a *Mullard* ECC83 twin-triode and fulfills the combined function of phase splitter and driver amplifier. It is of the cathode-coupled type and enables a high degree of push-pull balance to be obtained.

The first stage is a high-gain pentode voltage amplifier using an EF86 low-hum pentode. High-stability carbon resistors are used in plate, screen-grid, and cathode circuits and give appreciable improvement in measured background noise level as compared with ordinary carbon resistors. This stage is d.c.-coupled to the input grid of the phase splitter in order to minimize low-frequency phase shift in the amplifier and improve low-frequency stability when feedback is applied.

Despite the high degree of negative feedback used in the present design, an adequate margin of stability has been achieved. Complete stability is maintained under open-circuit conditions in this circuit. An increase in feedback of at least 10 db, obtained by reducing the value of R_{15}, should be possible before signs of high-frequency instability occur. The loop gain, overall frequency response, and phase shift characteristics of the whole amplifier are shown in Fig. 4.

The harmonic distortion of this amplifier at 400 cps, measured without feedback under resistive load conditions, is shown in Fig. 5. The distortion curve towards the overload point is also shown for feedback conditions. At the 20-watt level the distortion level without feedback is well below 1% and with feedback applied falls to below 0.05%. Harmonic distortion at 400 cps reaches 0.2% at approximately 36 watts output. The loop gain characteristics are such that at least 20 db feedback is maintained from 15 to 25,000 cps.

Measurement of intermodulation products has been made, using a carrier frequency of 10,000 cps, and a modulating frequency of 40 cps, with a ratio of 40 to 10,000 cps amplitudes of 4:1. With the combined peak amplitude of the mixed output at a level corresponding to the peak sine wave amplitude at 36 watts r.m.s. power, intermodulation products expressed in r.m.s. terms totaled 0.8% of the 10,000 cps carrier amplitude.

The sensitivity of the amplifier is approximately 0.3 volt for 36 watts output. The background level in this amplifier was 89 db below at 36 watts, measured with a source resistance of 10,000 ohms. -30-

Highway Hi-Fi

(*Continued from page* 45)

weight to accurately balance it around the pivot point in the horizontal plane. This greatly reduces the tendency of the tone arm to move about the pivot when acted upon by forces resulting from the movement of the automobile.

To prevent the physical relationship between the pivot and the tone arm from being disturbed by very rapid changes in speed or direction, a viscous fluid is used between the tone arm pivot and its bearing. This dampens rapid movement, while providing almost complete absence of friction at the slow rate of travel required to track the record. The cartridge is mounted in a rocker assembly which is fastened to a horizontal pivot pin, as shown in Fig. 4. The pin rotates in two small nylon bearings mounted in the sides of the tone arm. The entire rocker assembly is accurately balanced around the pivot pin, which eliminates undesired up or down movement of the stylus.

The required stylus pressure is provided by a small spring, acting between the cartridge rocker arm and the tone arm.

Servicing

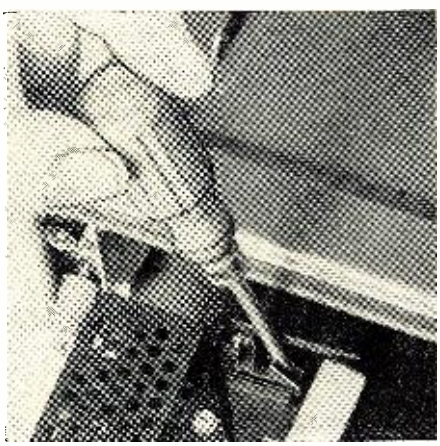
Equipped with the proper tools and exercising due caution, the technician will encounter little difficulty in adjusting and repairing this unit when necessary.

A stylus pressure gauge that reads accurately at 2.5 grams, an audio amplifier system, and a 12-volt d.c. supply for checking the performance of the unit, are required. The automobile radio may be removed from the car and used as an audio amplifier. This has the advantage of providing a complete check of the system, including the action of the radio-phono switch on the record player.

Table 1 lists all of the troubles which are likely to be encountered and their causes. The various adjustment and balancing operations are described below.

How to adjust the tone arm stop is shown in Fig. 5. The stop is adjusted

Fig. 5. Adjusting the tone arm stop.



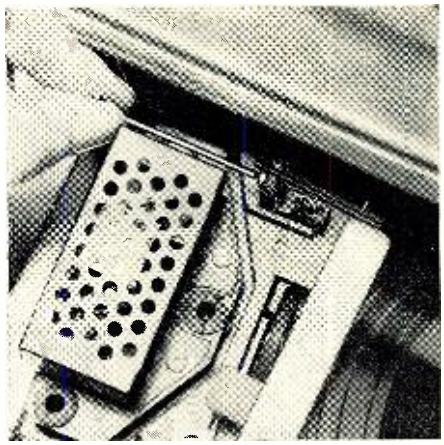


Fig. 6. The adjustment shown here is made if the tone arm does not stop over the run-in groove of the record when starting.

by loosening the retaining screw, and moving the stop until the stylus sets down properly at the start of the record.

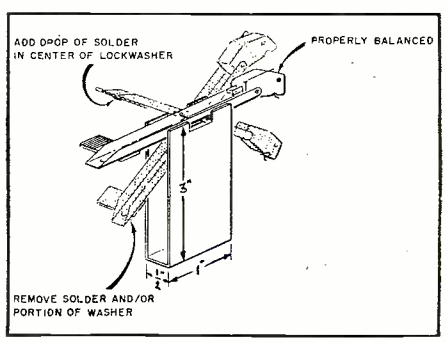
The tone arm indexing latch is adjusted by loosening a small lock nut, inserting a #3 *Allen* wrench in the set screw, and turning the screw in or out to raise or lower the latch, see Fig. 6. To check the latch for proper height, depress the red tab on the side of the tone arm and move the arm out of the rest position. The latch should stop the tone arm; if not, the latch must be lowered. Now, release the red tab to see if the arm clears the latch. If it does not, the latch must be raised.

When replacing any part of the tone arm or rocker arm, other than the stylus, the tone arm and rocker arm balance must be checked.

To check the rocker arm balance requires a small jig such as the one shown in Fig. 7. The cartridge pickup leads and the clip provided to protect the stylus in a new cartridge must be removed. Slip a set of spare pickup lead clips on the cartridge and suspend the rocker arm by its pivot pin. Balance is obtained by adding solder in the center of a lockwasher riveted to one end of the rocker arm or removing solder with a file. Proper balance is indicated when the arm seeks and remains in a horizontal position.

The technique employed to check the tone arm balance is illustrated in Fig. 8. The tone arm pivot is slipped over the shank of a 5/16" drill inserted in a block of wood. The check must

Fig. 7. Technique for properly balancing the pickup rocker assembly.



GREATEST VERSATILITY!

NEW Altec 342A
AMPLIFIER with the
"input-matcher" feature

typical specification

Gain:	110 db
Input Sensitivity:	.0042 volts rms for rated output
Power Output:	20 watts at less than 2.0% thd, 40—20,000 cps
Frequency Response:	±1db, 20—20,000 cps
Input Impedance:	Nominal 100,000 ohms
Source Impedance:	30/50, 250/300, 500/600 with 4665 plug-in transformer
Load Impedance:	4, 8, 16 ohms and 70 v line
Output Impedance:	Less than 20% of nominal load impedance
Noise Level:	Equivalent input noise—123 db, output noise —13 dbm
Controls:	4 mixer controls, 1 master volume control, 1 each bass treble equalizer control; all cont. variable composition
Power Supply:	117 volts, 60 cps, 110 watts
External Power Available:	117 volt AC receptacle at rear of chassis
Tubes:	3—12AX7, 1—6CG7, 2—6L6GB, 1—5U4GB
Dimensions:	7" H, 19⅝" W, 8⅛" D overall
Color:	Green
Weight:	22 lbs.
Accessories:	4665 Plug-in Transformer 12227 Assembly—plug-in phono equalizer 12210 Assembly—rack mounting assembly Cannon XL-3-12 straight cord plug.

The new Altec 20 watt public address amplifier is truly outstanding in its flexibility of function. Pick any combination of four inputs, plug in the convenient "input-matcher" for each source and the Altec 342A amplifier is matched to your exact circuit needs. In minutes the 342A can be input-matched to any high or low impedance microphone, crystal or magnetic phono pickup, tuner or tape recorder—merely plug in the proper "input-matcher."

The 342A has individual volume controls for each of four inputs, a master volume control and separate bass and treble tone controls. DC operation of the heaters of the input tubes insures hum-free performance and eliminates the need for tube selection. The quality, reliability and amazing flexibility of the new Altec 342A amplifier make it ideal for every public address use either permanent or portable.

ALTEC LANSING CORPORATION — Distributed by GISER

ALTEC FIDELITY IS HIGHEST FIDELITY

Dept. 4-T
9356 Santa Monica Blvd., Beverly Hills, Calif.
161 Sixth Avenue, New York 13, New York

BUILD 16 PRINTED CIRCUIT AND METAL CHASSIS RADIO CIRCUITS only $19.95 complete

With the New Deluxe 1956 PROGRESSIVE RADIO "EDU-KIT"

A Practical Home Radio Course

Build 16 Receiver, Transmitter, Code Oscillator, Signal Tracer, Signal Injector Circuits

- No Knowledge of Radio Necessary
- No Additional Parts Needed
- Excellent Background for TV
- Learn High Fidelity
- Used In 79 Countries
- School Inquiries Invited
- Learn Practical Radio Theory, Construction

Reg. U. S. Pat. Off. Pend.

FREE RADIO and TELEVISION SERVICING LITERATURE ON REQUEST (See Coupon Below)

WHAT THE "EDU-KIT" OFFERS YOU

Our Kit is designed to provide a fundamental background in radio, with the basic facts of Radio Theory and Construction Practice expressed simply and clearly. You will gain a knowledge of basic Radio Principles involved in Radio Reception, Radio Transmission and Audio Amplification.

You will learn how to identify Radio Symbols and Diagrams; how to build radios, using regular radio circuit schematics; how to mount various radio parts; how to wire and solder in a Professional manner. You will learn proper chassis layout. You will learn Printed Circuitry. You will learn how to service and trouble-shoot radios. You will learn code. You will receive training for F.C.C. Novice License. You will learn High Fidelity.

In brief, you will receive a practical basic education in Radio, worth many times the small price you pay.

THE KIT FOR EVERYONE

The Progressive Radio "Edu-Kit was specifically prepared for any person who has a desire to learn Radio. The Kit has been used successfully by young and old in all parts of the world. It is not necessary that you have even the slightest background in science or radio.

The Progressive Radio "Edu-Kit" is used by many Radio Schools and Clubs in this country and abroad. It is used by Armed Forces Personnel and Veterans throughout the world for training and rehabilitation.

The Progressive Radio "Edu-Kit" requires no instructor. All instructions are included. All parts are individually boxed, and identified by name, illustration and diagram. Every step involved in building these sets is carefully explained.

"LEARN BY DOING"—PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" comes complete with instructions. These instructions are arranged in a clear, simple and progressive manner. The theory of Radio Transmission, Radio Reception, Audio Amplification and servicing by Signal Tracing is clearly explained. Every part is identified by illustration and diagram. You will learn the function and theory of every part used.

The Progressive Radio "Edu-Kit" uses the principle of "Learn by Doing." Therefore you will build radio circuits, perform jobs, and conduct experiments to illustrate the principles which you learn. These circuits are designed in a modern manner, according to the best principles of present-day educational practice. You begin by building a simple radio. The next set that you build is slightly more advanced. Gradually, in a progressive manner, you will find yourself constructing still more advanced multi-tube radio sets and doing work like a professional Radio Technician. Altogether you will build Receiver, Transmitter, Code Oscillator, Signal Tracer, Signal Injector Circuits—16 in all. These sets operate on 105-125 V. AC/DC. For use in Foreign Countries having 210-250 Volt Source, and Adaptor for 210-250 V. AC/DC operation is available.

THE PROGRESSIVE RADIO "EDU-KIT" IS COMPLETE

You will receive every part necessary to build 16 different radio circuits. Our "Edu-Kits" contain all tubes, tube sockets, chassis, variable, electrolytic, and paper condensers, resistors, tie strips, coils, hardware, tubing, Instruction Manuals, Printed Circuit chassis, Printed Circuit tube sockets and hardware, Printed Circuit Instruction Manual, etc. Selenium rectification is used throughout.

Every part that you need is included. These parts are individually packaged, so that you can easily identify every item. A soldering iron is included, as well as an Electrical and Radio Tester. Complete, easy-to-follow instructions are provided. All parts are guaranteed, brand new, carefully selected and matched.

In addition, the "Edu-Kit" now contains lessons for servicing with the Progressive Signal Tracer and Progressive Signal Injector, F.C.C. instructions, quizzes, High Fidelity Instructions. The Progressive Radio "Edu-Kit" is a practical home radio course at rock bottom price.

TROUBLE-SHOOTING LESSONS

Trouble-shooting and servicing are included. You will be taught to recognize and repair troubles. You will build and learn to operate a professional Signal Tracer and Signal Injector. You will receive an Electrical and Radio Tester, and learn to use it for radio repairs. While you are learning in this practical way, you will be able to do many a repair job for your neighbors and friends, and charge fees which will far exceed the cost of the "Edu-Kit." Here is your opportunity to learn radio quickly and easily and have others pay for it. Our consultation service will help you with any technical problems which you may have.

Printed Circuitry Now Included

You build a Printed Circuit Signal Injector, a servicing instrument that can detect many Radio and TV troubles. A Printed Circuit is a special insulated board on which has been deposited a conducting material which takes the place of wiring. Various parts are plugged in and soldered to terminals. This new process is now popular in commercial radios, TV, hearing aids, industrial electronics, etc.

FREE EXTRAS

- RADIO AND ELECTRICAL TESTER
- ELECTRIC SOLDERING IRON
- HIGH FIDELITY GUIDE
- QUIZZES
- CONSULTATION SERVICE
- TESTER INSTRUCTION MANUAL
- TELEVISION BOOK

30 DAY UNCONDITIONAL MONEY-BACK GUARANTEE

MAIL TODAY—ORDER SHIPPED SAME DAY RECEIVED

- ☐ Send "Edu-Kit" Postpaid. I enclose full payment of $19.95.
- ☐ Send "Edu-Kit" C.O.D I will pay $19.95 plus postage.
- ☐ Send me FREE additional information describing "Edu-Kit." Include FREE valuable Radio and TV Servicing Literature. No obligation.

(Outside U.S.A.—No C.O.D.'s. Send check on U.S. bank or Intern'l M.O. "Edu-Kit" for 105-125 V. AC/DC $20.95; 210-250 V. AC/DC $23.45.)

Name .....

Address .....

.....

PROGRESSIVE "EDU-KITS" INC.
497 Union Ave., Room 52E, Progressive Bldg., Brooklyn 11, N. Y.

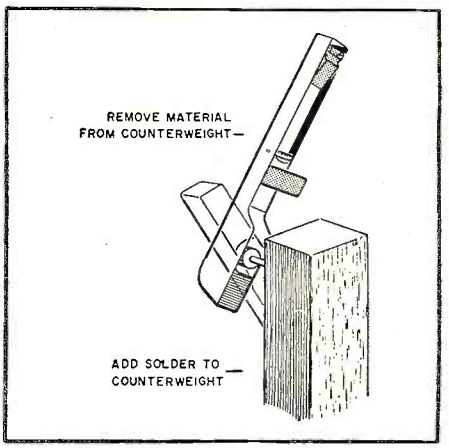
be made with all components, including the pickup leads, properly mounted in the arm. The leads should be positioned so that they hang straight down from the small retaining clip which holds them in place in the arm when the arm is in a horizontal position. Balance is obtained by drilling out a portion of the counterweight with an electric drill, or by dropping solder in the hole previously drilled in the counterweight. If it is necessary to add solder, more than required should be used. The excess solder may then be removed a little at a time until balance is achieved. When properly balanced, the arm will remain in whatever position it is placed on the balancing jig.

When a unit is serviced, the stylus pressure should be checked and adjusted if necessary. With the tone arm held in a level position, place the arm of the gauge under the cartridge, close to the stylus, and raise the gauge until the center of the front cartridge-mounting screw is in line with the lower edge of the tone arm. The stylus pressure reading on the gauge should be 2.5 grams.

If the stylus pressure is not correct, make sure that the pickup leads are not interfering with the movement of the rocker arm. The stylus pressure is adjusted by grasping the short end of the stylus pressure spring, which hooks over the side of the rocker arm, and pushing it toward, or pulling it away from, the rocker arm pivot pin. The adjustment should be made with a pair of needle-nose pliers. With a little practice this is a relatively simple operation.

When the repair job is complete, give the player a thorough check. With the unit operating and pushed entirely into its case, slap the side of the case with the palm of your hand. You should be able to hit it a fairly hard blow without noticeable effect on the sound output. Slide the case from side to side on the bench. If either of these tests cause the stylus to jump the groove, make the checks indicated in Table. 1. —30—

Fig. 8. The tone arm must be balanced exactly to keep the pickup stylus in the record grooves. A 5/16" drill inserted in a block of wood makes an excellent balancing pivot.



Hi-Fi Audio Equipment

(*Continued from page* 96)

sure minimum induction hum when magnetic cartridges are used. Motor and turntable suspension is handled by three *Lord* vibration mounts.

Using center-drive with variable speed motor, wow and flutter are held to less than .2 per-cent and garbling of high frequencies is reduced to more than 40 db below average recording level.

For full information on this new turntable, write to Dept. 17 of the company.

30-WATT SPEAKER

University Loudspeakers, Inc., 80 S. Kensico Ave., White Plains, N. Y. is now marketing the 6303, a quality 30-watt speaker for hi-fi applications.

The design features a tweeter unit fitted with a "reciprocating flares" horn through the center of the woofer and mid-range speaker assemblies. This provides response from below 30 cps to beyond audibility.

CORNER HORN KIT

River Edge Sales Corp., 80 Shore Road, Port Washington, New York is offering a "do-it-yourself" version of its popular corner speaker enclosure design.

The new Model 900 kit is a true, horn-loaded corner enclosure with proper acoustic design for optimum reproduction. It will handle a variety of speakers, including tweeters of any size and shape.

The kit comes complete with all cabinet parts as well as the necessary grille cloth, etc. A full description of this and other units in the company's assembled and kit line is available from Dept. V-A1 of the firm.

EXTENDED-RANGE SPEAKER

Beam Instruments Corp., 350 Fifth Avenue, New York 1, New York is now offering a new extended-range loudspeaker which features unique mid-range stability.

The "Stentorian" Model H.F. 1214 utilizes the company's cambric cone construction which provides good low-frequency response. In addition, the model incorporates six new stabilizing discs of long-staple fibers which are impregnated into the front of the cone. The result is smooth response in the mid-register, from 1000 to 3000 cps.

Specifications on this speaker include bass resonance at 39 cps, over-all response from 25 to 14,000 cps, power rating of 15 watts, a 5 pound, 8 ounce 3″ magnet, and an impedance of 15 ohms.

Write the manufacturer direct for price and additional information.

AM TUNER

Fisher Radio Corporation, 21-21 44th Drive, Long Island City 1, New York has added an AM tuner to its line of audio equipment.

The Model AM-80 features a meter for micro-accurate station selection, a

three-position adjustable bandwidth control for broad, medium, or sharp tuning, and the pulling power of a professional communications receiver.

According to the company, the new tuner is capable of excellent reception under adverse conditions. The Model AM-80 comes in chassis form with blonde or mahogany cabinets available at a slight additional cost.

NEW CATALOGUES

E-V BUYING GUIDE

Electro-Voice, Inc., Buchanan, Michigan has issued a colorful and informative new "Guide to High-Fidelity Loudspeaker Systems," which is being offered to the public for twenty-five cents a copy.

This comprehensive booklet explains the importance of the loudspeaker in any home music center and provides basic facts on how to choose a loud-

speaker for maximum enjoyment of hi-fi music reproduction.

The publication also provides details on integrated, separate, and completely-assembled two-way, three-way, and four-way speaker systems, and acoustically-designed enclosures to suit individual budgets and tastes.

When writing for a copy, please specify "Catalogue Guide No. 117."

ALLIED SUPPLEMENT

Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Illinois has issued a 72-page catalogue supplement which gives up-to-the-minute information on new high-fidelity components, kits, p.a. systems, and tools.

Designed to be used in conjunction with the regular Catalogue 150, the new No. 155 supplement is available without charge on request.

BOGEN REPRINT

David Bogen Co., Inc., 29 Ninth Avenue, New York 14, New York is offering a 24-page reprint of a series of three articles covering the fundamentals of sound system operation and installation.

Copies of this handy publication, "What You Should Know About Sound Systems," are available from the company for 10 cents each.

UNIVERSITY PUBLICATIONS

University Loudspeakers, Inc., 80 S. Kensico Ave., White Plains, New York has announced the publication of three new brochures of interest to audiophiles.

The first is a new guide to progressive speaker expansion (PSE). This handy brochure contains detailed information for the expansion of speaker systems, illustrating step-by-step expansion with simple color-coded charts.

The second booklet, "The Ultimate in Sound," is a 28-page publication on speaker systems and enclosures which has been written for the layman.

The third brochure covers the company's line of "Decor-Coustic" three-way speaker systems. The booklet carries full details on performance and physical specifications of the various units currently available.

All of this material is available without charge by addressing your requests to Desk LA32 at the company.

ENCLOSURES FOR HI-FI

Cabinart, a division of *G & H Wood Products Co., Inc.,* 99 N. 11th Street, Brooklyn 11, New York is now offering copies of its 1956 catalogue, a 34-page brochure which lists speaker enclosures and enclosure kits, equipment cabinets, cabinet kits, multiple-unit speaker systems, and furniture hardware and accessories for the sound enthusiast.

The booklet itself is fully illustrated with pertinent details such as dimensions and finishes given on each enclosure. Those planning home music systems will find this handy publication of help in determining the components for their systems. —30—

Solar Battery Powers Radio Receiver

Lab model operates continuously in daylight and up to 500 hours in darkness without recharging.

IN A demonstration of transistor and solar battery efficiency, Edward Keonjian and James O'Hern of General Electric Company have developed a miniature transistor radio receiver which is powered by a solar battery. Although the device is too expensive at the present time to justify its manufacture, the development points the way toward the possible application of solar power to radio receivers.

The receiver is housed in a plastic case which measures 1¼" thick, 3" high, and 5½" wide, including the antenna, solar and storage batteries. The unit weighs 10 ounces and is designed to be used with a standard earphone or earplug.

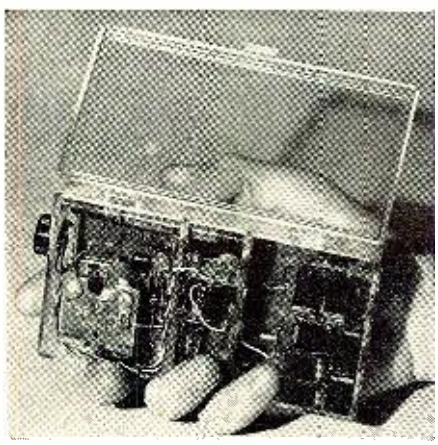
The circuit uses four standard "n-p-n" transistors, one as a converter, two as i.f. amplifiers, and one as the audio amplifier. The solar battery is comprised of seven selenium cells in series. They are type B2M cells made by International Rectifier Company.

The receiver will operate continuously in daylight and will run 500 hours in darkness without recharging. If used at the rate of two hours a day, it would work for a minimum of 250 days in absolute blackout.

Long operation in total darkness is made possible by the use of a miniature storage battery which is contained in the case.

Only two manual controls are needed, a turn-on knob which also adjusts volume and a knob for selecting a station anywhere in the broadcast band (550 to 1600 kc.). —30—

Close-up view of the experimental solar-battery-powered transistor receiver made by General Electric. The transparent case permits the battery to be recharged every time receiver is used in sunlight or under high artificial light intensities.



Certified Record Revue

(*Continued from page 64*)

reading. Bohm is a thorough craftsman and his tempi and phrasings, his dynamic shadings are all above reproach. Throughout the recording, it is obvious that Bohm has respect for the score and under his urgings the Vienna Philharmonic performs with stunning precision and great beauty of tone. The chorus is superbly trained and with the general level of brilliance in the cast, this is a supremely beautiful and exciting recording. As noted, the sound is extraordinary, the timbres of soloists and chorus richly revealed, the orchestra clean-lined and ultra-sonorous. Frequency and dynamic range was very wide, distortions of any kind, including choral "blur" were minimal. Another "Magic Flute" may arrive before this Mozart year is out, but it will have to be a most formidable combination of virtues to eclipse this altogether wonderful recording.

TCHAIKOVSKY
SWAN LAKE (ACTS 2 AND 3)
NBC Symphony Orchestra conducted by Leopold Stokowski. Victor LM1894. RIAA curve. Price $3.98.

For those people who cannot afford the completeness of the recent Dorati/*Mercury* album or for those who don't feel up to wading through the whole ballet, this is their dish of tea. Few conductors are so wise and knowing about "Swan Lake" as Leopold Stokowski. His reading is an absolute model and shows very clearly that although the years are advancing on Stokowski, his interpretive powers are undiminished. In fact the spirit and vitality of his perusal of the 2nd and 3rd acts, is not matched by many conductors his junior. Soundwise the Dorati/*Mercury* is the more opulent, but of a different nature too, since it was a single-mike job and Stokowski's was his typical close-up multi-mike set-up. Interesting comparison between the two, and a very good example of the vital difference acoustics can make . . . Stoky's is a studio job and although it is tastefully reverbed, it doesn't have the "concert hall sheen" of the big hall *Mercury* sound.

Speaking of Stokowski, I wonder if *Victor* has contracted to record him with the Houston Symphony. After all, few people realize that the Houston assignment is Stokowski's first permanent conductor set-up since he left the Philadelphia about 1936. Since I understand he is being given a free hand as far as repertoire is concerned, etc. the results of some recording sessions could be the most stimulating. I, for one, think that if *Victor* is really on the ball, while Stoky has a permanent deal they should record some of his specialties—things like the Shostakovich 5th and 6th symphonies, the Gliere 3rd, Stravinsky's "Firebird" and "Rite of Spring," etc. Oh, well! I'm just day-dreaming. Getting back to this recording, we can conclude by recommending it most highly to anyone not interested in any more of the score than it represents.

STAINER
THE CRUCIFIXION
George Lapham, tenor, Roy Wilde, baritone with chorus of the First Presbyterian Church, Philadelphia, Alexander McCurdy, organist and choirmaster. WFB Records WH1200L. RIAA curve. Price $4.95.

Just in time for Easter comes the third and best recording of "The Crucifixion." The label is as new to me as it will be to you. It is evidently an offshoot of some individual's personal enthusiasm for the not inconsiderable talents of McCurdy and his excellent choir. At any rate, the recording is a laudable endeavor which far outshines the two previous recordings in the LP catalogue. Admittedly, the version on the *Camden* label has the services of Crooks and Tibbett, and as good as Messrs. Lapham and Wilde are, they cannot measure up to these stalwarts. On the other hand, the *Camden* disc is an old 78 rpm transfer and cannot begin to compete with this present recording as far as sound is concerned.

Years ago when I was a pink-cheeked choirboy, I used to sing in this work and therefore have some of my own ideas on how this work should be performed. This reading is pretty much along the same lines as my own experience and preferences would indicate. Dramatic unity was very good as was the phrasing and dynamics. My one quibble is some of Mr. McCurdy's tempi, which for my taste were a little on the draggy side. Wilde does quite well in his role, with fine clear enunciation and a firm tone. Lapham has a nice quality voice and is most articulate, but is plagued by an inordinate amount of tremolo. The choir is typical of the better ones found in the bigger Presbyterian churches. Plenty of enthusiasm, good intonation and diction, a highly musical sound which offsets the fact that no matter how well trained, the transient personnel in a choir can't be expected to have perfect attack and release. McCurdy, of course, is splendid on the fine sounding organ and justifies his reputation.

Engineering was excellent, with nice rich sonorities from the organ, a good balance between choir and organ, soloists not too prominent yet well defined vocally. Good wide frequency and dynamic range and an appropriate acoustic spaciousness are plus virtues. This work does not have the reputation of some others in the sacred repertoire, but it is a work of compelling beauty, and is highly listenable. Try it for something different this Easter, and you will find your interest well rewarded.

THE SIENA PIANOFORTE
Esoteric ESP-3002. RIAA curve. Price $4.95.

This is probably one of the most controversial pianos in history. Its authenticity is questioned by many, its sound praised by some and damned by others. That it is an old instrument is undoubtedly true. But the most fantastic thing about this instrument is the tale of its making and its various travels and travails until it reached the possession of *Esoteric Records*. It's a succession of plots and intrigues and even a war or two thrown in for good measure! The story of its resurrection is scoffed at by a number of the critical press. I don't know whether the stories are true or not, nor do I care.

The instrument itself is the interesting thing and it is heard on this disc as played by Marisa Regules in works by Turina, Albeniz, Villa-Lobos, and Mompou. As you can see the repertoire has a decided Spanish cast and it is a pleasure to hear these works played with such great verve and enthusiasm. As to the sound of the Siena pianoforte . . . well, I am not going to start any arguments, but I'll be the first to admit that it certainly does not resemble our modern piano nor sound like some of the oldtimers I have heard. On the other hand, it is a singularly interesting sound, and whether or not this sound meets the approval of everyone, no one can deny that it is not superbly recorded.

Esoteric has done a beautiful job, with no trace of wow or flutter, no harsh ringing or other distortions in evidence. As far as I'm concerned, I am ignoring the fact that it does not sound like the piano I am familiar with and I like the sound of the instrument for itself. In fact this sound quality is so good that it would make an excellent demonstration rec-

ord. The jacket notes on the piano's history are worth the price of the record itself. Highly recommended to those who are not of prejudiced ear.

MASSENET
SCENES PITTORESQUES
SCENES ALSACIENNES
L'Orchestre de la Societe des Concerts du Conservatoire de Paris conducted by Albert Wolff. London LL1298. RIAA curve. Price $3.98.

There are a number of recordings of both of these works in the LP catalogue, and while some of them are fairly modern, reasonably good-sounding discs, all of them pale before the virtues of this latest entry. Somehow, all the discs that have been issued by *London* with Albert Wolff as the conductor have been outstanding in sound quality, and this is no exception. Both of these colorful, highly atmospheric works are given rousing performances by Wolff who knows how to extract the utmost in orchestral sonorities from any group he conducts. The "Fete Boheme" from the "Scenes Pittoresques" is the best-known of the sections in the works and has been part of many a "pop" concert program. This "Fete" is a real sonic *tour-de-force,* and the other sections of both works are also superbly recorded. String tone is clean and smooth, brass, especially the trumpets, is striking in its delineation and there are some fabulous percussives to gladden the hi-fi heart. Add some spacious acoustics which contribute to *London's* typical "big hall sound" and this is recording of exceptional realism. If you don't know these works I urge you to lend an ear to some of Massenet's most melodious output.

GOULD
FALL RIVER LEGEND
BERNSTEIN
FACSIMILE
The Ballet Theatre Orchestra conducted by Joseph Levine. Capitol P8320. RIAA curve. Price $4.98.

This will be an especially welcome disc to balletomanes as this is a considerable step upward in quality over the existing recordings of the works. "Facsimile" is more likely to be appreciated than the "Fall River Legend," since the only other recording is on the *Camden* label with Bernstein himself conducting and this is an old 78 rpm transfer of very limited quality. "Fall River Legend" on the other hand has had a fairly recent recording on *Columbia* and while the sound quality is not as good as this present recording, it is good enough to have spurred a lot of purchases. Well, if a person is really interested in these works, an extra recording will not loom too large. At any rate, Levine carries on the fine work as exemplified in his earlier recordings with the Ballet Theatre Orchestra. I cannot say that Levine is superior to Bernstein in his reading, but neither is he very greatly at variance with the composer's ideas on the score. His tempi are firm, his phrasing meticulous, his dynamic expressiveness reasonable. Most important, Levine elicits some splendid playing from the orchestra and his sense of balance and sonic proportions is outstandingly excellent. These same qualities are also much in evidence in his fine reading of the Gould work. Certainly he has no competition from Mitropoulos on the *Columbia* disc, who is too heavy-handed with this sort of repertoire.

The "Fall River Legend" concerns the murderous exploits of Lizzie Borden, the famous ax killer of the 1890's. As a ballet this is quite an experience, as a recording some of the programmatic intent is lost, but it is nonetheless an interesting score. Gould is almost self-consciously "modern" in some of the scoring, although on the whole this is an easily assimilated, highly listenable work. Bernstein's "Facsimile" is a somewhat brittle cynical comment on the psychological climate of today. Here, too, this astringent score is better as a ballet than heard on a record, but since we all can't visit the ballet our imaginations will have to substitute. There is more musical substance here than in the Gould piece, and although Bernstein's idiom is "modern," the dissonances and atonalities seem comfortable here where they are obvious with Gould.

The sound is one of *Capitol's* finest efforts. The smoothness of the strings is a delight to the ear, the brass is weighty and brazen, woodwinds are heard with extremely live intonation, percussion is outstanding for its accuracy and sharpness of detail. The acoustic perspective is ideal for the scoring, and not the least virtue of this recording is the utterly quiet *Capitol* surfaces. Strange, but this item of surface noises is so important a contribution to realism, but most companies still do not pay it enough attention. *Capitol* has a deservedly good reputation as regards surfaces and this is smart merchandising being an added plus to an already fine product. Getting back to this disc if you dig ballet, this is on your "must" list.

* * *

DAUNTLESS INTERNATIONAL

There is a fairly new distributing company in the record field called *Dauntless International.* This outfit represents quite a few of the "off-beat" labels and their catalogue has some of the most varied and some of the doggondest repertoire in the LP catalogue. Many of their items have certain historical interest such as recordings by John Barrymore and an air check of the original Orson Welles "Invasion from Mars" scare broadcast. Obviously, from a sound standpoint, items like these hold little interest for the hi-fi fan. Doing an abrupt about face, many of their other recordings are among the most consciously hi-fi in the catalogue. From a whole slue of stuff, I have picked out a number of them which I feel are interesting in content and outstanding enough in sound to warrant your attention.

STRINGS OF PEARL
Pearl Chertok, harpist and Willie Rodriguez, drummer. Audio Fidelity AFLP-1805. RIAA curve. Price $4.95.

Here is a "pop" harp record of amazing realism. The tone of the instrument is richly resonant, and all the subtle little nuances that are a part of the harpist's bag of tricks are heard with extreme clarity of detail. The ultra-soft thrumming of the strings with the thumb, the little sharp "plucked" percussives, the sweeping arpeggios, and many other "effects" can be noted in this recording. Frequency and dynamic range is among today's widest and transient distortion (so important in harp recordings) is limited to the normal intermodulation of the instrument. Miss Chertok holds forth on some standard numbers like "Willow Weep for Me," "Tenderly," and others.

The most interesting is a delightfully clever arrangement of "Laura," wherein the thematic material of "Laura" is combined with a part of Ravel's "Introduction and Allegro"! On the flip side of the record Miss Chertok teams up with drummer Rodriguez in a group of exotically titled originals. Not much musical substance here but the combination of harp and drums is interesting and the drums are exceptionally well reproduced. Miss Chertok's playing is wholly expert and for harp enthusiasts, this disc is a must.

MARIMBA-MAMBO-CHA-CHA-CHA
Audio Fidelity AFLP1802. RIAA curve. Price $4.95.

Now I personally am not of the stature which allows for tripping the light fantastic

in Mambos or Cha-Cha-Chas or anything else, but this disc is so full of rhythmically propulsive music that it darn near got me involved in such shennanigans! If you dig this Latin-American stuff, this is your dish of tea. The marimbas (there are four or more playing at times) are in the hands of experts and when combined with all the other paraphernalia of the typical mambo orchestra such as the bongo drums, gourds, etc. the beat is strong . . . so feet, get hot! Musically the orchestra plays many numbers that are indigenous South of the Border, but also plays tunes that have gained wide popularity "Up Nawth", such as the "Carioca," "Frenesi" and "Oye Negra." The sound is ultra-modern, wide-range stuff and if you want something to test the transient response of your speaker, friends, this is it! The percussive sock of the mallets on the wooden blocks and high sharp tone of the bongos will really throw the pulses through your system. A top-notch recording with a little too much reverb my only quibble.

THE BRAVE BULLS
Audio Fidelity AFLP1801. RIAA curve. Price $4.95.

If you like your recordings bizarre and unusual this is for you. This is, believe it or not, the authentic music as played during a Mexican bullfight by the "Banda Taurina", the official band of the Plaza Mexico, world's largest bull ring. The music? Idiomatic to be sure . . . the various numbers depicting parts of the ritual of bull fighting. As you can well imagine, all is of decidedly Spanish flavor, with the strong rhythm of the percussion and the typical flourishes and staccato shrillness of high register trumpets most prominent.

The sound is quite extraordinary in its almost tangible "liveness" . . . the piercing brazen bluster of the trumpets and other instruments is captured in wide range sound with the remarkable and exciting acoustics of the bull ring. As an added plus for you lovers of percussion, this band must have the largest, most overstuffed bass drum in the world for there are mighty *whumps* on this disc, which certainly could not have been produced by the ordinary garden variety of instrument. To complete this unusual and interesting package, there is included a small booklet showing the various passes used in bullfighting. Printed in full color, this series of paintings graphically illustrate the ever-present danger of death in this most dangerous of sports.

GLOCKENSPIELS, TRAPS AND PLENTY OF PIPES
Replica 33x507. RIAA curve. Price $3.95. Vol. 4.

Probably most hi-fi fans, especially those who favor organ recordings have long since made acquaintance with the preceding volumes in this series. For the benefit of those to whom this material is totally new, let me say this, because of the peculiarities of construction and acoustic environment plus fabulously accurate recording this organ is about as live-sounding as anything ever put on record. Even the cheapest and most miserable of phonographs can be made to sound halfway acceptable with this disc. which explains its frequent use for demonstration. Technically the recording is very close-up, and because of this, every voice and pipe is heard with startling clarity and definition. However, unlike many close-up recordings, the engineers here have learned how to control the excessive dynamics this type of miking involves. With just the right degree of reverb, the fantastic grunts, wheezes and groans and the clank, clatter, and boom of the huge percussion battery that is part of this odd-ball *Wurlitzer* is not quite believable. Highs, lows, middles . . . transients galore, this is a super

test record, however corny it may be in musical content. This volume has more of the same type of "pop" tunes as the first disc, all of them played to the hilt by organist Leon Berry.

THE BEAST IN THE BASEMENT
Replica 33x509. RIAA curve. Price $4.95.

No, this isn't incidental music for a Fu Manchu movie . . . it's another of those zany *Replica* organ records. This time we are in the basement of organist Leon Berry's home, where reposes his pride and joy, a resurrected two-manual *Wurlitzer*. Replete with all the percussion and sound effect devices so dear to Mr. Berry this disc recounts some of the fantastic sounds of which this mad assemblage is capable! In a repertoire as diverse as the "Shiek of Araby," the "Marines' Hymn" and the "Beer Barrel Polka" among others, you can hear the familiar close-up type of recording as in the other Berry discs. This time however, there is a difference . . . the residual acoustics are not quite so productive of liveness as the other discs. Being in a basement is somewhat confining for a *Wurlitzer* organ and it sounds that way. Particularly noticeable was the lack of any really heavy low pedal. For what it represents, the recording is notably as accurate as the other *Replica* organ discs. I predict the grooves of the opening cymbal clash in the "Shiek of Araby" will soon be worn by eager demonstrators!

THE KING OF INSTRUMENTS
Marilyn Mason in recital. Aeolian-Skinner. RIAA curve. Price $5.95. Vol. 7.

The *Dauntless* outfit has its share of labels devoted to more serious musical pursuits as well as the gimmick stuff. One of their most praiseworthy is the series of recordings put out under the sponsorship of *Aeolian-Skinner*, one of America's most prominent organ builders. The first volume in this group is perhaps the most valuable and instructive organ record ever issued. Actually, the first volume which is a narrative account with musical examples of organ construction, was issued as a promotional piece by *Aeolian-Skinner*, but it caught the fancy of many an organ enthusiast both for its unusual content as well as the wonderful sound.

Encouraged by this success, there have been successive issues, each devoted to certain aspects of the organ repertoire and performed on a variety of *Aeolian-Skinner* installations. This is the 7th and latest and continues the excellent work of the others. This disc presents one of the foremost women organists, Marilyn Mason, in a program of works ranging from the baroque to modern. The instrument used is in St. John's Chapel at the Groton School, Massachusetts. Miss Mason is a sensitive performer and uses her registrations with restraint, which is not to say that she is not vigorous when the score calls for this quality.

In the "Carnival Suite for Organ" by Robert Crandell she exhibits her facile technique and feeling for this kind of repertoire but I think she is at her best and most comfortable in the "Prelude and Fugue in D Major" (not to be confused with the famous "D Minor Tocata and Fugue") of Bach. This is a splendidly evocative performance and is about the best version of the work on discs. Sound is bright and clean with some nice sonorous pedals to whet the hi-fi appetite. Acoustics are spacious but fortunately not so much that detail is obscured. Try this for a different approach to organ recording.

That's all for now, but next month I'll tackle a part of the growing pile of Mozart Bicentennial releases I have on hand so that you lovers of Mozart can start planning your record purchases for late Spring and Summer. —30—

TV Retrace Lines

(*Continued from page 52*)

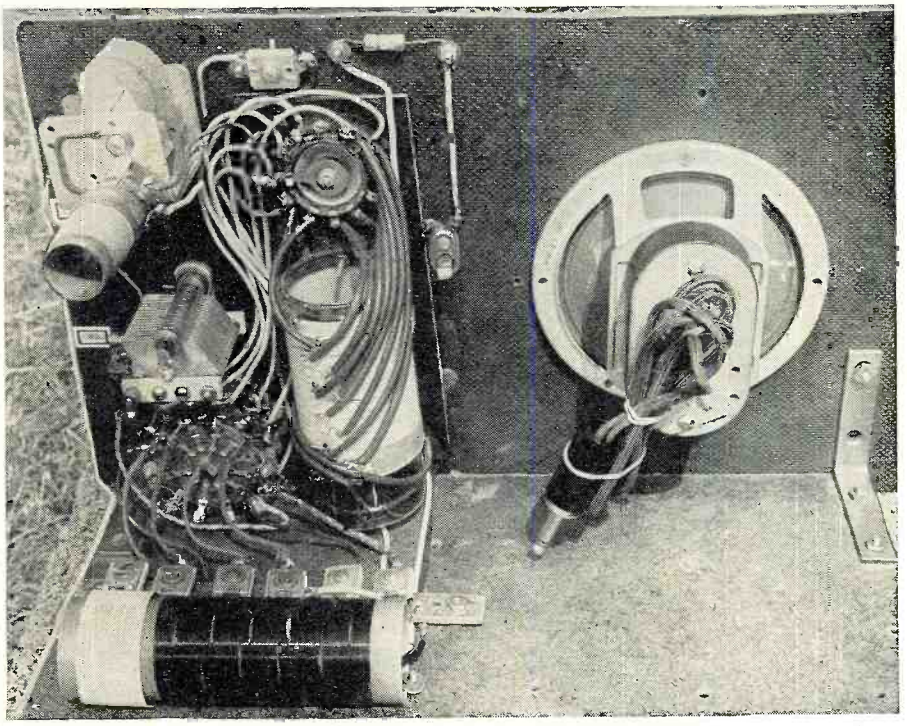
This cannot, of course, be done directly; a blocking capacitor is needed to isolate the d.c. voltages and an isolating resistor is required to prevent the deflection coils from shorting the video. The two necessary components R_3 and C_3 are placed in series and connected as shown.

R_1 and R_2 are normally rated in the hundreds of thousands of ohms, and a first thought is to wonder why, with a value of 22,000 ohms for R_3, the coils do not short the video amplifier output. The answer, of course, is that a cathode-ray tube is still a tube, basically of the standard amplifier type. Such a tube always has a very low effective a.c. cathode-to-ground impedance and in the standard picture-tube circuit it operates as a grounded-grid amplifier. Since the cathode impedance itself is low, an impedance a good deal higher, represented by the 22,000-ohm resistor and the coils in series, cannot affect it when placed in shunt. R_2 also has little effect on the video, but it is proportioned as it is for d.c. reasons as well as for best functioning with the other circuits not shown, including the sync take-offs.

It would, of course, have been possible (and may be desirable in some receivers) to obtain the vertical output pulses from the grid of the vertical output tube and apply them to the picture-tube grid, since they will be of negative polarity. To do this with a receiver whose circuits are similar to Fig. 2, simply insert a resistance (experiment for the correct value) in series with the picture-tube grid, and then couple the pulses through a blocking capacitor to the grid. To do this correctly, several requirements must be satisfied. The picture-tube grid resistor must be small enough so that no perceptible shunting of highs to ground takes place in the capacitance of the leads because of the grid's high impedance above ground. Second, the additional loading placed on the vertical deflection circuit must be light enough to avoid affecting it —reducing picture height; this requires a large resistor. Probably the best compromise is to have a resistor between the pulse source and the picture-tube grid as well as in series with the grid.

The preferable method is that shown in Fig. 2 because it causes no perceptible effect on either the picture or the sweep, and because it is physically such an easy job. It is only necessary to bare a half inch or so of the picture-tube socket lead going to the cathode and the lead going to the "hot" side of the vertical deflection coils. If the receiver diagram leaves any doubt as to which is which (and that happens often) check with oscilloscope before making connections. Solder R_3 and C_3 together with minimum lead length between them. —30—

CHANNEL-TUNED CRYSTAL RECEIVER



Over-all view of the home-built, channel-tuned crystal receiver. An oversize chassis is used to avoid interaction.

By **JOSEPH D. AMOROSE**

This easy-to-build crystal receiver tunes automatically to broadcast band locals and provides DX reception too.

"WOULDN'T it be nice if you could make a crystal set that would tune in all locals with just a flick of a switch, like this?," said a fellow crystal radio enthusiast as he turned the "channel" switch on his TV receiver.

The idea of an automatically-tuned crystal set has long intrigued experimenters who have wanted something more than another "one-control" receiver. The "ideal" set should not only tune in all locals with the turn of a single switch but also bring in each station at peak sensitivity and selectivity. All this—without compromises. In addition, it should also have means for switching instantly to manual tuning whenever DX reception is desired. Other important criteria were minimum expense, minimum components, and circuit simplicity. All this sounds like a tall order—and it was! After months of experimenting, the receiver to be described was evolved.

The schematic diagram, as shown, is basically the circuit popularized by an old hand in the crystal field, M. M. Schuman of Baltimore. This circuit received, clearly and consistently, all eight local stations in that city. In Richmond, Va., the test proved to be stiffer. Here there are six locals, three of which transmit on frequencies only 40 kc. apart. Worse still, one is a weak transmitter, flanked by two strong ones which swamp its signal. The set to be described in this article gets them all. Volume is good and station separation is excellent. Speaker operation is obtained from WRNL's 5 kw. transmitter located 5 miles away. Reception of DX is quite impressive too. Although tested during a July heatwave, many stations in the eastern half of the U.S. were received and recorded frequently.

Constructing the set from the diagram should be easy. When building the unit, connect all wires except those for positions 1-9 (inclusive) on S_1. The reason for this is that the set must first be put into manual operation. Only then can it be determined which of the L_1 leads (providing optimum performance) should go to these, the fixed-tuned, S_1 positions.

To adjust the fixed-tuned circuits and to select the proper L_1 taps for S_1, follow this procedure: Move S_1 to #11 —the manual tuning position. Unmesh C_2's rotor completely if no local station interferes strongly. Should interference exist, tune this signal to peak, then turn C_2 until the station signal disappears. Reverse L_3 leads if "hand-capacity-effect" is encountered.

Adjustments for tuning in the highest frequency local should be made first. In Richmond, this station is WLEE at 1480 kc. The tuning procedure used in Richmond will be de-

NEW INDOOR ANTENNA Brings in UHF and VHF. Use on all types of TV. List $9.95 ..... **$3.49**

Complete Outdoor ALL CHANNEL CONICAL ANTENNA Includes: 8 element antenna with crossbar, 8 ft. seamless aluminum mast chimney mount or 7" wall bracket (state your need), 8 stand offs, 50 ft. of 300 ohm wire. List $15 ..... **$8.29**

ANTENNA COMPONENTS

300 Ohm TV Lead-In Wire	2¢ ft.
3" Standoffs	2¢
7" Standoffs	3¢
5 Ft. Aluminum Seamless Mask	89¢
7" Wall Bracket	99¢
Aluminum Chimney Mount	$3.49
Philco 8-Element All Channel Antenna	$4.49

PICTURE TUBE BRIGHTENER 94¢

Boland & Byce PICTURE TUBE TESTER and REJUVENATOR **$59.95**

Sheldon Hi-Po 6SN7 89¢ | **Sheldon Hi-Po 5U4 79¢**

WELLER DUAL-LITE SOLDER GUN KIT 135 watt gun . . . dual spotlight illuminates work when iron is on. Kit includes wire soldering brush, Weller soldering aid to make tight wire twists and reopen old solder joints, pkg. of Kester Solder. **$5.49**

UNIVERSAL 4-Prong Auto Radio Vibrator Takes care of 90% of 6 volt auto sets. List $4.90. ..... **$1.19**

RCA CHEATER CORD 29¢

EICO TUBE CHECKER Completely wired! List $49.95 ..... **$39.25**

All Parts and Test Equipment F. O. B. Harrison, N. J.

USED TV SETS
In Working Condition!

10" Table Model	$22.50	Console	$35.00
Console	$25.00	16" Table Model	$39.50
12" Table Model	$27.50	Console	$44.00
Console	$31.00	17" Table Model	$45.00
14" Table Model	$32.50	Console	$49.50

Shipped F.O.B. Harrison, N. J.

NEW LIBERAL TERMS

NO MINIMUM ORDER . . . ALL POSTAGE PAID ON ORDERS OVER $10.00 IN U.S.A., A.P.O.'s AND TERRITORIES. 10% DEPOSIT ON C.O.D.'s TO OUR CANADIAN AND FOREIGN FRIENDS: PLEASE SEND APPROXIMATE FREIGHT, EXCESS WILL BE REFUNDED. ORDERS SUBJECT TO PRIOR SALE.

WE WANT NEW ACCOUNTS
If you are rated, your credit is good with us.

Send for Free complete tube listing and monthly specials! Get on our mailing list.

NEW STOCK OF PRE-TESTED TELTRON TUBES

GUARANTEED! . . . LOWEST PRICES EVER!

All tubes individually boxed . . . unconditionally guaranteed for one year!

GIFT OFFER! One 6BG6G tube will be shipped FREE with any $10 order accompanying this ad.

PICTURE TUBES

SPECIALS

16KP4	15.99	16TP4	15.99
16RP4	15.99	16ZP4	19.19

10BP4	11.19	16CP4	18.79
12LP4	13.79	16DP4	18.69
12UP4	14.25	16EP4	19.29
14BP4	15.77	16GP4	19.29
14CP4	15.77	16HP4	18.79
15BP4	18.53	16JP4	18.79
(for Dumont)		16LP4	18.79
16AP4	18.79		
17BP4	17.99	21AP4	27.49
17CP4	20.79	21EP4	27.47
17GP4	21.79	21FP4	27.99
19AP4	23.49	21YP4	27.99
19DP4	23.19	24AP4	43.99
20CP4	24.19	24CP4	43.99
20DP4	24.19	27EP4	64.99

Send for Free complete tube listing and monthly specials. Get on our mailing list.

FREE $7.50 list value Bonus Box of three 6SN7 tubes and 25 assorted resistors with each order of $25 or more, of receiving tubes only.

Type	Price	Type	Price	Type	Price	Type	Price
0Z4	.45	6BA7	.58	6SQ7	.40	12SN7GT	.56
1A7GT	.53	6BC5	.48	6T8	.71	12SQ7	.38
1B3GT	.62	6BC7	.75	6U8	.76	14A7	.43
1H5GT	.51	6BE6	.46	6V3	.80	14B6	.36
1L4	.51	6BF5	.48	6V6GT	.48	14Q7	.52
1L6	.51	6BF6	.48	6W4GT	.43	19BG6G	1.48
1LC6	.49	6BG6G	1.18	6W6GT	.53	19T8	.71
1N5GT	.51	6BH6	.51	6X4	.37	25L6GT	.41
1R5	.51	6BJ6	.51	6X5GT	.38	25BQ6GT	.82
1S5	.43	6BK5	.75	6X8	.80	25W4GT	.43
1T4	.51	6BK7	.78	6Y6G	.61	25Z5	.55
1U4	.51	6BL7GT	.78	7A8	.46	25Z6GT	.36
1U5	.43	6BN6	.90	7C5	.44	35A5	.48
1X2	.65	6BQ6GT	.83	7F7	.59	35B5	.48
3A5	.65	6BQ7	.85	7F8	.77	35C5	.48
3Q5GT	.61	6BY5G	.60	7N7	.52	35L6GT	.41
3S4	.48	6C4	.41	12AT6	.37	35W4	.33
3V4	.48	6C5	.46	12AT7	.71	35Y4	.42
5R4	.95	6CD6G	1.63	12AU7	.58	35Z3	.41
5V4	.49	6CU6	.95	12AV6	.42	35Z5GT	.33
5Y3	.30	6D6	.59	12AV7	.73	37	.59
5Y4G	.37	6E5	.60	12AX4GT	.60	43	.55
6AB	.40	6F5	.44	12AX7	.61	45	.55
6AB4	.43	6F6	.42	12AZ7	.61	50A5	.49
6AC7	.65	6H6	.50	12B4	.72	50B5	.48
6AG5	.52	6J5	.49	12BA6	.46	50L6GT	.50
6AH4GT	.65	6J6	.61	12BA7	.58	50X6	.53
6AF4	1.02	6K5	.60	12BE6	.46	75	.44
6AK5	.9¢	6K6GT	.39	12BH7	.61	77	.55
6AL5	.43	6K7	.40	12BY7	.65	80	.40
6AQ5	.48	6L6	.78	12H6	.50	84	.46
6AR5	.48	6Q7	.40	12J5	.40	117GT	1.20
6AS5	.52	6S4	.41	12K7	.40	117L7GT	1.20
6AU5GT	.60	6S8GT	.65	12Q7	.48	117N7GT	1.20
6AV5GT	.60	6SA7	.45	12SA7	.45	117P7GT	1.20
6AV6	.37	6SK7	.45	12SJ7	.45	117Z3	.33
6AX4GT	.60	6SJ7	.45	125K7	.45	117Z6GT	.65
6AX5GT	.60	6SN7GT	.60	12SL7	.60	1629	.39

We have thousands of tube types too numerous to list here. On ordering types not listed take 75% off current list price for cost of tube.

TELTRON ELECTRIC COMPANY

428 Harrison Ave., Harrison, N. J.

Dept. RN-4 *Phone HUmboldt 4-9848*

KIT KING MAMMOTH ANNIVERSARY SA E!

FREE! NEW ANNIVERSARY FLYER...PACKED WITH BARGAINS

in Optics . . . Cameras . . . Tools . . . Electronics! Write for yours TODAY!

★ FREE! ANY KIT WITH EACH $10 ORDER! ★ FREE GIFT WITH *EVERY* ORDER!

Thousands of Kit King kits sold . . . Not one returned! Order Now!

☐ **60 TUBULAR CONDENSERS.** 25 values! .00035 to 1 mf., up to 6000V. Oils, too. Wt. 2 lbs. Reg. $10. **$1**

☐ **10 FP & TWIST ELECTROLYTICS.** Asstd. to 1000 mfd. to 450V. Some multiples. Wt. 2 lbs. **$1** Reg. $12.

☐ **1500 PCS. SPAGHETTI TUBING.** Asstd. sizes, colors, lengths to 3 ft. **$1** Wt. ½ lb. Reg. $7.

☐ **8 PC. NUTDRIVER KIT.** Plastic handle; 3/16, 7/32, ¼, 5/16, 11/32, ⅜, 7/16" steel socket wrenches; plastic case. Wt. ½ lb. $3.50 value. **$1**

☐ **G.E. PREAMPLIFIER KIT.** Chassis, condensers, resistors, wire, socket, schematic (less 6SC7 tube) for famous equalizer. Wt. 1 lb. Reg. $4.50. **$1**

☐ **2000 PCS. HARDWARE.** Radio, TV, shop, woodworking screws, springs, grommets, etc. Wt. 2½ lbs. Reg. $15. **$1**

☐ **40 MOULDED CONDENSERS.** Best known makes! .0005 to 0.1 mf to 1000V. Wt. ½ lb. Reg. $13. **$1**

☐ **30 CERAMIC DISC CONDENSERS.** 5 mmf to .01 mf, to 3000V. TV repairmen note! Wt. ½ lb. Reg. $13. **$1**

☐ **8 TUBULAR ELECTROLYTICS.** Popular values to 450V. Top makes, axial leads. Wt. 1 lb. Reg. $11. **$1**

☐ **60 KNOBS.** Instrument, radio, TV types. Push-on & set screw types. Some 35¢ ea. Wt. 1 lb. Reg. $9. **$1**

☐ **10 PANEL SWITCHES.** Micro, car, momentary, push & rotary. Wide variety. Wt. 1 lb. Reg. $12. **$1**

☐ **3 LBS. HOOKUP WIRE.** Hundreds of pre-cut, tinned lengths, to 18". Asstd. colors, sizes, stranding. Reg. $10. **$1**

☐ **20 POWER RESISTORS.** Wirewound. 20 values, 5 ohms to 12,000. 5 to 50 watts. Candohm & tubular types. Wt. 2 lbs. **$1**

☐ **60 MICA CONDENSERS.** Rare offer! Postage stamp types, 25 values, .00001 to .01; to 1200 WVDC. Many silver, 5% too! Wt. ½ lb. Reg. $21. **$1**

☐ **50 RF COILS & CHOKES** and slug-tuned coils for TV, radio, lab. 20 types. Wt. 1 lb. Reg. $15. **$1**

☐ **125 CARBON RESISTORS.** 30 values; 100 ohms to 1 meg; ⅛, ½, 1 & 2W. Many 5%. Uninsulated. Wt. 1 lb. Reg. $21. **$1**

☐ **12 VOLUME CONTROLS.** Handy shop asst. of radio, TV, lab units. Some WW. Wt. 1 lb. Reg. $9. **$1**

☐ **30 POPULAR BULBS.** Special! Wide variety standard, miniature, screw and bayonet types. 1.1 thru 6V. $4 value! **$1**

☐ **12 LINE CORDS.** AC/DC cords; molded plugs. For all electrical eqpt. Stock up now! Wt. 1 lb. Reg. $3. **$1**

☐ **100 COIL FORMS.** Experimenters, note! Wide variety of shapes & sizes, Ceramic and bakelite. Wt. 2 lbs. Reg. $25. **$1**

☐ **60 CARBON RESISTORS.** Insulated; 35 values, 15 ohms to 10 megs. ½, 1 & 2W; 5% too! Incl. famous Allen Bradley! Wt. ½ lb. Reg. $18. **$1**

☐ **7 PC. MAGNETIC SCREWDRIVER SET,** w/mtg. rack. Fireproof, nonbreakable plastic handles; to 7" long. Wt. 2 lbs. $3 value! **$1**

☐ **SAW & RULER SET.** Heavy duty coping saw, blade and 3 ft. spring-type rule in case. Wt. 1 lb. Reg. $2.50 value. **$1**

☐ **110 RADIO PARTS.** Asstd. moulded, mica, paper tubular condensers & carbon resistors. Mtd. on term strips. Wt. 2 lbs. Reg. $15. **$1**

☐ **25 TUBE SOCKETS.** Scoop! Subminiatures, 7 & 9-pin miniatures. 4 to 8-pins. Mica-filled & ceramic; shield base type, too! Wt. 1 lb. Reg. $9. **$1**

☐ **50 CERAMIC CONDENSERS.** Tubular, disc, button & standoffs! 5 to .01 mmf to 1000V. Wt. ½ lb. Reg. $14. **$1**

☐ **60 TERMINAL STRIPS.** Solder term. strips & boards; 2 to 9 lugs. Builders, note! Wt. ½ lb. Reg. $4. **$1**

☐ **KNIFE & OIL STONE SET.** Wonderful gift or pick one up for yourself! 5 in 1 stag handle SCOUT knife, with pocket sharpening stone. Wt. 1 lb. Reg. $4. **$1**

☐ **10 "HI-FI" KNOBS** by CRONAME. Knurled brown & black bakelite; gold-bronze and aluminum inlays. "VOL.", "ON-OFF", "TV-FM-Rad.-PH", "BASS", "TREBLE", "TUNING". Brass Inserts w/set screws. Wt. 1 lb. Reg. $4. **$1**

☐ **REMOTE CONTROL SCOOP!** Chassis w/fil. xfmr. 115 to 6.3V @ 1.5A; miniature 3,000 ohm SPST relay; plus 18 condensers, resistors, sockets. Reg. $15. **$1**

Imported 7 x 50 BINOCULARS Reg. $42 ONLY **$22.50** *plus 10% F.E. tax

- COMPLETE WITH LEATHER CASE & STRAPS
- FINEST QUALITY PRISM LENSES
- INDIVIDUAL FOCUS
- STURDY, HANDSOME

PLUS—FREE. **Your choice of any two kits advertised at left.**

☐ **Scoop! 500 VDC @ 260 mils POWER SUPPLY KIT!** Reg. $45 ANNIVERSARY PRICE, **$17.50**

Transf. 115 VAC to 1100 VCT @ 260 ma; 5V @ 3A; 6.3V @ 12A; 6.3 @ 3A; two 6.3V @ 5A. Choke, 2 oil cond., chassis, switch, fuse post, sockets, bleeder, wire, schematic. Brand new!

BLOWER MOTOR SALE!

☐ **Reg. $12 ANNIVERSARY PRICE ONLY $3.88**

FOR DARKROOMS, SHOPS, ATTICS, TRANSMITTERS, OTHER EQUIPMENT! COMPLETELY ENCLOSED BEARING, MOTOR BY G.E. NEEDS NO OILING FOR YEARS!

Ideal for all shop & household uses. 115 VAC, 1/60 H.P. 1500 rpm, 4" dia.; 18" leads. Wt. 4 lbs.

☐ 10" fan blade for above (500 CFM) Only 88c

☐ **0 to 60 minute TIMER**

Reg. $6 Sale PRICE.. **$1.19**

- BRAND NEW!
- STURDY PANEL MOUNTING TYPE
- VERNIER CONTROL
- EASY TO READ DIAL
- LOUD BELL ALARM AT END OF CYCLE

Wt. 3 lbs.

HOW TO ORDER Check items wanted. Return entire ad with check or money order. Include sufficient postage, excess returned. C.O.D. orders 25% down. Rated, net 30 days.

Name_____

Street_____

City_____ Zone____ State_____

Enclosed $_____ for Items, $_____ for postage.

KIT KING

LEKTRON SPECIALTIES

28 GARDNER ST CHELSEA 50, MASS.

Visit our showroom at 131 Everett Avenue, Chelsea

scribed since the same technique may be used in any location. Unmesh the plates of C_{13}. Turn S_2 to #12 (a 500 $\mu\mu$fd. trimmer is in circuit here); no L_1 taps have been selected. Adjust C_1 to almost full capacity then adjust C_{13} for maximum volume on the 1480 kc. station. Re-adjust C_1 and C_{13} if necessary. Now switch from "manual" to "automatic" tuning by turning S_1 to #10. Adjust trimmer C_{12} until peak signal of 1480 kc. station is again heard. C_{12} merely duplicates the previous C_{13} adjustment. This step completed, the 1480 kc. station is now "fixed-tuned."

Next, select the L_1 taps for positions 1 to 9 on S_1 as follows: Return S_1 to the #11 (manual) tuning position. The 1380 kc. station WMBG will be tuned next. Move S_2 to #11, turn C_{13} slightly until peak volume is obtained. Connect the L_1 tap used to #9 of S_1. Next, turn S_1 to #9 and adjust C_{11} until the 1380 kc. signal is again maximum. This completes the automatic tuning adjustment for this station.

On all of the remaining stations, follow the same procedure for selecting the optimum tap, connecting the chosen L_1 lead to S_1 and adjusting the matching secondary trimmer as previously outlined for the 1380 kc. station.

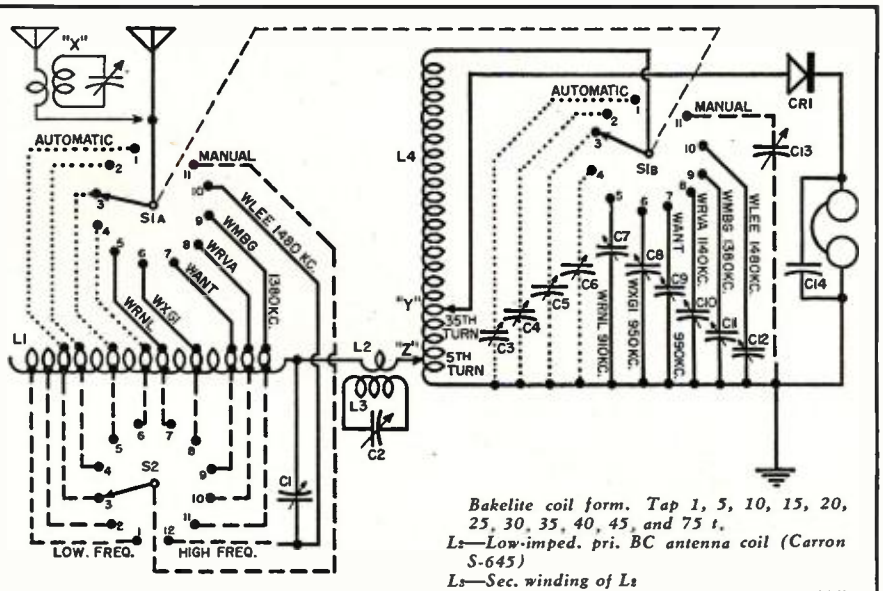
One more example, to adjust for station WRVA (1140 kc.), S_1 again goes back to #11. S_2 connects to the optimum tap #10, following which C_{13} is adjusted to peak. The selected L_1 tap lead is connected to #8 position on S_1. S_1 then moves to #8 and C_{10} is adjusted for maximum volume. Adjustments for the 990 kc. station are also completed, and so on, until all stations are set.

A good antenna and ground are essential. Use an antenna at least 100 feet long, exclusive of lead-in, and place it as high in the air as possible. Attach the ground to a cold-water pipe, as close to earth as possible. Remember, rusty pipe joints can cause considerable signal loss. If two traps are used, set both before making any other adjustments on the receiver. The experienced builder may add a third switch section in the detector circuit, the photo shows L_1 tapped for this addition. Although the set is highly selective with the detector tap compromisingly set at the 35th turn, this third tuned (detector) circuit will facilitate tuning in many of the weaker local stations in highly crowded station areas, such as are encountered in cities like New York, Chicago, Los Angeles, etc.

The addition of extra grounds increases the volume noticeably on weak stations and is, therefore, recommended.

Use large panels when constructing

Schematic and parts list for the channel-tuned crystal receiver. Solid black lines indicate parts in use when set is in automatic, fixed-tuned position. Positions 1 to 10, inclusive, comprise the automatically tuned positions on switch S_{1A}. Dotted lines indicate parts to be used for tuning additional stations—Richmond, Va., has only 6 stations which come in at switch positions shown on S_{1A} and S_{1B}. Broken lines show parts in use when set is on manual tuning, when S_{1A} would be on position No. 11. S_2 and C_{13} are the manually tuned units. See text for details on this set.



C_1—500 $\mu\mu$fd. trimmer capacitor
C_2—350 $\mu\mu$fd. var. capacitor (one section of 2-gang unit was used)
C_3, C_4, C_5, C_6, C_7, C_8, C_9, C_{10}—350 $\mu\mu$fd. trimmer capacitor
C_{11}, C_{12}—250 $\mu\mu$fd. trimmer capacitor
C_{13}—350 $\mu\mu$fd. single-section var. capacitor
C_{14}—.001 μfd. capacitor (value not critical)
S_{1A}, S_{1B}—3-gang, 11-pos. rotary switch (Mallory-Yaxley type. Two gangs used, third may be connected in detector circuit, if desired)
S_2—12-pos. rotary switch, single deck
L_1—75 t. #22 d.c.c. wound 2" dia., 4" long Bakelite coil form. Tap 1, 5, 10, 15, 20, 25, 30, 35, 40, 45, and 75 t.
L_2—Low-imped. pri. BC antenna coil (Carron S-645)
L_3—Sec. winding of L_2
L_4—110 t. #22 en. or d.c.c. wound on 1½" dia., 4" long Bakelite form. Tap 5, 35 t.
CR_1—1N34 crystal detector
X—Optional absorption wavetrap (same as L_2, L_3, C_2)
Y—Optional adj. Tap 35th t. on L_4. Matches impedance of CR_1 to inductance chosen on L_4 (See text)
Z—Selectivity control. Tap 5th t. down on L_4. Moving either "Y" or "Z" downward increases selectivity, decreases signal strength. Upward movement increases volume, reduces selectivity. Try 5th and 35th turns first.

this set and separate the parts as widely as possible, especially the coils. This procedure will insure maximum selectivity. Scrape all connecting wires clean and keep leads as short as possible.

Note: The order of the L_1 taps chosen for S_1 are shown to be in linear progression. This is not a hard-and-fast rule. Rather, the builder is advised to try all taps on L_1 when making the selections for positions 1 to 9 on S_1, even if it means using the same coil taps for two or more stations. Often, depending on the stations' relative frequencies, better volume and selectivity is secured this way.

It is particularly important to use headphones of standard impedance—at least 2000 ohms impedance. Low-impedance phones do not work well in crystal set circuits—they do not tune over as wide a range and also do not provide the required sensitivity.

The jaded crystal set addict, weary of twirling dials and straining at micrometric adjustments, should find this receiver a welcome addition to his shack. A flick of the wrist and there are your stations. What more could one ask? —30—

TAPE RECORDER HINT

By JAMES A. McROBERTS

A *WEBCOR* tape recorder Model 210 was brought into the shop because the erase circuit seemed to be faulty. While recording, there was a background of prior recordings, and the new recording just put on contained hiss.

The symptoms definitely pointed to a defect in the a.c. bias, which also serves as erase. Measurement of the erase oscillator grid bias revealed a trifle less than normal, showing that it was oscillating. The conclusion was that the oscillator was working at too high a frequency.

Further investigation revealed that the capacitor shunting the bias oscillator tank coil (in the plate circuit) was open. This capacitor is rated at .0068 μfd. at 600 volts. When this was replaced with a good molded type, the trouble was cleared up. —30—

SOME DIAL CORD HINTS

By A. VON ZOOK

OVER a period of use, all dial cords tend to stretch and become loose on the dial cord drum. This causes the dial cord to slip. Instead of replacing with new cord, put some adhesive tape wrappings on the tuning shaft.

Work the cord toward front of the shaft. Now wrap several layers of narrow tape onto the shaft where the cord was. Now work the dial cord back over and onto the tape. To prevent forward slipping, place some more adhesive tape on the tuning shaft. Now the dial cord will not slip or work forward on the tuning shaft.

If the dial cord knot (where the cord is tied onto the spring) looks like it will become loose, put a generous amount of radio cement or coil dope over this knot. Be sure to tighten up the knot first. Two pairs of long nose pliers come in handy in pulling short knot ends tight. —30—

Geiger Counter

(Continued from page 60)

ing sure that the integrating circuit has stabilized at each value before reading and proceeding to the next. From these recorded values, a curve is plotted, and the scale calibrations determined from it.

The second function of the meter on this counter is for battery checking. With the meter switch in the battery position, note the position of the pointer when the voltage regulator tube is just operating (very faint blue glow). This is the normal position for the high voltage. Now press the battery switch to the "A" position and note the pointer position, which should be the same as for the high voltage. Next, substitute a variable voltage for the filament battery, and note the meter readings for 3.2 and 2.8 volts. These are the limits for the "batteries normal" range.

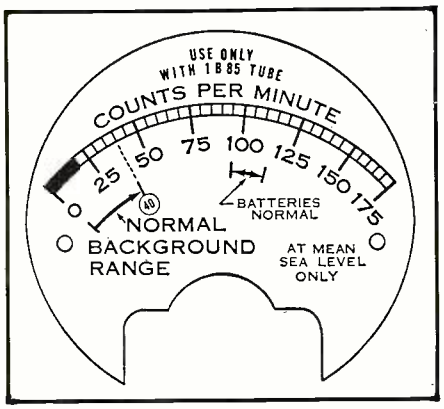
From this information, draw up a scale for the rate meter to suit your own taste and needs, using any one of a number of standard methods.[3] The scale used on the instrument described is shown in Fig. 11.

Field Use

This counter was designed for serious field use in rugged terrain. In consequence, operation has been simplified as much as possible. The only field adjustment normally needed is that of the high voltage. This is done at the first turn-on of the day, and after each three hours of service, if necessary. To adjust high voltage, turn R_{1S} all the way counterclockwise, turn the battery switch to "on" position, and the meter switch to "volts" position. Then, while watching the meter, advance the high-voltage adjustment slowly. When the pointer reaches the top of the "batteries normal" arc (about 930 volts) it will suddenly drop back, as the voltage regulator tube ignites, to about the middle of the arc. This is the desired adjustment. Lock the high-voltage dial there.

After the high voltage is adjusted, switch the meter to "rate," and observe incoming radioactivity (and cos-

Fig. 11. Geiger counter scale. See text for full details on laying this out.



mic rays) to your heart's content. Normal background, at mean sea level, is approximately 40 counts per minute, with a variation of plus or minus ten counts per minute to be expected. At higher altitudes, both the background and the variability increase rather rapidly.

Sensitivity of this instrument is such that one ounce of ordinary uranium at a distance of one foot from the side of the tube produces a count increment of 1700 per minute. The meter reading, with such a sample, will be 1700 plus the background, or about 1740 counts per minute. For tests of this type of material, the "X 10" range is useful.

The high range is most useful for CD work, a count of 12,000 per minute being the maximum safe continuous exposure for normal humans.

An ordinary luminous wrist watch of good manufacture is a good safe device for checking the sensitivity of a Geiger counter. Many such watches give a count increment of about 100 at one foot from the side of the tube.

General appearance of this counter, as carried and used in the field, is shown in Fig. 1.

Performance

Performance of this counter in rather extensive field use leaves little to be desired, provided temperatures remain above about zero Fahrenheit. At lower temperatures, the batteries don't work very well. Although it weighs 14 pounds complete with its steel case (11½ pounds with a magnesium case), carrying by means of the shoulder strap is no problem.

In more than 600 hours of actual use, requiring 15 sets of "A" and "B" batteries, average battery life was found to be about 40 hours, with no "on" cycle lasting more than two hours. One set of "B" batteries "died" suddenly after only 7½ hours of service, another was still marginally good after 84 hours. The "C" battery, installed originally more than two years ago, is still good. One 3Q4 went gassy after 90 hours of service; all other tubes are still good. The Geiger-Muller tube is conservatively rated at 10^5 counts, or about 4½ years of indication of normal background.

REFERENCES

1. Watkins, L. C.: "A Professional Type Geiger Counter," Radio & Television News, February 1952.
2. Ives, R. L.: "Devices for Calibration of Slow-Counting-Rate Meters," Nucleonics, October 1952.
3. Ives, R. L.: "Make Your Own Meter Scales," Audio, April 1955.

—30—

NEREM ANNIVERSARY

THE New England Radio-Electronics Meeting celebrates its 10th anniversary April 23-24 with the appropriate theme "Stocktaking of Electronic Progress—Present and Future."

Approximately 2500 persons are expected to attend the sessions at the Sheraton-Plaza Hotel in Boston. Meeting headquarters are at Room 1006, 73 Tremont St., Boston 8, Mass. Additional details are available from them on request. —30—

Mac's Service Shop

(*Continued from page* 74)

"I can understand you would want to remove the parallel impedance of the output transformer secondary from across the voice coil when that coil was being driven from the tape recorder," Barney remarked, "but I don't get the point of the resistor load across the transformer secondary."

"It serves two purposes," Mac explained. "In the first place, if the radio or TV set is accidentally turned on while the output transformer is disconnected from the speaker voice coil, this resistive load will prevent any damage to the transformer or the output tubes that might occur if the secondary were left open-circuited. Furthermore, if you wish to make a silent recording of the program coming through the set, the patchcord can be clipped across this resistor while the output transformer is feeding it."

"Now I get you," Barney said, "but one more question about these recordings: do you think that the *Berkshire* recordings are any better than any of the other recorded tapes that are now coming on the market?"

"I have no way of knowing about that, but I have no reason for thinking such is the case," Mac reflected. "My point is that *all* modern recorded tapes—of which these are doubtless good examples—are a vast improvement over those put on the market a few years back. A person who owns a tape recorder is missing a lot of pleasure if he does not try some of these new tapes. I believe that most of the tape recording companies put out some sort of 'sampler' tape similar to this 'H-1' that permits the recorder owner, at very small cost to himself, to see whether or not he wants to invest in the full-length recordings."

"You're a great believer in *using* tape recorders, aren't you?"

"You can bet your life I am. It grinds my soul to realize that all over the country there are tape recorders gathering dust in clothes closets simply because the owners do not realize the many capabilities of these entertaining, useful, versatile instruments. My motto is: Get 'em out! Dust 'em off! Use 'em!

"One way to get a lot of pleasure out of your tape recorder," Mac went on, "is to join one of the tape correspondence clubs. It is amazing how much pleasure and education you can receive from chatting intimately on tape with people in faraway places. Last winter I recorded the Noel Coward-Mary Martin TV show and sent it over to tape friends in Paignton, England. They enjoyed immensely hearing one of their artists and one of ours putting on this wonderful show and shared the recording with their neighbors and friends. On their part they recorded and sent over a BBC program on Dartmoor. As I listened to this beautifully-presented program that was a mixture of narration and description, I was transported right to the bleak locale of Doyle's 'Hound of the Baskervilles.' What is more, for the first time I knew what that word 'moor' really meant, and I understood why this wild wasteland has remained untilled, unchanged, and unconquered since the time of the earliest Britons.

"And finally," Mac concluded, "no small advantage of this corresponding by tape is the increased understanding that springs up between people of different countries. When you have listened to the voices of people in another country, have heard them laugh, and have listened to the cozy sound of a coal fire crackling on their hearths, they somehow cease to be foreigners and become friends. For example, whenever I hear people these days speak of 'The British,' I do not picture some John Bull caricature or some stock film portrayal. Instead I think fondly of my friends at 'Brambledown' on Shorton Road in Devonshire, and I am grateful to the electronic marvel of tape recording that makes such world-wide friendships possible." —30—

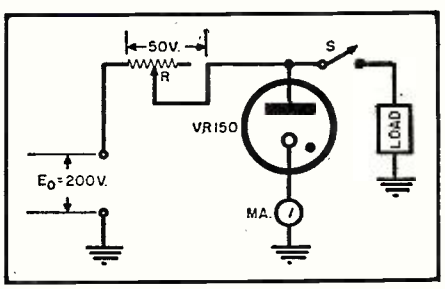
Service Shop Power Supply

(*Continued from page* 56)

current through the VR150 tube to 40 milliamperes.

Assume that R has been adjusted so that the current through the VR150 tube is 40 milliamperes with switch S open. Further assume that when the source voltage was next read with a voltmeter it was found to be 200 volts. Since the sum of the various voltage drops in a series circuit must equal the supply voltage, the voltage drop across R will be 50 volts. In order for the output voltage across the VR150 tube to remain at 150 volts, the current through resistor R must remain constant so that the voltage drop across R stays at 50 volts. If the load current in this circuit is zero, the tube will draw 40 milliamperes and the output voltage will be 150 volts. If the load current increases, the VR150 tube current will decrease correspondingly, maintaining a relatively constant output voltage. If the load current rises to 35 milliamperes, the current through the VR150 tube will then be 5 milliamperes, which is its minimum value. Therefore, this circuit will provide regulation for any value of load

Fig. 3. Simplified schematic diagram illustrating the action of a voltage regulator tube under various loads. See text.



current between zero and 35 milliamperes.

If for some reason a power transformer other than the one specified in the parts list of Fig. 2 is used, the value of R_1 and R_2 must be determined. Any transformer that can supply 350 volts and more and 70 milliamperes at the output of the filter network can be used. In order to determine the value of R_1, throw switch S_3 to the VR105 position and insert a milliammeter in series with the VR105 tube. The best procedure is to connect a 10,000-ohm, 50-watt rheostat in place of R_1. Starting with maximum resistance, reduce the value of resistance until the milliammeter reads 40 milliamperes. Disconnect the rheostat and measure the value of resistance that must be inserted in place of R_1. This resistor must be equal or higher than the value determined.

In order to determine the value of R_2, keep S_3 in the VR105 position and the milliammeter in series with the regulator tube. Connect a rheostat and a voltmeter from the +250 terminal post to ground. Starting with maximum resistance, reduce the resistance until the voltage at the +250 volt terminal starts to drop. Substitute a resistor of sufficient ohmage and wattage for the value just determined and then connect the rheostat across R_1. Switch on the power and, starting with maximum resistance, decrease the resistance until the current in the VR105 is back to 40 milliamperes. Disconnect the rheostat and measure the value of resistance just determined. This is the value of resistance that should be used in place of R_2.

The maximum load that may be connected to either the +100- or +150-volt terminals is 40 milliamperes. The maximum load at the +250- or +300-volt terminals is approximately 70 milliamperes.

A three-circuit microphone jack is shown in Fig. 1 and is used for the quick connection to the power supply of certain equipment such as a grid-dip oscillator. The three-circuit jack is so wired that if a three-connector-type plug were inserted, the tip would receive +250 volts, the next ring 6.3 volts a.c., and the outside sleeve would go to ground. Since neither side of the 6.3-volt winding goes to ground, a jumper should be made with a banana plug on each end to enable grounding one side or the centertap of this winding.

To prepare the power supply for use, see that switch S_2 is in the normal load position. One end of the 6.3-volt winding or the centertap may be grounded for a particular hookup simply by connecting a jumper from one end of the winding or the centertap to one of the ground terminal posts. If a heavy load is connected to the +250- or +300-volt terminals causing the voltage to go below these values, throw switch S_2 to the heavy load (closed) position. Caution: before the heavy load is removed, throw S_2 back to the normal load position. —30—

RADIO-TV Service Industry News

AS REPORTED BY THE TELEVISION TECHNICIANS LECTURE BUREAU

EVERY business man, irrespective of the size and worth of his business, has potential liabilities, any one of which could result in the loss of his business as well as a substantial part of his personal possessions. He is liable to be a party to a damage suit for personal injuries if a person is hurt on the sidewalk in front of his store if it can be shown that the accident was due to negligence on his part in keeping the sidewalk clean and in good repair. He is liable for damages if anyone is hurt in any way inside of his store or place of business.

Men who operate electronic service businesses are subject not only to the liabilities that are common to all businesses, but they have a lot more that are peculiar to the radio-TV service business. Quite a few operators, for instance, have lost their businesses because they failed to have a set owner sign an agreement to relieve them of the liability when the customer refused to pay for the proper type of lightning arrester when the service operator installed a TV antenna. They carried no liability insurance and when the customer's home was severely damaged by fire caused by lightning, they lost damage suits for substantial sums that cost them their businesses.

Most owners of full-time service businesses are cognizant of the dangers of inadequate insurance protection and protect themselves against any possible liability. Their insurance agents are helpful in that they usually make an exhaustive study of each type of business and can recommend the most economical ways of getting full and safe coverage.

Part-time technicians, however, are seldom concerned with protection against the liabilities they incur in working on TV sets. It may be that they are not liable for damage to an owner's property when they are working on his set. Courts might hold that the set owner is responsible because he employed a man to work for him who did the work as a hobby or avocation.

Home Owner's Liabilities

It is usually assumed that when a person needs work done on his premises he will deal with a business organization that specializes in that work. In that case, he contracts for an established business to do the work and they assume all liabilities in connection with doing it, including the welfare of their employees who are assigned to do the work. In the event an employee of the company is hurt while doing the work, the contracting company is responsible. The home owner has no personal liability in the matter.

When a person employs a part-time technician or hobbyist to service a radio or TV set he is apt to assume an employer-employee relationship with the service technician. In that event, the home owner might be liable for any injuries the technician incurs while working on the set in the owner's home. For example, suppose a picture tube should implode while the technician is working on the set. Since few technicians wear eye-guards, the flying glass could easily result in a complete loss of sight for the technician.

It is quite possible that a court would hold the home owner liable for the personal injuries to the technician and, if he did not carry liability insurance that covered such contingencies, the resulting judgment might cost him his home, automobile, and other possessions.

Another factor that undoubtedly will be injected into the situation of part-time workers who handle general consumer work is the reporting of the payments made for such services to the Internal Revenue Bureau. The IRB has taken notice of the unreported income that is handled by individuals acting as non-listed businesses which may bring about some action on the part of this Federal bureau. Since a large part of this business is solicited in want ads which give only a telephone number, a detailed investigation of the advertisers may be the first step in forcing the reporting of this elusive income.

Sucker Bait

The Federal Trade Commission, the government agency responsible for riding herd on the advertising claims of businesses, recently issued a list of the 10 easiest ways for the public to get hooked—and rooked.

In its report, the FTC cautioned the

Forrest L. Baker, past president of the Texas Electronics Association, was elected chairman of the AEC. Bert Bregenzer, chairman of the Federation of Radio-Television Service Associations of Pennsylvania, was elected to serve as vice-chairman. Murray Barlowe, president of the Radio Television Technicians Guild of Long Island, was elected to the post of treasurer, and Howard Wolfson, chairman of the Associated Radio Service Dealers of Chicago, was named secretary.

Four sub-committees were set up by the group. These committees will handle publicity, finance, objectives, and fact-finding questionnaires. C. D. "Jack" Hughes, manager of the Wichita Appliance Dealers Association, was named chairman of the organization committee; Ralph McDonald of Fort Worth, Texas, heads up the fact-finding questionnaire committee; Van J. Roarck, president of the Texas Electronics Association, was named chairman of the finance committee; and the publicity committee is headed up by Harold Chase, chairman of the board of the Television Service Association of Michigan.

The Television Electronic Service Association of Missouri, Inc., was formed officially in Jefferson, Mo., early this year. Jack Mulford of *Jack's Radio & TV Shop*, Springfield, was elected president. He had served as chairman of the organizing committee.

Wayne Lemons of Buffalo, Ed Angel of Crystal City, Marion Craine of St. Joseph, and Denison Houghton of Columbia were elected sectional vice-presidents. Mac Metoyer and Howard Siegen, both of Kansas City, were selected for the posts of secretary and treasurer, respectively.

Directors to serve one-year terms include Ken Garthe of St. Louis, James Faulkner of Kansas City, and Burt Hayes of St. Joseph. Paul Lubin of St. Louis, Smithy Preston of Kansas City, William Pryor of Mountain Grove, and Burt Hickman of Cross Timbers, were elected for two-year terms on the Board.

The Television Dealers and Servicemen's Association, Inc., a new trade group recently organized in Atlanta, Ga., listed the following objectives among others in its corporate charter:

"To create friendship, goodwill, unity, and cooperation among all television dealers and servicemen.

"To continue and improve public relations with the consuming public.

"To ascertain and be certain that fair play and honesty is practiced and carried on at all times between dealers and servicemen and consumers.

"To improve and advance the business, commercial, educational, civic, social, and economic interest of all television dealers and servicemen.

"To prescribe rules, regulations and ethics to fully carry out the objects and purposes of the association."

Claiming an initial membership of 70 made up of television dealers, servicemen, and television specialty firms, the following men were elected officers

of the newly-chartered, non-profit association:

B. H. Sturm of the *Television Center,* president; James W. Kemph of *Kemph TV,* vice-president; George Price of *Price Television Center,* secretary; and T. E. Childress of *Television Center,* treasurer.

Concurrently with the installation of the officers who are to serve during 1956, the Federation of Radio and Television Servicemen's Associations of Pennsylvania pushed its plan of self-licensing which it plans to put into effect by April first.

Officers elected to lead the FRTSAP in the year ahead include B. A. Bregenzer of Pittsburgh, president; William Morrow of Chester, vice-president; Leon Helk of Carbondale, corresponding secretary; and Raymond Blackwood of Industry, recording secretary. L. B. Smith of Hershey was elected to the post of treasurer.

In speaking before the meeting of delegates in Harrisburg, your editor pointed out that the greatest single need of the electronic replacement industry is for closer liaison between independent parts distributors and their service customers to enable both to benefit from the rapidly growing installation and service business in the expanding electronics industry.

While the independent elements of the electronic replacement industry are busy fighting each other, the specter of manufacturer-controlled service casts a growing shadow over their futures. In a companion industry, the independent appliance parts distributors are bending every effort to wean major appliance servicing away from the manufacturer-controlled depots that dominate service in their field.

A fact that is often overlooked by independent electronic parts distributors is that in other industries where service has been driven into the arms of manufacturer-dominated or controlled agencies, the economic consequences are more disastrous to the jobbing industry than they are to the independent servicing element. Efficiently operated independent service businesses can always get parts and supplies from the original equipment manufacturers' distributors. When manufacturer-controlled servicing depots reach a point where they dominate an industry, the independent parts jobber finds that his sources of supply gradually dry up.

Parts distributors that stay aloof from the problems of their customers who operate full-time service businesses are sowing the seeds of their own destruction. The present basic structure of the independent electronic service industry is made up of the best businessmen parts distributors will ever have the privilege of working with. If independent parts distributors cannot build a strong servicing industry on the structure that now exists, they will eventually see a marked deterioration in their own activity as color television, dominated by a few large manufacturers, moves

in with a steady expansion in controlled service.

Tube Discounts

A lively discussion is taking place among the members of the Radio Television Technicians Guild of Long Island over a suggestion that the service industry meet the tube "discount" situation head-on by selling tubes at a more realistic mark-up.

In an article in the December issue of the "Guild News," the Association's president, Murray Barlowe, pointed out that service operators are trying to maintain a fictitious manufacturers' list price on tubes in a market that is being rapidly won by discounters. He said that the average service shop buys tubes at 60 per-cent off the list price.

If the service industry took a realistic view of the present retail marketing picture, it would sell all tubes at 40 per-cent off list. Using a two dollar tube (list price) as an example, he stated that by selling these tubes for one dollar and twenty cents, the service operator would realize a 50 per-cent markup on his cost. In outlining the probable effect on competition, he said:

"If tubes were available to the consumer locally at forty per-cent off list, the drug stores, hardware stores, and super-markets would have to drop their prices to meet competition. This would take the beautiful one hundred and fifty per-cent profit that we have created for these operators to split between themselves and the stores, and chop it down to a realistic fifty per-cent! After deducting the cost of amortizing the tube checkers, the losses due to pilferage, insurance, etc., there would hardly be enough left over after the split to cover the shipping! As a natural result, the tubes and testers would vanish from the scene."

Major opposition to the idea stems from the fact that service charges prevalent on Long Island are too low to cover the cost of operating, hence the large markup on tubes and parts is necessary to compensate for the inadequate charges. -30-

"OLD TIMERS' NITE"

THE Delaware Valley Radio Association is dedicating this year's annual "Old Timers' Nite" to a celebration of the 50th anniversary of Dr. Lee de Forest's grid vacuum tube (1906).

The event is scheduled for Saturday evening, April 21st, at the Stacy-Trent Hotel in downtown Trenton, N. J. As is customary, the affair will be stag.

Dinner will be served at 6:30 with a varied program planned for the evening. Tickets are by reservation only. Those whose prepaid reservations are received before April 16th will be assessed $5.00 while late-comers will have to pay $6.00 for their ducats at the door.

Ed G. Raser, W2ZI, is general chairman of the event. Full details and reservations for the banquet may be made direct with him. -30-

JFD'S "ZIP KIT" DISPLAY

JFD Manufacturing Company, Inc., 6101 16th Avenue, Brooklyn 4, New York has announced the availability of a new display which is designed to sell the consumer the company's "Zip Kit," a "do-it-yourself" antenna package.

The display measures 30" x 64" and is designed to hold samples of everything contained in the kit, *i.e.,* two pre-assembled conical antennas, two lengths of 5-foot masting, a lightning arrester, base mount, wall stand-offs, mast stand-offs, and twin-lead wire.

This display is part of the company's program for helping service dealers get their share of the antenna replacement market. It is designed to assist the service dealer in cashing in on the growing "do-it-yourself" trend and aid

in selling the set owner a better, more elaborate installation by pointing up the need for antenna replacement.

* * *

CBS MAILING PIECES

To assist distributors in stimulating dealer interest and increase attendance at showings of its new 1956 TV and radio line, *CBS-Columbia,* 3400 47th Avenue, Long Island City 1, New York has prepared a complete series of mailing pieces for local use.

All that the distributor need do is have his local printer fill in name and meeting details. The basic material is supplied to him in kit form. The kit consists of a "Wet-Me" invitation card with a secret message already printed on this item. Six different "teaser" mailing cards, advertising authorization, credit memo, and dealer quiz pieces are also included.

A letter, mailed from New York and appearing over Arthur Godfrey's signature, invites the dealer to the distributor's showing in his locality.

* * *

SYLVANIA PROMOTIONS

The Radio and Television division of *Sylvania Electric Products Inc.,* Buffalo, New York has developed a "promotion-per-month" advertising program for its line of television and radio receivers and high-fidelity audio equipment.

In connection with the promotions the company is supplying TV, radio, and newspaper advertising; billboard messages; movie theater commercials; point-of-purchase displays; and trade press coverage. An intensive publicity campaign has also been included.

One of the featured units in the campaign is the company's "Halo-Light" television set. A free-form point-of-sale display, designed by *Lakeside Plastics,* is one of the pro-

motional items available to dealers. Light is supplied by a 15 watt, 110 volt a.c. lamp. The display itself is done in attention-getting colors and mounted on three golden metal legs tipped with white rubber cushions to provide support and protection.

A sales contest for dealers, with trips to Nassau for successful contestants, has also been scheduled.

* * *

ANTENNA KIT DISPLAY

Medal Manufacturing Company, 194 Silver Street, Sharon, Pa. has introduced a complete line of TV antenna kits whose packaging constitutes both promotional and sales stimuli.

Carrying the "Captain" trademark, the package doubles as a point-of-purchase display when opened. The company has complete information on these carton-display units along with

technical details on its line of antennas available in the form of a free catalogue which will be mailed on request.

* * *

AMPRO TAPE PROMOTION

Ampro Corporation, 1345 Diversey Parkway, Chicago 14, Illinois has launched its "Spring Song" campaign to promote its "Hi-Fi Two-Speed" tape recorders.

The program which will run through May accents a special offer whereby a purchaser of one of these recorders

receives free a one-year membership in the "Recorded Tape-of-the-Month Club," 12 monthly preview tapes, plus a full-length tape selection of the purchaser's choice.

Consumer books will carry announcements of this offer and a complete merchandising kit, including a co-op program, newspaper mats, radio spots, and point-of-sale materials, is available to dealers.

* * *

"SHOWMAN ON WHEELS"

Rohn Manufacturing Company, 116 Limestone, Bellevue, Peoria, Ill. has combined advertising and transportation of its line of antenna products in a custom-designed trailer-tractor.

The new unit has been designed as the center of attraction and impressive sales display at distributor and dealer open houses and special events.

The display is available to interested distributors and dealers who can obtain scheduling information by contacting the company or its representatives.

* * *

CONSERVATION KIT

As part of its previously-announced plan to help the government conserve scarce selenium, *Federal Telephone and Radio Company* of Clifton, New Jersey is sending its distributors a conservation promotion kit for use by distributors, dealers, and service technicians.

The kit contains reproductions of the government's appeal to conserve selenium, letters explaining the company's program, and banners and circulars which may be displayed on walls as a continuing reminder of the campaign.

The kit also points out that the company is offering merchandising credits on trade-ins.

* * *

SOLDERING EQUIPMENT DISPLAY

A merchandising counter display featuring the company's soldering gun and new technician's kit of six tips is now available from *Electric Soldering Iron Company* of Deep River, Conn.

This sales-promoting wire rack, which exhibits the company's new "Esico Luger" gun and tips, is finished in modernistic flat black and takes a minimum of counter space.

* * *

DEMONSTRATION TAPES

V-M Corporation of Benton Harbor, Michigan is now supplying a pair of demonstration tapes to aid in merchandising its line of tape recorders.

Combining musical pleasure with point-of-purchase sales appeal, these new tapes are available to dealers now. There is a standard monaural

recorded tape used for in-store demonstrations and a binaural tape used to demonstrate the company's "Stereo-matic Binaural Conversion Kit."

Both of these tapes are available to *V-M* dealers at nominal cost through the company's distributors.

* * *

CONSUMER-DEALER DRIVE

"There is a 'Mellotone' grille fabric to meet every hi-fi need" is the theme of the new promotion campaign recently launched by *Wendell Plastic Fabrics Corp.*, 17 West 17th Street, New York 11, New York.

A limited special offer is announced to the consumer, asking that he write to the manufacturer advising his color requirements. Upon receipt of the request a free sample swatch of an appropriate "Mellotone" pattern is mailed to the consumer.

The consumer takes this sample to his local dealer to make his purchase. Combined with the company's national advertising campaign in consumer and jobber publications, the firm expects widespread acceptance of the plan.

* * *

TAPE RECORDER MIKE

A new and colorful merchandising display designed to help promote its popular 203 tape recorder microphone has been prepared by *American Microphone Company*, a division of *Elgin National Watch Company*, 370 South Fair Oaks Ave., Pasadena 1, California.

Styled in charcoal and pink, the dealer-help features a handy cut-out for the counter display of the new microphone.

* * *

SENCO DISPLAY BOARD

Service Instruments Company, 171 Official Road, Addison, Illinois has announced the availability of a new four-color board which is designed to display the *Senco* line of small service units.

The units are held with "handy hooks" while small sales cards are mounted beside each unit with red plastic golf tees. The card is used for sales and education of the technician.

The board comes equipped with both easels and hooks so that it can be hung or set on a counter. Every 60 days a new service unit will be added to the board. —30—

RAPSCO DX CONTEST

EARL COCHRAN of Colorado Springs, Colo., the fifth place winner in last year's DX contest sponsored by Radio Products Sales Company of Denver, walked off with first-place honors in this year's contest with a total of 4318 points.

FCC engineer, Dave Ablowich, Jr. of Grand Island, Nebraska won second honors while third to fourteenth place awards went to: R. Calvin Taylor, T. J. Gordon, R. V. Rosellini, R. L. MacAdam, Milt Schradsky, Tim Young, Leo Ohman, T. F. Marshall, D. H. Powell, Bill Grebe, Al Meyer, and Loren Denney.

Merchandise prizes donated by RAPSCO, E. F. Johnson Co., National Company, Precision Radiation Instruments, Mosley, Gonset, Thordarson-Meissner, and Multi Products were awarded. —30—

the sun. When they enter the earth's magnetic field, they are caught up by it and spiral toward the pole. The net result is more ionization in the lower region of the ionosphere.

According to one school of thought, ionization by meteors is the dominant mechanism. Literally millions of tiny particles of meteor dust enter the earth's atmosphere every day, but usually burn themselves out before striking the surface. Their passage through the atmosphere produces trails of intensely-ionized gas which scatter radio waves. The meteor theory says that there are enough meteors to produce a continuous mechanism for the propagation by the overlapping trails of ionization, and that this is the major contribution to the received signal.

The principal factors that limit the utilization of ionospheric forward scatter are frequency and distance. Useful frequencies are between 25 and 60 mc. The signal strength falls off very rapidly as the frequency is increased. Thus the lower frequencies of the range will generally permit more efficient transmission. However, if too low a frequency is chosen, ionospheric reflection will also take place at certain times, and then the scatter circuit may be affected by multipath propagation of its own transmission or by other transmissions, or it may cause interference in other circuits.

Distance dependence has been found to be governed largely by the magnitude of the scattering angle and the height of the layer of the ionosphere that produces the scatter. (The scattering angle is defined as the angle between the incident wave and the scattered wave that reaches the receiver.)

As observed in a number of Bureau tests, the strength of the scattered signal falls off rapidly as the scattering angle is increased. This occurs as the path is shortened. At less than 600 miles the ionospheric signal becomes too weak for practical use.

At the longer distances, the signal intensity has been found usable because the angle is small, until the limiting distance is reached. The maximum distance is reached when the portion of the ionosphere from which the scattering occurs meets the horizon as seen from the transmitter. Increasing antenna height has been found to help slightly toward increasing the distance range.

The Bureau's records reveal that a path from St. John's, Newfoundland, to Terceira Island in the Azores provided an excellent opportunity to study problems associated with extreme distance; 1411 miles in this instance. Here the terrain was such that high antenna sites could be chosen overlooking the ocean. Under these circumstances it was verified that a distance of 1400 miles is entirely feasible for reliable operation.

NEW TV STATIONS ON THE AIR

(As of March 25, 1956)

The following new stations bring the lists published in previous issues up to date.

STATE, CITY	STATION	CHANNEL	FREQUENCY RANGE (IN MC.)	VIDEO WAVELENGTH (IN FT.)	VIDEO POWER (IN KW.)
Michigan					
Marquette	WDMJ-TV	6	82-88	11.8	100
Mississippi					
Hattiesburg	WDAM-TV	9	186-192	5.25	57.5
Oregon					
Roseburg	KPIC	4	66-72	14.6	5.4

The frequency of the video carrier = 1.25 + channel lower freq. limit. Total number of TV stations now on the air in U.S.: 480 (116 of which are u. h. f.).

As part of this country's participation in the International Geophysical Year, the Bureau plans to carry out in '57-'58 an ionospheric scatter experiment in Peru, where the midpoint of the path will be nearly at the geomagnetic equator. This experiment, it is believed, will determine scattering behavior in a geographical region having ionospheric characteristics not previously studied from the scattering standpoint. The possibility of high-level scattering in that region will be investigated.

Large rhombic antennas have been used at both ends of paths for a number of experiments. Where space and suitable terrain were not available for rhombics, yagi arrays were usually substituted. Rhombics up to 25 wavelengths on a side have been built.

Since only a small portion of the transmitted signal is scattered, it has been found necessary to use large amounts of gain in communications systems. Operating circuits that have been installed use 40-kw. transmitters. In one series of tests using these transmitters for Air Force teletype service, reliability was excellent; traffic utilization was 91 per-cent.

A NOVEL TUBE INFORMATION service for accumulating and distributing technical data on both domestic and foreign radio tubes has been established by the Bureau of Standards.

The program, initiated about seven years ago as a service to the personnel of the Bureau, has now been expanded to provide information about any particular tube; tube types whose electrical characteristics, bulb sizes, or base configurations fall within particular ranges; and domestic tubes that can be substituted for unavailable foreign types. The program also includes junction diodes and transistors.

Typical data that the service provides are American equivalents for tubes such as the KT-66 (which would be the 6L6, WGA, or 5932); designations of subminiatures having a high mu and high G_m, similar to the 5744WA (which would be 6151 as the closest equivalent); and characteristics of crystal diodes and transistors.

Thus far, the Bureau has received requests for information from other government agencies, the military, foreign governments, and private business. Queries on tube types with specified electrical, mechanical, or geometric characteristics are usually answered by a combination of machine card-sorting and reference research.

While the coding on punched cards has been completed only for miniature and subminiature tubes with bulb sizes up to T6½, arrangements are being made to set up codes for other types.

The new service is open to all who have legitimate requests; inquiries may be made by telephone. All questions should be directed to C. P. Marsden, chief, electron tubes section, National Bureau of Standards, Washington 25, D. C.

A MILD FLURRY of station grant activity in the early months of the year resulted in the authorization of seven stations, all in the v.h.f. band, as the listing below shows. . . . L.W.

NEW TV GRANTS SINCE FREEZE LIFT

Continuing the listing of construction permits granted by FCC since lifting of freeze. Additional stations will be carried next month.

STATE	CITY	CALL	CHANNEL	FREQUENCY	POWER*
Arizona	Yuma	———	13	210-216	24
California	Fresno	———	12	204-210	233
Florida	Miami	———	7	174-180	316
Indiana	Evansville	WTVW	7	174-180	316
Kansas	Ensign	———	6	82-88	26.9
New Mexico	Santa Fe	———	2	54-60	49 (watts)
Tennessee	Knoxville	———	10	192-198	316

NEW CALL LETTER ASSIGNMENTS

STATE	CITY	CALL	CHANNEL	FREQUENCY
New York	Buffalo	WNYT-TV	59	740-746
Wisconsin	Madison	WISC-TV	3	60-66

*ERP=(effective radiated power, kw.)

TVI From Power Lines

(*Continued from page 65*)

shown in Fig. 4. In a majority of cases investigated, the amplitude of the interference or noise pulses is not large enough to cause loss of synchronization.

Tests have indicated that pigtail insulator ties and voltage leakage across the top skirt of an insulator are responsible for the generation of most power-line noise. In some instances, new lines have been known to cause interference, nullifying the theory that only old insulators are responsible for the trouble. Fig. 5 shows a typical dis-

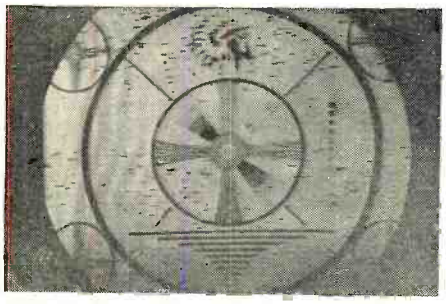


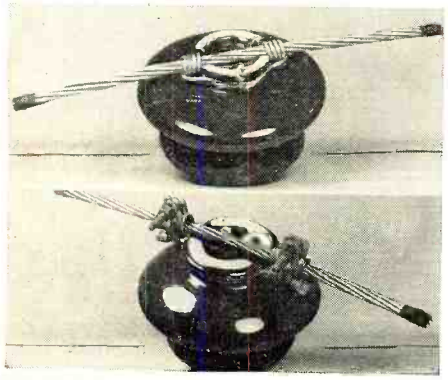
Fig. 4. Power line interference produces the effect shown here on a TV picture tube.

tribution-type insulator utilizing a pigtail tie. To remedy faults from loose ties, the pigtail is replaced by a clamp arrangement, also shown in Fig. 5. This type of replacement, however, is expensive.

Since interference problems are ones that seem destined to plague radio systems for some time to come, it is necessary that responsible organizations associated with television adopt some definite policy in dealing with interference. Electric utilities are cooperating in reducing noise sources whenever this is economically possible.

The service technician, when locating noise sources that are traced to power lines, should notify the electric utility concerned. It must be remembered, however, that no legal obligation exists for the utility to eliminate all power-line noise. However, by intelligent cooperation of all parties concerned, noise from power lines can be reduced to acceptable limits. —30—

Fig. 5. Shown here are two methods used for clamping a power line to an insulator. The pigtail type tie often is a source of noise; the clamp will eliminate it.



Within the Industry

(*Continued from page 32*)

CORPORATION and will operate it as a subsidiary . . . The assets of **TECHNICAL REPRODUCTIONS, INC.**, a California printed circuit firm, have been purchased by **PACKARD-BELL COMPANY.** It will become a department of the parent firm . . . The business and assets of **BURLINGTON INSTRUMENT COMPANY** have been purchased by **TEXAS INSTRUMENTS INCORPORATED.** The subsidiary's operations will be transferred from Burlington, Iowa to Dallas, Texas as soon as practical . . . **TAP, INC.** has opened its doors at 3100 N. Cicero Ave., Chicago 14, Illinois. The firm will provide technical writing, technical illustrating, copy production, and printing services for the electronics industry . . . **NEW LONDON INSTRUMENT COMPANY** has been taken over by Messrs. H. Dowd, R. L. Barrows, and R. Coshnear of Boston . . . **JERROLD ELECTRONICS CORPORATION** of Philadelphia has purchased the **SPANISH MOUNTAIN TELEVISION CORPORATION** which owns and operates the community antenna system in Ukiah, California . . . **TECHNOLOGY INSTRUMENT CORPORATION'S** instrument division has been acquired by **ACTON LABORATORIES, INC.** of Acton, Mass.

* * *

KEN HATHAWAY, manager of the electronic distributor division of *Ward Leonard Electric Co.*, has been elected treasurer of the Association of Electronic Parts and Equipment Manufacturers.

He succeeds Helen Staniland Quam, of the *Quam-Nichols Co.*, Chicago, whose twenty-year tenure as treasurer of the association ended on January 31st. Mrs. Quam resigned due to pressure of business.

Mr. Hathaway is a pioneer in electronics distribution circles and has been connected with the industry in some capacity since 1925. EP & EM is one of the sponsors of the Radio Parts Show which is held annually in Chicago during the month of May.

* * *

RAY R. SIMPSON, founder of *Simpson Electric Company,* was honored recently at a dinner marking the company's 50th year in the electrical instrument business. He was presented with a gold-plated v.o.m. which was the 500,000th of its kind to be produced by the Chicago firm . . . *Crescent Industries, Inc.* of Chicago has appointed **GROVER J. BEACH** to the post of engineering manager and **PAUL F. LEOPOLD** as sales manager of its home instrument division . . . **JAMES W. SAUBER** is the new chief instrument engineer for *Waters Manufacturing, Inc.* . . . **DR. GREENLEAF WHITTIER PICKARD,** one of the earliest specialists in the radio communications field, passed away recently at his home in Newton Centre, Mass. He held many U.S. and foreign patents and was an active radio amateur for over forty years, with the call W1FUR . . . **JAMES L. CADDIGAN** has been named director of the new Electronicam Division of *Allen B. Du Mont Laboratories, Inc.* . . . **DR. H. F. OLSON,** pioneer sound engineer and scientist of *Radio Corporation of America,* received the John Scott Award of the Engineers' Club of Philadelphia for the development of his velocity microphone some 25 years ago. The award was made in recognition of the continuing importance of his development . . . **WILLIAM G. YOUNG** has been named vice-president of the *Capehart-Farnsworth Company.* He was formerly general sales manager of the firm . . . *Mosley Electronics, Inc.,* has elected two new vice-presidents, **JACK R. MOSLEY** who will serve as vice-president and assistant manager and **GEORGE E. MOBUS** who will be in charge of sales and advertising . . . **KENNETH H. GRADY** is the new vice-president and comptroller of *Merit Coil & Transformer Corp.* He has been with the company since 1953 . . . **JAMES BAXTER** has been elected vice-president of *Cornish Wire Company* of New York. He will also retain his duties as sales manager of the firm . . . *American Elite, Inc.* has named **BEN JACOBS** to the post of sales manager of the firm's tube and component parts department . . . **EDWARD F. CRAFTS** is the new advertising and sales promotion manager of *Brush Electronics Company* . . . **ROBERT M. CUNHA** has been appointed assistant director of sales for the five associated companies of *Gulton Industries, Inc.* He will make his headquarters in Metuchen, New Jersey . . . **DAVID S. BLACKWELL** has been named manager of quality control for *CBS-Columbia* . . . **EDWARD KLEEMAN,** a pioneer in the electronic distributing field, passed away recently at his home. He was associated with *British Industries Corporation* and *Carduner Sales Corporation* during the past twenty years . . . **DR. OSKAR HEIL** has joined *Eitel-McCullough, Inc.* as group leader of the advanced research group recently formed in the research laboratory . . . **MARCH FISHER,** manager of distribution for *Philco's* accessory division, succumbed to a heart ailment recently at his home in Philadelphia. He was 65 years old and had been with the company for 25 years . . . **LOREN B. GAITHER,** a retired colonel in the Signal Corps, has been named director of engineering for the government and industrial division of *Magnavox Company* . . . **GILBERT C. LARSON** is the new assistant general manager of *Westinghouse's* television-radio division in Metuchen, N.J. . . . **ALLEN B. DU MONT, JR.** has been named assistant to the television receiver division manager of *Allen B. Du Mont Laboratories, Inc.* He has been with the firm since 1953 . . . **THOMAS C. FLYNN** has been named public relations represent-

ative for the *Federal Telephone and Radio Company*, Clifton, New Jersey.

* * *

FRANK A. GUNTHER, vice-president of *Radio Engineering Laboratories Inc.* of Long Island City, has been elected president of The Radio Club of America, Inc., 11 West 42nd Street, New York, New York.

Serving with him are Walter A. Knoop, Jr., of *Gawler-Knoop Co.*, vice-president; O. James Morelock, radio consultant, corresponding secretary; Joseph J. Stantley, *Continental Sales Co., Inc.*, treasurer; and John H. Bose, Electronics Research Laboratories of Columbia University, recording secretary.

The Club was organized in New York on January 2, 1909, making it the oldest group of its kind in this country. Membership includes outstanding men in the field of radio engineering and invention both in the U. S. and abroad.

* * *

NARTB will hold its 10th Annual Broadcast Engineering Conference on April 16, 18, and 19 in conjunction with the 34th annual Convention of the Association at Chicago's Conrad Hilton Hotel.

The first session, on Monday, will be devoted to developments in both monochrome and color television.

Wednesday will be "Radio Day" with discussions of remote control, automatic operation, and other radio topics. The television sessions on Thursday will deal with new developments and operating techniques in that field.

Full details on the affair are available from the National Association of Radio and Television Broadcasters, 1771 N Street, N.W., Washington 6, D. C.

* * *

ELECTRONIC PARTS SHOW'S 1956 session will convene at the Conrad Hilton Hotel in Chicago on May 21 and run through Thursday, May 24th.

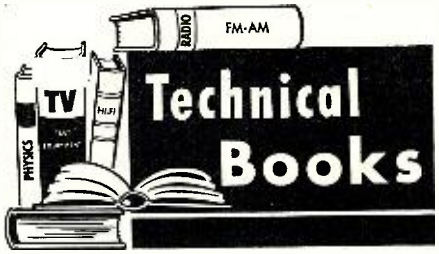
The Show, as in previous years, is closed to the public and only those persons who have registered in advance will be admitted. Those who have registered are reminded to bring their badges since replacements will cost $2.00. The replacement badges will not entitle holders to any Show benefits except admission. —30—

FREE SERVICE CONTRACT

THE MAGNAVOX COMPANY of Fort Wayne, Indiana, is now offering a free three-month service contract and a one-year guarantee of tubes and parts with all of its television receivers selling at $249.50 and up. This policy, called the "Gold Seal Program," is applicable to those sets using the new 1956 TV chassis.

Under the plan, servicing will be furnished either by regular service agencies or by Magnavox dealers. The cost will be borne by Magnavox.

According to Frank M. Freimann, president of Magnavox, such a program is common practice in the automobile and major home appliance industries. It allows the manufacturer to offer guaranteed performance of his product to his customers. —30—



"SOLID STATE PHYSICS" edited by Frederick Seitz and David Turnbull. Published by *Academic Press, Inc.,* New York. 409 pages. Price $10.00. Volume 1.

This is the first of a series of volumes designed to meet the need for an up-to-date treatise on solid state science.

It consists of a series of six individual sections, each prepared by an expert in his particular field. Typical section titles are: "Methods of the One-Electron Theory of Solids," "Qualitative Analysis of the Cohesion in Metals," and "The Quantum Defeat Method."

* * *

"LIMITERS AND CLIPPERS" edited by Alexander Schure. Published by *John F. Rider Publisher, Inc.,* New York. Price $1.25. Paper bound. Volume 6.

This compact book covers one facet of electronic circuitry and deals with its specialized application in speech clipping or in communications, television, radar, amateur broadcast receivers, and ham transmitters.

The text material discusses and analyzes series and parallel diode limiters of both negative and positive types, limiting to specified magnitudes, limiting above and below ground potential, peak passing diodes, multi-grid limiters, saturation and cut-off limiters, and limiter and clipper circuit applications.

As a specialized text on specialized circuitry, this little book will find wide acceptance among both the amateur and engineering fraternity.

* * *

"ELECTRONIC ENGINEERING" by Samuel Seely. Published by *McGraw-Hill Book Co., Inc.,* New York. 513 pages. Price $8.00.

This is a companion volume to the author's "Radio Electronics." Although for various reasons it was necessary to repeat some of the basic material appearing in the earlier book, this duplication is minimal and should not prove distracting to the student.

The present text contains detailed information on a wide variety of electronic circuits which are used in such fields as radar, television, electronic control and instrumentation, and computers. Circuits normally found only in radio receivers are not covered in this book. The presentation is both mathematical and analytical. The text material is divided into sixteen chapters which cover tube circuits, basic amplifier principles and circuitry, computer circuits, oscillators, sweep generators of various types, rectifiers, electronic instruments, a discussion of

solid-state theory, and transistors as circuit elements.

This work is suitable either as a classroom text or as a home-study aid for the student on his own.

* * *

"WORLD RADIO HANDBOOK" edited by O. Lund Johansen, Copenhagen. English edition available from *Gilfer Associates*, P. O. Box 239, Grand Central Station, New York, New York. Price $2.00. Paper bound.

This is the 10th anniversary edition of a practical short-wave handbook which has gained the respect and admiration of a world-wide audience. This manual represents a virtual "how-to-do-it" handbook and encyclopedia for the DX-er and SWL. Directories of broadcast and television stations are included along with detailed listings of short-wave programs, call-letters, and "best reception" data.

The countries having broadcast services are listed alphabetically in a compact index while charts which show the major world divisions are a plus feature that dial twirlers will find invaluable.

The U. S. distributor is also offering a companion booklet, "How to Listen," for 40 cents a copy.

* * *

"RADIO PHILATELIA" by Herbert Rosen. Published by *Audio-Master Corp.*, 17 E. 45th Street, New York, N. Y. Price $2.00. Paper bound.

This is an "off-beat" item that will interest many radio amateurs who have also added stamp collecting to their list of hobbies. This is a topical listing of all stamps that have anything to to do with radio, communications, electronics, or the men responsible for major electronic developments as issued by all countries.

The text is presented in English, French, and German and pictures some three hundred stamps and lists over 500 stamps that fall into the category of "radio philatelia." All stamps are listed in the four leading international catalogues; the American "Scott," the English "Gibbons," the French "Yvert," and the German "Michel."

Stamp collectors and hams alike will find this a fascinating book.

* * *

"FUNDAMENTALS OF ELECTRO-ACOUSTICS" by F. A. Fischer. Published by *Interscience Publishers, Inc.*, New York. 184 pages. Price $6.00.

This specialized text has been translated from the German and represents a series of lectures delivered by the author during the years he was associated with various electroacoustical laboratories in Germany.

While the text material assumes no previous experience in the electro-acoustical field, the student should be familiar with differential and integral calculus and understand the general theory of oscillations of alternating currents. Other fundamentals required for an understanding of the text material have been included.

The book is divided into twelve main sections which deal with electric and

mechanical oscillators, forces exerted on matter by electric and magnetic fields, electroacoustic energy conversion principles, systematic presentation of electroacoustic transducers, differential equations of transducers, electric and acoustic impedance of transducers, radiation of sound, transducer efficiency, transducer sensitivity, broadband transducers, electromechanical coupling, and transducers employing electric resistances among other topics.

Although this is a specialized work, we know of no other book currently in the field that contains all of this information between a single set of covers.

* * *

"MODERN PHYSICS: A TEXTBOOK FOR ENGINEERS" by Robert L. Sproull. Published by *John Wiley & Sons, Inc.*, New York. 479 pages. Price $7.75.

As the title implies, this book has been written for practical and practicing engineers whose work requires that they have a more complete understanding of modern physics than that supplied by their formal engineering college curriculum. The text itself is so arranged that it can be used in the classroom or for the engineer who wants to brush up on his own.

Because the readers of this book are assumed to have basics well under control, the author pulls no punches in his presentation. Mathematics are used freely as required for clarity of presentation. Only those facets of physics likely to be encountered by the electronics engineer are covered in this text with all of the material slanted toward that particular engineering readership.

Thirteen chapters comprise the text material and deal with particles, atoms and nuclei, molecules, properties of solids, semiconductors, physical electronics, applied nuclear physics, and other pertinent data.

The electronic engineer in industry or the college student who hopes to join an industrial engineering team will find this textbook an extremely helpful adjunct to his store of practical knowledge. —30—

A FIVE-TRANSISTOR AMPLIFIER

OF INTEREST to readers who have been seeking a practical audio amplifier circuit which uses transistors is the one shown in the diagram below. It uses five moderately-priced transistors and two special push-pull input and output transformers.

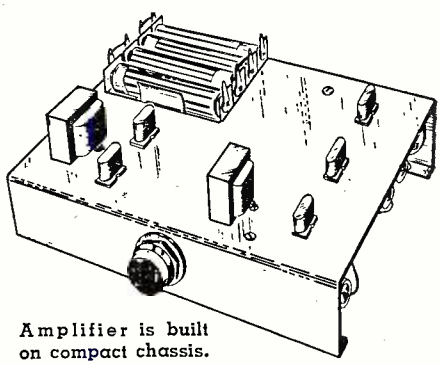
Two inputs are provided, one for magnetic cartridges and various microphones, the other for crystal or ceramic cartridges and radio tuners.

The amplifier operates on four 1½ volt penlite cells. The preamplifier stage is so designed that it will operate with G-E variable reluctance and other high-fidelity magnetic cartridges, providing the extra amplification and equalization required. This stage features extremely low distortion, low noise, and no hum. The special transformers (AR109 and AR119) have been designed for transistor circuit applications by Argonne Electronics Mfg. Co.

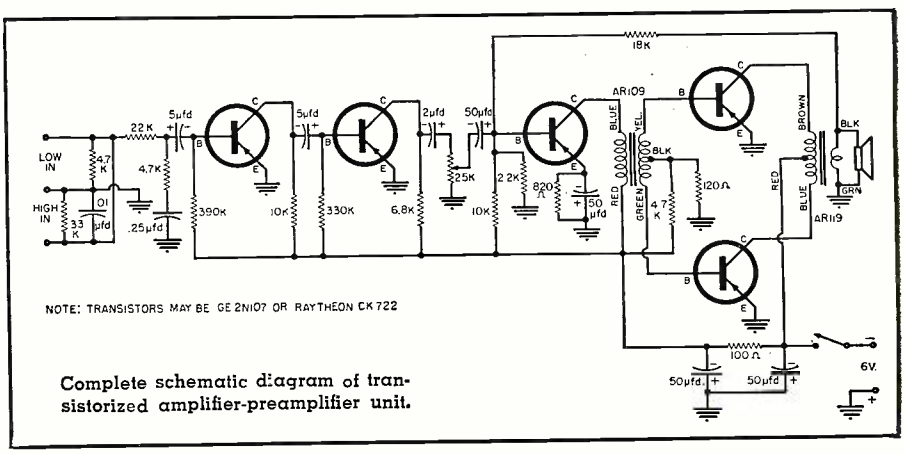
The output power is 200 mw., enough to operate a good quality 8" PM speaker of 3-4 ohms impedance over a frequency range of 50 to 15,000 cps. Power consumption is 25 ma. @ 6 volts. For applications in which long periods of uninterrupted service are required, the penlite cells can be removed and a heavy-duty, 6-volt battery attached across the battery circuit instead.

The circuit can be built on a chassis measuring as little as 5⅛" x 4" x 1". These measurements can, of course, be altered at the discretion of the builder.

With the exception of the two special transformers, all of the parts required to build this compact amplifier-preamp are readily available. For those wishing the convenience of a kit, Lafayette Radio, 100 Sixth Ave., New York 13, N. Y., has packaged all of the necessary components, including the transformers, as its KT-82 which retails for $19.50 complete with chassis and instructions. —30—



Amplifier is built on compact chassis.



Complete schematic diagram of transistorized amplifier-preamplifier unit.

Amateur Control Unit

(*Continued from page 63*)

the two primary power switches are attached at the extreme left end of the panel. The four power outlets, fuse, and power cord mount directly behind, on the chassis.

A two-inch square milliammeter mounts at the center of the panel. The toggle switches S_7, S_8, and S_4, and marker oscillator crystal socket fill the panel space between meter and power switches on the left. The calibration resistors, R_3 and R_1 are attached below the marker crystal socket. It might be wise to use locking shaft type controls here so that settings will not be inadvertently disturbed once calibration is completed.

The send-receive switch, S_3, mounts at the extreme right end of the panel. Controls for the "Monitone," including the input and output audio jacks, S_5, S_6, R_{11}, and R_{16} occupy the space left. This completes the front panel.

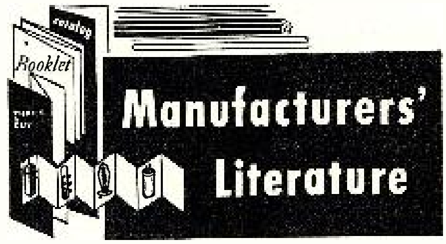
The relays are attached to the rear chassis deck, taking up the space behind the "Monitone" shelf. Included are the *Jones* connections for the leads to the equipment involved. Space behind the meter and oscillator shelf is used for the power pack for the accessories, with these parts attached along the chassis deck mounting surface.

Once completed, the top and bottom sides of the assembly are covered with perforated metal or screen to preclude possibilities of accidental contact with voltage points. This is especially important in view of the a.c. distribution within the chassis, and the open frame construction style.

The completed control unit is fastened below the receiver on the operating desk. A simple plywood shelf can be used to advantage in this case, to support the receiver and provide, simultaneously, a housing for the control. Other installation possibilities will suggest themselves to constructors in adapting the unit to particular installations.

Operation of the control is practically self-evident. All power switches on equipment are left on, with switching of power done at the control unit.

It will be seen that the functions of a.c. distribution and switching for the entire station, complete receive-transmit change over, a 100 kc. crystal calibrator, marker oscillator, r.f. carrier output indicator, modulation monitor, and "Monitone" c.w. and phone monitoring facilities have been included in one compact control unit. As such, the assembly is worthy of space on any ham station operating table for use with transmitters in the 100-watt class. The operating conveniences gained by the addition of the control unit to the station will be very readily appreciated, particularly after a few hours operation with the unit. The advantage of the accessories, plus centralized control of all equipment, are obvious to all hams. —30—



PRECISION TEST GEAR

Precision Apparatus Company, Inc., 70-31 84th Street, Glendale 27, Long Island, New York has just issued a 12-page catalogue covering its line of test equipment for industry, radio-TV, laboratory, and electrical engineering applications.

Each of the units in the line is pictured and completely described as to physical and electronic characteristics. The listing includes generators, ohmmeters, scopes, tube testers, and various test sets. A brief yet informative article on the "Principles of Electronamic Tube Testing" is also included in Catalogue 23 which is available without charge.

"ELECTRONIC PHONO FACTS"

Audak Company, 500 Fifth Avenue, New York 36, New York has released a fact-filled 22-page booklet, "Electronic Phono Facts," to audiophiles and music lovers.

Included is data on pickups, styli, tone arms, turntables, styli wear tests, brushes, static removers, pre-emphasis and de-emphasis, record care, etc. Written by Maximilian Weil, the book normally sells for $1.00 but for a short time will be available without charge from the company's dealers or the company direct.

AUTO RADIO CAPACITORS

Sprague Products Company, 51 Marshall Street, North Adams, Massachusetts has just released a new "Auto Radio Replacement Capacitor Manual" which provides complete information on every auto radio manufactured from 1946 through 1955. Each brand is listed alphabetically. The proper *Sprague* "Twist-Lok" electrolytic capacitors are then fully described in terms of capacitance, voltage rating, and list price, and cross-referenced to the original part numbers.

The manual, which measures just 5½"x8½", is designed to be carried in pocket or tool kit. Manual K-300 is available free from the company's distributors or from the company direct.

SIMPSON INSTRUMENTS

Simpson Electric Company, 5200 W. Kinzie Street, Chicago 44, Illinois is now offering two new publications to the trade.

The first is its catalogue #3001 which is a detailed, comprehensive bulletin designed especially for service technicians. The second offering, bulletin A-103, is a completely descriptive three-color flyer featuring the company's Model 458 seven-inch "Colorscope" and, on the reverse side, the new 434 "Vari-dot" white dot generator. The flyer contains pictures of these instruments along with specifications and information on their usage.

Either or both of these publications are available upon request without charge.

RCA TUBE DATA

The Tube Division of *Radio Corporation of America,* Harrison, N. J. has recently released a new 16-page book, entitled *"RCA* Picture Tubes" (Form No. KB-106), which contains ratings, characteristics, and base-connection diagrams for all of the company's picture tubes including color tubes, and features a replacement directory giving information on recommended replacements for more than 150 industry types. The booklet is 20 cents a copy.

The second booklet. entitled *"RCA* Photosensitive Devices and Cathode-Ray Tubes" (Form No. CRPD-105), contains 24 pages and carries data on 45 types of phototubes, 6 types of TV camera tubes, and 56 types of cathode-ray tubes. This booklet is also 20 cents.

The third booklet is a revised edition of the "Interchangeability Directory for Non-Receiving Tubes." This 16-page booklet, Form No. ID-1020A, lists 2000 type designations of 26 different manufacturers, listed in alphabetical-numerical sequence, and shows the direct *RCA* replacement. This booklet is priced at 20 cents.

Any or all of these publications are available from tube distributors or from the Commercial Engineering Department of the Tube Division.

C-D CERAMIC CAPACITORS

Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey has just issued a comprehensive 20-page catalogue covering its line of standard ceramic capacitors, disc, tubular, slug-types, and special-types.

The illustrated, three-color catalogue No. 616 provides all pertinent data on the line as required by engineers and factory purchasing agents. A copy of the catalogue is available upon company letterhead request to the Sales Promotion Department of the firm.

MINIATURE POT LINE

Waters Manufacturing, Inc., 4 Gordon Street, Waltham, Massachusetts has released a compact catalogue covering its line of precision wire-wound potentiometers with bushing- or servo-mounts, ranging from ½" to 1⅛" in diameter, with resistance ranging from 10 to 100,000 ohms.

The new "Aerohm" catalogue lists mechanical and electrical specifications in chart form for greatest ease in locating pertinent data about any one of the units.

The catalogue will be sent without charge upon written request to the manufacturer.

CERAMIC TRANSDUCERS

A comprehensive twelve-page brochure covering the use of piezoelectric ceramic transducers is now avail-

able without charge from *Gulton Mfg. Corp.*, Metuchen, N.J.

The two-color booklet outlines the applications of ceramic transducers including ultrasonic, shock and vibration, medical and underwater sound equipment, in addition to presenting complete physical and electrical properties and specifications for the ceramic materials.

Other features covered include a discussion of resonant frequency characteristics and detailed tables outlining standard sizes and shapes of the available transducers.

ANDREW CATALOGUE

Andrew Corporation, 363 East 75th Street, Chicago 19, Illinois has recently released a comprehensive catalogue covering its line of antennas, antenna systems, and transmission line.

The 100-page catalogue contains a description and engineering data on over 500 of the company's products. Twenty pages are devoted to system engineering data and related information that engineers specializing in this field of electronics will find informative.

The catalogue is available on letterhead request.

SOLDERING HINTS

A compact guide to the improved industrial use of solders and fluxes is being offered free by *Anchor Metal Co., Inc.*, 244 Boerum Street, Brooklyn 6, New York.

Entitled "Solder and Its Proper Application," this publication includes soldering hints and tips, explains the varied types of soft and hard solders used in metal joining, explains nine different methods of applying heat to solder and joint, the advance preparation required before soldering, determination of heat requirements, etc. A special section is devoted to problems common to aluminum soldering and their solution.

TRIPLETT SCOPE BOOK

Triplett Electrical Instrument Company, Bluffton, Ohio has published a new book for technicians entitled "Scope Connections."

Written by Vern L. Walker, a sales engineer for the firm, the subject matter ranges from elementary data on the functions of an oscilloscope to information on over-all video response. The text material is based on the premise that if you can use a v.o.m. you can use a scope.

The book is $2.00 a copy and is available by mail direct from the manufacturer.

EIMAC DATA SHEETS

Eitel-McCullough, Inc., San Bruno, California has published two data sheets of interest to engineers.

The first carries information on the firm's new *Eimac* 4X250F radial-beam power tetrode—a tube intended for use with 26-volt electrical systems as required in airborne and some vehicular operations.

The second publication is a "field en-

gineers sheet" which lists the location of the firm's field representatives throughout the U. S. and Canada.

Write the company's Application Engineering Department for either or both of these data sheets.

"TRANSFORMER LAMINATIONS"

Allegheny Ludlum Steel Corporation, 2020 Oliver Building, Pittsburgh 22, Pa. has announced publication of the seventh edition of its "Transformer Laminations" book.

The 120-page manual has been revised and expanded to provide detailed information and drawings on 100 different standard lamination shapes made by the company. Such items as direction of grain, count and weight of lamination, magnetic and mechanical dimensions. lamination die layout, as well as other important data are included in the book.

Copies of this publication are available from the Sales Department of the company.

RECTIFIERS-POWER SUPPLIES

Technical Apparatus Builders, 109 Liberty Street, New York 6, New York has issued a new catalogue, PR156, which lists the complete specifications, ratings, and prices on its line of d.c. power components, "Tabtron" selenium rectifiers, chokes and transformers, and d.c. power supplies.

The d.c. power supplies include units for automation, aviation, automotive, battery charging, electroplating, industry, marine, metallurgy, missile, radar, radio, railroad, telephone, television, etc. which meet JAN specifications.

VIBRATOR REPLACEMENTS

James Vibrapowr Company, 4050 N. Rockwell Street, Chicago 18, Illinois now has available a new 12-volt vibrator replacement and servicing guide which it is offering without charge to technicians.

Since the 12-volt automotive system is now standard on all 1956 models, the vibrator power supply operations on these high-voltage ignition systems requires special vibrators and new service techniques. The replacement guide outlines equivalent models for all 12-volt system cars. Also included as part of the guide is a useful service bulletin.

ELECTRONIC COMPONENTS

Micro Instrument Company, 80 Trowbridge Street, Cambridge 38, Mass. is now offering a four-page brochure which covers some of the items in its extensive line of equipment and components used in the electrical and electronic industries.

Among the items on which complete specifications are given are u.h.f. coaxial wavemeters, laminated phenolic engraving stock, flexible engraving stock, toroid winders, fly cutters, panel engravers, solderers, inductors, toroids, and ratio transformers.

U.H.F. ATTENUATORS

An 8-page brochure entitled "UHF Attenuators" is now available from

Stoddart Aircraft Radio, Inc., 6644 Santa Monica, Hollywood 38, Calif.

The company's full line of coaxial attenuators and coaxial line terminations is illustrated with full description and complete specifications. Especially detailed description is given on the company's small turret attenuator which affords selection of any of six steps of attenuation.

COMPONENTS AND ACCESSORIES

Herman H. Smith, Inc., 2326 Nostrand Avenue, Brooklyn 10, New York has issued a 30-page catalogue covering its complete line of electronic components and television accessories.

Catalogue No. 56 provides specifications and all pertinent data on plugs, jacks, switches, test leads, hardware, and connectors. Each item is illustrated with photographs and dimensional diagrams for maximum usability.

Requests for copies of this catalogue should be made on company letterhead.

COLUMBIA WIRE SUPPLEMENT

Columbia Wire & Supply Company, 2850 Irving Park Road, Chicago 18, Illinois has announced the availability of a new four-page supplement to its #105 catalogue.

The supplement carries a new price list covering both the supplement and the catalogue. This publication is available without cost upon written request to the company. —30—

PHOTO CREDITS

Page	Credit
44 (top)	CBS-Columbia
44 (bottom), 45, 140, 142	Chrysler Corporation
50, 51, 87	Sylvania Electric Products Inc.
57, 58, 59, 60	Cornell Aeronautical Lab.
61, 63	Station WAAM-TV
69, 70 (bottom), 71	Radio Corporation of America
70 (top)	Hoffman Radio Div.
88	Permo, Incorporated
90, 91	Allied Radio Corporation
105	Friez Instrument Div., Bendix
106, 107	Harman-Kardon, Inc.
119, 124	Bell Telephone Laboratories
145	General Electric Company
176	Lafayette Radio

ERRATA

Part 3 of Milton S. Kiver's series, "Transistor Radios," will appear in the May issue instead of this issue as previously announced.

* * *

On page 71 of the December 1955 issue, in the article "Troubleshooting TV I.F. Strips," the author stated that if the cathode resistor of tube V_{200} (Fig. 1) were open, a voltmeter would read zero volts at the cathode pin. This is in error since the voltmeter itself would complete the cathode circuit and the meter would read an abnormally high voltage due to its internal resistance. Also, eight lines from the bottom of the first column (page 71) capacitor C_{230} is mentioned. This should read C_{225}.

* * *

In the parts list accompanying the schematic of the "Transistor-Tube Intercom" (February issue, page 108) transformer T_1 was listed as a Stancor 2900. This is not a jobber item. A Thordarson #24S62, available at parts distributors, can be substituted instead.

INDEX OF Advertisers

APRIL 1956

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

Classified

RATE: 50¢ per word. Minimum 10 words. June issue closes April 10th. Send order and remittance to: RADIO & TELEVISION NEWS, 366 Madison Ave., N. Y. C. 17.

RADIO ENGINEERING

COMPLETE radio, electronics theory & practice; television; broadcasting; servicing; aviation, marine, police radio. 18 or 21 months. Catalog. Valparaiso Technical Institute, Dept. N, Valparaiso, Ind.

FOR SALE

TRADE-IN Television Sets $14. Jones Radio, 1115 Rambler, Pottstown, Pa.

DIAGRAMS—Radio $1.00; record changers, recorders $1.25. Television with service data $2.00. Where model unknown, give part numbers. Kramer's Radio Service, Dept. JA5, 36 Columbus Ave., New York 23, N. Y.

BC-348P RECEIVER, brand new, original carton, covers 6 bands, 200-500 kc., 1.5-18 mc. Designed for 28 v.d.c., easily converted to 117 v.a.c. $75.00 f.o.b., N. Y. Box 51, % RADIO & T.V. NEWS.

DIAGRAMS for repairing radios $1.00. Television $2.00. Give make, model. Diagram Service, Box 672 RN, Hartford 1, Conn.

TV Trade-In sets. Philco, R.C.A., Emerson, others. List available. 10"—$12. 12" to 17"—$15. up. Washtek Service Co., Dept. R, 956 Southern Blvd., Bronx, N. Y.

TUBES—TV, Radio, Transmitting And Industrial Types At Sensibly Low Prices. New, Guaranteed, 1st Quality, Top Name Brands Only. Write For Free Catalog or Call Walker 5-7000, Barry Electronics Corp., 512 Broadway, New York 12N, N. Y.

FIDELITY Unlimited Expands And Changes Its Name To Sound Mart Unlimited, Inc. Increased stock and facilities to handle all your Hi-Fidelity requirements. See ad below.

SOUND Mart Unlimited, Inc. Authorized Distributors Of Brand New Hi-Fidelity Components. Special: English Brenell Dual Track—3-speed, 3-motor Tape Deck And Preamp. True Hi-Fi. Frequency response: 30 to 15,000 cps at 15 ips. No clutches, idlers. Wow, Flutter minus .2%. 115 VAC, Preamp with VU Meter. All inputs with 3 record curves. Separate Record and playback preamplifiers. Only $159.50 Prepaid. Adaptable Portable case, only $5.00. Special: True Craftsmanship From Germany. Dekamix 3 speed intermix changer. Non-magnetic heavy turntable—Asynchronous 4 pole motor. Dual plug-in heads—muting switch—absolute Minimum wow and flutter. Complete with mtg. board. $39.75 Prepaid. Immediate Delivery. Full line of Amplifiers, Tuners, Turntables etc. Everything for prompt delivery. Write Today For All Hi-Fi Requirements. 63-03 39th Avenue. Woodside 77, New York. Retail Outlet Only: 169A West 57 Street, New York 19. Opposite Carnegie Hall.

TV, Radio Parts, Tubes, Antennas, Wire, Speakers, Condensers, Selenium Rectifiers, Rotators, Towers, Benches, Shelving, Test Equipment, TV Tables. Make us your leading supplier. Catalog free. Radio Tube Merchandising Company, 508 Clifford Street, Flint 3, Michigan.

SURPLUS T.V.-Radio tubes. Carton containing 20 assorted $5.00 ppd. A. Valencic, 905 E. 210 St., Euclid 19, Ohio.

EASY build radios, Hi-Fi phono-amplifiers. Plans, $1.00 each. Wolins, Amazon Rd., Peekskill, N. Y.

TELEVISIONS, Trade-ins; Test Equipment. W4-API, 1420 South Randolph, Arlington 4, Virginia.

SURPLUS Walkie-talkies, radar, short-wave, parts. Fantastic prices. List 5c. Meshna, 580 Lynn, Malden 48, Mass.

BUY Surplus radios, receivers, electronic equipment. Direct from Government. List $1.00, Box 1842N Hartford 1, Conn.

HERMETICALLY Sealed Power Transformers!!!! New Freed, 60 cycle, 105/115/125 primary, 800 V.C.T., 200 MA, 6.3 V. at 3.0 Amps., 5.0 V. at 3.0 Amps., 6.3 V. at 6.0 Amps. $8.00 each, F.O.B. Los Alamos. E. Grothus, Box 795, Los Alamos, New Mexico.

TV-FM antennas. All types including UHF. Mounts, Accessories. Lowest prices. Wholesale Supply Co., Dept. H, Lunenburg, Mass.

SCINTILLATION Crystals. NE-101 Plastic Phosphors at new low cost, with instructions for use. Scintillation counter circuit $1. Uranium Yearbook $2. Geiger tubes only $5. Geiger counters $37.50 to $545. Scintillation counters $289 to $3500. Ultraviolet lamps. Metal detectors. Western Radiation Laboratory, 1107 West 24th Street, Los Angeles 7, California.

SURPLUS, BC-1206-CM, used w/tubes. $6.95. R15/cwr-7, 75mc superhet receiver, easily converted to 6 or 2 meters, used for 4 function model control, less tubes and case $5.95. R-3-5 Receiver 2 for $1.50. Attenuator L-101-A 30 to 100 db. $9.95. T-17 Microphones, Used-Checked. $3.50. 249C tubes, $2.50. New Meters Burlington 3" O-IV-fs, $2.25, Triplett 3" 0-150VAC, $2.95, Triplett 3" 0-100 microamps, $6.95. Capacitor, 8mfd. 2500V oil, $7.95. Minimum order $2.50. 25% on C.O.D.'s. All orders F.O.B. Dallas. Texas Electronics, Rt. 1, Box 221B, Grand Prairie, Texas.

WANTED

CYLINDER and old disc phonographs. Edison Concert, Balmoral, Conqueror, Opera, and Oratorio models. Berliner Gramophones and Zono-o-phones, Columbia disc and cylinder Graphophones. Bettini micro-reproducer. Want old catalogues and literature on early phonos prior to 1919. Will pay cash or trade late hi-fi components. Box 50 % RADIO & TELEVISION NEWS.

AN/APR-4, AN/APR-9, other "APR-," "ARR-," "TS-," ARC-1, ARC-3, ART-13, everything surplus; Tubes, Manuals, Laboratory equipment. Describe, price in first letter. Engineering Associates, 434 Patterson Rd., Dayton 9, Ohio.

WANTED: ART-13 transmitters and parts—also ARC-1, ARC-3 and ARN-7. Have requirement for ARN-6 material, Iron Core Loops, need all types Collins and Bendix Aircraft Radio equipment. Florida Aircraft Radio & Marine, Inc. P. O. Box 205, International Airport Branch, Miami 48, Florida.

WANTED—Used Community TV. equipment: Amplifiers, mixers, converters, cable, tap-offs, Jerrold Field Strength Meter, etc. Write description and prices to: Community TV, Williamsburg, Ky.

WANTED—Electronic Tubes, all types: broadcast, transmitting, receiving, Magnetrons, Klystrons, AN/GRC-9. Also urgently need all types airborne electronic equipment: ARC-1, ARC-15, ARN-6, ARN-7, ARN-14, BC-788, I-152, 51-R3, etc. Top Dollar Paid! Bob Sanett, W6REX, 1524 S. Edris Dr., Los Angeles 35, Calif.

WANTED: Receiver R5/ARN-7, MN-62A Transceivers, RT18/ARC-1, AN/ARC-3, BC-788C, I-152C, Collins, Bendix equipment. Test Sets, Dynamotors, Inverters. We pay highest prices. Advise quantity, condition, price first letter. Aircraft Radio Industries, Inc., 15 East 40th St., New York City, telephone LExington 2-6254.

TUBES and equipment bought, sold, and exchanged. For action and a fair deal write B. F. Gensler, W2LN1, 56 Crosby St., N. Y. 12N, N. Y.

MANUAL Or Alignment Instructions For R-28/ARC-5 VHF Receiver. A. M. Nohe, 246 W. 6th Ave., Huntington 1, W. Va.

ART-13T47A Transmitters $200.00; ART-13T47 Transmitters $150.00; BC-788C Altimeters $160.00; ARC-3 Complete $250.00; R5/ARN-7 Radio Compass $175.00; BC-348 Rec'r Modified $25.00; BC-348 Rec'r Unmodified $50.00; ARC-1 Radio Complete $300.00; BC-312 Rec'r $40.00; BC-342 Rec'r $50.00. Ship via Express C.O.D. Subject to Inspection to H. Finnegan, 49 Washington Ave., Little Ferry, N. J.

REPAIRS AND SERVICING

HIGH Fidelity Speakers Repaired. Amprite Speaker Service, 70 Vesey St., N. Y. 7, N. Y. Ba. 7-2580.

TELEVISION Tuner Repairs. Dan's Television Laboratory, 9 West 183rd St., N.Y. 53, N.Y.

TAPE RECORDERS

TAPE Recorders, Tapes, Accessories. Unusual Values. Dressner, Box 66R, Peter Stuyvesant Station, N. Y. 9.

TAPE Recorders, Tapes; Wholesale Prices. Klarston, 215 E. 88, New York City 28.

PRE-recorded tape music, recording tape recorders, accessories. Excellent values. Catalogue. Efsco Sales, 270 W. Concord, West Hempstead, N.Y.

RECORDERS. Tapes. Sensational Discounts. Free Catalog. Towers, Box 155, Philadelphia 5.

CORRESPONDENCE COURSES

USED Correspondence Courses and Books sold and rented. Money back guarantee. Catalog free. (Courses bought.) Lee Mountain, Pisgah, Ala.

MISCELLANEOUS

SELL your Radio-TV Station For Cash. Want to diversify. No reason for you to pay 20 to 91% tax —if we buy you pay only 25% tax long-term capital gain. Interested in businesses worth from $1,000,000 to $25,000,000. Write Box 550 % RADIO & TELEVISION NEWS.

Superior's New Model TC-55

TUBE TESTER

FOR { **The Experimenter or Part-time Serviceman,** who has delayed purchasing a higher priced Tube Tester.
The Professional Serviceman, who needs an extra Tube Tester for outside calls.
The busy TV Service Organization, which needs extra Tube Testers for its field men.

Speedy, yet efficient operation is accomplished by:

1. Simplification of all switching and controls.
2. Elimination of old style sockets used for testing obsolete tubes (26, 27, 57, 59, etc.) and providing sockets and circuits for efficiently testing the new Noval and Sub-Minar-types.

You can't insert a tube in wrong socket
It is impossible to insert the tube in the wrong socket when using the new Model TC-55. Separate sockets are used, one for each type of tube base. If the tube fits in the socket it can be tested.

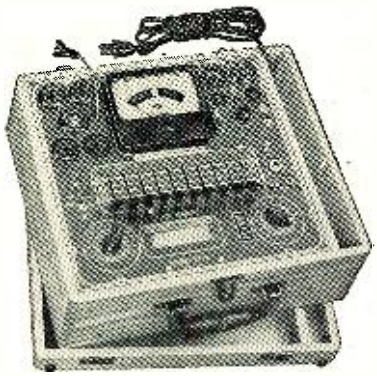
"Free-point" element switching system
The Model TC-55 incorporates a newly designed element selector switch system which reduces the possibility of obsolescence to an absolute minimum. Any pin may be used as a filament pin and the voltage applied between that pin and any other pin, or even the "top-cap"

Checks for shorts and leakages between all elements
The Model TC-55 provides a super sensitive method of checking for shorts and leakages up to 5 Megohms between any and all of the terminals. Continuity between various sections is individually indicated. This is important, especially in the case of an element terminating at more than one pin. In such cases the element or internal connection often completes a circuit.

Elemental switches are numbered in strict accordance with R.M.A. specification.
One of the most important improvements, we believe, is the fact that the 4 position fast-action snap switches are all numbered in exact accordance with the standard R.M.A. numbering system. Thus, if the element terminating in pin No. 7 of a tube is under test, button No. 7 is used for that test.

The Model TC-55 comes complete with operating instructions and charts. Housed in rugged steel cabinet. Use it on the bench—use it for field calls. A streamlined carrying case, included at no extra charge, accommodates the tester and book of instructions.

$26.95 NET



Superior's new Model TV-11

TUBE TESTER

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

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

EXTRA SERVICE—The Model TV-11 may be used as an extremely sensitive Condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute.

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

★ Free-moving built-in roll chart provides complete data for all tubes.

★ Newly designed Line Voltage Control compensates for variation of any Line Voltage between 105 Volts and 130 Volts.

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

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

$47.50 NET

ALSO TESTS TRANSISTORS!

Superior's New Model TV-12

TRANS-CONDUCTANCE TUBE TESTER

TESTING TUBES

★ **Employs improved TRANS-CONDUCTANCE circuit.** An in-phase signal is impressed on the input section of a tube and the resultant plate current change is measured. This provides the most suitable method of simulating the manner in which tubes actually operate in Radio & TV receivers, amplifiers and other circuits. Amplification factor, plate resistance and cathode emission are all correlated in one meter reading.

★ **NEW LINE VOLTAGE ADJUSTING SYSTEM.** A tapped transformer makes it possible to compensate for line voltage variations to a tolerance of better than 2%.

★ **SAFETY BUTTON**—protects both the tube under test and the instrument meter against damage due to overload or other form of improper switching.

★ **NEWLY DESIGNED FIVE POSITION LEVER SWITCH ASSEMBLY.** Permits application of separate voltages as required for both plate and grid of tube under test, resulting in improved Trans-Conductance circuit.

TESTING TRANSISTORS

A transistor can be safely and adequately tested only under dynamic conditions. The Model TV-12 will test all transistors in that approved manner, and quality is read directly on a special "transistor only" meter scale.

The Model TV-12 will accommodate all transistors including NPN's, PNP's, Photo and Tetrodes, whether made of Germanium or Silicon, either point contact or junction contact types.
Model TV-12 housed in handsome rugged portable cabinet sells for only

$72.50 NET

ABOUT TESTING PICTURE-TUBES...

Of course you can buy an "adapter" which theoretically will convert your standard Tube Tester into a picture-tube tester Sounds fine—but—it simply doesn't work out that way!

We do not make nor do we recommend use of C.R.T. adapters because a Cathode Ray Tube is a very complex device and to properly test it, you need an instrument designed exclusively to test C. R. Tubes and nothing else. As compared to a makeshift adapter, which sells for about five dollars, our Model TV-40 C.R.T. Tube Tester sells for $15.85. But, if you believe that Television is here to stay, then you must agree that the difference in price is more than justified by the many years of valuable service you will get out of this indispensable instrument.

Incidentally, the Model TV-40 is the ONLY low-priced C.R.T. Tube Tester, which includes a real meter. Neons are fine for gadgets and electro-line testers, but there is no substitute for a meter with an honest-to-goodness emission reading scale.

Superior's New Model TV-40

C. R. T. TUBE TESTER

Tests ALL magnetically deflected tubes...in the set...out of the set...in the carton!!

- Tests all magnetically deflected picture tubes from 7 inch to 30 inch types.
- Tests for quality by the well established emission method. All readings on "Good-Bad" scale.
- Tests for inter-element shorts and leakages up to 5 megohms.
- Test for open elements.

EASY TO USE: Simply insert line cord into any 110 volt A.C. outlet, then attach tester socket to tube base (Ion trap need not be on tube). Throw switch up for quality test...read direct on Good-Bad scale. Throw switch down for all leakage tests.

Model TV-40 C.R.T. Tube Tester comes absolutely complete—nothing else to buy. Housed in round cornered, molded bakelite case. Only

$15.85 NET

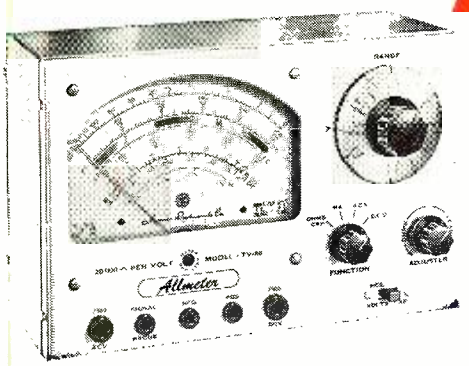
EXAMINE BEFORE YOU BUY!

USE APPROVAL FORM ON NEXT PAGE

Superior's New Model TV-60

20,000 OHMS PER VOLT

ALLMETER



FEATURES

- A sensitive, accurate Volt-Ohm-Milliammeter with *giant* meter and *mirrored* scale.
- An accurate direct-reading Capacity meter.
- A Kilovoltmeter.
- An R.F. Signal Tracer.
- An Audio Signal Tracer.
- Giant recessed 6½ inch 40 Microampere meter with *mirrored* scale assures accuracy and easy-reading. All calibrations are printed in large easy-to-read type. Fractional divisions are easily read with the aid of the mirrored scale.
- The line cord, used only when making Capacity measurements, need be plugged in only when using that service. It is out of the way, stored in its pliofilm compartment at all other times.
- A built-in Isolation Transformer automatically isolates the Model TV-60 from the power line when the capacity service is in use.
- Selected, 1% zero temperature coefficient metallized resistors are used as multipliers assuring *unchanging* accurate readings on all ranges.
- Use of the latest type of *printed circuit* guarantees maintenance of top quality standard in the production runs of this precise instrument.

Includes services never before provided by an instrument of this type. Read and compare features and specifications below!

- A new *improved* type of high-voltage probe is used for the measurement of high voltages up to 30,000 Volts. This service will be required when servicing color TV receivers.
- Simply plug-in the R.F. probe and convert the Model TV-60 into an efficient R.F. SIGNAL TRACER permitting the measurement of stage-gain and cause of trouble in the R.F. and I.F. circuits of A.M., F.M., and TV receivers.
- Plug in the Audio probe and convert the Model TV-60 into an efficient AUDIO SIGNAL TRACER. Measure the signal levels and comparative efficiency of hearing-aids, public-address systems, the amplifier sections of Radio & TV receivers etc.

SPECIFICATIONS

8 D.C. VOLTAGE RANGES: (At a sensitivity of 20,000 Ohms per Volt) 0 to 15/75/150/300/750/1500/7500/30 000 Volts.

7 A.C. VOLTAGE RANGES: (At a sensitivity of 5,000 Ohms per Volt) 0 to 15/75/150/300/750/1500/7500 Volts.

3 RESISTANCE RANGES: 0 to 2,000/200,000 Ohms, 0-20 Megohms.

2 CAPACITY RANGES: .00025 Mfd. to 30 Mfd.

5 D.C. CURRENT RANGES: 0-75 Microamperes, 0 to 7.5/75/750 Milliamperes, 0 to 15 Amperes.

3 DECIBEL RANGES: — 6 db to + 58 db

R. F. SIGNAL TRACER SERVICE:

Enables following the R.F. signal from the antenna to speaker of any radio or TV receiver and using that signal as a basis of measurement to first isolate the faulty stage and finally the component or circuit condition causing the trouble.

AUDIO SIGNAL TRACER SERVICE:

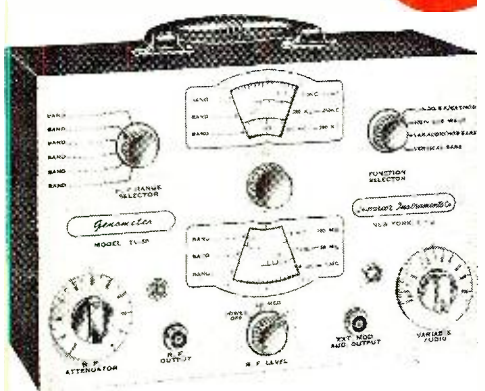
Functions in the same manner as the R.F. Signal Tracing service specified above except that it is used for the location of cause of trouble in all audio and amplifier systems.

Model TV-60 comes complete with book of instructions; pair of standard test leads; high-voltage probe; detachable line cord; R.F. Signal Tracer Probe and Audio Signal Tracer Probe, Pliofilm bag for all above accessories is also included. Price complete. Nothing else to buy. Only

$52.50 NET

Superior's New Model TV-50

GENOMETER



A versatile all-inclusive GENERATOR which provides ALL the outputs for servicing:

A.M. Radio • F.M. Radio • Amplifiers • Black and White TV • Color TV

7 Signal Generators in One!

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

R. F. SIGNAL GENERATOR: The Model TV-50 Genometer provides complete coverage for A.M. and F.M. alignment. Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

VARIABLE AUDIO FREQUENCY GENERATOR: In addition to a fixed 400 cycle sine-wave audio, the Model TV-50 Genometer provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.

BAR GENERATOR: The Model TV 50 projects an actual Bar Pattern on any TV Receiver Screen. Pattern will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars.

CROSS HATCH GENERATOR: The Model TV-50 Genometer will project a cross-hatch pattern on any TV picture tube. The pattern will consist of non-shifting horizontal and vertical lines interlaced to provide a stable cross-hatch effect.

DOT PATTERN GENERATOR (FOR COLOR TV): Although you will be able to use most of your regular standard equipment for servicing Color TV, the one addition which is a "must" is a Dot Pattern Generator. The Dot Pattern projected on any color TV Receiver tube by the Model TV-50 will enable you to adjust for proper color convergence.

MARKER GENERATOR: The Model TV-50 includes all the most frequently needed marker points. The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency.)

THE MODEL TV-50 comes absolutely complete with shielded leads and operating instructions.

Only .....

$47.50 NET

SHIPPED ON APPROVAL

NO MONEY WITH ORDER — NO C.O.D.

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

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-224, 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked. I agree to pay down payment within 10 days and to pay the monthly balance as shown. It is understand there will be no finance, interest or any other charges, provided I send my monthly payments when due. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

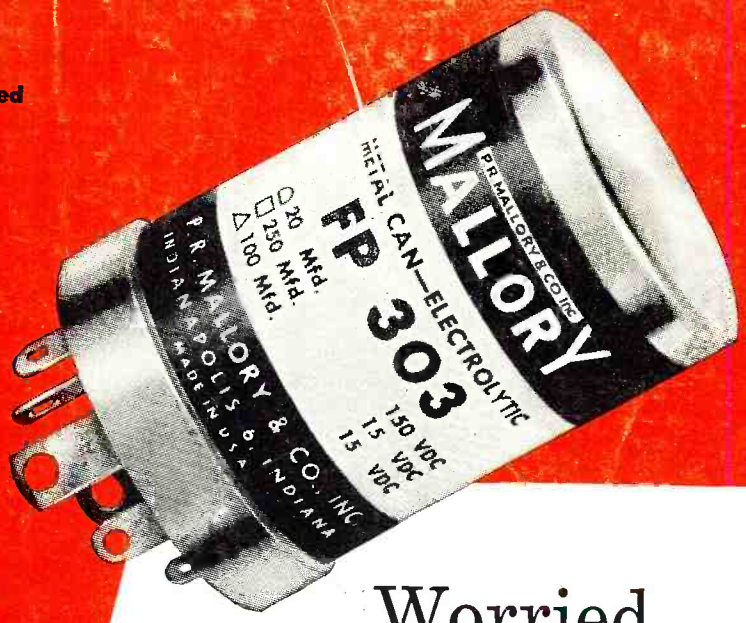
Name.....

Address.....

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

- ☐ Model TV-60.....Total Price $52.50 $12.50 within 10 days. Balance $8.00 monthly for 5 months.
- ☐ Model TV-11.....Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.
- ☐ Model TV-40.....Total Price $15.85 $3.85 within 10 days. Balance $4.00 monthly for 3 months.
- ☐ Model TV-50.....Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.
- ☐ Model TC-55.....Total Price $26.95 $6.95 within 10 days. Balance $5.00 monthly for 4 months.
- ☐ Model TV-12.....Total Price $72.50 $22.50 within 10 days. Balance $10.00 monthly for 5 months.

. . . another
MALLORY
service-engineered
product



Worried about ripple? . . . *Use* FP CAPACITORS

High ripple currents in TV sets, especially in color, make ripple rating a major factor in choosing electrolytic capacitors. For these applications, you can be sure of getting the performance you need in Mallory FP capacitors.

Extensive life tests at ambient temperatures of 85° C prove that FP's can withstand 50 to 100% more ripple current than usual industry expectation for a given capacity and voltage rating. This extra performance comes from superior heat dissipating ability, made possible by the fabricated plate (FP) construction that puts more anode area and more electrolyte into a smaller can.

For the best in electrolytics, always insist on Mallory FP . . . the original fabricated plate, 85° C capacitor. Don't settle for substitutes!

P.R. MALLORY & CO. Inc.
MALLORY

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

• Capacitors • Vibrators • Resistors • Controls • Switches
• Rectifiers • Power Supplies • Filters • Mercury Batteries