FEBRUARY
1949
RADIO-ELECTRONIC ENGINEERING EDITION

# RADIO & TELEVISION NEWS

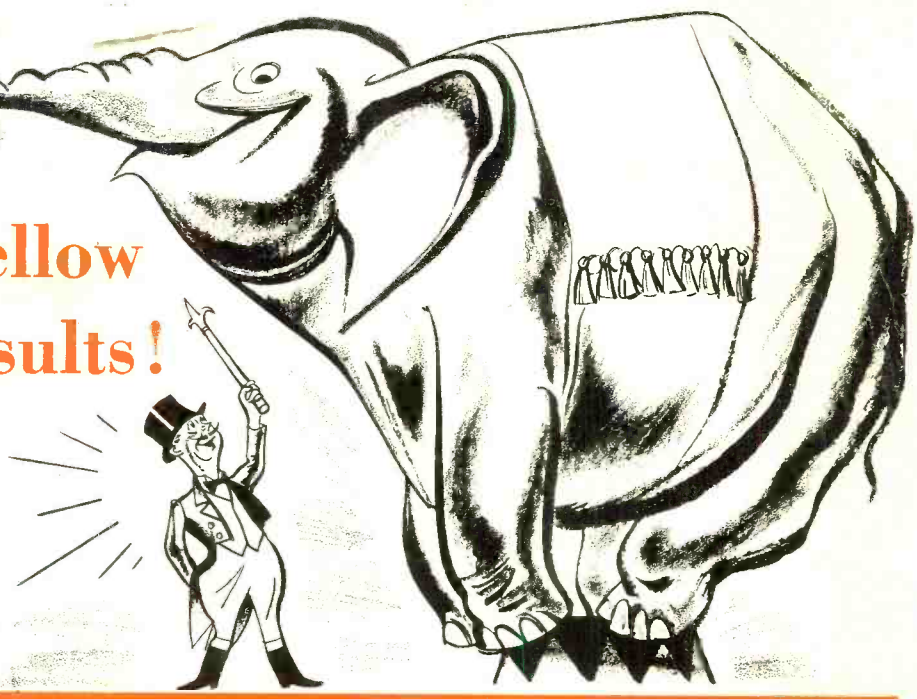
## $10,000.00 AMATEUR RADIO CONTEST

See Page 27

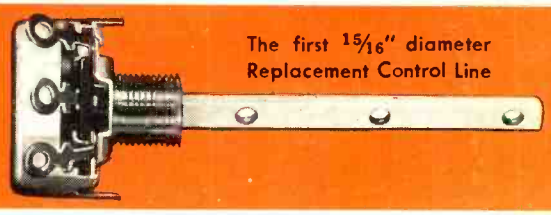
## TELEVISION STANDS WATCH FOR U. S. NAVY

Page 40

# The Little Fellow Gets BIG Results!



## The Mallory Midgetrol



The first 15/16" diameter Replacement Control Line

"Phenomenal!"—that's the only word to describe the lightning-like acceptance of Mallory's revolutionary new standard in volume controls. But its success was a foregone conclusion when you realize what the Mallory Midgetrol offers:

**WIDER APPLICATION**—The small size lets you service portables, auto radios and small AC-DC receivers requiring 15/16" controls.

**SIMPLER INSTALLATION**—The new and unique flat shaft design of the Mallory Midgetrol saves installation time with *all* types of knobs.

**LESS INVENTORY**—Electrical characteristics allow you to use the Mallory Midgetrol to replace 1 1/8" as well as 15/16" controls. Since no special shafts are required, you carry fewer controls in stock.

### Quietest and Smoothest by Actual Tests

And Mallory Midgetrol stays quiet, too. Creative research that has made Mallory the standard in carbon controls has seen to that. In addition, the Mallory Midgetrol offers nine big features all NEW:

NEW SIZE — NEW SHAFT — NEW SWITCH — NEW CONTACT
NEW DESIGN — NEW EXTENSION — NEW ELEMENT — NEW TERMINAL
NEW TWO-POINT SUSPENSION

***See your Mallory Distributor for this new standard in carbon controls***

P.R. MALLORY & CO. Inc.

**MALLORY**

CAPACITORS • CONTROLS • VIBRATORS • SWITCHES • RESISTORS
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See how I give you practical experience building Radio circuits with BIG KITS OF PARTS I SEND. Illustrated book shows how you make EXTRA MONEY fixing Radios in spare time while still learning. Read letters from men I trained, telling what they are doing, earning. See the kind of fascinating jobs Radio, Television, Electronics offer. FREE with coupon below!


## ACTUAL RADIO LESS

Same coupon entitles you to FREE lesson, "Getting Acquainted With Receiver Servicing." Discloses short-cuts Radio repairmen use. Tells how "superhet" circuits work, gives reasons why tubes fail, locating defects, repairing loudspeaker. Over 80 pictures, diagrams. FREE, send coupon!

# See for yourself how I train you at home to BE A RADIO-TELEVISION TECHNICIAN

Want a good-pay job in the fast-growing RADIO-TELEVISION Industry? Want a money-making Radio-Television shop of your own? Here's your opportunity. I've trained hundreds of men to be Radio Technicians . . . MEN WITH NO PREVIOUS EXPERIENCE. My tested and proved train-at-home method makes learning easy. You learn Radio-Television principles from illustrated lessons. You get practical experience building, testing, experimenting with MANY KITS OF PARTS I send. All equipment yours to keep.

### MAKE EXTRA MONEY IN SPARE TIME

The day you enroll, I start sending SPECIAL BOOKLETS that show you how to make EXTRA MONEY fixing neighbors' Radios in spare time. From here it's a short step to your own shop, or a good-pay Radio-Television servicing job. Or get into Police, Aviation, Marine Radio, Broadcasting, Radio Manufacturing or Public Address work. And think of getting in on the ground floor of the booming Television Industry. Trained men are already in demand . . . new stations are going on the air, manufacturers are building over 100,000 sets a month, more and more homes are getting sets. The man who prepares now will reap rich rewards.

### SEE WHAT N.R.I. CAN DO FOR YOU

Act now! Send for my DOUBLE FREE OFFER. Coupon entitles you to actual lesson, "GETTING ACQUAINTED WITH RECEIVER SERVICING," absolutely free. Over 80 pictures and diagrams! You also get my 64-page book, "HOW TO BE A SUCCESS IN RADIO and TELEVISION-ELECTRONICS." Tells more about YOUR opportunities, details of my Course, how quickly, easily you can get started. Send coupon in envelope or paste on penny postal. J. E. SMITH, President, Dept. 9BR, National Radio Institute, *Pioneer Home Study Radio School*, Washington 9, D. C.

## You Build This MODERN RADIO with Parts I Send

Complete, powerful Radio receiver brings in local and distant stations. NRI gives you ALL the Radio parts . . . speaker, chassis, transformer, sockets, loop antenna, etc.

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COVER PHOTO: A Television "first"—NBC in conjunction with the U.S. Navy televised the *USS Leyte* during a simulated battle attack for the benefit of TV audiences. (NBC photo by Sidney Desfor)

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# RADIO & TELEVISION NEWS

Radio News Trade Mark Reg. U.S. Pat. Office No. 378427

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### DEPARTMENTS



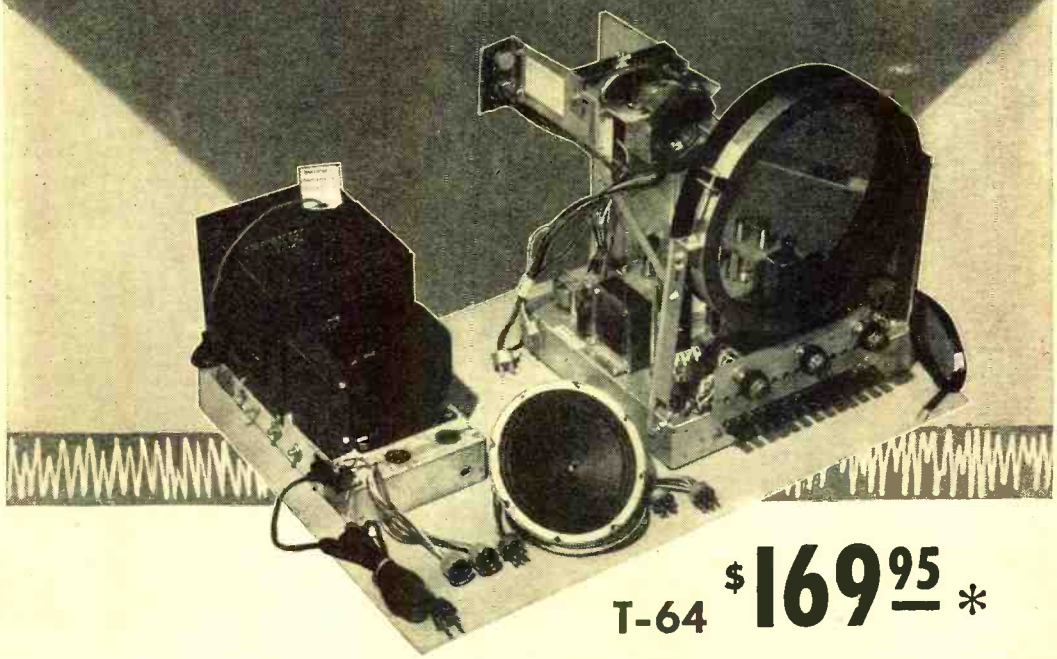

185 North Wabash Ave., Chicago 1, Ill.
VOLUME 41 • NUMBER 2

Member
Audit Bureau of
Circulations

RADIO & TELEVISION NEWS is published monthly by the Ziff-Davis Publishing Company, 185 N. Wabash Ave., Chicago 1, Ill. Subscription Rates: in U. S. and Canada $4.00 (12 issues), single copies 35 cents; in Mexico, South and Central America, and U. S. Possessions, $4.00 (12 issues); in British Empire, $5.00 (12 issues)—all other foreign countries $5.00 (12 issues). Subscribers should allow at least 2 weeks for change of address. All communications about subscriptions should be addressed to: Director of Circulation, 185 N. Wabash Ave., Chicago 1, Ill. Entered as second class matter July 21, 1948, at the Post Office, Chicago, Illinois, under the Act of March 3, 1879. Entered as second class matter at the Post Office Dept., Ottawa, Canada. Contributors should retain a copy of contributions and include return postage. Contributions will be handled with reasonable care but this magazine assumes no responsibility for their safety. Accepted material is subject to whatever revisions and by-line changes that are necessary. Payment made at our current rates, covers all authors', contributors' or contestants' rights, title, and interest in and to accepted material, including photographs and drawings.

# hallicrafters

## NEW *Custom Installation* TV!



**T-64 $169.95 ***

## . . . for 10-inch or 12-inch tube *

Our *improved* 10-inch chassis with new Dual Focus switch; one position gives completely linear 56 sq. in. picture; the other, a big circular telescopic 64 sq. in. view for dramatic close-ups.

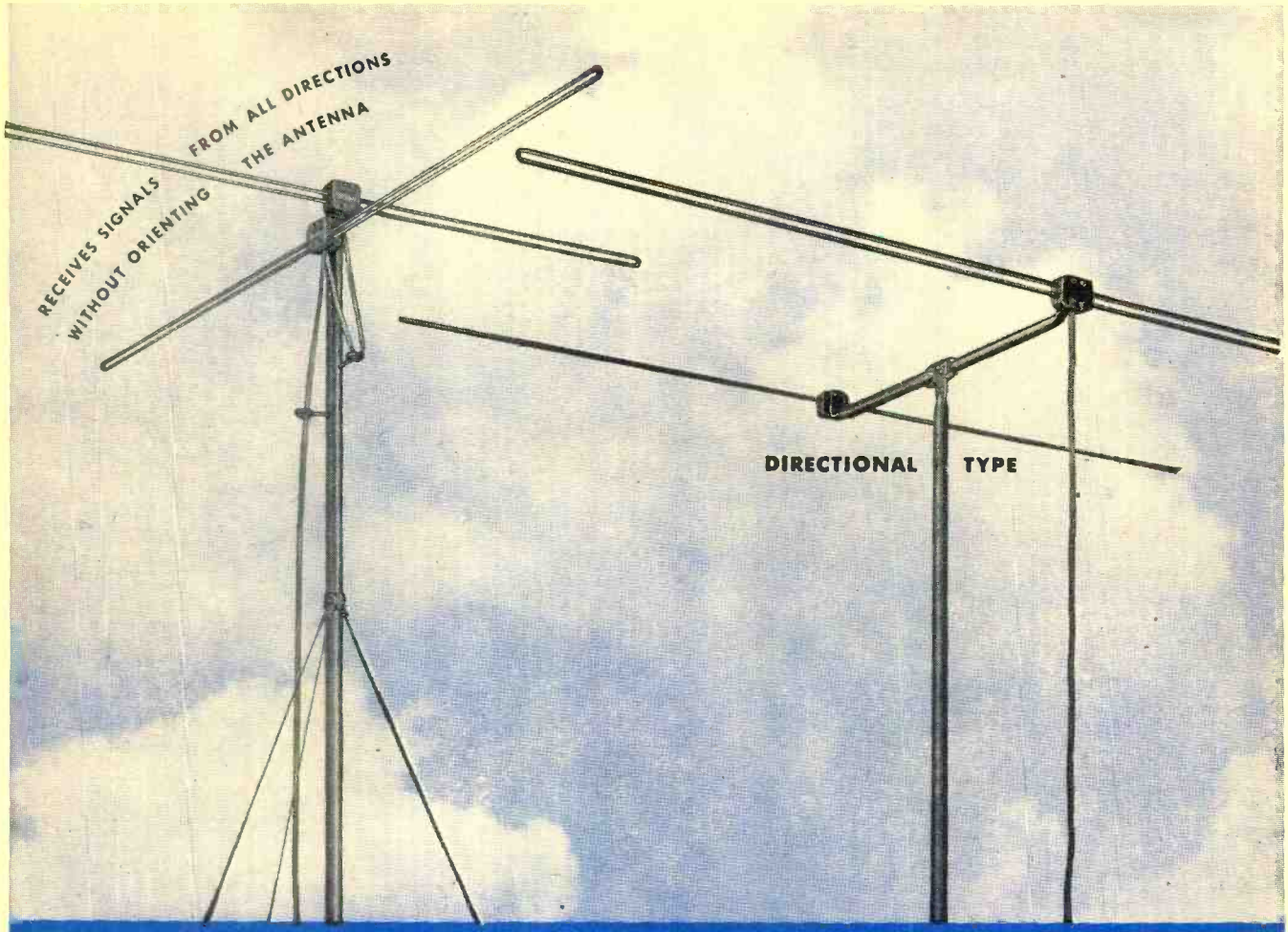
Chassis taken right out of our regular production, factory-wired, completely aligned and tested. Regular RMA 90-day guarantee applies to all parts. Complete with speaker and all tubes except CR tube. See your local parts distributor or write to the factory for data sheet S-220-R.

* **Regularly supplied with frame for 10-inch tube. Frame for mounting 12-inch tube approximately $8.50, including all necessary parts.**

## the hallicrafters co.

**4401 W. Fifth Ave., Chicago 24, Ill.**

***MANUFACTURERS OF PRECISION RADIO AND TELEVISION EQUIPMENT***




# *Insure* FM Performance with a GOOD FM ANTENNA


- Belden FM Antennas are engineered for finest FM reception.
- Use Belden 8322 Poly-Point Antenna to receive signals from all directions without turning!
- Use Belden 8320 Dipole Antenna for installations requiring directional characteristics.
- Sturdy aluminum construction withstands severe ice loading and high wind.
- COMMON-SENSE PRICES.

ASK your Belden Jobber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# GET THESE 2 BIG BOOKS FREE..

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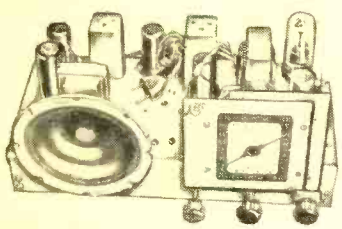
**FRANK L. SPRAYBERRY**
famous Radio teacher of hundreds of successful Radio men.

### I TRAIN YOU *RIGHT* BY SENDING YOU 8 BIG KITS OF RADIO EQUIPMENT INCLUDING A POWERFUL 6 TUBE SUPERHET RECEIVER AND 16 RANGE TEST METER!

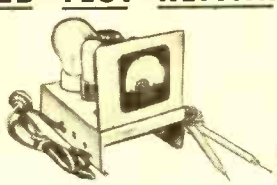
Find out NOW how Sprayberry Training prepares you for a Radio Service Business of your own — or a good pay Radio job. Just mail the coupon for a FREE Sample Lesson and my big FREE book, "How To Make Money In Radio, Electronics, Television." It tells how I train you at home during spare hours by putting you to work building, testing, repairing Radio equipment. The Sprayberry Course teaches you Radio by working with 8 big kits of Radio parts I supply. You build a powerful 6 tube superhet Radio, a 16-range test meter, perform over 175 interesting, PRACTICAL experiments. My lessons are easy and interesting — you need no previous experience in Radio. I start you at the beginning... and give you valuable "bench" experience that sticks with you.

Soon after you start I send you my famous BUSINESS BUILDERS that help you earn EXTRA CASH getting and doing neighborhood Radio Service jobs while learning. You couldn't pick a better time to get into Radio. The Radio Repair Business is booming! Good Radio Service and Repair Shops are needed everywhere as millions of new sets are in use. Trained men are wanted for opportunities in Police, Aviation and Marine Radio, F. M. and Standard Broadcasting and Television. Manufacturers are looking for men who know Radio as production reaches new peaks. GET THE FACTS ABOUT YOUR FUTURE IN RADIO. MAIL the COUPON TODAY for my FREE BOOKS.

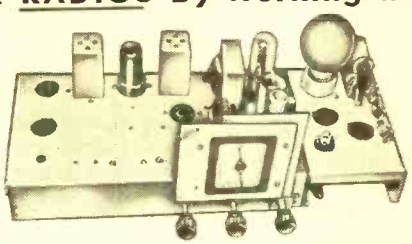
### LEARN HOW TO BUILD-TEST-REPAIR RADIOS *By Working with* YOUR HANDS!



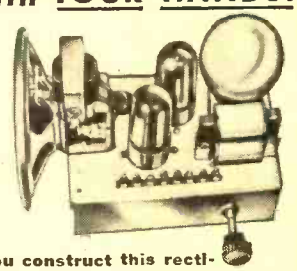
**You really learn Radio the PRACTICAL way ... when you build this big, powerful 6-tube Superhet Radio from parts I send you.**



**I give you a fine, moving coil type Meter—with parts for a complete analyzer and Circuit Continuity Tester. "Trouble-shoot" with professional accuracy.**



**You don't have to buy expensive ready-made equipment. You get valuable experience building this Signal Generator and Multi-purpose Tester.**



**You construct this rectifier and filter, resistor and condenser tester, and really get on the Practical end of Radio.**

*Trained Radio men can step into their own profitable Radio Service Shop*

## LOW COST RADIO TRAINING

**STUDY AT HOME IN SPARE HOURS**

Sprayberry Training costs surprisingly little! Easy monthly payments, if desired. Everything you need is furnished — nothing else to buy. With Sprayberry Training to back you up, you will be able to step into your own profitable Radio Service Business or go on to a big opportunity in Radio, Electronics or Television. The equipment I send you is yours "for keeps" — to use in your business or job. I have trained hundreds of successful Radio men — and I can help you too. Get the facts about Sprayberry Training — it's your first step to success, security and a bigger income in a field where you'll really enjoy your work. Fill out and mail coupon TODAY. I'll rush my two FREE books to you by return mail.

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# For the RECORD

BY THE EDITOR

TELEVISION servicemen have been faced with the problem of convincing prospective customers that television sets are now highly perfected and that there is little likelihood that any radical changes will be made in these receivers for many months to come.

You will notice a monogram on the front cover this month which we feel is indicative of our new opportunities in Television—the greatest Industry of our time.

Many improvements will be made, and are being made, almost daily in TV transmitters, cameras, and studio equipment. These improvements in many cases are obvious to video viewers and to the serviceman. Another feeling is that the price of television receivers will drop sharply as public demand increases. We do not concur that prices will come down in the near future.

During 1949 there will be a trend towards, and a preference for, larger picture tubes. The announcement of new processes by several manufacturers employing metal rather than glass for the picture tube envelope will step-up production and result in a lower cost per tube. However, we don't see where the over-all cost of the set can possibly be reduced due to the requirements for larger housings, higher voltages, more costly components, cabinets, and other contributing factors, which while improving the picture size will present other problems which will also have to be met. Many sets manufactured during the past two years used five- and six-inch speakers for so-called high quality reproduction. The choice of these small speakers was indicated by lack of cabinet space and the choice of a balanced layout of the front panel. Many of these speakers were mounted on the sides of table cabinets and many were mounted on top. A lot of them were no better than those speakers found in inexpensive table model radios.

Inasmuch as television employs an FM sound channel and customers have been led to believe that FM is a cure-all for static-free high fidelity sound, many customers who have heard the difference between "run of the mill" vs. high quality reproducers in their AM sets are quick to observe the poor sound reproduction they get from their television sets.

While we realize that the necessary mass of a television picture tube makes speaker placement rather awkward, we do feel that the public does want and is willing to pay for, better installations and cabinetry.

Another objection as far as the television serviceman is concerned is the cramming of component parts in certain sections of the television chassis. When attempting to service these receivers they find that getting at a troublesome component is like attempting to stuff a marshmallow into a piggy bank.

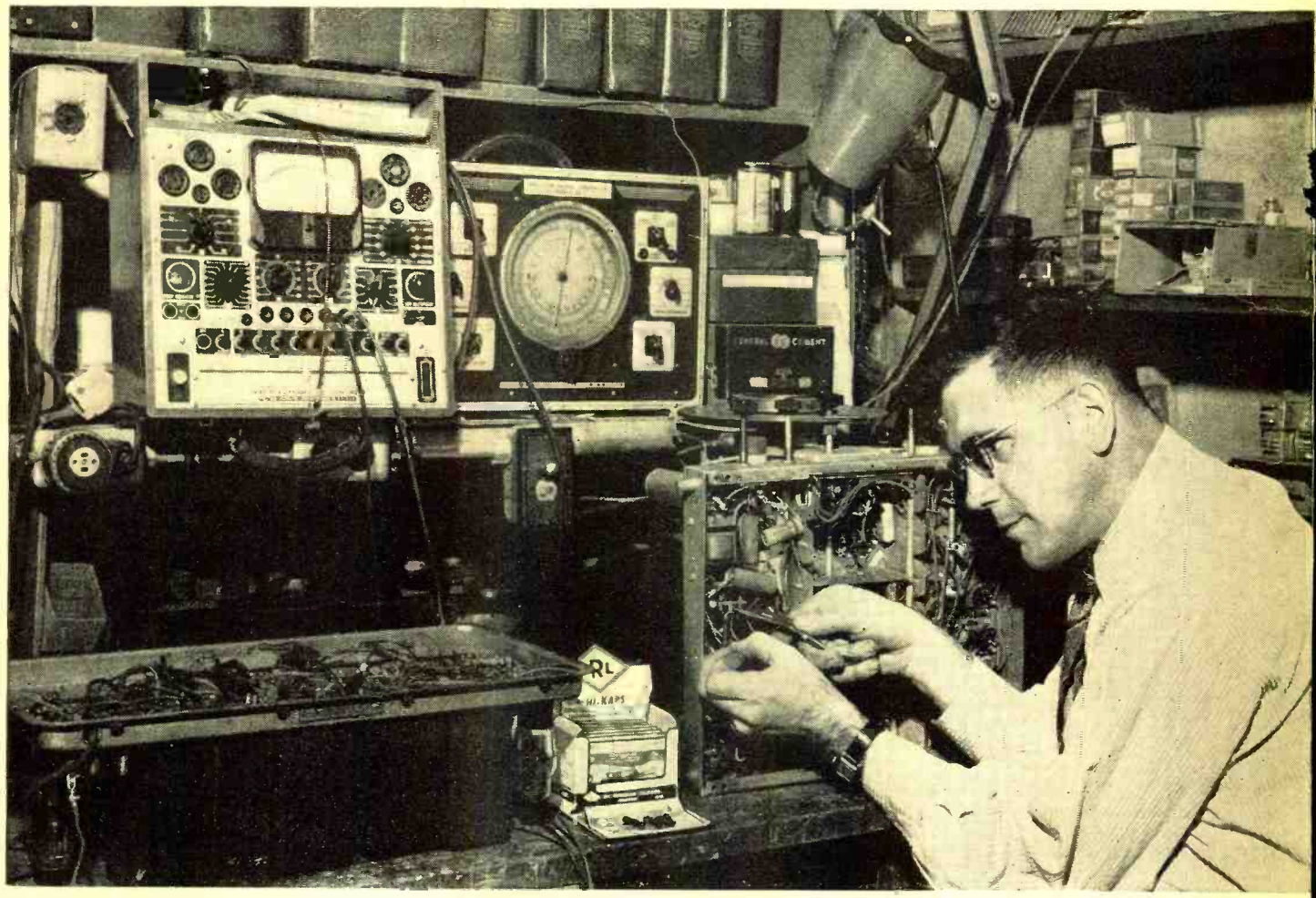
One prominent speaker manufacturer in Chicago told us recently that there is a definite reversal on the part of certain manufacturers when deciding between large and small speaker systems. This is certainly a step in the right direction and will greatly improve the excellent reception that FM is capable of providing.

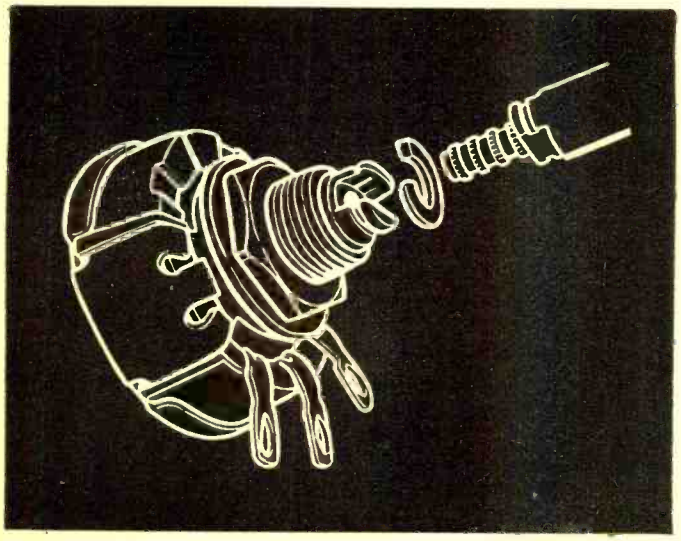
Yes, 1949 is Television Year. The television industry will boom for many months to come. The industry now anticipates the opening of 43 new markets with the completion of installations of 70 television stations. With approximately 125 stations in 70 cities in operation by the end of the year, television servicemen must gear themselves now for the vast market which will soon be theirs.

We repeat what we have said before. The serviceman must train himself and study television if he is to come in for his share of profits that can, and are being made by the sale and maintenance of television equipment. And, don't forget the custom-built angle. Here's a golden opportunity to specialize in custom installations. Not only are the profits greater, but chances are that there will be far less grief from quality installations than will result from a "sell anything that is available" approach.

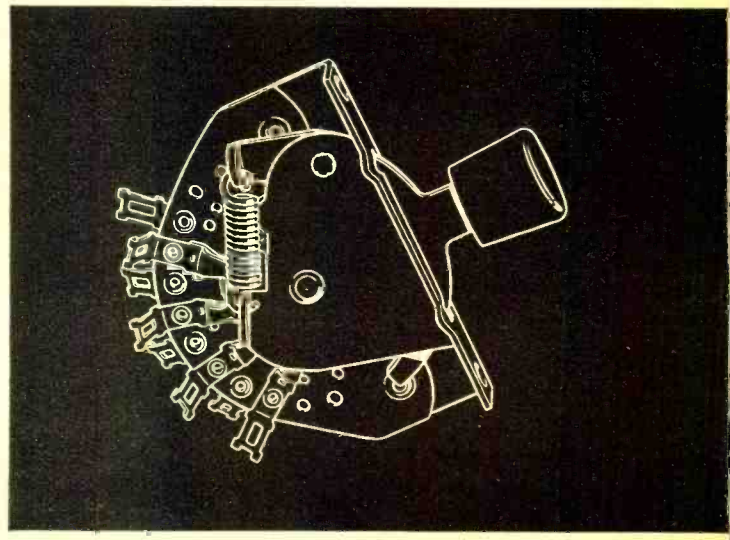
Approximately three times as many television units will be produced this year as were manufactured during the entire year of 1948. This means that nearly 3,000,000 sets will be in operation in 1949 and close to 10,000,000 sets by the end of 1952. The television industry promises to reach an expenditure of $5,000,000,000 during the next few years. Television is one of America's fastest growing post-war industries. Will you get your share? . . O.R.

# Big profits come in





**Controls:** With CRL's improved *Adashaft* Radiohms you can carry a small stock of controls, yet be ready to handle almost any kind of control replacement problem. No wiggle, no wobble, no slip. Just insert shaft pilot in control stub shaft, and slip "C" washer into place. Available in all sizes for all model "M" volume control applications. Six types of shafts.



**Switches:** Centralab offers you a complete line of Tone, Rotary Selector, Lever Action and Medium Duty Power Switches, which features a wide variety in both laminated phenolic and steatite insulation. Available with shorting or non-shorting contacts. See your Centralab Distributor for further information, or write direct for new Catalog 26.

# ALLIED presents NEW hallicrafters Television!

**NEW** LOW-PRICED 10-INCH AND 7-INCH TABLE MODELS

**NEW** EXCLUSIVE! "SELECT-VIEW" PICTURE FEATURE

ROUND for Big Picture Viewing

LINEAR for Conventional Viewing

*Have BOTH in One TV Receiver*

## NEW 10-Inch Wood Model 508

**WITH THE NEW SELECT-VIEW PICTURE**

**NEW! DIFFERENT!** An amazingly finer 10-inch direct-view TV receiver at an unbelievably low price! Incorporates remarkable new Select-View feature. Have your choice at the flip of a switch of a *round* picture for enlarged (64 square-inch) telescopic view for dramatic close-ups, or of a *linear* (56 square-inch) picture for conventional viewing. Either way, you get a sharp picture, with excellent stability and truly photographic contrast. Features include: 12 channel push-button tuning—covers all U. S. TV channels; RF amplifier; 3 IF amplifiers; 2 video amplifiers; improved sync circuits; Automatic Gain Control; static-free FM audio system. Complete with 19 tubes, plus 10" picture tube and 3 rectifiers. Presented in a beautiful mahogany wood table cabinet, 17½" high, 16⅜" wide, 19⅞" deep. For 105-125 volts, 50-60 cycles AC. Shpg. wt., 105 lbs.

**Hallicrafters 508,** 10" TV wood table model. NET, f.o.b. Chicago, only..... **$269.50**

*$53.90 down, $19.04 monthly for 12 months*

## NEW 7-Inch Select-View Model T-65

**IN HANDSOME FURNITURE STEEL CABINET**

There's nothing like it at this low price! Here's perfected, clear, sharp, bright Television—with a brand-new feature—Select-View. It's remarkable—just flip a switch and view a *round* enlarged (28 square-inch) telescopic view for dramatic close-ups, or have your choice of a *linear* (24 square-inch) picture for conventional viewing—have *both* in *one* receiver! And check these additional features: factory pre-set push-button tuning of all U. S. television channels; simplified contrast control, easy horizontal and vertical framing; fine-tuning control; advanced type static-free FM audio system, using 4" x 6" oval PM dynamic speaker—plenty of audio output and exceptional tonal fidelity. Distinctively styled; in handsome furniture-steel cabinet in rich silver-gray; 20½" long, 11" high, 17" deep. For 105-125 volts, 50-60 cycles AC. Complete with tubes. Shpg. wt., 45 lbs.

**Hallicrafters T-65.** 7" TV model in furniture-steel cabinet. NET, f.o.b. Chicago, only..... **$169.50**

*$33.90 down, $11.98 monthly for 12 months*

**507 WOOD MODEL.** Identical to model described above, except in deluxe mahogany wood table model cabinet. Includes Select-View picture feature. NET, f.o.b. Chicago, only..... **$179.50**

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.....Enclosed $.....

☐ Full Payment ☐ Part Payment (Bal. C.O.D.)

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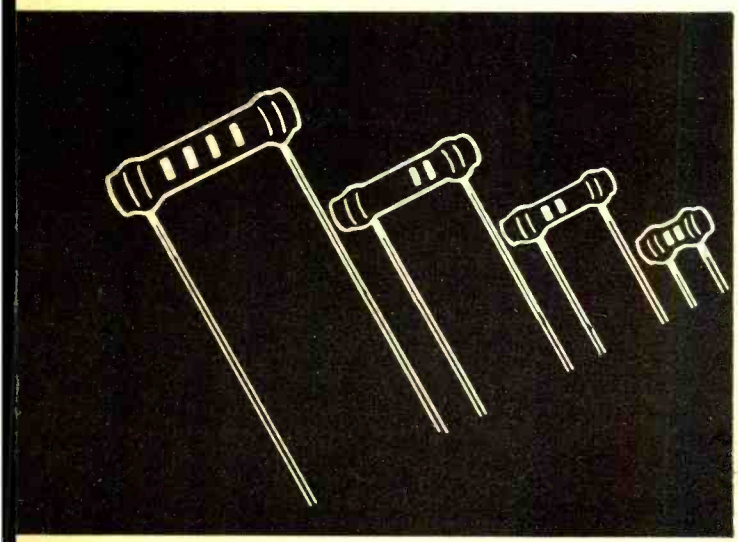
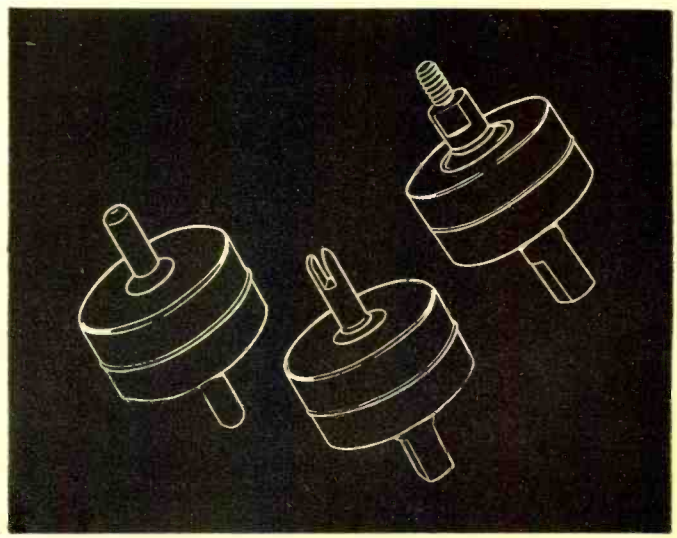
***Yes — CRL containers bring you more than just replacement parts. They hold important extras that can help transform an ordinary repair shop into a really profitable service business. Consider performance. You'll find dependability that insures repeat orders. . . invites new customers. Consider repair time — and you'll see how easy-to-use CRL parts speed output by eliminating tricky bending or fitting operations. Consider handling — and prove to yourself how clearly-marked CRL parts provide quick, positive identification. Yes — consider all the advantages and you'll agree with successful servicemen everywhere that it pays to use quality Centralab parts. For the complete story on the CRL line, call your Centralab distributor.***

—LaVerne C. Garman, owner of Garman Radio Service, West Allis, Wisconsin, says, "Centralab replacement parts help us turn out better work . . . quicker. And our experience proves this is the best combination for building customer goodwill."

Centralab
CRL
Division of GLOBE-UNION INC., Milwaukee



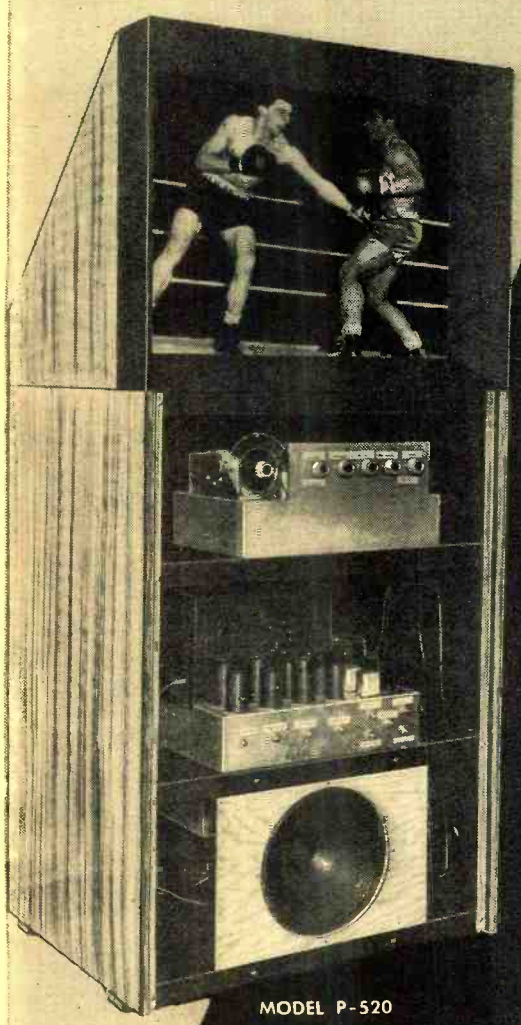
**"Hi-Kaps":** CRL line of ceramic By-pass and Coupling Capacitors gives you ceramic dependability and permanence at a new low price! Packaged in a convenient envelope of five, *Hi-Kaps* are clean, easy to stock and handle. Wide range from .000050 to .010000 mfd. Rating — 600 WVDC, 1000 VDC. flash tested. Ask your Centralab Distributor for all the facts.



**"Hi-Vo-Kaps":** Just out! Centralab's new high voltage capacitors for television and high voltage applications. Made of Ceramic-X, *Hi-Vo-Kaps* combine high voltage and small size to give you convenient, dependable performance. 10,000 WVDC, flash tested. 20,000 VDC. Capacity — 500 mmf. See your CRL Distributor, or write direct.

TELEVISION ASSEMBLY CO.

# for the best in TELEVISION for CUSTOM-BUILT installations




## 520 SQUARE INCH PICTURE 20 INCHES BY 26 INCHES

### PROJECTION TELEVISION

Bausch & Lomb Optical Electronic System provides a contrasty sparkling picture projected onto the Eastman Kodak Glass Projection Screen, completely glare-proof. Every part of the entire set is designed, engineered and manufactured for the express purpose of bringing you the finest in television . . . ready for CUSTOM-BUILT installations in homes, schools, lodges, clubs, hospitals, taverns and other public places.

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- **RCA** 5TP4 PROJECTION C. R. TUBE
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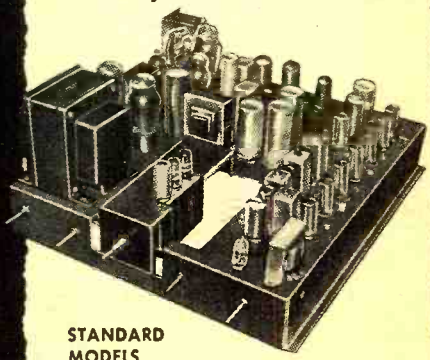

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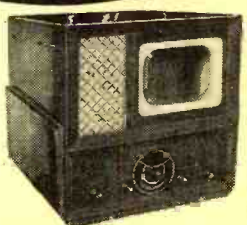

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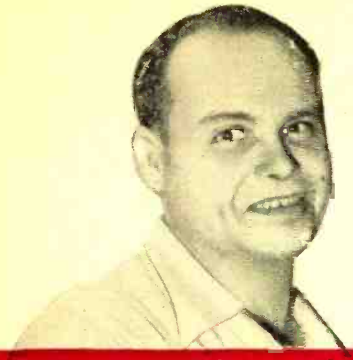

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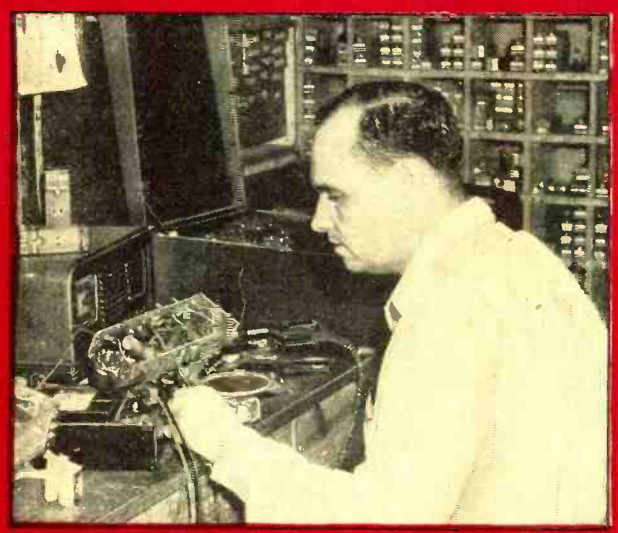

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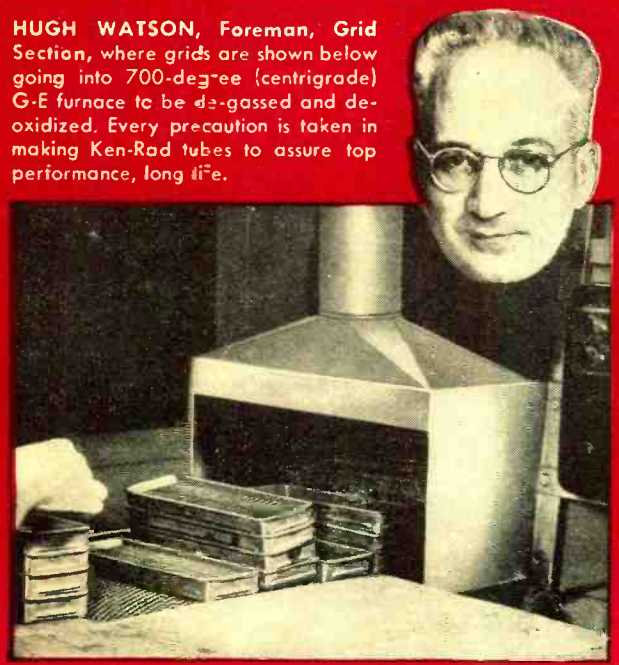

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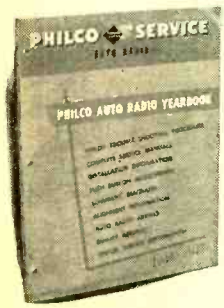


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# Spot Radio News

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

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

**TV,** which in '48 received such rapt attention in industry, large metropolitan areas of the nation and particularly Washington, streaked to a new high in interest in the closing days of the year during the all-important television-allocation engineering conferences, which it was hoped would result in a workable plan for telecast channeling. Appearing before the engineering divisions of the FCC, scores of witnesses presented a variety of ideas which they felt would solve the much debated problem. Not only did the usual assembly of consultants and legal representatives of broadcasters and associations appear, but a number of TV station chief engineers as well as engineers of those manufacturing receivers, antennas, and related components took the stand, too. Among the personalities who appeared in the crowded Department of Commerce auditorium, the scene of this and most of the other conferences and hearings, were Major E. H. Armstrong, former FCC Chief Engineers George Adair and T. E. M. Craven, and IRE President-Elect Stuart Bailey.

Two camps of approach to the allocation jigsaw puzzle appeared, one of which involved pure engineering considerations and the other philosophical thinking, where the number of people who would or would not receive programs was deemed a more essential factor than the actual interfering aspects of the case. To set a pattern of impartial procedure, the FCC presented some very pertinent technical information in the form of five reports. One report contained a tabulation of the results of thirty-six series of measurements of tropospheric fields on frequencies between 40 and 400 megacycles, over distances between 33 and 337 miles, and over periods from one month to one year. This data was analyzed to develop empirical laws governing the range of variation of the fields and the absolute field intensities, as affected by transmitting antenna height, distance, and frequency. To predict the intensities of tropospheric fields which will be exceeded for various percentages of time at various distances from the transmitter, four families of propagation curves at frequencies of 63, 82, 98, and 195 megacycles were offered. Nominal transmitting and receiving heights of 500 and 30 feet were used as a basis of the plots. The report also included a study of simultaneous fading of two signals over similar paths, from which it was concluded that fading was random. That is, from an interference standpoint, it was found that the variation of the desired signal from tropospheric effects could not be relied upon to compensate even in part for an increase in the undesired signal from tropospheric effects. In addition, the variations of both the desired and the undesired signals were found to contribute to the degradation of service.

**IN THE SECOND REPORT** the simultaneous fading effects were probed in a detailed way. This report disclosed that for co-channel interference, where the undesired field intensities vary much more than the desired, the use of groundwave (or median) fields against percentage time tropospheric fields will provide a closely approximate answer. In the third report appeared the results of measurements made at Princeton, N. J., Southampton, Pa., and Laurel, Md., on 47.1, 106.5, and 700 megacycles. The fourth report was an extremely interesting one, covering terrain effects. The FCC noted that when the study for this report was begun, it was supposed that terrain effects might be divided into two general classes; gross and detailed effects. That is, it was supposed that measurements along a radial might show that various sectors of the radial would evidence individually an overall shadowing, while within a sector, the terrain effect might appear as a random variation of field intensity, perhaps independently of the extent of the general shadowing. Tests proved this supposition and showed that the random variation depended on whether the relatively near terrain was smooth or rough. In the fifth report covering a suggested basis for TV and FM allocation rules, the FCC engineers presented a plot which illustrated the individual interferences to a 50-kw. TV station from two similar stations on adjacent and co-channel frequencies, the former 75 miles away and the latter 150 miles away. The plots showed that the service deteriorated much more rapidly by adjacent channel interference than by co-channel interference. The FCC experts explained that there might be other factors which would affect the

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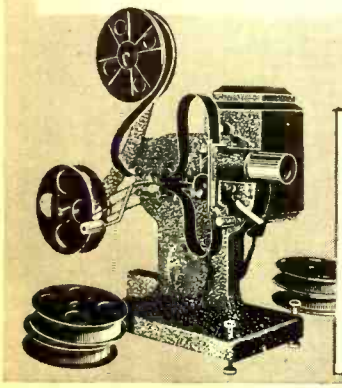

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rate of deterioration, such as relative powers, antenna heights, and spacing between stations. Because of these wide variations in the rate of interference or service deterioration, a single limitation to protect the primary service would not be adequate, the report added. Therefore, the FCC analysts believed that it would not be realistic to set up rules for protection of a given primary service area or contour and to disregard the service beyond; an 80 per-cent service may be extremely useful even though the 90 per-cent service may be defined as the outer boundary of the primary service area.

**AS A SOLUTION** to the problem the FCC suggested another limitation to the contour further out. This limitation would restrict those proposed operations which would cause too rapid a deterioration immediately beyond the primary service contour. For example, it might be specified that the 50 per-cent interference contour from the proposed operation shall not invade the 1-millivolt-per-meter contour of an existing station in addition to the other limitation that the 10 per-cent interference contour from the proposed operation shall not extend within a 2-millivolt-per-meter service contour. These limitations could be applied to both co-channel and adjacent channel applicants or different limitations might be applied to various types of interference.

Commenting on the interference report, the FCC said that the Canadian border stations will have to be considered carefully, too, in any allocations plan. As an example, they cited the present setup in Cleveland with channels 2, 4, 5 and 11, which would be altered to include channel 8 and eliminate channel 2. In another northern-border proposed change, Buffalo-Niagara, now with channels 4, 7 and 9, would lose 9.

From industry appeared several ingenious engineering plans. In one, Ray D. Kell of *RCA Labs,* presented a synchronous carrier system, which by synchronization of carrier currents would permit operation of co-channel stations 150 miles apart, in accordance with present practice. Another suggestion involved the use of higher power in certain areas and directional antennas. William B. Lodge, of *CBS,* presented an engineering-economic type plan in which he stressed the importance of considering the possible uses of the ultra-highs. In offering his proposal, Lodge posed several pertinent questions:

"What relative importance should be attached to the need for more TV stations and larger service areas? . . . Are the v.h.f. channels to be allocated permanently to TV? . . . Are the ultra-highs to be considered in v.h.f. planning? . . . If the ultra-highs are to be considered, should both the present and ultra-high assignments be planned for the same city?"

In reply to the first query, Lodge

(*Continued on page* 130)

FEBRUARY, 1949

RADIO & TELEVISION NEWS

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## FEBRUARY, 1949



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VOLUME 12, NUMBER 2, 

COVER PHOTO — Courtesy of Sylvania Electric Products, Inc.

One step in the manufacture of television picture tubes at Sylvania Electric Products, Inc., Emporium, Pa. After the television picture tube screens have been thoroughly dried and inspected they are marked for positioning of the internal graphite coating.

# INDUSTRIAL TELEVISION

By
**R. W. SANDERS**
Farnsworth Research Corp.

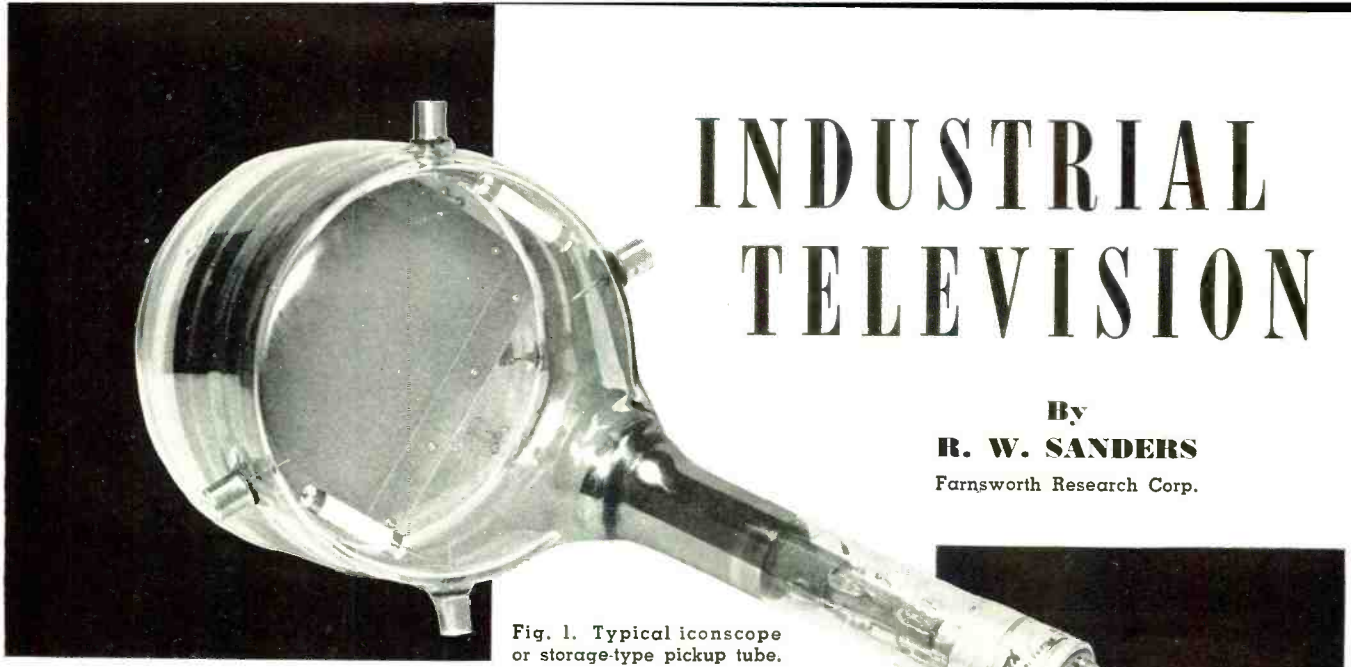


Fig. 1. Typical iconscope or storage-type pickup tube.

***Details of a wired television system of 200 lines which has many applications in industry.***

INDUSTRIAL TELEVISION is beginning to play an important role in the commercial television industry. Although final development of industrial television systems did not start until after V-J Day, much of the preliminary development work was started in 1940 and carried on during the war.

Simplified television systems were first developed for the Armed Forces as "eyes" for robot bombs. These bombs were divided into two categories, low-angle and high-angle bombs. The low-angle or glide bomb had a wing and tail assembly and was equipped with radio control equipment such that it could be guided from the bomber which had released it. The television equipment was located in the front of the glide bomb and a picture transmitted back to the control position in the bomber.

The high-angle bomb was a normal bomb with controllable fins on the rear for guiding. Complete television equipment was located in the nose of the bomb and the television picture was transmitted back to the plane where the control man could see on the receiver the target for which the bomb was headed. The tail of the bomb contained remote control equipment enabling the bomb to be guided from the bomber.

There were three main requisites for this type television equipment:

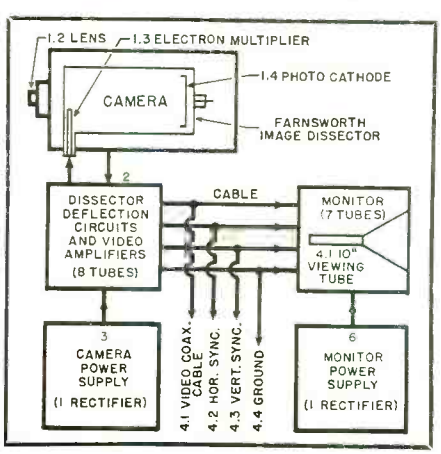
1. The equipment must be compact
2. Must be simple and foolproof to operate
3. Equipment must be stable

In 1940 there were three popular types of television pickup tubes. One type was known as the iconoscope or "Ike," the other as the image dissector. A third type, the orthicon, was also a storage type tube with characteristics quite similar to the iconoscope.

Without going deeply into these tubes, we will touch briefly on their relative advantages and disadvantages.

Fig. 1 shows a picture of a typical iconoscope, known as a storage-type pickup tube. It consists of an electron gun with an electrostatic focus ring, a photoelectric mosaic, and a collector ring. The photosensitive mosaic consists of an area of tiny photocells deposited on a mica plate, backed up by a metal film that makes up the output signal electrode. Each photosensitive island is less than one mil in diameter and constitutes a small condenser by virtue of its capacitance through the mica to the output signal plate behind the mica. Connection to the photoelectric island is made by means of the electron beam which scans, or commutates, the islands, under the influence of the deflecting fields.

Fig. 2. Functional block diagram of the complete industrial television system.




Each island is well insulated from all the others. Sometimes a slight amount of leakage exists between these islands, due to the particles of free caesium deposited on the mica during the photosensitizing process in manufacturing the tube. But generally this leakage is quite low in value and does not disrupt the operation of the tube. Briefly operation is as follows:

1. A light image is projected on the mosaic.
2. Photoelectrons leave the photosensitive islands and flow to the collector so that each island charges up to a potential depending upon the light intensity of that portion of the image which illuminates it.
3. The negative, commutating, scanning beam discharges the positive, photoelectric charge accumulated.
4. The discharge current which is capacitively coupled to the signal-output plate generates an electrical signal for each island contacted, as the electron beam commutates these islands in succession during the scanning process.

This type pickup tube, although not without disadvantages, has several advantages.

1. Good signal to noise ratio at reasonable light values
2. Signal to noise ratio does not vary substantially between low definition pictures and pictures of approximately 500 lines definition. (Except that noise increases with square root of bandwidth required)

Disadvantages of the tube are:

1. The output of the tube is very low,

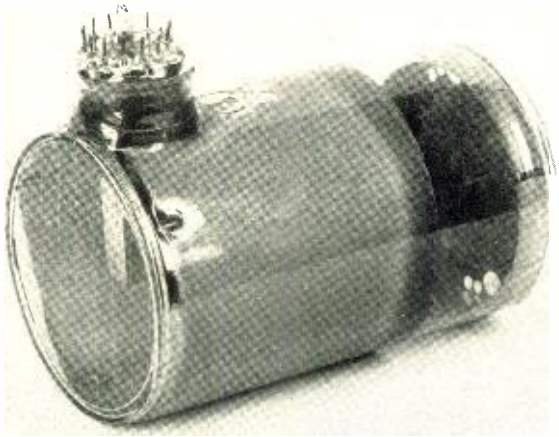


Fig. 3. Typical image dissector tube.

usually in the order of 2 millivolts peak to peak.

2. Shading compensation is necessary.

3. Since an electron gun is used, the tube has a limited life.

The other type tube is the image dissector, and is known as an instantaneous type. The action of this tube is altogether different than that of the iconoscope. A picture of a typical image dissector is shown in Fig. 3.

This tube comprises a photosensitive cathode of the caesium-oxide-silver type, arranged in an evacuated envelope opposite an optical window. An 11-stage electron multiplier, placed directly inside of the optical window, contains an aperture, usually square and varying in dimensions from 5 mils to 80 mils. The size of the aperture will vary with the amount of detail desired, that is, the higher the definitions desired the smaller will be the aperture. Size and shape of the aperture may vary from tube to tube, depending upon the magnification of the electron image between cathode and aperture, and the resolution desired. This electron image extends outward from the cathode like bristles in a brush, usually diverging from the cathode. It is possible to obtain a blow-up in image-size up to 2½ times, according to the type of magnetic focussing-field utilized. The extended electron image is focussed in the plane of the aperture by a longitudinal field parallel to the axis of the dissector. This image is deflected across the aperture, either horizontally or vertically, or both, by rectilinear, sawtoothed magnetic fields, arranged at right angles to one another. The tube is relatively non-microphonic.

As the extended image is scanned across the aperture, the portion of the extended space current entering the multiplier is proportional, at every instant, to the part of the extended-image current density at which the aperture is looking. Aperture current is proportional to the area of the aperture, illumination on the cathode, and photosensitivity of the cathode. The photosensitivity is approximately 20 microamperes per lumen, and there are approximately $10^{-10}$ amperes entering a 40-mil aperture at any instant of time, when the cathode illumination is 40 foot candles. This varying current, after passing through the aperture, strikes the plate of the first multiplier stage. The multiplier stages are coated with a secondary emissive surface and each multiplier stage has a gain of 3 or 4 when the voltage per stage is 200 volts. Total gain of the 11-stage multiplier is approximately one million.

The signal to noise ratio of the dissector varies as the square root of the aperture area. However, the resolution obtainable with the dissector varies inversely as the aperture length. From the above, it can be seen that the dissector with a given amount of light will give a good noise-free picture where the resolution requirements are not too severe. If definition in the order of 500 lines is desired, the picture may be noisy unless an extremely large amount of light is used on the cathode. The advantages of the image dissector are:

1. No shading is necessary.

2. No electron gun is needed. Therefore the tube has unlimited life, if carefully treated.

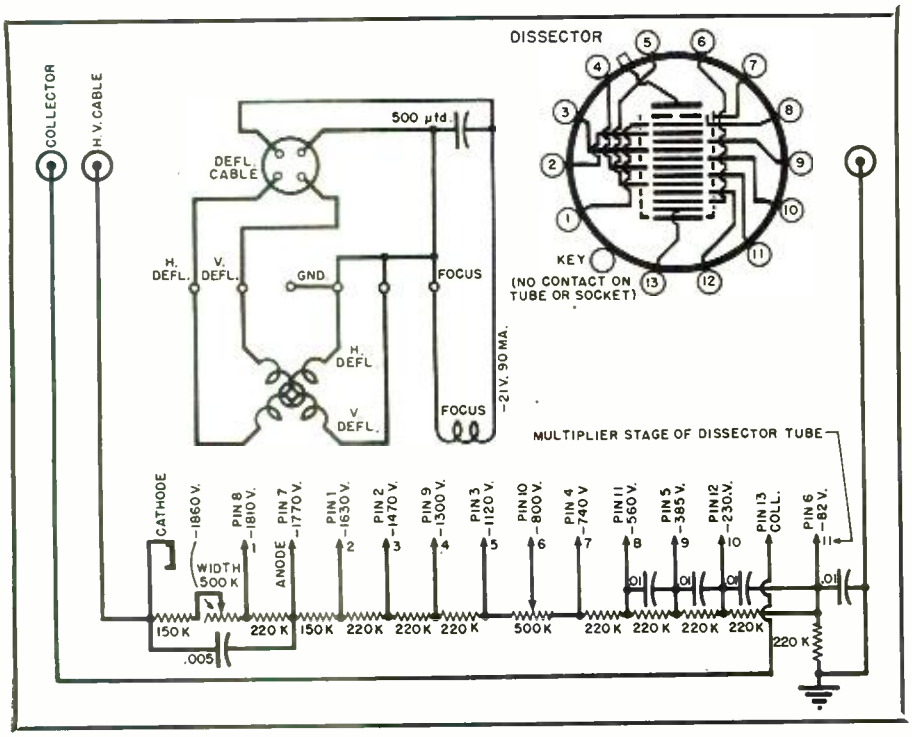
3. There is high signal output which eliminates need for many video amplifier stages which are inherently microphonic.

The disadvantage of this type is that signal to noise ratio is much poorer than that of the iconoscope, except in cases where large values of light are available or the maximum resolution is in the order of 200 lines or less. Actually this is the only disadvantage of the dissector, but it eliminates the dissector as a direct pickup tube for commercial television. With present-day light sources the deflection problem is slightly more severe with the dissector. It is necessary to correct for Keystone distortion in the iconoscope, but it is necessary to have a well designed coil system for the dissector to eliminate S distortion. It is, however, a highly desirable tube to use in conjuction with a motion picture projector where the light level can be made very high conveniently.

Since military applications did not require high-resolution pictures (pictures beyond the order of 200 or 250 lines resolution) the dissector made an ideal pickup tube for use in simple television systems which could be used under conditions of light values of 2½ f.c. or more on the pickup tube cathode.

In 1940, the NDRC approached *Farnsworth Television & Radio Corporation* and asked them to develop a

Fig. 4. Schematic diagram of the image dissector pickup unit.



simple television system which could be used primarily in conjunction with the guided missile projects. The outcome of this development was a simple television system capable of showing over 200 lines resolution with light values comparable to the light available on a cloudy day. The equipment was capable of transmitting the picture satisfactorily over five miles.

This complete transmitter consisted of only 13 tubes including the image dissector and was powered completely for over thirty minutes from a small 12-volt storage battery.

In September, 1945, *Farnsworth* was requested by the *Diamond Power Specialty Corporation* to undertake development of a simple television system for use in power stations. The most urgent need for this type equipment was to enable the man in the control room of the power house to be able to see the water gauges on the boiler which was usually located 300 or 400 feet from the control room. At that time the only means available for transmitting this picture to the control room was a complicated system of mirrors which obviously was very unsatisfactory. Requirements of this type equipment were very rigid.

The primary design characteristic of the equipment places emphasis on simplicity, freedom from service trouble, and continuous unattended performance over long periods of time. The *utiliscope*, as the equipment will be referred to, was designed as an operating system containing the smallest number of vacuum tubes considered adequate for the purpose. It is a well known fact that failure in vacuum tubes is a prime source of service calls. It follows, therefore, that the fewer the vacuum tubes used, the less time for servicing.

Actually the system for this service must operate continuously 24 hours a day for three months. The equipment must run unattended during this time except that the monitor brilliance and contrast controls may be adjusted if it is desirable. At the end of this three-month period, which is over 2000 hours, all tubes but the picture viewing tube and the image dissector will be changed. The picture tube will be replaced after one year's operation but the dissector tube should never need be replaced unless broken. To date only a few dissectors have shown any falling off of operating characteristics due to aging, unless subjected to severe sudden temperature changes. The simplicity of structure of the dissector allows it to be subjected to considerable mechanical beating. Since the equipment was designed primarily for operation near the boiler of a power station, the ambient temperature conditions under which the equipment must operate sometimes measure 140° F. Although light was no problem in this case, 200 lines resolution was considered adequate. The bandwidth required to transmit this picture, only 1.5 megacycles, can very readily be transmitted by wire without appreciable attenuation up to distances of over 1000 feet.

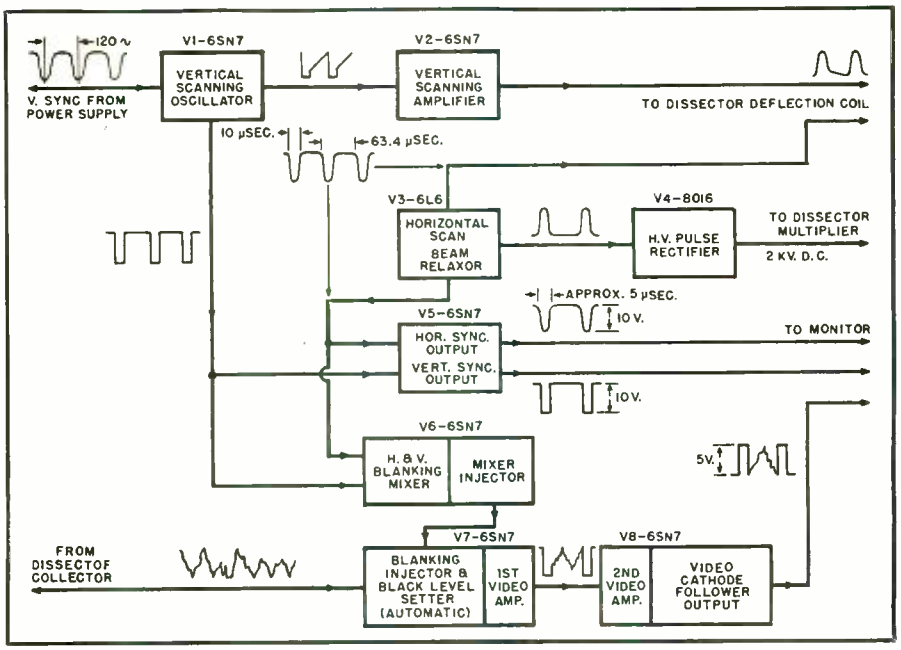



**Fig. 5. Block diagram of the deflection unit.**

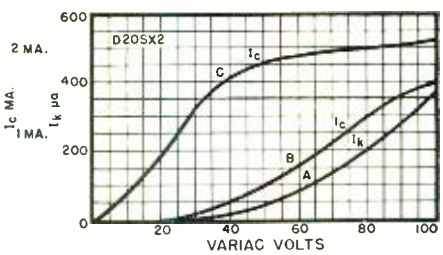
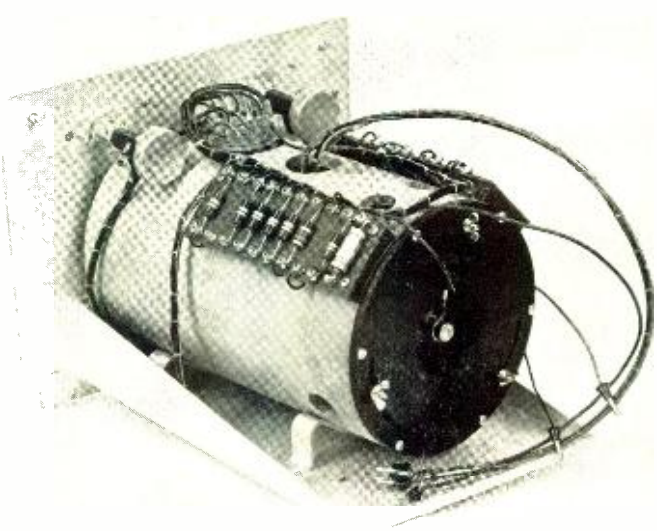



**Fig. 6. Saturation curves for electron multiplier. Curve A shows cathode current as it varies with light. B indicates collector current when gain of stage 6 has been reduced. C is curve showing saturation when 200 volts per stage is used.**

**Fig. 7. Sending end of the utiliscope.**

**Fig. 8. Rear view of camera pickup unit.**



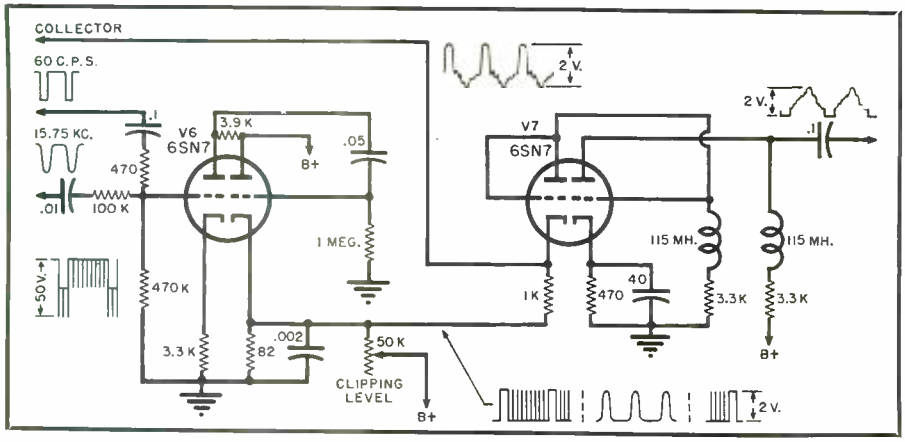



**Fig. 9. Circuit of the horizontal and vertical blanking mixer and mixer injector, and the blanking injector and automatic black level setter.**

Fig. 7 is the sending end of the utiliscope; the large case houses the dissector and its coil assembly in the lower portion, while the deflection unit circuits are contained in the upper portion. The small case includes the power supply, which delivers heater voltage and approximately 350 volts for the camera unit.

The equipment used at the receiving end of the system includes a large unit housing the monitor, which includes a standard 10-inch cathode ray tube. Aspect ratio of this equipment is 1 to 2 in keeping with the approximate aspect ratio of the water level gauge. A small unit houses the power supply which furnishes heater power and approximately 300 volts to the monitor.

Fig. 2 is a functional block diagram of the complete system. Item 1 is known as the camera or pickup unit and consists of the dissector, coil system, and voltage divider for furnishing proper voltages to the multiplier stages. Item 2 is the most complex unit and contains all deflection circuits and video circuits, as well as blanking and sync output circuits. Item 3 is the camera power supply and item 4 is the interconnecting cable between the camera position and the monitor position. This cable may be made over 1000 feet in length. 4 (right) is the monitor chassis which contains deflection circuits, video circuits and sync circuits associated with the picture tube. Item 6 is the monitor power supply. The complete equipment contains fifteen receiving type tubes, two receiving type rectifiers, one cathode ray tube and one image dissector.

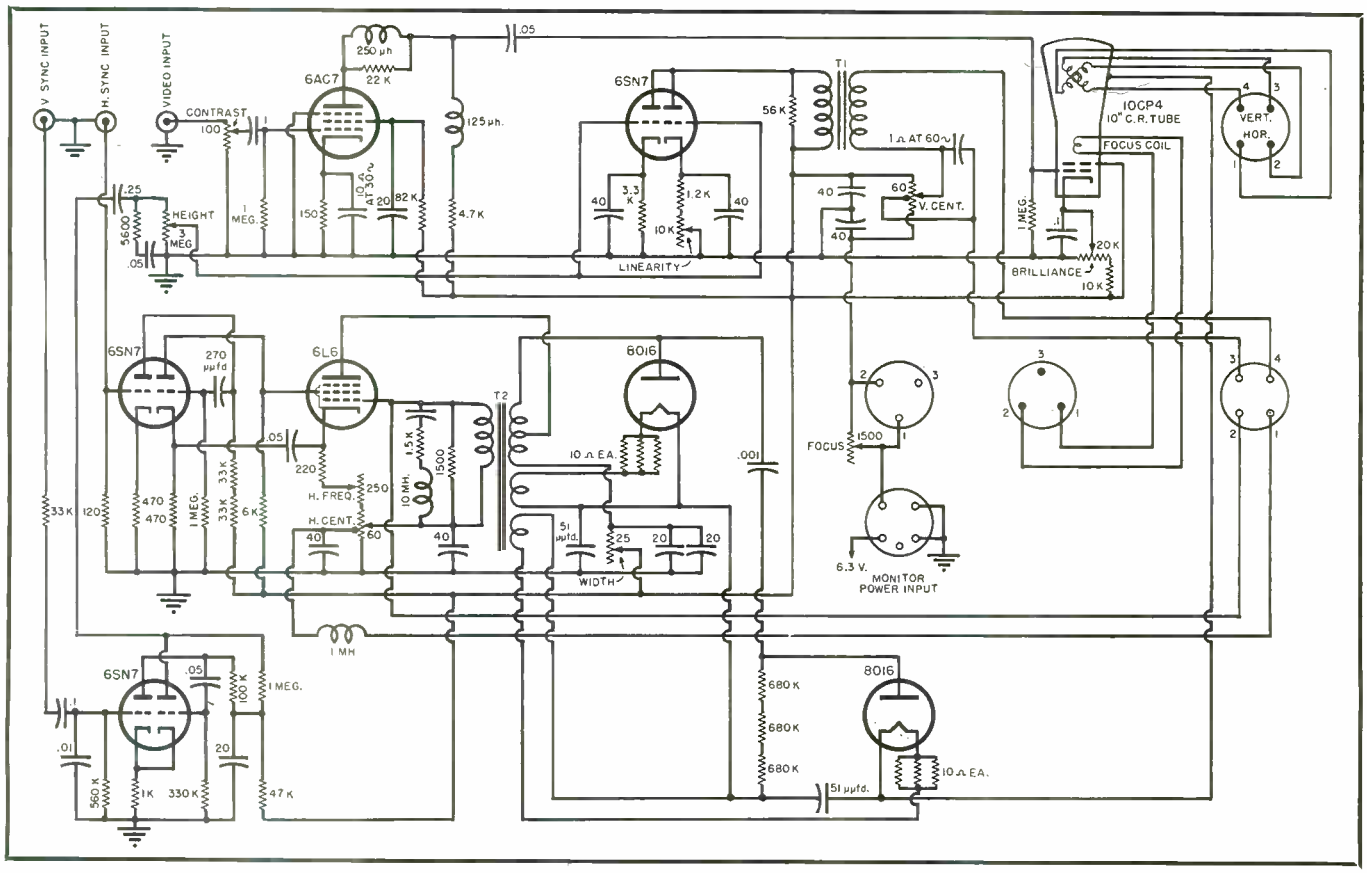
Fig. 11 shows a side view of the camera unit with the side of the case removed and Fig. 8 shows the camera or pickup unit removed from the case. This unit has the dissector deflection and focusing coils inside the bakelite housing. In addition, the multiplier voltage divider circuit can be seen on the side of the bakelite housing. There are two controls, width and video overload. These can be discussed by looking at Fig. 4 which is the pickup unit schematic.

The deflection sensitivity of the dissector is dependent upon the voltage between the photosensitive cathode and the anode, or multiplier. Therefore, the size control is simply a rheostat which varies this potential. Actually the gain of the dissector multiplier will vary from dissector to dissector between the limits of approximately 300,000 and somewhat over one million.

Dissector multipliers are generally operated at less than 200 volts per stage. But in order to realize as much

(*Continued on page* 30)

**Fig. 10. Complete schematic diagram of the monitor unit.**



# A 500-50,000 VOLT D.C. REGULATED SUPPLY

By ROY E. ANDERSON
General Electric Company

***Design and operation of a variable d.c. supply having excellent voltage regulation with low ripple content.***

A HIGH voltage power supply having unusually rigid specifications was developed recently at the *General Electric Company*. Originally intended for use with a parallel plate ionization chamber, it may find application in electron diffraction instruments, electron microscopes, various nuclear physics investigations and other applications requiring a low current power supply of wide voltage range, low ripple, exceptional regulation and stability.

The supply is entirely contained in a single cabinet of standard cross section seven feet tall. All controls are on the front panel, making operation of the unit very simple. A range switch chooses either of the two output voltage ranges, 500 to 5,000 volts or 5,000 to 50,000 volts and a control selects any voltage within a range. Fifteen turns of the control are required to cover a range. A turn counter and graduations on the control permit accurate setting and logging of the output voltage which is turned on and off by means of readily accessible momentary contact push buttons. A gravity operated grounding device shorts the output terminal to ground when the high voltage is turned off.

The input power requirements are 115 volts, 60 c.p.s., a.c. of commercial stability at ten amperes; output is 500 to 50,000 volts at a maximum of one milliampere. The ripple appearing at the output is between .006% and .04%, depending upon the voltage and load conditions. No load to full load voltage change is less than .02%. With constant load, the voltage drift is less than 100 parts per million per minute on the high range and less than 20 parts per million per minute on the low range.

Consideration of the problems presented by the wide voltage range and low ripple requirements led to the conclusion that a radio frequency type of supply would be best adapted to the purpose. The high frequency used makes filtering of the output relatively easy and results in smaller and lighter equipment than would be the case if power frequencies were used. Electronic control of the output voltage is feasible with the r. f. type of supply and the low short circuit current reduces hazard to operators.

The r. f. generator is a type 6L6 tube connected as a Hartley oscillator. By means of a capacitance decade unit, its frequency is variable in steps over a narrow range. Factors determining the oscillator frequency will be discussed later. The oscillator drives a pair of type 813 r. f. amplifier tubes in parallel which are biased to operate class C.

The tank coil of the amplifier is the primary of an air core transformer. The secondary of the transformer consists of five universally wound pies of litz wire with 500 turns per pie. This type of winding reduces the capacitance of the coil.

The secondary coil is connected to a ladder type voltage tripler circuit. A simplified diagram is shown in Fig. 3. Study of the diagram will reveal the means by which a d.c. voltage equal to three times the peak r. f. voltage of the coil appears across the load resistor. High voltage range output is taken across the tripler, while the low range output is taken from the plate of the first tube in the ladder circuit.

It will also be noted in Fig. 3 that the cathodes of the rectifier tubes must be operated far from ground potential. Thus filament transformers insulated for 50 kv. and having a very low capacitance and power factor were required. The lowest possible capacitance is necessary in order to permit a high operating frequency, since the capacitance of two of the trasformers is shunted across the coil. Low power factor is required in the interest of efficiency.

Filament transformers previously developed at the *General Electric Company* for use in a 50 kv. r.f. power supply for an electron diffraction instrument are used. These transformers are molded of polyethylene (Fig. 2). The secondary consists of a single turn of heavy wire embedded in the plastic block with its ends brought out through a coaxial connector. Just under the surface of the block, opposite

Fig. 1. Front view of the 500-50,000 volt regulated d.c. supply. A maximum output current of 1 ma. is available at any voltage within its range.

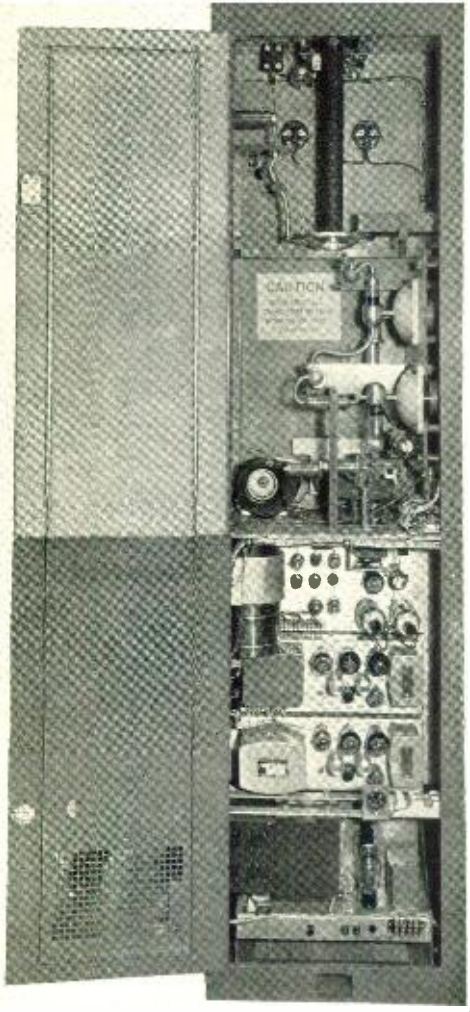
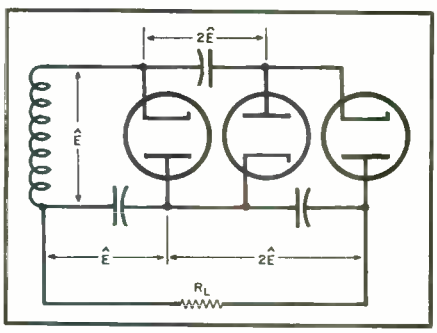


Fig. 2. Rear view of regulator with the door open.

the connector, is a faraday shield, operated at ground potential; thus all flux lines exist within the polyethylene. Primaries of the transformers are wound on bakelite forms and butted against the shield side of the secondaries. The three primary coils are wired in parallel and constitute the inductance of a one megacycle oscillator employing a type 6L6 tube. This tube is capable of supplying the filament power because the rectifiers are type 8016 tubes requiring only 1.25 volts at .20 amperes to heat the filaments.

The frequency of the power supplied to the high voltage coil and rectifier circuit is determined by the self resonant frequency of the transformer

Fig. 3. Simplified diagram of the voltage tripler circuit.




secondary circuit. This is kept as high as possible in order to make adequate filtering possible with small values of capacitance. The secondary resonant frequency is set by the inductance of the secondary coil and the capacitance which shunts it. The latter is the sum of several capacitances—that of the coil itself, two of the three plastic filament transformers, the capacitance voltage divider used in the first regulating loop, tube capacitances and stray wiring capacitance. The sum was estimated as 65 $\mu\mu$fd. Inductance of the coil was measured as 187 mh. From this the resonant frequency was calculated to be 45.5 kc. This was verified closely by a measurement made by applying a variable frequency signal from a constant voltage source to the untuned primary coil, and measuring the frequency at which maximum voltage appeared across the rectifier output.

Tuning of the primary was accomplished by applying an a.c. voltage at the secondary resonant frequency from a constant current source across the primary tuned circuit and observing the d.c. voltage at the output of the rectifier. The output voltage under this condition has two amplitude peaks, one on each side of the secondary resonant frequency, since the transformer is greatly overcoupled. The primary was varied until the two peaks were separated equally in frequency from secondary resonant frequency. This occurs when the primary and secondary are tuned to the same frequency. Oscillator frequency is adjusted to the same as that of the low frequency peak, about 40 kc., as operation at this peak was found to be more efficient than at the other. Theory pertaining to these adjustments will not be treated here but may be found in the literature.[1]

## The Regulating Loops

The high degree of regulation of the power supply is achieved by using two regulating loops. The first, an r.f. amplitude regulator, samples the radio frequency voltage appearing across the secondary of the r.f. transformer, rectifies it, compares it with a reference voltage, and by means of a d.c. amplifier controls the screen grid voltage of the type 813 r.f amplifier tubes. The second loop, the series tube regulator, samples the d.c. output voltage, compares it with a carefully stabilized reference voltage, and regulates the output by means of a d.c. amplifier and a series regulating tube.

### *The R.F. Amplitude Regulator*

The first regulating loop employs a capacitance voltage divider consisting of two 50 $\mu\mu$fd. vacuum capacitors and a mica capacitor in series as shown in Fig. 4. A different mica capacitor is used on each range to give the correct voltage division. The r.f. appearing across the mica capacitor is rectified by a type 6H6 tube, $V_{13}$, and the rectified voltage is compared with a reference voltage derived from a 1.0 megohm potentiometer shunting a type VR75 voltage regulator tube, $V_{12}$. The difference between the two voltages is impressed upon the grid of the first tube in a two stage d.c. amplifier employing two type 6SH7 tubes, $V_{11}$ and $V_9$. The second stage of this amplifier controls a type 6V6 tube, $V_8$, connected as a cathode follower which in turn controls the screen grid voltage of the type 813 tubes and thus the amplitude of the r.f. voltage appearing across the secondary coil.

The type VR150 tube, $V_{10}$, connected in the cathode of the second 6SH7, $V_9$, (Fig. 4) serves to fix the bias for that tube. The type VR150, $V_7$, in the plate circuit of $V_8$ is to limit the maximum positive excursion of the screens of the r.f. amplifier tubes so that under no circumstances will the screen voltage exceed 250 volts. Should this occur the output voltage would be excessively high and damage would result to components in the high voltage section or to the load.

The $\mu\beta$ of the first regulating loop, that is, the product of the amplification around the loop multiplied by the voltage division ratio, is calculated to be 15,000 on the high range, and 3800 on the low range. This is the factor by which the fluctuations in the r.f. voltage across the secondary of the high voltage transformer should be reduced. Actually, the circuit does not meet the calculated performance. The reason for this has not been completely explained but it is believed to be due to the difference in response of the high voltage rectifier circuit and the type 6H6 tube, $V_{13}$ (Fig. 4), to non-sinusoidal waveforms which result from loading the high voltage transformer secondary.

Regulation of the basic power supply was found to be very poor. This is due to the tendency of the r.f. amplifier tubes to maintain a constant voltage across the primary coil and is more or less inherent in such power supplies. An increase in load current will result in an increase in an equivalent series resistance of the secondary tuned circuit. This effectively reduces the series impedance of the primary, increasing its shunt impedance and resulting in a reduction in the power supplied. This reduces the output voltage.

The first regulating loop improves the regulation so that no load to full load voltage change is about three per-cent with only that loop operating.

### *The Series Tube Regulator*

The second regulating loop samples

the voltage appearing at the junction of two series resistors across the d.c. output of the power supply (Fig. 4). On the high voltage range the two series resistors are 500 megohms and three megohms, on the low range 50 megohms and three megohms. The three megohm resistors are not connected to ground but to the variable contact of a 15 turn potentiometer of 50,000 ohms across which the reference voltage is applied. Voltage between the variable contact of the potentiometer and ground is positive and the voltage between the power supply output and ground is negative. The junction of the three megohm resistor and the 500 megohm resistor, and thus the grid of the type 1634 tube, $V_{16}$, is very nearly at ground potential. It is kept there by the action of the d.c. amplifier which employs pins 6, 3 and 2 of $V_{16}$, pins 6, 4 and 5 of $V_{13}$, a type 6SL7 tube, and the type 2C53 series regulating tube, $V_{14}$.

The type 2C53 tube is a triode having the unusually high amplification factor of 500 and is designed to operate with plate potentials as high as 8000 volts. It is connected with its plate on the low voltage side of the rectifier-tripler circuit and its cathode to ground. It is, therefore, in series with the output. When some action occurs to change the output voltage, the d.c. amplifier acts to cause virtually the entire change to appear across the series tube, keeping the potential of the output terminal constant with respect to ground.

A convenient place to connect the output current meter was found to be the cathode of the series regulating tube. The meter, at ground potential, eliminates the mounting problem that would arise if the meter were to be connected in series with the output terminal. The disadvantage of connecting it in the chosen position is that it reads the voltage divider current as well as the load current. If load current must be known accurately, the divider current may be readily calculated and subtracted from the meter reading.

The $\mu\beta$ of the second regulating loop, and hence the factor by which the output voltage fluctuations should be reduced by the second regulating loop, is 2700 on the high range and 27,000 on the low range.

The output voltage change from full load to no load at 50 kv. is actually .013%. The calculated change in output voltage is the change without the second loop divided by $\mu\beta$, or .0011%.

The discrepancy is probably due to the change in d.c. plate current of the first amplifier tube caused by the change in the ripple voltage applied to the grid. Application of an a.c. voltage to a tube having non-linear characteristics will result in a slight change in d.c. plate current. This is of the right order of magnitude to explain the ten to one reduction in the expected performance. The change in output voltage is actually 6.5 V.

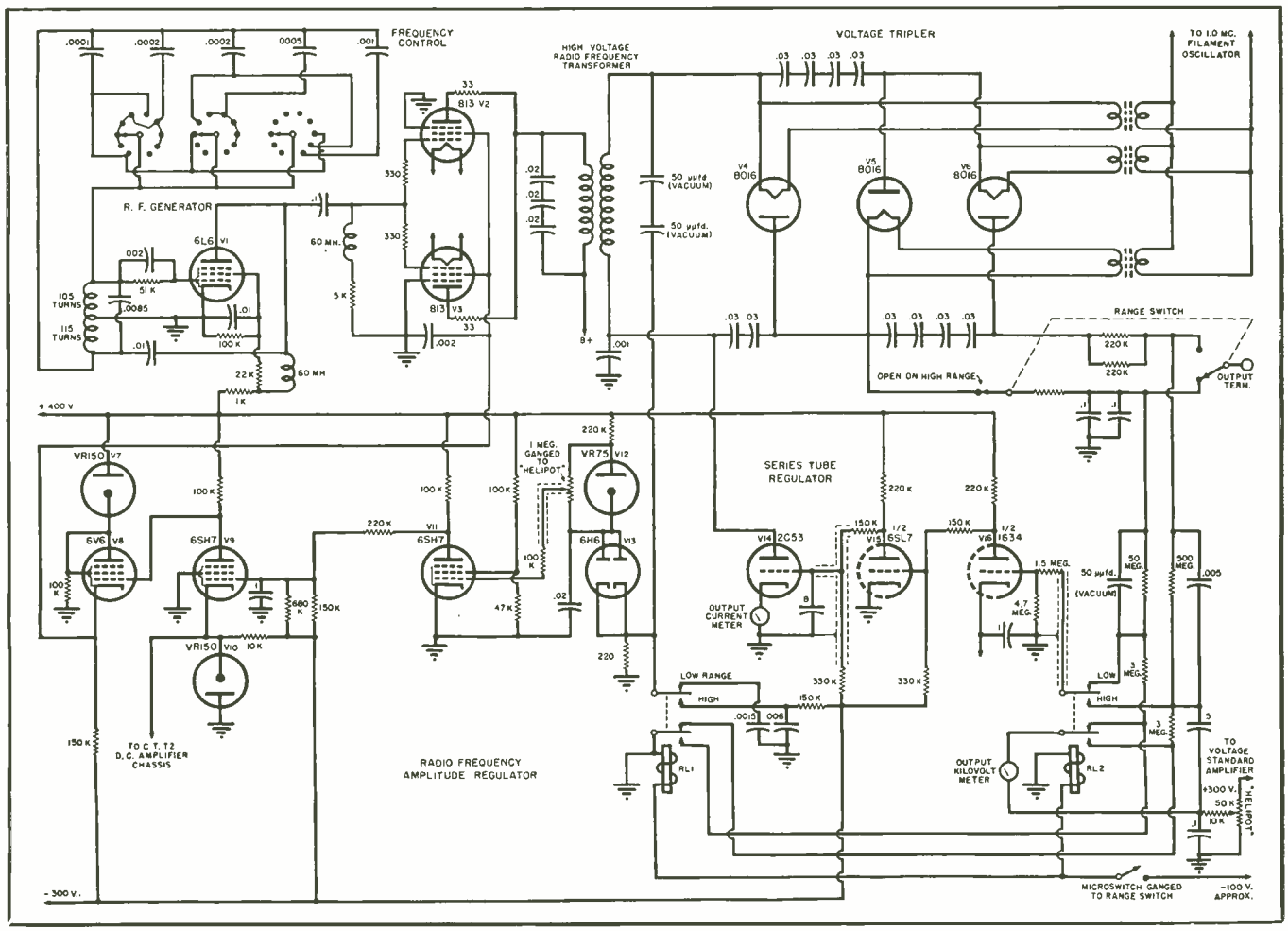
The gain of the circuit from the plate of the first amplifier tube to the output is 10,600. Consequently the plate current change in the first tube required to cause the voltage change is only $2.6 \times 10^{-9}$ amperes.

The values of resistance chosen in the output voltage divider fix the maximum divider current at 0.1 ma. on each range. It is proportional to the output voltage. The output voltmeter is a 0-100 microampere meter with a scale which reads 0-5 kv. connected so that the bleeder current flows through it. The proper multiplication factor, unity on the low range and ten on the high range, makes the output voltmeter convenient to read.

## Stability

The stability of the output voltage can be no greater than that of the ref-

**Fig. 4. Circuit diagram of the radio frequency amplitude regulator and the series regulator.**



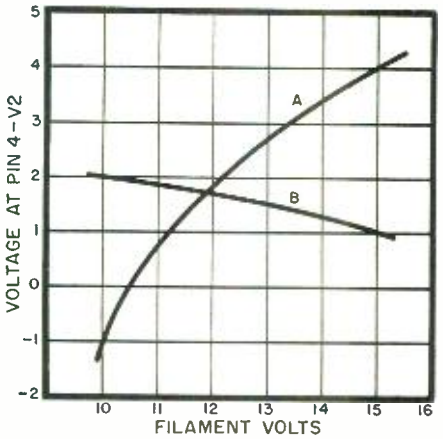



**Fig. 5. Improvement in regulation resulting from the use of the contact potential amplifier (curve B) over that without the amplifier (curve A).**

erence voltage with which the sample of the output is compared. A dry cell battery is very stable if its temperature is constant and if no current is drawn from it. Accordingly, a 300 volt battery of small physical size was chosen as the primary reference. It is wrapped in a thick layer of glass wool and mounted in a dewar flask to prevent a rate of temperature change that would result in excessive drift rate.

In order that no current be drawn from the battery, it is connected only in the grid circuit of a d.c. amplifier called the voltage standard amplifier, (Fig. 6) comprised of pins 6, 4 and 5 of $V_1$, a type 1634 tube, pins 4 and 5 of $V_2$, a type 1634 tube, and pins 6, 4 and 5 of $V_3$, a type 6SN7 tube. It is a two stage amplifier with a cathode follower output and 100 per-cent feedback. Output voltage is the same as the input voltage and is stabilized by the large feedback factor of approximately 2500.

The output of the d.c. amplifier is applied across the 15 turn potentiometer, which is ganged to the 1.0 megohm potentiometer across the reference voltage source in the r.f. amplitude regulator. These ganged potentiometers are rotated by the output voltage control on the front panel.

In conjunction with the reference voltage d.c. amplifier is another regulating loop designed to reduce the effects of contact potential at the input of the first tube. The term "contact potential" refers to the potential difference between grid and cathode of a vacuum tube due to initial electron velocities and the junction of dissimilar metals. The "contact potential" change may be due to changes in heater voltage and to changes in the emissivity of the cathode surface. In a vacuum tube circuit the result is the same as though an additional voltage generator were placed in the grid circuit. The circuit for reduction of this effect in the voltage standard amplifier utilizes the cathode and pins 2 and 3 of the type 1634 tube, $V_1$ (Fig. 6) pins 2 and 3 of the type 1634 tube, $V_2$, and pins 1, 3 and 2 of the type 6SN7, $V_3$.

The type 1634 is the same as the 12SC7 tube except that it is especially selected for equal mutual conductance of the two triodes. A single cathode structure serves for both triodes, and it is assumed that changes in cathode emission will be very nearly the same for both triodes.

Operation of the circuit is easily understood. When a change in contact potential occurs, it results in a change in plate current and in potential of the cathode of $V_1$, due to the 35 k. resistor (Fig. 6) connected from the cathode of $V_3$ to a fixed bias potential. As the grid, pin 3 of the type 1634 tube, $V_1$, is connected to ground, this results in a change of the grid to cathode potential of that triode and a consequent change in plate current and voltage. This signal is amplified by ½ of $V_1$ and ½ of $V_2$ and applied back to the 35 k. cathode resistor, which is common to $V_1$ and $V_3$. The signal is in the proper direction to oppose the original change.

The factor by which the contact potential effects are reduced due to the amplifier alone is equal to the gain of the amplifier, which is 1500.

Fig. 5 shows the actual measured improvement gained in the reduction of effects due to heater voltage changes with the amplifier. The voltage was measured at the grid, pin 4, of the type 1634 tube, $V_1$, in the voltage standard d.c. amplifier. Curve $A$ is without the contact potential amplifier and curve $B$ with the amplifier operating. The slope of $B$ is opposite to that of $A$ and the correction falls far short of that which would be due the amplifier alone, indicating that the two halves of the 1634 tube used were not well matched for equal plate current for a given grid voltage, or else that the two cathodes did not have exactly the same change of contact potential with heater voltage change.

*Reduction of Corona*

A study of the series tube regulator in Fig. 4 will reveal that instability of the output voltage would be caused by fluctuating corona currents from points between the ends of the output voltage divider resistors to other components or to ground, resulting in an incorrect ratio of voltages across the divider. To prevent this from occurring on the 500 megohm resistor, corona shields were installed. These consist of an 8 inch diameter disc at one end and a wheel of the same diameter at the other.

It is important to reduce corona to a minimum in an r.f. type of power supply, as power losses in air due to corona at high frequencies may become appreciable. Conductors not protected by corona shields have a minimum radius of curvature of one fourth inch. The connectors at high potential are made of phosphor bronze spring. All components and conductors are mounted to give a minimum spacing of one inch per ten thousand volts. This allows a safety factor for scratches or dust particles on the surfaces. As a further precaution against corona, the high voltage section is sealed and operated at low humidity. Moisture is removed from the air by installing bags of silica-gel dessicant.

*Reduction of Temperature Effects*

The temperature coefficients of the resistors in the voltage divider are important, for if they are not equal or if the power dissipation is such that the temperatures do not change at the same rate, the ratio of voltage division will change. Resistors having a very low temperature coefficient were not readily available in the required resistance and voltage ratings. Therefore it was necessary to provide a means of preventing the temperature of the resistors from changing at a rate which would cause the output voltage to vary faster than the allowed drift rate.

The temperature coefficient of resistors used in the divider is .05% per degree centigrade. From data provided by the manufacturer it was determined that the temperature rise would be 5°C.

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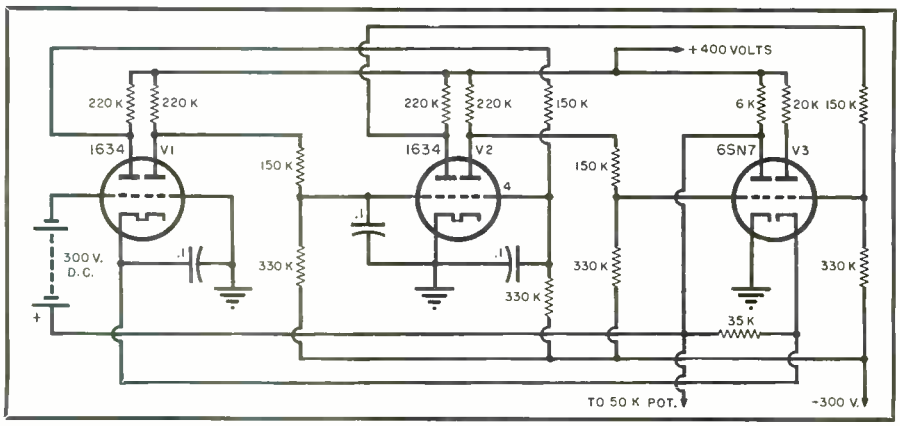
**Fig. 6. Circuit diagram of the voltage standard amplifier.**



# INDUCTION-HEATER POWER OUTPUT MEASUREMENTS

By R. A. WHITEMAN

Consulting Engineer

***Various methods of measuring the power output of induction heating units, with emphasis on a calorimeter method developed by the author.***

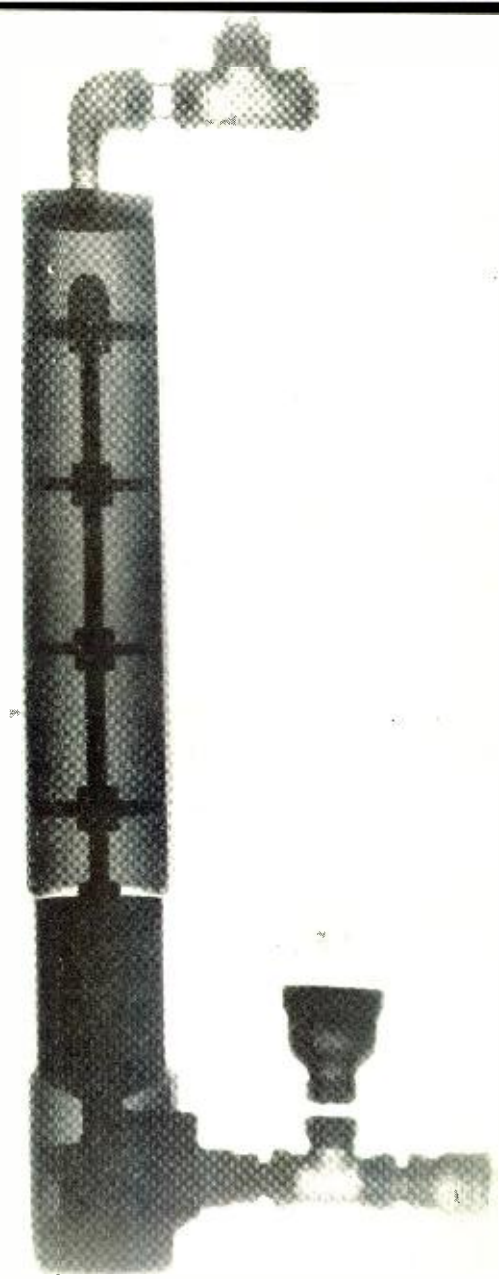


Fig. 1. X-ray photo of assembled calorimeter showing the baffles which produce water turbulence.

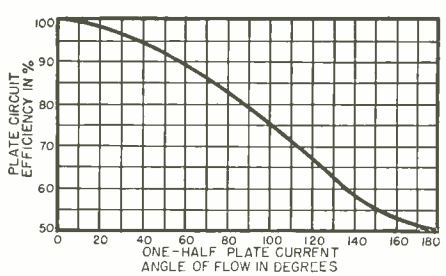
THE h.f. power output measurements made on an induction heating unit yield extremely important quantitative data associated with this type of equipment. Whether the unit is in the developmental stage, final inspection or on the production line, h.f. power output measurements provide basic information concerning the performance of the unit under operating conditions. It is a fact that an h.f. induction heating unit that has been adjusted or designed for a load using magnetic material will not, in general, provide the same power output when the same geometrically shaped load is non-magnetic. Although the same power output may not be required for different applications of the same induction heating unit, it is advisable as well as desirable to know the performance of the unit under specific load conditions.

From the point of view of the design engineer it is extremely important that he know the functional relation between the h.f. power output and such parameters as the grid bias, plate voltage and percentage feedback. With a knowledge of this data, the design engineer can easily make final adjustments of these parameters to obtain the precise operating point desired.

To illustrate the value of knowing the power output of an induction heating unit, consider the following set of adjustments used during the design checks on a 15 kw. heating unit. The power oscillator tube was the *Westinghouse* water-cooled type 892 with 13,500 volts applied to the anode. With the unit turned on and loaded with a calorimeter of the magnetic type, the d.c. plate current was 1.9 amperes and the d.c. grid current was 180 ma. These two current values alone indicated, with the aid of the characteristic curves of the 892 tube, that the power oscillator was working near the desired operating point. However, the measurements obtained with the calorimeter showed that the power oscillator was operating under very unfavorable conditions by giving a measured output power of only 11.0 kw. With a power input of 25.65 kw., the plate-circuit efficiency under these conditions was only 42 per-cent. There were two basic reasons why the efficiency of this power oscillator was so low. The first may be best explained with the aid of the concepts of plate current angle of flow and the second deals with the impedance match between the oscillator tube and the load. Without the proper impedance match, maximum power output was not attained and with the angle of flow more than 180° the efficiency was necessarily low.

If the percentage feedback is equal to the maximum permissible value without over-driving the grid circuit, then the efficiency will be a function of the plate current angle of flow, as shown in the graph of Fig. 2. If, however, the percentage feedback is insufficient, then the efficiencies as determined by Fig. 2 must be modified by a factor considerably less than unity. The numerical value of this factor is not important in order to improve the performance of the power oscillator but every effort should be made to increase its magnitude. The grid resistance was initially 5500 ohms and was increased to 10,000 ohms with the object of increasing the grid bias voltage and decreasing the plate current angle of flow. This change alone would decrease the input as well as the output power. The efficiency would necessarily increase but the unit would be operating far below its rated output. To compensate for the decrease in power, the percentage of the output voltage fed back to the grid circuit was

Fig. 2. Efficiency of power oscillator with maximum permissible feedback.



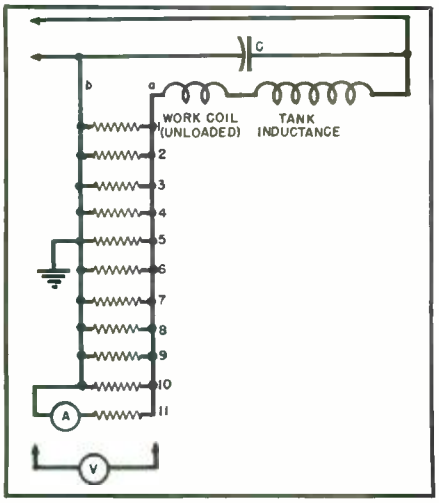



Fig. 3. Method of determining r.f. power using non-inductive antenna load resistors and ammeter or voltmeter.

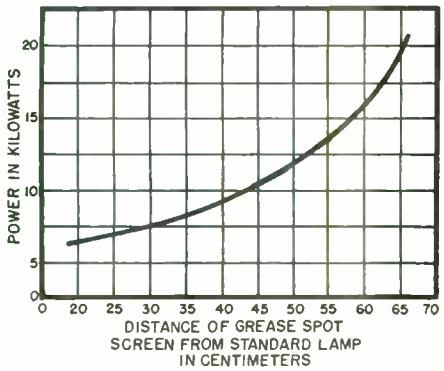



Fig. 4. Calibration curve of photometric load showing non-linear relation between power and photometric load.

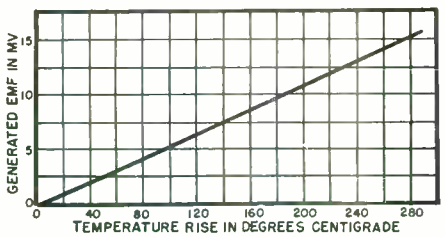



Fig. 5. Calibration curve for an iron-constantan thermocouple.

increased in accordance with Eqt. (1):

$$B = -\left(\frac{1}{\mu'} + \frac{\beta R_a}{\mu' Z_a}\right) \quad \ldots\ldots (1)$$

which is Barkhausen's modified formula for the feedback type oscillator, where $B$ is the percentage feedback, $\mu'$ is the modified amplification factor of the tube under oscillating conditions, $R_a$ the a.c. anode resistance, $\beta$ a function of the angle of plate current flow, and $Z_a$ the load impedance.

The set of recorded values obtained after the grid resistor was changed to 10,000 ohms and the percentage feedback increased was 170 ma. of grid current, 1.9 amperes of plate current, with a power output of 17.5 kw. With this arrangement the operating efficiency was 68 per-cent and the plate dissipation 8.1 kw. These results were achieved far more rapidly with the aid of the power output measurements than if they were attained by a trial and error procedure based upon qualitative results.

Another very interesting design application facilitated by h.f. power measurements was the design of current transformers for induction heating purposes, which has been described previously.[1] Although the mathematical procedure was given in that article for the design of a typical r.f. current transformer, the formulas presented were verified with the power output measurements using an induction heater calorimeter. The actual power output measurements in this design problem helped considerably to outline the procedure and serves to emphasize the importance of r.f. power output measurements applied to induction heating equipment.

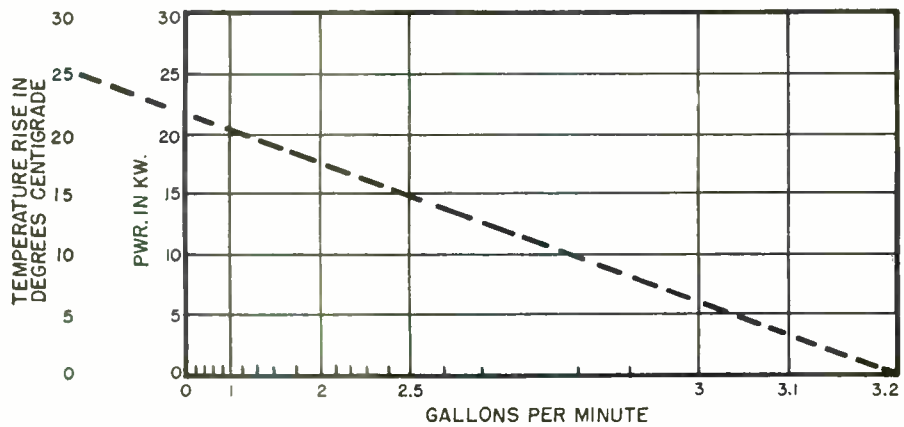
The measurement of power at audio frequencies has been developed to such an extent that commercial wattmeters as well as phase angle meters are available. These instruments have been designed and constructed to operate satisfactorily regardless of the particular application and therefore apply to many different types of low frequency circuits.

The situation concerning the measurement of r.f. power, however, is considerably different, and upon investigation one finds that any instrument available for the measurement of high frequency power is very limited in its field of application and cannot be applied to different types of circuits.

The types of r.f. circuits considered in this article are limited to those found in induction heating equipment and any method of measuring the high frequency power of these circuits may not conveniently provide a method of measuring the power in other types of circuits. There are five basic methods of measuring the high frequency power delivered by an induction heating unit. The first two methods are primarily of academic interest but will yield an answer if no other method is available. The latter three are by far the most practical to use and should be seriously considered for r.f. power measurements. These methods will be discussed and are briefly tabulated as follows: (1) using a series-parallel combination of non-inductive antenna-load resistances with one or two r.f. ammeters; (2) photometric measurements; (3) r.f. wattmeter method; (4) measurement of total losses of water-cooled tube; and (5) calorimeter measurements of power output.

The first method of measuring the high frequency power consists of using a number of non-inductive antenna-load resistors connected in series-parallel combinations to give the required load resistance to the high-frequency heating unit. When using antenna-load resistors for power measurement purposes, one or two r.f. ammeters or an r.f. voltmeter should be available to make certain measurements. The connections to the power oscillator tank circuit are shown in Fig. 3 with the non-inductive load resistors connected in series with the unloaded work coil. If this method of measurement is used when the work coil includes an r.f. transformer, then the resistors should be connected in series with the primary of the current transformer. The work coil should be unloaded but should remain connected to the secondary of the current transformer. To illustrate the procedure with typical test data, consider that the induction-heating unit was capable of delivering 10 kw. of r.f. power to the loaded work coil and also that the resistance introduced into the inductive branch of the tank circuit was 6.5 ohms. The resistance of 6.5 ohms was simulated by connecting eleven 72 ohm antenna-load resistors in parallel (Fig. 3). This actually introduced 6.54 ohms across the terminals marked $a$ and

Fig. 6. Nomogram for determining power in kw. from calorimeter measurements. Dotted line shows example. Flow was 3.2 gal. per min., and temperature rise was 25°C. Line connecting these two points shows output power of 21.4 kw.



*b*. Since terminal *b* is at r.f. ground potential, an r.f. ammeter was connected in the ground side of one of the load resistors and the current noted. This particular power oscillator was shunt fed so there was no d.c. passing through the inductive or load branch of the tank circuit. If, however, this had been a series-fed circuit, the ammeter would have indicated the total effective current and the r.f. current would have to be computed from.

$$I_1 = \sqrt{I_m^2 - I_{dc}^2} \quad \ldots\ldots\ldots\ldots (2)$$

where $I_m$ is the meter reading and $I_{dc}$ is the d.c. plate current. In the case of the shunt fed circuit $I_{dc}$ is zero and the formula also applies to this problem. This value of r.f. current squared and multiplied by 72 ohms gives the power in watts absorbed by one of the resistors. The total power absorbed by the load, or in other words the power delivered by the power oscillator, was eleven times the power absorbed by one resistor. In this particular case the current was 3.7 amperes and the total power was 10.8 kw. As a check on these figures an r.f. voltmeter was used in order to measure the r.f. voltage across one of the resistors. This was found to be 270 volts r.m.s., which actually appeared across 6.54 ohms. The calculated power obtained from these measurements yields 11.2 kw., which is a satisfactory check for this method of test. In order that these load resistors dissipate the heat generated during the test measurement, each resistor selected was rated at 1.0 kw. It is quite obvious that this method of determining the power output of induction heating units is not always applicable to large units where 20 and 30 kw. output are expected. Extreme care must be taken at all times during the test to insure that extraneous inductances and capacitances are not introduced into the load circuit. For that reason, it is not advisable to use long leads or too many load resistors of the dummy antenna type.

Another method which has been used, with some difficulty but a fair degree of success, is the photometric test method. This was used some years ago to measure the power output of small radio transmitters and seemed worth trying when measuring the power output of induction heating units. Instead of using dummy antenna resistors exclusively, as in the last application, a set of 10 antenna resistors rated at 1 kw. each was connected in parallel with a 1 kw. incandescent lamp. This dummy load was capable of dissipating a total of 11 kw. with the incandescent lamp glowing at full brilliance. With 11 kw. as one of the calibration points the resistor load was further calibrated

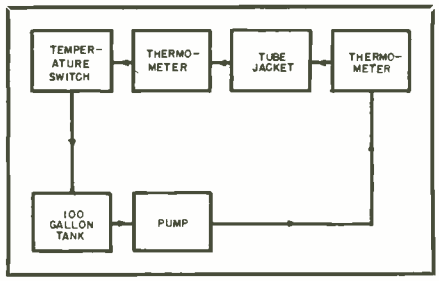



Fig. 7. Layout of cooling water system for measuring power loss.

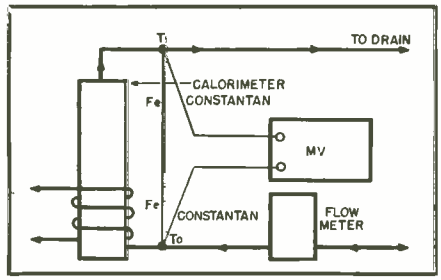



Fig. 8. Method of connecting thermocouples to indicate temperature difference.

with the aid of a 60 cycle power line and a voltmeter and ammeter. To convert these calibrated points to a photometric scale, a standard 6 volt lamp operated with batteries was used as a comparator in a grease-spot type photometer. The location of the photometer scale was fixed 15 feet from the resistor load and the position of the grease-spot screen was adjusted until the intensity of illumination from the incandescent dummy load balanced the standard lamp. The power supplied to the dummy load was noted, as well as the distance of the screen from the standard lamp. A graph was prepared in which kilowatts of power supplied to the load was plotted along the ordinate, and the distance of the screen from the standard lamp along the abscissa (Fig. 4) and was used as a calibration chart.

In order to apply the photometric method to an induction heater, the load was inserted in the inductive branch of the tank circuit as indicated in the first method using non-inductive resistors in conjunction with an r.f. ammeter and r.f. voltmeter. The same induction heating unit was used when measuring the power with the dummy antennas so that an interesting comparison could be made. With the full power supplied to the load, the photometric screen indicated a balance in the intensities of illumination at a distance of 45 cm. Referring to Fig. 4, the power corresponding to a distance of 45 cm. is 10.2 kw. and checks quite well with the current and voltage methods using non-inductive resistances exclusively.

Another method of measuring the r.f. power output of an induction heating unit employed in the past makes use of a direct reading wattmeter. Instruments which are capable of performing this function have been described.[2] This type of instrument was not available to compare directly with the calorimeter; furthermore it cannot be connected to different heating units and used immediately without a distinct calibration procedure.

The fourth method of measuring the r.f. power output of a water-cooled tube or set of tubes was indirect and was actually accomplished by measuring the

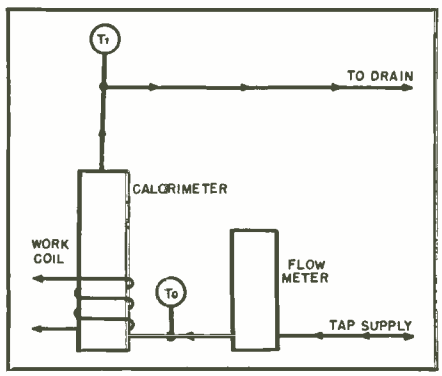



Fig. 9. Block diagram of calorimeter connections showing direction of water flow.

power input and the power loss. In the power-oscillator circuit, the power input was readily obtained by measuring the d.c. voltage and current from the power

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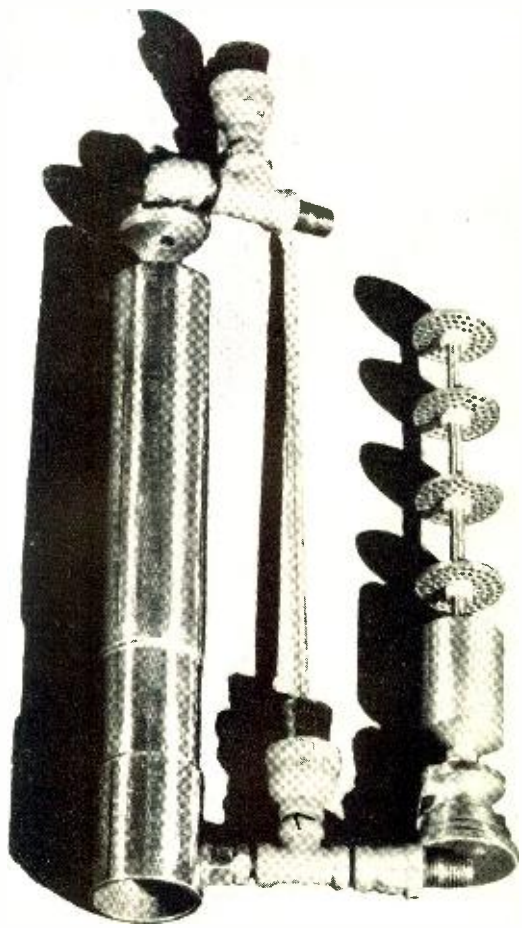
Fig. 10. Disassembled calorimeter showing brass plug and drilled baffles which fit inside of steel tube.



# TRANSMISSION MEASURING SET

By JOHN B. LEDBETTER

Station WKRC, Cincinnati, Ohio

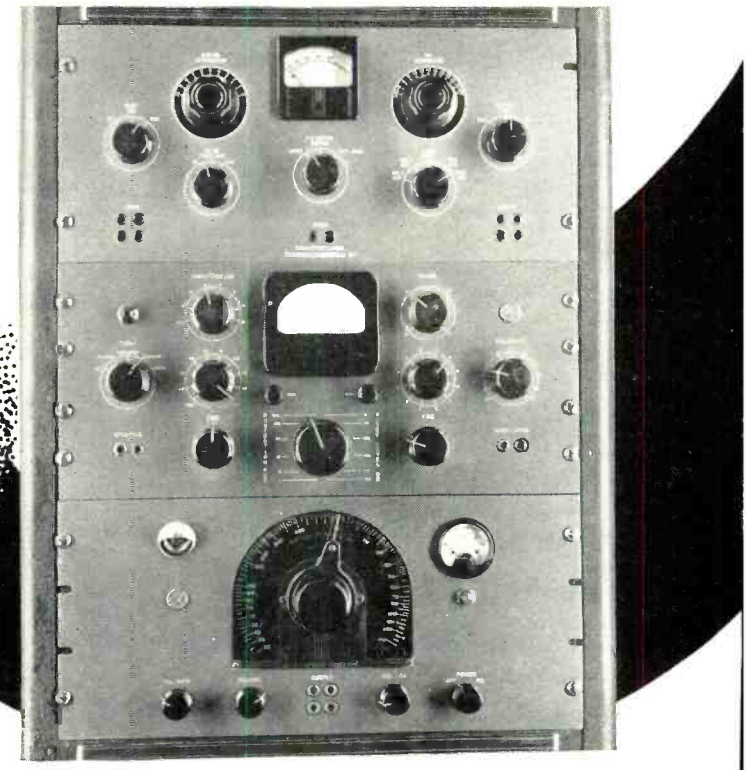


Fig. 1. Over-all view of the 1-B transmission measuring set.

***A precision audio-frequency test unit for quality measurements in broadcast and sound applications.***

THE recently revised FCC regulations[1] governing noise, distortion and frequency-response characteristics of broadcast audio equipment, in conjunction with the new RMA audio standards,[2] have raised the minimum requirements not only of the equipment itself, but of the various measuring instruments as well. While intended primarily as minimum requirements for audio facilities of FM broadcast stations, the new requirements are equally applicable for AM audio measurements. Moreover, they have been especially instrumental in the standardization of input and output impedances of audio and test facilities, and the recommended set-ups with which these measurements should be made.

In effect, the FCC regulations call for measurement of the over-all response of the complete audio facilities of a broadcast station, including every point from the microphone to the transmitter input. This places much stricter minimum requirement limits on studio and remote equipment than formerly, especially in cases where the studios or nemo originations are widely separated, or where the transmitter is situated several miles from the main studios and connected by open transmission lines or telephone cable.

Since the over-all response of any audio system depends on the performance of its individual sections, it follows that each unit must be capable of succeeding, or at least meeting, its own minimum performance requirements in order to allow an acceptable over-all response. It is imperative that the best possible performance be obtained from each section and sub-section, including the preamplifiers, studio control consoles, line amplifiers, isolation pads or coils, master control facilities, transmission lines, and transmitter audio facilities.

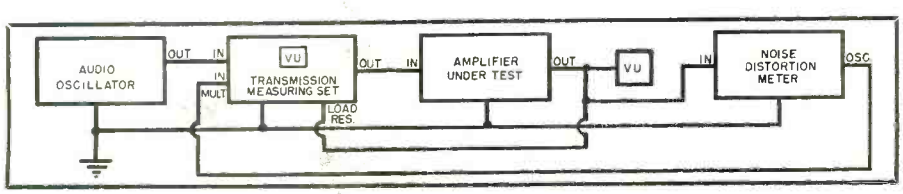
From an examination of the new requirements, it is also apparent that each article of measuring equipment must also be capable of excellent response and minimum distortion in order to allow a high order of accuracy in measurements. An accuracy of within ± 0.1 db. for frequency response measurements, and ± 0.2 db. for input and output level measurements should be attainable. For linear frequency response characteristics over the usable audio range, the measuring equipment should respond to all harmonic components up to the highest usable frequency's third harmonic (about 45 kc.) with a harmonic distortion content of 0.1 per-cent or less.

Primarily, a complete distortion-noise, response-frequency measuring set-up must contain (1) a stable audio oscillator covering 20 to 15,000 cycles, (2) an FCC approved distortion-noise meter, (3) impedance-matching transformers or resistors for source, input and load terminations, (4) variable and fixed attenuators for providing the proper input level to the audio equipment under test, and (5) one or more volume indicating (VU) meters with attenuators.

Years ago, performance measurements of audio facilities were tedious and time-consuming. A considerable portion of the time, in fact, was taken in setting up and connecting the various impedance-matching transformers, calibrated attenuation networks, terminating resistors, VU meters, etc. Variant factors such as ground lead connections and ground points, changes in coupling between components in the transmission and load circuits, spacing of interconnecting leads, etc., also resulted in difficulty in establishing repeat readings. The inherent disadvantages of this particular method of setting up audio quality measuring equipment resulted in the combining of these various components into one single unit, with calibrated controls adjustable from the front panel for simplicity of operation and ease in obtaining characteristic readings. This is the instrument which is to be described.

The use of such a unit, properly des-

Fig. 2. Typical set-up for broadcast audio measurements.

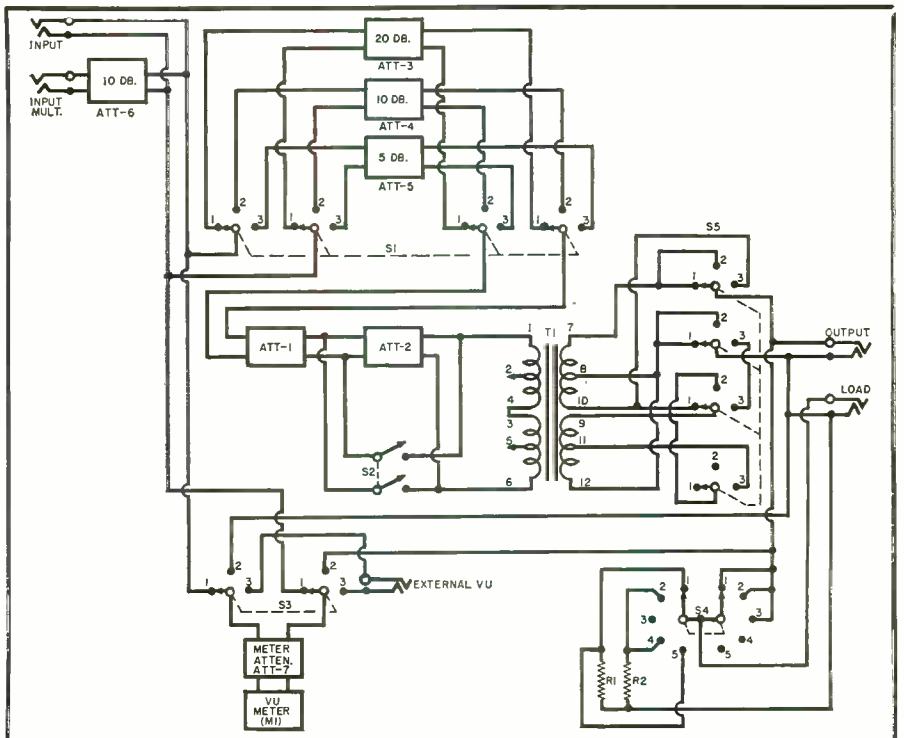


ignated as a transmission measuring set, has become wide-spread not only in broadcasting but in sound laboratories and associated electronic fields where accurate measurements of sound levels, impedance matching, amplifier gain and loss, and transmission line characteristics must be made.

The transmission measuring set to be described (the RCI 1-B) was designed and constructed by members of the WKRC-WCTS engineering staff and represents about the ultimate in simplicity of design and application. In this particular design, note that only one VU meter is incorporated in the measuring set itself. Although two indicating meters are recommended and usually required for applications where measurements are made on individual amplifiers or subsections of studio facilities at the time the studio is in regular operation, or where extreme flexibility in measurements is desired, the single-meter arrangement is adequate for the purpose for which the 1-B was designed. Since measurements of individual studio facilities ordinarily are made when that particular studio is not in use, the regular console or line VU meter is employed as the second indicating meter. Normally, this meter already is connected to the correct test point for over-all studio equipment measurements or for measurements involving the line amplifier alone. For isolated tests of individual preamplifiers and mixer circuits, this meter may be patched externally and connected to the proper output circuit.

For applications where the regular studio line meter or console VU meter cannot be patched externally, it will of course be necessary to employ a separate meter. (A second VU meter can be added to the 1-B panel simply by shifting the components and the location of meter $M_1$, and mounting both meters in line so that the panel still maintains its balanced appearance.)

The simplicity of design of the 1-B measuring set is apparent in Figs. 3 and 5. Although a fixed source impedance of 600 ohms is all that is required for terminating the audio test oscillator, an input selector switch allows the additional selection of either 50 or 250 ohms for use in measuring loss or gain in transmission lines, audio systems, etc. The minimum attenuation presented at these impedance values is approximately 5 db. for 600 ohms, 10 db. for 250 ohms and 20 db. for 50 ohms. (These values were the minimum which could be obtained commercially. Ideally, the same degree of attenuation should exist for each impedance value). A maximum attenuation of 105 db. in 5 db. steps is made possible by the use of only two attenuators. A variable attenuator ($ATT$-1) covers the 0-50 db. range in 5 db.




*$R_1$—250 ohm, 10 w. res. (Ohmite)*
*$R$ —600 ohm, 10 w. res. (Ohmite)*
*$T_1$—Multiple line to multiple line audio trans. (UTC LS-30X)*
*$M$—VU meter (Weston Model 732)*
*$ATT_1$—50 db. var. atten., 600/600 balanced "H" (Daven type 2527)*
*$ATT_2$—50 db. fixed atten., 600/600 balanced "H" (Daven type 950)*
*$ATT_3$—20 db. fixed atten., 50/600 balanced "H" (Daven type 950)*
*$ATT_4$—10 db. fixed atten., 250/600 balanced "H" (Daven type 950)*
*$ATT_5$—5 db. fixed atten., 600/600 balanced "H" (Daven type 950)*
*$ATT_6$—10 db. fixed atten., 500/500 balanced "H" (Daven type 950)*
*$ATT_7$—Meter attenuator, 7500/3900 "T" (Daven type T-994-2)*
*$SW_1$—4 gang, 3 pos. rotary sw. (Centralab)*
*$SW_2$—2 gang, 2 pos. rotary sw. (Centralab)*
*$SW_3$—2 gang, 3 pos. rotary sw. (Centralab)*
*$SW_4$—2 gang, 5 pos. rotary sw. (Centralab)*
*$SW_5$—4 gang, 3 pos. rotary sw. (Centralab)*

**Fig. 4. Circuit diagram and parts list for the unit.**

steps, while further range extension is provided by a fixed 50 db. attenuator ($ATT$-2) which may be switched into the circuit when needed.

In Fig. 3, the variable attenuator selector can be seen to the left of the VU meter; to the right is the meter attenuator. The lower controls, from left to right, are: source impedance selector switch, $S_1$; 50 db. fixed attenuator switch, $S_2$; meter selector switch, $S_3$; load impedance selector, $S_4$; and output impedance selector, $S_5$ Switch $S_2$ connects the 50 db. fixed attenuator in series with variable attenuator $ATT$-1 or bypasses it as desired; $S_3$, in conjunction with the external jacks immediately below it, allows the VU meter to be placed across the input or output circuits of the measuring set or to be used externally for program monitoring or other purposes. $S_5$ is used to select the proper taps on the secondary winding of the load isolation and matching transformer ($T_1$) for matching equipment output impedances of 600, 250 or 50 ohms. Operation of $S_4$ (a 5 position ro-

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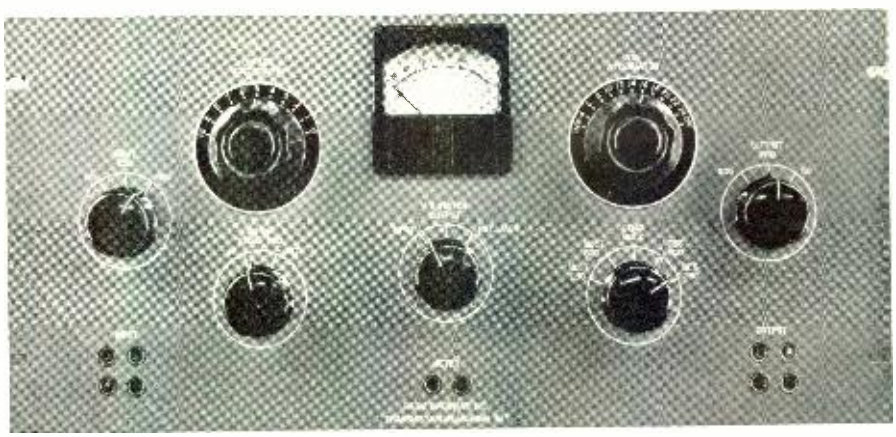
**Fig. 3. Front panel view of the transmission measuring set.**



# Television PRODUCTION LINE TESTING

By M. S. KIVER

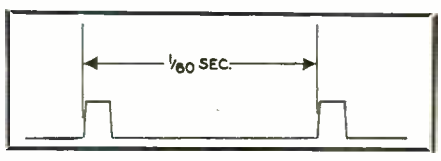

Fig. 1. The Tel-Instrument bar and dot generator.

***Part III. A discussion of the monitoring oscilloscope and bar and dot generators.***

THE output of the synchronizing generator described in Part I consisted of the RMA composite sync signals, blanking and driving voltages. It is advantageous, and often quite important, that a method be readily available for visually checking the shape of these generator output pulses in order to determine whether the equipment is operating normally. This is especially desirable when the sync generator is used to feed signals to a production line. Conventional oscilloscopes are not suitable for waveform inspection of horizontal sync pulses because of the limited frequency response of the vertical deflection system and the extremely short time duration of the pulses. Difficulty is also encountered in employing this oscilloscope for making comparative tests on television receiver synchronization systems. The need, then, for an oscilloscope of special design to cope with these problems is quite evident and it is expressly for this purpose that the monitoring oscilloscope to be described here was designed.

A block diagram of the monitoring oscilloscope (Fig. 4) reveals that it contains provisions for the simultaneous observation of two separate signals upon the same base. Each input contains a separate attenuator (in steps of 1, 10, and 100) and a separate continuously-variable gain control. Each input signal passes through a cathode-coupled amplifier ($V_{1A}$ or $V_{1B}$) to the grid of a second amplifier ($V_4$ or $V_{11}$). The outputs of both tubes are then combined across a common load resistor. Further amplification is achieved with $V_5$ and $V_6$, after which the signal is applied to the vertical deflection plates of the cathode-ray tube, a 7GP4. Push-pull output is obtained by using a common unbypassed cathode resistor for $V_5$ and $V_6$ and keeping the grid of $V_6$ at essentially ground potential except for a parasitic suppressor resistor of 75 ohms. The response of both vertical channels is identical and extends 30 to 4,000,000 c.p.s. Maximum vertical deflection is approximately 3".

Fig. 2. Voltage waveform at the plate of tube V8A (Fig. 4).




Due to the presence of the dual input channels, it is possible to observe the phase (and amplitude) of the same signal at various points in a sync generator or within a television receiver.

A second feature of the monitoring oscilloscope is its trace separation circuit which is used to separate odd and even lines of a television signal and permit portions of both fields to be simultaneously observed on the scope screen (Fig. 3). A switch is available which, when turned to the "on" position, places a 30 c.p.s. multivibrator in operation. The wave generated by this unit is a 50-50 square wave. The output is taken from the cathode of one section of the multivibrator, passed through a grounded-grid amplifier ($V_{2A}$) and the trace separation control to cathode follower $V_{2B}$. The cathode resistor of this latter tube is common to the cathode of $V_3$ and consequently the 30 cycle square wave appears as a biasing voltage at $V_4$. During the positive portion of this square wave the bias for $V_4$ is shifted in one direction (negative) whereas during the negative half of the square wave, $V_4$ operates with a more positive bias. The result is output signals of

different amplitudes. With no signal applied to the input terminals, two horizontal lines will be visible on the screen in place of one. How far these lines are separated will be a function of the setting of the trace separation control. If we now apply a composite video signal to the input terminals, the video signal for the odd lines will appear along one of the bases and the lines of the even field along the other one.

To stabilize the screen presentation, the 30 c.p.s. multivibrator should be synchronized with the sweep of the electron beam across the face of the monitor scope. A synchronizing pulse is obtained from the 60 cycle voltage which is ultimately converted to a sawtooth deflection voltage and applied to the horizontal plates of the cathode-ray tube. The 60 cycle synchronizing pulse fed to the multivibrator is developed in the network containing $V_{7A}$, $V_{7B}$, $V_{8A}$, and $V_{8B}$. Initially, this voltage is obtained from the power line and passed through a phase shifter before application to $V_{7A}$. The "Phase Shift" control permits full 360° phase rotation of the 60 cycle voltage. This is achieved by using a 5000 ohm potentiometer with four symmetrically placed taps, to which are 90° out of phase with each other. This provides a voltage of essentially constant amplitude but variable phase to be available from the potentiometer, the position of the arm determining the phase of the voltage.

The 60 cycle sine voltage from the phase shifter is amplified and clipped by $V_{7A}$, $V_{7B}$ and $V_{8A}$ until, at the plate of $V_{8A}$, it is a 60 cycle square wave with fairly steep sides (Fig. 2). This wave is differentiated by a .001 μfd. condenser and a 1 megohm resistor and applied simultaneously to the grids of $V_{8B}$ and $V_{9A}$. The differentiation produces a leading positive pip and a lagging negative pip. Since the grids of both these tubes are returned to B+, the positive pip does not appreciably alter the flow of current through either tube and so is effectively suppressed. On the other hand, the lagging negative pip produces a 2% positive pulse in the plate circuits of $V_{8B}$ and $V_{9A}$.

If we follow the path of the positive pulse appearing at the plate of $V_{8B}$, we see that it is used for two purposes: (1) To synchronize the 30 cycle multivibrator, $V_3$, and (2) to develop the sawtooth deflection voltage for the cathode-ray tube.

Note that the phase shift control can delay the appearance of this positive pip by as much as 1/60th of a second, or what is the same thing, 360° (at 60 cycles). Thus, we can shift the triggering time of the 30 cycle multivibrator and the triggering time of the horizontal sweep voltage of the cathode-ray tube. We can thus choose any time during the odd or even lines of a television signal for observation on the screen.

The positive pulse applied to $V_{9B}$ causes this tube to conduct heavily, discharging the .1 μfd. condenser in the plate circuit of $V_{9B}$ (Fig. 6). At the same time, the grid condenser of $V_{9B}$ receives a negative charge due to grid current flow. As soon as the pulse passes, the grid condenser starts to discharge through a 1 megohm grid resistor developing enough negative bias here to cut off the tube. The plate condenser can now begin to charge once again, starting the next sweep cycle. From the foregoing explanation, we see that the positive pulse ends the sweep cycle, initiating the retrace.

The sawtooth voltage waveform which appears at the plate of $V_{9B}$ is then coupled to pin #1 (grid) of $V_{10A}$, its magnitude being controlled by a 2 megohm potentiometer, which functions as a horizontal gain control. The second section of $V_{10}$ is driven from the plate circuit of the first section. The plates of $V_{10}$ are then coupled to the horizontal deflecting plates of the 7GP4 cathode-ray tube.

When the "Horizontal Sweep—INT & EXT" control is in the "EXT" position, the d.c. supply is removed from the plates of $V_7$, the cathode of $V_{9B}$ is connected to ground through a 2200 ohm resistor, the .1 μfd. condenser is disconnected from the plate of $V_{9B}$, and the external sweep jack on the front panel is connected to the grid of $V_{9B}$.

We come now to $V_{9A}$, which also receives the positive and negative differentiated pips from $V_{8A}$. As noted previously, only the lagging negative pip is effective in causing a change in plate current and, as a result, a positive pip appears in the output. Now the output

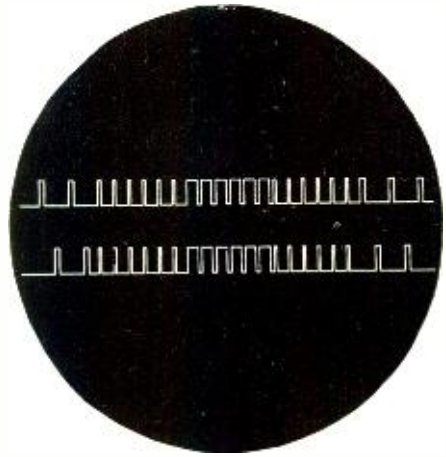
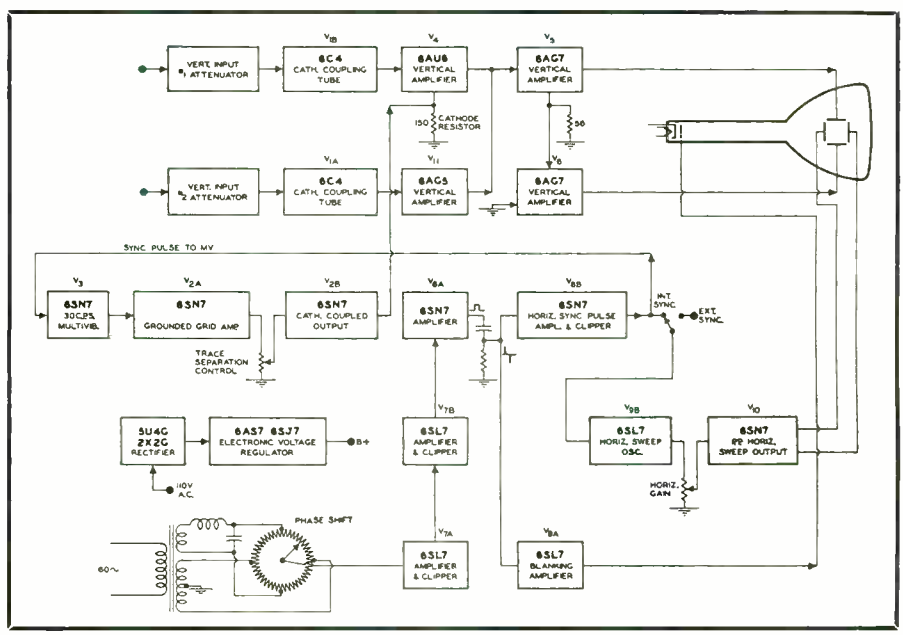


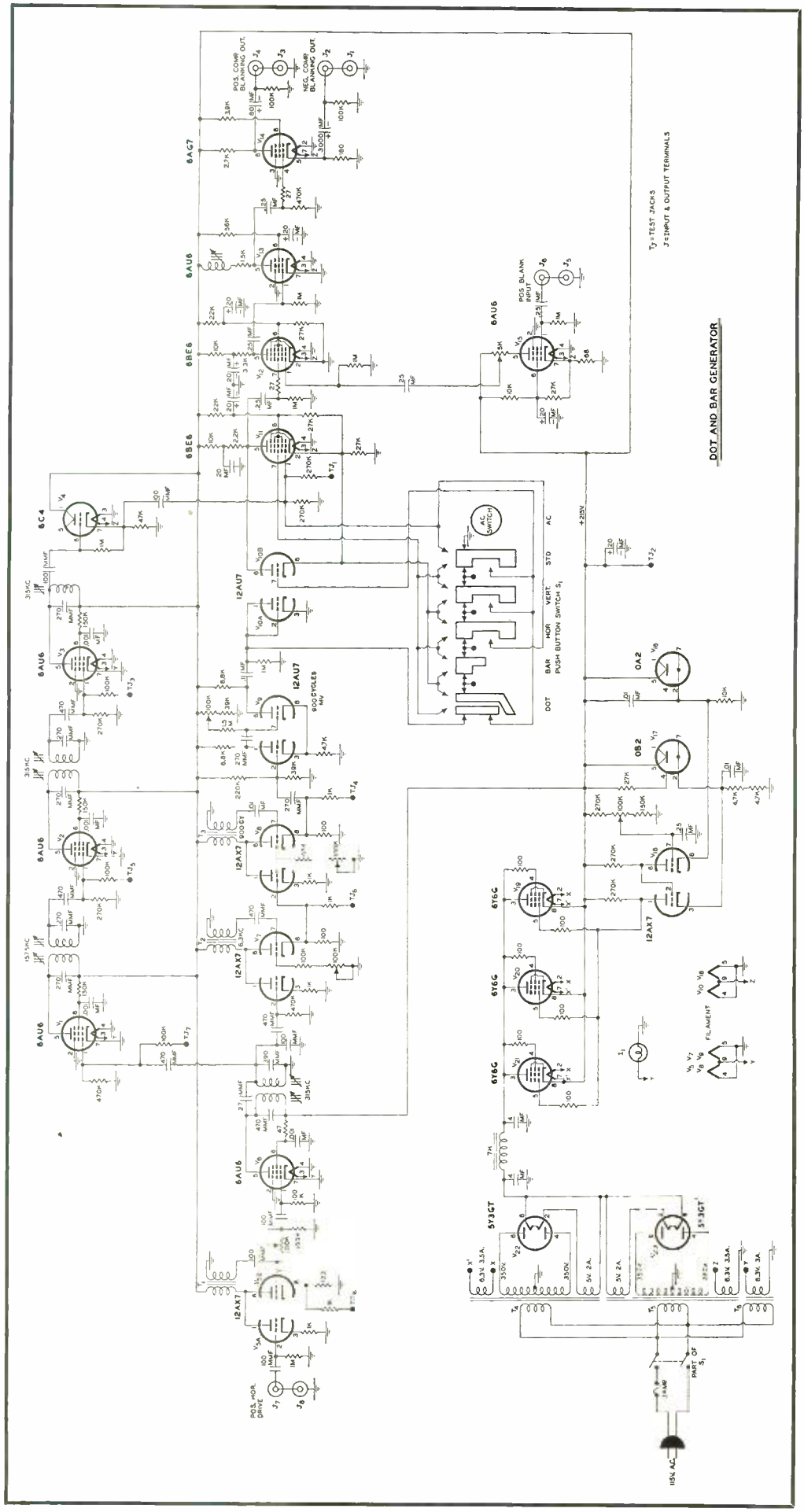
**Fig. 3. The odd and even line sync pulse presentation that can be obtained with the monitoring oscilloscope.**

is connected through an "on-off" switch (called the "Block-Out switch") to the grid of the cathode-ray tube. When the switch is in the "Off" position, the grid of the cathode is disconnected from $V_{9A}$ and the trace seen on the screen is approximately 98% of a full 60 c.p.s. wave in duration. This permits observation of the relatively slow vertical synchronizing pulse.

When the Block-Out switch is turned to the "On" position, the positive pulse at the plate of $V_{9A}$ reaches the control grid of the cathode-ray tube, causing a brighter trace during its interval of application. By suitably lowering the setting of the Intensity Control, the screen will be dark except during the interval that this positive pulse from $V_{9A}$ is active. However, since this positive pulse appears only during beam retrace, only this fast retrace will be visible. This permits us to observe relatively fast phenomena.

**Fig. 4. A block diagram of the Telequip monitoring oscilloscope.**






When in this position, approximately ten horizontal lines may be observed upon the horizontal time base.

A little thought will indicate that the horizontal sweep direction is in one direction for the slow or 98% trace and in the opposite direction for the fast 2% retrace. This must be true of all scope sweeps. In this particular circuit, with the Block-Out switch off, the sweep direction is from right to left. However, with the Block-Out switch on, the sweep direction is from left to right. This could be reversed, if desired, by interchanging the connections to the horizontal deflection plates.

**Bar and Dot Generators**

A useful device in the production line testing of television receivers is the bar and dot generator. This unit creates either bars or dots which can be superimposed over any test pattern. Since the bars or dots are equally spaced when generated, any unequal spacing when they appear on the receiver screen indicates non-linearity in the receiver sweep system. It may be wondered why a special instrument is required when the monoscope test pattern itself contains linearity test markings. In practice it is found, however, that the sweep system in the monoscope may change sufficiently during operation to produce a seriously distorted test pattern. At the production line test positions, the adjusters, observing this distorted pattern, will naturally assume that the receivers are at fault and "correct" this by misaligning the receiver controls. This will entail further correction when the sets are installed in the purchaser's home. However, through the use of a bar and dot generator, an absolute linearity pattern can be established which is not readily altered. This bar and dot pattern, superimposed over the monoscope test pattern, provides the adjusters on the production line with an absolute check on the linearity of the receiver sweep system.

**Fig. 5. Schematic diagram of the Tel-Instrument bar and dot generator.**

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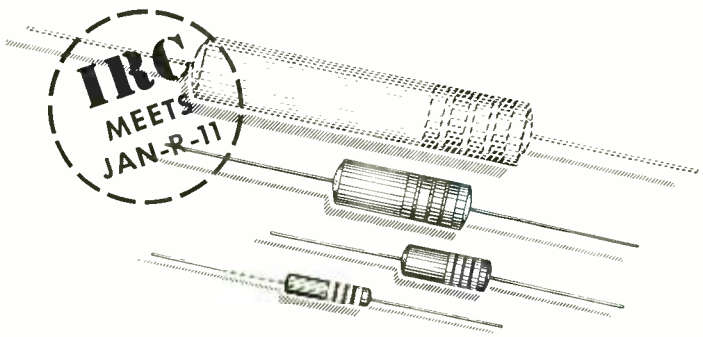


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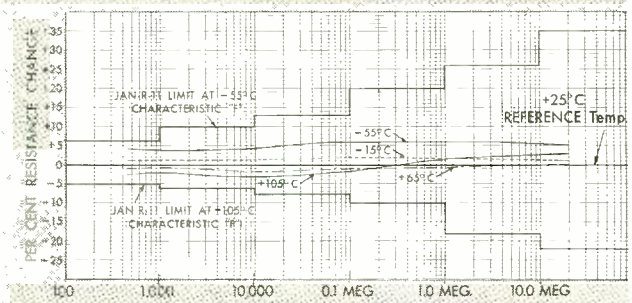
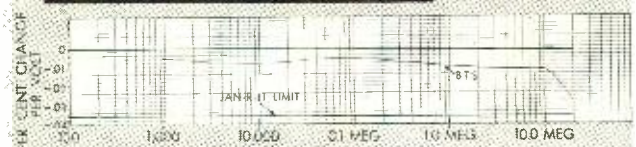



**VOLTAGE CHARACTERISTIC**
**IRC Type BTS ½ Watt**

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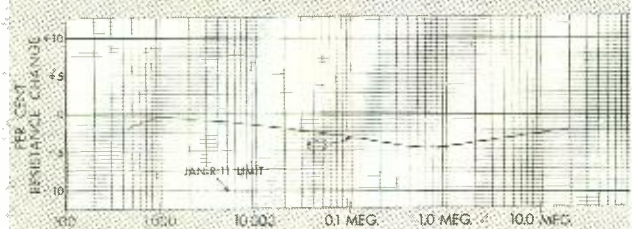


**250 HOUR HUMIDITY TEST**
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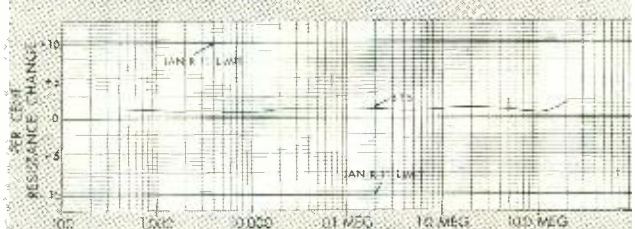


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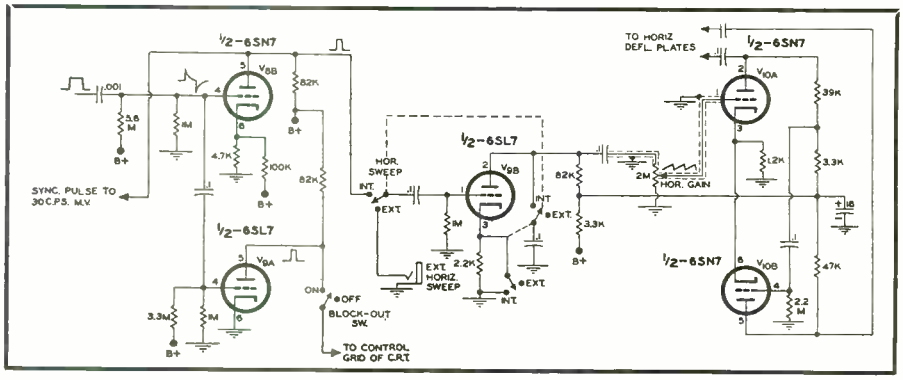



**Fig. 6. Circuit diagram showing V8B, V9, and V10 of Fig. 4.**

A bar and dot generator which has been used extensively is the unit designed and marketed by *Tel-Instrument* (Fig. 1). The unit operates from the horizontal driving signal and its output is inserted in the blanking signal line between the sync generator and the Monoscope unit. A push-button front panel selector provides means to select any of the following:

a. Standard blanking
b. Vertical bars only
c. Horizontal bars only
d. Vertical and horizontal bars
e. Complete dot pattern

There are 20 vertical horizontal bars less those blanked out (usually 10%) during the blanking interval. The width of the black lines or bars is approximately 10% of the space between the bars. The dot pattern is the intersection of the horizontal and vertical bars. A schematic diagram of the entire generator is shown in Fig. 5.

Positive horizontal driving pulses from the sync generator are applied to a 15.75 kc. blocking oscillator through a buffer amplifier, $V_{5A}$. The sharp positive pip developed across the cathode resistor of the blocking oscillator is applied to a frequency doubler, $V_6$. The output of $V_6$ is then fed to two separate branches, one which functions as a frequency multiplier and the other as a frequency divider. In the former system, containing $V_1$, $V_2$, $V_3$, and $V_4$, the 31.5 kc. output of $V_6$ is raised to 315 kc. This latter figure is 20 vertical lines (less those lost during the horizontal retrace period). $V_3$ functions as a voltage amplifier while $V_4$ is a cathode follower. The 315 kc. signal is transferred from the cathode of $V_4$ to grid #1 of $V_{11}$.

The frequency divider chain consists of two blocking oscillators, with associated buffer amplifiers, and a multivibrator. The first blocking oscillator reduces the 31.5 kc. by a factor of 5, or to 6.3 kc. The following blocking oscillator, $V_8$, further reduces the frequency to 900 cycles which will give us the required 15 horizontal bars, since 900 is 15 times greater than the 60 cycle field frequency. Multivibrator $V_9$ is synchronized by the 900 cycle pulses, producing a square pulse, at the same frequency, but possessing a width of about 3—4 horizontal lines.

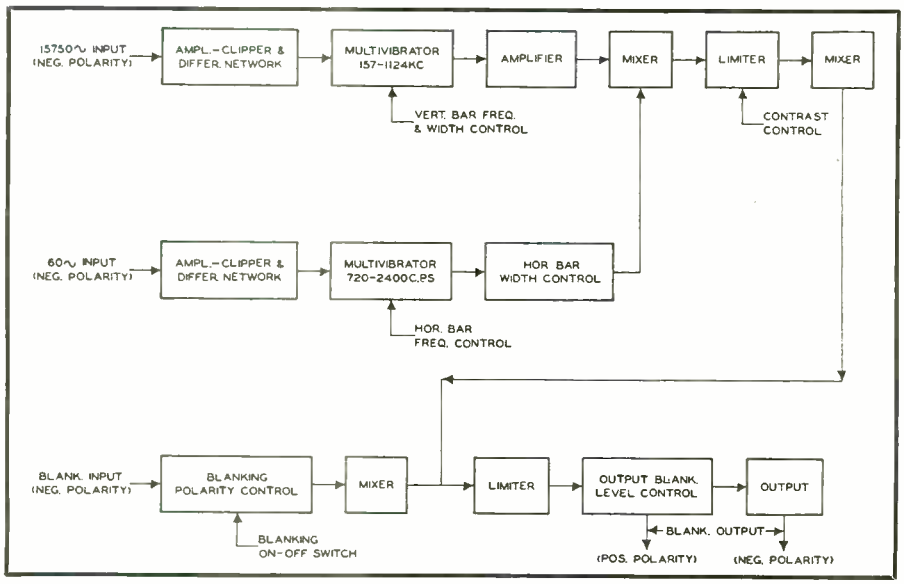
To select the type of bar or dot presentation, a 6 position push-button switch is available. In the position shown in the schematic, all of the push-buttons are in the "out" position. When the push-button marked "Standard" is depressed, none of the vertical or horizontal bars pass through $V_{11}$ and consequently no output is obtained from this tube. The positive blanking pulses from the sync generator then pass through $V_{15}$, $V_{12}$, $V_{13}$, and $V_{14}$ and appear at the output terminals of the generator unchanged in form. $V_{11}$ receives the vertical bar voltage at grid #1 and in "Standard" position, this grid is grounded. The horizontal bar voltage is likewise grounded out in this position.

When the push-button labeled "VERTICAL" is depressed, the output voltage of $V_9$ is grounded, preventing the horizontal bar signal from reaching $V_{12}$. Grid #1 of $V_{11}$, however, is not grounded, receiving the output of $V_4$, and after amplification by $V_{11}$, this voltage is mixed with the blanking signal in $V_{12}$. The control grid (No. 1) of $V_{11}$ is signal-biased by the 315 kc. voltage from $V_4$, permitting current to flow through this tube only at the most positive peaks of the 315 kc. sine wave. This produces a negative pulse of voltage at the plate of $V_{11}$ which combines with the negative blanking voltage applied to $V_{12}$ from $V_{15}$. Thus, the output blanking voltage not only contains the horizontal and vertical blanking pulses required in a normal signal, but, in addition, a second blanking voltage which appears momentarily 20 times during every line. When the composite video signal is formed in the Monoscope, each line will have 20 equally spaced black dots. When all the 525 lines are traced out on the screen, the black dots will form vertical bars extending from the top to the bottom of the image.

In the "HORIZONTAL" push-button position, grid No. 1 of $V_{11}$ is grounded, thereby rendering the output of $V_4$ ineffective. At the same time the cathode of $V_{10B}$ is grounded, while its grid receives the 900 cycle signal developed by $V_9$, amplifies it and then passes it on to $V_{12}$ where it combines with the blanking signal. $V_{11}$ is effectively bypassed in this switch position since none of the signals actually pass through it. The first triode section of $V_{10}$ is a d.c. clamper which keeps the output pulses of $V_9$ below zero level. In this way only the positive portions of the 900 cycle square wave pulses cause current conduction through $V_{10}$; the negative portion bias the tube to cut-off.

In the "BAR" position, both vertical and horizontal bars appear on the screen. The vertical bar voltage passes through $V_{11}$, combining with the horizontal bar signal across the 2200 ohm plate load resistor. The two signals then go to grid No. 3 of $V_{12}$ where they combine with the blanking signal.

**Fig. 7. Block diagram of the RCA Grating Generator.**



In the "DOT" position, both vertical and horizontal bar voltages are applied to $V_{11}$. The vertical bar voltage is received, as usual, by grid No. 1, while the horizontal voltage is now applied to grid No. 3 of $V_{11}$ instead of going from $V_9$ through $V_{10B}$ to $V_{12}$. $V_{10B}$ in this position is inactive. The voltage applied to grid No. 3 of $V_{11}$ is sufficiently negative to prevent current from flowing through $V_{11}$ except when the narrow positive pulse from $V_9$ appears. At the same time, no electrons pass grid No. 1 except on the positive peaks of the 315 kc. signal from $V_4$. Thus, current will flow only when both signal voltages are simultaneously active and at this time a short flow of current will occur. The dot pattern is thus the intersection of the vertical and horizontal bars.

*RCA* has designed a generator which produces a pattern of vertical and horizontal bars. No dots are available from this unit. This is Type WA-3A grating generator (Fig. 7).

The WA-3A generates the test signal as follows: A negative driving pulse of 15,750 cycles is amplified, clipped, and differentiated to synchronize a multivibrator. The pulse output of the multivibrator constitutes the vertical bar signal. It is amplified, then fed to a mixer stage. A negative driving pulse of 60 cycles is amplified, clipped, and differentiated to synchronize another multivibrator. The output is a multiple of 60 cycles. It is fed to a width control circuit, by means of which the pulse may be adjusted to 10 per-cent of the cycle over the entire frequency range. This pulse constitutes the horizontal bar signal, which is mixed with the vertical bar signal. The mixed signals are held to approximately equal levels by a limiter stage. Output is adjustable to provide for control of contrast.

Standard 60 cycle and 15,750 cycle signals from a video sync generator are employed for synchronizing the unit. The standard blanking signal from the sync generator is connected to a polarity control stage, with output taken from either cathode or plate circuit, depending upon desired polarity. Separate tubes having a common load combine the bar and blanking signals. A limiter stage prevents the bar signal from exceeding the blanking signal level.

Separate switches are provided for independent operation of the horizontal, vertical, and blanking signal circuits, The number of bars is adjustable for convenient spacing on different screens. Horizontal bars are adjustable from 12 to 36 bars; vertical bars are adjustable from 10 to 64. Bar width is adjustable to 10 per-cent of space between bars. Bar pulse level can be controlled independently of blanking level to give desired degree of contrast.

*(To be continued)*

# NEW PRODUCTS

### NEW MARINE RADIOTELEPHONE

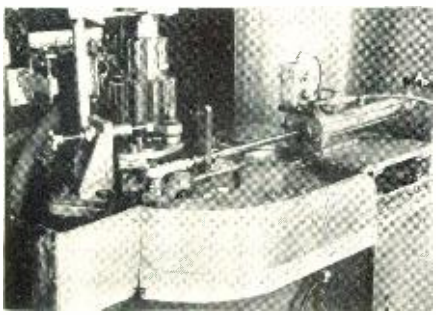
A new radiotelephone, Model 23, made by *Applied Electronics Company*, incorporates a four-channel crystal-controlled transmitter in combination with a tuneable broadcast and 2 to 3 mc. receiver. The transmitter features press-to-talk operation. Battery terminals are isolated from the chassis to prevent possible electrolysis.

For further information write the manufacturer at 1246 Folsum Street, San Francisco 3, California.

### THREE WAY GEAR PROCESSING UNIT

The *Induction Heating Corporation*, 181 Wythe Ave., Brooklyn 11, N. Y., has brought out a new processor for induction hardening of gear teeth, one tooth at a time. This is a completely automatic heating, quenching and indexing operation which involves only the insertion and removal of gears, and it is particularly adaptable both for high or low production requirements.

Gears which would require very large equipment to be hardened in one operation because of their size can now be processed with 20 kw. equipment and the use of this machine. The manufacturer credits its unusual design with



the ability to accommodate gears ranging from 20" in diameter with a 12" face or larger, depending upon generator capacity.

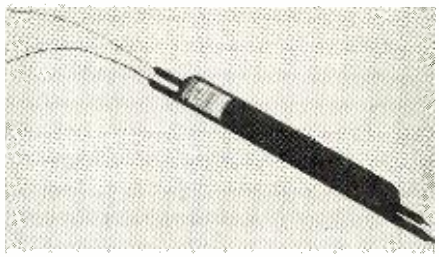
Controls are contained in a cabinet attached to the unit, and the machine may be mounted on any conventional sink table with ease.

### CATHODE-RAY OSCILLOGRAPH

*Allen B. DuMont Laboratories*, Inc., 1000 Main Avenue, Clifton, N. J. have a new Type 248-A oscillograph that can be operated at accelerating potentials up to 14,000 volts without modification. The basis for this increased versatility is the incorporation of the Type 5RP-A high-voltage cathode-ray tube. Since it has frequently been necessary to examine extremely high-speed transients with this instrument, photographic writing rates of the order of 69 inches per microsecond can now be recorded when using the increased accelerating potential. Where less light output is required, or where the writing speed is not so great, the Type 248-A can be operated at the normal accelerating potential of 4000 volts.

### GEIGER COUNTER TUBES

*Raytheon Manufacturing Company* announces three Geiger Mueller counter



tubes, types 1B90, CK1018 and CK1019. All are of the thin side wall glass type but vary in operating voltage. They are approximately 8 inches long, ¾-inch in diameter and are suitable for use in detecting and measuring high energy beta and gamma radiation. Further information and data may be obtained from the Special Tube Section, *Raytheon Manufacturing Company*, Newton 58, Mass.

### IMPROVED VU METER MULTIPLIER

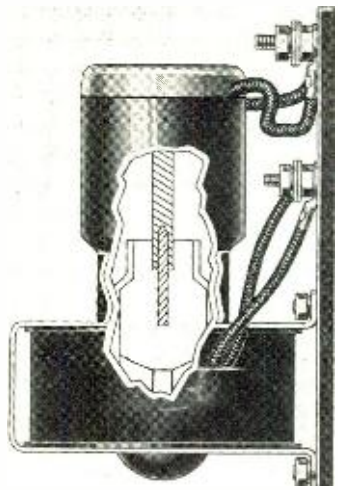
An attenuator developed by the *Shallcross Manufacturing Company* is said to embody new features never before available in a VU multiplier of comparable size.

Measuring 1¾ inches in diameter, the design provides five-step straight T performance in a control size normally limited to ladder and potentiometer circuits. The VU meter is connected to the auxiliary pair of terminals on the multiplier when in the OFF position, thus enabling the meter to be used for volume indication on another line, for tube checking, or other purposes.

Modification of these standard units can be produced to a wide variety of requirements. Complete information may be secured from the manufacturer at Collingdale, Pa.

### HYDROGEN ARC-QUENCHED RELAYS

The new mercury-type relays made available by *Durakool, Inc.*, Elkhart, Indiana, are particularly suitable for the switching of heavy loads in prac-



tically all fields, including highly inductive circuits such as solenoids and motors.

These "hydrogen arc-quenched" relays operate on the double flow principle and contacts are between two pools of mercury, in the presence of hydrogen gas under high pressure, keeping arcing at a minimum and virtually eliminating heat and corrosion, according to the manufacturer.

Another new feature is found in the method of sealing the hydrogen into the relay. The body is steel, welded in a pressure chamber so that the hydrogen gas in the relay is sealed in at about 60 pounds pressure.

### VICTOREEN COUNTER TUBE

An aluminum beta-gamma counter tube, produced by the *Victoreen Instrument Company*, 5806 Hough Avenue, Cleveland 3, Ohio, is intended to replace the thin-walled glass tubes previously used in laboratory and field radiation measuring instruments. The thyrode 1B85 operates at 900 volts, the plateau length is not less than 200 volts and the plateau slope does not exceed three per-cent per 100 volts. Nominal recovery time is 100 microseconds and minimum operating life test end point plateau 850 to 950 volts. The wall of 30 mg./cm.$^2$ aluminum provides

greater uniformity. A convenient plug-in base for practical water-tight probe or chassis mounting is featured.

### PERMANENT MAGNET SPEAKER

Two *RCA* speakers, 308S2 and 408S2, of the permanent magnet type have been announced. Differing from each other only in the weight of their Alnico V magnets, they are built with a one-piece stamped steel frame. Dustproof and rust resistant, their cones, voice coils and suspensions are moisture resistant. The voice coils have a ¾" diameter and consequent high sensitivity, together with a power handling capability of 6 watts. They were designed for use in television receivers, large table radios and small consoles. The Tube Department of *RCA*, Harrison, N. J., is the manufacturer.

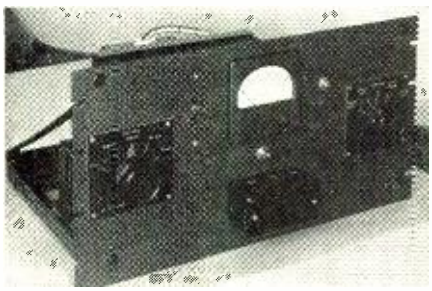
### CONTROL PROCESS TIMER

A new unit, the DB Timer, manufactured by *Struthers-Dunn, Inc.*, 150 North 13th St., Phila. 7, Pa., is particularly suited for the automatic timing of continuous processing work where the various process periods relate to the total time cycle.

The manufacturer states that in addition to eliminating the need for a number of timers arranged in cascade system, this new development requires less auxiliary equipment and makes for simplified and low cost process control installation.

### ELECTRIC OPERATION CHECKER

By means of a new test instrument manufactured by *Eastern Transformer Co., Inc.*, 147 West 22nd Street, New York 11, the operation of electrical components at rated under and over voltage may be checked quickly. Two controls are provided. One adjusts the output to the nominal voltage required for test, while the other adjusts the output to the required under or over voltage. If desired, a control for line voltage correction can be furnished. Because requirements vary widely, each unit is made to customer specification.



### RADIOACTIVITY DEMONSTRATOR

*Tracerlab, Inc.*, 55 Oliver St., Boston 10, Mass., has developed a new radioactivity demonstrator for the purpose of teaching basic principles of radioactivity in schools. Included with the demonstrator is a glass Geiger tube capable of detecting gamma and high energy beta rays.

With this instrument, it is possible to illustrate some of the properties of beta and gamma radiations, take background readings, plot the Geiger tube curve of counting rate versus applied voltage and to make rough qualitative checks of the amount of radioactivity in various natural substances. It has sufficient accuracy to permit carrying out simple classroom and laboratory demonstrations of basic principles.

### ELECTRICAL CONTACTS

Electrical contacts made from copper tungsten by the powder metallurgy process are now being manufactured by *Gibson Electric Co.*, 8362 Franks-town Ave., Pittsburgh 21, Pa.

They will interrupt very heavy currents with minimum erosion, having a hardness in the order of 90 Rockwell B, conductivity of 50 per-cent IACS and cross breaking strength of 135,000 P.S.I. Typical applications include air circuit breaker arcing tips and intermediate contacts, oil circuit breaker arcing tips and current carrying contacts, oil immersed contactor contacts and oil immersed transformer tap changer contacts.

### ELECTRONIC WELDING DEVICE

An oscillator and press, complete in one unit, for use in laboratories of plastic film manufacturers, will ascertain whether or not the sheeting will weld electronically, and at what frequency. The machine has a variable frequency shift where the frequency can be changed from 20 to 60 megacycles. It is entirely automatic and will enable a swatch of each roll of material to be electronically sealed. *Mayflower Electronic Devices, Inc.*, 6014 Hudson Blvd., West New York, N. J. produces these units.

# Personals

**DR. CLEDO BRUNETTI** will join the staff of Stanford Research Institute as associate director. During the war, Dr. Brunetti had a leading part in the development of the radar-guided bomb and of the radio-proximity-fuse. He also had a major part in the development of the two-way wrist radio and a radio transmitter so small it can be slipped into a lipstick cylinder. He attended the University of Minnesota and taught there and at George Washington and Lehigh.

**EARL E. ELDREDGE** has been appointed Chief Engineer of the *Press Wireless Manufacturing Company, Inc.* Prior to this, Mr. Eldredge, a graduate of Brown University, was Chief Engineer with *Erco Radio Laboratory*. During the war, he designed and supervised the building of high power transmitters for the Signal Corps, Navy, OSS and other government agencies as part of a radio communications network that reached battle fronts all over the world.

**DR. ROBERT D. HUNTOON** has been appointed Chief of the Atomic and Molecular Physics Division of the National Bureau of Standards. He received wide recognition in the fields of atomic-beam measurement, the phasing of oscillators and the study of the deuteron-deuteron nuclear reaction. Dr. Huntoon obtained his B.A. degree from Iowa State Teachers College and in 1938 received his Ph.D. from Iowa State University, specializing in nuclear physics.

**JOHN T. LUCAS** is the new supervisor of quality control and customer service for the Huntington Radio Tube Plant of *Sylvania Electric Products, Inc.* He was formerly supervisor of product engineering at the Altoona, Pa. radio tube plant. During the war he was head of product engineering for all *Sylvania* plants in Pennsylvania engaged in the Navy's proximity fuse program. Mr. Lucas has a degree in electrical engineering from Pennsylvania State College.

**DR. HAROLD A. ZAHL** has been appointed to fill the new position of Director of Research of the Signal Corps Engineering Laboratories, which are responsible for the research and development of ground signal equipment and special electronic devices for the United States Army. Dr. Zahl's responsibilities will cover research conducted within the Signal Corps' own laboratories and an extended external program carried on by contract in universities and in industry.

**BRONISLAW ZAPOLSKI,** Industrial Designer, specializing in the radio and television field, has started his own firm at 19 East 48th St., New York. Mr. Zapolski has designed cabinets for such popular sets as the *Jewel* "Wakemaster" and "TeeNee," *Air King* "Crown Princess," "Duchess," Model 625, and *DeWald, Templetone* and *Ansley*. His interest in radio cabinet design recently took him to England and France, where he made a comprehensive study of design.

## Regulated Supply

(*Continued from page* 10)

due to the power dissipated in the 500 megohm resistor, 5°C. in the 50 megohm resistor, and 1°C. in the 3 megohm resistors at maximum voltage output in uncirculated free air.

A blower capable of circulating 110 cubic feet of air per minute is mounted within the sealed upper compartment in such a way that it is directed upon the divider resistors. Thus the heat is carried away from them and is distributed throughout the compartment. This tends to give all components the same temperature rise and because the total thermal capacity of everything in the compartment is many times that of the resistors alone, their rate of temperature rise is greatly reduced.

There are other components in the same compartment dissipating heat but the total dissipation is small for the mass of material which must absorb it.

In order to prevent sudden changes in room temperature from causing short time changes in the temperature of the dividers, it was necessary to line the inside of the cabinet with heat insulating material. It was calculated that a one fourth inch layer of asbestos like that used in insulating furnace pipes would be the thickness which would give sufficient "filtering" of any reasonable fluctuations in room temperature to keep the output voltage drift within the requisite drift rate and at the same time conduct heat from the inside fast enough so that the equilibrium temperature was not high.

Stability with respect to line voltage changes is very good. This is partly due to the incorporation of a voltage stabilizer at the a.c. input of the power supply. The stabilizer keeps the a.c. applied to transformers in circuits affecting stability within one per-cent for line voltage changes from 100 volts to 130 volts. The circuits previously mentioned for reduction of contact potential and the use of regulated low voltage d.c. power supplies also contribute to stability with respect to line voltage fluctuations. A test at 5000 volts on the low range showed an output voltage change of less than 10 parts per million for a change in line voltage from 105 to 125 volts.

The writer acknowledges the important contributions of a number of *General Electric* engineers, particularly H. R. Summerhayes, Jr., C. E. Horton, E. S. Sampson and W. A. Ford in connection with the development of this power supply.

### REFERENCE

1. *Schade, O. H., "Radio-Frequency-Operated High-Voltage Supplies for Cathode-Ray Tubes." IRE Proceedings. Vol. 31, April,* 1943.

# TECHNICAL BOOKS

**"IONOSPHERIC RADIO PROPAGATION"** (Circular No. 462), the staff of the National Bureau of Standards. Published by U.S. Government Printing Office, Washington 25, D.C. 209 pages. $1.00.

In order to meet the need for an elementary presentation of the theory and practical use of radio-wave propagation involving ionosphere, this book has been prepared by the Central Radio Propagation Laboratory of the NBS. It is in part a revision and expansion of the radio propagation handbook that was prepared during the war. Current knowledge and techniques of making radio propagation calculations are summarized.

The theoretical treatment is not comprehensive but is intended to explain the basic facts and principles of electromagnetic propagation and ionosphere for persons who have not had advanced courses in electrodynamics. Frequent references to the literature are made to facilitate further study.

Data was gathered from ionospheric stations either directly or cooperatively managed by NBS, and much information that previously had only a limited circulation has been made available.

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**"PRINCIPLES OF RADAR"**, Denis Taylor & C. H. Westcott. Published by *The Macmillan Company*, 60 Fifth Avenue, New York, N.Y. 141 pages. $3.50.

Engineers, physicists, mathematicians and advanced students of radio will find this book aimed directly at them. It presents the principles of radar in the first eight chapters, excluding those cases where a 'responder' equipment is placed in the target to be located. The remaining parts give a summary of the characteristics of a selection of typical practical radar equipments and a discussion of the uses and principles of responder methods. The exposition and survey of principles underlying radar design is intended to help readers who have found so much detailed information perplexing, by indicating the common factors in the various radar material developed and used during the war. Emphasis is placed on factors determining the performance of some particular radar equipment, and those determining its suitability for a specified purpose, rather than the detailed behaviour of its component parts.

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**"SOURCES OF ENGINEERING INFORMATION"**, Blanche H. Dalton. Published by *University of California Press*, Berkeley and Los Angeles, California. 109 pages. $4.00.

This compilation is the revised edition of a syllabus originally written to be used with lectures on the use of the library presented for engineering, faculty members and graduate students of the University of California who wished to make effective use of library facilities when doing research. It is a practical guide to engineering literature and data and is designed as a concise reference.

The arrangement, based on studies of the use of an actual library collection, enables one to find the key to all research previously published in a particular field by turning directly to the topic. The volume includes information on every type of engineering—aeronautics, electronics, illumination, electrical engineering, mechanical engineering, metals and metallurgy, petroleum engineering, mining engineering, civil engineering, materials testing, ventilation, hydromechanics, etc.

As librarian of the Engineering Library of the University of California, the author has had wide experience in dealing with problems arising from research work, and is well equipped to deal with this subject.

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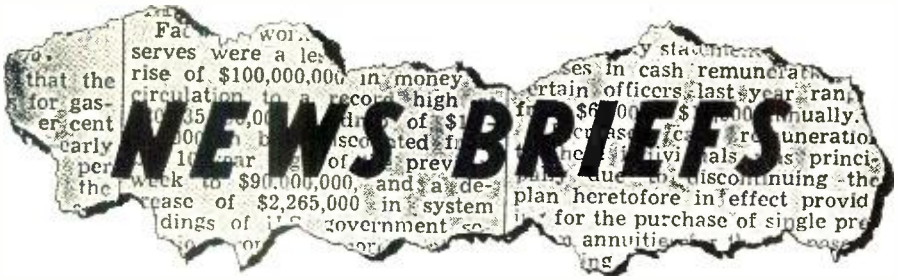
**"SPHERICAL HARMONICS"**, T. M. MacRobert. Published by *Dover Publications*, 1780 Broadway, New York 19, New York. 372 pages. $4.50.

A second completely revised edition, this volume contains the elements of the theory of spherical harmonics for students who have a good working knowledge of calculus but are not familiar with the method of contour integration or the modern theory of functions of a real variable. This edition has extended the theory to functions whose orders are any real numbers whatever, and added two new chapters which deal with some properties of the hyper-geometric function and an account of the associated Legendre functions of general real degree and order. A set of miscellaneous examples, arranged to correspond with the order of the text has also been included.

Other chapters include an elementary account of the theory of Fourier series, applications of this to conduction of heat and vibrations of strings, and Bessel functions. Throughout the book, considerable space has been devoted to applications in mathematical physics and engineering, particularly to problems of mechanical vibrations, heat conduction, potential theory and electrostatics.




### NATIONAL ELECTRONICS CONFERENCE

G. H. Fett, Professor of Electrical Engineering of the University of Illinois, and newly elected president of the 1949 National Electronics Conference, announced that the next meeting will be held September 26, 27 and 28 at the Edgewater Beach in Chicago. A. W. Graf, Chicago patent attorney, was named chairman of the board of directors. Other new officers and directors are: Executive Vice-President, O. D. Westerberg, *Commonwealth Edison Company;* Secretary, Karl Kramer, *Jensen Manufacturing Company;* Treasurer, Dr. R. R. Buss, Assistant Professor of Electrical Engineering, Northwestern University.

Committee chairmen and conference directors are as follows: Program: Dr. L. T. DeVore, University of Illinois; Publicity: James W. Armsey, Illinois Institute of Technology; Publications: P. K. Hudson, University of Illinois; Arrangements: James L. Murphy, Armour Research Foundation of Illinois Institute of Technology; Exhibits: N. Cohn, *Leeds-Northrup Company* and Housing: C. M. Brentlinger, *Western Telegraph Company.*

### MEASURING NUCLEAR-VOLTAGE THRESHOLDS

An investigation now being pursued by engineers of *Westinghouse Electric Corporation*, 306 Fourth Ave., Pittsburgh 30, Pa. is the accurate determination of the threshold voltages of elements, i.e., the voltage at which artificial radioactive transformations commence in a nuclear reaction. These have been measured before, but not to the high degree of accuracy that scientists require.

The equipment used consists in part of a 70 mc. resonant tube through which the ion stream from a Van de Graaff generator is fed. The intensity-modulated ion beam produces r.f. voltages by induction, and when these are 180 degrees out of phase, a minimum receiver signal results. At these points the voltage can be calculated from known and meter values by means of a relatively simple formula.

### COORDINATE RADIO INDUSTRY STANDARDS

Following the decision to reactivate the American Standards Association sectional committee on radio for the purpose of promoting interchangeability of civilian and Joint Army-Navy components, L. G. Cumming, technical secretary of the Institute of Radio Engineers, was appointed secretary of the group.

The committee on Radio C16, sponsored by the Institute of Radio Engineers, faces the problem of reviewing JAN specifications to coordinate them with civilian standards where possible. In the event of national emergency, this trend should facilitate and expedite procurement of a wide range of radio and electronic components.

### INSTITUTE OF RADIO ENGINEERS

March 7 to 10, the Hotel Commodore and Grand Central Palace in New York City will be the scene of the 1949 national convention of the IRE. Since so much of modern life and living is based upon electronics, "Radio-Electronics—Servant of Mankind" will be the theme of a program combining technical sessions, social events and manufacturers' exhibits. Television will be thoroughly covered.

The IRE's incoming president, Stuart L. Bailey, will be honored by a luncheon, and at the banquet the thirty-one members newly elevated to Fellow for their contributions to radio will be welcomed. Dr. Karl Spangenberg will deliver a speech of acceptance in their behalf.

Among the nearly two hundred exhibits of the latest outstanding developments and products of postwar research will be a center devoted entirely to nuclear instrumentation.

### INDELCO

A new firm in the field of electronics is the *Industrial Electronic Company, Inc.*, Hanover, Mass., formed to produce high quality industrial electronic controls of exceptionally rugged construction. The company is also equipped to do sub-contract work on small electrical or mechanical assemblies. Officers include Clifton Andrews and Harold King.

### RMA AND IRE SPRING MEETING

Virgil M. Graham, director of technical relations for *Sylvania Electric Products Inc.* of Emporium, Pa., announced that the Fourth Annual Spring Meeting of the RMA and the IRE will be held at the Benjamin Franklin Hotel, Philadelphia, Pa., April 25, 26 and 27.

According to Mr. Graham, who is also chairman of the committee, the program will include visits to *Philco* Television Station WPTV, and the *RCA* plant at Camden, N. J. The banquet will be held Tuesday evening, April 26.

### NEW LITERATURE

*Statistical Quality Control*

Production tolerances in the design of electronic systems are discussed in the most recent addition to the Office of Technical Services library on statistical quality control. "Statistical Methods in the Design and Development of Electronic Systems," PB 94625, is available from the Library of Congress, Photoduplication Service, Publication Board Project, Washington 25, D. C., at $7.50 in photostat, $2.75 in microfilm. Remittance should be payable to Librarian of Congress.

"Quality Control Reports," PB 27165, at $2.00 per set, is available directly from the Office of Technical Services, Department of Commerce, Wash., check or money order payable to Treasurer of the U. S.

*El-Tronics, Inc.*

Two bulletins, No. 485 and No. 486 on this firm's line of Geiger-Müller counter sets and survey instruments are available on request. For these and future releases, address Mr. Frank J. McGinnis, 922 Commercial Trust Building, Philadelphia 2, Pennsylvania.

*Radioactivity and Tracer Methodology.*

This hand book was prepared by the Air Material Command of the U. S. Air Forces. The main divisions are: Nuclei and Radioactivity, Measurement of Isotopes and Biological and Medical Applications of Isotopes. Address requests for PB 93615 to the Office of Technical Services, Dept. of Commerce, Washington 25, D. C., remittance payable to Treasurer of U. S.

*Secret Weapon Document*

The "History of Radar," prepared as a non-public document, is now available from the Office of Technical Services, Dept. of Commerce, Washington, D. C. It includes information hitherto classified as secret and, consequently, now freed from security restrictions, is a work of unmatched thoroughness. The development of radar is traced from the last century to the discovery of the Breit-Tuve method used for measuring the height of the ionosphere.

The manuscript is available at the Library of Congress in four parts, at the following prices: PB 93618, PB 93619, and PB 93620 at $9.00 each, and PB 93621 at $4.50, in microfilm. Photostat copies are $53.75, $55.00, $43.75, and $13.75 respectively.

# Industrial Review

### AUTOMATIC RECORDING SPECTRORADIOMETER

*Sylvania Electric Products Inc.*, Emporium, Pa., has designed and built a recording spectroradiometer which will plot the full range of visible light produced on a television viewing tube screen.

It is believed that this new instrument should prove a practical means of

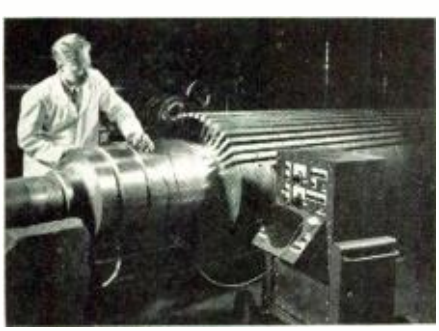
speeding the testing of commercial television tubes. By measuring and recording the degree of output of all visible light wavelengths progressively, the process analyzes the components of the light produced by tube screens, all in 48 seconds for each tube.

Scientific measurement heretofore has been a time-consuming process. The automatic recording spectroradiometer does a complete and accurate job and prints the result. This makes it practical as a quality control instrument, and it should also prove valuable in studying screen decay; that is, the degree of persistence of light on the television viewing tube screen.

* * *

### ULTRASONIC "STETHOSCOPE"

*Westinghouse Electric Corporation*, 306 Fourth Ave., Pittsburgh 30, Pa., has devised an ultrasonic "stethoscope"



which will enable their engineers to examine solid pieces of steel by means of sound waves and thus assure flawless quality in giant electric generators.

By means of this new technique, ultra-high-frequency sound waves are transmitted through massive steel parts. Electrical impulses are changed into sound waves and when projected through the metal reveal tiny cracks, cavities or foreign particles. They reflect sound back to the crystal and on being converted into electrical impulses, these reflections appear as bright vertical lines on the viewing screen of an electronic receiver.

This new testing process is called "ultrasonic" instead of "supersonic," because the word "supersonic" refers to speeds faster than sound, whereas "ultrasonic" refers to sound waves at frequencies beyond the range of hearing.

* * *

### SUPER SPEED X-RAY

While conducting research leading to the development of high-speed x-ray movies for analyzing the burning action of fuel in a rocket, *Westinghouse Research Laboratories* in Bloomfield, N. J. attained exposures of 10 millionths of a second on x-ray film moving at 150 frames a second. It was announced that a special high voltage radar-type pulse transformer and an electronic tube are key units in making exposures of such rapidity.

The electronic tube is flashed at 150,-

000 volts, and the flashes are repeated after 150th of a second pauses to recharge the power supply equipment. The tube used for x-ray movie work is a 14-inch-long cylinder, which is immersed, along with the radar-type transformer, in an insulating oil bath and is placed three feet from the x-ray film.

## Induction Heater

(*Continued from page* 15)

supply. This was the correct procedure whether the oscillator circuit was of the shunt-fed or series-fed type.

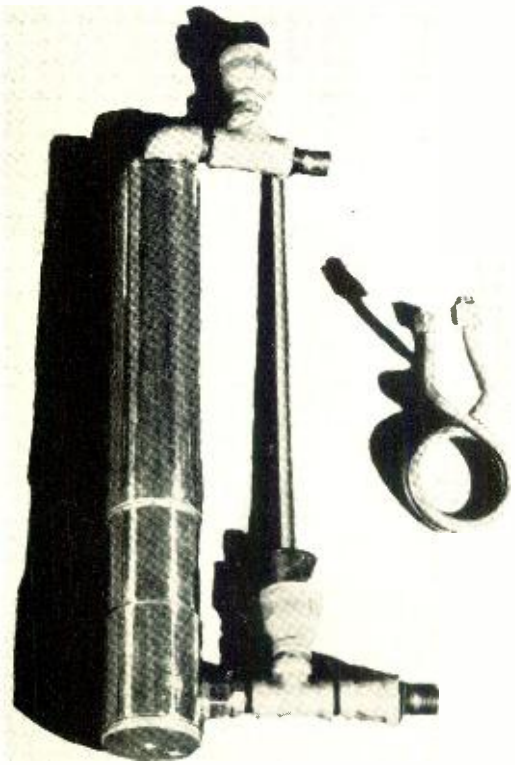
In this method of measurement, the important formula which must be considered is:

$$P = W - L \quad \ldots\ldots\ldots\ldots (3)$$

where $W$ is the input power to the oscillator circuit, $L$ is the power loss in this circuit and $P$ is the power output. To determine the quantity $L$, special care and equipment must be applied. The loss $L$ consists of the rate of dissipating heat energy due to the $I^2R$ loss at the anode and finally the $I^2R$ loss in the tank circuit conductors. All of these losses appear in the form of heat energy absorbed by the water in the cooling system. In order to remove the heat energy from the water-cooled tubes and tank-circuit conductors, it is necessary to force water through the cooling system with the aid of a centrifugal pump. The general layout of the system for measuring $L$ is shown in Fig. 7, with the pump circulating water in the closed system. The quantity of water in the piping system was negligible compared with the 100 gallons in the water tank. If, however, this added error must be eliminated, the quantity of water in the pipe and jacket should be measured and added to the quantity of water in the tank.

As an illustration, one system tested using this set-up had 110 gallons of water and required that the water circulate through the tube jacket at 8 gallons per minute. The time required to completely circulate the water once was 13.75 minutes with the tests actually running for 20 minutes. In one test it was found that the temperature rise in 20 minutes of the 110 gallons of water was 18.2°F. This represented a dissipation of 836 BTU per minute, or 14.75 kw. The total input power to the oscillator tube in this test was measured as 35.0 kw., giving an output power [Eqt. (3)] of 20.25 kw.

Fig 12. Assembled calorimeter.



The foregoing measurements were performed simultaneously with another method described as the calorimeter method.

The calorimeter used in these tests is shown assembled in Fig. 12 and consisted of low carbon, magnetic steel tubing. The calorimeter replaces the normal load of the induction heating unit, as shown in Fig. 9. The tap water supply was connected to the calorimeter hose and water forced through it at the rate of 3.20 gallons per minute. With the aid of the thermometers, the inlet water and outlet water temperatures were measured and the flow meter indicated the number of gallons of water flowing per minute. This information was sufficient to compute the number of kilowatts of power delivered to the calorimeter by referring to the nomogram in Fig. 6. The actual readings of the instruments during one of these tests were: inlet water temperature, 16°C.; outlet water temperature, 41°C.; rate of flow, 3.20 gallons per minute. The power output of the induction heating unit was then obtained with the aid of Fig. 6 by locating the point corresponding to 3.20 gallons per minute and also the point for a 25°C. rise in water temperature through the calorimeter. The former point lies along the abscissa and the latter along the left ordinate. To determine the power output in kilowatts, a straight-edge is placed along the two points and the intersection of this line and the right ordinate labeled, "Power in Kilowatts" is observed. The point of intersection is 21.4 kw., which checks very well with the calculated value of 20.25 kw. obtained by considering the power loss absorbed by the tube cooling water.

To determine the power range of a calorimeter it is interesting to estimate the maximum power advisable to supply a calorimeter of a given size. If less than this calculated power is supplied to the calorimeter, nothing harmful can happen; however, if more than the calculated maximum is supplied, the outer surface of the calorimeter will become red hot and severely oxidized.

The formula used for the purpose of evaluating the maximum power is:

$$kw. = \frac{2\pi k(T_o - T_1)R\,h}{56.8\,d} \quad \ldots\ldots (4)$$

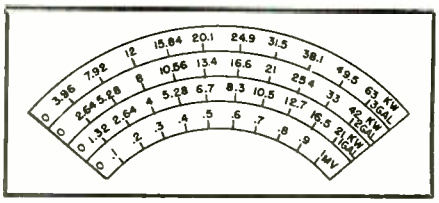



Fig. 11. Typical 1 millivolt scale modified to read kw. of output power using iron-constantan thermocouples.

where $k$ is the coefficient of thermal conductivity, $R$ the mean radius of the steel tubing, $h$ the height of the heated portion of the cylindrical tubing, $d$ the thickness of the heated portion, $T_1$ the inside wall temperature and $T_o$ the maximum advisable outer wall temp.

The calorimeter shown in Fig. 12 had the following dimensions; $R$ equal to .815", $k$ equal to 9.17 BTU/ft.²/C./in./min., $h$ equal to 0.75" and $d$ equal to 0.060". The inside wall temperature is considered to rise to a maximum of 100°C. while the outside wall temperature should not exceed 550°C.

The inside wall temperature will generally not exceed 100°C., since the cooling water is passing the inner wall surface with a very high velocity. The means of obtaining the high water velocity is shown in the photograph of the disassembled calorimeter, identified as Fig. 10. The large plug of brass reduces the cross-sectional area thereby producing a high water velocity at the inner wall surface. The position of the brass plug as well as the baffles with respect to the working section of the calorimeter is shown in Fig. 1.

Substituting these numerical values in Eqt. (4), the maximum power advisable is found to be 27 kw. If more than 27 kw. are supplied to the calorimeter, the outside wall temperature will exceed 550°C. and considerable oxidation of the steel will result. No other harmful effects will occur unless there is insufficient cooling water.

An added feature to the above calorimeter setup was achieved by replacing the mercury thermometers with iron-constantan thermocouples. The thermocouples were connected series opposing so that the voltage across the terminals shown in Fig. 8 was proportional to the difference of the inlet and outlet water temperatures. These terminals were then connected to a millivoltmeter movement. Using the calibration curve of Fig. 5 for the iron-constantan thermocouples the difference in the temperature was read directly. To eliminate reading the millivolt scale and the thermocouple calibration curves, a series of power scales was marked on the millivoltmeter scale, determined by the rates of water flow. Thus, for example, the particular rates of water flow were selected as 1.0, 2.0. and 3.0 gallons per

minute. A copy of this scale is shown in Fig. 11 where the millivolt scale is included as well as the power scales.

By reviewing the foregoing discussion of different methods for measuring and determining the r.f. power output of induction heating units, it is quite obvious that the calorimeter method is by far the most adaptable as well as the most reliable. The calorimeter may be connected from one heating unit to another for test without introducing changes in calibration, which is not generally true of other methods. Finally, it is possible to change the impedance load on the heating unit by first testing with a calorimeter made from a magnetic steel and then with one made from a non-magnetic stainless steel. The first test will yield results which correspond to a low impedance while the latter will correspond to a high impedance load. The performance at these two extreme conditions must not be overlooked when considering the adaptability of a given induction heating unit for general manufacturing purposes.


**REFERENCES:**

1. *Whiteman, R. A., "Current Transformers in Induction Heating,"* RADIO-ELECTRONIC ENGINEERING, *April*, 1947.
2. *Brown, Epstein, and Peterson, Proceedings of the IRE, August*, 1943.


## Transmission Set

(*Continued from page* 15)

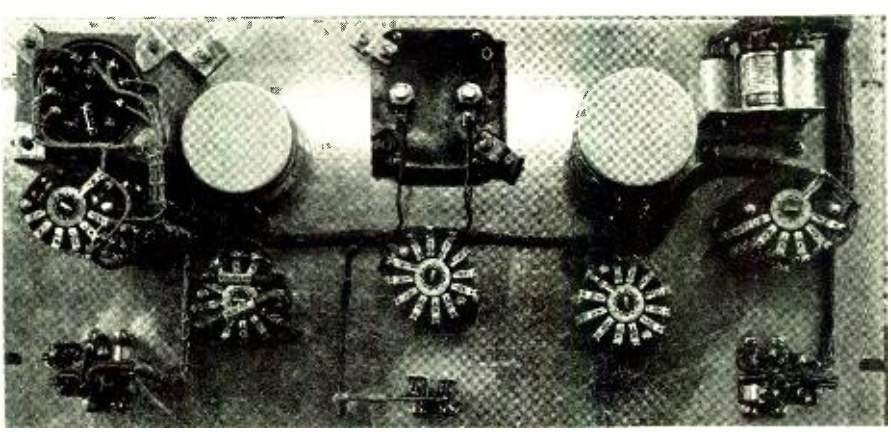
tary switch) places the output load multiple jacks across the load jacks with (1) a parallel 600 ohm resistive load, (2) a 250 ohm resistive load or (3) with no load. Loading the secondary of the output transformer is desirable for certain tests involving transmission line measurements or in other applications where the measuring set output is terminated only in the VU meter. The two additional switch positions cut the multiple jacks from the output circuit and connect a 600 ohm or 250 ohm resistive load, respectively, across the multiple jacks only. This allows the multiple jacks to be used as the terminating load for the equipment under test. The balanced circuit used throughout the measuring set allows uniform results both with balanced and unbalanced equipment.

In the measuring set-up combination shown in Fig. 1, it was found advantageous to insert a fixed 10 db. attenuator between the input and input multiple jacks of the 1-B. The audio oscillator output can then be fed directly into the 1-B input jacks and the distortion-noise meter input taken from the input multiple jacks at a 10 db. reduction in signal level. This permits the calibration control of the distortion-noise meter to be run at a correspondingly higher setting, which in this instance resulted in easier and less critical control adjustment.

The 1-B panel is regular 3/16" x 8¾" x 19" aluminum stock. The unusually neat appearance was made possible by drilling all mounting holes from the backside of the panel so that they penetrated to within about 1/16" of the front panel surface. Proper depth of these holes was determined by drilling a small piece of sample stock until the proper depth was acquired. A good drill press was used to insure perfect alignment and 7/32" high-speed drill bits used. The holes were then carefully tapped to receive 6/32" brass screws. This particular size allowed almost three turns of each screw, just enough to permit good holding action without danger of stripping. Mounting brackets were made for the fixed source attenuators and for the load transformer. Stand-off spacers were cut from ¼" copper tubing (no brass was available) for proper mounting and alignment of the jacks. After a full-scale drawing of the panel design was completed, the blank panels were sent to local concerns for spraying and engraving. A professional, matching panel, at reasonable cost, is the result. After all parts were mounted, the wiring was channeled and laced to prevent vibration and circuit interaction.

A typical set-up for broadcast audio measurements is shown in Fig. 2. The VU meter switch is set to "input" and the oscillator output adjusted to read

Fig. 5. Under-chassis view shows channeled and laced wiring.



the desired reference level. This value is then kept constant for all frequencies. The correct amount of attenuation is then switched into the circuit, about 50 to 65 db. for preamplifiers and about 10 to 20 db. for line or output amplifiers, and the output meter patched in and set to the same reference level. The amplifier gain in db. is then equal to the amount of attenuation in the measuring circuit. Amplifier loss, mismatch loss, etc., may be determined in the same manner.

Frequency-response measurements are made by holding one of the VU meters at reference level and noting the variation in db. of the other. Usually the input meter is used as reference unless appreciable limiting or compressing action is present in the amplifier system. In this case the output VU meter should be held at reference level and variations read on the input meter.

Distortion readings are made by feeding a signal frequency as above and connecting the amplifier output to the distortion-noise meter input. Calibration and control adjustment is carried out in accordance with the operating instructions of the particular noise meter being used. Distortion percentage is usually read directly on the meter scale. For noise readings, the signal frequency is removed and the amplifier input either shorted out or terminated with the proper resistive load. The residual noise is then read on the distortion-noise meter.

At the present time, three of the 1-B transmission measuring sets are in use. One is permanently rack-mounted with its associated distortion-noise meter and audio oscillator in the master-control room of WKRC's transmitter; the second is similarly mounted at the WCTS-FM transmitter. The third set (Fig. 1) is mounted on a portable dolly with an *RCA* Distortion-Noise Meter and an *RCA* Beat-Frequency Oscillator. The dolly is equipped with ball-bearing, rubber-tired rollers and can be moved very quickly from one studio to another. The flat top of the equipment cabinet supports a tube tester (not shown) to make a completely self-contained test unit.

Development of the 1-B measuring set was under the general supervision of George A. Wilson, Chief Engineer of WKRC, WCTS-FM and WKRC-TV, and was carried out by W.. H. Kennedy (Supervisor) and engineers Harold Magee (who also developed the present design), Eldon G. Bisbee, Jack Hohman, James Ringland and the author. Its operation has more than justified the time spent in its design and construction.

**REFERENCES**


1. *FCC "Standards of Good Engineering Practice for FM Stations."*
2. *RMA Standards Proosal Number 186, January 15. 1947.*


# Industrial Television

(*Continued from page 6*)

gain as possible, 200 volts per stage has been used on the utiliscope. If the multiplier in a particular tube happens to have an extremely high gain, it is quite probable that the last stages of the multiplier will be subject to current saturation. However, if a tube was used which had a comparatively low gain multiplier, it would be necessary to operate the stages at 200 volts in order to get more than ample video from the dissector at all usable light levels. To take care of the multiplier from tube to tube, as well as to provide a means for getting maximum peak to peak video signal from the dissector multiplier under various light conditions, a video overload control is used in conjunction with the multiplier. This control simply varies the gain of one of the earlier stages in the multiplier over wide limits. Since the saturation problem only concerns the last two or three multiplier stages, the control is used on stage #6.

Fig. 6 shows the saturation a little more clearly. Referring to the figure, the $x$ coordinate shows the light on the photosensitive cathode while the $y$ coordinate shows the collector current for varying amounts of light. Curve $A$ is a plot of the cathode current as it varies with light. If there is no multiplier saturation, the collector current should follow the same characteristics as this curve. Curve $C$ illustrates the saturation of the multiplier when using 200 volts per stage on this particular dissector. It will be noted that saturation occurs at a variac setting of approximately 30 volts. Curve $B$ shows the collector current curve for the case when the gain of stage #6 has been considerably reduced by dropping the voltage between multiplier stage #5 and #6. It will be noted that this curve is relatively linear up to the maximum variac setting. Incidentally the variac voltage shown is the voltage which was supplied to a small slide projector. The light from this projector was then projected on the cathode of the dissector. Referring again to the curve, it can be seen that if the light on the cathode varied between 50 and 100, the actual collector current change would be only about .3 ma. However, with the gain decreased in stage #6, the collector current change would be approximately 1.2 ma., or four times the video output. If the light were to swing between the values of approximately 20 and 80 or 90, it can readily be seen that the points which correspond to maximum light on the cathode would be crushed and the picture would have a washed-out appearance.

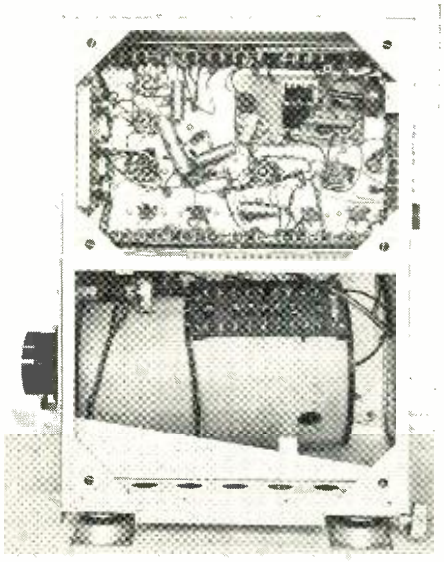


Fig. 11. Side view of camera unit.

Fig. 5 shows a block diagram of the deflection unit. $V_1$ is used as the vertical scanning oscillator for the dissector operating at a frequency of 60 cycles. In order to obtain a synchronizing pulse, a small amount of 120 cycles from the power supply rectifier is fed into a grid of the vertical oscillator. An integrating circuit is placed across the saw-tooth developed by the scanning oscillator in order to derive a 60 cycle pulse, which is later used for blanking and synchronizing of the monitor. The developed saw-tooth is then fed to $V_2$, the vertical scan amplifier, where it is amplified. Output of the vertical scanning amplifier then feeds the dissector vertical deflection coils through a matching transformer. The vertical deflection coil has an inductance of approximately 1 millihenry. $V_3$ is the horizontal scanning tube which furnishes the horizontal scan for the dissector, and a horizontal pulse which is used for synchronizing the monitor, as well as a pulse which is later shaped and used as the horizontal blanking pulse. (This circuit will be discussed later.) The beam relaxor, as it is called, also furnishes a pulse which has a peak amplitude of approximately 3 kilovolts which is rectified by $V_4$ to supply 2 kv. d.c. to the dissector multiplier.

Fig. 12 shows the beam relaxor and high voltage circuit a little more in detail.* This circuit operates at a fre-

*See—"A Deflection-type H. V. Power Supply for Television Receivers." RADIO-ELECTRONIC ENGINEERING edition of RADIO NEWS. June 1946.

**PHOTO CREDITS**

Pages

3, 4, 5, 30....Farnsworth Research Corp.

7, 8.....General Electric Co.

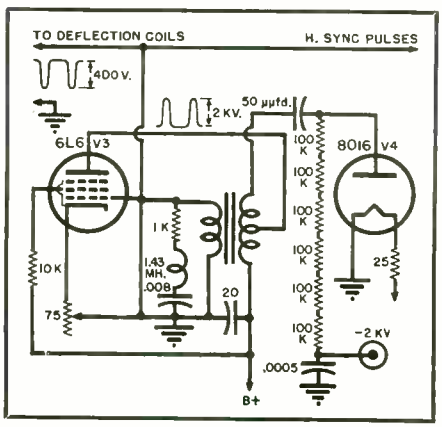
16.....Tel-Instrument Co.

quency of approximately 15,750 cycles. The oscillator is an $L/R$ type in which the frequency determining constants are the dynamic plate resistance of the tube and the plate circuit inductance. Actually the deflection coils, which are directly across the grid side of the transformer, and the stepup ratio of the transformer, determine the inductance in the plate circuit. Impedance of the horizontal deflection coil is approximately 2 millihenries. The turns ratio of the beam relaxor transformer is approximately 6 to 1. The operating dynamic resistance of the 6L6 is approximately 1000 ohms. This oscillator develops an impulse across the plate circuit which has a peak value of approximately 2000 volts. The grid wave is the same in form as the plate wave, and has an amplitude of approximately 400 volts. The linearizing circuit which is placed in parallel with the deflection coils is to remove overshoot which appears at the end of each pulse. Width of this pulse is approximately 10 microseconds. The frequency of the beam relaxor can most readily be controlled by varying the cathode resistance. In this case a fixed resistance is used in the cathode circuit inasmuch as the frequency of 15.75 kc. is not critical and a deviation of as much as plus or minus 500 cycles will make no difference.

An additional winding is placed on the beam relaxor transformer in order to raise the 2 kv. plate impulse to approximately 3 kv. This 3 kv. pulse is then rectified by the high voltage rectifier $V_1$ to supply the d.c. voltage for the dissector multiplier.

Referring once again to Fig. 5, $V_5$ is used for distributing out, at low impedance, horizontal and vertical synchronizing pulses to the monitor. The horizontal pulses obtained from the grid of the beam relaxor are divided down to approximately 40 volts where they are fed into the grid of one section of $V_6$. These horizontal pulses are then taken from the cathode of this tube and used

Fig. 12. Beam relaxor and high voltage circuit.




for snychronizing the monitor horizontal oscillator. The other half of $V_5$ is used to give a low impedance output source for the vertical synchronizing pulses. These same horizontal and vertical pulses which are fed to the sync output tubes are also fed to $V_6$, the horizontal and vertical blanking mixer and mixer injector. The function of this tube is to shape, mix, and clip the blanking pulses. These blanking signals are then fed to $V_7$, the first half of which is used as a blanking injector and automatic black level setter, and the second half is used as a video amplifier. To better understand this circuit, refer to Fig. 9. It can be seen that the horizontal and vertical signals are fed to the grid of the first half of $V_6$. These signals are then clipped in this section and fed to the second section of $V_6$. This section is used as a cathode follower. The 80 ohm cathode resistor is chosen so as to give approximately 5 volts peak blanking pulses at this point. Although these pulses are clipped in the first section of $V_7$, it is necessary that the amplitude of these pulses on the cathode of $V_6$ be no greater than necessary. If the amplitude of these pulses is extremely great, there will be a small amount of horizontal pulse fed through $V_7$ due to the grid-cathode capacitance of the tube. This small capacitance will cause the signal fed through to be differentiated, which will give a small negative pip in the video. This will show up as a bright bar on the leading edge of the picture.

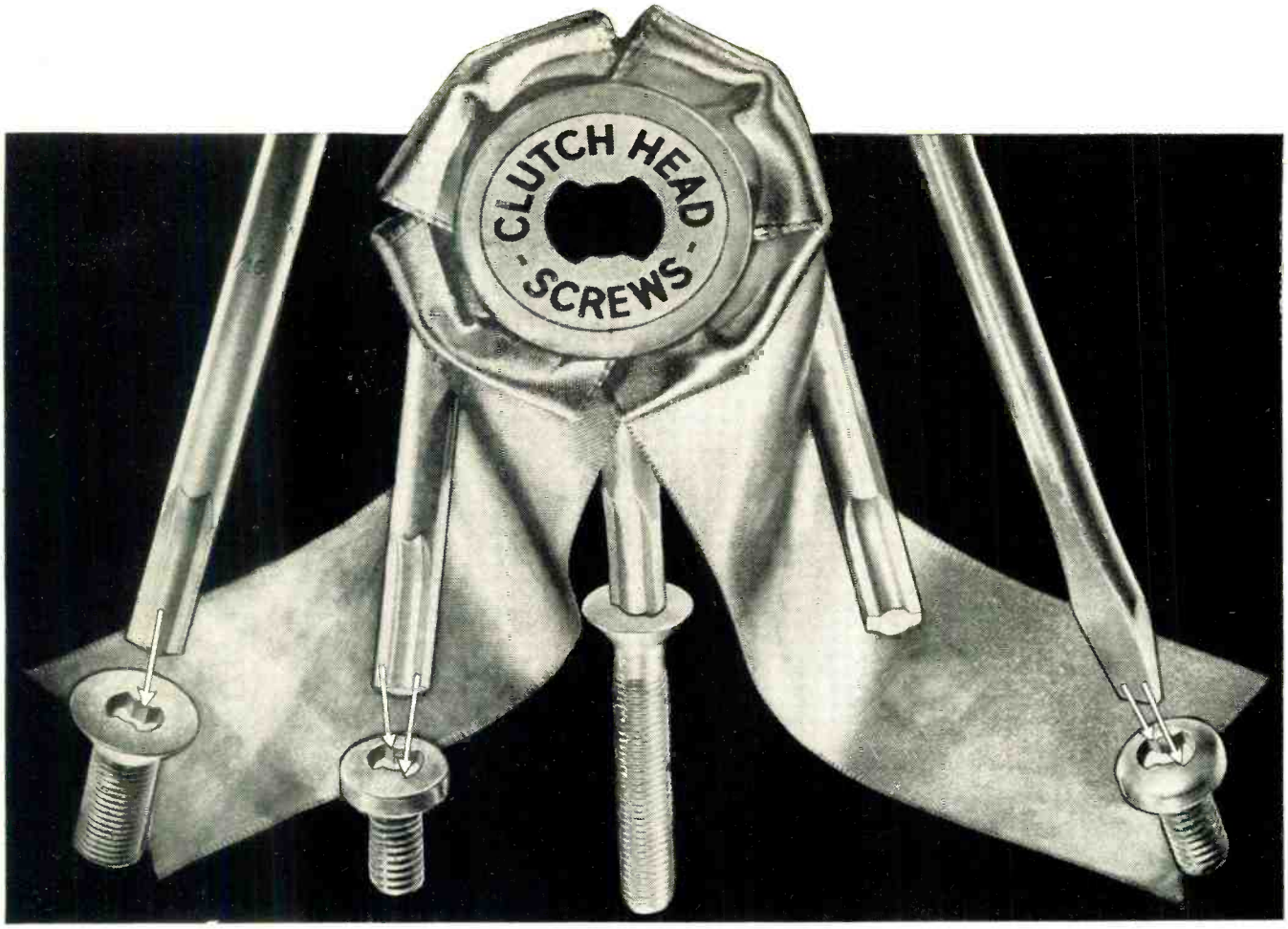
The d.c. voltage developed across the dissector collector load resistor due to random noise in the dissector will remain a constant value. Any light which strikes the cathode will cause a corresponding increase in collector current, hence increased negative voltage of collector. Since more light causes more electrons to flow to the collector, the collector becomes more negative with respect to ground.

The initial clipping level of the level setter can be set by applying just enough positive voltage to the cathode of $V_7$ to allow only a very small amount of the blanking pulses to come through. Any light on the dissector cathode will then cause more negative voltage to appear at the clipper cathode, which will pass through the diode, so the pedestal will always be full but no video can ever extend beyond black level.

Referring once again to Fig. 5, $V_4$ is used as the second video amplifier and cathode follower output tube. The cathode follower is designed to work into a 100 ohm line.

Fig. 10 shows a schematic of the monitor. The deflection circuits for the monitor are very similar to those used in the camera. The deflection yoke has an impedance of approximately 2 mh. and is matched to the vertical output amplifier by a transformer. Horizontal sync signals are amplified by a 6SN7 and this amplified pulse is injected into the screen of the beam relaxor by using a common impedance in the sync amplifier plate and beam relaxor screen. The one basic difference between the monitor and camera unit is that the high voltage needed for the cathode ray tube is positive and should be between 6 and 8 kilovolts. This voltage could be obtained by the use of one 8016 rectifier; however, it was felt that the additional safety factor obtained by using two rectifiers in a voltage doubler circuit was well worthwhile in view of the service requirements of the equipment. A 6AC7 is used as a video amplifier in order to raise the video level to approximately 15 volts peak to peak.

Although the equipment was initially designed for use in conjunction with the water gauges at power plants, there have been many uses for this type equipment. One of the most recent and probably most interesting is that one of these units had been subjected to intensive radiation in one of the places where a large amount of atomic research is being carried on. It was found that the radiation had no effect on the equipment and that it can be used as an aid in atomic research.

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COMMON SCREWDRIVER



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**2** Absence of "ride-out," due to CLUTCH HEAD'S non-tapered driving engagement, checks out hazard of driver skidding. Freedom from end pressure makes driving effortless, safer and smoother for a stepped up tempo.

**3** The Lock-On to check out fumble spots . . . screw and bit locking as a unit to permit one-handed reaching and driving from any angle.

**4** The unequalled durability of the Type "A" Bit with a record of driving 214,000 screws non-stop . . . plus the economy of its repeatable reconditioning in a simple 60-second operation.

**5** The importance of CLUTCH HEAD'S basic design for common screwdriver operation . . . to simplify adjustments and cure field service "headaches."

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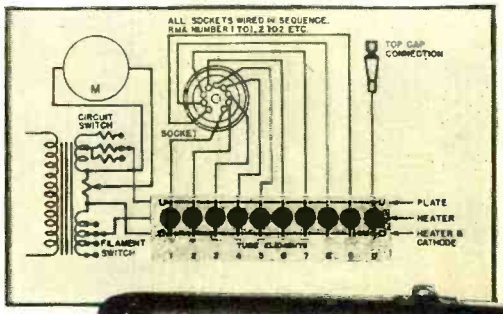
## Lever Switching Connects Each Tube Pin to Proper Circuit

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5. **"PICTURE" YOUR CIRCUIT** —Assures confidence in tests and enables special tube checks for balanced circuits, special loads, etc. "Trick" switching circuits make it more difficult for the serviceman to "picture" his test circuit.
6. **SET UP YOUR OWN TEST FOR NEW TUBES** — The "pictured" circuit and straightforward test procedures enable the user to set up data for new tubes. A feature rarely found in commercial type tube testers.
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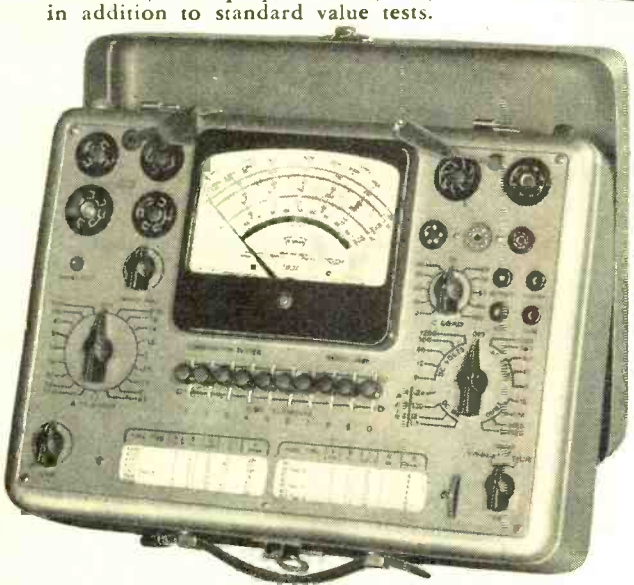

## . . . Combination Volt-Ohm-Mil-Ammeter Model 3480

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D. C. Amps: 0-12, at 250 Millivolts.
D. C. Milliamps: 0-1.2-12-120, at 250 Millivolts.
Ohms: 0-1000-10,000 (10-100 at center scale).
Megohms: 0-1-50 (10,000-500,000 Ohms center scale).
Output. Output Jacks, Condenser in series with A. C. Volt ranges.
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The West Madison Street outlet is one of the newest and neatest layouts in all Chicago. But it's still as homey and comfortable as an old felt hat. No matter how busy the place is with local radio men rushing in to pick up parts, there's always time to bat the breeze with visitors from Iowa or Kansas.

### MAIL ORDERS SPEEDED

Mail orders are handled at the Jackson Blvd. place. The orders pour in by the bushel basket every day, and they're processed right through the world's biggest radio supply organization, marked special all the way.

The Parts Counter at 229 West Madison St., Chicago

Usually by the same night, your order has been filled, checked and double checked, packed and sent winging on its way. Quite an operation! Lafayette can do it, because we're geared that way. We keep a tremendous stockpile in Chicago so that you won't be held up a minute. Thousands and thousands of different items are held in instant readiness including the hard-to-get things a man could spend days looking for.

### FRIENDLY, HELPFUL ADVICE

Lots of orders come in with pretty tough problems attached, including some lulu's on TV and hi-fi! But it's all in a day's work at Lafayette-Concord . . . and we have a staff of smart engineers who sit in their own private ivory tower and do nothing else but help solve your technical problems.

### REAL MONEY-SAVING VALUES

But most of all L-C customers go for the rock-bottom prices, whether they order from the mail order centers in Chicago, New York and Atlanta . . . or shop in person at any of the L-C outlets. With the cost of living what it is, that's a mighty important consideration these days.

**See Page 125 for L-C Bargain Supplement!**

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### 4 WAYS TO LOOK AT TELEVISION!

How do you get around the problem of congestion that comes up when groups gather around video? E. Burton Benjamin of New York has come up with an interesting answer. It's a 4-screened, 360 degree, all-angle-vision TV set, for which patent is now pending. This receiver can be encircled with chairs so that up to 100 people can see the action. Mr. Benjamin states that the 4-way screening is achieved without quadrupling the cost; using a single projected cathode ray tube with a series of semi-silvered mirrors that reflect and transmit the image from one projecting kinescope. Sounds like a sensible idea for circular bars, theaters, hotel lobbies and other public places.


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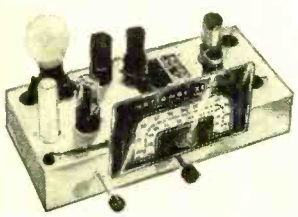

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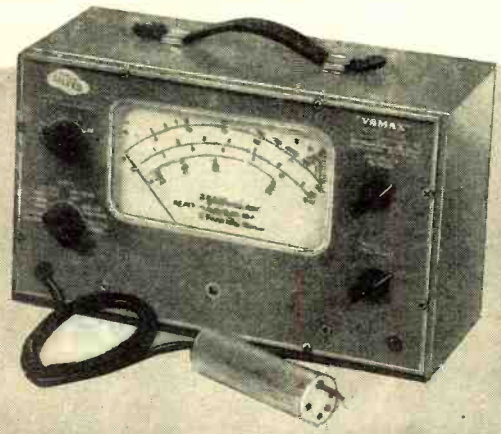

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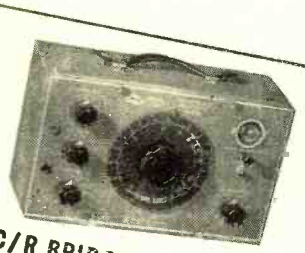

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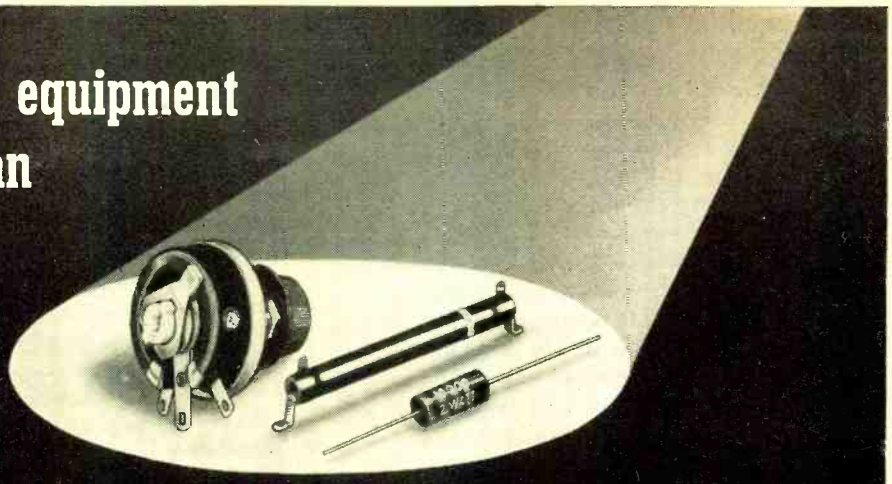

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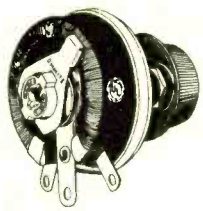

Here is the most extensive line of rheostats offered today . . . 10 sizes, from 25 to 1000 watts, with many resistance values. All-ceramic construction. Windings are locked in vitreous enamel.

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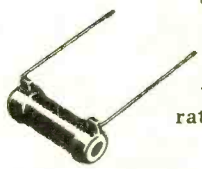
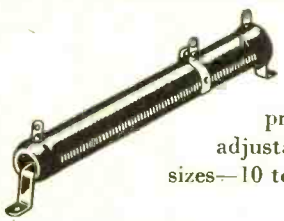


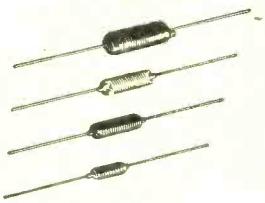
Resistors are wire wound on a ceramic core, rigidly held in place, insulated, and protected by vitreous enamel. Even winding dissipates heat rapidly —prevents hot spots. Many types, in ratings from 5 to 200 watts.

### DIVIDOHM ADJUSTABLE RESISTORS



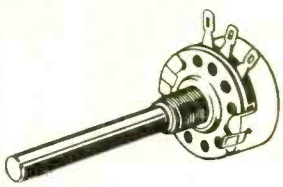
Used as multi-tap resistors or voltage dividers. Narrow strip of exposed winding provides contact surface for the adjustable lug. Available in seven sizes—10 to 200 watts.

### RADIO FREQUENCY PLATE CHOKES



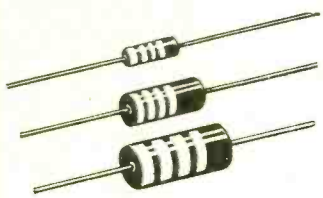
Single-layer wound on low power factor steatite or molded plastic cores. Seven stock sizes cover range 3 to 520 mc. Two units rated 600 ma; all others 1000 ma.

### MOLDED COMPOSITION POTENTIOMETER



A 2-watt molded composition unit with good margin of safety. It is unaffected by heat, cold, or moisture. Resistance element is a thick, solid-molded ring.

### MOLDED COMPOSITION RESISTORS



Small and sturdy, these "Little Devil" units come in ½, 1, and 2-watt sizes. 10 Ohms to 22 megohms. Tol. ± 10% and ± 5%.

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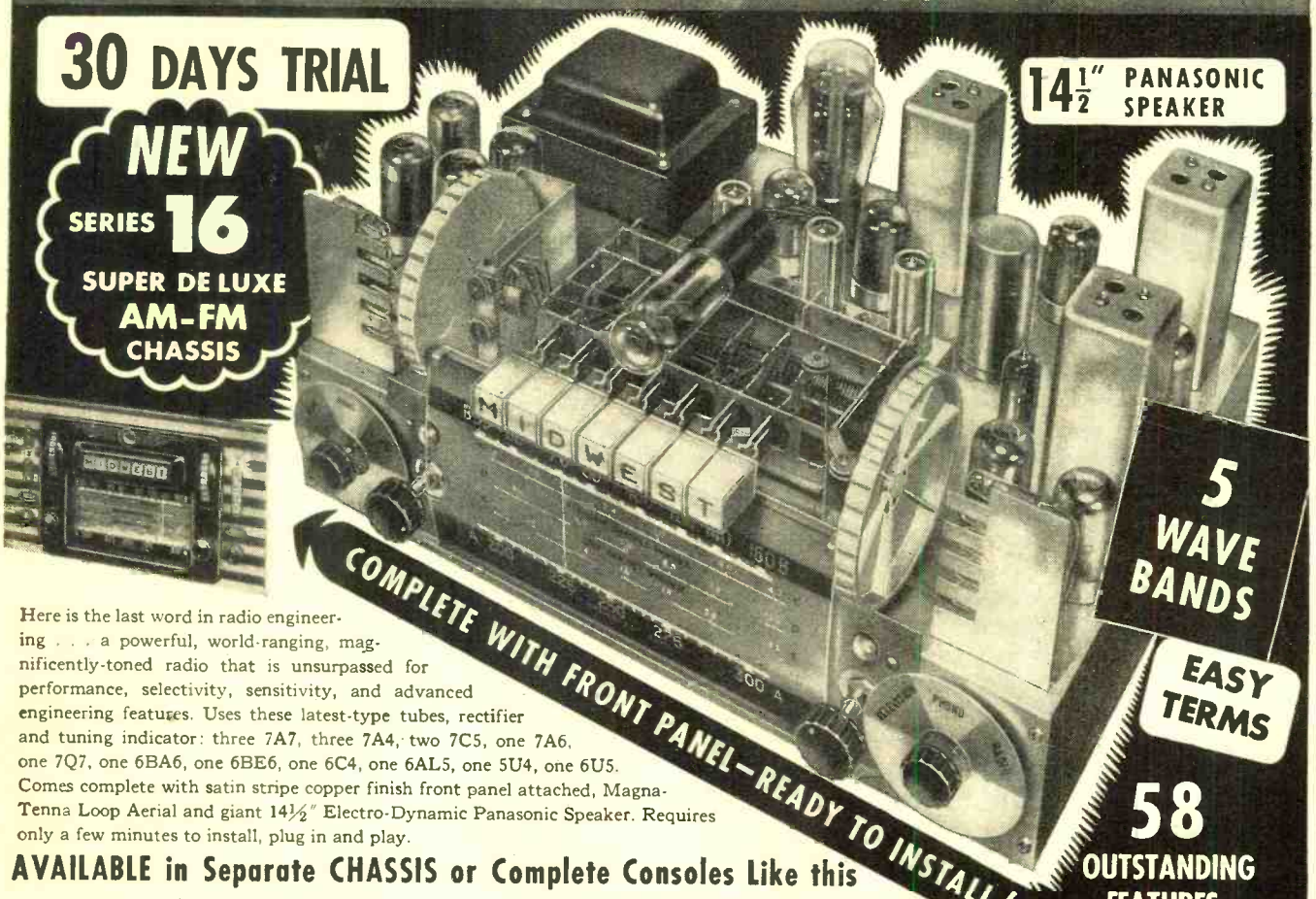
NEW SERIES 16 SUPER DE LUXE AM-FM CHASSIS

14½" PANASONIC SPEAKER




5 WAVE BANDS

EASY TERMS

COMPLETE WITH FRONT PANEL—READY TO INSTALL!

58 OUTSTANDING FEATURES

Including the Exclusive Midwest FLASH-O-MATIC Volume and Band Indication TELEVISION Audio Switch-Over FIDEL-A-STAT Color-Ray Tone Selection TRI-MAGNADYNE Coil System ...Plus NO-DRIFT FM and many other features

Here is the last word in radio engineering . . . a powerful, world-ranging, magnificently-toned radio that is unsurpassed for performance, selectivity, sensitivity, and advanced engineering features. Uses these latest-type tubes, rectifier and tuning indicator: three 7A7, three 7A4, two 7C5, one 7A6, one 7Q7, one 6BA6, one 6BE6, one 6C4, one 6AL5, one 5U4, one 6U5. Comes complete with satin stripe copper finish front panel attached, Magna-Tenna Loop Aerial and giant 14½" Electro-Dynamic Panasonic Speaker. Requires only a few minutes to install, plug in and play.

**AVAILABLE in Separate CHASSIS or Complete Consoles Like this**

Beautiful **SYMPHONY GRAND AM-FM RADIO PHONOGRAPH**

with NEW **DUAL-SPEED** Automatic **RECORD PLAYER**

For Both STANDARD and LP RECORDS

A Magnificent musical instrument and a masterpiece of cabinet design. Uses Series 16 Super DeLuxe AM-FM Chassis. Giant 14½" Panasonic Speaker; Tri-Magnadyne Coil System; Built-in Loop Antenna. Other luxurious console and table model cabinets available with Series 16, 12 and 8 chassis—on Easy Terms and 30 Days Free Trial.

**BUY DIRECT FROM FACTORY and SAVE!**

**MIDWEST RADIO & TELEVISION CORP.**

Dept. 377 909 Broadway, CINCINNATI 2, OHIO

**Rush for Free Catalog!**

Send This Coupon Today—Write In Name and Address (Please Print) on Coupon or 1c Postcard

MIDWEST RADIO & TELEVISION CORP.
Dept. 377 909 Broadway, Cincinnati 2, Ohio

Please send me your new FREE 1949 Catalog.

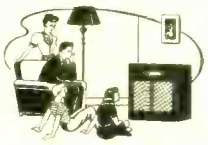
NAME .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

# SYLVANIA TUBES ARE RIGHT AT HOME IN THE FINEST HOME RECEIVERS


Admiral
Andrea
ARVIN
Automatic Radio
Belmont
Bendix Radio
CROSLEY
Emerson Radio
ESPEY
FADA Radio
Farnsworth
GAROD RADIO
GLOBE hallicrafters
Hoffman
Magnavox
Motorola
National
Olympic
PHILCO
Regal
Sentinel Radio
Silvertone
Sparton
STROMBERG-CARLSON
Tele-tone
Temple
TRAV-LER
Westinghouse
ZENITH RADIO



Sub-miniatures, seven- and nine-pin miniatures, standard types, and the great Lock-In radio tubes are all included in the famous Sylvania line . . . all represented in the leading makes of home receivers—from portable models to console combinations and television receivers.

It is the high quality of these Sylvania tubes that has made them preferred . . . has made them famous throughout the world.

For full information about Sylvania tubes, see a Sylvania Distributor, or write Sylvania Electric Products Inc., Radio Tube Division, Emporium, Pa.

# SYLVANIA ELECTRIC

RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; PHOTOLAMPS; ELECTRIC LIGHT BULBS

# Within the INDUSTRY

**ROBERT W. GALVIN** has been named executive vice-president of *Motorola, Inc.* filling a position which has been vacant since 1944, following the death of Joseph E. Galvin, who was co-founder of *Galvin Manufacturing Company,* forerunner of *Motorola, Inc.*

The new executive vice-president is 26 years old and has been a director of the company since 1945. Mr. Galvin has been with the company since 1940 and has served in various capacities.

Mr. Galvin served in the U. S. Army Signal Corps and received his medical discharge in 1943. Prior to his recent appointment he was, for two-and-a-half years, assistant to Elmer Wavering, vice-president in charge of *Motorola's* auto radio division.

* * *

**J.F.D. MANUFACTURING CO., INC.** of Brooklyn, New York has recently completed a new factory building which will provide 60,000 square feet of floor space in addition to an adjoining plot of 10,000 square feet.

The new factory is three stories and will be used for the mass production of more than 4000 radio items, 30 antennas, and 50 television accessories. The expanded facilities occupy the block between 61 and 62 Street on 16th Avenue in Brooklyn and will include the latest in automatic fabricating equipment, an indoor-outdoor shipping department, a materials storage room, a tool and machine shop, an engineering department, etc. as well as the executive and sales offices which will be located on the second floor of the building.

* * *

**RUDY BLANK,** long-time veteran in point-of-purchase promotions, has been named Eastern sales promotion manager for *The Magnavox Company* of Fort Wayne, Indiana.

Most recently active in field sales promotion for the *International Silver Company,* Mr. Blank was previously associated with the display and promotion departments of *Calvert Distillers Corporation* and a number of well-known display manufacturers.

In his new position, Mr. Blank will assist franchised *Magnavox* dealers throughout the east in all types of promotional efforts, store and window displays, direct mail, and local newspaper advertising. He will serve as field coordinator for the company and dealer promotional activities.

* * *

**HOWARD W. SAMS & CO., INC.** is currently issuing a "Round Robin" which will be distributed as a service to radio service associations.

According to the publication, the new "Round Robin" will act as a clearing house for material of interest to the various service organizations throughout the company. The publisher has emphasized that his role is merely one of "gathering, analyzing, collating, interpreting, and publishing factual material that will add to the efficiency, economy, and profitable operation of any business that has occasion to use it."

Copies of this new publication are available to the officers of any radio service organization requesting them. Requests for copies should be addressed to *Howard W. Sams & Co., Inc.,* 2924 East Washington Street, Indianapolis 7, Indiana.

* * *

**H. S. MORRIS** has recently been promoted to the post of products sales manager for the *Altec Service Corporation* of New York.

This new move has been designed to materially expand the sales organization. Mr. Morris who was formerly Eastern representative for *Altec Lansing Corporation, Altec Service's* manufacturing subsidiary, will be responsible for sales in the Eastern, Middle Western, and Southern territories in which the company's industrial, public address, and home music system products are sold through electrical dealer and contractor organizations.

* * *

**ILLINOIS INSTITUTE OF TECHNOLOGY** is now accepting applications for the 1949 *Westinghouse* fellowship in power systems engineering.

An award of $1500 and free tuition for three semesters of full-time intensive training leading to a master of science degree in electrical engineering is made to the successful applicant.

Candidates must have a bachelor's degree in electrical engineering from an accredited engineering college. The award will be based on personal qualifications, interest, and scholarship.

Terms of the fellowship will begin

RADIO & TELEVISION NEWS

# $10,000 CONTEST

## CONTEST RULES

1. This contest is open to licensed amateurs only and is restricted territorially to the United States, its Possessions and Canada. Licensed status to be determined by listing shown in the Winter issue of the 1948-1949 Radio Amateur Callbook.
2. All entries to this contest must be made on official entry blanks available in Radio & Television News (Feb., Mar., and April 1949 issues) or from contest editor, Radio & Television News, 185 North Wabash Avenue, Chicago 1, Illinois.
3. Two sets of awards will be given: Individual, and Club or Association. Awards will be made on a point system, points to be determined as follows:

   For the training and bringing to operator and station licensed status of any new amateur, 1 point for the individual trainer and 1 point for his club or association.

Notification of the completion of training and the securance of license for any new licensee must be made by the trainer of that person and sent by him to Radio & Television News on official entry blank. A master file of the licensees will be maintained, with proper credit to the contestant for the year 1949. New contest blanks and a statement of your status in the contest will be sent you by return mail. In case of ties, earliest postmarked entrees will be the winners.

Final determination as to the official licensed status of all new licensees will be checked with the Spring 1950 edition of the Radio Amateur Callbook, but all entrees must be postmarked not later than midnight, Dec. 1, 1949. The new licensee will sign the entry blank to attest that he secured his license through the help and training secured from the contestant. Contest closes midnight Dec. 1, 1949.

## INDIVIDUAL AWARDS

**1st Prize.** To the individual responsible for the successful licensing of the largest number of new amateurs, a complete ham station worth $1500.

**2nd Prize.** To the individual responsible for the second largest number of new amateurs, a complete ham station worth $750.

**3rd Prize.** A $300 transmitter or receiver.

**Runner-up Awards.** Ten $100 receivers.

**Consolation Awards.** Fifty merchandise awards of a value not less than $10 each.

## CLUB and ASSOCIATION AWARDS

**1st Prize.** To the amateur radio club or association adding the largest percentage of new members licensed during the contest period, a $1500 ham station. In determining percentage of membership increase, accurate numerical status of membership as of January 1, 1949 will be sworn and attested to by association secretary. All statements must be postmarked not later than March 15, 1949 to be eligible in this contest.

**2nd Prize.** To the amateur radio club or association adding the second largest percentage of new members licensed during the contest period, a $750 ham station.

**3rd Prize.** A $300 transmitter or receiver.

**Runner-up Awards.** Ten $100 receivers.

**Consolation Awards.** Fifty merchandise awards of a value not less than $10 each.

(All values based on manufacturers amateur net prices)

## JUDGES

Oliver Read, W9ETI, Editor of Radio & Television News
Ray Frank, W9JU, Associate Editor of Radio & Television News
Charles Stimpson, W9TRD, Publisher of Radio Amateur Callbook
Fred Schnell, W9UZ, National Service Mgr., Motorola Communications Equipment Division.

### *126 Merchandise Awards for Licensed Hams, and Ham Clubs, Training New Licensees During 1949.*

The Purpose of this contest is to increase the number of licensed amateurs from its present level of 80,000 to a minimum of 100,000 in 1949.

According to government statistics, amateur radio is showing a declining rate of numerical gain. Coupled with this is the fact that the age of the average licensed amateur has increased from the pre-war average of 29-30 to a current average of 34.

Amateur radio needs new blood. To get it, Radio & Television News is offering $10,000 in amateur radio equipment as reward for those contributing most to the increase, betterment and future security of amateur radio in 1949.

## ENTRY BLANK

Name of Contestant.....Call.....

Address.....

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

**The following new amateurs were qualified by me in securing their amateur license during the contest period.**

Club Affiliation.....

Name.....Signature of Licensee.....

Address.....

Call.....Date of Issuance.....

Name.....Signature of Licensee.....

Address.....

Call.....Date of Issuance.....

***Attach additional sheets here as required***

September 13, 1949. Further information and application blanks may be obtained from Dean Lewis, *Illinois Institute of Technology*, Technology Center, Chicago 16, Illinois.

* * *

**MARIO A. GARDNER** is the new director of purchases for *Air King Products Co., Inc.*, Brooklyn manufacturers of radios, combinations, wire recorders, and television receivers.

Mr. Gardner was formerly director of purchases and a member of the board of directors of *Templetone Radio Manufacturing Co.*

Prior to that he was associated with *Radio Corporation of America* and *Emerson Radio Corporation* in purchasing duties of executive nature.

* * *

**NOBLITT-SPARKS INDUSTRIES, INC.** has announced its entry into the television field with a line of video receivers carrying the *"Arvin"* tradename.

The new television line will be manufactured at the company's Columbus, Indiana plant. The engineering department of the company is currently being expanded to handle the new receivers. Ben H. Irwin will head the television engineering staff while Orphie R. Bridges has been named superintendent of the newly-created television and radio manufacturing division.

* * *

**PAUL BRADY**, head of *Paul Brady and Associates* of Minneapolis, has been named manufacturer's representative for *Air King Products Co., Inc.* of Brooklyn.

Mr. Brady, who maintains offices at 415 Essex Building in Minneapolis, will cover Northern Wisconsin, Minnesota, North Dakota, and South Dakota for the company.

He has been a radio buyer and merchandise man since the days of the crystal set. In that capacity he spent 25 years with the *New England Furniture Company*. He is a member of the Board of Directors of the Electric Appliance Dealers Association and has twice served as president of the Northwest Radio Trades Association.

* * *

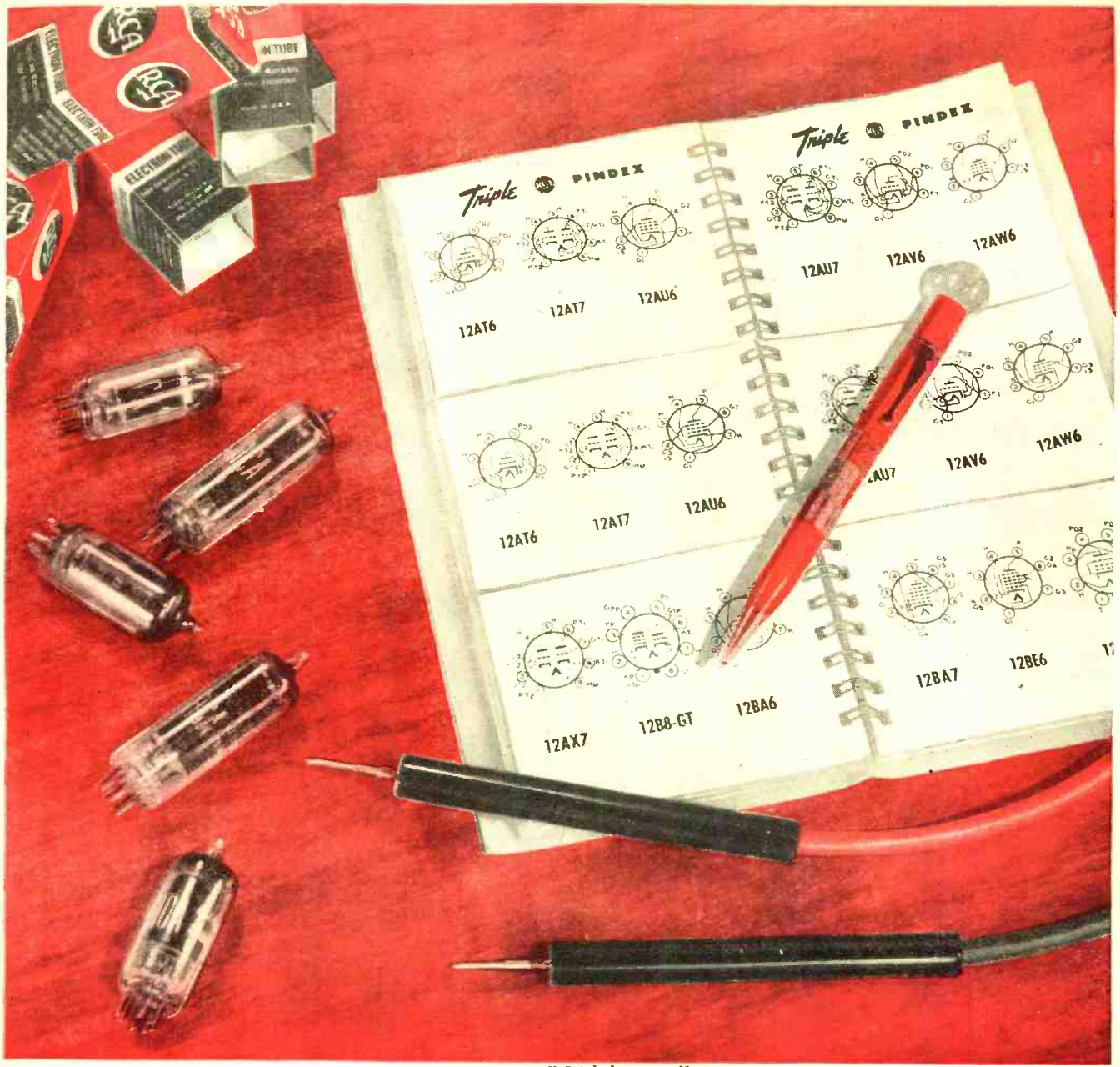
**ANDREA RADIO CORP.** has announced several new appointments to its staff.

R. Masvidal, export manager of the company, has just been made assistant to the general sales manager of the organization. He will continue his duties as export manager.

Daniel F. Lee, formerly associated with *Petro-Chem Development Co.*, has been added to the purchasing department of the company.

Also revealed was the appointment of Joseph Poitress, formerly works manager of *Fada* and more recently

(*Continued on page* 164)




*RCA helps you all the way . . . with the best in business and sales aids.*

# There's *more* business in RCA miniatures

FEATURE FOR FEATURE, RCA miniatures have electrical and mechanical characteristics that set them apart from other tubes. That's why more RCA miniatures are used in FM and TV receivers *where it's the tube that counts.*

This extra quality cuts down costly service call backs . . . builds customer confidence—brings you *more business.*

When you push RCA tubes you're selling the brand that holds top customer acceptance. So . . . *push RCA tubes and watch your business grow!*


***Sign Up!* for more profits**

RCA's famous "Fire Ball" fluorescent sign out front will bring in more customers. Sign up for yours today.

**ALWAYS KEEP IN TOUCH WITH YOUR RCA TUBE DISTRIBUTOR.**

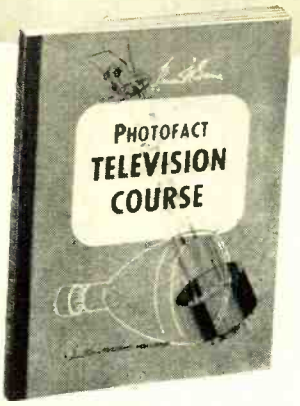
**TUBE DEPARTMENT**

**RADIO CORPORATION of AMERICA**

**HARRISON, N. J.**

# NOW! The Famous $500 Photofact TELEVISION COURSE in Book Form!

**Previously available only to Photofact subscribers—now published to answer the insistent demand of the entire Radio Industry**




Now you can own the book that gives you a *complete, clear* understanding of modern TV principles, operation and practice. Previously available only in PHOTOFACT Folder Sets, this superb course has been bound in unified book form to meet an overwhelming demand from radio men in every branch of the industry. Written in clear, easy-to-follow language, profusely illustrated, packed with valuable up-to-the-minute data. Covers every phase of television—gives you the groundwork you *must* have to become a successful TV service technician. Bring your television knowledge up-to-date this easy, economical way. The PHOTOFACT Television Course is available at your jobber—order your copy today! Over 200 pages; fully illustrated; sturdy binding, 8½ x 11". Only.. **$3.00**

**A "Must" for Everyone in Radio!**


## NEW! 1948 Automatic Record Changer Manual

**New Volume 2 covers 45 models made in 1948,** including new LP and dual-speed changers, plus leading Wire and Tape recorders. It's easy to service record changers when you have the PHOTOFACT Record Changer Manual handy. Complete, accurate data—based on analysis of actual equipment. Gives full change cycle data, information on adjustments, hints and kinks, complete parts lists, exclusive "exploded" diagrams. Have this time-saving, money-making book in your shop. Over 400 pages; de luxe bound, 8½ x 11". Only..... **$6.75**

**1947 EDITION. Volume 1,** Automatic Record Changer Manual. Covers more than 40 different post-war changer models manufactured up to 1948. Includes full hard-to-get data on leading Wire, Ribbon, Tape and Paper Disc Recorders. 400 pages; fully illustrated; 8½ x 11", hard cover. Only..... **$4.95**

## NEW! Specialized Photofact Volumes


POST-WAR
**AUDIO AMPLIFIERS and Associated Equipment**

This is the book that's wanted by custom-builders, audio men and sound engineers. Covers a wide variety of well-known audio amplifiers and FM and AM tuners, *plus* data on important wire and tape recorders. Presents a complete analysis of each unit. A "must" for custom-installers and for sound service specialists. 352 pages; fully illustrated; in sturdy binding, 8½ x 11". Only..... **$3.95**

POST-WAR
**COMMUNICATIONS RECEIVER MANUAL**


New! Invaluable to Amateurs and Short Wave Listeners. Complete technical analysis of more than 50 of the most popular communications sets on the market. An invaluable service aid, a perfect buying guide for purchasers of communications receivers. All data based on actual examination and study of each unit. 264 pages; profusely illustrated; durably bound, 8½ x 11". Only..... **$3.00**

## NEW! Photofact Volume 5

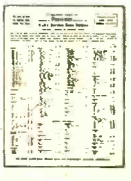
Latest addition to the famous PHOTOFACT Volume series—brings your file of post-war receiver service data right up to December 1948! Most accurate and complete radio data ever published—preferred and used daily by thousands of Radio Service Technicians. Everything you need for faster, more profitable servicing. Order Volume 5 today—keep ahead with PHOTOFACT—the *only* Radio Service data that meets *all* your needs! In deluxe Binder... **$18.39**

- **Vol. 5.** Models from July 1, 1948 to Dec. 1, 1948
- **Vol. 4.** Models from Jan. 1, 1948 to July 1, 1948
- **Vol. 3.** Models from July 1, 1947 to Jan. 1, 1948
- **Vol. 2.** Models from Jan. 1, 1947 to July 1, 1947
- **Vol. 1.** All post-war models up to Jan. 1, 1947


## Radio Industry Red Book

The RED BOOK tells you *in one volume* what you need to know about replacement parts for approximately 17,000 sets made from 1938 to 1948. Includes complete, accurate listings of all 9 major replacement components—not just one. Lists correct replacement parts made by 17 leading manufacturers—not just one. Covers original parts numbers, proper replacement numbers and valuable installation notes on: Capacitors, Transformers, Controls, IF's, Speakers, Vibrators, Phono-Cartridges. *Plus*—Tube and Dial Light data, and Battery replacement data. 448 pages, 8½ x 11", sewed binding. ONLY..... **$3.95**

## FREE Photofact Cumulative Index



The easiest way to own the world's finest Radio Service Data is to subscribe regularly to PHOTOFACT Folder Sets. Send for the FREE Cumulative Index to PHOTOFACT Folders covering *all* post-war receivers up to the present. Helps you find the Folders you want in a jiffy. Get this FREE Index at your Jobber or write for it now.

**TUBE PLACEMENT GUIDE.** Shows you exactly where to replace each tube in 5500 radio models, covering 1938 to 1947 receivers. Each tube layout is illustrated by a clear, accurate diagram. Saves time—eliminates risky hit-and-miss methods. 192 pages; handy index. ONLY..... **$1.25**

**DIAL CORD STRINGING GUIDE.** The book that shows you the *one right* way to string a dial cord. Here, in one handy pocket-sized book, are all available dial cord diagrams covering over 2300 receivers, 1938 through 1946. Makes dial cord restringing jobs quick and simple. ONLY..... **$1.00**

***ORDER THESE BOOKS FROM YOUR JOBBER***

**HOWARD W. SAMS & CO., INC.**
**INDIANAPOLIS 7, INDIANA**

# TRANSVISION

## PRESENTS THE NEW
## MODEL 12CL TV KIT

*Brings the biggest and best in television within the reach of everyone.*

- Features 12½" tube with fitted All-Angle Lens, giving over 200 sq. inch picture which is visible from anyplace in a room.
- Gives ideal long-range reception with CONTINUOUS TUNING on ALL CHANNELS.
- COMPLETE with Cabinet, Lens, Roto-Table, Antenna, Lead-in Wire.
- A BIG PROFIT-MAKER for service dealers. This kit is TOPS—ideal for homes, clubs, taverns, and other commercial installations.

• • • • •

**EASY TO ASSEMBLE . . .**
**NO TECHNICAL KNOWLEDGE REQUIRED**

Transvision's simple step-by-step Instruction Sheet makes assembling a TV Kit a pleasure. Each kit comes complete with all-channel double-folded dipole antenna and 60 ft. of lead-in wire. *Nothing else to buy!*

**MODEL 12CL TV KIT**

**$399.00 NET**

Includes Cabinet, Lens, Table, Antenna

Here's amazing
## GIGANTIC VALUE!

OVER
# 200
**SQ. IN. PICTURE**
**VISIBLE from ALL ANGLES**

(Picture much bigger than a tabloid newspaper page)

IMAGE IS EQUAL to that of a 20" tube—even sharper and clearer—and it is visible from all angles.

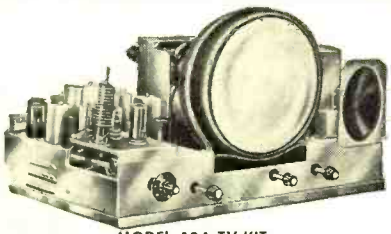
• • • •

**EQUIVALENT OF $1000.00 SETS!**

Price of the new 12CL electromagnetic kit includes these outstanding features:

- 12½" picture tube with special fitted All-Angle Lens and color kit.
- Beautiful select-grain cabinet and roto-table.
- New all-channel continuous tuner Model CT-1.
- New all-channel hi-gain antenna and 60 feet of lead-in wire.
  Nothing else to buy.

## NEW 10" TV KIT at amazingly LOW PRICE!



MODEL 10A TV KIT

The new Transvision Model 10A electromagnetic TV Kit gives a bright, stable 52 sq. in. picture. Has 10" picture tube, and CONTINUOUS TUNING on all 12 channels. Its high sensitivity makes for improved long distance reception; especially good on high channels. Complete with all-channel double-folded dipole antenna and 60 ft. of lead-in wire.

MODEL 10A TV KIT, less cabinet ..... Net $199.00

MODEL 12A TV KIT, same as above, but has a 12" picture tube ..... Net $263.00

**NEW STREAMLINED CABINETS**

for Transvision Model 10A or 12A TV Kit. Made of select grain walnut with beautiful rubbed finish. Fully drilled, ready for installation of assembled receiver. Choice of finishes:

Walnut Cabinet for 10A or 12A (Specify) ..... Net $44.95

Mahogany and Blonde slightly higher.

### TRANSVISION ALL-CHANNEL TELEVISION BOOSTER

To assure television reception in weak signal areas, or areas which are out of range of certain broadcast stations, Transvision engineers have designed this new booster. It increases signal strength on all television channels. Tunes all television channels continuously. Can be used with any type of television receiver. Unusually high gain in upper television channels.

Model B-1 ..... LIST $44.95

### TRANSVISION REMOTE CONTROL UNIT KIT

Will operate any TV receiver from a distance. Turns set on, tunes in stations, controls contrast and brightness, turns set off. Ideal for installations where the television receiver is inaccessible. Tuner unit is a high gain, all-channel unit with about 50 micro-volt sensitivity. Easy to assemble in about an hour.

Model TRCU, with 25 feet of cable ..... Net $69.00

Without cabinet ..... Net $65.00

### TRANSVISION COMPLETE LINE OF TELEVISION COMPONENTS

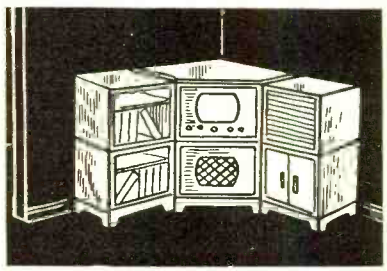
*Essential units for building a quality television set . . .* Transvision makes available a complete line of high quality parts competitively priced. Included in this line are Filter Chokes, all types of Transformers, Focus Coils, Deflection Yokes, Coils—and of course major units such as Picture Tubes, Antennas, Lenses, etc., etc.

**WRITE FOR COMPONENTS FOLDER P-1**

TRANSVISION ALL-ANGLE LENSES for ALL TV SETS. Give picture sizes up to 150 sq. in. Exclusive patented feature makes image visible from wide angle. Lenses come with adapter for installation on ANY 7" or 10" picture tube, and with color kits. All-Angle Lens for 7" tubes (gives 75 sq. in. picture), Net $21.95. All-Angle Lens for 10" tubes (gives 150 sq. in. picture), Net $32.50.

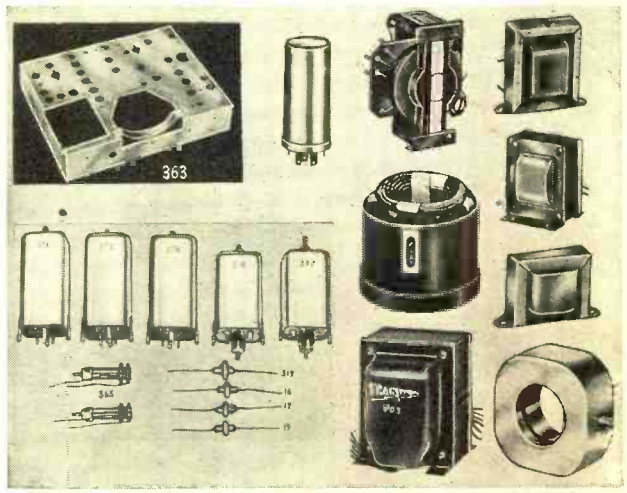
### ASSEMBLE Your Own CABINETS

Transvision's "MODULAR" Cabinets come in knock-down, unpainted units, offering an unlimited range of combinations, including even a bar. Finish them off to suit your taste and need.



Corner piece, shown above, has room for TV, Phono, Record Storage, and open Book Case. COMPLETE ..... Net $84.00

For other units and prices, write for "Modular" Catalog.




### GET into the TELEVISION BUSINESS in a BIG WAY

Radiomen, Servicemen, Dealers . . . Transvision offers you, through your jobber, a 3-point Dealer Plan for making big money in television: (1) Sell TV sets constructed by you from Transvision Kits. (2) Sell exclusive Custom-Built Jobs with beautiful "Custom-Art" Cabinets. (3) Sell "packaged" Transvision TV Products, including Kits, Components, and Accessories. For FULL DETAILS about this amazing plan, WRITE FOR FOLDER No. D-1, or ask your jobber.

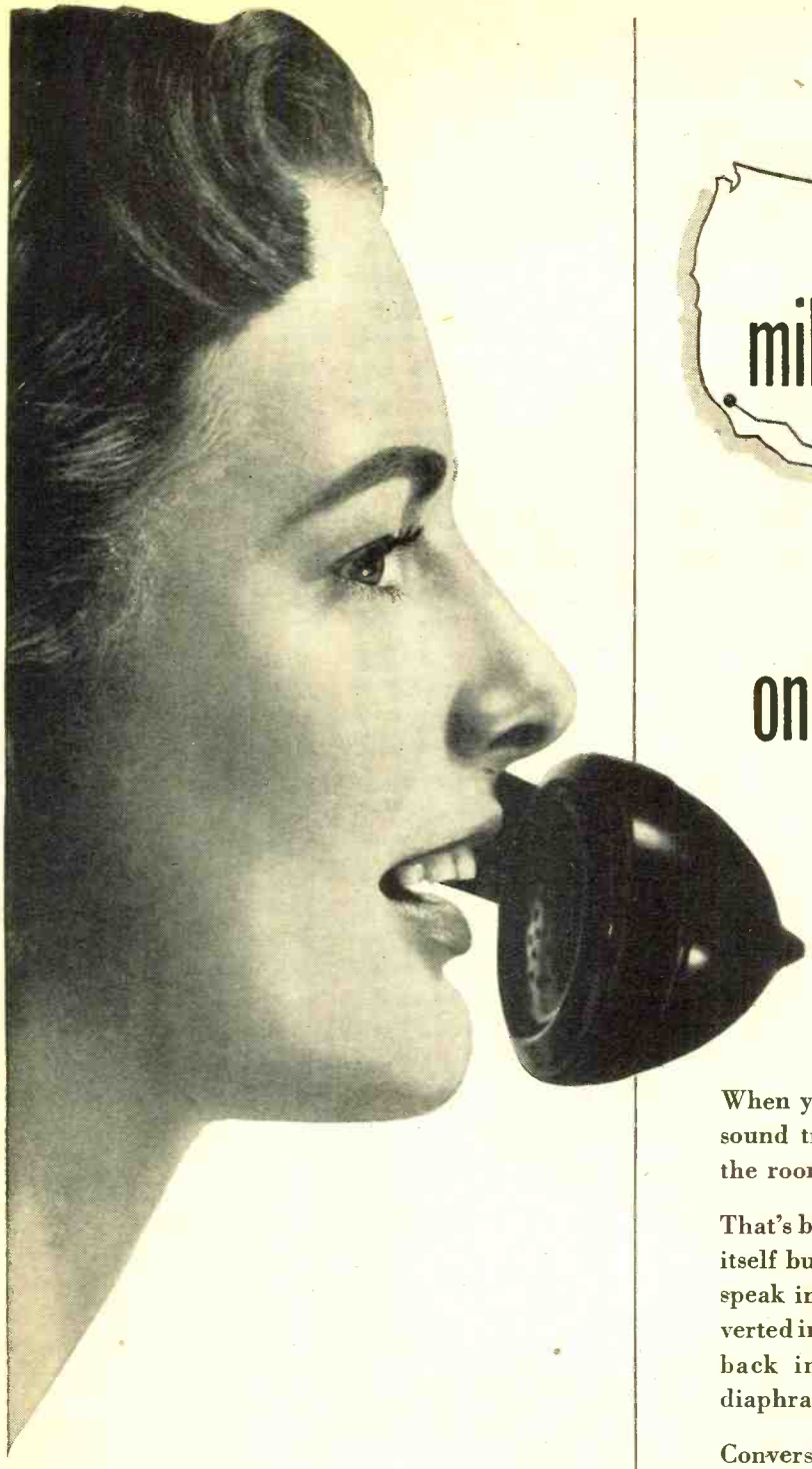
FREE 162 p. TELEVISION COURSE with purchase of any Transvision TV Kit . . . You don't need this course to assemble a Transvision Kit, because the job is easy enough and our instruction sheet is simple and clear. BUT, if you want a good introduction to television fundamentals as a basis for further study, the Transvision Television Home-Study Course is ideal. Remember, you pay nothing extra for this course. Ask your jobber.

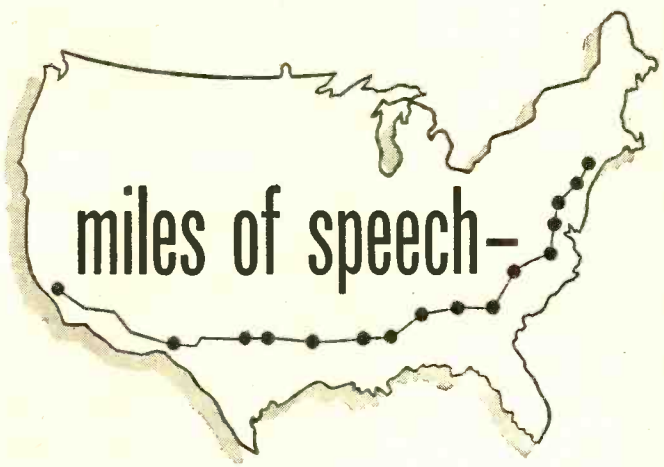
*All Transvision Prices are fair traded; subject to change without notice. Prices 5% higher west of the Mississippi.*

**TRANSVISION, INC.,** Dept. RN, **NEW ROCHELLE, N. Y.**

**IN CALIF.: TRANSVISION OF CALIFORNIA, 8572 SANTA MONICA BLVD., HOLLYWOOD 46**

***For FREE 20 p. TV BOOKLET and 8 p. CATALOG, SEE YOUR TRANSVISION JOBBER***






# only inches of sound!

When you talk by telephone, far or near, the actual sound travels much less than when you talk across the room!

That's because the telephone system carries not sound itself but an electrical facsimile of sound. When you speak into a telephone transmitter your voice is converted into electrical vibrations which are not changed back into sound until they reach the receiver diaphragm.

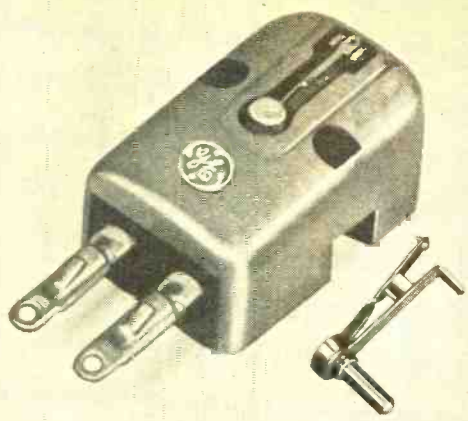
Conversion of sound into its electrical equivalent, through the invention of the telephone, opened the way to the measurement of sound by accurate electrical methods. In developing means to make the telephone talk farther and sound clearer, the scientists of Bell Telephone Laboratories had to develop the tools for sound-wave analysis and measurement.

The condenser microphone, the wave filter, the amplifier — each the product of telephone research — have helped to reveal the structure of sound as never before. Each has helped to build the world's finest telephone system.

BELL TELEPHONE LABORATORIES

EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE.

# NEW!



# G-E VARIABLE RELUCTANCE CARTRIDGE

## *with the replaceable stylus for Conventional and Long Playing Records*

**NOW**—in one small unit—all the sales and performance advantages of the G-E Variable Reluctance Cartridge plus this additional consumer economy feature—the Replaceable Stylus.

Negligible needle scratch and needle talk, minimum record wear, wide frequency response, freedom from resonance peaks, realistic reproduction—these are maintained at all times, simply, easily, economically with the Replaceable Stylus.

No more changing of the entire cartridge means more frequent replacement of stylus by the consumer because he can do it himself so easily.

Four simple steps—and presto! The worn stylus is replaced and maximum high quality performance is restored for the critical listener.

Note, too, these additional features:

- **New notched design . . . one-third smaller . . . improved shape . . . more generally adaptable to various tone arms.**
- **More clearance for record changers.**
- **Higher lateral compliance for more faithful tracking.**
- **More economical for the customer—more sales for the dealer.**
- **Cartridges available for LP records with 1 mil stylus; for conventional records with 3 mil stylus.**

For complete information on the new Variable Reluctance Cartridge write: *General Electric Company, Electronics Park, Syracuse, New York.*

1 Simply remove cartridge from tone arm.

2 Use paper clip or wire to force stylus out of the cartridge.

3 Insert new stylus into cartridge with fingers.

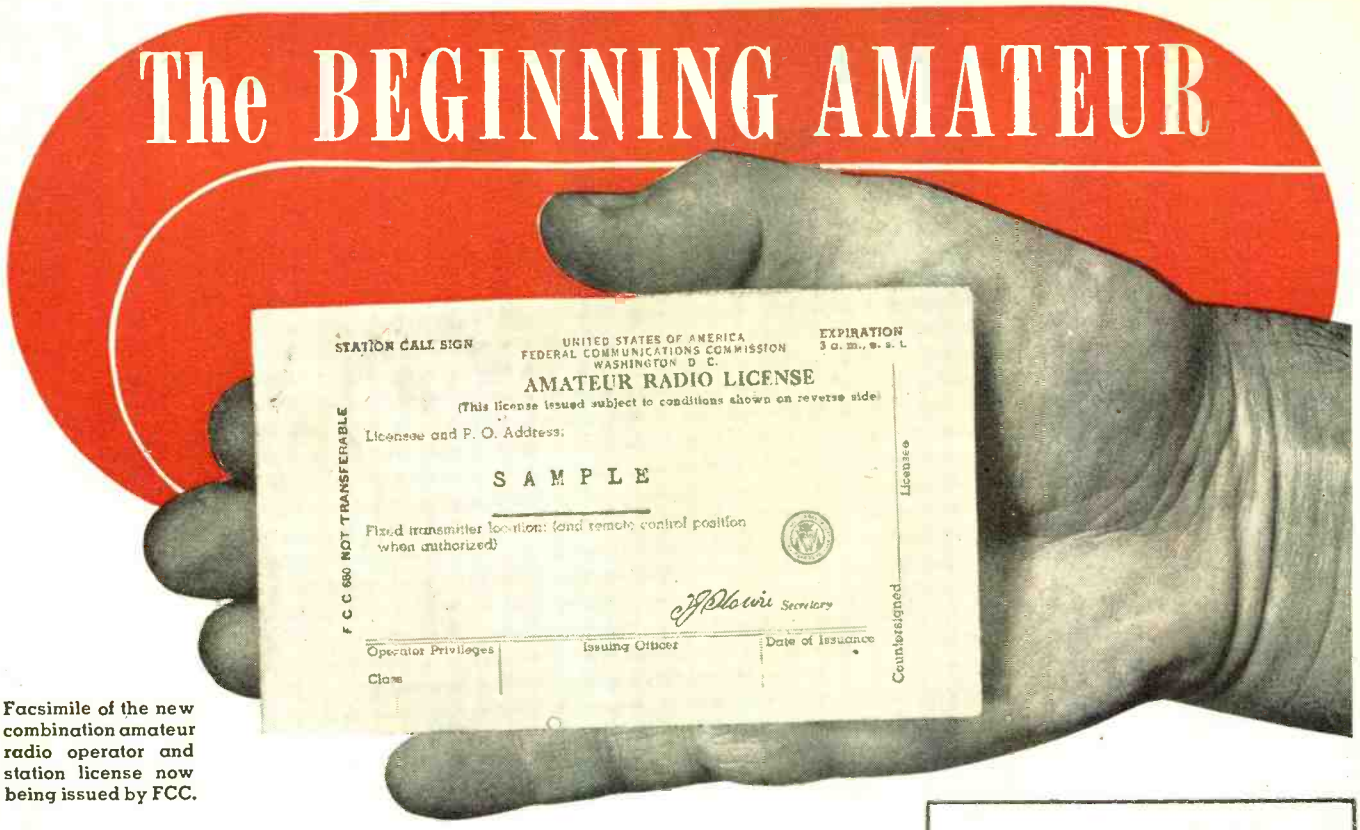
4 Press firmly into position with thumb nail.

*You can put your confidence in—*

# GENERAL ELECTRIC

17a-H1

# The BEGINNING AMATEUR




Facsimile of the new combination amateur radio operator and station license now being issued by FCC.

**By ROBERT HERTZBERG, W2DJJ**

***Part 1. The first of a series of articles outlining the ways and means for securing your amateur ticket.***

THERE is nothing much of interest coming through on the regular broadcast band of the family's all-wave receiver, so you flip the range switch and look into the police band for a little excitement. It's a quiet evening, and even the dispatchers sound bored as they send out time checks. You keep cranking the tuning knob, yawning a bit, and suddenly you run into a veritable bedlam of voices. You look at the dial and note that it reads somewhere around "3.9 megacycles."

"What a racket!" you remark to yourself, but something makes you listen. About half the voices seem to be pleading with someone called "CQ," whoever that might be. Although you recognize most of the talking as English, you can't make head or tail of the lengthy conversations about QSO, QSL, QRM, TVI, handles, rigs, 73's and other queer items that sound like a combination of jive and double talk. Then out of the mess pops a girl's voice with a charming and unmistakeable Dixie drawl.

"Hello CQ, calling CQ, CQ, CQ. Calling any 75-meter amateur phone. This is W4XYZ in Richmond, Virginia. What say someone please?"

This invitation brings immediate and startling results. Apparently every amateur radio operator in the East heard it, for the dial is crowded with anxious males calling W4XYZ and pleading with her to answer them.

"Hm, this is getting to be interesting," you say. "Wonder what she does now?"

Even while some lads are still anxiously calling her, Dixie Belle answers a lucky one in Philadelphia. During the next thirty minutes of conversation they exchange their names, describe their sending and receiving equipment and are fast friends before they sign off. You hear every word but curiously you don't feel that you've been eavesdropping, because it's all been so cozy and congenial.

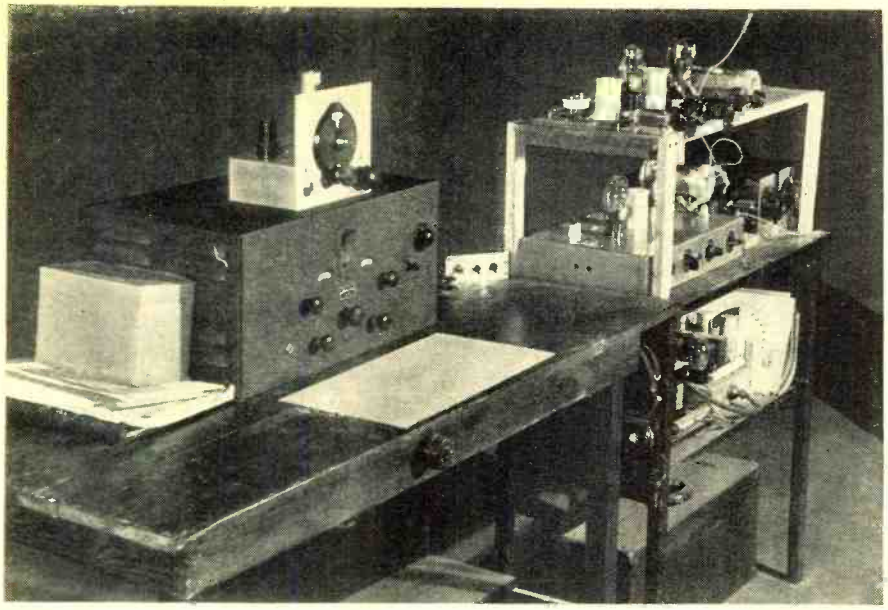
*EDITOR'S NOTE: If you are just getting interested in amateur radio and don't quite know how to get rolling, you'll find the answers in this new series of articles by Robert Hertzberg, W2DJJ. In this first of twelve monthly articles, you'll learn the basic facts about the "ham game," with the most fundamental terms clearly explained. Succeeding articles will deal with learning the code; building a "first" receiver; getting a ham license; making and adjusting a simple transmitter; being a good operator; selecting a communications receiver; test equipment for the ham shack; phone operation; mobile operation; buying a transmitter; and careers in radio for hams.*

*If you are already an experienced ham and you know of young chaps who are prospective hams, tell them about this series. It will save you the trouble of answering their numerous questions.*

***ROBERT HERTZBERG has been a prolific contributor to radio and hobby magazines for many years. His active interest in ham radio goes back to 1917 and he has built and operated numerous stations under various call letters in New York, New Jersey, and Massachusetts. He now operates as W2DJJ.***

"This can be a lot of fun," you mutter. "I'll have to look into it further."

By this time it's past midnight and the rest of the family is beginning to complain about the racket from the loudspeaker. The next day you are full of questions, to which you may or may not get the answers from friends. How does a guy get himself on the air with his own broadcasting station? Who issues the licenses mentioned by the operators you heard last night? How much do they cost? What's the age requirement? How much does a sending set cost? Is special training necessary? What books are good to read on the subject? In other words, *How does a beginner get started?* You don't quite realize it yet, but you have been bitten by the radio bug and you



For the ham who is continually experimenting, the tables holding receiving and transmitting equipment are best left in the open so that there is access to all sides. The transmitter, on the extreme right, looks slightly haywire and it is, but that is because the owner was playing with a new circuit. A very common occurrence among hams.

are about to join the ranks of one of the greatest hobbies in the world.

One of the first things you learn is that amateur radio operators never call themselves that; the world over, they are "hams." Just how the term originated no one really knows. In other fields of activity, calling a man a "ham" is likely to get you a swift poke in the nose, but in radio the word is a mark of distinction. Next, hams do not "broadcast" in the sense that what they say is intended for public entertainment. In fact, they are specifically prohibited from "broadcasting" under the rules and regulations of the Federal Communications Commission (the "FCC"), the government agency that regulates all radio, television, telephone, and telegraph facilities in the United States. Hams communicate with each other individually; more commonly, they use the expression "to work." Boasting about a piece of good luck, a ham will say, "I worked ZS1AB in South Africa last night."

*Every amateur radio station must be licensed by the FCC.* You can buy and use as many receivers as you like, but you must have your "ticket" before you can go on the air. Ham radio has been encouraged by the government ever since the first general radio law was enacted by Congress in 1912, and hams are accorded priceless privileges to pursue their hobby because the art of radio communication has benefited greatly from their experiments. "Bootleggers," stupid and unscrupulous characters who operate without licenses, are relentlessly run down by the hams themselves in cooperation with the FCC.

The word "priceless" was used. A ham ticket is just that. It doesn't cost a cent, either in its original form or as a renewal! To be eligible for one, you must be a citizen of the United States, but beyond that there are absolutely no restrictions as to age, sex, color, race, or physical condition. Some years ago a girl of 9 successfully passed the required examination, and applicants of 11 and 12 have ceased to be out of the ordinary. For invalids, shut-ins and the blind, ham radio is a mind-filling hobby of unlimited possibilities, so much so that the FCC makes special provisions to facilitate the licensing of the handicapped.

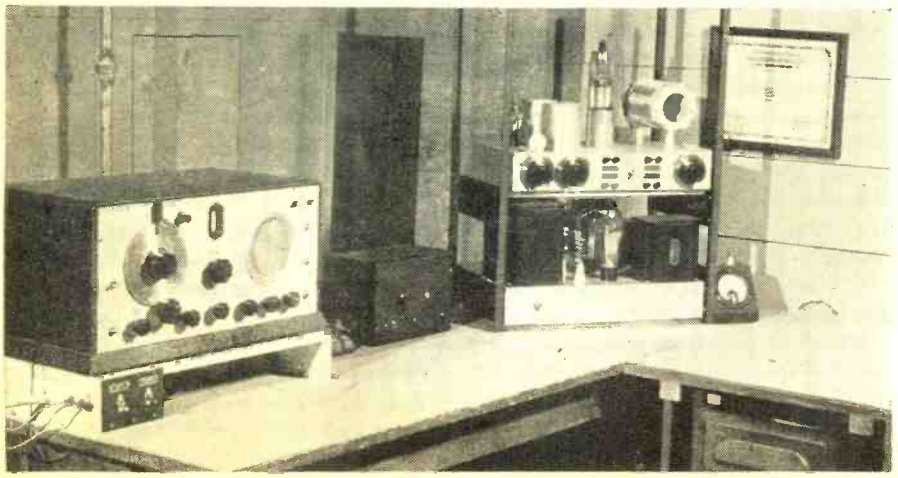
The number of females who are proud to call themselves hams is increasing all the time. Many a friendship started by a casual conversation over the air has ripened into romance and marriage, and there are now families in which father, mother and the children are all active amateurs. You've probably heard hams refer to the "YL" or the "XYL" and have wondered what they meant. "YL" is merely the abbreviation for "young lady," and "XYL" for "wife"; ex-young lady!

The license test consists of two parts: code and theory, with a few questions regarding the radio laws thrown in. Every prospective ham must be able to send and receive messages in the Continental Code at the rate of 13 words per minute, each word averaging five letters. The code consists of combinations of short and long tones, known popularly as dots and dashes because that's how the alphabet is represented in print. The next article of this series will be devoted entirely to the subject of the code and how to learn it.

For no good reason whatsoever, the code is a stumbling block for many prospective hams. They want to rush right on the air and start talking to other hams in various parts of the world, and they are apt to feel frustrated when they discover they have to take a little time out to do a little studying. The code is the real language of radio, and a knowledge of it enables a ham to obtain the maximum enjoyment from the game. Besides, it's much easier to master than you might think. It is easy enough for 9-, 11-, and 13-year old children to learn, so it certainly can't be very tough. The final proof that it is a simple step in the process of becoming a ham lies in some concrete figures: at the present time there are about 75,000 licensed radio amateurs in the United States alone.

Hams refer to dot-and-dash operation as "CW," meaning "continuous waves." The radio energy generated in a transmitter is radiated into space by an aerial, and is broken into short and long spurts (dots and dashes) by a hand-manipulated switch called a "key." If the energy is controlled or "modulated" by a microphone into which the operator speaks, the equipment is called a "phone" transmitter. Many hams disdain phone operation as sissy stuff, and prefer CW because it's more fun and also because CW communication is often possible under conditions that make phone unintelligible. Even though you intend to use phone exclusively, you must know the code to get your license, and that's that!

This neat and orderly layout, receiver on the left and open rack transmitter on the right, is designed for operating rather than experimentation. The receiver shown is a commercially-built job while the transmitter is one constructed by the operator.



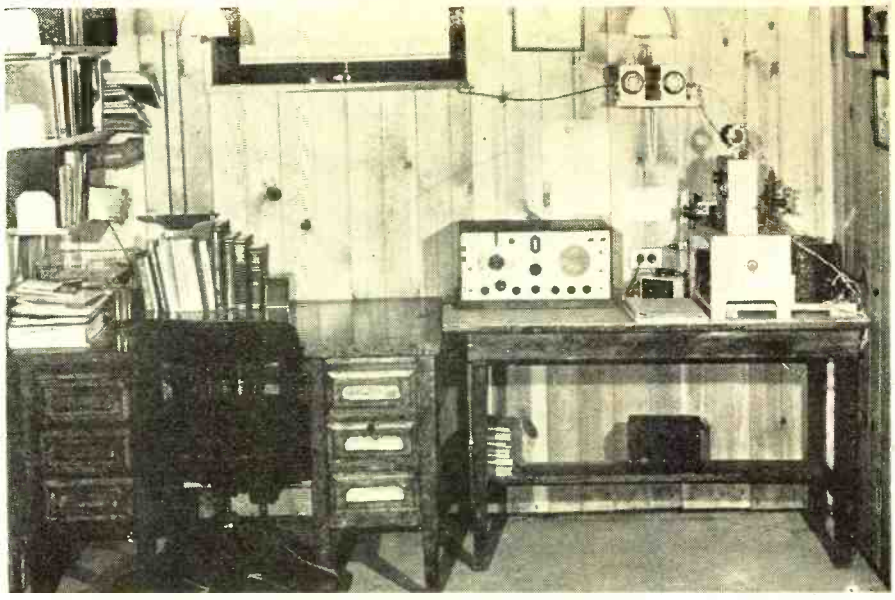
The theory part of the examination merely requires a bit of reading, which you will want to do anyway in order to become familiar with ham receivers, transmitters, aerials, and accessories. Beginning hams are fortunate in having available two wonderful pieces of technical literature: "The Radio Amateur's Handbook," now in its 25th year of publication, and "The Radio Handbook," in its eleventh edition. If you know absolutely nothing about radio . . . can't even tell a microphone from a mousetrap . . . but are able to read and use your hands and are willing to start on page 1 and proceed slowly; you will be a competent radio technician in six months. Many a successful radio engineer owes his start to these handbooks, and still refers to them for the valuable information they contain. One or the other (preferably both!) is a MUST for every ham.

The license examinations are conducted at numerous places in the United States and its possessions by representatives of the FCC. After you have learned the code as prescribed in Part 2 of this series, and become familiar with the ham "bands" as outlined in article 3, you will be ready for detailed dope on getting your ticket as explained in Part 4.

The coveted "ticket" itself is a pocket-size card measuring only 4½ by 2¾ inches. One side is marked "Amateur Radio Operator License" and the other "Amateur Radio Station License." * It is good for five years and is renewable. The most important bit of information on the license is the listing of "Call Letters" on the station side. Every station is assigned a call, which becomes the identity of that station and its operator on the air. By international agreement, the initial letter or letters of the call indicates the country and a following number from 1 to 0 (zero) a subdivision within the country, a territory or an island or group of islands. After the number there will be one, two or three letters.

The initial letters *W*, *K*, and *N* are assigned exclusively to the United States, *N* being reserved for Naval radio stations. The continental United States is divided into ten radio "districts," numbered from 1 to zero. All U. S. calls have two or three letters following the district number. Until recently, the prefix *W* was used exclusively, but in some districts all the available combinations of *W* and a number plus two or three letters have been exhausted, so the FCC is now issuing *K* calls. Typical U. S. calls are W1AC, W2DJJ (the writer's), W3DH, K9AAB, WØYTT. A diagonal line is struck through the cipher (zero) to distinguish it from the letter O. Otherwise, think of the trouble that might arise if Wallace O. Wohlstrom, of Minneapolis, Minn., wrote his call as W0OOF, instead of WØOOF, which is actually his call.

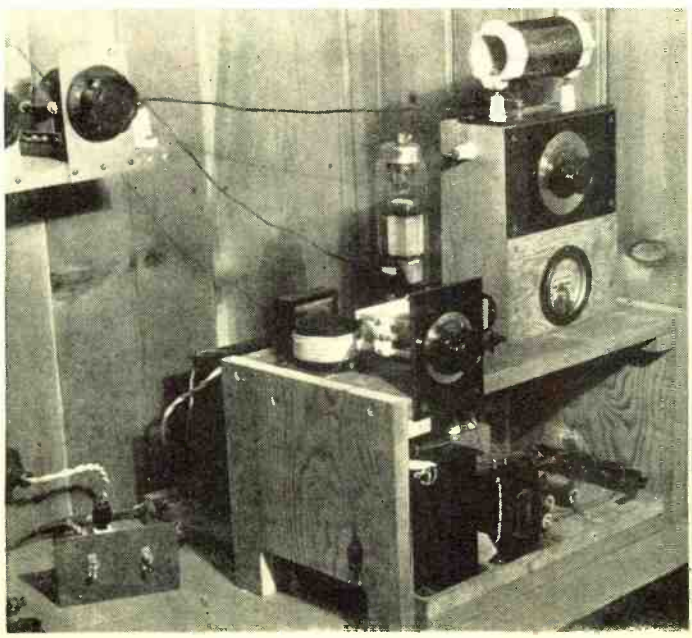
Hams in Alaska get calls starting with *KL7;* in Hawaii, *KH6;* Canal Zone, *KZ5;* Puerto Rico, *KP4*. Our friends in Canada have *VE;* in Mexico, *XE;* in Australia, *VK;* in Great Britain, *G*. If you want to know the exact address of any station you hear, you can find it in "The Radio Amateur Call



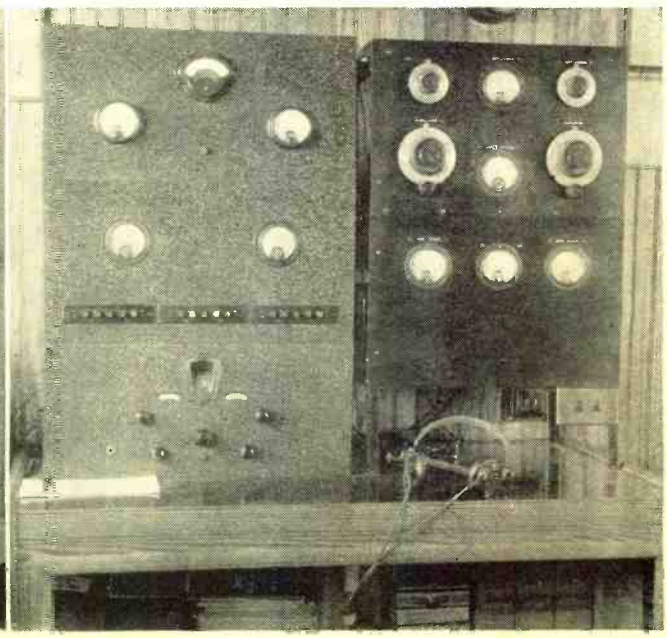
**The four-foot table on the right holds a complete if modest ham station. A low-priced receiver is on the left end of the table, a home-made transmitter, built up breadboard style, on the right end. This cellar arrangement is neat and convenient and the radio equipment doesn't interfere with the study desk. A fine layout for the young student.**

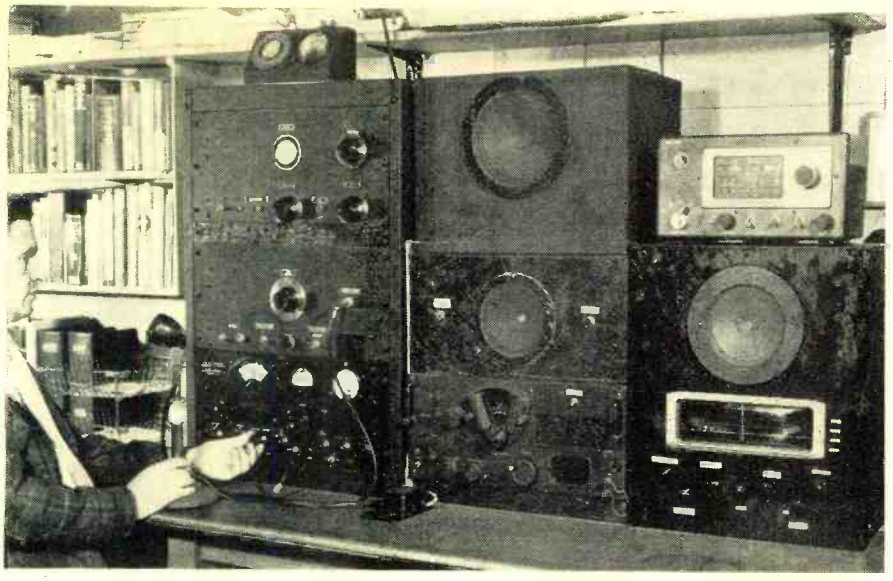
*Ed. Note: The FCC has just combined the operator and station license on one card. This new form is shown on page 35.

**Close-up of the breadboard transmitter shown in photo above. This one-tube c.w. unit is easy and inexpensive to construct and allows changes to be made with a minimum of work. Parts carrying high voltages are mounted on separate bakelite panels.**



**A model of neatness, compactness, and efficiency, this complete station of Fred A. Parsons, W2EXM, resembles the radio shack of a ship. It is located in a summer bungalow at Rockaway Point, Long Island, on the very edge of the Atlantic.**





**Receivers and transmitters are built up vertically in this rather elaborate station in order to conserve table space. The author is shown at the controls of W2DJJ which comprises three receivers and two transmitters. The legs of the table are fitted with casters so that the heavy assembly can be swung away from the wall when connections in the back must be changed. Accumulation of this type of equipment takes several years.**

Book," a fat 300-page directory that is revised quarterly.

Because the letters *B, C, D* and *V* are likely to sound pretty much the same on the air, hams who work on phone use a phonetic alphabet to make their calls clear. Unfortunately, there is no standard or officially prescribed alphabet of this kind, and many hams give their imaginations full rein in making up their own. For instance, a certain station with the letters *JEH* as the final part of its call was always heard as W—Jackasses Eating Hay! The phonetic words most generally employed nowadays are borrowed from the military services, as many amateurs used them during the war. The complete alphabet, which may help to clarify some of the apparently crazy things you have heard from ham stations, is as follows:

| | | |
|---|---|---|
| A—Able | J—Jig | R—Roger |
| B—Baker | K—King | S—Sugar |
| C—Charlie | L—Love | T—Tare |
| D—Dog | M—Mike | U—Uncle |
| E—Easy | N—Nan | V—Victor |
| F—Fox | O—Oboe | W—William |
| G—George | P—Peter | X—X-ray |
| H—How | Q—Queen | Y—Yoke |
| I—Item | | Z—Zebra |

Thus, W5ABE might identify himself on phone by saying, "This is William Five Able Baker Easy."

The mysterious "CQ" that everybody seems to be calling morning, noon, and night is no station at all, but any station. Read that again! "CQ" is a general call. It simply means that the calling operator is on the air and will talk to anyone who answers him; it's a cordial, warm-hearted invitation to strike up a conversation. Sometimes a CQ may be directional and specific. For instance, American hams on duty with occupation forces overseas often attempt to contact stations in particular cities, so that they can arrange to have relatives or friends brought around for direct person-to-person conversations. Some really wonderful QSO's of this kind can be heard.

"What's a QSO?"

Just more of ham lingo; actually, an international signal. In any of the aforementioned books you'll find a list of "Q" signals. These are three-letter combinations, all starting with Q, intended primarily to permit ship radio operators of different nationalities to exchange important information via the Morse Code even though they don't know each other's language. The "Q" list has been translated into practically all tongues. Thus, the radio man on a Greek vessel, entering a Spanish port, can send QTE?, meaning, "What is my true bearing in relation to you?" The answer will come back QTE 28, meaning "Your true bearing in relation to me is 28 degrees," and while it will be all Greek to the ship operator, because his "Q" list is printed in Greek, it makes sense to him.

Very few of the Q signals have exact meanings or utility from the ham standpoint, but some of them are twisted around a bit to give them popular significance. For instance, while QSO actually means, "I can communicate with.....direct (or through the medium of.....)," it is commonly used as a synonym for "contact." Example: "I had a swell QSO this morning with G3ED."

"Rig" is a transmitter or the whole station. "Handle" is just a way of saying "name." You'll often hear, "The handle here is John." After a few weeks of listening on the ham bands you too can talk to your friends and sound crazy!

Talking of bands: You probably heard your first hams around 3.9 on the dial. If your all-wave receiver covers higher frequency bands, you'll hear extraordinary DX ("long distance" to you) in the vicinity of 14.2 megacycles. These are only two of the frequencies assigned for amateur use. Fifteen other bands are also open, most of them being suitable at the present time only for experimental work, rather than DX communication. Hams must stay in their prescribed bands. If they wander out of them they promptly receive little pink tickets of warning from the FCC.

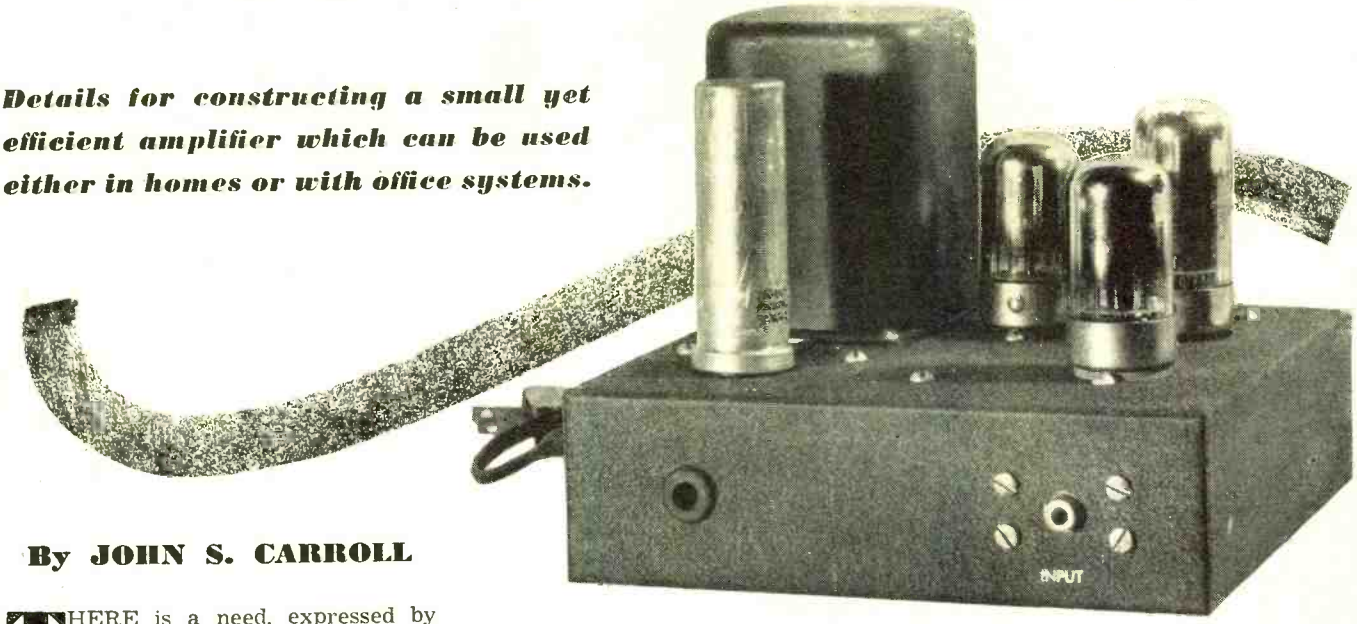
All of this so far is very informative, but you are probably itching to ask the $64 question, "How much does it cost to get started?" Well, $64 is more than enough. The *only* way to get rolling is to build your own receiver and transmitter, and you'll be told how in Parts 3 and 5 of this series. You

(*Continued on page* 169)

**This is a complete ham station, with receiver on left and complete phone transmitter in the little box on the right. A simple rig like this can be installed in a bookcase.**

# A Feedback Amplifier for Pilotuners and Phonographs

***Details for constructing a small yet efficient amplifier which can be used either in homes or with office systems.***




**By JOHN S. CARROLL**

Fig. 1. External view of completed amplifier. The entire unit can be built on a 7" x 7" chassis. No tone controls were incorporated in this model, but may be added if desired.

THERE is a need, expressed by many people, for a small amplifier of limited output and high quality. The usual method of making such amplifiers is to use small beam power tubes such as the 25L6 or 50L6 in an a.c.-d.c. circuit, and usually in push-pull, to reduce distortion and increase power output. The result is approximately 4 watts at distortion of about 4 to 5%.

While such amplifiers have the advantage of requiring no power transformer, the saving is slight when the necessity for designing and wiring a phase inverter is considered. In addition, the filtering of a half-wave rectifier is difficult, and hum level is often excessive. Further hum difficulties may frequently be traced to high a.c. heater-cathode potentials.

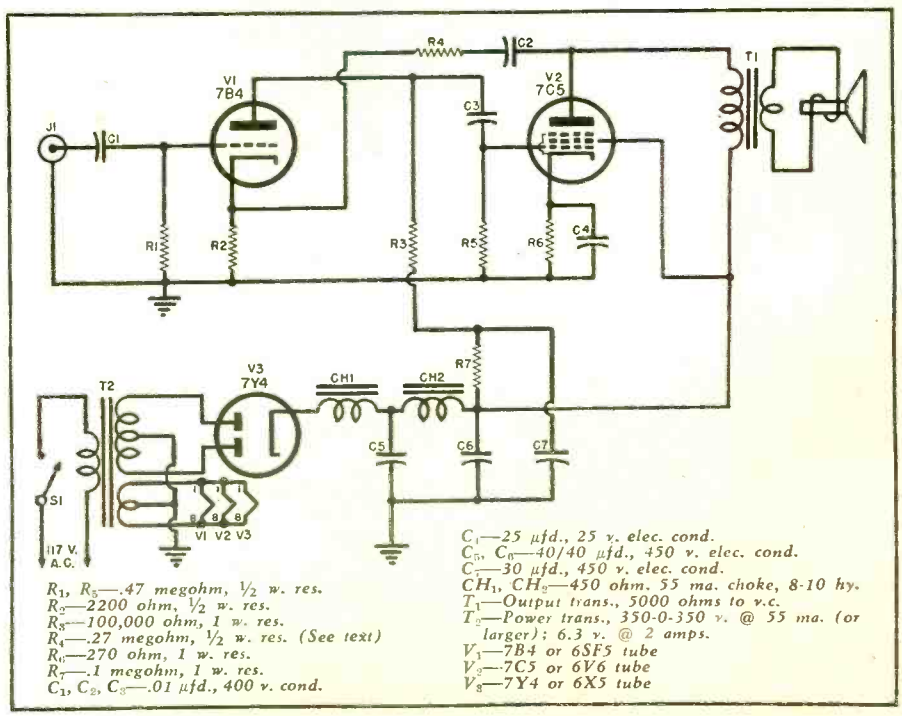
When a small amplifier was required for an office background-music system, to be fed either by an FM tuner or a new *Philco-Columbia* Microgroove record player, it was decided to take advantage of the plentiful supply of 7C5 and 7Y4 tubes on the surplus market, and the availability of a small power transformer to build a single-ended amplifier incorporating inverse feedback to reduce distortion. The accompanying photographs and circuits show the resulting unit, which puts about 4 watts into an extended range 8-inch speaker with over-all tone quality and frequency response fully adequate for average FM reproduction. The power level is more than sufficient for background music in a medium sized office and would be quite sufficient for a 10-inch or 12-inch speaker in a home radio.

The circuit is conventional in every way except for the use of a choke-input filter, which may not have been necessary but seems to improve transient response in the bass because of its excellent regulation. Inexpensive a.c.-d.c. chokes are used, in connection with large filter condensers. The first stage is decoupled, not to prevent motorboating which is unlikely in a 2-stage amplifier, but to provide additional hum-reduction.

The interesting feature of the am-

(*Continued on page* 134)

Fig. 2. Schematic of the basic amplifier. Only 7 resistors and 7 condensers are needed.




$R_1$, $R_5$—.47 megohm, ½ w. res.
$R_2$—2200 ohm, ½ w. res.
$R_3$—100,000 ohm, 1 w. res.
$R_4$—.27 megohm, ½ w. res. (See text)
$R_6$—270 ohm, 1 w. res.
$R_7$—.1 megohm, 1 w. res.
$C_1$, $C_2$, $C_3$—.01 µfd., 400 v. cond.

$C_4$—25 µfd., 25 v. elec. cond.
$C_5$, $C_6$—40/40 µfd., 450 v. elec. cond.
$C_7$—30 µfd., 450 v. elec. cond.
$CH_1$, $CH_2$—450 ohm. 55 ma. choke, 8-10 hy.
$T_1$—Output trans., 5000 ohms to v.c.
$T_2$—Power trans., 350-0-350 v. @ 55 ma. (or larger); 6.3 v. @ 2 amps.
$V_1$—7B4 or 6SF5 tube
$V_2$—7C5 or 6V6 tube
$V_3$—7Y4 or 6X5 tube

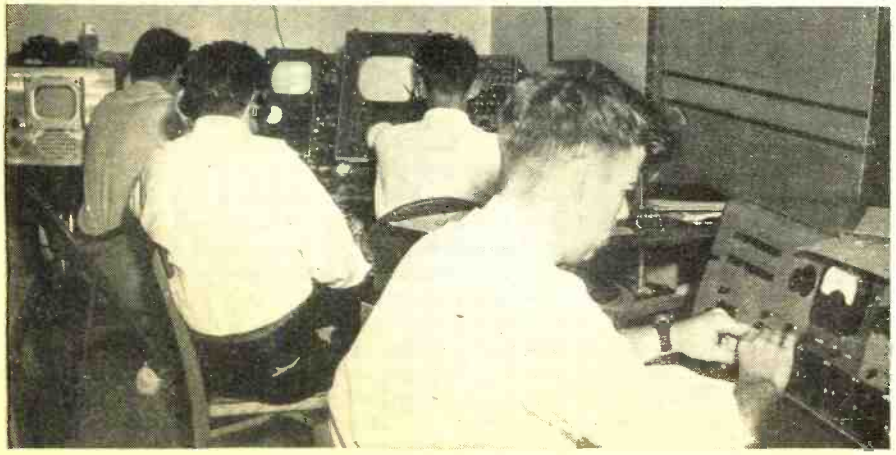
# OPERATION TV

Telecasting goes to sea on the carrier USS Leyte.

**By ALFRED E. JACKSON**

***Televiewers on the Eastern Seaboard witness a Navy carrier operation under simulated battle conditions. "Show" included an aircraft attack on the carrier.***

"Control room" set up aboard the USS Leyte for handling "Operation TV."



TELEVISION, which had long been confined to studio and sports arenas, took to the high seas a short time ago and the result was 100 minutes of some of the most interesting program material ever witnessed on a television screen. The whole operation, which took five months of preparation, was in the "indefinite" stage as close as three minutes to air time.

The net result of the program, which was designated as "Task Force TV," was that an estimated audience of 2,000,000 persons sat comfortably at home and watched the carrier *USS Leyte* undergo a simulated attack by its own planes—under simulated battle conditions.

After the original plan for this telecast was discussed by executives of the *National Broadcasting Company* and high-ranking officers of the United States Navy, a preliminary visit was made to the *USS Kearsage,* an *Essex* type carrier, to determine the feasibility of such a pick-up. A careful analysis of conditions aboard the carrier indicated that such a telecast was not impossible from an engineering standpoint. The Navy was faced with the difficult task of finding a carrier that could be made available to *NBC* for a

series of test and for the actual program.

Eventually the *USS Leyte* was chosen and James Davis, surveying engineer, and Doug Rodgers, assisting director of the program department, made a series of visits to the ship to discuss the operation with the *Leyte's* officers. The biggest problem encountered was the completion of the tremendous amount of engineering coordination and planning that was required in order to plot the video and audio signals with accuracy.

The video signal was sent from the deck of the *Leyte* to the roof of the Empire State Building in New York City. From there it was relayed to Radio City for mixing with the audio, then was relayed to the Empire State Building for telecasting to the viewing audience. The audio signal was sent from the *Leyte* to *RCA* at Riverhead, Long Island where the program material was relayed to the *RCA Communications* Building in New York City from where it was carried to Radio City to be mixed with the video carrier and thus on to the Empire State Building where the program finally took to the air. The possibility of error naturally increased as each new link was added to the chain.

Another major problem involved the necessary orders to the *USS Leyte* from Washington and the tremendous expense involved in "rehearsals." It had been originally planned that the "rehearsals" would begin two weeks before the show. Actually, the first test was made just four days before the event.

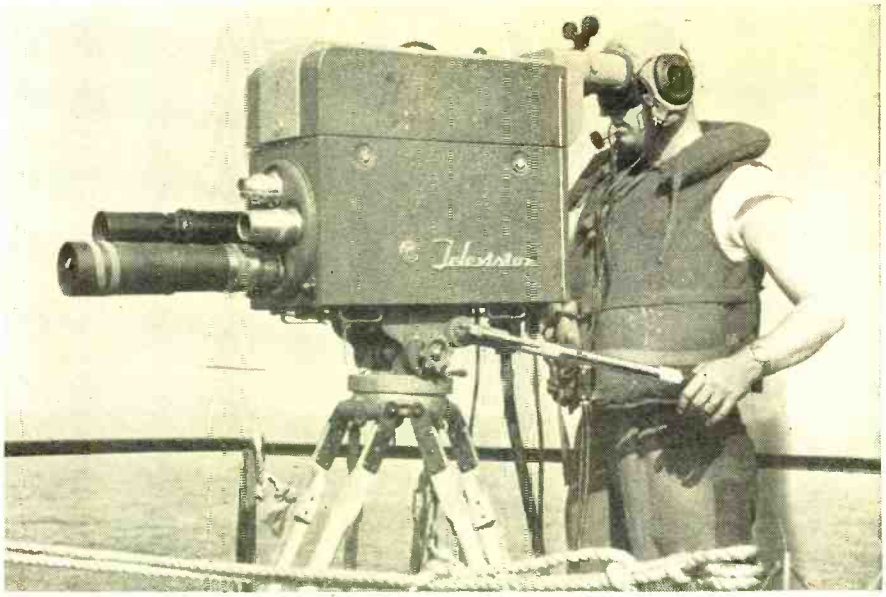
To operate from a carrier it was necessary for the *NBC Development Laboratory* to build a special transmitter. This 1300 mc. unit with a beam antenna, built in New York City, was transferred by automobile to the ship which was docked at the Quonset Naval Base in Rhode Island.

On the Thursday before the telecast, which was scheduled for a Sunday, two tons of equipment valued at almost $200,000 plus about 8000 feet of cable was loaded aboard the ship. After it was all properly placed, the testing began. Then the Navy entered the picture and several meetings were held to decide just what could and could not be done. The limited amount of fuel that the planes could carry was one of the problems posed. That factor naturally governed the length of time the planes could remain aloft. There were the usual amount of security problems which governed secret gear that could not be televised, and the procedures to be followed in the event of a crash onto the deck or into the sea.

The immobility of the camera was another factor which had to be considered. Weather and wind were other variables which had to be figured and the approach of a hurricane from Florida made that angle none too promising.

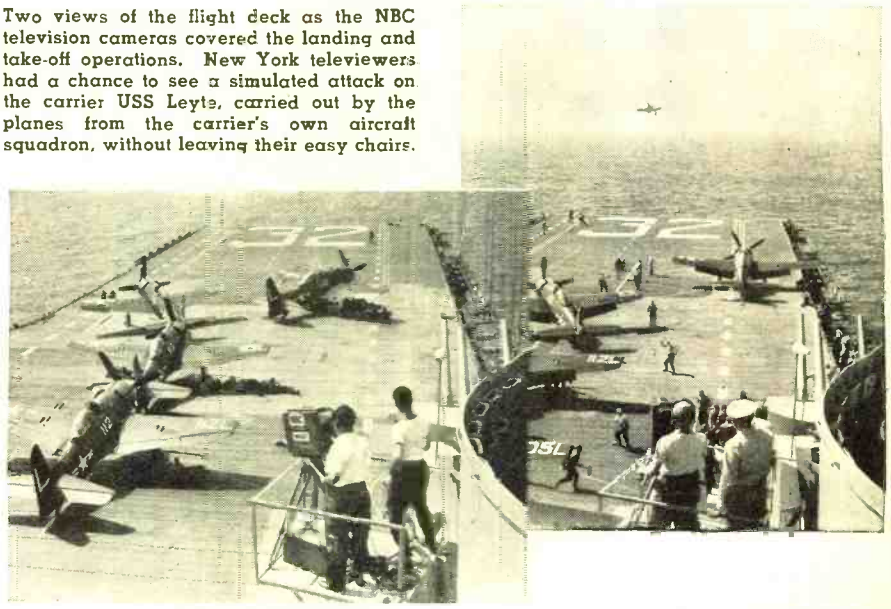
The major factor in planning the

(*Continued on page* 136)

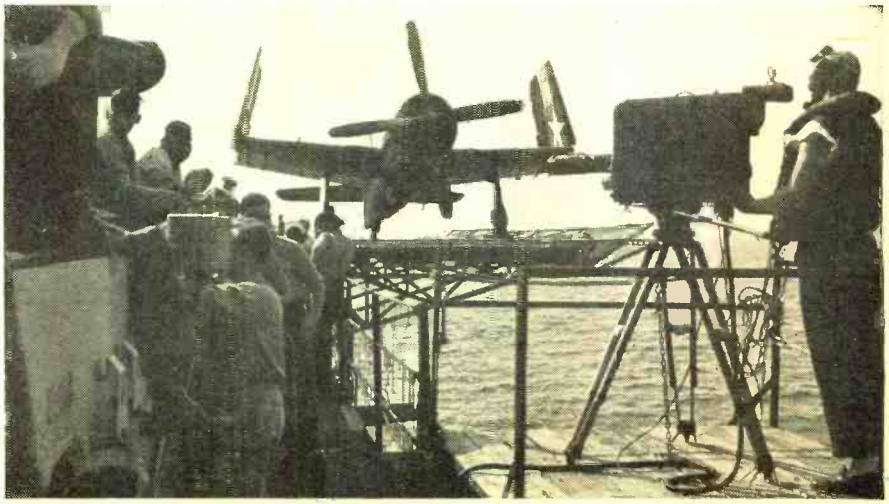


Although life jackets are not considered "standard" for television cameraman, this NBC operator found it comforting in case he was forced to abandon ship suddenly.

Two views of the flight deck as the NBC television cameras covered the landing and take-off operations. New York televiewers had a chance to see a simulated attack on the carrier USS Leyte, carried out by the planes from the carrier's own aircraft squadron, without leaving their easy chairs.



A close-up view of all the operations preparatory to launching aircraft from the carrier were witnessed by East Coast viewers when NBC and the Navy telecast "Operation TV."



# Latest in Triode HIGH FIDELITY AMPLIFIERS

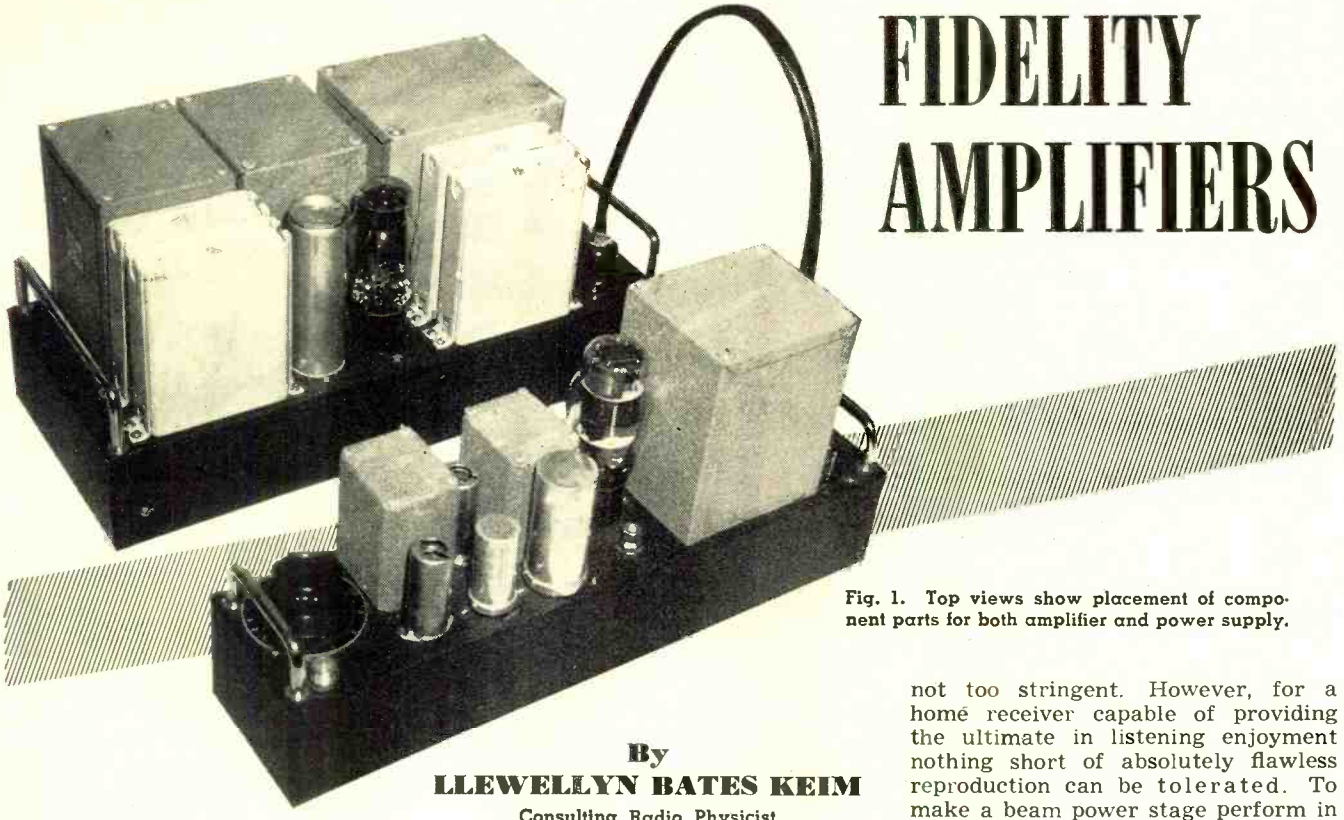


Fig. 1. Top views show placement of component parts for both amplifier and power supply.

By
**LLEWELLYN BATES KEIM**
Consulting Radio Physicist

***This transformer-coupled amplifier provides 60 db. gain and incorporates a specially designed tone-compensated volume control.***

A GREAT deal has been written lately about the advisability of "unit" construction for high fidelity receiver and radio-phonograph combinations. This type of construction does have the advantage of allowing for the inclusion of a new tuner, or an improved record changer, or the addition of some new component without the necessity for rebuilding the entire installation.

Because this trend is gaining momentum, the author determined to investigate the possibilities of designing an amplifier and associated power supply which would provide high fidelity reproduction.

It has long been recognized that triode amplifiers are the most stable, quietest, and easiest to maintain in top operating condition. The earliest models of high quality receivers incorporated the triode type amplifiers, as the old timers in the business will readily recall. These sets used the 210's, and 250's which were later supplanted by the 45 and 2A3 types. Not for almost two decades, however, has there been a new triode on the market which offered interesting potentialities as an output tube until the appearance of the war-developed dual triode unit in one envelope. This tube was originally designed for voltage regulation service in power supply applications and as a deflection tube in cathode-ray work. Designated the 6AS7G, this new tube has certain characteristics that make it most interesting for audio applications, notably its very low plate resistance. This low plate resistance is an important feature when operating a loudspeaker because of the effective damping it places on the transducer without having to resort to inverse feedback and all the inherent disadvantages this system implies. Accordingly, the amplifier to be described has been designed around this new dual triode.

Before describing the new unit, a few words might be in order regarding the effectiveness of triode operation as opposed to beam power tubes. Much has been written on the subject and each system has its share of adherents. The beam power tube provides a cheap and easy way of generating large amounts of audio power and is especially suitable for public address systems where the demands upon the fidelity of reproduction are not too stringent. However, for a home receiver capable of providing the ultimate in listening enjoyment nothing short of absolutely flawless reproduction can be tolerated. To make a beam power stage perform in this manner large amounts of inverse feedback are necessary to maintain stability, freedom from self-oscillation at supersonic frequencies, and to present a low impedance source from which to operate the loudspeaker. Without elaborate test equipment and knowledge of the proper testing techniques the average home constructor may find it impossible to design and operate a feedback loop that is uniformly effective over the audio spectrum. While the feedback loop may be effective at certain frequencies, it may well become regenerative at other frequencies, with extremely unsatisfactory results. Another disadvantage in using beam power tubes is that even though the facilities and techniques for adjusting a perfect feedback connection are present the system still depends upon resistances and capacitances for its operation. These components have the inherent disadvantage of shifting values due to aging, heating, etc. with the result that the circuit eventually becomes unstable.

On the other hand, a well-designed triode amplifier requires no such complex circuit parameters for circuit operation, consequently, for all-around stability and uniformly good results it can hardly be exceeded.

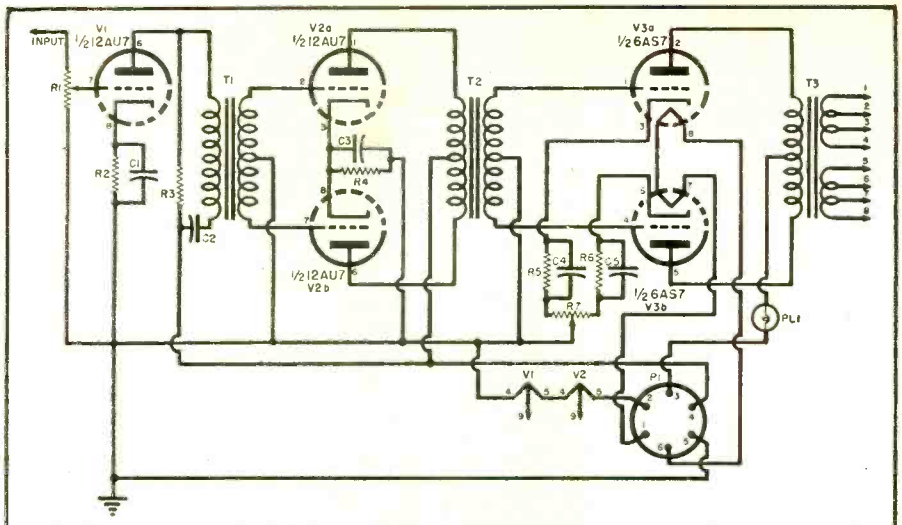
Another aspect of the audio system is rarely discussed despite its importance. This is the amount of power needed in order to operate the loudspeaker effectively. With present-day, high relative efficiency speakers very

little audio power is needed to produce more-than-adequate living room volume. Hence, a ten watt amplifier will usually be adequate and there is no advantage to be gained from operating a "power house" in the living room as such an installation serves no useful purpose. For best operation a loudspeaker requires a low impedance source from which to operate. The lower this impedance, the more adequate the damping on the speaker and consequently unwanted excursions of the voice coil and cone structure are eliminated.

The 6AS7G triode has the lowest plate impedance of any of the triodes or triode combinations as can be seen from the listing of tube characteristics given in Table 1. It obviously becomes the most suitable source of power for driving a speaker. Add to this its small size, high efficiency, and low cost, it becomes almost the ideal output tube for this application. Its a.c. plate-to-plate resistance is on the order of 560 ohms, which is considerably below that of beam power output stages employing a high percentage of inverse feedback.

Some mention of the amount of power needed to fill a living room at a comfortable listening level might be appropriate here. A well-known dual system, employing a 15" low frequency speaker and a metallic diaphragm high frequency speaker, when coupled to a multicellular horn and including the approximate ½ db. lost in the dividing network, will more than fill a room of 6000 cubic feet with 100 milliwatts input to the dividing network. It can be seen, then, that the 6AS7G, rated at over 10 watts output, has a margin of safety of over 100 to 1, if used with this particular speaker installation. Assuming however that the constructor might choose one of the new 8" wide range single unit speakers to obtain the same listening level, it will require between ½ and ¾ watt of audio power. Thus there is still adequate reserve power available to handle crescendos when they occur in the reproduced music.

Another feature which recommended the triode in the design of this amplifier was its quietness of operation, especially in cases where the triode employs a heater cathode type of electron emitting system. No matter how carefully balanced the filament circuit itself there is a residual hum level below which it is impossible to operate unless the filament itself is operated on direct current. This is an inherent drawback of all available triodes on the market today with the exception of the 6AS7G. By employing a cathode as the electron emitting element, the heater can be operated on a.c. without contributing noise voltages to the output of the tube. Each triode section has its own cathode, brought out to a separate base pin, consequently its two units can be individually balanced in their plate current consumption in order to improve the quietness of operation and avoid a



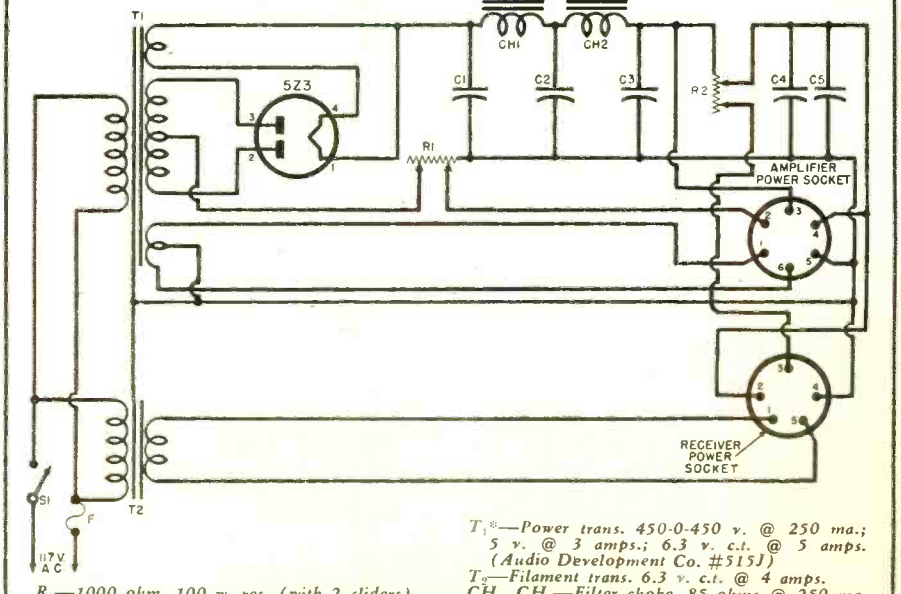

$R_1$*—*Volume control (Tech Laboratories, Inc. #PB-722)*
$R_2$—*820 ohm, 1 w. res.*
$R_3$—*20,000 ohm, 1 w. res.*
$R_4$—*390 ohm, 1 w. res.*
$R_5$, $R_6$—*1250 ohm, 10 w. res.*
$R_7$—*500 ohm var. res. (Mallory #M500P)*
$C_1$, $C_3$—*100/100 µfd., 25 v. dual elec. cond. (Mallory #SPO64956A)*
$C_2$—*1 µfd., 500 v. cond.*
$C_4$, $C_5$—*100/100 µfd., 150 v. elec. cond. (Mallory #SPO64956B)*
$PL_1$—*6.3 v. @ .150 amp. pilot lamp*
$P_1$—*6-prong plug*
$T_1$—*Interstage trans. Pri. (10,000 ohms) to p.p. grids (80,000 ohms grid-to-grid) (Audio Development Co. #214H)*
$T_2$—*Interstage trans. p.p. plates to p.p. grids (20,000 ohms plate-to-plate to 80,000 ohms grid-to-grid) (Audio Development Co. #214J)*
$T_3$—*Output trans. 4000 ohms plate-to-plate to voice coil (Audio Development Co. universal trans. #314C was used)*
2—*12AU7 tubes*
1—*6AS7 tube*
**Note: The author used a newly-developed grid potentiometer of the attenuator type with the added feature of four steps of bass compensation for low listening levels. This unit is available from Allied Radio Corp., 833 W. Jackson Blvd., Chicago 7, Ill. Price quoted is $11.50. A standard 500,000 ohm pot may be used in its place, however performance will be sacrificed.*

**Fig. 2. Schematic diagram of the all-triode, transformer-coupled amplifier unit.**

direct current unbalance in the primary coil of the output transformer. This is an important feature for good low frequency transfer characteristics of this component of the system.

With the quiet output stage which is possible with this tube it was decided to operate all the heaters of the voltage stages on direct current. Thus any possible hum which might find its way into the early stages due to emission of the heater wire loop will be eliminated. There are, of course, two methods for obtaining this needed d.c. power. One is by means of a selenium rectifier and its associated filtering condenser and choke, or by using the plate current of the amplifier itself as the heater power source. As the entire amplifier is a class A unit with

**Fig. 3. Circuit diagram of the power supply designed to be used with the amplifier.**




$R_1$—*1000 ohm, 100 w. res. (with 2 sliders)*
$R_2$—*7500 ohm, 100 w. res. (with 2 sliders)*
$C_1$—*4 µfd., 600 v. oil-filled cond.*
$C_2$, $C_3$, $C_4$, $C_5$—*10 µfd., 600 v. oil-filled cond.*
$S_1$—*S.p.s.t. toggle sw.*
$F$—*3 amp. line fuse*
$T_1$*—*Power trans. 450-0-450 v. @ 250 ma.; 5 v. @ 3 amps.; 6.3 v. c.t. @ 5 amps. (Audio Development Co. #515J)*
$T_2$—*Filament trans. 6.3 v. c.t. @ 4 amps.*
$CH_1$, $CH_2$—*Filter choke, 85 ohms @ 250 ma.*
1—*5Z3 tube*
**Note: Power transformer is a new item with Audio Development Co. It is available and will be listed in their next catalogue. Any equivalent component may be substituted.*

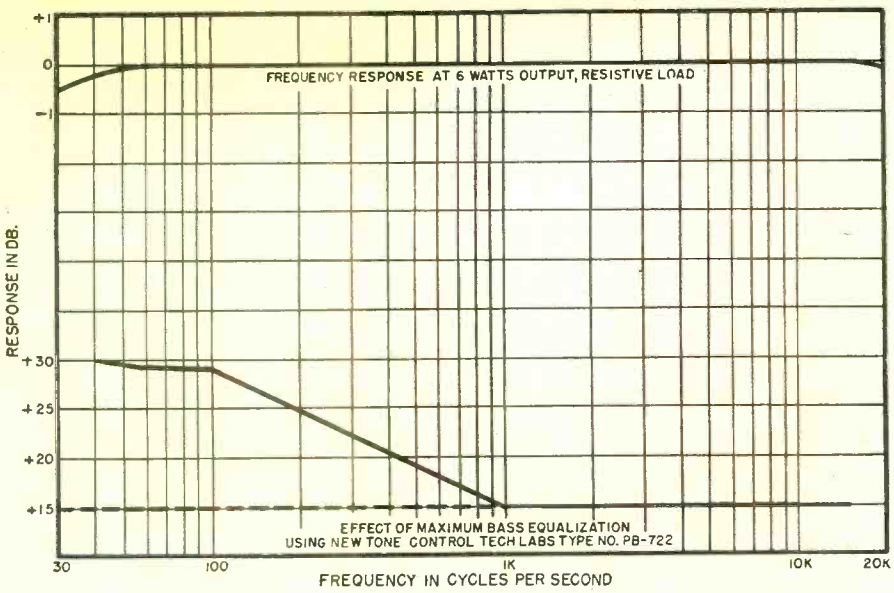



**Fig. 4. Frequency response curves of the all-triode, transformer-coupled amplifier.**

a stable plate drain and since the power unit was designed to operate a tuner, some 200 milliamperes of d.c. are available for heating the voltage stages. There is a wide selection of 150 milliampere heater tubes now being manufactured and from this group the 12AU7 was selected for the input as well as the driver stages of the amplifier. The 12AU7 is a dual triode in one envelope and serves to drive the output stage by using a single tube which helps to cut down on the number of tubes required and keeps the amplifier small and compact. The input stage employs only one set of elements of the 12AU7, the remaining elements are left idle. Through the basing arrangement of these tubes, it is possible to light only one of the heaters. This has not been done either in the circuit diagram or in the amplifier as it was constructed.

Realizing that the tubes selected were going to provide the finest possible quality of output, the choice of the other necessary components was made with the same high standard in mind. If such an amplifier is to render long years of service, as it is capable of doing, then using inferior components is one sure way of defeating the primary objective of the original design. The availability of fine transformers has been somewhat limited since the war but it is now possible to obtain a full complement of audio as well as power components for this amplifier from *Audio Development Co.* By using the products of a single manufacturer the appearance of the unit is enhanced and "sales appeal" is increased should the builder decide to market the unit after completion.

All condensers used in this amplifier are of the oil-filled variety with the exception of the high capacity cathode bypass units which were especially designed for this unit by *P. R. Mallory & Co., Inc.* These units will soon be available to the public through regular distribution channels.

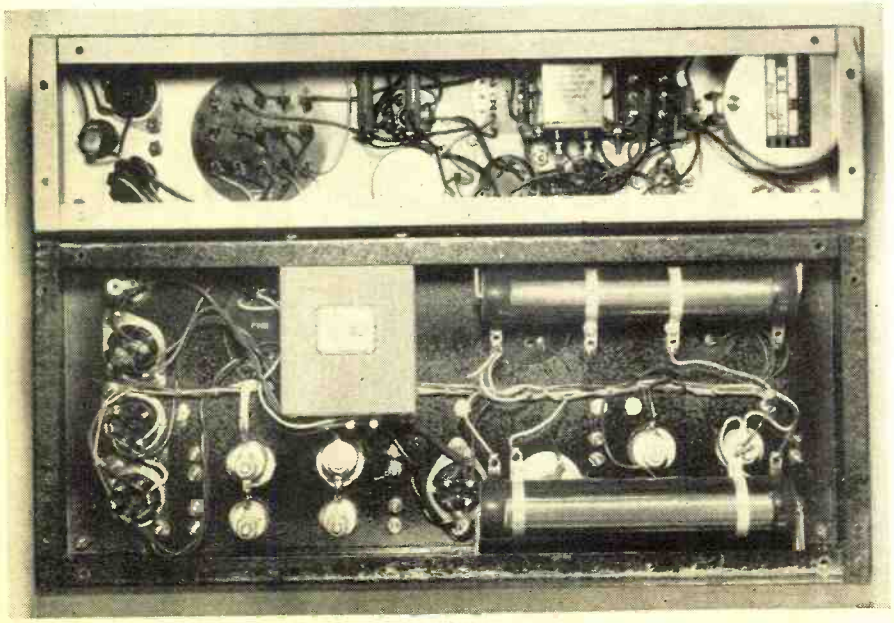
The gain control is a newly-developed grid potentiometer of the attenuator type with the added feature of four steps of bass compensation for low listening levels so that the response of the human ear closely adheres to the well-known Fletcher-Munson curves. This compensation is variable from the front of the control or can be eliminated entirely for flat response of the amplifier if that is desired.

Separate chassis are used for the amplifier and the power supply in conformity with the best engineering practice. While there is room on the amplifier itself to mount a two-stage phonograph preamplifier an investigation has shown that such a unit should be located next to the record player itself so that adjustment of the roll-over point and the high frequency attenuation can be made as the records are played. While the preamplifier was not built on the main amplifier chassis there is adequate space to mount a plug for the power and audio leads from such a unit. Fig. 2 shows the schematic diagram of the amplifier. The input tube has its plate shunt-fed so that the direct current is isolated from the primary of the coupling transformer. The driver stage employs a common cathode resistor, adequately bypassed, and is capable of delivering the relatively high audio voltage at the output of the driving transformer secondary to fully excite the output tube.

Separate cathode resistors and bypass condensers are used in the 6AS7G stage in order to allow for the balancing of the plate currents of the two sections. The *Mallory* 500 ohm wirewound control handles this adjustment. A *CTC* shaft lock is provided so that the adjustment, once set, cannot be altered inadvertently. Since a phase inverter and resistance coupling methods are incapable of supplying the large driving voltage needed by the 6AS7G without resorting to a power triode worked to its limit, transformers were used instead. While their use adds somewhat to the total cost of the equipment the resultant performance and improved appearance make them desirable. The output transformer employed has primary windings of 3000 and 5000 ohms impedance. The 5000 ohm winding should be used with the 6AS7G tube. All the line and voice coil taps are brought out on the octal plug. Wiring the output to a plug has its advantages in that the strapping of several terminals to obtain a desired impedance can be more easily accomplished on a socket. Any required changes are more easily made on the socket than on the plug when it comes to selecting the winding necessary for the particular speaker or line used. Another reason for this construction was to avoid inserting a

(*Continued on page* 88)

**Fig. 5. Internal view of amplifier. Adequate spacing has been allowed to facilitate servicing.**



# A Compact 10-METER CONVERTER

By ROBERT BAIN

Front and underchassis views of the home-built 10-meter converter. The unit is constructed on a 4" x 5" x 6" chassis.

***This novel unit can be built of highest quality parts at a cost of less than a dollar-per-meter.***

MANY an embryo ham as well as the active ham with a lean pocketbook has been searching diligently for an inexpensive 10-meter converter which would prove sensitive and stable yet not disrupt the family budget.

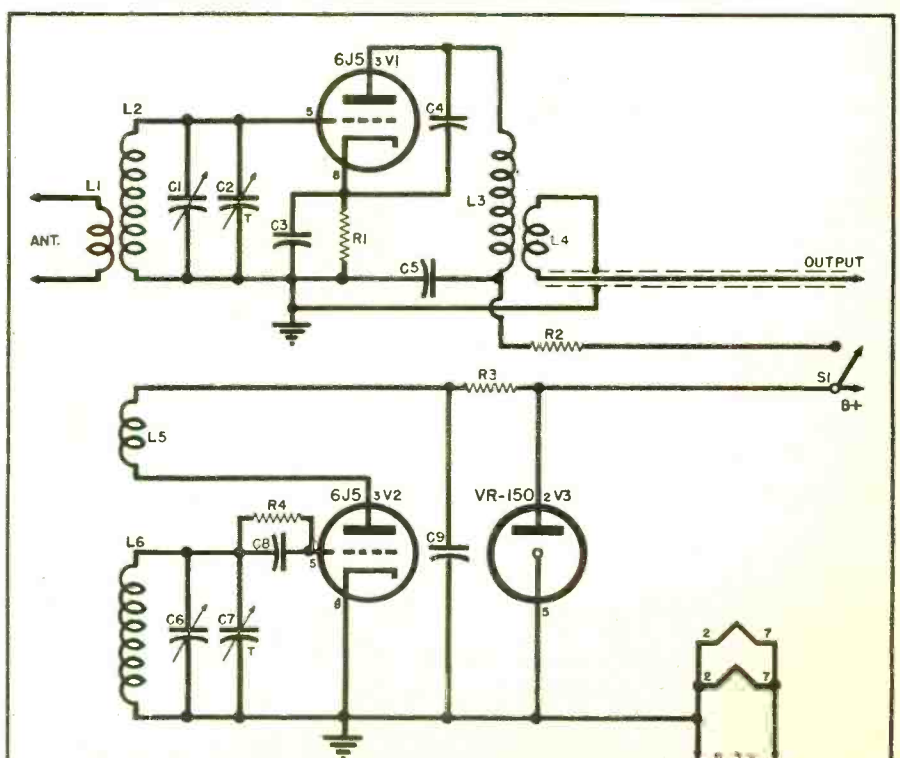
The converter described in this article seems to meet these requirements in all respects. The unit was constructed of quality parts at a cost of less than a dollar per meter. The set is easy to construct and its lack of critical circuits makes it suitable as a project for the tyro as well as the more advanced amateur.

The wiring diagram shows one 6J5 tube used as an oscillator operating on the low side while another 6J5 is used as a mixer. The plate circuit of the second 6J5 is tuned to approximately 1600 kc. A triode mixer proved to be a real revelation in quietness. S2 and S3 signals are often masked on converters with the conventional 6AK5 mixer, due to the high hiss and shot effect. Using this converter in conjunction with a SX-43 receiver indicated a rise of less than one-half "S" unit, with no antenna connected.

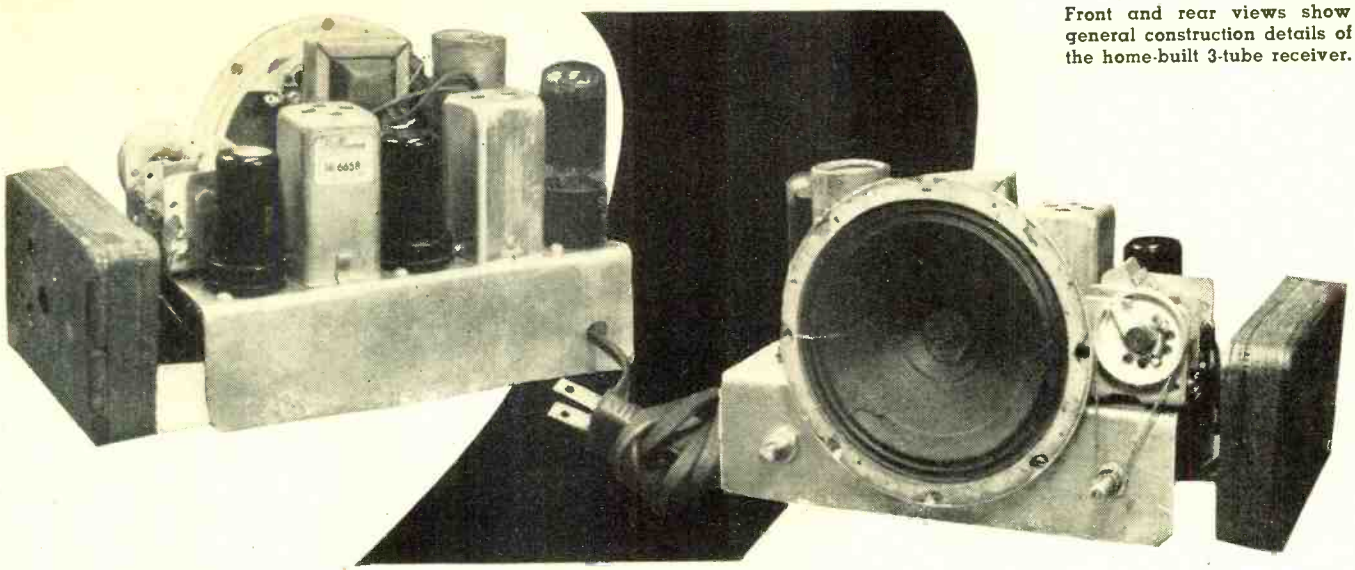
Voltages to the oscillator and mixer tubes are stabilized by a VR150. The standby switch removes only the mixer high voltage. Since the oscillator frequency does not change, the converter can also be used as a monitor on strong local stations or with the transmitter itself.

(*Continued on page* 151)

Wiring diagram of the three-tube, low-cost 10-meter converter unit.




$R_1$—20,000 ohm, ½ w. res.
$R_2$, $R_3$—470 ohm, ½ w. res.
$R_4$—50,000 ohm, ½ w. res.
$C_1$, $C_6$—15 μμfd. var. cond. (Cardwell ZR-15-AS)
$C_2$—3-30 μμfd. mica trimmer
$C_3$, $C_5$—.01 μfd. mica cond.
$C_4$—250 μμfd. silver mica cond.
$C_7$—3-30 μμfd. ceramic trimmer
$C_8$—100 μμfd. silver mica cond.
$C_9$—250 μμfd. mica cond.
$S_1$—S.p.s.t. toggle sw.
$L_1$, $L_2$, $L_3$, $L_4$, $L_5$, $L_6$—See coil table (Page 151)



Front and rear views show general construction details of the home-built 3-tube receiver.

# Reflex Amplifier Considerations in Receiver Design

By EDWARD KASNER

***Although this circuit is obsolete compared to present-day design standards, its many inherent problems have been solved by the author. Result—a low-cost 3-tube receiver.***

REFLEX amplifiers can provide i.f. amplification, detection, a.v.c., and audio amplification within a single tube. In the basic reflex circuit shown in Fig. 1, an incoming i.f. signal is amplified by $V_1$ and detected by $V_2$ in a conventional manner. The audio signal thus developed is fed *back* to the grid of $V_1$ for further amplification. The amplified audio signal appears across $R_4$ and is fed directly to the power output stage through $C_8$. In effect, the signal "lifts itself by its bootstraps." The use of a diode-pentode in place of $V_1$ and $V_2$ permits single tube operation. The a.v.c. bias for the converter grid may be obtained from the detector, or from the second diode plate of a duo-diode-pentode.

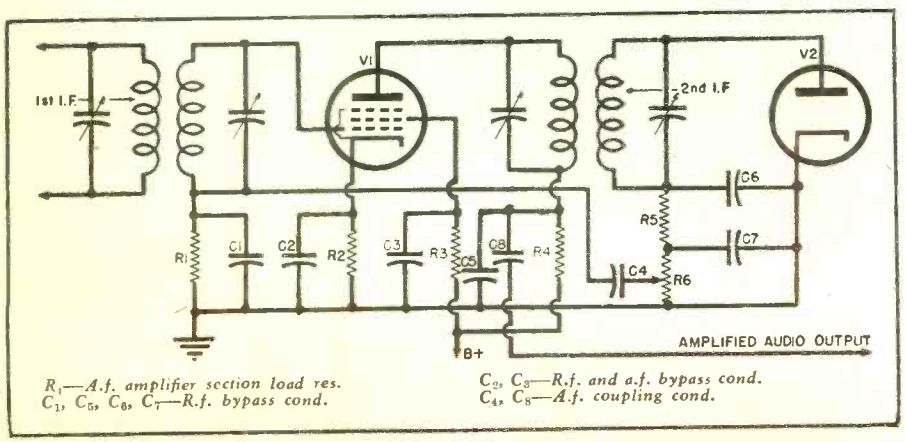
It is apparent that a feedback circuit, such as the reflex amplifier, would tend to be unstable. Adequate bypassing must be incorporated following the detector so that no amplified i.f. can be returned to the input. It is advisable to connect the second i.f. transformer in such a manner that i.f. signals which might leak past the bypassing will be fed back degeneratively.

Although the operational principles of the reflex amplifier are fairly well-known, the circuit has met with little popularity among receiver designers. This reluctance is due largely to a few undesirable characteristics inherent in the circuit. The most serious fault of the reflex amplifier is the harmonic distortion produced by the non-linearity of the control grid characteristic. The limited number of diode-pentodes readily available restrict the selection of tubes suitable for both r.f. and a.f. operation. The type 12SF7 is, however, perfectly suited for reflex amplification. Although the 12SF7 is of super-control construction, the upper portion of its control grid characteristic has a fairly linear slope through a substantial grid voltage variation. The harmonic distortion introduced by a 12SF7 in this application is slight and was unnoticeable in the circuit shown in Fig. 2.

Another troublesome condition encountered in reflex amplifiers is the presence of a residual signal after the volume control has been turned completely down. This condition, referred to as "minimum volume effect," is caused by the plate detection of strong carriers in the i.f. section (preceding the detector). Plate detection, occurring at the curved portion of the control grid characteristic, is a phenomenon common to all i.f. amplifiers employing variable $\mu$ tubes. However, in a conventional i.f. amplifier, the audio signal cannot pass through the i.f. transformer and so does not appear at

(*Continued on page* 114)

Fig. 1. Circuit diagram of a basic i.f.-a.f. reflex amplifier.




$R_1$—A.f. amplifier section load res.
$C_1$, $C_5$, $C_6$, $C_7$—R.f. bypass cond.
$C_2$, $C_3$—R.f. and a.f. bypass cond.
$C_4$, $C_8$—A.f. coupling cond.

# Adapting HOME RECORDERS for Professional Use

By
**JOHN B. LEDBETTER**
Eng., WKRC, WCTS-FM

The Brush Model BK-401 "Soundmirror" recorder.

***A few simple changes can lift the popular home recorder into the "professional" recorder class.***

FOR years, sound engineers and servicemen have recognized the possibilities of magnetic tape and magnetic wire recorders in obtaining high-grade, professional-type recordings. The *magnetic tape* recorder, in particular, lends itself admirably to radio broadcasting purposes where fast, easy editing, splicing, and playback of certain portions of special programs is desirable. It also finds ready application in recording studios, in the home, and in other uses too numerous to mention.

In the past, professional recorders of the foregoing types have not been available except in limited quantities. Serious drawbacks, such as wire and tape breakage and snarling on rewinds, high cost of the wire itself, and in some models of tape recorders, inter-layer leakage in the tape reel, were prevalent in early models. Then, too, their bulk and weight ruled out the feasibility of their widespread use in remote or portable operation. Most of these disadvantages have been overcome in current models, however, and these units are finding practical applications in every phase of the radio and sound field.

In the period when professional-type recorders were relatively unavailable, quite a number of home recorders were released. These home recorders, because of their low cost, necessarily had many of the more desirable features and circuit refinements omitted. These features, when added and accompanied by minor circuit changes, result in increased quality and performance which in many cases approaches that of professional-type recorders, at least in a practical manner of speaking.

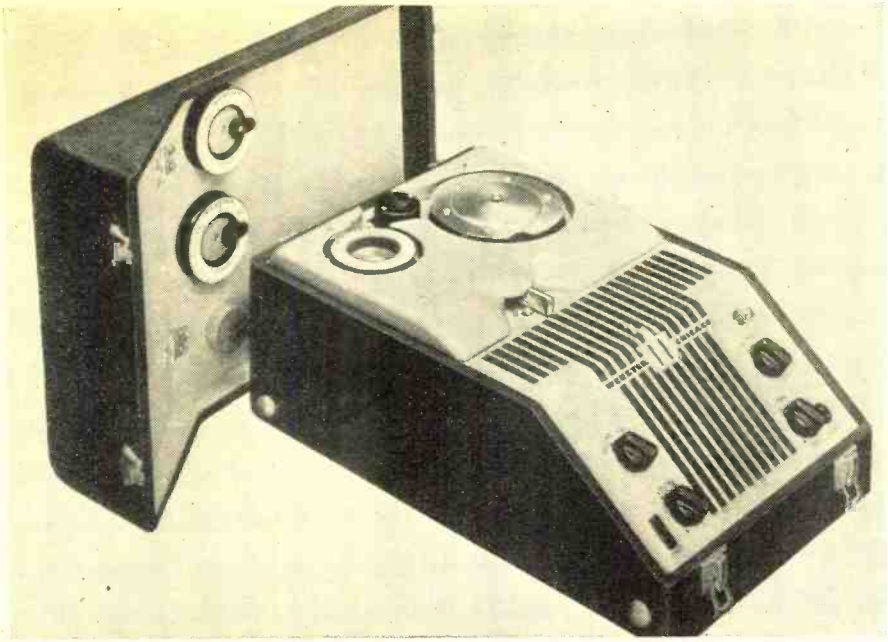
A number of these medium and low-cost recorders were purchased by broadcast stations for interim use until the more professional units could be obtained. Modifications and improvements were made in these recorders which, although intended primarily for broadcast use, are equally suited to improvement of these and similar recorders for use in the home or recording studio. The serviceman with access to a large number of customers in possession of such recorders should be able to add these refinements at a reasonably handsome profit.

Most of the changes described in this article can be applied equally well to models and types other than the ones treated. Basically, all modifications are sound, sensible improvements which in many cases will reduce noise and hum pickup by as much as 6 to 8 db.

### Noise Reduction in Recorders

The noise output of a recorder when operated on "Playback" is due to the additive effects of (1) thermal noise in the input circuit, (2) random wire or tape noise, (3) partial magnetization of the recording medium after erasing, (4) pickup of powerline hum by the pickup head and input circuits, and (5) noise pickup from external sources such as diathermy equipment, fluorescent lights, and r.f. interference from radio stations. These latter sources of noise are of course limited to certain localities and may usually be eliminated by installing simple line filters, by adequate shielding of all low-level circuits, and by otherwise bypassing the noise energy to ground.

Taking up the first four sources of noise, in order, we find that thermal noise can generally be ignored. Excessive thermal noise of course is indicative of a faulty tube or component and should be corrected. Random wire or tape noise is effectively reduced when powerline hum and other noise pickup has been reduced. Magnetic images remaining on the recording medium after erasing may be removed or reduced to an insignificant level by double erasure. Pickup of powerline hum can be reduced considerably by orienting the power supply chassis so that a minimum a.c. field is present at the recording amplifier input, by removing common ground circuits between high and low-level stages and a.c. circuits, and by adding a humbucking potentiometer in the heater circuit. (The latter applies only in the case of a.c. transformer-operated systems. Hum pickup in a.c.-d.c. circuits can often be reduced



Over-all view of the Webster-Chicago Corporation's Model 80 wire recorder.

by installing an isolation transformer in the a.c. power line circuit.)

Further reduction in hum pickup may be afforded by shielding all low-level grid leads and by connecting the recorder chassis to ground. (Again, external grounding applies mainly to a.c. transformer-operated recorders.) Such a.c.-d.c. units may be grounded provided such action does not short-circuit the ground return system, or provided an isolation transformer is used in the line. Often hum in a.c.-d.c. recorders may be reduced and the quality improved by reversing the line plug. This is applicable in some cases to transformer-supply systems.

### Modification Requirements

One of the first and most important modifications to be made, especially in broadcasting, is to equip the recorder with suitable input and output coupling transformers for connecting to 250 or 600-ohm lines. These transformers are just as useful to the sound man since they allow the use of ribbon or dynamic microphones in addition to the regular crystal microphone, and permit feeding the output of the recorder into a p.a. system or broadcast line.

A typical coupling transformer arrangement is shown in Fig. 1A. A slightly more elaborate arrangement is sometimes required for broadcast setups, but since the majority of sound engineers and servicemen have little occasion to work in conjunction with broadcasting, we shall confine our discussion primarily to recording and sound applications. In Fig. 1A, the transformer is a 250/20,000-ohm microphone-to-grid matching unit. This unit can be either a standard-type transformer mounted in a small, shielded box, or a small cable-type transformer. In either case, see that it is well-shielded, and that the common ground circuit is not interrupted.

Some types of dynamic and ribbon microphones have an output impedance of 30 ohms. For voice applications, a fairly good match is obtained with the 250/20,000-ohm matching coil. For more exacting work a 30/20,000-ohm matching transformer should be used. A similar input coupler used for broadcast purposes usually has a tapped primary (250 ohms for dynamic-ribbon microphone connections, and 15,000 or 20,000 ohms for bridging). The latter allows connection across a program source without interruption or appreciable loading of the program. This transformer is enclosed in a metal box provided with a *Cannon* 3-pin microphone receptacle at the input and a *Hubbell* twist-lock or similar connector at the output. Usually an attenuator is included in the output circuit.

An arrangement for feeding the recorder output into a p.a. system is shown in Fig. 1B. A bridging transformer, 100,000/250 ohms, is tied across the 8-ohm voice coil of the recorder, in series with a 100,000 ohm resistor. This arrangement gives an apparent source impedance of 250 ohms and introduces a loss of about 55 db. Thus for normal speaker level (about 10 dbm.) the bridging output can be fed directly into a microphone circuit of the p.a. system. (This assumes a 250-ohm microphone input. Since most p.a. systems are equipped with high-impedance input circuits, it will be necessary to include a 250/20,000-ohm cable-type transformer between the bridging output and microphone input). Comparable results could probably be obtained by making the bridging transformer 100,000/20,000-ohms in the first place. The original arrangement, however, seems to provide better apparent matching.

For most sound applications, the existing volume indicator (usually an electron-ray "eye" tube) will be satisfactory. For those requiring a more positive indication of recording level, an indicating meter may be substituted. This may consist of a sensitive output meter connected across the voice-coil winding or across the output transformer primary (in the latter instance in series with a condenser to prevent d.c. voltage effects). Sufficient resistance can be added in series with the meter to give a midscale reading at the desired maximum recording level.

### Circuit Modifications

For practical purposes, let us discuss the modifications and minor circuit changes of one particular home recorder unit as being representative of all other types. True, there may be some specific departure in treatment of individual cases, but for the most part the following notes will apply to the mass of home recorders now in the field. The *Brush* BK-401 ("Soundmirror") magnetic tape recorder is described, since it is one of the most popular types of recorders in the low-cost field. It has also found favor in many sound and broadcast applications. Other popular recorders include the *Webster-Chicago* Model 80 and the *RCA* Model MI-12875, both being wire recorders in the low-price range.

As was noted before, it is possible to reduce hum pickup by as much as 8 db. This not only improves the program-to-noise ratio, but also increases the frequency range and response characteristics of the recording system as a whole. The noise and hum level can in many cases be lowered still further by exercising a greater amount of care in shielding low-level circuits and in dressing heater and a.c. leads as far as possible from grid and coupling circuits.

The following modification notes may be followed in or out of order:

Disconnect the heater winding centertap from the voltage divider and install a 50-ohm wirewound potentiometer across the winding. The potentiometer arm is connected to the original centertap return point on the divider and adjusted for minimum hum. A further reduction in hum will result if the arm is bypassed to ground with a 450-volt electrolytic condenser rated at 16 μfd. or higher. This modification, of course, is applicable only to those recorders utilizing an a.c. transformer supply. In many a.c.-d.c. recorders, a considerable drop in hum level can be attained by adding an a.c. line isolation transformer.

A considerable amount of hum may be introduced into the amplifier unit by the a.c. field surrounding the power transformer and chokes. The point of minimum hum pickup from this source may be found by removing the power supply mounting bolts and turning the supply slowly around on its axis until a spot of minimum hum pickup is obtained. It may then be securely fastened in this position. With the *Brush* BK-403 a very slight angle (usually between 10 and 20 degrees) between

the original position of the power supply and the rear edge of the recorder unit will be about right.

Once the point of minimum hum pickup from the power supply has been found, the next step is to remove common ground connections which involve the pickup coil circuit. In the "Soundmirror," one of the rotor points in the "Play-Record" switch acts as a ground connection not only for the shield on the pickup coil lead, but this same ground point is also common to the high-level audio and the motor circuits. The lead which connects the pickup shield to the other ground circuits should be removed. This will leave the pickup coil shield "floating." It should then be connected to the new audio lead shielding as described in the next paragraph.

All low-level open or twisted leads, including the short leads from the microphone jack to the "Play-Record" switch and the leads from the jack to the screw terminal at the rear of the chassis should be removed and replaced with *shielded* leads. All low-level circuits should be rerouted and grounded at the first amplifier tube ground terminal. The pickup lead shield is also to be connected at this point. This independent shielding not only reduces internal hum pickup by breaking up magnetic currents but also reduces interference from external sources of man-made noise.

The possibility of noise pickup from the open-frame take-up motor should be investigated. It may be necessary to place a shield between its exposed sides and the amplifier.

In cases where the recorder is to be operated for continuous periods of an hour or more, it is advisable to install a cooling fan to prevent overheating. An enclosed-type induction fan motor should be used to prevent commutator interference, and should be placed as near the main amplifier unit as possible in order to afford maximum cooling. A small fan should be sufficient in most instances.

All a.c. and filament leads should be dressed away from low-level circuits to prevent hum pickup at these points.

A minor item in modification is the fuse container. The original fuse in the "Soundmirror" (and in most other recorders) is located under the chassis. It may be replaced with a regular extractor-post type fuse mounted either on the back of the chassis or at the rear of the cabinet for greater ease in replacing.

After these modifications have been made, it is wise to check all mechanical operations of the recorder. The sharp edges of the plastic "Reverse-Stopping" switch guide, for instance, sometimes catch the tape and prevent its slipping into place in the guide slot and thus making it necessary to thread the tape by hand. These sharp edges should be carefully dressed with a small file until the tape falls easily into the groove. This precaution may save considerable trouble in the future.

The magnetic tape coating tends in operation to rub off onto the recording head surfaces. This action results in an accumulation of magnetic particles on various parts of the heads. The ultimate effect is a reduction of signal level and high-frequency response on "Play" and "Record," and a lowering of efficiency in the erase head. These particles should be removed *carefully* by rubbing with a soft cloth dampened with alcohol or carbon tetrachloride. Extreme care must be used to prevent touching the tape coating with these solvents; it will dissolve very easily.

It is recommended that both the "Play-Record" and erase heads be cleaned after three or four hours of operation in order to prevent accumulation of magnetic particles. This of course applies only to magnetic tape recorders. Magnetic wire recorders need only to be checked occasionally to keep lint and foreign material out of the head apertures.

Coating disintegration in magnetic tape recorders is also responsible for failure of the reverse stopping switch to operate on the "Rewind" position. Sufficient coating will cause the switch mechanism to jam and thus fail to stop the tape reel when the tape has been completely rewound. The result often is destruction or serious damage to the tape.

A smooth or greasy surface on the reel drive mechanism is often responsible for failure of the tape to pull through the heads in the "Forward" position. The surface of this mechanism should be cleaned with a lint-free cloth saturated with carbon tetrachloride and roughened if necessary with a very fine grade of sandpaper. A second application of tetrachloride should be made to remove the residue.

Failure of brake action in either the takeup or supply motor in the "Soundmirror" has been found in most cases to be due to a defective 117Z6 rectifier tube. This tube supplies the d.c. braking voltage to both motors. The filter unit associated with this circuit should also be checked.

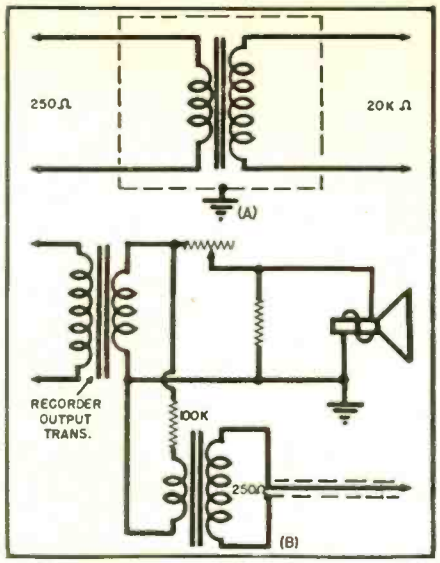



**Fig. 1. (A) A typical coupling transformer arrangement used in the converted recorder unit. (B) Arrangement for feeding the recorder output into a p.a. system.**

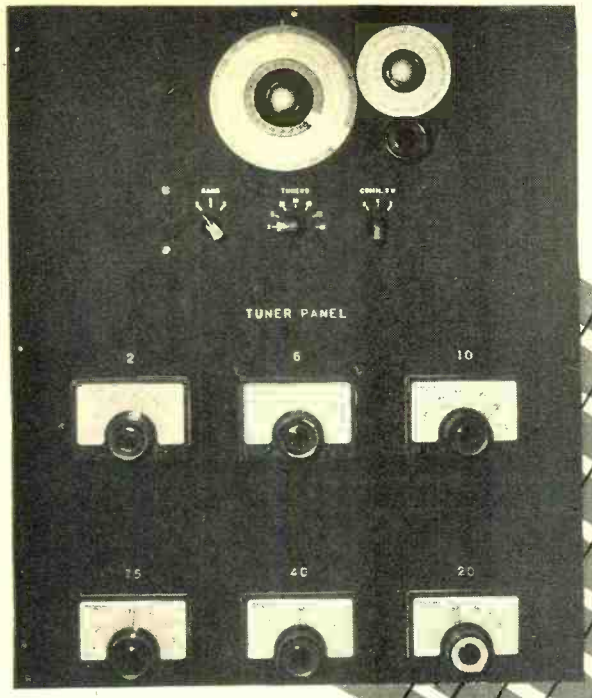
If the start and takeup motors do not run after the start button is released, the *Acro* snap-action switch is usually at fault. Failure of this switch will also result in failure of the supply motor to continue on "Rewind" after the start button is released. At the same time the motor stops, braking action is applied to the takeup motor. The cause of switch failure is in most cases due to breakage or displacement of the small fiber spacer in the switch. Replacement is recommended, although temporary repairs may be made by making a suitable spacer and fitting properly. The *Acro* switch may be obtained directly from *The Brush Development Company* or the *Acro Electric Co.*, both of Cleveland, Ohio.

The improvements described in this article were carried out by a number of broadcast stations throughout the country. The author is indebted to these various sources for the accu-

(*Continued on page* 157)

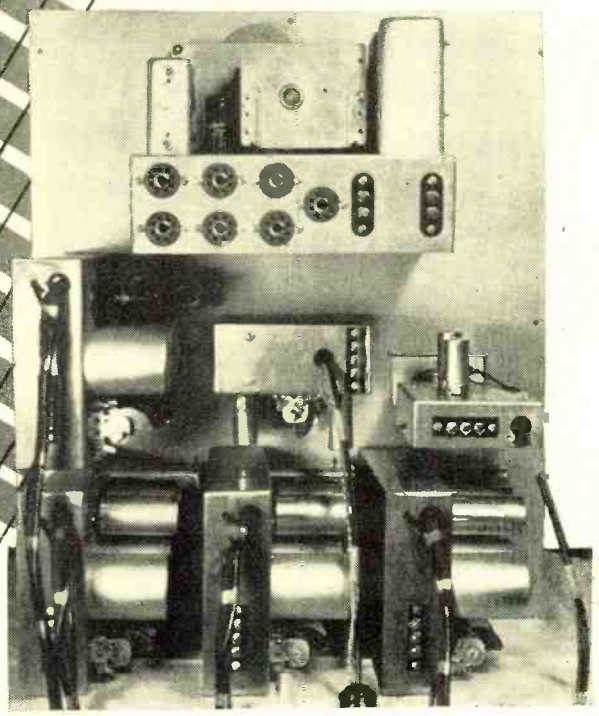
**The Brush Development Company's Model BK-403 "Soundmirror" tape recorder.**

# Build Your Own COMMUNICATIONS RECEIVER




Front panel view shows how the all-wave tuner and the six individual converters are combined into a single installation.

Rear view of converter and tuner assembly.



By

**J. T. GOODE**

Standard Coil Products Co.

***Part 7. The concluding article of this series shows how all of the individual units covered previously can be combined into a single panel-mounted installation.***

IN THE previous articles, every effort has been made to build a receiver that would equal or exceed the performance of most radios, both communications and broadcast. The next step in construction is equally as important, if not more so.

The fact that a receiver operates satisfactorily is not enough. It must have a neat appearance. This feature is recognized by receiver manufacturing concerns. Often the cost of a dial and cabinet exceeds the cost of the chassis.

If your radio looks like a pile of junk, the chances are that it will become just that sooner or later. Complete your receiver with a neat panel, mounting it in a cabinet or rack.

First decide whether the equipment is to be enclosed in a rack or cabinet. Next determine the amount of space required. The method of mounting the individual chassis requires careful consideration at this time.

Symmetry of the various controls on the panel is a must. Labeling each control is also important.

The best way to make panel layouts is on paper. Each chassis has its maximum dimensions. Measure the various chassis and let the widest chassis determine the width of the panel. The standard rack width of nineteen inches is satisfactory.

Take a large piece of paper forty inches long and draw two parallel lines nineteen inches apart. Draw a line at right angles to the parallel lines, approximately one inch from the bottom of the paper. This line will be the starting point for all dimensions.

Since the power supply and audio chassis weighs more than the other chassis, it should be mounted at the bottom of the panel. Measure from the bottom of this chassis to the center line of the control shafts. Add one-sixteenth of an inch to this dimension and draw a line across the bottom of the paper corresponding to your measurements.

This sixteenth of an inch will place the panel below the bottom of the chassis. When the panel is mounted to a cabinet, no visible crack will show between the cabinet and panel edge.

Draw a center line between the nineteen-inch parallel lines. Next measure the distance between the various controls and mark these locations on your paper. Make all these measurements to scale on the large piece of paper. This paper will become your template for the panel when completed. Simply secure the paper to the panel and center punch through the paper to locate the various holes.

Measure from the center line of the controls to the highest object on the chassis. This will more than likely be the top of the rectifier tube. Place this dimension on the paper and draw a dotted line showing the location. Obviously, the chassis to be mounted above the bottom chassis must be above this line for clearance. Add one-quarter of an inch to the above dimension to allow space for removing tubes.

This new dimension locates the bottom of the next chassis. This chassis is the i. f. section. Repeat the same procedure and locate the controls on the paper, using the center line to locate the center control. Locate the highest object on the chassis and again make a dotted line corresponding to this measurement on the paper.

By mounting the 75, 40, and 20-meter tuners on their sides the panel could be made symmetrical for the location of the dials. Make all necessary measurements on the paper.

The 10, 6, and 2-meter chassis mount directly above the lower frequency tuners, so simply extend the lines on the paper. No further measurements are required, other than the correct distance between the top and bottom row of tuners.

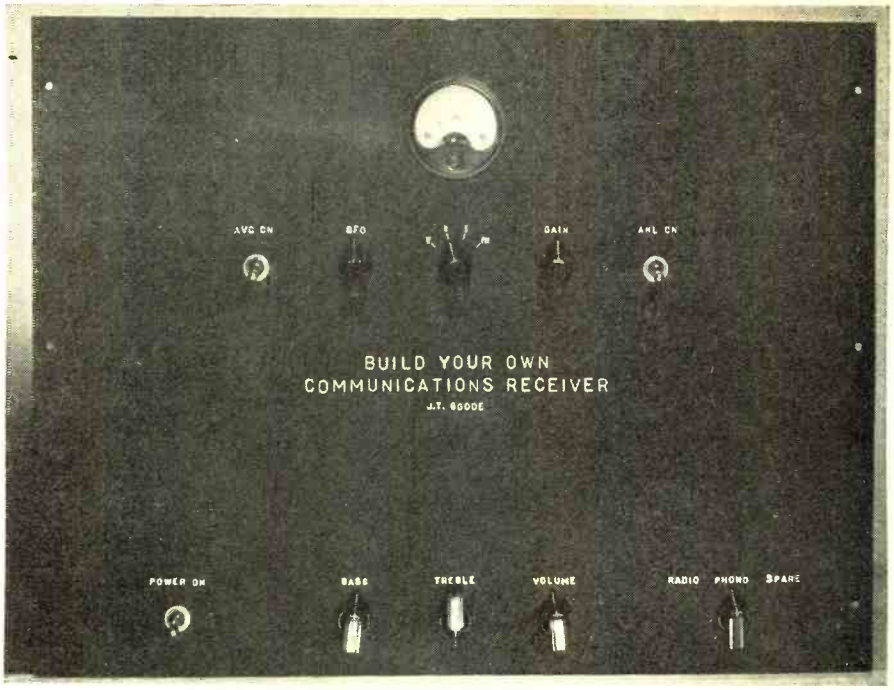
The location of the All Wave tuner is determined in the same manner. Locate the controls, placing the center control on the center line. Measure carefully for the location of the main tuning dial shafts, for these are not symmetrical to the rest of the panel.

The dial frame for the *National* dials can be used as a template to mark their cutouts on the paper. If the dial lights are eliminated it is only necessary to cut out round holes to mount the dial; otherwise make the cutout to correspond with the inside of the dial frame.

Volume controls and band switches require three-eighths clearance holes for mounting. Due to small errors that may develop in drilling, it is advisable to place seven-sixteenth inch holes in the panel for these controls. The mounting nut will cover the excess hole and eliminate the necessity of very accurate drilling. This is known as taking advantage of a tolerance.

The power supply and i. f. chassis are mounted to the panel by the control mounting nuts. The tuner chassis are mounted by means of bolts through the panel, using half-inch spacers to space the chassis behind the panel. This allows space for the dial mechanism. The All Wave chassis is mounted in the same manner.

These mounting screw holes in the panel are countersunk and flathead screws are used. This gives flush mounting screws which can be painted to blend with the panel finish.




Front panel view shows how the power supply, audio amplifier, and i.f. channel are mounted.

Mounting holes are located around the edge of the panel and should be placed as required.

By laying out the panel as described, the builder is in a position to meet practically every mounting problem. All necessary mounting details now appear on the paper layout.

One large panel thirty-seven by nineteen inches will mount the entire equipment. The panels can be split as shown in the photographs. Various nineteen-inch cabinets are available so the builder can adjust the size of the panels to fit existing cabinets.

The entire equipment can be mounted in one rack. Mounting the audio control knobs at approximately knee level makes all controls and dials available from a sitting position.

The panel is made of one-eighth inch aluminum using a fine wrinkle finish.

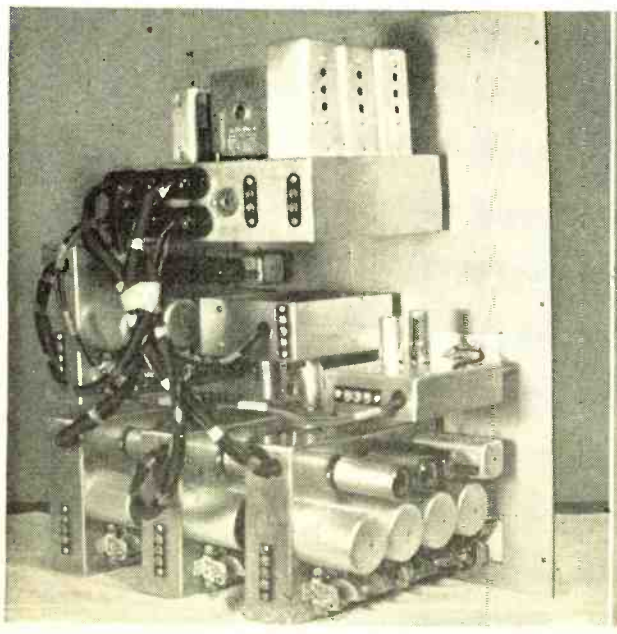
Engraving is somewhat expensive but gives a neat, durable lettering job that is well worthwhile. Engraving costs between five and ten cents per letter.

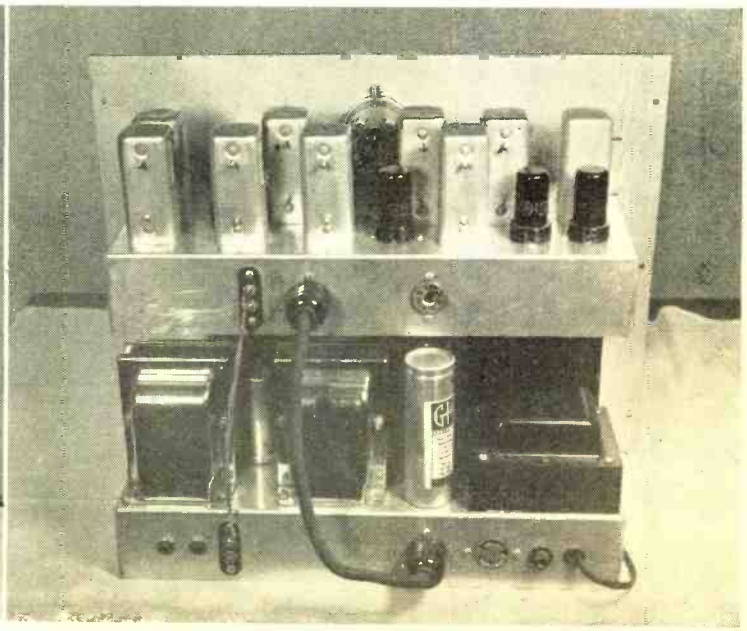
The mounting of the tuner chassis is somewhat unorthodox but does result in using a minimum amount of panel space and allows a symmetrical layout of the tuning dials.

When your receiver is complete, you will have a piece of communications equipment that is second to none.

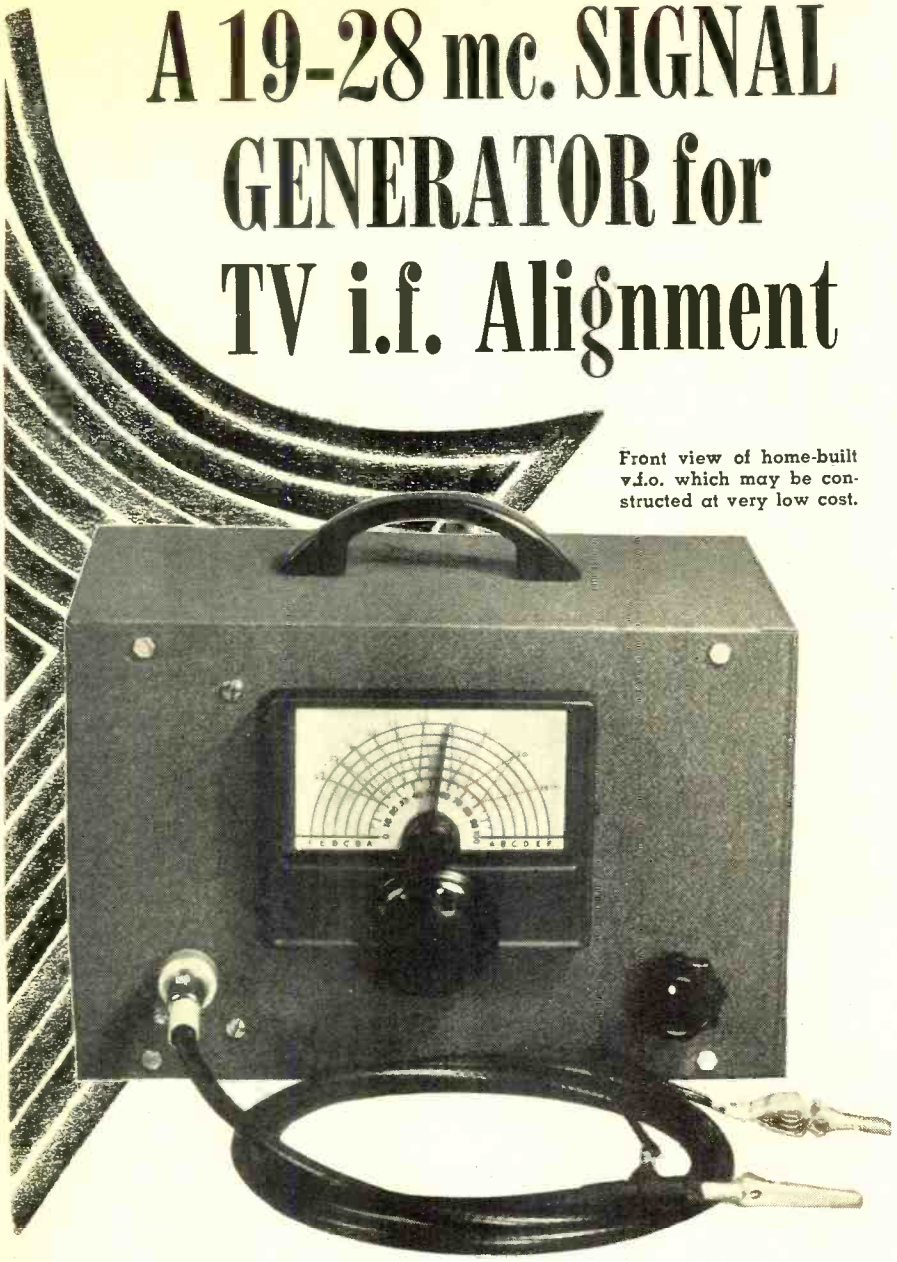
-30-

(Left) Another view of the tuner and converter assembly. (Right) Rear view of the power supply, amplifier, and i.f. channel unit.





# A 19-28 mc. SIGNAL GENERATOR for TV i.f. Alignment



Front view of home-built v.f.o. which may be constructed at very low cost.

By
**ROBERT L. DONALDSON**

***This compact test unit is especially suited for home service calls as well as regular shop work.***

THE average serviceman working on TV sets has acquired a sweep frequency generator and according to regular procedure optimistically hooks it up in conjunction with his regular AM signal generator and oscilloscope and proceeds to attempt to align the i.f. stages of the TV set according to manufacturers' instructions. Since most TV sets use some variation of stagger tuning in video i.f. stages and incorporate several traps tuned to different frequencies, it is necessary that the signal generator be set successively to a great number of slightly different frequencies within the i.f. band, such as 19.75 mc., 21.25 mc., 21.8 mc. and so forth up the scale. However, he finds that no matter what kind of signal generator he has, the calibrations are so close together and so indefinite on the regular scale that he is at a loss to tell whether he actually has the marker frequencies he wants. Needless to say if the marker signals are in error, the over-all alignment will be unsatisfactory.

The instrument described in this article provides a stable unmodulated output from 19.0 mc. to 28.0 mc. with good bandspread and clearly defined calibrations. It can be assembled from standard parts, most of which will be on hand, although "junk-box" parts which have suffered from previous use should not, in the interest of stability, be used. One-half of a 6SN7 is used as a Colpitts oscillator and the other half as a cathode follower output. This arrangement is standard and gives complete isolation and independence of the oscillator from changes in output impedance and loading, thus further stabilizing the signal produced. A simple attenuator is used in the cathode leg of the output section, since in use the output lead is merely brought close to the *"Sweep Generator"* output lead and adjustment of this loose coupling is sufficient to inject the proper amount of marker signal to give a clear indication on the scope. When this instrument is used as a fixed frequency generator for alignment without the sweep generator the output is usually cut down to a low level by coupling to the set through a "gimmick" made of two pieces of insulated wire twisted together, connecting one wire to the oscillator output lead and the other to the proper point in the set. It is never necessary to know the absolute value of marker injection voltage and so this crude attenuator is perfectly satisfactory in use. The difficulty of making a step attenuator that will reduce to zero at these frequencies explains the lack of such a refinement in this instrument.

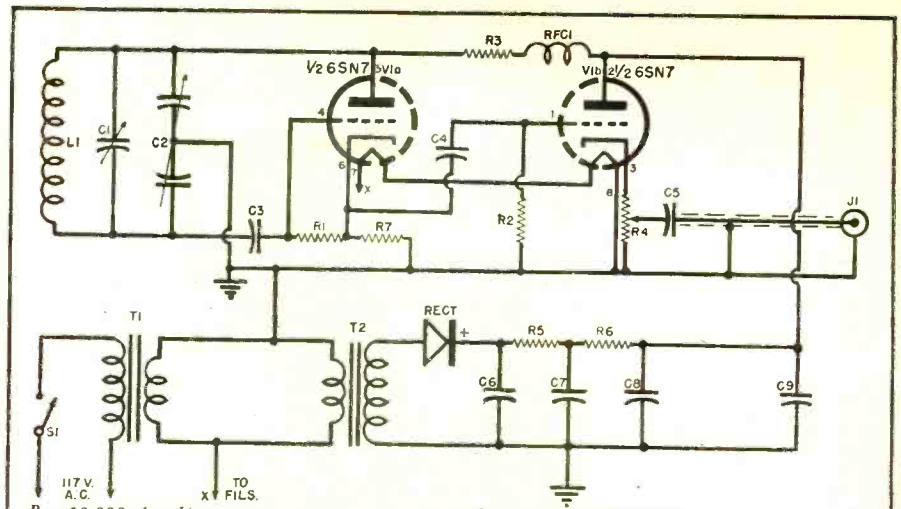
The power supply is unconventional only in that it uses two midget 6.3 volt filament transformers back-to-back and a selenium rectifier. This works out very well, effectively isolating the instrument from the power line, and affording plate voltage of good regulation for the oscillator, without much heat, weight, or unnecessary bulk.

Construction of the unit should proceed without difficulty. It is advisable to mount the parts so that all the power supply and other heat producing units are separated from the oscillator tank coil and condenser to minimize drift upon warm-up . In the pictured unit this is effectively accomplished by the dividing partition. Everything should be firmly mounted so as to minimize vibration-induced changes in frequency. All high frequency leads should be as short and heavy as possible, although it isn't necessary to go to extremes in this. Ordinary good wiring practice is all that is required.

If the type dial shown, a *Millen* 10039, or other similar unit such as the *National* ACN, etc. is used, calibration may be made to .1 mc. on direct markings by use of the following system. First, the temporary setup of Fig. 2 is assembled, utilizing the signal from a good signal generator as the primary source, mixing with the signal from the uncalibrated oscillator in the 1N34 crystal to produce an audible beat note in the earphones. The signal generator is set to the first even number that is desired, i.e., 19.0 mc., then the new oscillator is carefully adjusted to yield zero beat. Mark this point on the outside scale. Set generator to 19.5

mc., zero beat again and mark this point on the inside scale. Repeat this procedure all the way up the scale, marking even megacycle points on the outside scale and half megacycle points on the inside scale. After all these points are noted, diagonal lines may be drawn from each outside point down to the adjacent inside scale points. The intersections of the diagonal lines and the intermediate scales will point out the setting for .1, .2, .3 etc., without further marking. It will thus be seen that the original signal generator used need only have precise markings for each megacycle and half megacycle, which most do, and yet the new oscillator will have exact markings each .1 mc. from 19.0 mc. up. This excellent calibration makes it easy to set the dial for such odd values as 23.4 mc., etc. that are required in TV alignment. The average signal generator requires a lot of mental gymnastics and patience to arrive at even an approximate setting for such in-between values.

The physical size of this instrument is kept small, 5"x6"x9", so that it lends itself to easy portability. Thus, if a service call indicates that only an adjustment of the trap circuits, etc. is required, this may easily be performed by the use of this unit in conjunction with either v.t.v.m. or even a sensitive v.o.m. Thus a great number of calls can be serviced in the customer's home without the bother and risk of carting the whole TV chassis to the shop. Of course if examination of the set shows that a complete i.f. and r.f. alignment is needed this work is best done in the shop. But frequently calls will be made that require only that, for instance, the sound traps be reset, or the sound i.f. be brought into alignment, or similar simple adjustments. It seems much more reasonable to perform these tasks in the home, where they can be completed in a few minutes, rather than to waste time and effort in taking the chassis to the shop. Besides, the writer knows of many cases where more damage was done to the set during transportation than the original fault. A customer cannot be blamed for feeling that he is being treated unfairly if his television set is taken away from him for possibly several days or a week, if all that was the matter with it in the first place was the occasional appearance of sound bars. The instrument described will be found to be indispensable once it has been used on such work. —30—




$R_1$—10,000 ohm, ½ w. res.
$R_2$—330,000 ohm, ½ w. res.
$R_3$—3300 ohm. ½ w. res.
$R_4$—500 ohm carbon pot. (IRC #N-157)
$R_5$—82 ohm, ½ w. res.
$R_6$—3300 ohm, 2 w. res.
$R_7$—33 ohm ½ w. res.
$C_1$—1.5-7 μμfd. trimmer cond.
$C_2$—50/50 μμfd. dual var. cond.
$C_3$—25 μμfd. mica cond.
$C_4$—10 μμfd. mica cond.
$C_5$—.01 μfd., 400 v. cond.
$C_6$, $C_9$—.001 μfd., 400 v. cond.
$C_7$, $C_8$—40 μfd., 150 v. cond.
$L_1$—17 t. #18 en., ½" diam., spaced to ¾" long.
$RFC_1$—2½ mh. r.f. choke
$T_1$, $T_2$—Fil. trans. 117 volts; 6.3 v. @ 1 amp.
Rect.—100 ma. selenium rectifier
$S_1$—S.p.s.t. sw. (on $R_4$)
$J_1$—Output jack

Fig. 1. Circuit diagram of the easily-constructed signal generator for TV alignment.

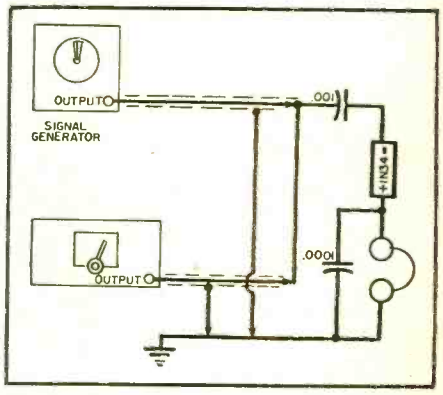
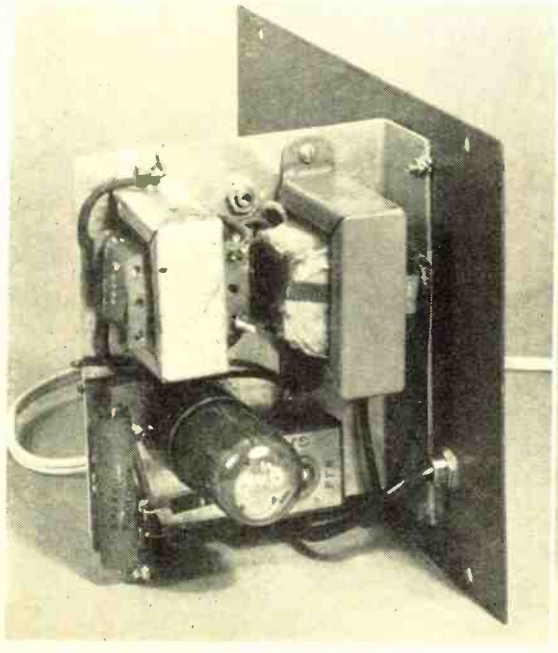
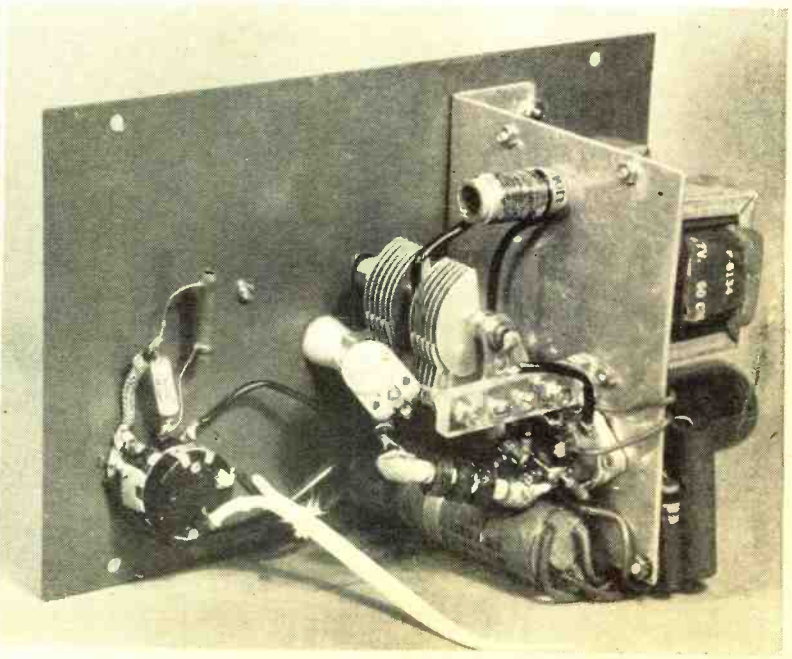



Fig. 2. Suggested setup for calibrating unit.

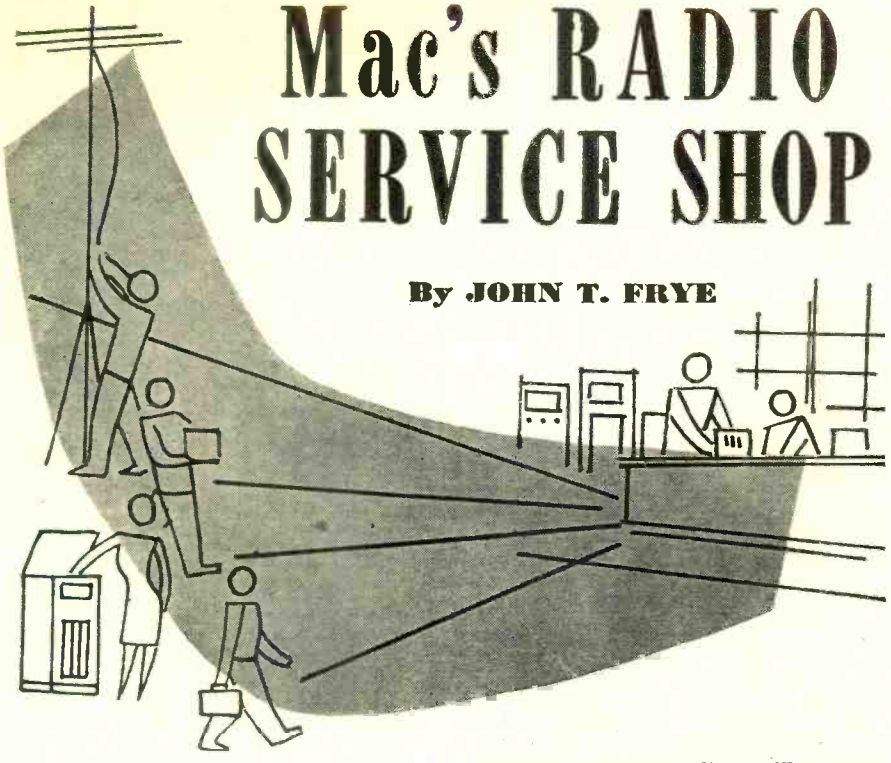
(Left) Side view of unit showing power supply and other heat-producing units mounted on one side of the dividing partition. (Right) Another view of unit showing proper positioning of oscillator tank coil and condenser.





# Mac's RADIO SERVICE SHOP

By JOHN T. FRYE



## Intermittents Still Pursue

WHEN Barney, the red-headed apprentice of Mac's Radio Service Shop, had gone into the chassis-cleaning booth twenty minutes before, there had not been a single wire recorder in the shop; but when he came out, Mac was busily engaged in taking one out of its case.

"Doggone it!" Barney exclaimed, snapping his fingers, "I wish I'd seen her!"

"What 'her'?" Mac grunted without looking up.

"Why, the beautiful creature that persuaded you to run her wire recorder around all of these other sets stacked up here! That gal really must have had something."

"For your information, Junior, this wire recorder belongs to the young minister of that church on Ninth Street. I am giving it priority because of the use he puts it to. Each Sunday he makes a recording of the entire church service. Then, during the week, he takes it around to the homes of the sick and aged members who cannot get out and lets them go to church right in their homes. Several of these old people are quite hard of hearing, and he wants me to install a phone jack for their benefit."

"Hey, that's swell!" Barney exclaimed; "that's really using the old noodle."

"It certainly is," Mac agreed, "and speaking of 'using the old noodle,' as you vulgarly put it, I think it is about time we had another chalk-talk on intermittents."

With a flourish Barney whipped out his beat-up notebook and perched himself on the end of the bench. "Yes, sir; whenever you are ready, sir," he invited with mock deference.

"Well," Mac began, still working on the recorder and pausing now and then when what he was doing required a little extra attention, "first I want to impress on your alleged mind that the amount of time that elapses between the time the set is turned on and the time at which the erratic behavior starts is very informative. Most intermittent conditions are caused by expansion of defective parts; and this expansion, in turn, is caused by heating. Since not all of the parts warm up at the same time, but, instead, take on heat according to a definite sequence, you can make a pretty shrewd guess at where the defective part is by how long it takes for the trouble to start."

"For example, the tubes heat up first; then the resistors increase in temperature; gradually the heat spreads through the chassis and warms up the coils and condensers. The proximity of a particular part to a tube or hot resistor must also be taken into account. In general, though, if your trouble begins as soon as the set is turned on, be especially suspicious of tubes and resistors. The filament of an a.c.-d.c. tube that opens up as soon as the filament is hot and then re-establishes contact when it cools down is a well-known example of this. Usually, but not always, this defect will show up in the first five minutes of operation.

"Another case that is fairly common is that of the set that has a lot of noise and abrupt changes of volume when it is first turned on but that settles down and plays faultlessly after about fifteen minutes of operation. In several cases, I have found the trouble to be in a metal-encased resistor riveted to the chassis. The taps on this resistor make poor contact when the resistor is cold; but when the resistor heats and expands, it wedges the metal band of the tap tightly between the element and the case and makes a good contact until the resistor is allowed to cool down again.

"If the set plays all right for a half-hour or so and then begins to misbehave, it is a good idea to suspect condensers or coils. We talked before about how to locate a condenser that is opening up, but I want to mention, too, that you can often tell in what circuit a condenser is opening by listening to the change in the *quality* of the signal when it drops in volume. An opening coupling condenser will often cause a severe loss of low frequencies, because the highs will still be passed by the small amount of capacity between leads, etc. A plate, cathode, or a.v.c. bypass that is opening will often cause a characteristic hissing 'near-oscillation' sound to accompany the drop in volume. A defective coupling condenser in the oscillator circuit will often have a detuning effect on the signal just before the set quits playing."

"You told me last month that changes in volume were not the only troubles that came under the heading of 'intermittents,'" Barney said. "What other kinds are there?"

"Well, intermittent noisy conditions are quite common. We already have spoken about noisy resistors. Coils that open up are very common, especially in circuits that carry d.c. current. This takes in the primaries of r.f., i.f., oscillator coils, and audio transformers, and it also includes speaker field windings. An experienced serviceman can usually spot one of these 'opening coil' cases by the distinctive sound they make. In addition to an intermittent rustling sound, there is often a kind of high-pitched squeaking sound, like this:"

Mac drew his breath in between tightly-pursed lips to produce the sound that many people use to call a near-by dog. Barney dropped his notebook, clapped both hands over his heart, and rolled his eyes blissfully toward the ceiling. "Ah!" he exclaimed rapturously, "that reminds me of how Margie says goodnight!"

"You keep your mind on what I'm saying, or I'll 'goodnight' you," Mac warned trying to scowl fiercely. "You can often show up which winding is going out by increasing the current through it. To do this, connect a resistor of around 5000 ohms between the point fed through the coil and the ground for two or three seconds. If the coil is OK, it will pass this temporary overload without harm; but if it is defective, the noise will become much worse or the coil will open up completely.

"Another very common noisy condition, especially with a.c.-d.c. sets, is caused by a defective filter condenser. I am not sure as to exactly what hap-

(*Continued on page* 154)

# NEW PROCESS TO RELIEVE TV BOTTLENECK

***Pittsburgh Plate Glass Company's new tube manufacturing process will increase output.***

RCA's Caroline Tufts holds the newly developed Pittsburgh Plate Glass television picture tube face plate against the all-glass funnel to which plate is flame-sealed.

A NEW technique for manufacturing face plates for television picture tubes has been recently announced by *Pittsburgh Plate Glass Company,* originator of the process.

The production of 5 inch tubes has been stepped up and this saving in production time is expected to be extended to the manufacture of 10", 12", and even larger sized tubes as soon as the machinery is installed.

The new process, which hinges on the development of a special glass tailor-made to meet the needs of the television industry, is the result of nearly three years of research and development.

The key to the mass production schedule lies in the fact that the slow process of molding glass blanks and then putting them through rigorous optical grinding and polishing operations to obtain spherical perfection has been replaced by a method whereby the meticulous grinding and polishing operations are reduced to a standardized process which is completed while the glass is still flat. A newly developed bending process permits perfect sphericity without marring the precision surface obtained before the blanks are cut to size.

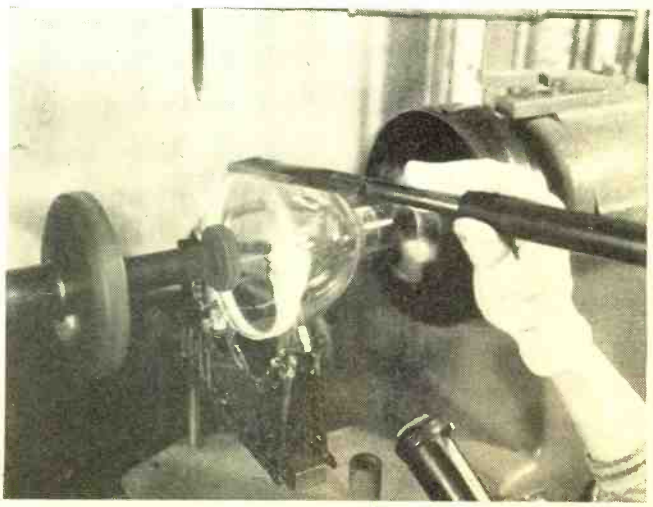
It has been pointed out that the bottleneck in picture tube manufacture which had receiving set production heavily handicapped throughout the industry has not been on account of the bulk of glass used but because of the many time-consuming precision requirements.

The new *Pittsburgh* face plate may be used not only on the special alloy metal developed for television tube manufacture but may also be fused to the all-glass tube. Because of the weight and bulk of the latter, especially in large direct-view tube sizes, many manufacturers are retooling to use the metal-glass tube which incorporates a number of advantages.

*Pittsburgh* is currently experimenting with a high-expansion glass for fusing to lower cost metals than those now in use. The high-expansion glass is expected to substantially decrease the cost of tube manufacture. —30—

At RCA's Lancaster tube plant a television picture tube face plate, newly developed for mass production, is flame-sealed to tube funnel. The process can also be used with metal units.

A close-up view of the fusing operation which seals the newly developed Pittsburgh Plate Glass Company's television face plate for the picture tube to the rest of the tube assembly.



# There's Money In CUSTOM INSTALLATIONS

Here the speakers are installed in the wall above the modern custom ribbon mahogany cabinet.

**By JOHN D. GOODELL**
The Minnesota Electronics Corporation

***Part 2. Further details covering the proper placement of speakers and playback equipment.***

AS EARLY as possible in the discussion with a customer for high quality music reproducing equipment, it is good sales psychology to direct the conversation rapidly toward the decision of which loudspeaker to use, how much power in the amplifier, etc. Assume that he will buy equipment from you. Don't dodge the price question. Discuss it as soon as possible and indicate the various brackets in which he may select components. Describe the problems involved and guide yourself in accordance with this reaction. Don't try to sell him a 20-watt amplifier if he needs only 10 watts. Your customer will recognize complete honesty very quickly—a real effort to guide him toward the best equipment he can afford that will accomplish the result he desires. Once you have his confidence, the sale is essentially made.

As indicated in the first section of this article, it is well worthwhile to call on the customer at his home. It is definitely true that you will be able to advise him more intelligently about the equipment he should have if you can actually see the room in which he will use it, observe the characteristics of his existing equipment, and listen to a few records with him. In most instances, he will appreciate your offer to look over the room and advise him accordingly. It is to his advantage as well as to yours. This provides the opportunity to guide his thinking in the direction of a decision with regard to the manner of installation, taking for granted that he will purchase your equipment.

A large portion of the people who are in the market for high quality equipment are listeners with long experience in attending live concerts and in listening to records. If you are to sell them successfully, it is important that you be able to listen with ears as competent and critical as theirs. This means, whether you like it or not, that you must develop some understanding of serious classical music, as well as an understanding of serious boogie-woogie, be-bop, etc. Along with this, it must be borne constantly in mind that at least one member of almost every family likes middle-of-the-road standards, pleasant background music of the musical comedy variety. Play at least one such record if you are demonstrating for a group.

Guide yourself in your discussion by the kind of music your customer finds interesting. Above all things, if he says something doesn't sound right—that a violin tone sounds thin or too brilliant or fuzzy, or any one of a number of things that are hard to define—don't tell him he is absolutely wrong, that everything measures flat, that there is no distortion in the equipment, etc. Sit down and try to find out what he is hearing that he doesn't like. Remember that in almost every instance he is trying to select equipment that will sound clean and right to him, and if it doesn't, you certainly want to know why. You will learn more about listening by tracking down the things your potential customers find objectionable than in any other way, because you will have the guidance of their combined experience in listening.

This doesn't mean that the customer will always be right. He may be hearing a tone that is characteristic of a certain musician or singer that he doesn't like but is still a valid reproduction of the original. He may have done so much continuous critical listening that his perspective is out of line, but this may be equally true of you. Don't jump to this conclusion and *never* express it to him without careful qualification, indicating that you just aren't sure and would like to listen to some other signal sources with him to find out just what is wrong, if anything.

You should be more critical, if possible, than your fussiest customer. The difference will be mostly that you are able to rationalize what you hear in terms of your technical knowledge. If you really do know that the equipment has no distortion components that could produce a fuzzy violin tone, then you will be able rapidly to ascribe

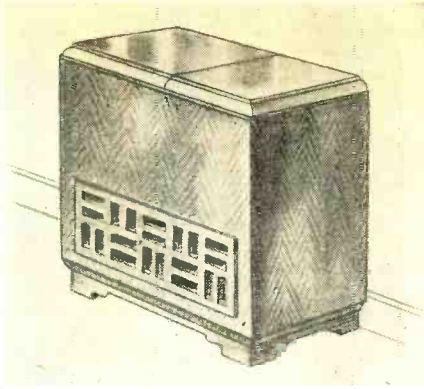
such a sound to the recording or broadcast or whatever source of signal you are observing. Your customer will know only that it doesn't sound right to him.

It is important that you try to educate your customer to have the desire to enjoy and listen to wide range reproduction. Don't try to convince him that he should learn to tolerate high surface noise levels in order to enjoy full range reproduction. Some customers will already have learned to do this, to reject the noise subconsciously and listen to the music. Others will refuse to tolerate it, and pressure from you in this regard will simply drive them to another source of supply. If you have an amplifier with noise suppression built in, demonstrate it to them. Show them how successfully it is possible on many records to remove objectionable noise and still retain wide range response. Demonstrate the use of tone controls for this purpose, at the same time emphasizing the value of having wide range facilities available for the records with good surfaces, the good FM broadcasts, etc.

Remember that the enjoyment of music involves a great many different reactions. Music may be enjoyed as a soothing audio syrup with which to shut out distractions while you concentrate on something else. It may be enjoyed emotionally, rhythmically, or it may be a purely intellectual pleasure associated with an appreciation of the intricacies of a Bach fugue, the ideas expressed in variations on "Lady Be Good," etc., or finally it may be simply an enjoyment of variations in quality of tone. There are many apparently anomalous conditions to be found in studying the reactions of various people to music reproducing systems. It is curious, for example, that relatively few musicians appear to be greatly concerned with the wide range frequency response. There are many theoretical explanations advanced for this. It has been suggested that the musician has sufficient intuitive imagination to "hear" inwardly the full frequency range, whether it is reproduced or not. A good musician is entirely capable of reading the musical score of a composition and effectively "hearing" the music, so this is not an unreasonable possibility. At any rate, the fact is there and it is typical of the contradictions with what would appear to be reasonable theory in anticipating the reactions of people to music reproduction. A realization of these facts will prepare the custom-builder for widely varying reactions on the part of potential customers, and an acceptance of the vagaries inherent in listening observations will help him to understand the customer's concepts.

There is only one satisfactory criterion that does not require direct comparison of various systems. This criterion is dependent upon audio memory (which is notoriously poor), but with a little practice it may be used to advantage. If a neighbor is playing the piano, there will almost never be any question in your mind as to whether it is a real piano or reproduced sound. If you hear a phonograph playing in the next room, you will somehow know instantly that it is not a live orchestra. If you walk into a bar or restaurant, leaving out visual considerations, there will rarely, if ever, be the slightest doubt in your mind as to whether a live orchestra is playing or if a phonograph is being used to provide music. Now, with this type of judgment as a reference, the criterion is, "How close does a particular music reproducing system come to being able to fool you? Would you have even an instant of hesitation in knowing whether you were listening to live music or to the reproducing system under consideration?" If you listen carefully and become experienced and critical, it will be rare indeed that you will find a reproducing system that could really trap you into guessing wrong. It is important once in a while to attend a live concert or to listen to a live dance band in order to retain your realization of how crisp and clean music can be.

Generalities about anything are not good. This is particularly true of music reproduction. A great deal of poor reproducing equipment has excessive and boomy low frequency response with very poor high frequency contribution. Don't let this mislead you into discounting the importance of low frequencies. They shouldn't be boomy, they shouldn't hang over, they shouldn't be too prominent—but they *must* be present if a system is to sound well. In any combination of instruments for playing live music, a bass instrument is almost an absolute requirement. The top two octaves above the fundamental range are important in contributing to the quality of tone from the various instruments, but the bottom two octaves contain fundamentals that are essential to the basic structure of the music as written. The point is that you should not permit yourself to fall into the error of using only one section of the frequency range as your criterion of full frequency response. Don't be too quick to condemn your customer as having a tin ear because he is more disturbed about a lack of bass than about brilliant highs.

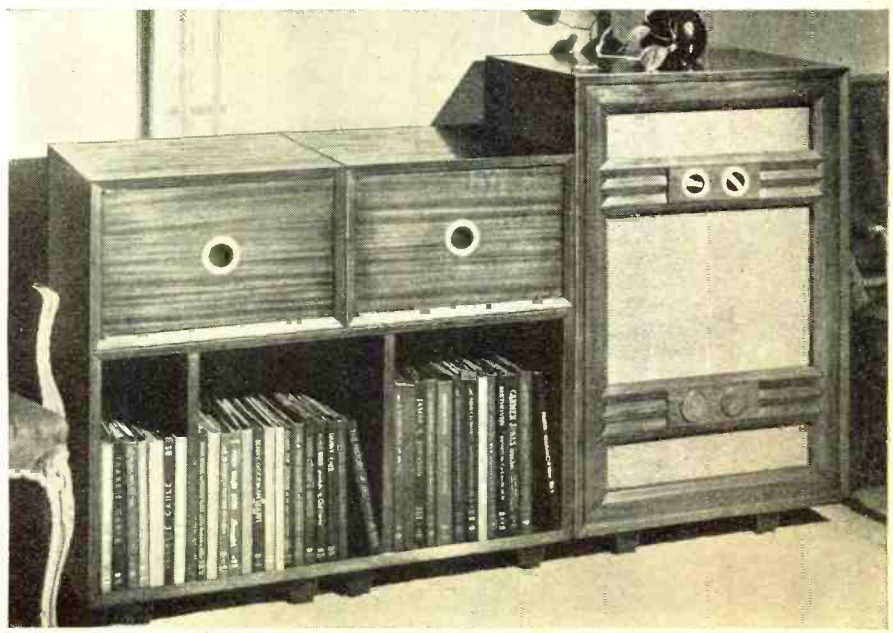


Sketch of a radio-phonograph unit such as might be submitted to your customer as an incentive to purchase custom-built sets.

Finally, don't talk about "high fidelity." The term has been used so loosely in the industry as to become completely meaningless. "High quality" is a better choice under the circumstances.

Now, the customer is sold. He has selected the components he wants in his system and the problem is to decide on the installation. In some instances it just isn't practical to have the equipment housed in more than one cabinet, nor to have it built in. Often one member of the family is interested primarily in the quality of music reproduction while another member is interested only in whether the installation takes up as little space as possible and is housed in a cabinet that

One of the interesting and flexible arrangements which can be achieved using the new Jensen "Customode" units. Individual sections are available in any combination.



A custom-built French Provincial cabinet in which all equipment is housed in drawers.

conforms with the general decor of the room. It is important to have a connection with a local cabinet maker and a carpenter for built-in work. Many customers will suggest the purchase of a piece of furniture (designed for some other purpose) to be modified properly for housing the equipment, or they may already have something they consider suitable. In general, this is very undesirable and should be avoided whenever possible. It can be done, of course, but the dimensions will never be exactly right. The tuner or amplifier often winds up in a location that requires standing on your head to change a tube and practically tearing the cabinet apart if a voltage measurement must be made. It is better to lose a sale than to wind up with an unsatisfactory installation. You probably will not lose the sale anyway by insisting on doing the job right, because if the problems are explained the customer usually agrees. It is well to have a few sketches available of various cabinet styles—photographs of cabinets you have already used, if possible. Thumbing through a few of the better home decoration magazines will usually produce a few good cabinet designs that may be clipped out for your scrapbook.

Whenever it is possible, it is desirable to have the loudspeaker in a separate cabinet, preferably remote from the listening location. Though the reasons for this may seem obvious to you, it is well to explain them clearly to the customer. It is not possible to house all the equipment, together with the loudspeaker, in one cabinet and have optimum acoustic conditions for the speaker (unless it is an unreasonably large cabinet). Furthermore, it is distinctly desirable to adjust the controls from the listening location, yet undesirable to sit practically on top of the loudspeaker. If wide range reproduction at high level is to be achieved, the problem of acoustic feedback from speaker to pickup or preamplifier is often very difficult in an all-inclusive cabinet.

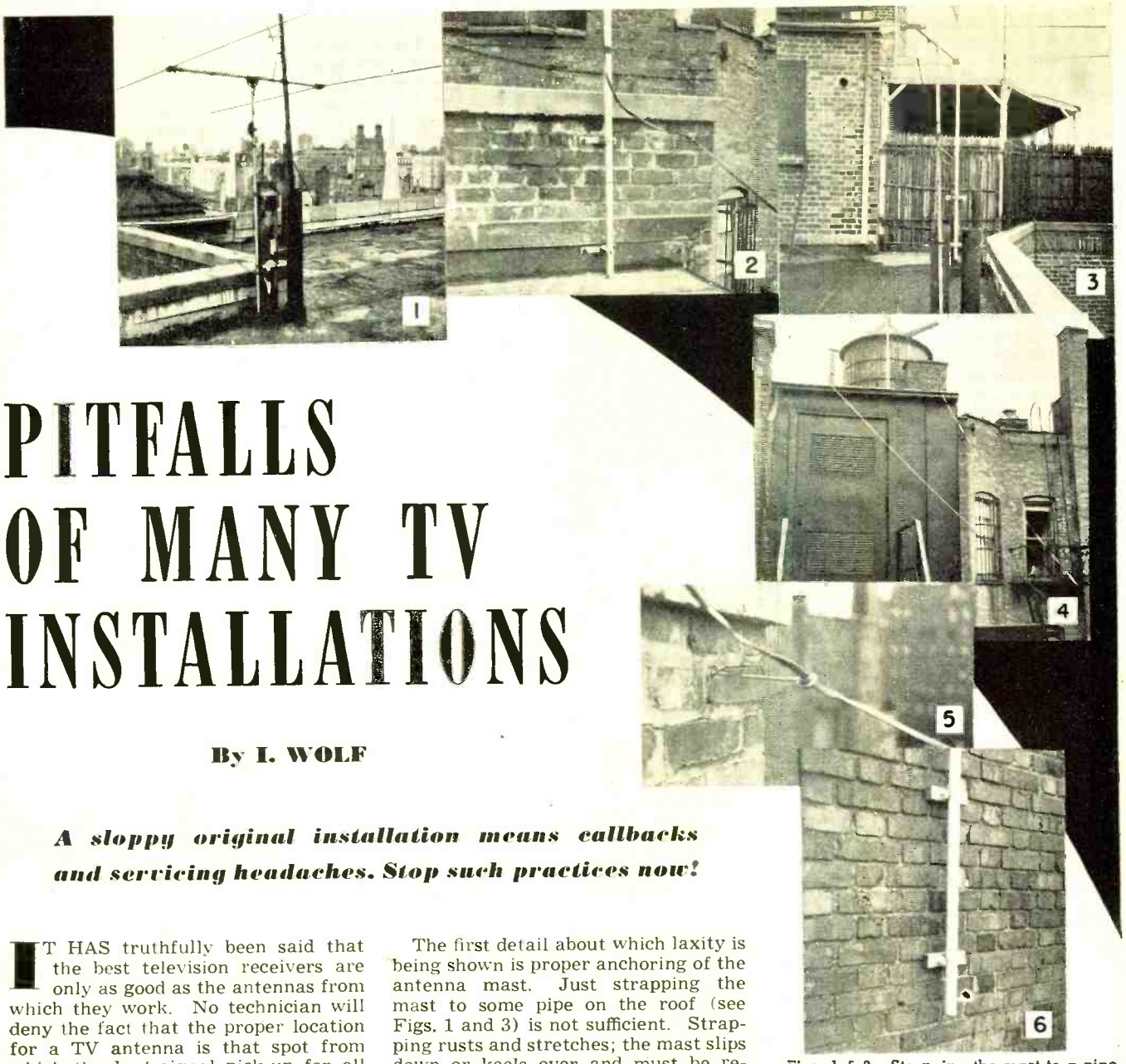
Nearly all loudspeaker manufacturers are influenced in the design of cabinets for their speakers by considerations of size and cost. Cabinet making is expensive, wood is expensive, and while custom-building of cabinets individually is costly in labor, it is partially compensated by the fewer profits involved in the selling process. It is important that the speaker cabinet be large enough to permit reproduction of low frequencies without resonance at harmonics that will cause hang-over boominess. It is equally important that it be solidly constructed of sufficiently heavy material properly reenforced to eliminate sounding board effects.

Where it is practical to do so, a corner cabinet of adequate dimensions is desirable. This accomplishes a dual result. It provides the impedance of the walls for the speaker to work into at low frequencies, and it makes it impossible to find a point in the room that is more than 45 degrees off center. This means that the high frequency distribution will be as close to optimum as the speaker design allows. In many instances, the customer will wish to place the speaker around a corner, in a hallway or, not uncommonly, under the piano. The dangers of the latter type of installation are obvious because any strings not thoroughly damped in the piano are likely to resonate unpleasantly.

It is a matter of some controversy as to whether it is more desirable to have the source of sound beamed to the listener by proper placement of the loudspeaker, or to prefer the diffusion offered by placing it where the sound must pass around corners and furniture before reaching the listener. Edward Tatnall Canby has recently written that he prefers a diffused source of sound, a condition where the listener has difficulty in locating the source. This depends on many factors. The engineer will object to it on the grounds that high frequencies tend to beam and be absorbed under these conditions, detracting from the full appreciation of the quality of tone. This same viewpoint will be taken by many listeners. Others, such as Mr. Canby, doubtless feel that the spatial distribution of the effective source makes up for this high frequency loss. Granting that a point source of sound is far from reality in reproducing music, it may also be argued that few people would deliberately place a

(*Continued on page* 160)

This walnut cabinet was designed to conform with the walnut panelling in a library.



# PITFALLS OF MANY TV INSTALLATIONS

By I. WOLF

***A sloppy original installation means callbacks and servicing headaches. Stop such practices now!***

IT HAS truthfully been said that the best television receivers are only as good as the antennas from which they work. No technician will deny the fact that the proper location for a TV antenna is that spot from which the *best* signal pick-up for all channels is possible. The thousands of men in the service industry who are daily installing the nation's TV receivers know that more often than not that best spot must actually be probed for.

The methods by which such probing is most quickly and efficiently accomplished are already standardized procedures. Sufficient data has been given in RADIO & TELEVISION NEWS and elsewhere on the subject so that even the apprentice in installation need not lack ready information.

But while there is evidence that the majority of technicians has learned the necessity of properly locating the antenna for best reception, there is equally strong witness that the smaller, but nonetheless critical, details of installation are not receiving the care they must have if the antenna is to remain in working order for any considerable period. A tour of apartment house rooftops in such a typical city as New York will show how these "petty" details are being neglected.

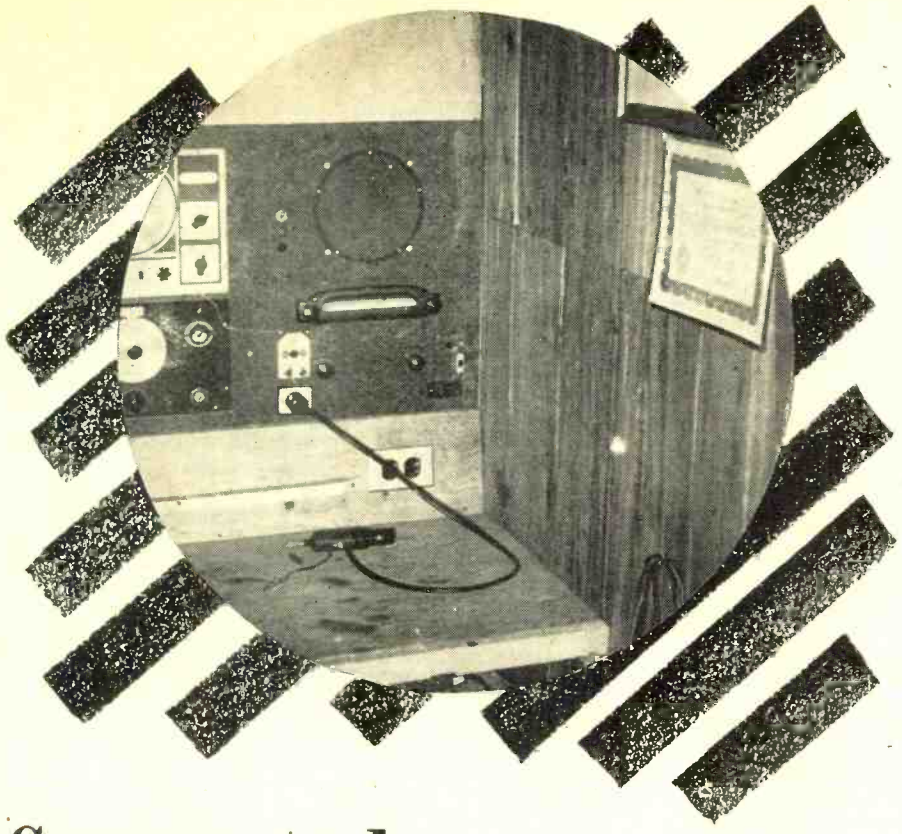
The first detail about which laxity is being shown is proper anchoring of the antenna mast. Just strapping the mast to some pipe on the roof (see Figs. 1 and 3) is not sufficient. Strapping rusts and stretches; the mast slips down or keels over and must be resecured. The best anchor is by means of pipe clamps (supplied with some packaged antennas) against the side of the house or some brick wall as shown in Figs. 2 and 6. Of course that means drilling into brick, a task from which many technicians understandably shy away. But there are enough good stone drills available at present to make cutting fairly simple. Even with the old standby, the star drill, the job is not too difficult.

An additional method by which the mast and antenna can be made more secure is by means of guy wires. Three wires properly spaced around the mast make an installation which even winds of hurricane strength (New York is occasionally subject to such storms) scarcely disturb. Guy wires are a must in installations where the only means of achieving additional antenna height is by increasing the length of the mast.

A second "minor" detail being overlooked is the coupling of the lead-in to the antenna elements. Simply wrapping the bared wire of the lead-in around the bolts on each element and counting on the nut to tighten down on the wire is no guarantee of good contact. Many a weak signal in a strong signal area can be traced to the high resistant contact of such a joint. At the very least, flat washers above and below the wire should be used to insure good contact. The best method for such installation, however, is by means

(*Continued on page* 156)

**Figs. 1 & 3. Strapping the mast to a pipe is a quick way of making an installation but is liable to require frequent servicing callbacks. Figs. 2 & 6. Anchoring the masts to brick walls insures security and saves time in the long run. Fig. 4. Metal objects, such as the housing for elevator controls and stairways, can be a serious source of trouble and should be avoided. This photograph also points up the fact that long lengths of lead-in should not be used unless anchored at frequent intervals. Fig. 5. Using eyelet insulators keeps the lead-in firm, prevents movement and wear, and is a good servicing procedure to follow in all installations.**



Over-all view of the home-built test unit and the associated vacuum tube type r.f. probe. Directly above the probe socket is a plate which carries a phono socket, three pin jacks, and two toggle switches. Above the plate and alongside the speaker opening are a toggle switch and two pin jacks which are used in conjunction with the test speaker function. At the lower right of the panel is another group of controls comprising two pin jacks for making gain measurements, a slide switch which disconnects the antenna from the test set, and a double binding post for antenna and ground connections. The two knobs below the dial are for volume control and tone control with on-off switch respectively. The radio is tuned by knobs alongside the dial. Readers will undoubtedly recognize the equipment at the lower left of the signal tracer as the Wien-type bridge described in the article "Build this Radioman's R-C Bridge" by Rufus P. Turner in the April, 1947 issue of RADIO NEWS.

# Converted Home RECEIVER Ideal for Signal Tracer

**By J. R. FRISTIK**

***You do not need a spare receiver—your present set, although converted, can serve a dual purpose as a test instrument and as an entertainment medium.***

A TRANSFORMER-TYPE a.c. receiver can be easily converted into a valuable and versatile test instrument with only minor circuit changes and the addition of about $5.00 worth of parts. Such a conversion does not prevent the receiver from operating in its normal manner so any receiver around the home can be used in this manner. A transformer-type set must be used in order to provide filament voltage for the probe. It is desirable to use a table model receiver in order to conserve space and permit easy portability when the set is used as a test instrument. Naturally, the better the original receiver, the more satisfactory will be its operation as a test instrument.

The author used an old *General Electric* Model A-64 table model which had the following tube complement: 6A8, 6K7, 6H6, 6J7, 6F6, and 5Z4. I mounted the receiver behind a Masonite panel on my work bench but a panel could just as easily be attached to the back of the radio and the switches and pin jacks brought out to the back without marring the appearance of the front panel.

The instrument can perform the following functions:

1. A monitor radio
2. Audible r.f. signal tracer with vacuum tube probe
3. Audio signal tracer
4. Audio signal source
5. Phonograph pickup tester
6. Test speaker
7. Gain measurements
8. Antenna and ground source.

Other possibilities may suggest themselves to the builder after the unit is put into operation.

The conversion is performed as follows. All leads and parts are disconnected from the high side of the volume control and from the control grid of the first audio tube as shown at "*X*" (*A* and *B*) and at "*X*" (*C* and *D*) of Fig. 1, the diagram of the receiver before conversion. This leaves four places that have to be reconnected, i.e., *A, B, C,* and *D*. Three pin jacks, a phone jack and two single-pole, double-throw switches, are required for the new connections. These should be set up on the panel close together and preferably near the first audio tube. If long leads are necessary they should be shielded. The high side of the volume control "*A*" is connected to the pole of one of the switches which can be designated the "*A*" switch. The connection "*B*", previously removed from the high side of the volume control, is connected to position No. 1 of this switch. Position No. 2 of the switch is connected through a .02 μfd., 600 volt condenser to pin jack "*X*" and the hot lead of the phono jack. The outside of the phono jack is connected to the chassis. This completes the connections for switch "*A*."

The connections previously removed from the control grid of the first audio tube "*C*" are connected to the pole of the second switch which can be designated the "*C*" switch. The grid "*D*" of the first audio tube is connected to position No. 1 on the switch. Position No. 2 on the switch is connected to pin jack "*Z*" (Fig. 2). Pin jack "*Y*" is grounded to the chassis and provides a common ground for all other jacks. This completes the connections to this group.

Another pin jack should be mounted, preferably near the 6F6 output tube and a lead from the plate of the output tube is connected to this pin jack. This is used for making gain measurements as will be explained later.

Two pin jacks and a single-pole, single-throw switch are mounted near the speaker. The lead going from one side of the output transformer to one side of the voice coil is disconnected and these leads brought to the switch so that the leads can be broken and

reconnected through the switch. Leads are then brought out to the two pin jacks from each side of the voice coil. The result is that when the switch is open, the voice coil is accessible through the pin jacks.

An octal socket into which the probe is to be plugged is mounted on the panel and connections made as shown in Fig. 2. The plate lead goes to the No. 2 position of switch "*A*" through a .02 μfd., 600 volt condenser. The plate supply voltage used in this set for the probe was about 120 volts. This goes to the plate through a 20,000 ohm resistor and a 250,000 ohm resistor. A 4 μfd., 50 volt condenser was used as a decoupler to keep hum out of the probe.

The probe was constructed from junk box parts. A 6SQ7 tube was used with the diodes not in the circuit. This tube was used because it has no grid cap and is pretty generally available. The two-wire shielded rubber-covered cable (about 3 feet long and terminating in an *Amphenol* male octal plug) was used to connect the probe to the set. The probe itself was made from a discarded 5T4 tube with the base cut off with a hacksaw. A 6L6 tube shell could be used equally well. A round, ring-type octal socket will fit into this shell very nicely and can be held securely in place with a small self-tapping screw. A hole is drilled in the end or top of the shell to accommodate a rubber grommet and a pin plug of the type commonly used on test leads is cemented into the grommet. A hole is drilled in the side of the shell to admit the two-wire shielded cable. This is held in place by soldering a soldering lug to the shield and fastening this lug to the shell with a small bolt and nut. This same method was also used for fastening the ground lead and alligator clip to the shell. Sufficient slack should be allowed on the leads from the cable so that the whole can be easily assembled, as shown in Fig. 3. Other methods for making this probe may occur to the reader, however after the 6SQ7 is plugged into the top, it makes a very neat, professional-looking goose-neck probe.

This completes the necessary alterations and the construction of the probe. With switches "*A*" and "*C*" in the No. 1 position, and the voice coil switch closed, the radio will operate in the regular manner.

### How to Use the Instrument

*1. A monitor radio*

Switches "*A*" and "*C*" are thrown to the No. 1 position, the voice coil switch is closed. The probe is not plugged in.

In this position the radio operates normally as a receiver and is valuable on the service bench for checking the dial setting of a receiver being serviced to determine whether the stations come in at the right point on the dial. It is also useful after a set is aligned for the same purpose—to provide a quick check.

*2. Audible r.f. signal tracer with vacuum tube probe*

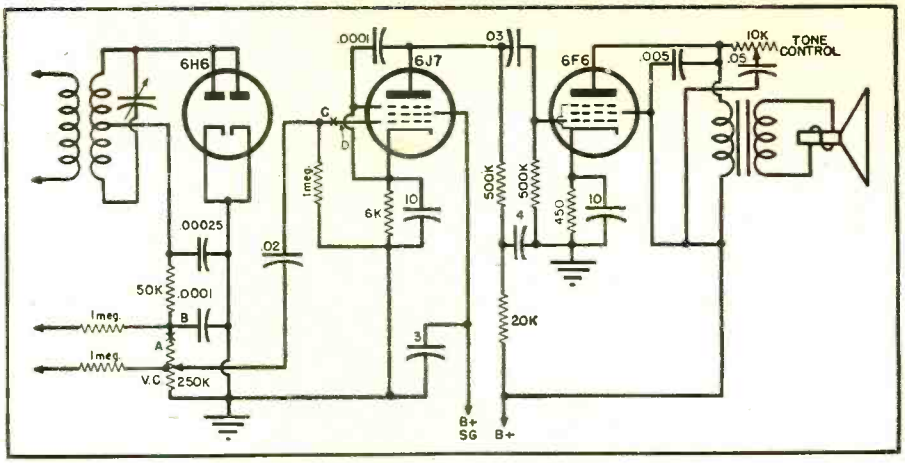



**Fig. 1. Schematic diagram of the audio section of the G.E. Model A-64 receiver used by the author in building his test unit. Any other straight a.c. type receiver can be used. The circuits of most modern table model receivers are quite similar to the G.E. set.**

Switch "*A*" should be thrown to the No. 2 position and switch "*C*" in the No. 1 position. The voice coil switch is closed and the probe is plugged in. Ground the lead from the probe to the chassis of the receiver being tested or provide a separate ground lead from the chassis to pin jack "*Y*."

Place the probe on the antenna terminal, regulating the volume with the volume control of the converted set, and tune the receiver being tested. It should be possible to tune in a station. Move the probe to the grid of the first tube. The signal should now be much louder. Continue from grid to plate to the second detector. The sound increases in strength from stage to stage. If it is impossible to pick up anything, then you have just passed through the defective stage. The program will, of course, be heard through the speaker of the converted set. Hum, noise, distortion, etc. can be traced in the same manner. The probe demodulates and amplifies the signal and passes it into the audio section of the converted set.

*3. Audio signal tracer*

The switches are set in the same position as under point 2 but the probe is not plugged in. Instead, test leads are plugged into pin jacks "*X*" and "*Y*", "*Y*" going to the chassis of the set being tested. The test lead going to "*X*" is used to pick up the audio signal in any part of the audio circuit and send it through the audio section of the converted set, checking for hum, distortion, etc. It has not been found necessary to change probes and the setup on point 2 as it works as well for audio as for r.f. signals. The probe will be found to be so sensitive that bringing the point of the probe near some leads, without touching them, is sufficient to pick up the sound.

*4. Audio signal source*

Switch "*A*" should be in the No. 1 position while switch "*C*" is in the No. 2 position. The voice coil switch is closed and the probe is not plugged in. The set is tuned to a broadcast station. Test leads are inserted in pin jacks "*Y*" and "*Z*."

With the apparatus set up in this

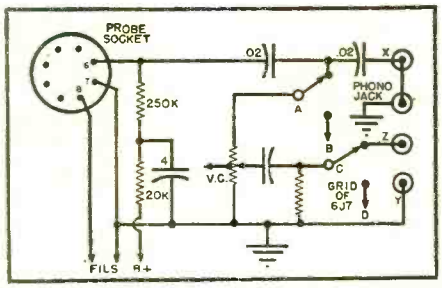



**Fig. 2. Wiring diagram shows method of connecting probe socket, switch, and jacks.**

manner, the program picked up by the set is available through the test leads and can be injected into the audio section of a radio or amplifier by connecting "*Y*" to the chassis and "*Z*" to the grid of any audio tube. The same signal can be used to modulate the output of a signal generator and the strength of the audio signal can be controlled by the volume control on the converted set. It makes an audio signal

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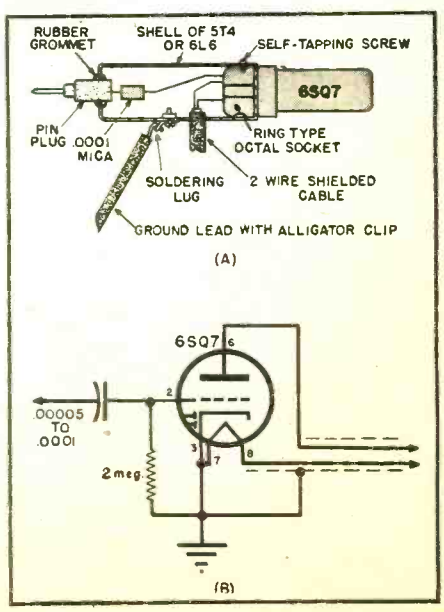
**Fig. 3. Schematic diagram and mechanical assembly of vacuum tube type r.f. probe.**



# EQUALIZER for PHONO AMPLIFIER

***This equalizer has an attenuation curve tailored to the NAB standard lateral recording characteristics and consists of two resistors plus two condensers. How it eliminates "scratch" is thoroughly explained in the text.***

**By ZYGMUNT HOF**

PROBABLY no phase of the radio field engenders such a diversity of opinion as the subject of audio amplifier response and tone control circuits.

Very often professional engineers forget that the ultimate purpose of a good amplifier is the faithful reproduction of sound and that the final judge of the performance of a reproducing system is the listener! The product of his design should, then, be subject to a critical *listening* test, for there is no more conclusive evidence obtainable.

On the other hand, the musically minded public, although it has the final word on amplifier quality, is inclined to be trapped by superficial impressions and catchwords and is rather prone to dismiss any attempt at a scientifically guided analysis of construction details.

The result is that response defects in an inferior amplifier installation are often left to be corrected by manipulation of tone controls and, conversely, good amplifier installations are often nullified by careless or inexperienced setting of the tone controls.

Amplifier performance would be more satisfactory if it were generally accepted that the chain from the phonograph pickup or radio tuner through the amplifier to the loudspeaker should reproduce the program material with perfect fidelity. One-hundred per-cent fidelity can be accomplished both technically and economically. The tone control should, as a rule, be used only to correct deficiencies outside of the amplifier chain, such as peculiarities of the records or the broadcast and the acoustics of the listening room.

It must be remembered that the listener is to be given a tone picture of the original rendition of the program in such a way that it sounds as it would were the listener on the spot. This reproduction must be available despite the fact that the program material is being reproduced at a different volume and in different surroundings. The tone control should restore those frequencies which are lacking and cut away those which have been added to the original program material. See Fig. 1A. One has only to see the various characteristics of all kinds of distortion that occur during reception, detection, in recording, or of acoustical properties of rooms and the influence of loudspeaker position in order to realize how coarse the compensation, which can be affected by a tone control, is for those deficiencies. See Fig. 1B.

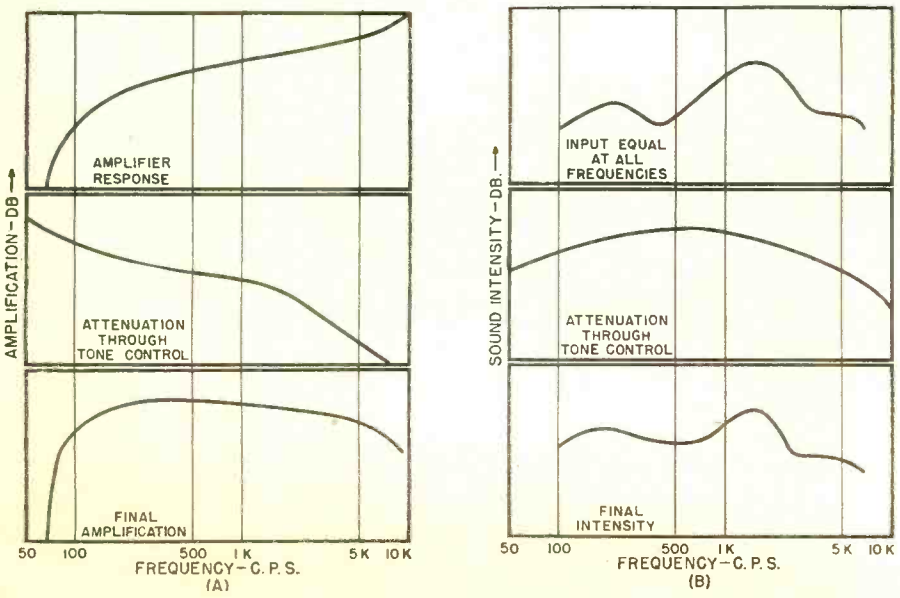
Compare the sharp peaks at certain resonant frequencies in the reverberation characteristics of a "boomy" room with the smoothly rounded cut-off curves of a tone control. Its flat characteristics could only counteract equally flat characteristics, such as the gradual drop in sensitivity at low frequencies of the human ear. Even in expert hands, with predetermined settings, a tone control can compensate but little for complex frequency anomalies outside the reproducing system. The average operator would adjust the tone control so that the reproduction would sound most pleasant to his ears, which is far from true fidelity.

Thus the logical way to achieve perfect reproduction would be to build a reproducing system with a wide range, flat frequency response, and a variable tone control which would be used only for frequency anomalies originating outside the amplifier system, i.e., the varying sensitivity of the human ear with volume, interference tones at the extreme ends of the frequency range, or proportionally increasing harmonics. For installations which are to be operated by the layman a variable tone control could be omitted entirely.

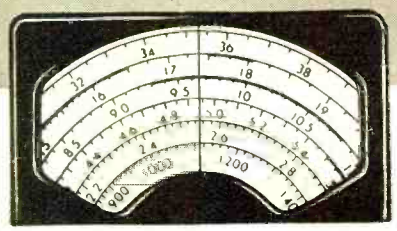
In its stead, the author proposes the use of a *fixed* tone control circuit or equalizer, each serving a definite purpose. The method of approach is to list the most common causes requiring frequency correction in order of their importance as to frequency of occurrence and disturbing effect. The fre-

(*Continued on page* 122)

Fig. 1. (A) Compensating action of a tone control. (B) Showing how insufficient tone control action compensates only partially for selective reverberation in room.



# International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

ON SUNDAY, January 30, *Radio Australia's* weekly DX session was dedicated to the International Short Wave Club, with headquarters in London. Transcribed messages were used from Arther E. Bear, London, ISWC official; Arne Skoog, Sweden; Ken Boord, RADIO & TELEVISION NEWS, and others.

Current schedules for the weekly DX sessions from *"Down Under"* are Sundays—0025 on 15.320 to North America West Coast; 15.200 to ships at sea en route Colombo-Australia; 21.540 to Africa. At 0027 on 9.540, 11.810, to North America East Coast. At 0902 on 15.200 to Northern Asia, British Isles, and Europe; 15.210, 11.710, 11.760, to Southern Asia, British Isles, and Europe.

* * *

### Club Notes

*New Zealand*—The *"DX Bulletin,"* P.O. Box 283, Invercargill, New Zealand, has been replaced by the *"N.Z. DX Times,"* house organ of the newly-formed New Zealand Radio DX League. The N. Z. RDXL was organized by an enthusiastic gathering of Otago and Southland DX-ers at Invercargill some months ago. The League is governed by a Board of Directors, five from Southland and five from Otago. The five Otago representatives constitute the Administrative Committee, while the five Southlanders form the Magazine Committee. The Board is composed of Lloyd Warburton, Invercargill, president; Jack Fox, Dunedin, and Merv Branks, Invercargill, vice-presidents; Des Lynn, A.R.A.—N.Z., Dunedin, secretary-treasurer; Ken Mackey, Jim Martin, Peter Thorn, Dunedin, and Alex Allan, Dudley Carter, Arthur Cushen, Invercargill, board members. Bert Matthews, Dunedin, is Auditor and George Goodsir has been added to the Magazine Committee as Printer. (Cushen)

* * *

### Publications

Anyone interested in subscribing to "The DX-ers Bulletin" of the Manawatu Branch, N.Z. DX Radio Association, should send for details from the North American representative—William G. Milnes, Jr., 27 Becker Avenue, Manton 9, Rhode Island.

Inquiries concerning the Winter Edition of "World Radio Handbook," published in Copenhagen, Denmark, by O. Lund Johansen, should be sent direct to the North American agent, Ben E. Wilbur, 32 Whittlesey Avenue, East Orange, New Jersey.

I have received a copy of the new edition of "The World in Your Loudspeaker" which contains a good station list. It is available for three International Reply Coupons—from DX Editor, Swedish Broadcasting Corporation, Stockholm, Sweden.

* * *

### Verifications

For those who may have missed QRA of *"The Voice of America in Manila,"* it is The Foreign Service of the United States of America, International Broadcasting Division, c/o American Embassy, Manila, Philippine Islands. (Stein, Calif.)

Verification by letter has been received by an Eastern DX-er from Compania Nacional de Espana, Madrid, for report on EDM, 19.030. Transmitter is a single sideband *Western Electric,* 600 watts with rhombic antenna directed to New York; works New York daily; QRA is Compania Telefonica Nocional de Espana, Aveneda Jose Antonio, 28, Madrid, Spain (Espana); actual transmitter location is just outside Madrid, at Pozuelo del Rey.

A letter from *Radio Monte Carlo* states: "We decided to make special verification cards for our listeners; therefore, we ask you for a little patience until we can send it to you." This was in response to a second report from an Eastern DX-er. Probably these cards will be sent out by the time you read this.

*Radio Nariz del Diablo,* Quito, Ecuador, verified by letter in Spanish, stating that assigned frequency is 9.163 although it actually operates on 9.190. At last report this station was temporarily off the air, pending installation of a medium-wave outlet for local consumption. Station is operated by Ecuadorian State Railways, which explains the frequent sound of a locomotive chugging and accompanying whistle. QRA is Direccion Radio "Nariz del Diablo," Director: S. Rafael Larrea Andrade, Empresa de Ferrocarriles del Estado, Quito, Ecuador.

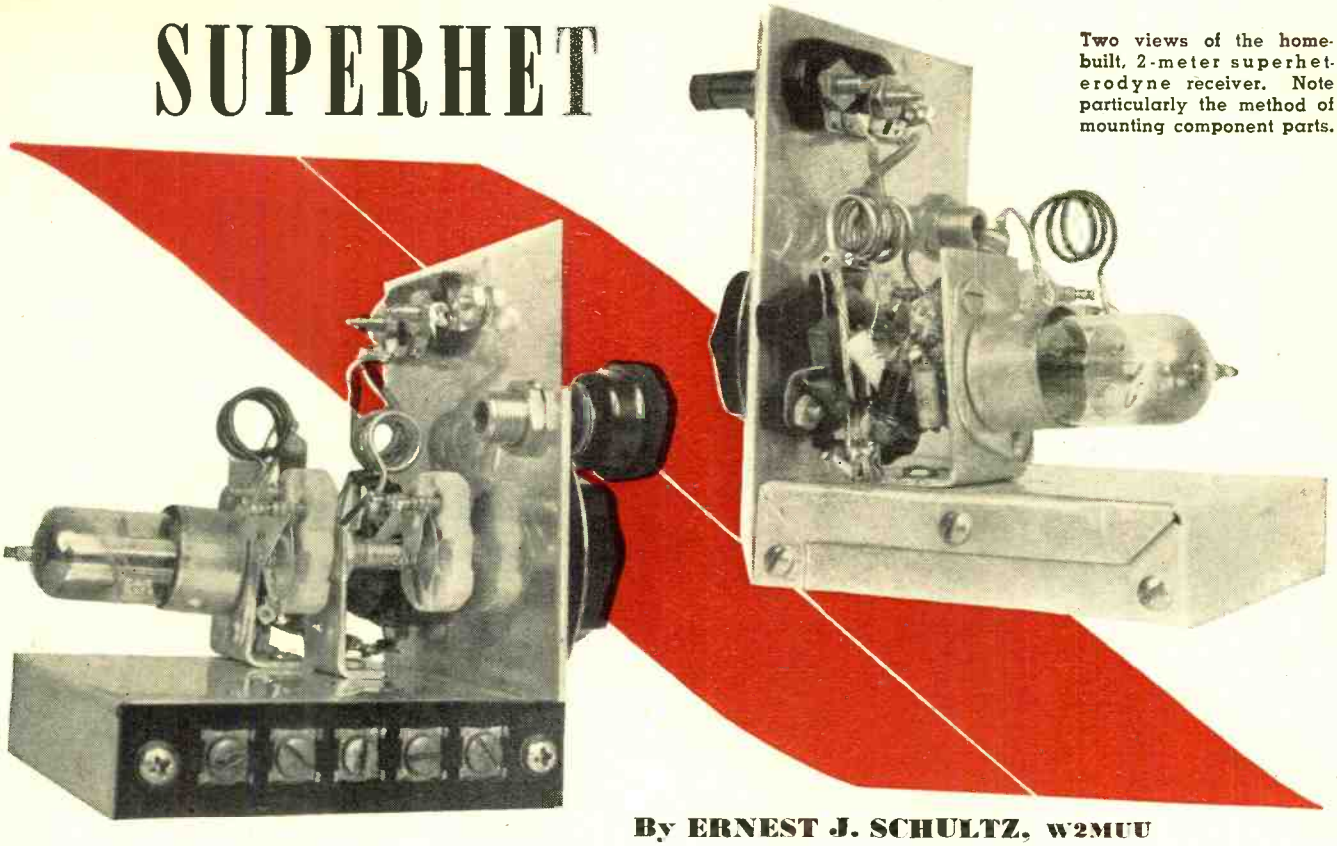
Vertification card being sent out by OZF, 9.520, Copenhagen, Denmark, is postal card size and shows a view of Radio-House, Copenhagen; is written in both Danish and *English* and asks for listeners' opinions, especially on the last 90 minutes of daily broadcasts to North America (that is at 2300-0030

(*Continued on page* 105)

(Note: Unless otherwise indicated, all time herein is expressed in American EST; add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.)

**Veteran DX-er C. S. Sutton of Toledo uses a Hammarlund HQ-129X plus a preselector.**

# A One Tube 2-Meter SUPERHET



Two views of the home-built, 2-meter superheterodyne receiver. Note particularly the method of mounting component parts.

By ERNEST J. SCHULTZ, W2MUU
Eng., Interstate Broadcasting Corp.

***The first adaptation of recent developments in superregeneration to amateur use. Design is based on Hazeltine's "FreModyne" circuit.***

COUNTLESS papers have been written on all forms of superregenerative-detectors, both constructional and technical. However, only recently have the vagaries of the superregenerator's operation been brought to light through laboratory research and development. It is now possible to predict such heretofore unknown quantities as gain and selectivity. (See "Electronics" Sept. 1948, W. F. Bradley—"Superregenerative Detection Theory" and A. Hazeltine, D. Richman and B. D. Loughlin—"Superregenerator Design"). It is beyond the scope of this article to go into the involved mathematics accompanying such design predictions. A few considerations which determined the design of the receiver herein described are incorporated in the text, but are of necessity not detailed.

The receiver is a self-quenched, converting superregenerator needing nothing but moderate audio amplification to complement it in operation. The design is an adaptation and modification of a circuit originally designed to receive FM signals in the 88-108 mc. band (Hazeltine FreModyne). In the FM application, the superregenerator is actually an AM receiver "side-tuned" in the same manner as we hams receive NBFM on a conventional AM receiver. Such operation is possible because the particular design produces an excellent over-all selectivity response comparable to a conventional superhet with several i.f. stages operating at a high intermediate frequency. The operation of the detector is "stabilized," and, consequently, needs no bothersome adjustment of regeneration controls.

Since the regenerator is a converter and converts the signal frequency to an i.f. frequency, the radiation is far less than that normally encountered in conventional S-R detectors (about 30-40 db. down). Coupling to the antenna is also less of a problem, and it is only necessary to couple for optimum results and not consider the detector going in and out of oscillation as, in the normal S-R set. A slight frequency shift is, however, encountered when making wide variations in antenna coupling, but this is due to local oscillator "pulling." The circuit discriminates against ignition and other types of impulse noise, as superregeneration makes the receiver periodically sensitive for short intervals and ignores many impulses occurring between these intervals.

The circuit employs a 12AT7 miniature tube which is a high $G_m$ twin triode with completely separated elements. One triode serves the manifold purposes of r.f. detector amplifier, converter, i.f. amplifier and superregenerative second-detector. The other triode operates as the local oscillator and operates on the "high" side of the received signal. The i.f. tank is wound directly on a damping resistor, and resonates with tank condensers to the i.f. frequency. As the i.f. tank is oscillating, a frequency must be chosen which has no harmonics in the desired tuning range. For 2 meters a frequency between 30 and 40 mc. is satisfactory, as no harmonic multiplications of these frequencies fall in the 144-148 mc. band. A coil wound to the specifications given in the parts list resonated at 38 mc.

Many parts unusual to the normal S-R detector are found in this circuit. They all serve special functions and result in heretofore unpredictable performance, namely, forming the quenching wave shape, the largest factor in determining selectivity in a S-R circuit, and "stabilization," which eliminates regeneration controls and maintains stable operation. Audio fre-

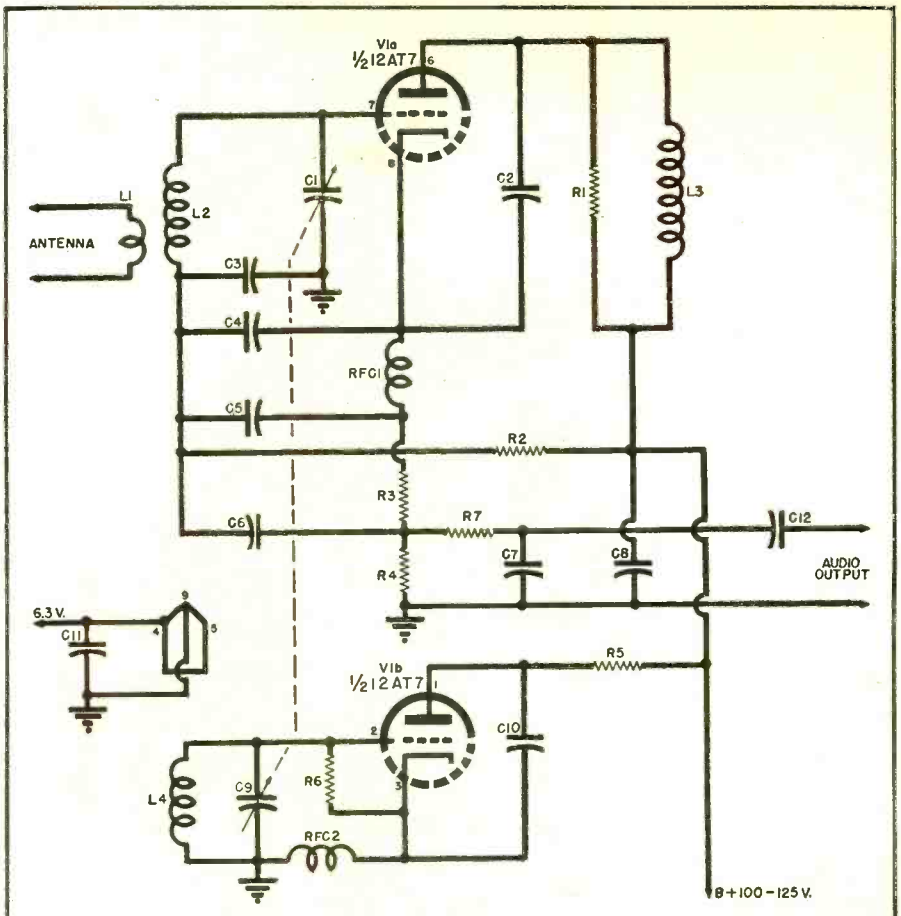
quency filtering is included and removes the greater part of the quenching pulse from the audio output. The audio output is taken from a load resistor in the cathode circuit in place of the usual plate load.

It has been shown that the lowest possible quench frequency should be used in order to achieve narrowest bandpass or greatest selectivity, and the limit on selectivity with a given quench wave shape is twice the highest audio frequency to be received. For those experimenting, who wish to achieve the maximum in selectivity and gain, it is suggested that the 1500 ohm cathode resistor be made variable in part or full to shape the quench wave and that the 150,000 ohm "stabilizing" resistor be replaced also with a variable resistor to vary the quench frequency. The values given, however, are a good compromise and result in excellent and even surprising performance. Signals in congested areas are received with both good strength and selection.

The model described herein represents one type of construction, and, of course, may be modified to suit the individual requirements such as incorporation in an existing low frequency receiver, or perhaps building it on a large chassis complete with power supply and audio. The chassis is made of 1/16" aluminum and is 3¼" x 3" x ⅞" with a 3½" x 4⅝" panel of 3/32" aluminum. Any small two-gang condenser may be used, such as the *Hammarlund* HFD 15X. However, the gang in the model was made of two three-plate tuning condensers whittled down to one rotor and one stator each, and with the shafts soldered together to form a gang.

The normal high frequency precautions must be observed to keep high frequency lead lengths to a minimum. The tube socket is mounted on a bracket placed in proximity to the tuning gang in such a way as to make possible direct connection to the tuned circuit mounted on the gang. The antenna terminal is mounted on the panel above the converter circuit and provides easy access to coupling the antenna to the converter grid coil. Incidentally, the gang nearest the panel is the one used for the converter circuit with the oscillator section in the rear. This arrangement was thought desirable to keep the hand as far away from the oscillator as possible when tuning, in the open type construction used.

The local oscillator circuit is conventional, being the two-terminal type with an inductance in the cathode. No coupling other than that provided by stray and inter-tube capacity is employed, as experiment with this particular layout showed further coupling undesirable. In different layouts additional coupling between the oscillator and converter might be advantageous and can be secured with a 1 or 2 μμfd. condenser from the oscillator tank to the converter tank. If optimum performance is to be achieved,




$R_1$—15,000 ohm ½ w. res.
$R_2$—150.000 ohm ½ w. res.
$R_3$—1500 ohm ½ w. res.
$R_4$—22,000 ohm, ½ w. res.
$R_5$—150 ohm ½ w. res.
$R_6$—27.000 ohm ½ w. res.
$R_7$—100.000 ohm ½ w. res.
$C_1$, $C_9$—2-gang midget variable cond. (ea. section 2 plates) (see text)
$C_2$, $C_4$—30 μμfd. mica cond.
$C_3$, $C_8$, $C_{10}$, $C_{11}$—500 μμfd. mica cond.
$C_5$—2500 μμfd. mica cond.
$C_6$—10 μfd. at 50 v. elec. cond.
$C_7$—1000 μμfd. mica cond.
$C_{12}$—.02 μfd. at 400 v. cond.
$L_1$—2 t. #20 insulated wire, placed between $L_2$
$L_2$—4 t. #14 bare tinned, ⅜" i.d., ⅜" long
$L_3$—20 t. #28 en. closewound on a 15,000 ohm ½ w. res., 3/16" diam.
$L_4$—3 t. otherwise same as $L_2$
$RFC_1$—45 t. #34 s.s.e. scramble wound on 1 megohm ½ w. res., 3/16" diam.
$RFC_2$—30 t. #34 s.s.e. closewound on 1 megohm ½ w. res., 3/16" diam.
1—12AT7 tube

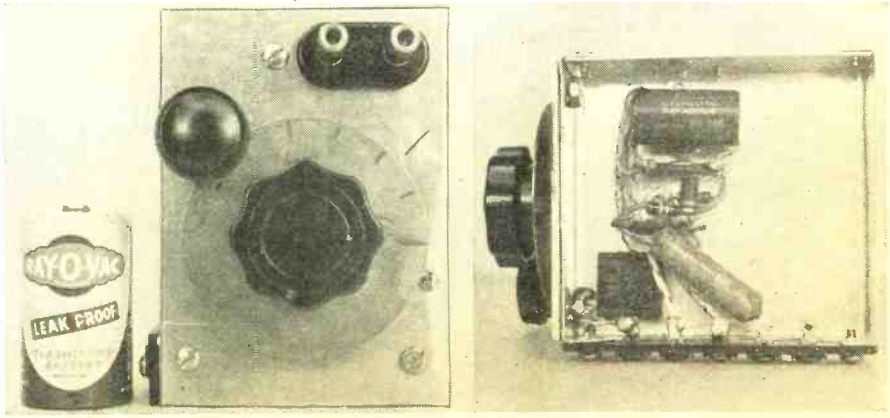
**Circuit diagram of receiver. An external power source is required.**

no deviation from the parts list is recommended, with the exception of the two previously mentioned components and the tuning gang. The values are quite critical (within the normal tolerances).

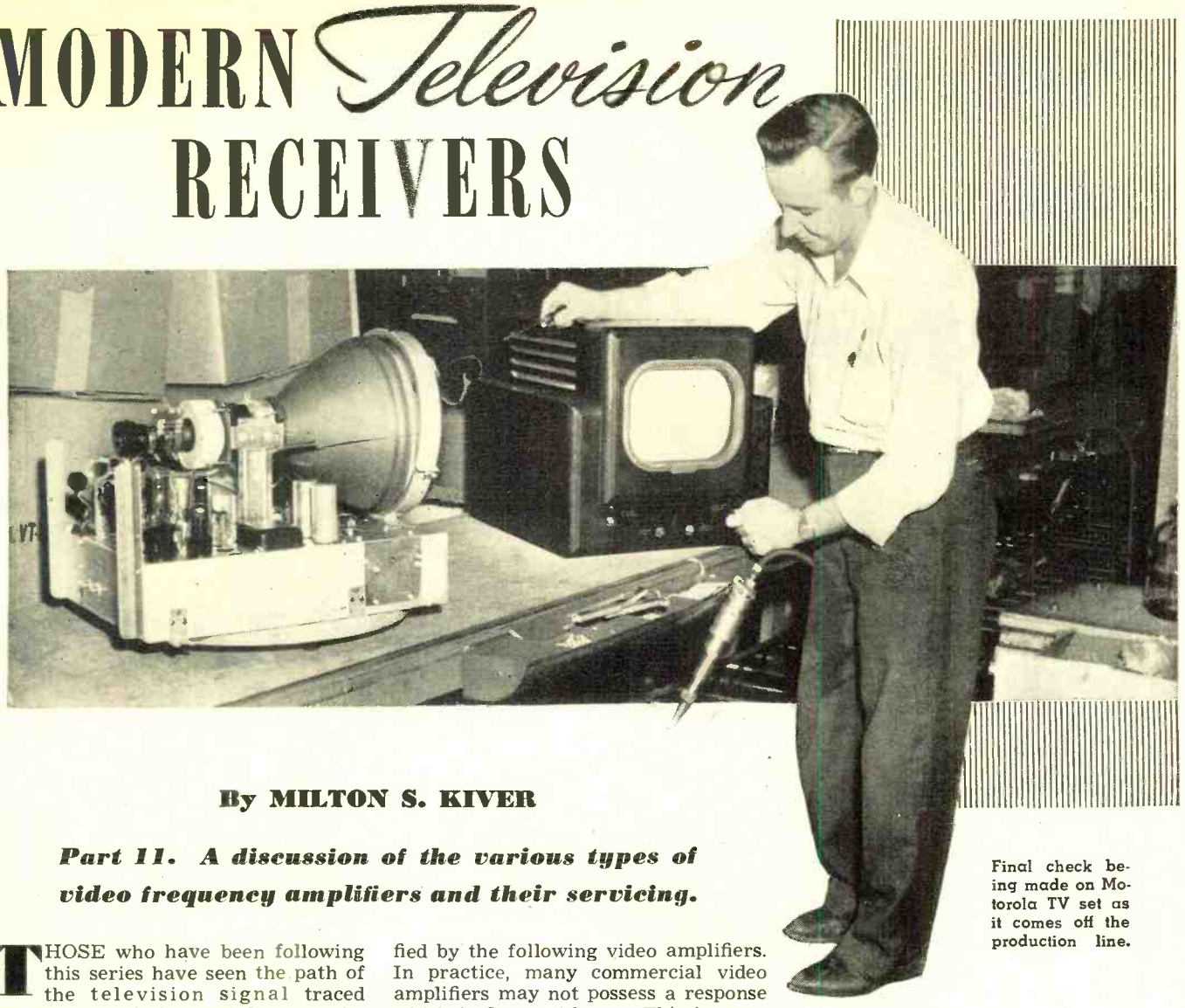
The alignment is rather straightforward. When the voltages are applied and the output connected to an audio amplifier, the old superregenerative hiss will be heard, although quite subdued and containing none of those ear-piercing whistles. Determine the i.f. frequency with an absorption wavemeter held near the con-

(*Continued on page* 70)

**Front and bottom views of the superregenerative-superheterodyne receiver. Bottom view shows electrolytic, audio filtering, and coupling condensers.**



# MODERN *Television* RECEIVERS



Final check being made on Motorola TV set as it comes off the production line.

**By MILTON S. KIVER**

***Part 11. A discussion of the various types of video frequency amplifiers and their servicing.***

THOSE who have been following this series have seen the path of the television signal traced through the r.f., i.f., and detector circuits of modern television receivers. At some point along the line, the audio and video signals were separated and transferred to their respective systems. We are now ready to take the detected video signal (which contains all of the picture information, the blanking voltages, and the synchronizing pulses) and groom it for application to the cathode-ray tube. For this we require additional amplification, since the rectified signal at the output of the detector is too weak for direct application to the cathode-ray tube, and recourse is made to video-frequency amplifiers. These video-frequency amplifiers are analogous to the audio-frequency amplifiers which follow the second detector in a sound receiver. The number of video stages is governed by the polarity of the rectified video voltage (as previously described) and the strength of the detector output.

Video signals, as is well-known by now, possess a frequency distribution from approximately 10 cycles to 4.0 mc. These are the frequency components which are present in the video voltage at the output of the video second detector and these are the frequencies which must be successfully amplified by the following video amplifiers. In practice, many commercial video amplifiers may not possess a response which is flat to 4.0 mc. This is especially true of sets using 7-inch cathode-ray tubes. However, where the viewed image is 6 x 8 inches or more (and this includes projection receivers), the full 4.0 mc. response is needed.

The design of an amplifier possessing a uniform response from 10 cycles to 4.0 mc. presents quite a problem. A high-fidelity audio amplifier has a response flat only to 15,000 cycles, yet here we face the task of extending the response to 4.0 mc., a band fully 266 times as wide. The solution is achieved by taking an ordinary resistance-capacitance coupled amplifier and employing special compensating networks to improve and extend its high and low-frequency characteristics.

In addition to the wide frequency response of an amplifier, we find, for television work, that we must also give consideration to the phase response. In audio amplifiers, phase is seldom thought of because the human ear is not especially sensitive to phase distortion. In video systems, phase distortion alters the waveform of the signal and this, in turn, will alter the image traced out on the screen. Since even the slightest visual distortions are immediately apparent to the human eye, every effort must be made to maintain phase distortion at as low a value as possible.

The design of video amplifiers has already been fully discussed in many places (see references at the end of article) and no extended discussion is required here. Briefly an ordinary *RC* amplifier (Fig. 1A) is taken as the basic circuit and special compensating networks added to extend its frequency response. It is well-known that the high-frequency limit of any *RC* amplifier is determined by the tube, wiring, and stray capacities which shunt the signal path. To minimize this effect, several steps are taken. First, the plate load resistor is lowered to relatively low values (1500-10,000 ohms), thereby minimizing the ability of the shunting capacitances to divert the signal voltage. Unfortunately, stage amplification decreases with load resistance reduction, but in television receivers, fidelity is a more important consideration than amplification.

To the lowered plate resistor is added an inductance which acts to cancel part of the shunting capacitance. An illustration of a shunt and a series

peaking coil is shown in Fig. 1B and 1C. Better results can be obtained by combining both coils within the same circuit, as is shown in Fig. 1D or 1E. The advantage of employing two coils lies in the fact that they tend to divide the various shunting capacities, permitting each peaking coil to deal more effectively with these capacitances and, in addition, permitting higher load resistances to be used. Remember that the load resistance value is purposely lowered in order to offset the effect of the shunting capacitances. Hence, anything which will neutralize or counteract the effect of these shunting capacitances, such as the peaking coils, will permit a higher value of load resistance to be used. And, of course, the higher the load resistance, the greater the stage gain.

To the serviceman, the peaking coil is important only when it fails and must be replaced. If the replacement coil does not match the original coil, then either one of two effects will occur.

1. If the coil inductance is less than the part replaced, the high-frequency response of that stage will decrease. This will result in the blurring of fine detail in the image.

2. If the coil inductance is greater than the coil replaced, there will be a peak in the high-frequency response of the amplifier. In its worst form this will produce little dark spots over the image, especially near fine detail.

Determine the correct value of the peaking coil to be replaced from the manufacturer's service notes. When the replacement coil's inductance is such that it is too high, it is possible to prevent a peak in the high-frequency response by shunting a resistor across the coil. The resistor should have a value somewhere between 15,000 and 40,000 ohms.

Not only is the extension of the high frequency end important, but the response at the low end must also be given consideration. Poor low-frequency response produces smearing of the large objects in an image. The same defect will also cause a white background to change from white at the top to gray and even black at the bottom of the image. Low-frequency compensation consists generally of the addition of the filter $R_f$, $C_f$ (Fig. 1B, 1C, 1D, 1E), use of large cathode bypass condensers, and large screen grid bypass condensers. If any of these components become defective, special care should be taken to use exact replacements.

Phase distortion is little understood by most radiomen and yet it can be qualitatively explained in a simple manner. Consider the complex wave shown in Fig. 2A. This voltage, applied to the control grid of a cathode-ray tube, would cause a certain light pattern to appear across the screen. This wave actually consists of a fundamental and its third harmonic in combination. See Fig. 2B. When this complex wave is passed through a network in which the phase change is not proportional to frequency (as it should be for no phase distortion), then each frequency component in this complex wave will be affected differently and the result may appear as shown in Fig. 2C. Obviously the light pattern produced by this altered wave will differ from the pattern traced out by the original wave. In many respects, the phase response of a video amplifier is more important than the frequency response, although the two are closely related. Hence, the special emphasis that is being placed on the use of exact replacement parts.

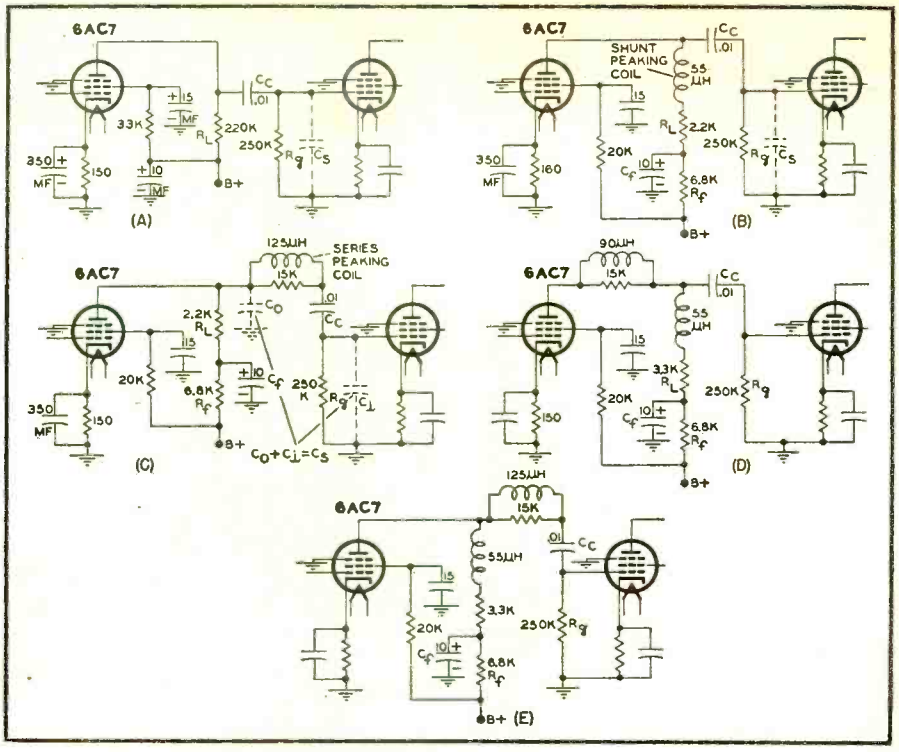



Fig. 1. (A) The basic RC-coupled amplifier. (B, C, D, E) Various forms of high and low frequency compensated RC-coupled amplifier circuits.

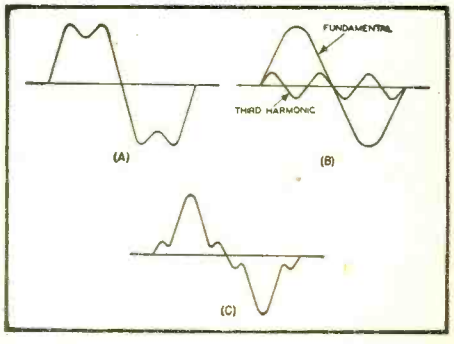
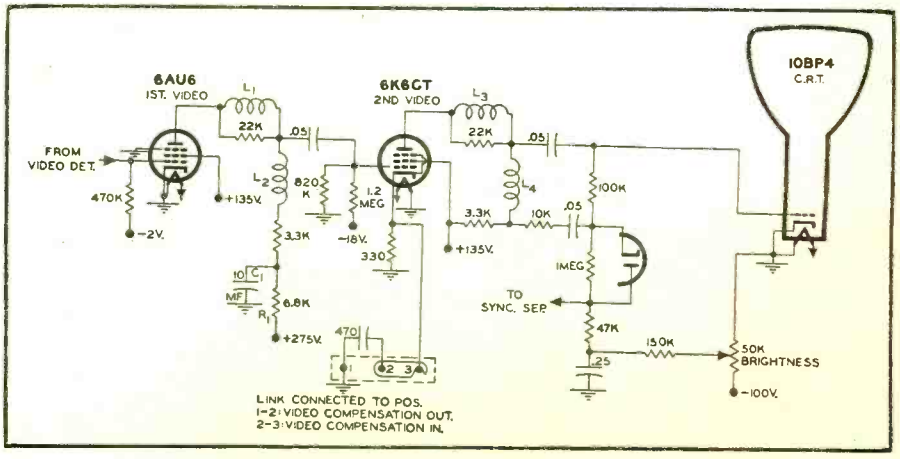



Fig. 2. (A) Complex wave. (B) Components of this complex wave, and (C) shape of complex wave after the phase relationship between the two components has been altered.

### Commercial Video Amplifiers

The number of video amplifiers in current television receivers seldom exceed two in number, this being sufficient to fully modulate the electron beam in the cathode-ray tube. About 60 volts, peak-to-peak, are needed to obtain full contrast on the screen of a 10BP4. Since the normal output from the video detector will be between 2 and 5 volts (depending upon the

Fig. 3. A two-stage video frequency amplifier employed in RCA and many other television receivers. See the text for a complete list.



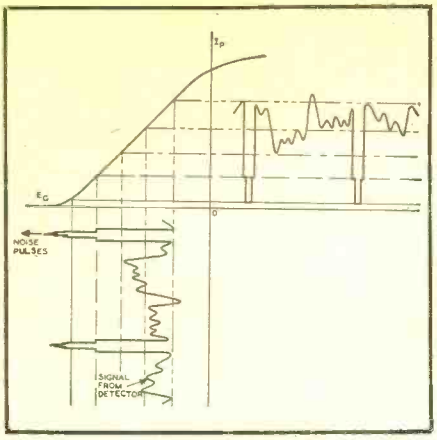



Fig. 4. The 6AU6 video frequency amplifier of Fig. 3 is designed to operate as a partial limiter, thereby improving the receiver's signal-to-noise ratio.

strength of the received signal and the amplification afforded by the receiver), we need an amplification of from 30 to 12 times. The lower figure can be supplied by one stage of video amplification, but two stages are required for the higher figure.

The two-stage video-frequency amplifier found in many of the larger *RCA* receivers is shown in Fig. 3. The first video amplifier is a 6AU6, the second, a 6K6-GT. $L_1$ and $L_3$ are the series peaking coils, $L_2$ and $L_4$ the shunt peaking coils. Each series coil is shunted by a 22,000-ohm resistor to prevent overpeaking. The load resistor for each tube is a 3300-ohm resistor. Low-frequency compensation is provided by $C_1$ and $R_1$. The 6AU6 has been biased to operate along its $E_c$-$I_p$ curve as illustrated in Fig. 4. The sync pulse tip just drives the tube into cut-off. Consequently, any noise voltage extending beyond this level will not appear in the output of the tube. Essentially, then, the stage functions as a noise limiter, effectively improving the signal-to-noise response of the receiver. When the contrast control is turned up with normal signals, a point will be reached where the 6AU6 will clip off the sync pulses, resulting in a loss of horizontal and vertical synchronization. This contrast control position, however, occurs far beyond the point of normal contrast setting.

There are additional features in this two-stage video-frequency amplifier that have been purposely introduced to maintain a good over-all response. Through the use of fixed bias fed directly to the grid of the tube, it has been possible to ground the cathode directly, thereby obviating the necessity of including resistors and bypass condensers in this circuit, components which would tend to produce a loss at the low frequencies. Another innovation is the direct application of the proper voltage to each screen grid—again eliminating the need for dropping resistors and bypass condensers. In the second video-frequency amplifier, a high-frequency peaking circuit is available in the cathode circuit. In passing through the i.f. and video-frequency amplifiers, the high-frequency video components are more apt to be attenuated than any other portion of the video signal. Hence it was felt that the inclusion of a 470 $\mu\mu$fd. bypass condenser across the cathode resistor of the 6K6 amplifier would tend to counteract some of this loss. By means of this arrangement, all frequencies except the highest video frequencies suffer degeneration because of the rather low value of the bypass condenser (470 $\mu\mu$fd.). If the inclusion of this condenser results in over-peaking, then it may be removed by changing the link connections.

As a practical matter, most servicemen will find that a better picture (visually) is produced when the over-all response of the set results in a *slight* overpeaking of the high frequencies. However, this must be approached with caution because too much overpeaking results in the "spotty" picture previously mentioned.

A d.c. restorer is connected across the signal path between the output amplifier and the cathode-ray tube. From this same point in the circuit a portion of the video signal is tapped off and transferred to the sync circuits. A complete explanation of the operation of this portion of the circuit will be given in the next article.

The two-stage video amplifier system employed in the *Motorola* VK-101 sets is similar to the *RCA* circuit with the exception of the screen dropping resistors and screen-grid bypass condensers. The latter are necessary because the screen voltage is obtained from a higher voltage source than we need for the screen. Other receivers employing closely similar video-fre-

(*Continued on page* 146)

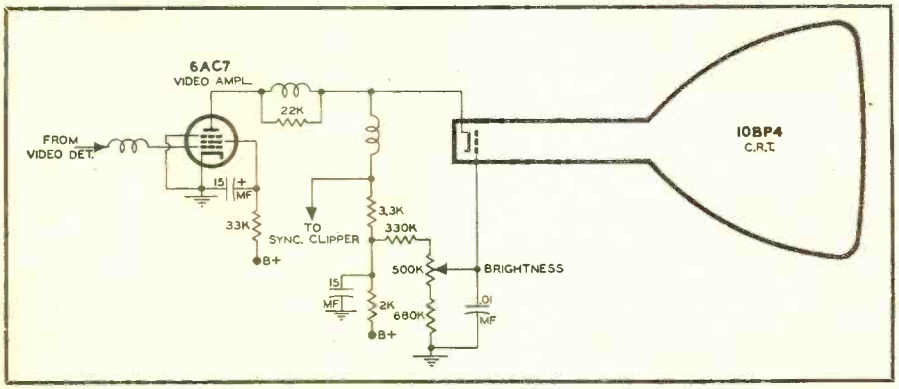



Fig. 5. Some of the General Electric television receivers employ direct coupling between the video amplifier and the cathode-ray TV tube.

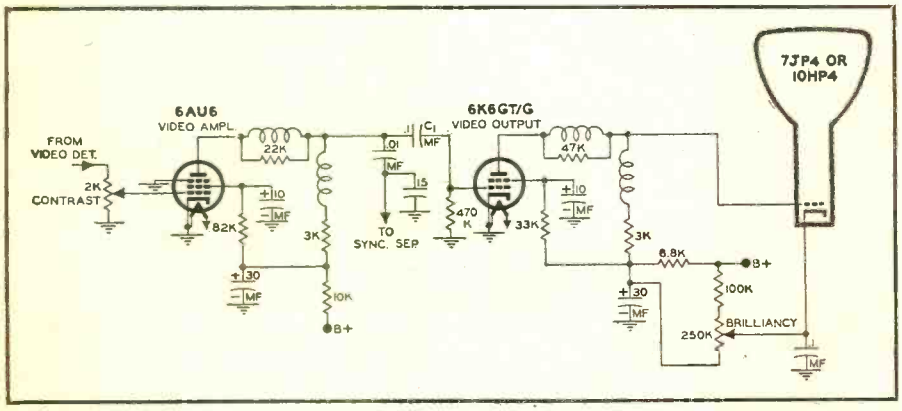
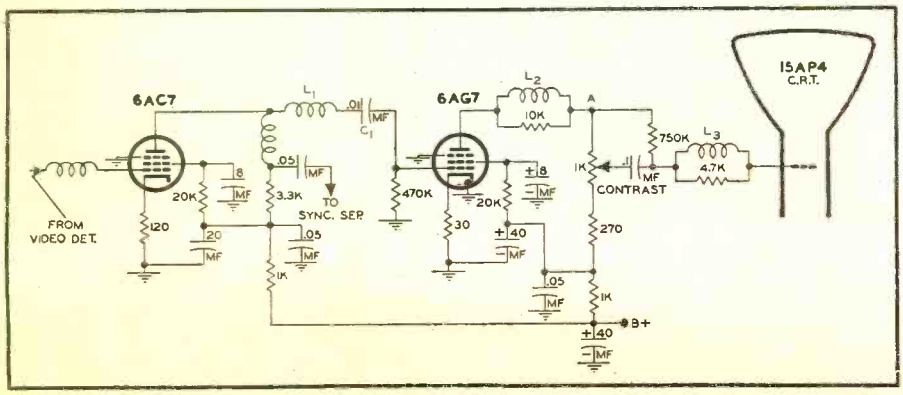
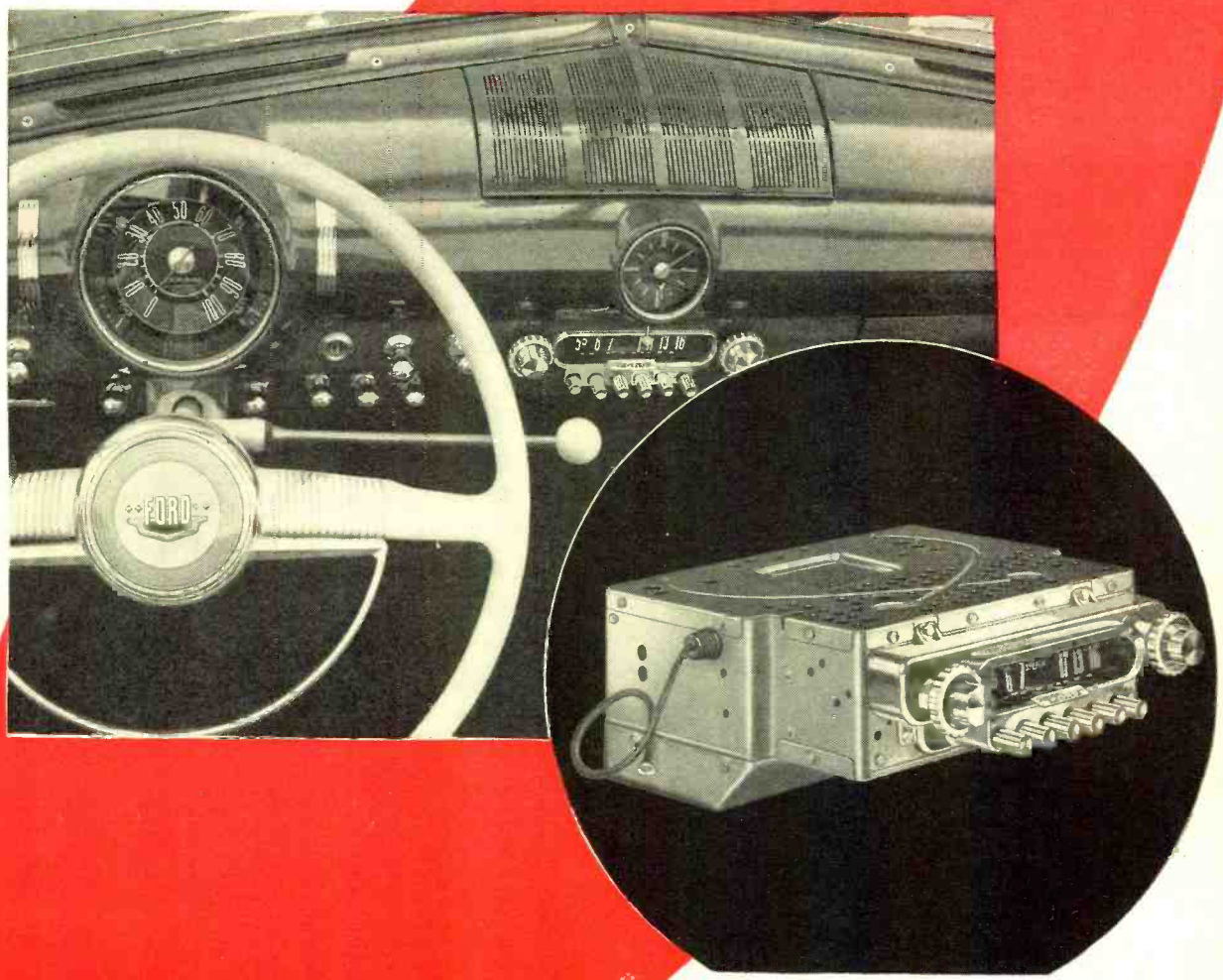



Fig. 6. The video frequency amplifier system used in Belmont TV receivers.

Fig. 7. The Tele-King two-stage video amplifier system used in their TV sets.



# AUTO RADIO and HYTRON go together




"A Ford in your future?" There will probably be a fine new Ford radio receiver on the dash. Chances are good this receiver will be equipped with tubes by Hytron. For Hytron is a major supplier of Ford auto radio tubes. That is only natural. Hytron *specializes* in auto radio tubes — both GT and miniature. Close engineering co-operation with leaders like Ford help make Hytron auto radio tubes leaders, too. 'Nuff said. Hytron and auto radio go together.


SPECIALISTS IN RADIO RECEIVING TUBES SINCE 1921.

**HYTRON**

**RADIO AND ELECTRONICS CORP.**

MAIN OFFICE: SALEM, MASSACHUSETTS

### 2-Meter Superhet

(*Continued from page 65*)

verter plate tank: a cessation or quieting in the S-R hiss will be heard when the wavemeter is tuned to the frequency of the tank. As mentioned previously, the frequency should lie between 30 and 40 mc.

Next the oscillator tuning is adjusted to cover desired frequency range. As before, a loosely coupled wavemeter, or in this case, Lecher wires may be used to set the range. The frequency is adjusted by squeezing or spreading the coil, the former lowering and the latter raising the frequency. The approximate range of the oscillator should be 180 to 190 megacyles, for an i.f. of 40 mc., or the desired tuning range plus your i.f. frequency. The receiver is then connected to the antenna and a signal tuned in near the center of the band. It is preferable to use a weak, unmodulated signal. The signal is peaked as indicated by minimum S-R hiss by squeezing or spreading the converter grid coil.

A further refinement could be made by using a small trimmer across the converter grid condenser and peaking it at the high end of the band and adjusting the coil at the low end. This was found unnecessary in the model receiver as the tracking was perfect over the two meter band. It may be pointed out that the use of a "diddle stick," (an alignment tool consisting of an insulated rod with a brass slug in one end and powdered iron core in the other end) is highly desirable in such alignment procedure. It shows whether the circuit needs to be increased or decreased in frequency without the pains of trial and error. The brass end improving alignment indicates the need of less inductance or capacity, and the iron end vice-versa. The coils are then adjusted accordingly, should they not track properly across the band.

It is felt by the author that this receiver fills in the gap for those interested in two meters who do not want to go so far as building a specialized two-meter superhet, but want something better than an ordinary "rush box," with its "barn door" selectivity. The converter should also prove a boon to mobile men as all that is needed is an audio amplifier for good image-free two-meter reception.

It can be further pointed out that operation on still higher frequency, such as 1¼ meters, should be possible with improved performance there also.

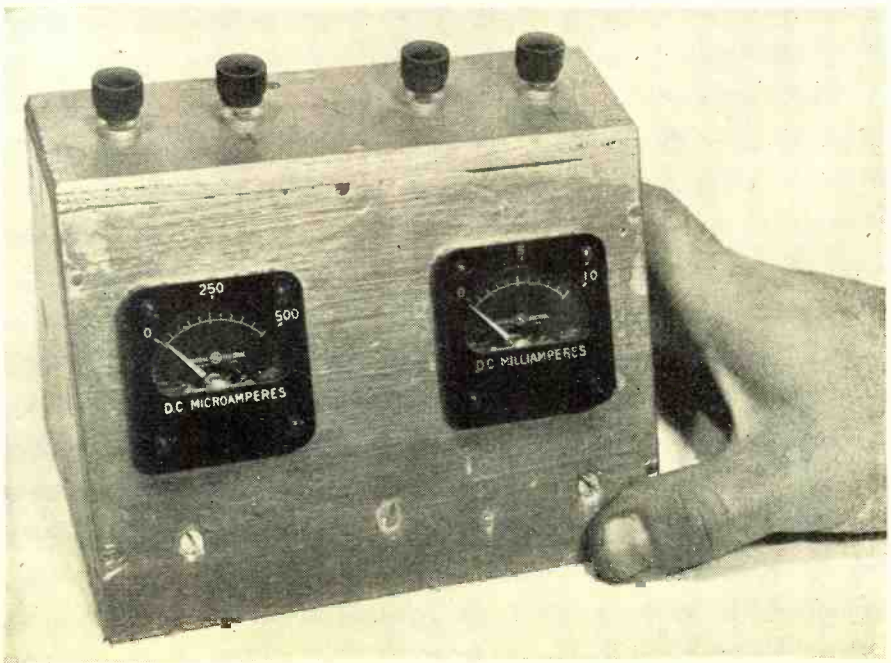
—30—

## A HANDFUL OF METERS

**THE 1¾-inch square "miniature" meters available at bargain prices are cute little things, but something of a problem to handle when used individually. However, two of them mounted in a common container make a convenient handful. The container is a simple inclined-front box made of scraps of ¼-inch plywood.**

**The combination shown, of a 0-500 microampere unit and a 0-10 milliampere unit, has proven extremely useful and versatile for both transmitter adjustment and for tricky trouble-shooting in receivers. The microammeter reveals leakage in unsuspected places, and the milliammeter is fine for checking grid current of transmitter tubes and screen current of receiving tubes.** R.H.

Two of the miniature meters mounted in a single cabinet make a handy test instrument.

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| 1B24 | 4.95 | 250R | 7.95 | 925 | 1.40 | VR75 | .98 | 5X4G | .72 | 6SJ7GT | .66 | 12SR7GT | .39 |
| 1C21 | 1.29 | 250TH | 19.50 | 929 | 1.25 | VR78 | .75 | 5Y3GT | .42 | 6SK7 | .66 | 12X3 | .98 |
| 1S21 | 1.95 | 250TL | 19.50 | 930 | 1.10 | VR90 | .75 | 5Y4G | .60 | 6SK7GT | .66 | 12Z3 | .88 |
| 2AP1 | 3.95 | 252A | 4.95 | 931A | 4.95 | VR91 | 1.49 | 5Z3 | .72 | 6SL7GT | .96 | 14A7/12B7 | .88 |
| 2C21 | .98 | 254 | 19.95 | 954 | .75 | VR105 | .75 | 5Z4 | 1.06 | 6SN7GT | .88 | 14AF7/XXD | .88 |
| 2C22 | .89 | 259A | 4.95 | 955 | .75 | VR150 | .98 | 6A3 | 1.28 | 6SQ7 | .60 | 14B6 | .88 |
| 2C26A | .75 | 274A/B | 1.25 | 956 | .75 | VT127A | 3.00 | 6A6 | 1.06 | 6SQ7GT | .60 | 14B8 | .88 |
| 2C34 | .59 | 282A/B | 9.95 | 957 | .75 | VU111 | 1.19 | 6A7 | .80 | 6SR7 | .72 | 14C5 | .88 |
| 2C40 | 1.98 | 304TH | 6.95 | 958A | .75 | WL460 | 14.95 | 6A8 | .80 | 6SR7GT | .72 | 14C7 | .88 |
| 2C43 | 7.50 | 304TL | 1.49 | 1000 SPEC. | 24.95 | WL468 | 14.95 | 6A8GT | .80 | 6SS7 | .66 | 14E6 | .72 |
| 2C44 | 1.75 | 307A | 4.95 | 1608 | 4.95 | WL532A | 4.95 | 6AB5/6N5 | .88 | 6ST7 | .88 | 14E7 | .88 |
| 2C46 | 7.50 | 310 | 4.95 | 1613 | .75 | WL562 | 150.00 | 6AB7/1853 | 1.06 | 6SV7 | .88 | 14F7 | .88 |
| 2D21 | 1.69 | 311A | 1.98 | 1614 | 1.75 | WL616 | 105.00 | 6AC5GT | 1.16 | 6T7G | 1.24 | 14F8 | 1.06 |
| 2E22 | 1.50 | 316A | .69 | 1616 | 1.39 | Z225 | 1.95 | 6AC7/1852 | 1.16 | 6U5/6G5 | .72 | 14H7 | .88 |
| 2E24 | 4.95 | 322A | 120.00 | 1619 | .75 | ZB120 | 6.95 | 6AD6 | .88 | 6U6GT | .72 | 14J7 | 1.06 |
| 2E25 | 4.25 | 327A | 4.95 | 1621 | 1.98 | ZP477 | 14.99 | 6AD7G | 1.28 | 6U7G | .72 | 14N7 | 1.06 |
| 2E26 | 3.95 | 331A | 5.95 | 1622 | 1.75 | 0A2 | 1.69 | 6AF6 | 1.25 | 6V6 | 1.28 | 14Q7 | .88 |
| 2E30 | 2.49 | 338A | 4.95 | 1624 | 1.75 | 0A3/VR75 | .98 | 6AG5 | 1.06 | 6V6GT | .80 | 14R7 | .88 |
| 2J21A | 14.95 | 350A/B | 2.95 | 1625 | .49 | 0A4G | 1.06 | 6AG7 | 1.28 | 6W7G | .88 | 14S7 | 1.06 |
| 2J26 | 14.95 | 354C/D | 19.95 | 1626 | .49 | 0B2 | 2.05 | 6AH6 | 3.90 | 6X4 | .60 | 14W7 | 1.06 |
| 2J31 | 24.95 | 368AS | 4.95 | 1628 | 4.95 | 0B3/VR90 | .75 | 6AJ5 | .99 | 6X5GT | .60 | 14X7 | 1.06 |
| 2J32 | 24.95 | 371A/B | 2.95 | 1629 | .69 | 0C3/VR105 | .75 | 6AK5 | 1.56 | 6Y6G | .96 | 14X4 | .88 |
| 2J33 | 24.95 | 393A | 7.95 | 1631 | 1.50 | 0D3/VR150 | .75 | 6AK6 | .96 | 6Y7G | .88 | 19 | 1.28 |
| 2J34 | 24.95 | 394A | 4.50 | 1633 | 1.65 | 0Y4 | .88 | 6AL5 | .80 | 6Z7G | 1.28 | 19T8 | 1.06 |
| 2J37 | 24.95 | 417A | 24.95 | 1634 | .79 | 0Z4 | .88 | 6AL7GT | 1.06 | 6ZY5G | .88 | 22 | 1.28 |
| 2J38 | 24.95 | 434A | 3.95 | 1635 | 1.10 | 0Z4G | .88 | 6AQ5 | .80 | 7A4/XXL | .72 | 24A | .88 |
| 2JB51 | 4.95 | 446A/B | 1.95 | 1636 | 5.95 | 01A | .50 | 6AQ6 | .72 | 7A5 | .72 | 25A6 | 1.06 |
| 2J54B | 25.00 | 450TH | 24.95 | 1638 | .98 | 1A3 | .72 | 6AQ7GT | .88 | 7A6 | .72 | 25A6G | 1.06 |
| 2K25 | 24.95 | 464A | 7.50 | 1641 | .79 | 1A4 | 1.28 | 6AR5 | .66 | 7A7 | .72 | 25AC5GT | 1.16 |
| 2K28 | 34.95 | 527 | 12.95 | 1642 | .98 | 1A4P | 1.56 | 6AS7G | 4.95 | 7A8 | .72 | 25L6GT | .66 |
| 2K33 | 34.95 | 531 | 24.50 | 1644 | 1.49 | 1A5GT | .72 | 6AT6 | .60 | 7AD7 | 1.06 | 25Y5 | 1.16 |
| 3AP1 | 4.95 | 575A | 14.95 | 1654 | 1.98 | 1A6 | 1.28 | 6AU6 | .80 | 7AF7 | .72 | 25Z5 | .60 |
| 3B22 | 4.95 | 701A | 4.95 | 1851 | 1.25 | 1A7GT | .80 | 6AV6 | .60 | 7AG7 | .88 | 25Z6GT | .60 |
| 3B23 | 4.95 | 703A | 4.95 | 1852 | 1.06 | 1B3GT | 1.49 | 6B4G | 1.28 | 7AH7 | .88 | 26 | .72 |
| 3B24 | 1.95 | 705A | 2.95 | 1853 | 1.06 | 1B4 | 1.56 | 6B5 | 1.56 | 7B4 | .72 | 27 | .60 |
| 3B26 | 5.95 | 707A/B | 24.95 | 1960 | .95 | 1B5/25S | 1.28 | 6B6G | .88 | 7B5 | .72 | 28D7 | .39 |
| 3BP1 | 3.95 | 708A | 7.95 | 2050 | 1.19 | 1B7GT | 1.06 | 6B7 | 1.28 | 7B6 | .72 | 30 | .39 |
| 3C21 | 5.95 | 710A | 2.95 | 2051 | .98 | 1C5GT | .88 | 6B8 | 1.28 | 7B7 | .72 | 31 | .39 |
| 3C22 | 12.95 | 713A | 1.65 | 5514 | 4.95 | 1C6 | 1.28 | 6B8G | 1.28 | 7B8 | .72 | 32 | 1.28 |
| 3C23 | 4.95 | 715A/B | 9.95 | 5516 | 5.95 | 1C7G | 1.28 | 6BA6 | .80 | 7C4/1203A | .39 | 32L7GT | 1.28 |
| 3C24 | .69 | 715C | 24.95 | 5562 | 10.00 | 1D5GP | 1.55 | 6BE6 | .72 | 7C5 | .72 | 33 | .39 |
| 3C30 | 1.50 | 717A | .99 | 7193 | .39 | 1D7G | 1.28 | 6BG6G | 1.92 | 7C6 | .72 | 34 | .39 |
| 3CP1 | 3.00 | 720DY | 34.95 | 8003 | 5.95 | 1D8GT | 1.56 | 6BH6 | .80 | 7C7 | .72 | 35/51 | .80 |
| 3DP1 | 3.95 | 721A/B | 4.35 | 8005 | 4.95 | 1E5GT | 1.38 | 6BJ6 | .80 | 7E5/1201 | 1.06 | 35A5 | .72 |
| 3EP1 | 3.95 | 723AB | 7.95 | 8008 | 3.75 | 1E7G | 1.56 | 6C4 | .39 | 7E6 | .72 | 35B5 | .80 |
| 3E29 | 4.95 | 724A/B | 4.95 | 8011 | 2.95 | 1F4 | 1.06 | 6C5 | .66 | 7E7 | .88 | 35L6GT | .66 |
| 3FP7 | 3.95 | 725A | 24.95 | 8012 | 4.95 | 1F5G | 1.06 | 6C5GT | .66 | 7F7 | .88 | 35W4 | .46 |
| 3J31 | 49.50 | 726A | 23.50 | 8013 | 2.95 | 1F6 | 1.56 | 6C6 | .80 | 7F8 | 1.06 | 35Y4 | .72 |
| 4-65A | 14.50 | 750TL | 49.50 | 8014A | 24.95 | 1F7G | 1.56 | 6C7 | 1.28 | 7G7/1232 | 1.06 | 35Z3 | .72 |
| 4-125A | 27.50 | 800 | 2.25 | 8016 | 1.49 | 1G4GT | 1.06 | 6C8G | 1.28 | 7H7 | .80 | 35Z4GT | .60 |
| 4-250A | 37.50 | 801A | .98 | 8020 | 3.95 | 1G6GT | 1.06 | 6D6 | .66 | 7J7 | 1.06 | 35Z5GT | .50 |
| 4A1 | 1.98 | 802 | 2.95 | 8025 | 7.95 | 1H4G | .88 | 6D8G | 1.28 | 7K7 | 1.06 | 36 | .39 |
| 4AP10 | 6.95 | 803 | 8.95 | C5B | 12.95 | 1H5GT | .66 | 6E5 | .85 | 7L7 | .88 | 37 | .39 |
| 4B24 | 4.95 | 804 | 12.95 | C6J | 12.95 | 1H6G | 1.28 | 6E6 | 1.06 | 7N7 | .88 | 38 | .39 |
| 4C35 | 19.95 | 805 | 5.95 | CEQ72 | 1.95 | 1H6GT | 1.28 | 6F5 | .66 | 7Q7 | .72 | 39/44 | .39 |
| 4J26 | 110.00 | 807 | 1.25 | CK1005 | .39 | 1J6GT | 1.28 | 6F5GT | .66 | 7R7 | .88 | 41 | .66 |
| 4J33 | 49.50 | 809 | 2.95 | CK1006 | .69 | 1L4 | .80 | 6F6 | .80 | 7S7 | 1.06 | 42 | .66 |
| 5AP1 | 4.95 | 810 | 7.95 | CK1090 | 4.95 | 1LA4 | 1.06 | 6F6GT | .66 | 7V7 | 1.06 | 43 | .66 |
| 5AP4 | 5.95 | 811 | 2.45 | EF50 | .79 | 1LA6 | 1.06 | 6F7 | 1.06 | 7W7 | 1.06 | 45 | .66 |
| 5BP1 | 2.95 | 812 | 2.95 | EL3C | 4.95 | 1LB4 | 1.06 | 6F8G | 1.28 | 7X7/XXFM | 1.06 | 45Z3 | .60 |
| 5BP4 | 4.95 | 812H | 6.90 | EL225 | 1.95 | 1LC5 | 1.06 | 6G6G | 1.06 | 7Y4 | .72 | 45Z5GT | .72 |
| 5CP1 | 3.95 | 813 | 8.95 | F123A | 12.95 | 1LC6 | 1.06 | 6H6 | .60 | 7Z4 | .72 | 46 | 1.06 |
| 5CP7 | 13.95 | 814 | 3.95 | F660 | 150.00 | 1LD5 | 1.06 | 6H6GT | .60 | 10 | .69 | 47 | .96 |
| 5D21 | 29.95 | 815 | 2.95 | FG17 | 3.25 | 1LE3 | 1.06 | 6J5 | .54 | 12A | .60 | 49 | .88 |
| 5FP7 | 3.95 | 816 | 1.19 | FG27A | 9.95 | 1LG5 | 1.06 | 6J5GT | .54 | 12A6 | .39 | 50 | 1.56 |
| 5GP1 | 9.95 | 826 | .69 | FG33 | 8.95 | 1LH4 | 1.06 | 6J6 | 1.16 | 12A6GT | .39 | 50A5 | .88 |
| 5HP4 | 9.95 | 828 | 6.95 | FG67 | 12.95 | 1LN5 | 1.06 | 6J7 | .80 | 12A7 | 1.28 | 50B5 | .66 |
| 5LP1 | 11.95 | 829A/B | 7.95 | FG81A | 6.95 | 1N5GT | .80 | 6J7GT | .80 | 12A8GT | .80 | 50L6GT | .66 |
| 6AF6G | .88 | 829B/3E29 | 4.95 | FG105 | 19.95 | 1P5GT | 1.06 | 6J8G | 1.28 | 12AH7GT | .88 | 50Y6GT | .72 |
| 6C21 | 24.95 | 830 | 2.95 | FG172A | 32.50 | 1Q5GT | 1.06 | 6K5GT | .96 | 12AL5 | .80 | 53 | 1.06 |
| 6D4 | 1.29 | 830B | 5.25 | FG235 | 59.50 | 1R4 | 1.06 | 6K6GT | .60 | 12AT6 | .60 | 56 | .72 |
| 7BP7 | 4.95 | 832/A | 4.95 | FG238B | 160.00 | 1R5 | .80 | 6K7 | .66 | 12AT7 | 1.06 | 57 | .80 |
| 7EP4 | 17.95 | 833A | 34.50 | GL146 | 11.00 | 1S4 | .96 | 6K7GT | .66 | 12AU6 | .80 | 58 | .80 |
| 9AP4 | 24.95 | 834 | 5.95 | GL207 | 110.00 | 1S5 | .72 | 6K8 | .96 | 12AU7 | .96 | 59 | 1.06 |
| 9GP7 | 15.00 | 836 | 1.15 | GL530 | 49.50 | 1T4 | .80 | 6K8GT | .96 | 12BA6 | .72 | 70L7GT | 1.56 |
| 9JP1 | 7.95 | 837 | 2.50 | GL559 | 5.35 | 1T5GT | 1.06 | 6L5G | 1.06 | 12BE6 | .72 | 71A | .80 |
| 9MP7 | 14.95 | 838 | 3.95 | GL697 | 150.00 | 1U4 | .80 | 6L6 | 1.42 | 12C8 | .69 | 75 | .66 |
| 10Y | .69 | 841 | .69 | HF100 | 3.95 | 1U5 | .72 | 6L6G | 1.16 | 12F5GT | .72 | 76 | .66 |
| 10SPEC | .69 | 843 | .69 | HF210 | 17.95 | 1V | .88 | 6L6GA | 1.16 | 12H6 | .39 | 77 | .66 |
| 12DP7 | 14.95 | 845 | 4.95 | HY65 | 2.49 | 2A3 | 1.28 | 6L7 | .96 | 12J5GT | .39 | 78 | .66 |
| 12DP8 | 14.95 | 845W | 5.95 | HY69 | 2.49 | 2A4G | 1.28 | 6L7G | 1.16 | 12J7G | .80 | 79 | .88 |
| 12GP7 | 14.95 | 849A | 60.00 | HY75 | 1.25 | 2A5 | .88 | 6N6G | 1.56 | 12J7GT | .80 | 80 | .46 |
| 12HP7 | 14.95 | 849H | 60.00 | HY615 | 1.25 | 2A6 | 1.06 | 6N7 | .96 | 12K7GT | .66 | 81 | 1.56 |
| 15E | 1.50 | 851 | 75.00 | HYE1148 | .48 | 2A7 | 1.06 | 6N7GT | .96 | 12K8 | .88 | 82 | 1.06 |
| 15R | 1.50 | 860 | 3.00 | KU610 | 9.95 | 2B7 | .88 | 6P5GT | .96 | 12K8GT | .96 | 83 | 1.06 |
| 23D4 | .49 | 861 | 49.95 | ML101 | 150.00 | 2E5 | .88 | 6Q6G/6T7G | 1.06 | 12Q7GT | .72 | 83V | 1.28 |
| 24G | .98 | 864 | .69 | REL21 | 4.25 | 2V3G | 1.98 | 6Q7 | .80 | 12SA7 | .66 | 84/6Z4 | .72 |
| 45SPEC | .49 | 865 | 2.98 | RK12 | 1.95 | 2X2A | 1.25 | 6Q7GT | .72 | 12SA7GT | .66 | 85 | .88 |
| 75TL | 3.95 | 866A | .99 | RK21 | 3.95 | 3A4 | .39 | 6R7 | 1.06 | 12SC7 | .72 | 89 | .72 |
| 100TH | 12.95 | 866JR | 1.25 | RK22 | 4.95 | 3A5 | 1.39 | 6R7GT | 1.06 | 12SF5 | .80 | 89Y | .39 |
| 100TS | 3.00 | 868 | 1.95 | RK25 | 2.95 | 3B7 | .36 | 6S7 | 1.28 | 12SF5GT | .80 | 117L7GT | 1.56 |
| 114A | .69 | 869B | 75.00 | RK33 | .98 | 3D6 | .36 | 6S7G | 1.28 | 12SF7 | .80 | 117M7GT | 1.56 |
| 114B | 1.25 | 872A | 2.95 | RK34 | .59 | 3Q4 | .88 | 6S8GT | 1.06 | 12SF7GT | .80 | 117N7GT | 1.56 |
| 120 | 5.95 | 874 | 2.49 | RK59 | 3.95 | 3Q5GT | .96 | 6SA7 | .66 | 12SG7 | .72 | 117P7GT | 1.56 |
| 121A | 2.65 | 878 | 2.49 | RK60 | .79 | 3S4 | .80 | 6SA7GT | .66 | 12SH7 | .39 | 117Z3 | .60 |
| 205B | 4.50 | 884 | 1.49 | RK65 | 24.95 | 3V4 | .80 | 6SB7Y | .88 | 12SJ7 | .66 | 117Z4GT | 1.16 |
| 211 | .98 | 885 | .98 | RK72 | 1.95 | 5AZ4 | .50 | 6SC | .72 | 12SJ7GT | .66 | 117Z6GT | .96 |
| 215A | 3.00 | 891 | 110.00 | RK73 | 3.95 | 5R4GY | 1.15 | 6SD7GT | .49 | 12SK7 | .66 | FM-1000 | 1.28 |
| 217C | 7.50 | 902P1 | 7.95 | RX120 | 10.00 | 5T4 | 1.28 | 6SF5 | .66 | 12SK7GT | .66 | UX120 | 1.38 |
| 218 | 49.50 | 904 | 9.95 | SD809 | 4.95 | 5U4G | .60 | 6SF5GT | .72 | 12SL7GT | .88 | UX200 | 1.28 |
| 221A | 2.95 | 905 | 11.95 | TB35 | 1.98 | 5V4G | .96 | 6SF7 | .80 | 12SN7GT | .80 | 9001 | .89 |
| 227A | 3.95 | 913 | 7.95 | TZ40 | 2.95 | 5W4 | 1.60 | 6SH7 | .39 | 12SQ7 | .60 | 9002 | .39 |
| | | 920 | 2.95 | UH50 | 5.95 | | | | | 12SQ7GT | .60 | 9003 | .69 |
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# Training An Industry

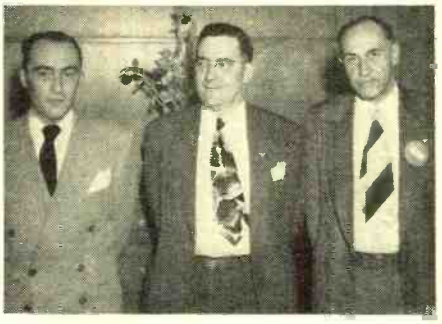
***Many groups are offering TV training for service technicians. Here's one organization's program.***

ON A chill, wet night last November about twenty-five hundred radio technicians, dealers, and engineers attended a meeting in Chicago to hear A. C. W. Saunders, television lecturer for *Howard W. Sams & Co., Inc.*, of Indianapolis, discuss practical television installation and service. Estimated to be the largest gathering ever to attend a lecture on radio or television service techniques in that city it typified the deep interest in practical information on television installation and maintenance that is evident in every city, town, and hamlet across the country.

The vast organization of independent businessmen who constitute the dealer and service phase of the radio industry is alert to the many opportunities offered by the new industry—television—and is seeking every bit of practical information it can find.

Two years ago only its most avid proponents anticipated the enthusiastic public interest and acceptance of television that has marked its introduction into each new area. In city after city "T-day" has found dealers swamped with orders and crying to their factories for larger allotments of receivers. And the public, spurred by the small fry who have taken to television like a duck takes to water, have placed their stamp of approval on this new dimension in home entertainment by buying receivers as rapidly as they become available.

In the eyes of those who wore the darker shades of glasses in scanning the future for television one of the major bottlenecks they envisioned was the lack of competent, trained personnel for installing and maintaining home television receivers. They presumed that since so few men were trained and qualified to handle the so-called intricacies of television installation and service the industry would have to crawl forward slowly saleswise while the training was effected.



M. E. Schifino, Rochester Radio Supply Co., A. C. W. Saunders, and T. L. Raymo, president of the Rochester Radio Technicians Guild, were snapped at the Rochester meeting sponsored by Rochester Radio Supply. Edw. G. Masline, the Rochester RTG, and Howard W. Sams & Co., Inc., of Indianapolis, Ind.

At the moment nearly 50 television stations are on the air with regular programs. In practically every instance "T-day" in each of these areas found capable men available to handle the installation and maintenance of the receivers the dealers have sold. In those few areas where the initial television enthusiasm on the part of the buying public has subsided the fault lies with the TV station programming and broadcasting and not with the maintenance part of the business.

Typifying the widespread interest in practical television servicing, more than 300 radio service technicians and dealers registered at the television service meeting in Dallas sponsored by Howard W. Sams & Co., Inc., in cooperation with All State Distributing Co., Crabtrees Wholesale Radio Co., Ra-Tel, Inc., and Wilkinson Bros., all of Dallas.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We think your opportunities are so great, that over a two year period we have been developing this brand new, practical course. It is written for *today's* serviceman to meet *today's* problems and opportunities.

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*RADIO SERVICE DIVISION OF*

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*An Accredited Technical Institute*

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☐ I AM ENTITLED TO TRAINING UNDER G. I. BILL.

In addition to a highly receptive market, television inherited a vast pool of radio-trained technicians eager for all of the practical information and instruction they could find that would be helpful to them in comprehending these new circuits and the application of television receivers in the home. This immense need for practical information is now being ably met by many publishing houses, manufacturers, and distributors.

One of the first comprehensive courses in practical television principles was made available to the radio service industry, in installment form, in regular issues of "Photofact" Folders published by *Howard W. Sams & Co., Inc.*, of Indianapolis, Indiana. This course was based on a series of sixteen lectures developed by A. C. W. Saunders of the *Saunders Radio and Electronics School* of Newton, Mass., to provide orientation training in television installation and service for skilled radio service technicians.

In order to dispel fears in the minds of radio service technicians that television circuits were too "complex", Mr. Saunders prepared a two hour lecture on television installation and circuitry for delivery in key cities across the country under the sponsorship of *Howard W. Sams.*

Starting in Cleveland, Ohio, on September 8, Mr. Saunders has spoken before a total audience of more than 10,000 radio service technicians, engineers, and dealers in 27 cities. In each city these meetings, which were completely non-commercial, were cosponsored by local radio parts distributors. In seventy-five per-cent of the cities the audiences represented the largest attendance for a meeting of its kind ever held in those towns.

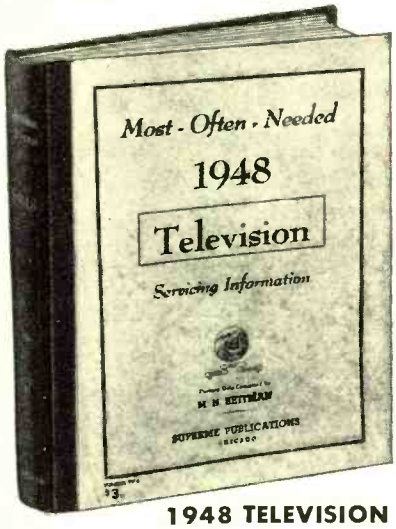
Thirty years of intense radio development and activity has provided a vast pool of radio-trained and radio-minded technicians capable of absorbing new radio techniques when supplied with the right kind of information and literature. In the amateur fraternity alone there are upwards of seventy thousand hams who are well acquainted with the peculiarities and idiosyncrasies of broadcast frequencies in the present television spectrum.

And through the years, a very sound basic independent radio service industry has developed around men who have weathered the storms and lean days of radio service to develop stable and substantial businesses. To these men who have very capably adapted their organizations to handle multi-band home receivers with complex automatic record changers, home recorders, etc., television is just a new branch of the radio industry with a lot of its problems still to be solved.

It is these men whose job is not to design and build television receivers but to replace components and adjust receivers already built who will drive many miles in their spare time to acquire some of the practical information they need to prepare them in this new industry. —30—

# New Supreme TELEVISION Manual

## Includes Every Popular Television Receiver




In this giant volume of television factory data, you have everything you need to repair every modern television set. For only $3, total price, you get complete service and alignment material on all popular T-V sets. You receive easy-to-understand explanations of circuits, 144 pages of alignment procedure, test patterns, T-V antenna data, response curves, oscilloscope waveforms, voltage charts, adjustment hints, many diagrams on mammoth 11x17-inch blueprints, everything to bring you up to date and make you an expert in television repairs.

Compiled by M.N.Beitman, radio engineer, teacher, author & serviceman.

### 1948 TELEVISION

Contains material on all popular television sets, of Admiral, Belmont Radio, DuMont, Farnsworth, General-Electric, Hallicrafters, Motorola, Philco, R.C.A., Sonora, Stromberg-Carlson, and others. Gives description of circuits, many pages of test patterns, response curves, oscilloscope waveforms, alignment tables, service hints, many diagrams in the form of giant double-spread blueprints, test points, voltage charts, etc. Large size: 8½x11 in., manual style binding, flexible covers, priced at only ... **$3.00**

### FIND-FIX ALL TELEVISION FAULTS

Use this new practical "cyclopedia" of television servicing as your guide to quick fault finding and repair of any modern television set. Eliminates guesswork — tells you just where to look and what to do. Cuts hour-wasting jobs to pleasant moments. Use test patterns for quick adjustment, or look up probable cause of trouble in the pages of hints after simply observing fault of picture on screen. No equipment needed with these tests. Or use your voltmeter and compare values with many voltage charts included. Observe waveforms similar to hundreds illustrated using test points suggested and in a flash locate what used-to-be a hard-to-find fault. This manual will give you the know-how of a television expert and will repay for itself with time saved on the first T-V job. Order at our risk for a 10-day trial.

### BIGGEST VALUE IN T-V TRAINING

For 15 years, radio servicemen expected and received remarkable bargains in **Supreme Publications** service manuals. The new 1948 **Television** Manual is a virtual treatise on practical television repairs. By normal standards, such a large manual packed as it is with practical data, illustrations, diagrams, charts, photographs, and expensive extra-large blueprints, should sell for $10. — but as another **Supreme** special value, it is priced to servicemen at only $3, postpaid. Only a publisher who sold over one million of various radio manuals can offer such bargain prices based on tremendous volume-sales. Read about this new T-V manual at left. Find out about other radio manuals listed below. Use and save with Supreme Publications.


### F.M. and TELEVISION

Use this manual of factory instructions for trouble-shooting, repairing, and alignment of all popular 1947 F.M. and Television sets. Covers every popular make, including F.M. tuners, AM-FM combinations, and all types of television receivers. Details circuit diagrams, theory of operation, test hints, alignment data. This is the material you need to fix F.M. or Television sets. Don't turn this profitable work away for lack of knowledge and information. Use this recent **Supreme** manual to save time and money on your very next F.M. job. Data on 192 large pages. 8½x11 inches. Sturdy, manual-style binding. Tremendous Supreme value at only ... **$2**

### 1948 RADIO DIAGRAMS

Be prepared to repair quickly all new 1948 radio receivers. In this big single volume you have clearly-printed, large schematics, needed alignment data, replacement parts lists, voltage values, and information on stage gain, location of trimmers, and dial stringing, for almost all recently released sets. Makes toughest jobs amazingly easy. Find faults in a jiffy. Speed-up all repairs. A worthy companion to the 7 previous volumes used by over 120,000 shrewd radio servicemen. Manual covers models of 42 different manufacturers. Giant size, 8½x11", 192 pages + index. Manual-style binding. Bargain price, only ... **$2**

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Learn new speed-tricks of radio fault finding, case histories of common troubles, servicing short-cuts, extra profit ideas. Many large lessons on the use of regular test equipment, signal tracing, television, recording. Many active servicemen used this reduced price radio training for brush-up and study of new service methods. Complete, 22 lessons, size 8½x11 inches, 224 pages. New 1948 edition. With self-testing questions and index. Greatest bargain in home-study radio training. Postpaid, only ... **$2.50**

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# Features that make Heathkits the best kits....

## 1 KITS THAT FIT

Heathkit chassis are precision punched to fit the quality parts supplied. The grey crackle aluminum cabinet and the two color panels are die punched to assure proper fitting.

Many builders have written marveling at the ease with which assembly can be accomplished.

The chassis are specially engineered for easy assembly and wiring — there are no small tight corners which cannot be reached — the ends of the chassis are left open in order that installation of parts and soldering can be done with both hands.

## 2 PRECISION PARTS

Wherever required, the finest quality 1% ceramic resistors are supplied. These require no aging and do not shift. No matching of common resistors is required. You find in Heathkit the same quality voltage divider resistors as in the most expensive equipment.

The transformers are designed especially for the Heathkit unit. The scope transformer has two electrostatic shields to prevent interaction of AC fields.

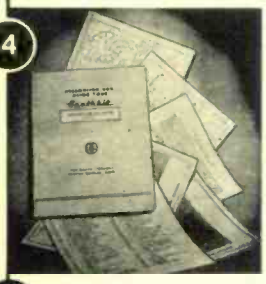
These transformers are built by several of the finest transformer companies in the United States.

## 3 COMPLETE KITS

When you receive your Heathkit you are assured of every necessary part for the proper operation of the instrument.

Beautiful cabinets, handles, 2 color panels, all tubes, test leads where they are a necessary part of the instrument, quality rubber line cords and plugs, rubber feet for each instrument, all scales and dials ready printed and calibrated. Every Heathkit is 110V 60 cy. power transformer operated by a husky transformer especially designed for the job.

## 4 COMPLETE INSTRUCTION MANUALS



Everyone is pleased at the thorough instructions covering the assembly of each Heathkit instrument. Every detail of the assembly is covered, together with sections on the use of the instrument and trouble shooting instructions in case of difficulty. Actual photos of the assembled instrument enable fast and accurate assembly, clear schematics and pictorial diagrams of the confusing parts such as rotary switches enable the wiring to be completed quickly.

## 5 BEST OF ENGINEERING...

Heathkits are the result of many years experience in the test equipment field. Heathkit oscilloscopes have been under development and test since 1943 and most other instruments now being produced have had over two years of thorough testing.

As proof of their design, Heathkits have been adopted by many of the largest Universities and laboratories in the United States. Thousands of engineering students are receiving their training using Heathkits.

## 6 BEST OF PARTS

You will find many famous names on the parts in your Heathkit. Mallory switches and filter condensers, Chicago Transformer Corporation and Electrical Assembly Transformers, Centralab Potentiometers, Belden Cable, IRC & Allen Bradley resistors, G.E. tubes, Cinch and Amphenol sockets with silver plated contacts, Defiance variable condensers, Eby binding post and many other quality parts. The finest of parts are used to assure long trouble-free service from Heathkits.

## 7 MODERN STYLING

Heathkits have brought a new conception of beauty to laboratories and service benches.

Many organizations have standardized on Heathkits to make their shops appear attractive and uniform.

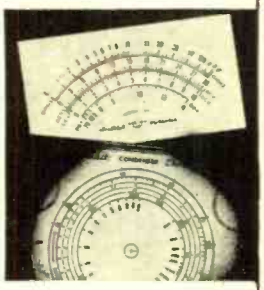
The panels are produced in grey and maroon and the modern streamline aluminum handles give the instruments a pleasant professional appearance.

There is no waste space or false effort to appear large in Heathkits — space on service benches is at a premium and the size of Heathkit instruments is kept as small as is consistent with good engineering design.

## 8 LARGE EASILY READ CALIBRATIONS

No charts or calculations are necessary to use any Heathkit properly. All scales are simply and plainly marked.

The operator instantly knows the proper use of the instrument and can proceed confidently. No multiplication is required as each scale is calibrated independently of the others.



## 9 IDEAL FOR SCHOOLS

Heathkits have been adopted as standard equipment of many of the largest universities and colleges. The low cost plus the fact that the students learn by actual assembly make them ideal training mediums. Many high schools and small colleges are finding that they too can have a modern physics and electronics laboratory by using Heathkits.

Some of the largest technical schools recommend Heathkits to their students as the best means of securing the necessary equipment to start their own shops.

## 10 WHY NOT BUILD YOUR OWN...

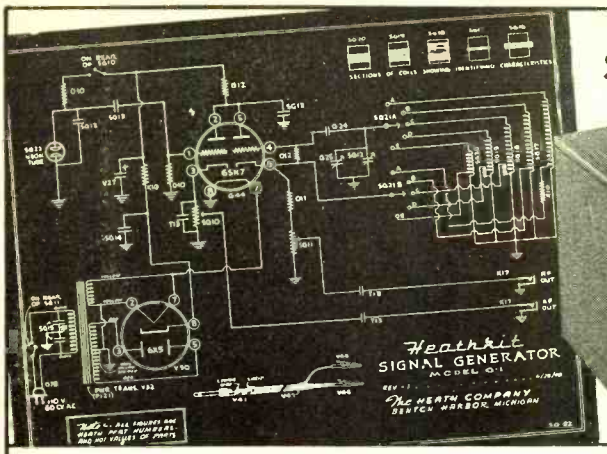
The great strides made in electronics during the war have made it hard for everyone to keep abreast of new developments. By actually assembling modern test equipment knowledge is gained in the most practical manner. Further a complete knowledge of the instrument allows greater flexibility of use and many possible uses suggest themselves.

Lastly with the cost of everything shooting upward any means of eliminating costs is welcomed. This reduction is a remarkable saving, as can be seen by comparing Heathkit prices with comparable built up test equipment.

ON THE FOLLOWING PAGES THE BEST KITS . . . ORDER DIRECT FROM THIS AD.

★ ★ ★ The HEATH COMPANY ... BENTON HARBOR 15, MICHIGAN

## HEATHKIT RF
# SIGNAL GENERATOR KIT




Every shop needs a good signal generator. The Heathkit fulfills every servicing need, fundamentals from 150Kc. to 30 megacycles with strong harmonics over 100 megacycles covering the new television and FM bands. 110V 60 cycle transformer operated power supply.

400 cycle audio available for modulation or audio testing. Uses 6SN7 as RF oscillator and audio amplifier. Complete kit has every part necessary and detailed blueprints and instructions enable the builder to assemble it in a few hours. Large easy to read calibration. Convenient size 9" x 6" x 4¾". Shipping weight 4½ lbs.

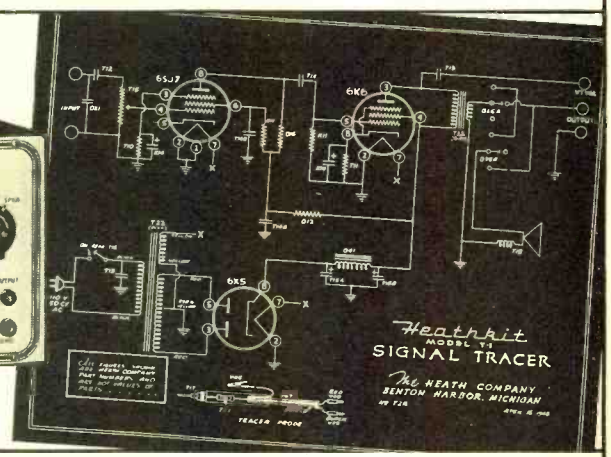
**$19.50**

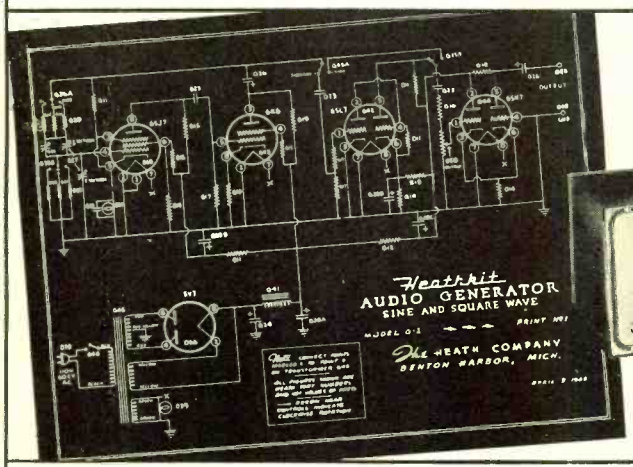
*Nothing* ELSE TO BUY

## HEATHKIT
# SIGNAL TRACER KIT

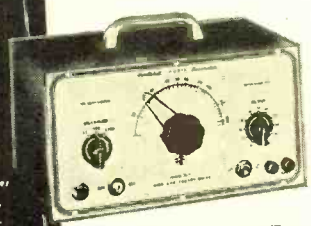
Let a Heathkit Signal Tracer do the tedious watching of intermittents while you go on to other profitable jobs. Follow the signal from the antenna to the defective part in a matter of seconds. Triples the repairs per man in many shops. A Heathkit Signal Tracer Kit pays for itself in a matter of days of operation. Locates faults immediately. Internal amplifier available for speaker testing and internal speaker available for amplifier testing. Connection for VTVM on panel allows visual tracing and gain measurements. Also tests phonograph pickups, microphones, PA systems, etc. Frequency range to 200 Mc. Complete ready to assemble. 110V 60 cycle transformer operated. Supplied with 3 tubes, diode probe, 2 color panel, all other parts. Easy to assemble, detailed blueprints and instructions. Shipping weight 10 lbs.

**$19.50**




## HEATHKIT SINE AND SQUARE
# AUDIO GENERATOR KIT



**$34.50**

*Nothing* ELSE TO BUY

Experimenters and servicemen working with a square wave for the first time invariably wonder why it was not introduced before. The characteristics of an amplifier can be determined in seconds compared to several hours of tedious plotting using older methods. Stage by stage, amplifier testing is as easy as signal tracing. The low distortion (less than 1%) and linear output (± one db.) make this Heathkit equal or superior to factory built equipment selling for three or four times its price. The circuit is the popular RC tuning circuit using a four gang variable condenser. Three ranges 20-200, 200-2,000, 2,000-20,000 cycles are provided by selector switch. Either sine or square waves instantly available at toggle switch. All components are of highest quality, cased 110V 60 cycle power transformer, Mallory F.P. filter condensers, 5 tubes, calibrated 2 color panel, grey crackle aluminum cabinet. The detailed instructions make assembly an interesting and instructive few hours. Shipping weight 13 lbs.

# *Heathkit* ELECTRONIC SWITCH KIT

***DOUBLES THE UTILITY OF ANY SCOPE***

An electronic switch used with any oscilloscope provides two separately controllable traces on the screen. Each trace is controlled independently and the position of the traces may be varied. The input and output traces of an amplifier may be observed one beside the other or one directly over the other illustrating perfectly any change occurring in the amplifier. Distortion—phase shift and other defects show up instantly. 110 Volt 60 cycle transformer operated. Uses 5 tubes (1—6X5, 2—6SN7's, 2—6SJ7's). Has individual gain controls, positioning control, and coarse and fine sweeping rate controls. The cabinet and panel match all other Heathkits. Every part supplied including detailed instructions for assembly and use. Shipping weight 11 lbs.

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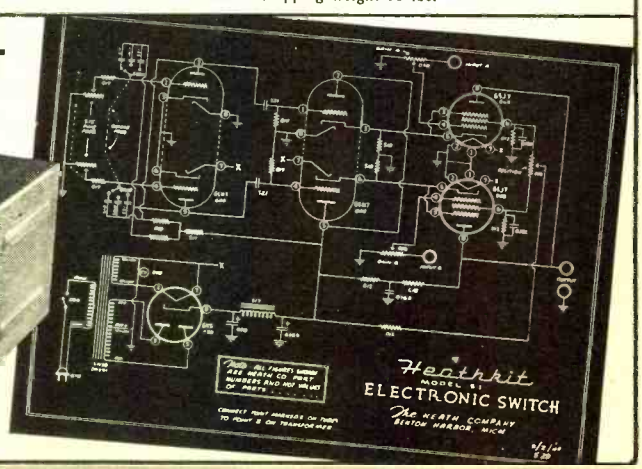


# The HEATH COMPANY

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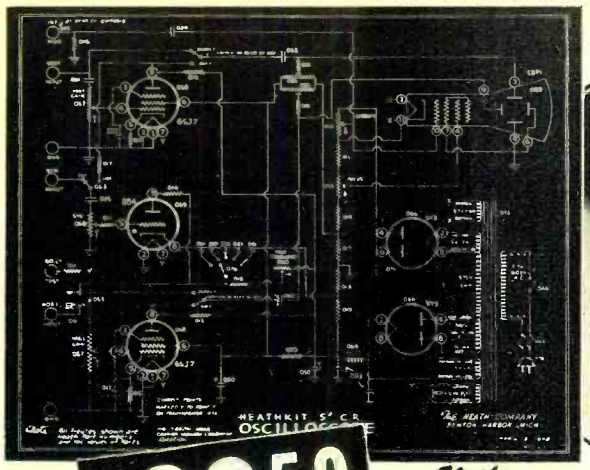


## Heathkit 5 INCH OSCILLOSCOPE KIT

### Features

- ★ Instant switching to plates or amplifier from front panel.
- ★ Sweep generator supplying variable sweep 15 cycles to 30,000 cycles.
- ★ All controls on front panel.
- ★ Cased electrostaticly shielded 110V 60 cycle power transformer.
- ★ AC test voltage post on front panel.
- ★ External synchronization post on front panel.
- ★ Deflection sensitivity .65V per inch full gain.
- ★ Frequency response ± 20% from 50 cycles to 50 Kc.
- ★ Input impedance 1 Megohm and 50 MMF.

**$39.50**

*Nothing* ELSE TO BUY

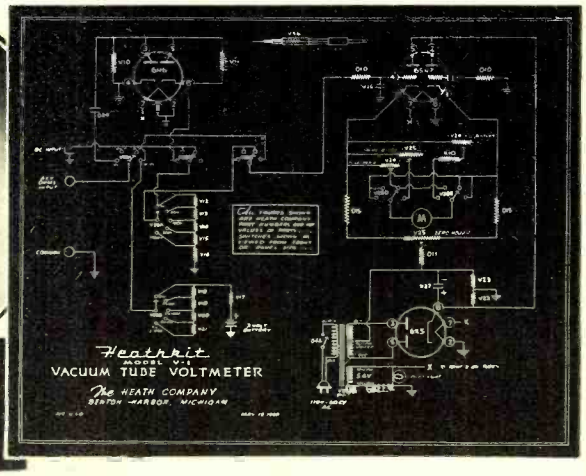
SHIPPING WT. 24 LBS.
EXPRESS ONLY

The Heathkit 5" Oscilloscope Kit fulfills every servicing need. The husky cased power transformer supplies 1100 Volts negative and 350 Volts positive. Tubes supplied are two 6SJ7 amplifiers, 884 sweep generator, two 5Y3 rectifiers, and 5BP1 or 5BP4 CR tube. Grey crackle aluminum cabinet and beautiful grey and maroon panel. Chassis especially designed for easy assembly.

An oscilloscope provides almost endless sources of experimentation in radio, electronics, medicine and scientific research.

Detailed instructions make assembly fun and instructive.

## Heathkit VACUUM TUBE VOLTMETER KIT




Everything you want in a VTVM. Shatterproof solid plastic meter face, automatic meter protection in burn-out proof circuit, push pull electronic voltmeter circuit assuring maximum stability. Linear DC and AC scales. Complete selection of voltage ranges starting with 3 Volts full scale up to 1,000 Volts. Isolated DC test prod for signal tracing and measurements of voltage while instrument is in operation. An ohmmeter section accurately measuring resistance of 1/10 ohm to one billion ohms with internal battery. Extremely high input resistance 11 megohms on all ranges DC and 6.5 megohms on AC. All these features and many more are the reasons hundreds of radio and television schools are using Heathkit VTVM's and recommending them to all students. Like all Heathkits, the VTVM kit is complete, 110V 60 cy power transformer, 500 microamp meter, tubes, grey crackle cabinet, panel, test leads, 1% ceramic precision divider resistors and all other parts. Complete instruction manual. Better start your laboratory now,

**$24.50**

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## HEATHKIT 3-TUBE ALL-WAVE RADIO

110 Volt AC Operation

**$8.75**

An ideal way to learn radio. This kit is complete ready to assemble, with tubes and all other parts. Operates from AC. Simple, clear detailed instructions make this a good radio training course. Covers regular broadcasts and short wave bands. Plug-in coils. Regenerative circuit.

Operates loud speaker. Add postage for 3 lbs.... $8.75
HS 30 Headphones per set ..... $1.00
2½" Permanent Magnet Loudspeaker ..... $1.95
Mahogany Cabinet ..... $2.95

## INTERPHONE 2-WAY CALL SYSTEM KIT

Ideal call and communication system for homes, offices, factories, stores, etc. Makes excellent electronic baby watcher. Easy to assemble with every part supplied including simple instructions. Distance up to 1/5 mile. Operates from 110V A.C. 3 tubes, one master and one remote speaker. Shipping weight 5 lbs. **$14.50**

## HEATHKIT HIGH FIDELITY AMPLIFIER KIT

**$14.95**

Build this high fidelity amplifier and save two-thirds of the cost. 110V 60 cy transformer operated. Push pull output using 1619 tubes (military type 6L6's), two amplifier stages using a dual triode (6SL7), as a phase inverter give this amplifier a linear reproduction equal to amplifiers selling for ten times this price. Every part supplied; punched and formed chassis, transformers (including quality output to 3-8 ohm voice coil), tubes, controls, and complete instructions. Add postage for 20 lbs.

12" PM Speakers for above ..... $6.95

Mahogany Speaker Cabinet, 14½" x 14½" x 8" ..... $8.75

## 110V.-A.C. MILITARY RECEIVER POWER SUPPLY KIT

**$5.95**

Ideal way to convert military sets. 110V 60 cy. transformer operated. Supplies 24 Volts for filament — no wiring changes inside radio. Also supplies 250V D.C. plate voltage at 50-60 MA. Connections direct to dynamotor input. Complete with all parts and detailed instructions. Shipping wt. 6 lbs.

## 110V.-A.C. TRANSMITTER POWER SUPPLY KIT

**$14.50**

For BC-645, 223, 522, 274N's, etc. Ideal for powering military transmitters. Supplies 500 to 600 Volts at 150 to 200 MA plate, 6.3 C.T. at 4 Amps, 6.3 at 4 Amps. and 12V at 4 Amps. Can be combined to supply 3-6-9-12 or 24 Volts at 4 Amperes. Kit supplied complete with husky 110V 60 cycle power transformer, 5U4 rectifier, oil filled condensers, cased choke, punched chassis, and all other parts, including detailed instructions. Complete — nothing else to buy. Shipping Wt. 22 lbs.

## The HEATH COMPANY

★ ★ ★ . . . BENTON HARBOR 15, MICHIGAN

## HEATHKIT FM AND TELEVISION
# SWEEP GENERATOR KIT

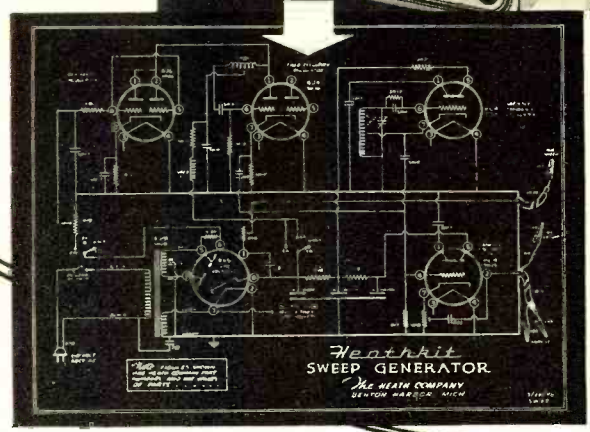
*Features*

- ★ 5 tube Circuit.
- ★ Covers 2 Mc to 226 Mc.
- ★ 110V 60 cy transformer operated.
- ★ Supplies either RF or FM.
- ★ Variable sweep width 0 to app. 10 Mc.
- ★ Large calibrated dial.
- ★ Variable phasing control.
- ★ Sweep output for scope.
- ★ No band switching necessary.
- ★ Uses new miniature HF tubes.

A necessity for television and FM. This Heathkit completely covers the entire FM and TV bands. 2 megacycles to 230 megacycles. The unit is 110V 60 cy power transformer operated. Uses two 6J6 tubes, two 6C4 tubes and a 6X5 rectifier. An electronic sweep circuit is incorporated allowing a range of 0 to 10 Mc. A sawtooth horizontal sweeping voltage and phase control are provided for the oscilloscope.

The coils are ready assembled and precision adjusted to exact frequency. As in all Heathkits, the best of parts are supplied, Mallory filter condenser, zero coef. ceramic condensers, all punched and formed parts, grey crackle cabinet, 5 tubes, test leads, etc. Better get it built now and be ready for the FM and TV business. Shipping wt. 6 lbs.

**$24.50**
*Nothing*
**ELSE TO BUY**

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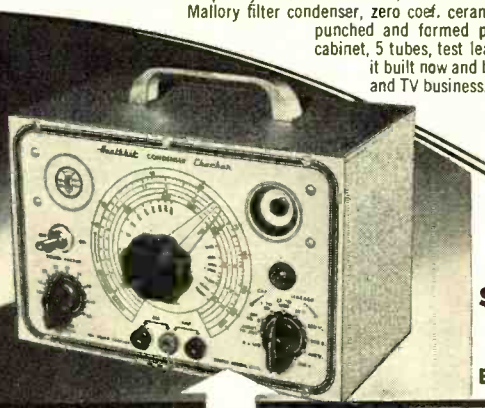
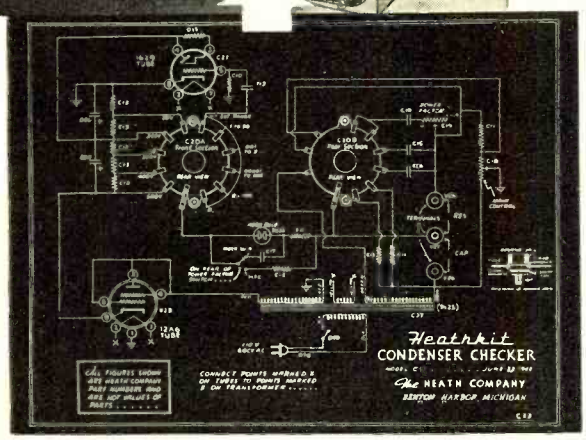


**$19.50**
*Nothing*
**ELSE TO BUY**




## HEATHKIT
# CONDENSER CHECKER KIT

*Features*

- ★ Bridge type circuit.
- ★ Magic eye indicator.
- ★ 110V transformer operated.
- ★ All scales on panel.
- ★ Power factor scale.
- ★ Measures resistance.
- ★ Measures leakage.
- ★ Checks paper-mica-electrolytics.

Checks all types of condensers, paper-mica-electrolytic-ceramic over a range of .00001 MFD to 1000 MFD. All on readable scales that are read direct from the panel. NO CHARTS OR MULTIPLIERS NECESSARY. A condenser checker anyone can read without a college education. A leakage test and polarizing voltage for 20 to 500 volts provided. Measures power factor of electrolytics between 0% and 50%. 110V 60 cycle transformer operated complete with rectifier and magic eye tubes, cabinet, calibrated panel, test leads and all other parts. Clear detailed instructions for assembly and use. Why guess at the quality and capacity of a condenser when you can know for less than a twenty dollar bill. Shipping weight 7 lbs.

## *Why* BUILD YOUR OWN TEST EQUIPMENT

1. You save two-thirds in cost. With increasing prices of most everything, labor costs are an important factor. Eliminating assembly labor costs, we can offer the Heathkit Oscilloscope, VTVM and Signal Generator at a total of only $83.50—about the cost of a factory-built VTVM alone.

2. You have all the fun and learn while you save. The thrill of assembling these beautiful instruments makes them seem more your own to be used with justifiable pride. Through knowledge of construction gained in assembly, better use can be made of the instruments and you can keep them in better repair if need arises.

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# Buy HEATH SURPLUS Now!

ALL QUANTITIES LIMITED SUBJECT TO PRIOR SALES

## APN/1 RADIO ALTIMETERS

NO. 200. The last chance to get a complete new 14 tube radio altimeter. Contains 420 Mc. transmitter and receiver, power supply, range switches, two antennas, meter indicator, all plugs and instruction manual. This unit makes excellent amateur station as it is right in the band. Shipped in original export crate. Weight 87 lbs.

**$34.50**

## BC 645 GENERAL ELECTRIC TRANSCEIVER

NO. 201. Complete 15 tube transmitter-receiver. Ideal for new citizens band 460 Mc. for communication between office and car, home, boat, etc. Conversion article in August ELECTRONICS Magazine. Brand new in original G.E. cartons with tubes. Add postage for 25 lbs.

**$19.50 . . . 2 for $35.00**

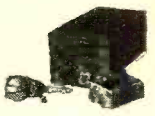
ACCESSORIES FOR BC 645

PE101C Dynamotor for car use ..... $ 3.95

110V 60 Cycle Power Supply for home or office use ... $14.50

## RCA NAVY COMMUNICATION RECEIVER

NO. 202. The last of these beautiful RCA sets. Covers 195 Kc. to 9.1 Mc. continuously. Supplied complete with tubes, control box, tuning unit, 24 Volt dynamotor, band change motor, plugs and circuit diagram. Superheterodyne circuit covers aircraft, broadcast, short wave, marine, foreign broadcasts. Has sharp ar broad I.F.'s B.F.O., etc. Shpg. Wt. 30 lbs.



**$29.50**

## G.E. BC 375 TUNING UNIT

NO. 203. Model TU10B covers 10 Mc. to 12.5 Mc. New complete with aluminum cabinet. The best buy of surplus. Over $30.00 worth of new variable condensers, coil, dials, switches, etc. Add postage for 20 lbs.

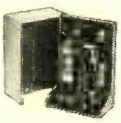
**$2.49**

## G.E. 50 AMP CIRCUIT BREAKER

**$2.95** EACH— 3 FOR $7.50

NO. 204. New General Electric 50 Amp 220 Volt AC circuit breakers. 100 Amp when used on 110V. Add postage for 4 lbs.

## BC 347 AIRCRAFT INTERPHONE AMPLIFIER



NO. 205. Interphone amplifier contains 6F8 tube, Ouncer transformers, diagrams, etc. in aluminum cabinet. Add postage for 4 lbs. ..... **$2.95**

## T32 TABLE MICROPHONE

NO. 210. One of the Army's best. Built by Kellogg, ideal for factory call system, public address, amateur use. Brand new in original cartons. Add postage for 5 lbs. **$2.95**

## MINIATURE ELECTRIC MOTOR

NO. 211. Tiny Delco motor only 1" x 1¼"x2" 10,000 RPM. Operates from 6 to 24 V. Excellent for models. Add postage for 1 lb. **$2.95**

## P. E. 103 6 VOLT DYNAMOTOR

NO. 212. Dynamotor only from PE 103 power supply. Input 6 or 12 Volts, output 500 Volts at 160 MA. Brand new original cartons. Shipping Weight 29 lbs. **$5.95**

## G. E. 1,000 VOLT 350 MA DYNAMOTOR

**$5.95**

NO. 213. An ideal dynamotor for mobile operation in taxicabs, police cars, sound systems and amateur stations. Supplies above voltage from 12 Volts or 500V. at 350 MA from 6 Volts. Complete with starting relay, and fuses. New. Our Dynamotor A. Shipping Weight 72 lbs.

## DM-36 DYNAMOTOR

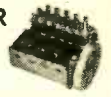
NO. 215. Western Electric 24 Volt input, 220V. at 60 MA out. With filter assembly. Shipping Weight 6 lbs. ..... **$2.95**

## PE 125 TRANSMITTER POWER SUPPLY

**$12.95**

NO. 223. Operates from 12 to 24 Volts and supplies 500 Volts at 160 MA. Extremely rugged construction used in Army tanks. Complete with fuses — relays — filters, etc. Ideal for boats. Shipping Weight 73 lbs.

## FM PUSH BUTTON TUNER



NO. 224. Brand new ten push button tuning assembly from Army FM receiver. Contains 4 gang 100 MMF silver plated tuning condenser. Add postage for 10 lbs. **$2.50** EACH

## RG 8/U FLEXIBLE COAXIAL CABLE

**4¢** PER FOOT

NO. 225. Standard television lead in 52 ohm. Any length up to 1,000 ft. Add for postage.

## 274N COMMAND SET ACCESSORIES

NO. 238. 5" PM Speaker with output transformer matching headphone output ..... $2.80

NO. 239. Dual receiver rack FT277A with connecting plugs ..... $1.00

NO. 240. Single transmitter rack FT234A ..... $1.00

NO. 241. Spline shaft for tuning command receivers. Allows use of regular tuning knob on BC 453-4-5 receivers ..... $ .39

### BC 451 CONTROL BOX

NO. 236. Control box for 274N transmitters. Contains proper cw-voice switch, 4 channel switch, power switch, mike jack and telegraph key.
Add postage for 2 lbs. ..... $1.95

## METER SPECIAL

NO. 237. Brand new DeJur Model 312 0-800 M.A. D.C. Square 3" 0-10 M.A. basic meter with built in shunt. Probably the best buy ever offered in a surplus meter. Shipping Weight 1 lb. ..... **$2.95**

## A-62 ARMY PHANTOM ANTENNA

NO. 206. Contains tuning condenser, coil, resistors, tuning dial, tuning indicator, binding posts, steel case, useful for building amateur transmitter. Add postage for 8 lbs. ..... **$1.95**

## BENDIX MR9C COMPASS CONTROL UNIT

NO. 207. Tuning and control unit for Bendix MN 26 radio compasses contains tuning dial, band switch, crystal switch, AVC switch, volume control, fuses, phone jacks, etc. Shipping Weight 5 lbs. **$9.50**

## BC731 CONTROL BOX

with Weston Model 476 AC Voltmeter

NO. 208. Excellent buy in motor control box. Size 8"x10"x5½". Contains Weston 0-150V. AC 3½" voltmeter, motor starting switch, 28 fuses all 30 Amp 110V. and 8 fuse holders. Fuses and holders alone worth the price. Shipping Weight 18 lbs. ..... **$7.95**

## G.E. BC 306 ANTENNA TUNING UNIT

NO. 231. Matches any aerial to 150 Watt transmitter, used on BC 375. Brand new. Add postage for 20 lbs. ..... **$2.95**

## W.E. BC456 MODULATOR

NO. 217. Modulator from 274N command transmitters contains 3 husky relays, 3 tubes, VR150, 12J5 and 1625. Brand new. Add postage for 11 lbs. **$3.95**

## BE 77 TELETYPE TEST SET

**$7.95**

NO. 218. Contains zero center volt-milliammeter, switches, relays, voltage divider resistors, neon indicator, etc. Excellent foundation for radio tester. Shipping Weight 10 lbs.

## BENDIX MN 20E DIRECTION FINDER LOOP

NO. 219. Ring type loop excellent for use on boat or aircraft. Extremely rugged construction. Low impedance manual type. Add postage for 8 lbs. **$9.95** EACH

## LP 18C DIRECTION FINDER LOOP

NO. 220. Motor driven streamline pod type loop used on automatic direction finders. Has Selsyn transmitter and motor, fits most military direction finders. Add postage for 20 lbs. ..... **$14.50** EACH

## KIT SPECIALS

### POTENTIOMETERS

NO. 232. Kit of 10 excellent shaft type potentiometers good variety. **$1.95**

### SOCKETS

NO. 233. Kit of 20 high quality sockets several different types ..... **$1.00**

## POWER TRANSFORMER *Specials*

NO. 226. Primary 117V. 60 cycle. Secondaries supply 746 V.CT at 220 MA, 6.3V. at 4.5 A., and 5V. at 4A. Will handle 13 tube radio receivers. Supply is limited, order early. Shipping Weight 11 lbs. each.

**$3.95 . . 3 for $9.95**

## OUTPUT TRANSFORMER

NO. 227. Push pull 6V6's to 6 - 8 ohm voice coil excellent characteristics, ..... **3 for $1.95**

## TRANSMITTER TRANSFORMER

NO. 228. The transformer for Transmitter Power Supply, 600 Volt at 200 MA and 4 Amp. filaments of 3 to 24 Volts. Also 5 Volts at 4 amperes for rectifier Shipping Weight 12 lbs. ..... **$9.50**

## MILITARY POWER TRANSFORMERS

NO. 229. Convert your military receivers without rewiring the filament. "A" type supplies 500 VCT at 50 MA, 5V. at 2A. and 24V. at ½ A. "B" type supplies 500 VCT at 50 MA, 5V. at 2A. and 12V. at 1 Amp. State whether A or B type desired. Shipping Weight 4 lbs. ..... **$2.95**

## HOME WORKSHOP GRINDER KIT

NO. 230. Easily assembled 110V AC or DC ball bearing fully enclosed motor from Army surplus dynamotar. Purchaser to make simple changes and shaft extensions, detailed instructions and all parts supplied. Motor approximately 5,000 R.P.M. Ideal for tool-post grinder, flexible shaft tool, model drill press, saw. Shipping Weight 6 lbs. **$3.95**

## HEARING AID HEADPHONES

NO. 216. The Army's best — eliminate flat ears and outside noise. Complete with transformer for conversion from low to high impedance. With cord and plug complete.
Add postage for 1 lb. ..... **$1.00**

## TELEVISION CONDENSERS

NO. 221. Tobe triple .2 MFD 4000 V.D.C. Filter used on Army radar. Ideal filter for H.V. television set. Add postage for 3 lbs. ..... $3.95

NO. 222. G.E. Pyranol capacitor .25 MFD 6000 V.D.C. Porcelain insulated, an outstanding buy for high voltage filters. Add postage for 3 lbs. ..... $3.95

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# The HEATH COMPANY

BENTON HARBOR 15, MICHIGAN

# ELECTRONIC BARGAINS *for* EXPERIMENTERS *and* HOBBYISTS

ALL QUANTITIES LIMITED SUBJECT TO PRIOR SALES

### STANCOR FILAMENT TRANSFORMER

NO. 242. Heavy duty Stancor No. ST355 supplies 5V at 6 Amps, 5V at 3 Amps and 5V at 3 Amps from 220V 60 Cy. primary or ½ above from 110V. Cased type. Ship. Wgt. 7 lbs. Each **$1.50**

### G.E. THYRATRON TRANSFORMER

NO. 243. New G.E. Transformer supplies 2.5V at .100 KVA, has 3KV insulation 100V 60 cy. primary. Shipping Wgt. 13 lbs. Each **$9.50**

### RCA SATURABLE REACTOR TRANSFORMER

NO. 246. New RCA No. CRV30531 AC current 750 MA DC current 2 Amperes. Rated 1.75 henries. Shipping wgt. 4 lbs. Each **$1.00**

### 12.6V POWER TRANSFORMER

NO. 247. New cased 110 V 60 cy. Power Transformer. Supplies 440V Ct. at 60 MA, 6.3V at 2A. and 12.6V at 1 Amp. Excellent for military sets. Shipping Wght. 6 lbs. Each **$1.95**

### RCA INPUT TRANSFORMER

NO. 248. Heavy duty RCA No CRV-30529. Input has primaries 600 to 200 and 25 ohms secondary 250,000 ohms C.T. Shipping Wgt. 2 lbs. Each **$1.00**

### REPLACEMENT POWER TRANSFORMER

NO. 251. Excellent value transformers made by one of largest transformer companies. 110V 60 cy. Primary supplies 746 V Ct. at 150 MA. 5V at 4A and 6.3V at 4.5 Amps. Shipping Wgt. 7 lbs. Each **$2.95**

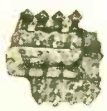
### FEDERAL POWER TRANSFORMER

NO. 252. New cased 110V 60 cy. Power Transformer. Supplies 480V CT at 50 MA and 6.3 V at 2.1 Amps. A beautiful transformer. Shipping Wgt. 4 lbs. Each **$1.50**

### HEAVY DUTY 6-12-24 VOLT VIBRATOR

NO. 253. A husky vibrator used on army transmitter. Rated 30 amperes at 6 Volts 220 cycle with contacts for 12 and 24 Volts, Synchronous type, has many industrial applications. Ship. Wgt. 3 lbs.

### 4 CHANNEL PUSH BUTTON TUNER



NO. 254. Permeability tuner from BC 728 containing RF, first detector, and oscillator coils. Covers 2 to 5 MC. Complete circuit diagram furnished. Shipping Wgt. 2 lbs. Each **$2.50**

### CONDENSER SPECIAL

NO. 255. An ideal oil filled power supply filter used in army 16 tube unit, has 2.5, 2.5 and 5 MFD all at 600V D.C. rating. Shipping Wgt. 3 lbs. Each **$1.50**

### AEROVOX TELEVISION CONDENSER

NO. 256. Aerovox Hyvol .05 MFD at 7500V. rating. Excellent television coupling condenser with mounting bracket. Shipping Wgt. 3 lbs. Each **$3.50**

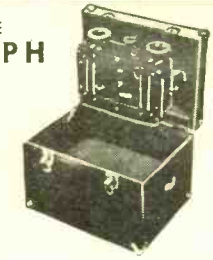
### BC 746 TUNING UNIT

NO. 257. Plug in transmitter tuning unit from army Walkie Talkie. Contains antenna and tank coils, tuning condenser, transmitting and receiving crystals. Ideal transmitter foundation. Shipping Wgt. 1 lb. Each **$1.00**
(Same as above except transmitter crystal in 80 meter amateur band ..... $2.50 each)

### T30 THROAT MICROPHONE

NO. 258. Makes excellent contact microphone for musical instrument or vibration pick-up. Shipping Wgt. 1 lb. ..... $1.00 each
Extension cord with switch for above ..... $ .50 each

### BRAND NEW ARMY AIR FORCE ASTROGRAPH



NO. 259. The case of this unit makes the finest tool and service kit ever designed. Plywood construction, 14 x 11 x 10" high, with 8 covered compartments in the bottom for repair parts, leather handle, steel reinforced covers, hinged lid. Also excellent as case for radio phonograph, movie projector, camera, shell case, fishing kit, picnic kit, etc. The astrograph itself, (which cost the government $125.00) makes an excellent contact printer, and can be used for a foundation for enlarger, strip map holder, etc. The case alone worth twice the give-away price of **$3.95**

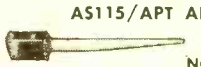
### AN27/ARN5 ANTENNA

NO. 260. Standard blind landing antenna system. Brand new in original crate. Ship. Wgt. 14 lbs. **$9.50**

### AS114/APT ANTENNA SYSTEM

NO. 261. New blade type antenna complete with case assembly, in original carton. Shipping Wgt. 9 lbs. **$7.50**

### AS115/APT ANTENNA SYSTEM



**$7.50**

NO. 262. New blade type antenna complete with case assembly, in original carton. Ship. Wgt. 11 lbs.

### AT38A/APT RADAR ANTENNA

NO. 263. New radar dome type antenna with mounting base and connections, in original carton. Ship. Wgt. 11 lbs. **$14.50**

### AN104A BLADE ANTENNA

**$1.50**

NO. 264. Standard blade antenna used on many military fighting planes with coaxial connection at base. Shipping Wgt. 3 lbs.

### BENDIX MT51C TRANSMITTER CONTROL BOX

NO. 235. Contains channel switch, emission switch, send receive switch, power switch and indicators for Bendix aircraft transmitters. Ship. Wgt. 3 lbs. **$5.50**

### BC 670B REMOTE CONTROL BOX

NO. 265. Motor starting control box has starting and stopping switch, indicator, cable and plug. Wooden case. Ship. Wgt. 6 lbs. Each **$1.95**

### BK 22 RELAY ASSEMBLY

NO. 266. Used on SCR 269 Radio Compasses. Contains stepping and control relays — junction box of aluminum. Brand new. Ship. Wgt. 7 lbs. Each **$3.95**

### HEINEMANN CIRCUIT BREAKER

NO. 267. Heavy duty type 7 Amp. 24 Volt D.C. Many uses around shop. Shipping Wgt. 2 lbs. Each **$1.00**

### CUTLER HAMMER MOTOR FIELD CONTROL

NO. 285. Rated 10 ohms. 3.2 Amps. Maximum. 6½" diameter with knob and mounting feet, can be used to regulate generator output voltage. Shipping. Wgt. 5 lbs. Each **$2.50**

### PENN THERMO RELAY

NO. 268. Thermo Relay with a range of 45° to 100° complete with 5 Ft. flexible cable to immersion bulb. Shipping Wgt. 6 lbs. **$3.50**

### B & W 11 to 14 MC TANK COIL

NO. 281. Plug in type used on BC 610 Transmitter. New, original cartons. Shipping Wgt. 2 lbs. Each **$1.50**

### DM 64A 12 VOLT DYNAMOTOR

NO. 269. Input 12V at 5 Amps. Output 275 Volt 150 MA. New. Shipping Wgt. 7 lbs. Each **$5.50**

### DM 32A COMMAND SET DYNAMOTOR

NO. 270. Part of 274N Command Receivers. Input 28 Volts, output 250V at 60 MA. Shipping Wgt. 4 lbs. Each **$5.50**

### DM 21 12 VOLT DYNAMOTOR

NO. 271. Used in Army BC 312 Communication Receiver. Input 12 Volts at 3.3 Amps. Output 235 Volts at 90 MA. New, original cartons. Shipping Wgt. 8 lbs. Each **$5.50**

### PE94C SCR 522 POWER SUPPLY

NO. 272. Complete dynamotor power supply for the SCR 522, operates from 28 Volts. Complete with controls, filters, etc. Original carton. Shipping Wgt. 34 lbs. Each **$8.75**

### PE101C BC645 POWER SUPPLY

NO. 273. Complete power supply for BC 645. Operates from 12 or 24 Volts. Supplies both AC and DC required. Shipping Wgt. 13 lbs. Each **$3.95**

### DM 35 12 VOLT DYNAMOTOR

NO. 274. New input 12 Volt at 18.7 Amperes. Supplies 675V at 275 MA or ½ above voltage from 6 volts. Excellent for auto use. Shipping Wgt. 11 lbs. Each **$7.50**

### PE 86 DYNAMOTOR

NO. 214. A popular 28 Volt receiver dynamotor used on present military equipment. Supplies 250V at 60 MA. Shipping Wgt. 4 lbs. Each **$5.50**

### GN 58 HAND GENERATOR

NO. 275. Makes excellent home lighting plant, operated by wind propeller, waterfall, gas engine, or hand crank. Reduction gear allows full output at slow speed; supplies 6 volts at 2.45 amp., 425 volts at .115 amp. New. Add postage for 28 lbs. Each **$7.95**
Handles for GN 58 ..... $ .50 each
Connecting cord for GN 58 with plugs CD1086 ..... $1.50 each

### COLLINS AUTOTUNE CONTROL HEAD

NO. 278. Brand new controls used on the ART/13, 100 Watt, Transmitter. Types 7, 8, 10, and 11 available. Get a spare while available as new cost is over $22.00 each. Shipping Wgt. 3 lbs. Price any type (mention when ordering). Each **$4.50**

### MC 432 VHF ANTENNA LOADING UNIT

NO. 279. Contains 2 pole, 5 position rotary switch with silver ceramic variable condensers, and coils for matching VHF Transmitter to AN109 antenna with 50 ohm line. Many useful parts. Shipping Wgt. 2 lbs. Each **$1.50**

### 148 OUTDOOR TELEGRAPH KEY

NO. 280. Rugged enclosed type for outdoor use, built for army to withstand hard useage. Complete with cord and PL55 plug. Shipping Wgt. 2 lbs. Each **$2.00**

### ONE KILOWATT ADJUSTABLE ANTENNA LOADING COIL

NO. 282. Huge porcelain coil 4" diameter 8¼" long, has 5 sliders for adjustments. Shipping Wgt. 5 lbs. **$3.50**

### 300 MA SELENIUM RECTIFIERS

NO. 209. Rated 300 MA at 36 Volts, complete with mounting brackets. Shipping Wgt. 1 lb. ..... 3 FOR $1.00

### DUAL SELENIUM RECTIFIER

NO. 283. Two units mounted on single bracket, each section rated 15V. at ½ Amp. Shipping Wgt. 1 lb. 2 FOR $1.00

**HOW TO ORDER • • • GIVE PART NUMBER AND DESCRIPTION . . . ADD POSTAGE FOR WEIGHT SHOWN. NO ORDERS UNDER $2.00 . . . WE WILL SHIP C.O.D.**

## The HEATH COMPANY

. . . BENTON HARBOR 15, MICHIGAN

# What's New in Radio

### CODE MACHINE

*Ultradyne Electronics* of Oswego, Oregon has announced production of a new radio code machine, the Model RCM-1.

Designed to provide efficient radio-telegraph code instruction, this model is a complete and self-contained unit for both sending and receiving prac-

tice. The machine is designed for class room operator training as well as for individual use.

The complete equipment consists of the radio code machine, code practice tapes, headphones, hand key, and a storage crate. The standard code practice tapes include a complete selection ranging from beginners' tapes (starting with over-all speeds of 5 w.p.m.) to those designed for advanced operator practice (up to speeds of 60 w.p.m. or more). Special tapes are also available to meet particular training needs.

The governor controlled tape-puller motor is continuously variable in speed over its entire range and maintains uniform speed at any setting of the speed control irrespective of normal power line fluctuations.

For literature describing the Model RCM-1 radio code machine in full write to *Ultradyne Electronics, Radio Code Machine Division,* Oswego, Oregon.

### LEAD-IN SUPPORTS

*Porcelain Products, Inc.* of Findlay, Ohio has introduced a series of lead-in supports for FM and TV.

Available for all popular types of lead-in cables, these units provide a rigid support for the lead-in wire, preventing it from twisting in the wind or going slack. The supports also eliminate annoying short circuits by giving quick moisture drainage at the support, yet holding the wire firmly without injury to the insulation.

Fabricated of porcelain, they are resistant to weather extremes, will not expand or contract allowing conductor to slip or crack the insulation. No taping or tying the conductor to insulator is necessary since they are constructed with a positive "Alligator" pressure grip which holds the lead-in wire taut without cutting or chafing.

For full details on this new line of porcelain lead-ins write direct to *Porcelain Products, Inc.,* Findlay, Ohio.

### CALL-LETTER CARDS

A novelty for radio amateurs has been introduced recently by *Robinson-Sherman* of New York.

The company is now offering personalized playing cards engraved with the amateur's call-letters. These novelty cards can also be supplied with a ham shack shot or family photo in place of ham calls, if desired.

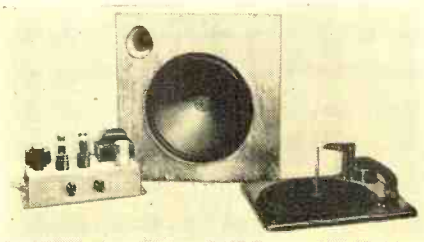
Interested hams should write to *Robinson-Sherman,* P.O. Box 169, Grand Central Station, New York 17, New York for full details and prices.

### CONVERSION KIT

Of particular interest to music lovers, the *David Bogen Co., Inc.* of New York has introduced its new PK High Fidelity System.

This new kit is for use both in the construction of custom-built consoles and for the conversion of old cabinets into modern high fidelity systems. The kit includes the company's PH10 amplifier; a dual hi-fi speaker consisting of a 12 inch Alnico V woofer and a *University* tweeter mounted with cross-over network and wired on a flat baffle, and the new *Webster* Model 148 automatic record changer. The changer is equipped with an *Astatic* 1J crystal cartridge, and wired so as to provide automatic disconnection of the pickup during the changing cycle.

The *Bogen* PH10 amplifier, which delivers ten watts at 5% distortion, has a peak power of 14 watts. A unique



feature of this amplifier is the multi-range tone control which provides four discrete response curves designed to meet the requirements of both AM and FM listeners, and provide excellent reproduction of both old and new records.

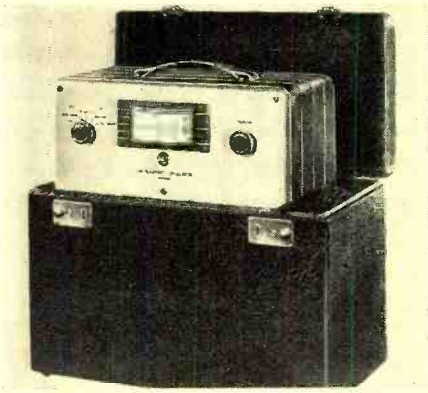
Complete instructions for assembling and mounting the system are included. For full information and prices write direct to *David Bogen Co., Inc.,* 663 Broadway, New York, New York.

### CARRYING CASE

A new portable carrying case, designed to hold any of the matched units of *RCA* test and measuring equipment has been announced by the Tube Department of *Radio Corporation of America.*

The latest aid to AM, FM, and television servicing, the new carrying case resembles a piece of luggage and is especially designed for transporting *RCA* test and measuring equipment to the job. The case is light in weight and ruggedly built to protect equipment and resist wear. It holds the equipment snugly and has an extra storage compartment for servicing accessories such as test leads, adaptors, and probes.

Styled in deep blue leatherette to harmonize with the blue-grey finish of



*RCA* test and measuring equipment, the case measures approximately 16 inches by 11 inches by 9 inches. It has a sturdy plywood frame, with a water-repellent covering, and features two luggage-type latches with locks and a key and a solid leather handle.

The new unit is available from *RCA* test and measuring equipment dealers or further information may be obtained by writing *Radio Corporation of America, RCA Victor Division,* Camden, New Jersey.

### MICROWAVE CALORIMETER

The measurement of absolute r.f. power in a series of frequency bands between 2600 and 26,500 mc. is now possible with a new "Calorimeter" developed by *De Mornay Budd, Inc.* of New York.

The new unit is a primary measuring device to give an accuracy of approximately 2 watts at average power readings of 100 to 500 watts. Although capable of measuring from about 5 watts upward, the percentage of accuracy increases rather than decreases with increase of power measured.

The heart of the apparatus is a compartmented glass water load internally connected inside a waveguide section that absorbs the entire energy. The limit of power measurement is that amount which causes circulating water in the water load to release dissolved gases at about 60 degrees centigrade.

By increasing the rate of water flow

**MONEY BACK GUARANTEE** — **We believe units offered for sale by mail order should be sold only on a "Money-Back-If-Not-Satisfied" basis. We carefully check on the design, calibration and value of all items advertised by us and unhesitatingly offer all merchandise subject to a return for credit or refund. You, the customer, are the sole judge as to value of the item or items you have purchased.**

## THE NEW MODEL 670
# SUPER METER

**A Combination VOLT-OHM-MILLIAMMETER plus CAPACITY REACTANCE, INDUCTANCE and DECIBEL MEASUREMENTS**

D.C. VOLTS: 0 to 7.5/15/75/150/750/1500/7500. A.C. VOLTS: 0 to 15/30/150 / 300 / 1500 / 3000 Volts. OUTPUT VOLTS: 0 to 15/30/150/300/1500/3000. D.C. CURRENT: 0 to 1.5/15/150 Ma.; 0 to 1.5 Amps. RESISTANCE: 0 to 500/100,000 ohms, 0 to 10 Megohms. CAPACITY: .001 to .2 Mfd., .1 to 4 Mfd. (Quality test for electrolytics). REACTANCE: 700 to 27,000 Ohms; 13,000 Ohms to 3 Megohms.

INDUCTANCE: 1.75 to 70 Henries; 35 to 8,000 Henries. DECIBELS: —10 to +18, +10 to +38, +30 to +58.

The model 670 comes housed in a rugged, Crackle-finished steel cabinet complete with test leads and operating instructions. Size 5½" x 7½" x 3". **28.40 net**

## THE NEW MODEL 770—AN ACCURATE POCKET-SIZE
# VOLT OHM MILLIAMMETER

**(Sensitivity: 1000 ohms per volt)**

**FEATURES:**

Compact—measures 3⅛" x 5⅞" x 2¼". Uses latest design 2% accurate 1 Mil. D'Arsonval type meter. Some zero adjustment holds for both resistance ranges. It is not necessary to readjust when switching from one resistance range to another. This is an important time-saving feature never before included in a V.O.M. in this price range. Housed in round-cornered, molded case. Beautiful black etched panel. Depressed letters filled with permanent white, insures long-life even with constant use. Specifications: 6 A.C. VOLTAGE RANGES: 0-15/30/150/300/1500/3000 volts.
6 D.C. VOLTAGE RANGES: 0-7½/15/75/150/750/1500 volts.
4 D.C. CURRENT RANGES: 0-1½/15/150 Ma., 0-1½ Amps.
2 RESISTANCE RANGES: 0-500 ohms. 0-1 Megohm.

The Model 770 comes complete with self contained batteries, test leads and all operating instructions **13.90 net**

## THE MODEL S-35—A POWERFUL
# REFLEX PROJECTOR

**COMPLETE WITH BUILT-IN DRIVER UNIT CONSERVATIVELY RATED AT 35 WATTS—HANDLES UP TO 55 WATTS WITHOUT BLASTING.**

**DRIVER UNIT MFG. BY WESTERN ELECTRIC**

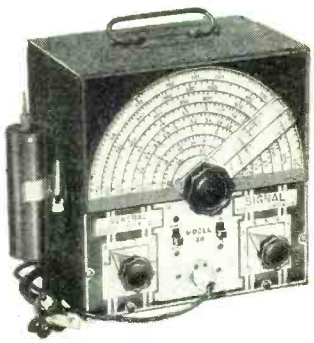
Heavy gauge aluminum in the main trumpet section completely eliminates blasting and blaring. New plastic diaphragm overcomes the resonant peaks of the old type; also it is absolutely impervious to atmospheric changes whereas the old type was subject to atmospheric corrosion. Complete unit unconditionally guaranteed for one year.

**SPECIFICATIONS:**

POWER (CONSERVATIVE)—35 WATTS; AIR COLUMN—3½ FT.; DISPERSION—80°; POWER (PEAK)—55 WATTS; BELL DIAMETER—15"; IMPEDANCE—8 ohms; FREQUENCY RANGE—130 to 5000 C.P.S. PROJECTION—½ mile; FINISH—Attractive two tone crystalline.

The Model S-35 Comes Complete with Built-in Driver Unit, ONLY **28.50 net**

## THE MODEL 88—*A COMBINATION*
# SIGNAL GENERATOR and SIGNAL TRACER



**SIGNAL GENERATOR SPECIFICATIONS:**

• Frequency Range: 150 Kilocycles to 50 Megacycles. • The R.F. Signal Frequency is kept completely constant at all out-put levels. • Modulation is accomplished by Grid-blocking action which is equally effective for alignment of amplitude and frequency modulation as well as for television receivers. • R.F. obtainable seporately or modulated by Audio Frequency.

**SIGNAL TRACER SPECIFICATIONS:**

• Uses the new Sylvania 1N34 Germanium crystal Diode which combined with a resistance-capacity network provides a frequency range of 300 cycles to 50 Megacycles. The Model 88 comes complete with all test leads and operating instructions. ONLY **28.85 net**

## THE NEW MODEL 247
# TUBE TESTER

***Check octals, loctals, bantam jr. peanuts, television miniatures, magic eye, hearing aids, thyratrons, the new type H.F. miniatures, etc.***

***Features:***

★ A newly designed element selector switch reduces the possibility of obsolescence to an absolute minimum.

★ When checking Diode, Triode and Pentode sections of multi-purpose tubes, sections can be tested individually. A special isolating circuit allows each section to be tested as if it were in a separate envelope.

★ The Model 247 provides a super sensitive method of checking for shorts and leakages up to 5 Megohms between any and all of the terminals.

★ 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.

Model 247 comes complete with new speed-read chart. Comes housed in handsome, hand-rubbed oak cabinet sloped for bench use. A slip-on portable hinged cover is indicated for outside use. Size: 10¾"x8¾" x5¾". ONLY.....

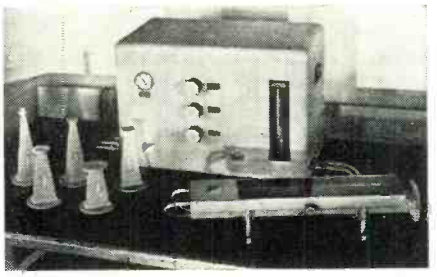
**ONLY $29.90 NET**

**20% DEPOSIT REQUIRED ON ALL C.O.D. ORDERS**

# GENERAL ELECTRONIC DISTRIBUTING CO.

**Dept. RN-2, 98 PARK PLACE NEW YORK 7, N. Y.**

and recalibrating, it is possible to increase the amount of absolute r.f. power measurement. The equipment is conservatively rated at 500 watts average power without regard to the



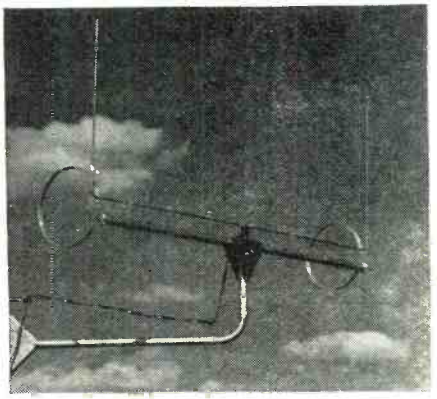
magnitude of peak pulsed power, with the present r.f. head. A higher power r.f. head is being designed and will be available at a later date.

Complete technical details covering the "Calorimeter" are available on request from *De Mornay Budd, Inc.,* 475 Grand Concourse, New York 51, New York.

### ALL-WAVE TV-FM ANTENNA

*Tricraft Products Company* of Chicago has introduced a new all-wave TV and FM antenna, the Model 500.

Designed for use in locations where roof installations are not permitted, the Model 500 features a full-sized antenna so designed that it may be used out of the window or porch; provides full coverage of both TV and FM bands; matches all sets with 300 ohm input; has a low standing wave ratio; weighs only 2½ pounds; and comes



complete with all mounting hardware, 35 foot 300-ohm line, and full instructions.

For further details on the Model 500 write direct to *Tricraft Products Company,* 1535 N. Ashland Avenue, Chicago, Illinois.

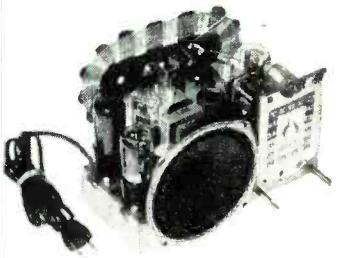
### COMPACT PREAMPLIFIER

In response to the demand for a flexible, compact preamplifier, *Brociner Electronics Laboratory* of New York has announced the availability of the Model A65 amplifier and a companion Model P6-300 d.c. power supply.

Permitting exact compensation for the widely varying recording characteristics in use in the past as well as today, the Model A65 amplifier provides 18 combinations of bass and treble curves. Turnover frequencies

(*Continued on page* 126)

# ROCK BOTTOM PRICES!
## ON ALL TOP QUALITY ITEMS



### CORONET 5 Tube Superheterodyne Receiver Kit

- Complete with plastic cabinet and carrying handle.
- 117V, AC-DC operated. Power supply rated at 30W.
- Tube Lineup—12SA7, 12SK7, 12SQ7, 35Z5, 50L6.
- Tuning range—540-1700 KC. Designed for fullest selectivity along entire band.
- Built-in loop antenna.
- All parts engineered to fit; no additional cutting or drilling to do.
- Nothing else to buy except solder. Kit packed complete including tubes.

This kit combines an excellent educational program with many hours of building and listening pleasure; particular stress being placed upon ease of construction. Easy step by step instructions are furnished, along with pictorial diagrams and voltage and resistance charts for efficient maintenance and further experimentation. Many circuit features employed by big name manufacturers are employed to make this set, when completed, comparable to any 5 Tube AC-DC Radio now on the market.

LIST PRICE **$11.95**

*Dealers, educational institutions, write for quantity discounts.*

### BY-PASS CONDENSERS

Why pay up to four times as much? These are brand new guaranteed condensers that usually sell for much more. Try a batch—return for full refund if not satisfied.

| CAP | WVDC | PER 10 | PER 100 |
|---|---|---|---|
| .001 | 600 | 54c | $4.86 |
| .005 | 600 | 54c | 4.86 |
| .01 | 600 | 54c | 4.86 |
| .02 | 600 | 63c | 5.67 |
| .05 | 600 | 72c | 6.48 |
| .1 | 600 | 90c | 8.10 |

### HOOK-UP WIRE

| | Per C | Per M |
|---|---|---|
| #12 Stranded | $1.15 | $9.00 |
| 14 Stranded | 1.05 | 8.50 |
| 16 Stranded | .95 | 7.50 |
| 18 Choice Sol or Str. | .75 | 6.50 |
| 20 Choice Sol or Str. | .65 | 5.50 |
| 22 Choice Sol or Str. | .55 | 3.75 |
| 24 Choice Sol or Str. | .45 | 3.50 |

### SOLDERING IRON

115V—100 W.....ea. **$1.50** 10 for **$13.50**

## RADIO CABINETS BELOW MANUFACTURERS COST

286

No. 286. Leatherette covered. 9½x12½x5". Leather handle. Ivory—Brown trim. Cutout as shown..... **$1.50**

No. 285. Some as above. Brown and Tan..... **$1.50**

261

No. 261. Leatherette covered. 12x11½x7½". Cutout as shown. Plastic handle. With grill and dial glass..... **$1.95**

### WAFER SWITCH

4 Gang. 1 Pale each gang, 12 position. Wafers easily removed for many additional switching requirements. Measures 3¼" overall length x 1⅞" overall diameter. ¼" Dia. Shaft ½".

**75c** each.....10 for **$5.80**

### F.M. CONVERTER CHASSIS

Completely wired except for adapter. Converts from 42-50 MC F.M. band to 88—108 F.M. Band. Brand new but needs aligning. 7N7, schematic and aligning instructions furnished.

$1.90 each.....10 for **$17.50**

### PAPER COND. ASSORTMENT

100 assorted paper tubular and molded paper bypass condensers. Wide assortment of standard capacities at 150V, 200V, 400V and 600 V. Every condenser guaranteed. Kit of 100.....**$3.85**

### SPEAKERS

**P. M. SPEAKERS**

Alnico V Magnet. All fully guaranteed.

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|---|---|---|---|
| 3".... | $0.98 | With 50L6 Transformer.... | $1.19 |
| 4".... | 1.19 | With 50L6 Transformer..... | 1.39 |
| 5".... | 1.29 | With 50L6 Transformer..... | 1.49 |

**EXCEPTIONAL BUY!!!**

5" P.M. Speaker. Alnico V Magnet. Minimum Quantity.....10 for **$7.50**

With 50L6 transformer.....10 for **9.50**

### DYNAMOTOR

Model ML-3420-194. 27.5V, 4 amp. input. 325V. 200 MA output. New.....**$2.95**

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### WAR SURPLUS TRANSMITTING TUBES

Each tube packed in individual, originally sealed carton. Every item covered by our usual 100% money back guarantee. Don't wait till there are no more to order! Supplies limited.

Deduct 10% from tube orders of $20.00 or over.

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|---|---|
| WL1B32/532A | $3.95 |
| 1B23 | 34.50 |
| 2X2 | 1.00 |
| 3BP1 | 3.95 |
| 3GP1 | 2.95 |
| 5BP1 | 2.95 |
| 5BP4 | 4.95 |
| 5CP1 | 3.95 |
| 304TL | 1.49 |
| 371B | 2.95 |
| WL-531 | 17.95 |
| 705A | 1.95 |
| 860 | 3.00 |
| 832A | 2.95 |
| 872A | 2.25 |
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| 1625 | .40 |
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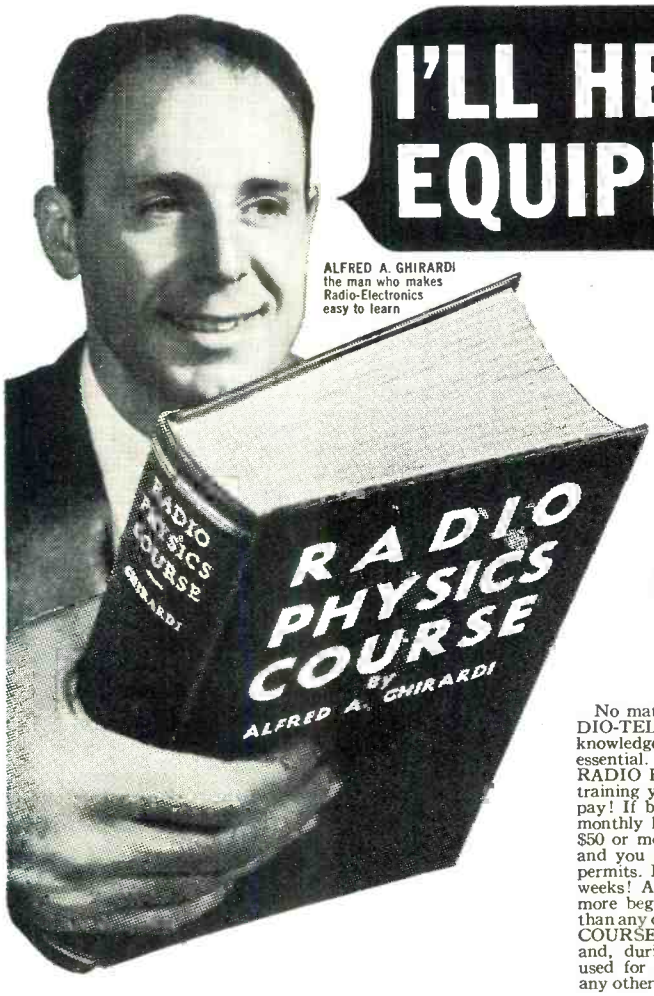
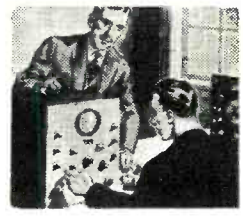



ALFRED A. GHIRARDI
the man who makes Radio-Electronics easy to learn

A few nights of **THIS**



Can pave the way to a prosperous future of **THIS**

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No matter what part of ELECTRONIC-RADIO-TELEVISION work you plan to enter, a knowledge of basic fundamentals is absolutely essential. Ghirardi's world-famous 972-page RADIO PHYSICS COURSE gives exactly the training you need—at a price you can afford to pay! If broken into "course" form and sent as monthly lessons, you'd regard it as a bargain at $50 or more! Instead, you buy it for only $5—and you progress as fast as spare reading time permits. Many have completed it in only a few weeks! Actually, this big 4-lb. book has given more beginners their start in Radio Electronics than any other book or course! RADIO PHYSICS COURSE is more widely used for home study and, during World War II, was more widely used for Signal Corps and Navy training than any other book of its kind.

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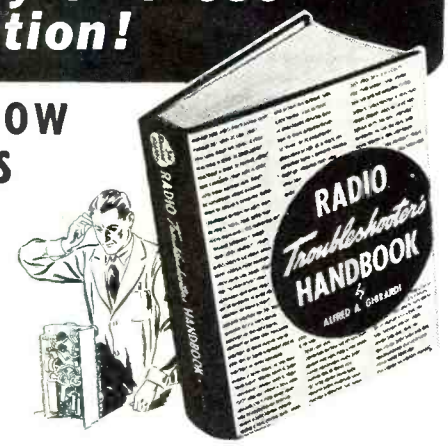


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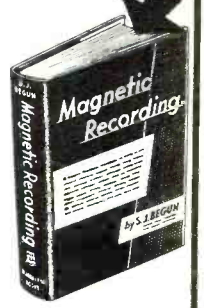


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## Triode Amplifier

(*Continued from page 44*)

loudspeaker connecting cord in a tube socket. This principle of "no two identical plugs" has been carried throughout the unit in order to avoid any possibility of making incorrect connections.

The relative placement of the various component parts may be seen from an examination of the photograph of Fig. 1, while the internal view is shown in Fig. 5. Notice that adequate space is available, even on these small chassis, for all parts and for the easy wiring and servicing of the units. The filament transformer, mounted inside the power supply, is for the tuner. This was done for two reasons, i.e., the winding on the 515-J power transformer was not adequate to take care of the added drain, and as most tuners are wired with one connection of all heaters grounded a separate transformer was deemed necessary to supply this voltage. This allows for grounding the center tap of the 6AS7G heater winding which permits a still further reduction of hum.

Construction of the amplifier is not difficult but a few hints may make the job even easier. Mount the amplifier transformers first and complete the wiring of the output plug. Then mount the three sockets and proceed with the remainder of the wiring. It will be necessary to mount the volume control last after the wiring of the input connector is completed. It is not necessary to use shielded wire for the input grid circuit, an advantage in preventing attenuation of the high frequency response. All ground connections are made to a bus which is terminated at the chassis at the input tube mounting. The internal shields of all *ADC* transformers, being isolated from the cases, can be connected with the ground bus thus allowing electrostatic shielding without causing a grounding loop.

The power supply is wired with a cabled harness made after the wire is all installed. A ground bus is used here and it terminates at the chassis at the power transformer. This means that the 4 μfd. oil-filled input condenser must be mounted on its insulating washers in order to prevent a ground loop but as the case is at ground potential there is no danger of shock. Each of the two power resistors requires two slides, the reason for which will become apparent shortly. When all the wiring is completed and checked against the schematic of Fig. 3; the preliminary adjustments can be made. An ohmmeter will be required for this operation.

As the entire plate current drain amounts to some 210 milliamperes, including that of the tuner which requires about 60 milliamperes, the full amount cannot be passed through the series-connected heaters of the two 12AU7 tubes. They are shunted with approximately 360 ohms resistance on $R_1$. It is well, however, to set the first slider at about 275 ohms as a starting point from which the final adjustment is made. The second slider can be set about ½ inch farther along the resistor. This is set, ultimately, to give just 200 volts on the plates of the output stage.

If no tuner is to be used with this amplifier it will be necessary to bleed off the equivalent plate load through $R_2$. Make up a five-prong plug, with pins 3 and 4 strapped together. Insert this plug in the proper socket on the power supply. Next insert the tubes and connect the amplifier power supply cord to the line.

It will now be necessary to make several adjustments but these need not be either difficult or time-consuming. Measure the voltage between the plate and cathode of the 6AS7G. The reading should be 200 volts. This value can be obtained by adjusting the second slider on $R_1$. Measure the voltage from ground to the filament heating connection on $R_1$. This should be about 25 volts after adjustments have been made. If, however, the slide was set with but 275 ohms in the circuit this value will be something below this figure. The second slide on $R_2$, connected to pin 3 of the five-prong socket, must pass about 60 milliamperes. Adjust for this value. The slide on $R_2$ will have to be set to give about 225-250 volts to the input tubes and also to the plate supply for the tuner (pin 2 of the five-prong socket). Recheck the plate voltage of the 6AS7G and the filament string, making such minor changes as are necessary.

Now turn your attention to the amplifier chassis and make the one adjustment necessary. Most output

Table 1. Comparison of tube characteristics of the 6AS7G, two 2A3's, and the 300-A.

| | 6AS7G | 2—2A3's | 300-A |
|---|---|---|---|
| Plate voltage | 200 v. | 250 v. | 250 v. |
| Grid voltage | —95 v. | —45 v. | —52 v. |
| Peak a.f. voltage (grid-to-grid, full output) | 190 v. | 90 v. | 50 v. |
| Zero signal plate current (total) | 125 ma. | 120 ma. | 40 ma. |
| Plate load resistance | 4000 ohms | 5000 ohms | 3000 ohms |
| Max. signal power output | 11 w. | 7 w. | 4 w. |
| Total harmonic distortion | 4% | 5% | 5% |
| Tube cost (approx.) | $4.25 | $4.00 | $8.60 |

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transformers do not have identical resistance windings on the primary. Connect a low range, high resistance voltmeter to the two plate terminals of the output tube and adjust $R_7$ for zero voltage reading. If this is set at about mid-position before beginning the adjustment there is little chance of causing the voltmeter to read backwards. A zero-center microammeter with a high external resistor is an ideal instrument with which to make this adjustment. Once this adjustment is made, lock the shaft of $R_7$ with the lock provided.

Table 1, already mentioned, shows what can be expected from the 6AS7G as compared with a pair of 2A3's operating as class A triodes, or a single 300-A similarly used. It is interesting to note that at a lower plate voltage and with but very slightly more plate current the single tube will give almost twice as much power output as the two tubes and with a lower harmonic content, less space, and at no increase in price.

The quietness of operation, absence from hum, and stability of operation do not show up in such a tabular presentation. It is necessary to listen to the amplifier go through its paces to really appreciate its superiority on all of these counts. —30—

## METERING CIRCUIT

By LEON G. WILDE

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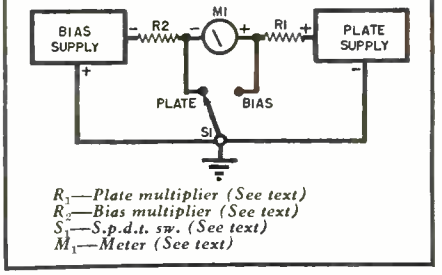
**The advantages of this circuit are extra simplicity resulting from the use of a single-pole switch, low voltages on the switch and wiring, and constant load on the power supplies which permit the use of an inexpensive meter for reading bias.**

—30—

Diagram of transmitter metering circuit.




*$R_1$—Plate multiplier (See text)*
*$R_2$—Bias multiplier (See text)*
*$S_1$—S.p.d.t. sw. (See text)*
*$M_1$—Meter (See text)*

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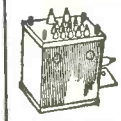

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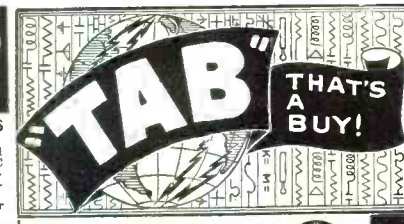


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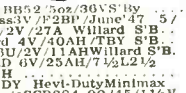

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| 1P5GT | .69 | 6AF6 | .86 | 7Q7 | .86 | 701A | 3.95 | 1622 | 1.69 |
| 1P24 | 2.95 | 6AG5 | 1.09 | 7S7 | 1.04 | 702A/702B | 3.49 | 1625 | .40 |
| 1Q5GT | 1.04 | 6AK5 | 1.05 | 7V7 | 1.04 | 703A | 4.90 | 1626 | .45 |
| 1S5 | .70 | 6AL5 | .98 | 9-3Ballast | .59 | 704A | 1.75 | 1629 | .58 |
| 1T4 | .69 | 6AK5 | .89 | 9JP1 | 3.95 | 705A/ RK60 | .75 | 1641/ RK60 | .75 |
| 1T5GT | 1.04 | 6AS6 | .98 | 9LP7 | 2.69 | 807 | 2.25 | 1851 | 1.23 |
| 1V | .86 | 6B4G | 1.15 | 10 | .67 | 807B/ 2K28 | 10.98 | 2050 | .69 |
| 2A3 | 1.04 | 6B5 | 1.54 | 10-4BBallast | .59 | 710A/ 8011 | 2.75 | 2051 | .88 |
| 2A5 | .86 | 6B8 | 1.26 | 10Y | .60 | 7130 | 1.63 | 7193 | .38 |
| 2A6 | 1.04 | 6B8G | 1.15 | 12A6 | .23 | 715B | 8.90 | 8013A | 3.95 |
| 2A7 | 1.04 | 6B8H | 1.54 | 12AH7GT | .87 | 717A | 1.49 | 8016 | 1.47 |
| 2B7 | 1.26 | 6C4 | .27 | 12C8 | .39 | 722A/ 287A | 9.95 | 8020 | 3.49 |
| 2C21/1642 | .81 | 6C5 | .54 | 12DP7 | 12.95 | 723 | 4.95 | 9001 | .40 |
| 2C26 | .59 | 6C6 | .71 | 12GP7 | 14.75 | 723A | 5.50 | 9002 | .59 |
| 2C34/RK34 | .55 | 6C8G | 1.05 | 12H6GT | .39 | 723AB | 5.90 | 9003 | .49 |
| 2C40/446A | .75 | 6C21/ 10TH. | 24.90 | 12J5 | .39 | 725A | 24.95 | 9004 | .40 |
| 2C43/464A | 4.49 | 6D4 | 1.25 | 12K8 | .85 | 802 | 2.95 | 9006 | .40 |
| 2C44 | 1.69 | 6E5 | .71 | 12Q7GT | .70 | CRC/814 | 2.70 | C6J | 4.95 |
| 2D21 | 1.20 | 6F6/1613 | .69 | 12SA7GT | .64 | CK1005 | 4.95 | CK1006 | 7.95 |
| 2E22 | 1.45 | 6F8 | 1.04 | 12SC7 | .70 | CRD72 | 1.85 | CRD12 | 1.85 |
| 2E25/HY65 | 3.49 | 6G6G | 1.04 | 12SH7 | .71 | FG27A | 9.90 | F127A | 18.00 |
| 2J21/725 | 12.95 | 6H6G | .49 | 12SJ7 | .64 | FG32A | 4.50 | FG27A | 9.90 |
| 2J26 | 12.95 | 6J4 | .95 | 12SJ7GT | .59 | FG104 | 1.15 | FG104 | 14.95 |
| 2J31 | 16.95 | 6J5 | .56 | 12SK7 | .58 | FG105 | 2.25 | FG105 | 11.95 |
| 2J33 | 14.50 | 6J6 | .95 | 12SL7GT | .86 | FG166 | 49.00 | FG166 | 49.00 |
| 2J34 | 18.95 | 6J7 | .70 | 12SQ7 | .58 | GL434 | 6.95 | GL434 | 7.95 |
| 2J42/ 700A | 29.95 | 6K5G | .86 | 12SR7 | .39 | GL534/ 1521 | 1.95 | GL534/ 1521 | 1.95 |
| 2K25 | 24.49 | 6K6GT | .69 | 14B6 | .69 | M55B/ 6J4 | .39 | M55B/ REL36/ 6J4 | .98 |
| 2K28 | 10.98 | 6K7 | .70 | 14R7 | .86 | RK18 | 2.98 | RK18 | 2.98 |
| 2K29 | 6.98 | 6K7G | .64 | 15E | 1.39 | RX215 | 7.95 | RX215 | 7.95 |
| 2V3 | 1.96 | 6K8 | .86 | 24G/3C24 | .69 | UX6653 | .69 | UX6653 | .69 |
| 2V3G | 1.05 | 6L5 | 1.04 | 25B6 | 1.98 | VR90/0D3 | .74 | VR90/0D3 | .74 |
| 2X2 | .49 | 6L6 | 1.04 | 25Z5 | .53 | VR92 | .23 | VR92 | .23 |
| 3A4 | .70 | 6L6M/1622 | .90 | 25Z6GT | .59 | VR105/ OC3 | .74 | VR105/ OC3 | .74 |
| 3B7/1291 | .95 | 6L7 | .75 | 28D7 | .39 | VR150/ OD3 | .90 | VR150/ OD3 | .90 |
| 3B24 | 1.29 | 6N7/1635 | .85 | 30 | .39 | WE215A | 1.80 | WE215A | 1.80 |
| 3BP1 | 1.49 | 6P5G | .94 | 31 | .39 | WL468 | 9.95 | WL468 | 9.95 |
| 3BP1A | 2.95 | 6S7 | .87 | 32L7GT | 1.19 | WL531 | 9.95 | WL531 | 9.95 |
| 3C23 | 4.95 | 6SA7 | .54 | 35A5 | .70 | WL619 | 20.00 | WL619 | 20.00 |
| 3CP1/ 1808P1 | 4.95 | 6SA7GT | .49 | 35L6GT | .58 | | | | |
| 3D22 | .34 | 6SC7 | .71 | 35W4 | .44 | | | | |
| 3D6/1299 | .85 | 6SG7 | .71 | 35Z5GT | .45 | | | | |
| 3E29/829B | 3.85 | 6SH7 | .69 | 37 | .78 | | | | |
| 3GP1 | 4.95 | 6SJ7 | .72 | 38 | .39 | | | | |
| | | | | 39/44 | .39 | | | | |

**TUBE SPECIALS!**

**SNOOPERSCOPE INFRARED** Image-Converter Tube HiSensitivity simplified design. 2" dia., Willemite screen-Resolution up to 350 lines/in. Complete data & Tube. "TAB" SPECIAL ... $10.98

12DP7 GE Magnetic Defl. Television CR & Data SPECIAL $12.95, 2/$25; 10/ $115.00

5FP7—5" CR Tube SPECIAL $1.49; ... 2/ $2.75

9LP7—9" CR Tube SPECIAL $2.69; ... 2/ $4.98

6L6 Metal RCA Kenrod SPECIAL ea. 89c; ten for $8; 100 for ... $70.00

866A Combination Tubes Socket Xfmr ... $5.95

872A Combination Tubes Socket Xfmr ... $12.95

G.E. 6L43A similar 7C29/ 1KW, HF, RF ... $7.95

REL36 ACORN similar 6J4. gnd Grid. SPEC. ... .98

**RECTIFIERS**

SelFederal 100ma 79c; 200ma 98c; 2 for $1.98 Sel CT 18Vin/12 out 1.5 Amps ... $1.49

| In | Out | BRIDGE TYPE Amps | Price |
|---|---|---|---|
| 18 | 14 | 1.35 | $2.49 |
| 18 | 14 | 3.5 | 3.49 |
| 18 | 14 | 5. | 4.85 |
| 18 | 15 | 11. | 9.95 |
| 18 | 15 | 18. | 14.95 |
| 18 | 15 | 27. | 22.95 |
| 36 | 28 | .32 | 1.49 |
| 36 | 28 | 3.5 | 5.75 |
| 36 | 28 | 5. | 7.50 |
| 36 | 30 | 11. | 17.95 |
| 36 | 30 | 18. | 26.95 |
| 36 | 30 | 27. | 36.95 |
| 90 | 75 | 0.15 | 1.49 |
| 210 | 100 | .04 | .49 |

**ELECTROLYTIC CONDENSERS**

Famous Make—Specials! FP Type 30MFD/450V & 2x 20MFD/255V ... 10MFD/450V & 2x20MFD/25V, Both ... $0.59

FP 50MF/350V $.39; 10/ $3.50; 100/ $25.00

Write for Complete List—Quantity Prices

**TRANSFORMERS**

115V/60cy input

7500 or 1500V'Doubler/35ma ... $15.95

10800VCT or 21000V DBLR/95ma ... 19.95

TV Xfmr 2500V/10ma, 2.5V/1.75A, 6.3V/6A KENYON S13336 or equiv ... 8.95

1200VCT/300ma ... 5.95

10V/8A/2KV ... 6.95

500VCT/60ma,6.3V/4A HmtcllyCsd ... 1.29

5V/115Amp ... 10.95

2.5V,10A/10KV ... 3.98

Write for Complete XFMR List—Quantity Prices

**RELAYS—Famous Makes**

CLARE A12280 / 115V-60cy 3SPDT&3SPNC ... $2.98

CLARE Octal based 115 VAC/DPNC&SPNO ... 3.98

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S'DUNN 17AXX109/ 115VAC / SPNO/6to30A cts ... 1.98

LEACH 115VAC/DPDT/ 10AmpContacts ... 1.98

A Bradley 702/110VAC/ 3PSTD break 25Amp ...

Potter & B 115VAC/ DPNO/8Acontacts ... 1.79

CLARE VAC Nitrogen sld SK5010/DPDT/18-28V 3 Amp Cts octal base @ $1.49; w/115VAC rect. ... 1.98

Write for Complete Relay List—Quantity Prices

**AMPLIFIER KITS**

**High Fidelity**

A Hi-Fi circuit with perfect linear response, phase inverter & full tube complement featuring 2-2A3 PP output, 6SJ7&6SN7. All parts, tubes, controls, diagram & remarkable RCA Audio Amplif Chassis described below. Less Output Xfmr. THIS IS A TRULY GREAT BUY AT ... $14.95

17.5 WATT AMPLIFIER KIT—Similar above with all major components except 2-1619/6L6 delivering 17.5 WATTS. ... $16.50

14-Watt AMPLIFIER KIT—Similar above except 2-6V6GT delivering 14 Watts. 17.5 OR 14 WATT KIT—less outpt Xfmr. Only ... $12.95

RCA AUDIO AMPLIFIER CHASSIS — for AMPLIFIER KITS. Heavy duty Porcelain'ed chassis. Gray rust-proofed 7¼x12¼x2¼". 9 Amphenol sockets incl 6 octal 3 inpts, cutout for pwr transf & choke. Chassis marked for 2mic, Vol, Tone, Fuse, Tubes (7). Complete with 3FP triple section Electrolytics. ... $4.00

**VOLTAGE REGULATORS**

CONSTANT V' REG NEW RAYTHEON in95-130V/60cy; Output 115V/60cy Csd. ... $10.95

RAYTHEON—in 198 to 242V inpt/50-60cys; Output 220V/500Watts/0.5% Rgltn Rack mtg. ... $36.00

SOLA CONSTANT V'REG USN Cased in 95to190V/50-60 cys; Output 115or220V 2KW/17.4 Amps/ Constant Duty, 1% Regulation LN*. ... $130.00

Same Unit NEW, USN Cost $369. Only ... $162.00

Variac 200B/175Watt/0-135V GR ... $10.95

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100R/0-230or270V/2KW/115 or 230V in ... $39.95

POWERSTAT in 115V/out 0-130V/1KW ... $18.00

**FILTER CHOKES**

13.5Hy/1Amp/42ohm/ 17KV ins. ... $54.00

15-29Hy/150ma Swinging Cased ... 2.95

12HY/300ma ... 3.95

3HY/40ma ... 3 for 1.00

15HY 400ma or 20HY/ 300ma/12KV ins. ... 7.95

8HY/150maNewUTC crckedBkltT'Bd. 2 for 2.25

50HY/125ma Csd ... 1.95

8HY/100ma ... 1.10

12HY/275ma ... 3.29

30HY/50ma 49c, 5 for 2.00

15HY/85ma 69c, 5 for 3.00

**TUNGAR BULBS**

| | |
|---|---|
| 20X672* | $2.95 |
| 199698* | 2.95 |
| 289881* | 2.50 |

**MAZDA PL**

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|---|---|
| 47**Bx 10 | .50 |
| 49**Bx 10 | .60 |
| 64** @ | .07 |
| S6/T** | .15 |
| 10 for | 1.39 |
| 100W/20V** | .25 |
| 313/28V** | .10 |
| 323/3V** | .10 |

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|---|---|
| C1249/12VGR 25 for | 1.00 |
| Sealed Beam 4522/ 250W | 1.49 |
| 4560/ 600W | 3.50 |

TEL. Slide Lamps 6, 24, 30V 18c ea., 100 for $15

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|---|---|
| NE2—100 Qty | $4.50 |
| NE16/991. | .25 |
| NE51/NE20 | .08 |
| Qt 100—NE20 | 6.00 |

**Acorn Sockets**

5 for ... 1.00

**SOCKETS for**

| | |
|---|---|
| 2X2HV | .30 |
| 705/715 | .69 |
| 803/304TL | .90 |
| 807 | .27 |
| 829/832 | .25 |
| 866 | .24 |
| 872/211 | .49 |
| Diheptal | .69 |
| Magnal | .54 |
| Loktal 49SSL | .24 |
| Octal 7888 | .08 |
| Octal 49SS8 | .15 |
| Min 59500 | .12 |
| Min & SH | .25 |

**DYNAMIC MIKE & XFMR Special!**



A Terrific Bargain! Combination high gain dynamic mike transformer (UTC/Super Elec. 3wdg, 600CT&4000 ohms tapped 250 & 150 ohms. FullV shielded H'sld) plus excellent fidelity dynamic mike. While they last. $1.49

Both for ... $2.49

# DO YOU KNOW?

By DAVID SCOTT

28. Describe the image dissector tube.

A. *In the image dissector tube the image is focused on a photocathode which releases electrons over its surface exactly proportional to the light focused on it. This "electron" image moves down the tube and is brought to a focus at the plane of an aperture. The image is scanned vertically and horizontally by magnetic deflection coils at the proper speeds across this aperture. Inside the aperture is an eleven-stage electron multiplier giving a total gain of over 100,000.*

29. Describe the electron storage action of the iconoscope.

A. *The mosaic, which is illuminated through a lens by the scene to be transmitted, possesses the properties of photo-sensitivity and electrical insulation (capacitance). The photo-sensitive property releases electrons, and the insulation characteristic preserves the resulting charge deficiency. This makes it possible to use the light that falls on the image between passages of the scanning beam, i.e., every 1/30 of a second. This added light which is stored up makes the iconoscope much more sensitive than previous tubes.*

30. Why is there a loss in the stored charge of the iconoscope?

A. *Loss of stored charge results from the released secondary electrons not being collected by the anode but returning directly to the globules they were released from or to adjacent globules. The actual efficiency is only 5% to 10% of that theoretically possible due to the low value of the electric field on the surface of the mosaic available for draining off the photoelectrically emitted electrons.*

31. How can the sensitivity of the iconoscope be increased?

A. *Sensitivity of the iconoscope can be increased with bias lighting.*

32. What is bias lighting?

A. *Bias lighting consists of lighting the sides and rear walls of the iconoscope by means of small flashlight bulbs.*

33. What is the image iconoscope?

A. *The image iconoscope was developed for further sensitivity and for improvement of the depth of focus of the lens systems. The image iconoscope is a combination of the image dissector and the ordinary iconoscope.*

34. Describe the action of the image iconoscope.

A. *A transparent plate is coated on its back side with photoelectric globules. As this plate is illuminated an electron image comes off which is moved off and strikes a second anode (mosaic) capable of giving off many secondary electrons. These many secondary electrons coupled with the storage action plus the fact that there is a strong field to absorb the photoelectrically emitted electrons make it much more sensitive than the plain iconoscope.*

35. What are the advantages of the image iconoscope?

A. *Lenses of short focal length and smaller aperture opening (greater focal depth) can be used.*

36. Describe the action of the orthicon.

A. *In the orthicon a beam of low velocity electrons is used. Hence there is no secondary emission to cloud the picture with spurious signal but likewise there is less signal. However, since the beam is of low velocity and the field is fairly strong, all of the scanning electrons can be collected and utilized with the photo-electrons in the stored charge to achieve 100% efficiency. Focusing is accomplished by using three fields. One is axial for the forward motion. The horizontal plates angle the beam up and down the vertical plates from side to side. These up and down and forward motions can be made to occur at right angles at all times thus maintaining the focus without tangential spreading.*

37. What are the drawbacks of the orthicon?

A. *The greatest drawback to the orthicon is that low velocity beams are difficult to focus and are easily disturbed by stray fields. Adequate shielding is therefore necessary.*

38. What are the advantages of the orthicon?

A. *Advantages of the orthicon are that it is 10 to 20 times as sensitive as the iconoscope, there is no spurious signal to shade the picture, it has greater contrast, high resolution, and high signal-to-noise ratio.*

39. Describe the grid of an electron gun.

A. *The control grid is a nickel sleeve and cap with a small aperture. Electrons going through the grid are thus confined to a narrow angle.*

*(To be continued)*

# Complete 8-Tube Radio-Amplifier Kit with Short Wave and 12" Coaxial Speaker—$37.95

BUILD THIS

## 8-TUBE HI FIDELITY RADIO AND AMPLIFIER

8-Tube Kit

$37.95

● 8-INCH SLIDE RULE DIAL ● RECEIVES BROADCAST and 19 to 49 METERS ● PUSH PULL OUTPUT TUBES ● BASS BOOST TONE CONTROL ● EVERYTHING FURNISHED ● CHASSIS SIZE 9½ x 11 x 8" HIGH ● BEST RADIO KIT VALUE IN THE WORLD

Here is something new in radio. A real 15 watt power amplifier with bass and treble controls. Has extra gain stage for crystal or dynamic mikes. And on the same chassis, a standard superhet radio receiver. We furnish all parts, knobs, escutcheon plate and tubes: 6SA7, 6SK7, 6SR7, 6SN7, 6SJ7, two 6V6 and 5Y3. No cabinet. Extra care in designing the power supply section assures low hum level, making this unit ideal for recording as well as P.A. use. We furnish everything as well as schematic diagram and photos of the completed chassis. Weight 26 lbs. **$29.95**

**PRK-24.** Radio-Amp. Kit with 12" P.M. speaker. With tubes.....Net

**CPR-15.** Exactly the same kit as the PRK-24 kit, except it is furnished with a 12" Cinaudagraph wide range speaker. (Has built-in high frequency tweeter.) **$37.95**

This is our finest kit.....Net

### 12-WATT AMP. KIT, $10.95

**KIT MODEL AC-12.** 12 watt amplifier kit. Ideal for high quality record player as well as public address or recording amplifier. Matched component parts, ready punched chassis pan. One control fades from phono to microphone. Gain enough for crystal or dynamic microphone. 100 mil power transformer, for 110 volt AC 60 cycle operation. Priced complete with tubes: 2—6V6, 6SN7, 6SH7 and rectifier. Diagrams and photos furnished. Kit AC-12. Net **$10.95.** 12" Alnico 5 PM speaker extra; crystal microphone and desk stand $4.95 extra.

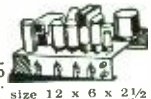
The above AC-12 amplifier wired and tested ready to operate net $14.95. Specify Stock No. AC-1125. 12-inch Alnico V PM speaker $5.95 extra. Crystal mike and desk stand $4.95.

### WALNUT ARM CHAIR CABINET, $29.95

**WILL HOUSE CRP-15 KIT**

Beautifully made walnut armchair cabinet. Outside dimensions 24" high, 16½" deep and 27" wide. Ample room for radio receiver 14" long, 9" high, and 10" deep. Will hold a changer up to 14" square. Will accommodate speaker up to 12". Has record album storage compartment. Hinged lid covers changer compartment. Cabinet AR-15. Net price **$29.95.** General Instrument changer $14.95, extra. Armchair cabinet in blonde finish. Net price $34.95.

### 20-WATT AMP. KIT, $17.95

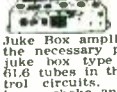


**Build this 20 watt utility 110 volt AC 20 Watt power amplifier.** Ready punched chassis, size 12 x 6 x 2½ inches. Has two input circuits, one mike and one phono. Mike stage has 135 DB gain for crystal or dynamic mike. Has bass and treble control. Designed for use with PM speakers; has 8-16 ohm output transformer. All parts and easy-to-follow diagram furnished, including tubes: 2—6SN7, 6J5, 2—6L6GA, 5Z3. Kit Model 20-LX. Net **$17.95.**

### DELUXE 30-WATT AMP. KIT, $29.95

Kit model RA-30. A complete 30 watt high fidelity Push pull 6L6 amplifier. Ready punched chassis with cover to match. Beautiful opalescent finish. Input for two mikes and crystal pick up. Perfect for the new GE VR Cartridge. Twin tone controls bass and treble. Inverse feed back. Heavy duty output trans for 4, 8, 16 and 500 ohm. Everything furnished including diagram and tubes 2—6SJ7, 2—6C5, 2—6L6, 5V4. Worth twice our price. Build an amp you will be proud of. Kit model RA-30. Net **$29.95.** Furnished with a merit impregnated and shielded wide range output transformer with 4, 8, 16, 250 and 500 ohm secondary $5.00 extra.

### JUKE BOX AMP. KIT, $24.95



Juke Box amplifier kit. Model KV 7. All the necessary parts and tubes to build a juke box type amplifier. Has push pull 6L6 tubes in the output. Proper tone control circuits. Super heavy duty power trans, choke and output trans. Everything furnished including tubes, diagram and photo, inputs for mike variable reluctance pick or crystal pickup. Gives 25 watts of power. Scoop price **$24.95.**

### 6-110 VOLT POWER SUPPLY KIT, $14.95

New utility power supply kit, works on either a 6 volt storage battery or 110 volts AC. Furnishes power for a 25 watt amplifier and will run a turntable from a storage battery. Kit 6-110 KR complete with diagram **$14.95.** 6-110 volt 60 cycle vibrator only **$1.98.** Thermador 6-110 power transformer **$5.95.**

**Complete Intercom SCOOP PRICE $14.95**

The nicest Inter-com you have ever seen. Made by a top quality manufacturer. A complete two-station unit with 50 feet of connecting wire. Sub-station and Master are black plastic case size 8 x 6 x 5 inches. Made to sell for **$25.00.** Stock No. DG-29. Sale Price **$14.95.**

### $59.50 Value Musical Amp., $24.95

8 watt musical amplifier, 4 tube AC type. Inputs for crystal or dynamic mike and phono or instrument pickup. 2 gain controls and tone control. Has heavy duty built-in 8" speaker. Attractive leatherette covered case. Made by a large manufacturer to sell at $59.95. Brand new, fully guaranteed. For 110 volt AC operation. Our scoop price, **$24.95.**

Stock No. XR-3

### PHONO-MOTORS, $1.98

**ALLIANCE**

Standard 78 RPM phono motor with turntable **$1.98.** Deluxe 78 RPM phono motor with turntable **$2.95.** General Industries RM 4 regular **$15.00.** 1st motor with weighted turntable 78 rpm, net **$5.95.** Dual speed rim drive for reg. and LP records **$4.95.** Replacement phono motor for automatic changers **$1.49.**

### DeLuxe Musical Amp., $39.95

30 Watt musical amplifier with 12 inch speaker, a $75.00 value. Has the same appearance as the musical amp above; however, it is our deluxe model with two 6L6 output tubes. Inputs for mike and instrument pick-up. The last word in musical amps. Stock No. MM-30X. Net, **$39.95.**

**SAVE 50%**

Astatic MLP-1 cartridge used in Webster Chicago and many other original equipment changers, with needles, **$1.49.** Astatic MLP-2 improvement over the MLP-1. Has quiet type QT needle, no surface noise. Scoop price, **$1.95.** Standard L-40, L-26, cartridges, old standbys, thousands in use. Complete with rest clip. Each, **$1.79;** 10 for **$15.00.** Astatic L-70, L-75, cartridges or equal. Each, **$1.79;** 10 for **$15.00.** Astatic L-72A or equal 3½ volt output, used in one lung record players, etc. Also where tone networks are used. **$1.79;** 10 for **$15.00.** NJ-1 Nylon cartridge with permanent, but changeable needle, **$3.29.** RCA magic-tone cell, with permanent sapphire needle. Modernization kit replaces 95% of old cartridges in RCA radio phonographs, built during 1938 and later. 4 page instruction book included. A scoop at only **$1.95.** Astatic QT 3-M cartridge with silent needle response to 10,000 CPS. Reg. $8.40 List. Scoop price, **$3.29.** Complete arm with 3½ V. cartridge. **$2.29.** Complete arm with 1 V. cartridge, **$2.29.** L.P. micro-groove arm with needle. **$3.95.**

**$110.00 S-56 Hallicrafter Only $59.50**

Hallicrafters Model S56 Chassis and dial (no cabinet). Made to sell for $110.00. The finest radio chassis value today. 11 tubes with high fidelity audio. Rec. FM and AM. While the last 50 we have lasts, only **$59.50** each.

### Hallicrafter's Model S-58 $39.95

Hallicrafter's Model S-58. A complete FM-AM (550 to 1700 kc and 88 to 108 mc) radio, 7 tube AC-DC in metal cabinet, with speaker. Made to sell for $59.50. McGee's scoop price, only **$39.95.** Better get your order in now; supply is limited.

### BC-458—New $5.95

Brand new Army BC-458 5.3 to 7. M.C. Transmitter in original cartons. While they last, **$5.95** each.

## GAROD PERSONAL RADIO KIT, $14.95

**Size 6½ x 3¼ x 4⅛—Weight 3½ Lbs.**

**Simple Assembly and Wiring Instructions**

This kit is ready for immediate delivery. The same nationally known factory that manufactures tens of thousands of this radio, is line producing this radio kit for us. Every part, from the cabinet down to the last resistor, is matched. The chassis is ready punched; all you do, is mount the parts and wire. This radio kit will assemble into a beautiful personal radio for you, just the same as it does for the factory. We furnish you a diagram, photograph of the completed chassis and full assembly instructions so that those with a minimum knowledge of radio may wire this kit. The beautiful case is made of metal with plastic hinged lid and snap-on back. The lucite face of the receiver has an inlaid gold design. The circuit is the conventional two gang superhet type, with A.V.C. Receives the broadcast band 540 to 1650 KC. Uses miniature tubes: 1R5 converter, 1S5 detector A.V.C., 1T4 amplifier and 3S4 power amplifier. Alnico V PM speaker. The loop antenna is built in the lid. Radio comes on automatically when lid opens. Operates on self-contained batteries. Priced complete with tubes and 67½ volt "B" battery and flash cell (Not AC-DC). Nothing else to buy.

**Model X-45, Price $14.95.** Include Postage for 6 lbs.

**Scoop Model X-45 Personal Portable Kit Wired and Tested With Batteries. Net $17.95**

## NEW 8-TUBE ECONOMY 3-GANG SUPERHET KIT, $16.95

Kit Model ABK-7. A complete kit of parts and tubes to build an 8-Tube utility radio chassis for custom installation. Made from basically Detrola components. Has 6" slide rule dial and 3 gang tuning condenser. R.F. stage on both broadcast and short wave. Receives 550 to 1650 kc and 6 to 18 megacycles. Has heavy duty 8" speaker. Kit is priced complete with all parts ready punched chassis and tubes: 2—6SD7, 6SA7, 6SQ7, 6J5, and push-pull 25L6's, 25Z6, photos and schematic diagrams. This kit has not only top selectivity and sensitivity, but high fidelity audio, with continuously variable tone control. A real McGee value for only **$16.95.**

Kit Model AC-AK6. Same chassis and frequency coverage as Model ABK-7 except has 6 tubes with single 6V6 output tube and 90 mill power transformer. Everything else is the same. It is designed for those who prefer a straight AC trans. type radio. A complete kit. Everything furnished including tubes and diagram. Net, **$16.95.** Basic Kit Model DBK-8—the same as ABK-7 shown above, but only the basic parts are furnished, no tubes or speaker. You get the diagram—dial punched chassis—all coils, tuning condenser and band switch and loop ant. Sale price, **$6.95.**

### 4-TUBE T.R.F. KIT

**BARGAIN SPECIAL $6.95**

4 tube AC-DC, TRF radio kit. Ideal for students and beginners. Every part furnished to build this kit, including tubes, diagrams and photos. Has Alnico V PM speaker and tubes 12SK7, 12SJ7, 50B5 and 35W4. Plastic cabinet with airplane dial. Receives broadcast 550 to 1600 KC. This is the easiest type of radio to build. Kit Model TF-4. Weight 6 lbs. Net **$6.95.**

### DELUXE 5-TUBE AC-DC KIT

**OUR LEADER $9.95**

**Made from Detrola Components**

A full size 5 tube superhet radio kit housed in a 13 inch wood cabinet with full plastic front. Lighted slide rule dial. Incorporates a standard 2 gang superhet circuit. Loop antenna, ready punched chassis, etc. This is another one of our line production radio kits. Every part is furnished including tubes. 12BA6, 12BE6, 12AT6, 50B5 and 35W4. Diagrams, photos and instructions are included. 5" dynamic speaker. Receives broadcast 550 to 1650 kc. Weight 9 lbs. **Kit model TF-6B.** Net **$9.95.**

**Model TF-6B** wired and tested. Net **$12.95.**

### McGee's Theatre Quality AMPLIFIER KIT $24.95

Our sales and engineering department, realizing that not everyone can afford a $100.00 audio amplifier, has designed a Theatre quality, 15 watt True-Fidelity Amplifier kit. Response essentially flat, from 20 to 17,000 cycles. Every part, tubes and ready punched chassis. Has input for a crystal or dynamic microphone and gain and tone compensation for the new G.E. Variable Reluctance pickup, as well as the conventional crystal pickups. A 4 step tone switch for tone equalization. This kit has a 34 watt Merit high fidelity, wax impregnated output transformer, with 4, 8, 16 and 500 ohm taps. The chassis is of heavy treated metal, ready punched; approximately 5x11 inches. The quality of all parts 15 second to none. Priced complete with tubes as follows: 4—6C4, 2—6AQ5, and 2—6X4. This is the best amplifier kit we know how to produce and we have made thousands. Kit Model ME-15R. Net price, **$24.95.**

### GAROD DELUXE 5-Tube Kit $12.95

This is our latest and finest AC-DC radio kit. Receives Broadcast, 540 to 1650 KC. Has full length illuminated slide rule dial. Choice of ivory or Walnut plastic cabinet. Full high efficiency 2 gang superhet circuit, with loop antenna. Ready punched chassis, full 5" PM speaker. Every part fits. Everything furnished, including tubes. 12SA7, 12SK7, 12SQ7, 35Z5 and 50L6. This kit will go together just like it would on the production line. Diagram, photos and instructions are furnished. Shipping weight 9 lbs. Kit model XA-49 Net **$12.95.**

## 100 CARTONED AND GUARANTEED RADIO TUBES for only $35.00

Popular GT tubes. All individually cartoned and branded Hy-Vac. Guaranteed best quality. Full replacement. These tubes meet the ever-growing need for low-cost service replacement and counter sales. Over 800,000 sold. A scoop item for the service dealer.

**39c EACH IN SMALLER QUANTITIES**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 117P7GT | 3V4 | 6SD7GT | 12BE6 | 3S4 | 6SF5 | 19T8 | 6DJ6 |
| 32L7GT | 6C5 | 6SK7GT | 35W4 | 1B4 | 6BA6 | ..... | 6AG6 |
| 12A8GT | 6K7GT | 6SN7GT | 35B5 | 12K8 | 6BE6 | 12S8 | ..... |
| 12K7GT | 6A8GT | 6SQ7GT | 50B5 | 12A6 | 6AT6 | 6AL5 | 12AU6 |
| 25Z6GT | 5Y3GT | 25L6GT | 1T4 | 12SF7 | 6X4 | 6C4 | 12AU7 |
| 6A7 | 6K6GT | 7017GT | 1L4 | 6F5 | 6BJ6 | 6AU7 | 12AT7 |
| 47 | 6Q7GT | 117L7GT | 1U4 | 6J5 | 6AK5 | 12BF6 | 12SN7 |
| 12F5GT | 6V6GT | 117Z3 | 1R5 | 6SJ7 | 6BH6 | 12BF7 | 6SL7 |
| 6S8GT | 6X5GT | 12AT6 | 1S5 | 12SJ7 | 80 | 12AX7 | ..... |
| 6P5GT | 6SA7GT | 12BA6 | 3Q4 | 6AJ5 | ..... | 6BF6 | |

### 75% OF THE TUBE YOU USE, 49c EACH, GUARANTEED NAME BRANDS CARTONED AND UNCARTONED

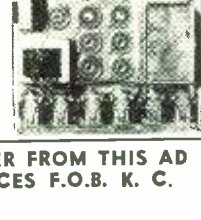
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 12AH7 | 6C5 | 6SC7 | 6SR7 | 12SG7 | 6R7 | 35Z5 GT | 6K5 GT |
| 27 | 6H6 | 6SF7 | 6V6 GT | 12SH7 | 6L7 | 35W4 | 6A3 |
| 26 | 6J5 | 6SQ7 | 6X5 GT | 12SJ7 | 7Z4 | 50B5 | 483 |
| 78 | 6K7 | 6SH7 | 6AB7 | 12SA7 | 12SQ7 | 2525 | 2051 |
| 76 | 9001 | 6SJ7 | 12AT6 | 12SL7 | 12SR7 | 2526 | 25Z5 |
| 3S4 | 9002 | 6SK7 | 12BA6 | 12SC7 | 50L6 | 6D6 | 6B4 |
| 5U4G | 9003 | 6SL7 | 12BE6 | 1T4 | 12SK7 | 6C6 | 6C4 |
| 5Y3G | 1625 | 6SG7 | 12H6 | 1R5 | 25L6 GT | 6J7 | |
| 6AC7 | 6SA7 | 6SN7 | 12J5 GT | 1S5 | 35L6 GT | 77 | |
| 35Y4 | 14Q7 | 7E5 | 7H7 | 7B6 | 7F7 | 7C5 | 7Y4 |
| 14A7 | 14B6 | 7E7 | 7C7 | 7A7 | 7N7 | 7Z4 | |

Sylvania or Equal. 1LN5, 1LD5, 1LH4, 1LC6, 1LA6, 1LB4, 1LC5, 1LG5, 3LE4, @ 59c; 10 for $5.50.

**Name Brand, 1st Line.** 1A7, 1H5, 1A5, 1N5, 3Q5, @ 59c. 50A5 or 35A5 or 6Z4, 69c.

**New Metal WAA 6L6 (Rusty).** Each, 49c; 10 for $4.50.

6L6G or Metal. Reg. stock, @ $1.09.



## Relay Salvage Scoop $1.00

**HAS 6 HIGH RESISTANCE RELAYS**

Auto pilot amplifier salvage scoop. Has 6 high resistance relays that operate in tube plate circuits on less than 8 mills. Also 4 controls. Choke cond., etc. Less tubes. Used but in good condition. Weight 12 lbs. Stock No. C-1T. Net, **$1.00** each. Full remittance plus postage on this item.

# McGEE RADIO COMPANY

ORDER FROM THIS AD PRICES F.O.B. K. C.

SEND 25% DEPOSIT—BALANCE C.O.D.

1225 McGEE ST., KANSAS CITY, MISSOURI

# Buy a 15-Inch Permanent Magnet Speaker at McGee for Only $9.95

## COAXIAL — 12 inch Alnico V. P.M. Speaker

Regular $27.50 List Only — **$12.95**

★ BRAND NEW ★ FACTORY CARTONED
★ ALNICO V MAGNET ★ BUILT IN MATCHING NETWORK
★ BEST SPEAKER VALUE IN AMERICA

Designed by one of America's finest speaker builders, for FM high fidelity radios, record players and P.A. systems. This speaker is incorporated in radios selling in the $500.00 bracket. It is a specially designed 12" Alnico V magnet PM, with built in 4" Alnico tweeter. The high-pass filter is concealed under the pot cover. Just hook to any 8 ohm output transformer. (Will hook in place of any house radio speaker, as most speakers have 8 ohm voice coils), only two wires to connect. Will handle approximately 18 watts. This co-axial PM speaker should sell for $35.00. Why buy an ordinary speaker, when we are offering a co-axial Alnico V PM for only $12.95? Latest 1948 production, not surplus, fully guaranteed. Stock No. 4-12X. Weight 8 lbs. Two for **$24.95.**

Brand New 1948 Production

## 15-INCH PERMANENT MAGNET SPEAKER SCOOP OF ALL TIMES

*New Molded Cone*

SCOOP PRICE **$9.95**

Pre-War or Post-War, you never bought a speaker like this, for such a scoop price. Made by a nationally known builder of fine speakers. A full 15" 12½ oz. Alnico V magnet speaker of juke box quality. Has standard 8 ohm voice coil. Will take up to 18 watts average or 25 watts peak. Here is a speaker that will bring out those low notes. Latest 1948 production; not line through-outs. Every speaker is guaranteed new and perfect. We may not be able to continue this offer for long, so place your order now. Stock No. 15-KR. INCLUDE POSTAGE. Weight 11 lbs. A $35.00 value for only **$9.95.**

$100.00 Value Wire Recorder

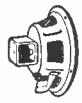
**Our Leader—Wire Recorder For Churches,** Net **$69.50**

Makes and plays back thru its own amplifier and speaker—a 1 hour, 30 Minute, or 15 Minute Wire Recording. Made to retail for $100.00 by Air King. Portable with Blue Leatherette carrying case, weight of 24 lbs. 1 Hour spools of wire $3.25 extra. Complete ready to operate Stock #A-725. **Net $69.50.**

## 15 INCH SUPER COAXIAL — $24.95

**The King Coax.** A 21.5 oz. 15 inch Alnico V PM speaker with a built-in high frequency tweeter. Will respond to from 50 to 12,000 cycles. This is a ruggedly built speaker with a curvelenier one piece molded cone. Built-in high pass filter. Just hook to any 8 ohm output. Built by the maker of our ever popular 12 inch coax model 4-12X. This speaker has a retail list of over $80.00. We offer you our 5-15X 15 inch coax for only **$24.95.** Weight 22 lbs.

## 12" 15 WATT P.M. SPEAKER 5 for $22.50



Nationally known 12" 6.8 oz. Alnico V PM, with 1" 8 ohm voice coil. Will take 15 watts. Grey finish. Our leading 12" speaker. Stock No. CH-12. Net, **$4.95.** 5 for **$22.50.**

**12" 12 Oz. Mag. Will Take 20 Watts $8.95**

Super heavy duty 12" 12½ oz. Alnico V magnet PM with 1¼" with 8 ohm voice coil. This speaker is equal to 60 oz. of old type magnet. Will take 25 watt peak. Stock No. CH-13—**$8.95;** two for **$17.00.**

## 15 INCH 35-WATT P.M. SPEAKER $16.95

**Model 15-LS.** 15" 21½ oz. Alnico V Magnet PM Speaker. Will take 35 watts with ease. Thousands of dollars were spent in building the fine tools to produce this speaker. The 8 ohm voice coil is 1½" in diameter and has been heat treated and plastic coated. Constructed to eliminate loose voice coils, wires and wrapping. Made by a renowned builder of fine speakers. Truly the King of juke box speakers. Weight 18 lbs. Net Price **$16.95.** 2 for **$32.95.**

## PORTABLE WIRE RECORDER WITH 12 WATT P.A. SYSTEM

**Why Not Record a Full Church Service and Replay for Shut Ins**

**Portable Wire Recorder Model GN-11** — **$69.95**

Has ready wired and tested 5 tube AC type amplifier with push-pull 6V6 tubes. Built-in eraser circuit. Input for crystal mike or phono pick-up. Diagrams show how you can record from any radio receiver. 3 position switch enables you to quickly change from record to playback or conventional P. A. system. This amp delivers 12 watts of good clean audio. Here is what you get: Webster 79 recording mechanism, with 15 minute spool of wire, attractive leatherette covered case, 6" heavy duty PM speaker and wired and tested 12 watt AC wire recording amplifier. All you do is mount the amp, recording mechanism and speaker. Simple instructions furnished. Portable Recorder Model GN-11 Net **$69.95.** Crystal mike **$4.95** extra.

Deluxe Portable Wire Recorder Model GN-12. Has same features as the model GN-11, as well as a larger split type leatherette covered case and a heavy duty 10 inch PM speaker. Deluxe Portable Wire Recorder Model GN-12. Net **$79.95.** Crystal Mike **$4.95** extra.

Recording Wire, 15 minute spool **$1.30.** 30 minute spool **$1.95,** 1 hour spool **$3.25.**

Either the GN-11 or the GN-12 wire recorder listed above may be had with the Webster wire recording mechanism or the AIR KING type wire recording mechanism which will record from a phono record. Specify when ordering which mechanism you want.

L-25 $19.95 BW-3L $29.95

## 15" THEATRE TWIN SPEAKER $29.95

Our sound laboratory has assembled this fine speaker combination. A super heavy duty 15" cinaudagraph Alnico V PM and a University Lab. trumpet type high frequency tweeter. Ready-cut plywood baffle and cut to fit grill cloth. All you do is bolt speakers to the baffle and connect in the 1 mfd. high pass filter. This combination will take 35 watts of audio and reproduce 40 to 10,000 cps. A speaker combination of theatre quality. Stock No. BW-3L. Net **$29.95.** If a baffle cabinet is desired, order the L-25 below.

University Lab. high frequency tweeter trumpet with connecting instruction. Same tweeter as used on the above theatre combination. Net **$11.76.**

Walnut floor type speaker baffle. Size 12x22x26". Will accommodate either 12" or 15" speakers. Air relief cutouts in corner of grill. Weight 30 lbs. A $25.00 value for only **$19.95.** Stock No. L-25. Net **$19.95.**

## SALE! RECORD PLAYERS—AUTOMATICS—LONG PLAYING AND STANDARD

### Children's Player Kit $7.95

New, children's electronic player. Offered in kit form. Includes all material necessary. Attractive red plywood cabinet, self-starting phono motor and crystal pick-up, 4x6" PM speaker and parts to build 70L7 amplifier. Diagram included. Stock No. LJ-1. Net Price **$7.95.**

**LJ-1 $7.95**

**Detrola Automatic Changer** works automatic on regular 78-RPM records—and manual on LP 33⅓ records—(2 Arm Type). Same as used on many original equipment radios. Scoop Price **$19.95.** Stock No. LP-D 2X.

**CAPITOL PORTABLE CASE CK-1 AND CC-8**

### ECONOMY PORTABLE PLAYER KIT $9.95

**Portable Player Kit Scoop $9.95**

Deluxe portable electronic record player kit in deluxe capitol case. Includes all parts and easy to wire diagram. Comes complete with grey leatherette portable carrying case self-starting phono motor, pickup, 5" PM speaker and all necessary parts to build 70L7 amplifier. Stock No. CK-1. Net Price **$9.95.**

### Record Player $14.95

Complete record player. Component parts shipped separately. Amplifier is ready wired and tested. Amplifier has four tubes, 12SQ7, 2—117Z3, 50L6. All parts are included, self-starting phono motor, crystal pickup, 5" heavy duty PM speaker and amplifier, with tone and volume control. Deluxe capitol heavy wooden case is covered with brown leatherette and has chrome fittings and speaker grill. Stock No. CC-8. Net Price **$14.95.** Model LP-CC8—Same as above only Dual speed with 2 pickups, **$19.95.**

### Super Portable Player With A.C. Amp. $19.95

Super deluxe record player with push pull 7C5 AC type amplifier and 6 inch speaker. All you do is mount amp. in the case. Case is of the accepted type. This player should sell for $30.00. Stock No. DL-3. Net **$19.95.** Offered with Stewart Warner automatic changer. Stock No. ARO-4. Net **$27.95.**

## SALE RECORD CHANGERS $12.95 Up

Latest Aero Changer, made for Stewart-Warner. Equipped with the popular Webster high list bouncing pickup cartridge. With permanent OT Needle. Plays 10 12" or 12 10" records automatically. Base size 12x13". Scoop price **$12.95.** 2 for **$25.00.**

General Instrument automatic changer. Base size 10½x12". Plays 10 12" or 12 10" records automatically. A real value at only **$14.95** each.

Farnsworth, 2 post automatic changer; complete with new variable reluctance cartridge. Net price, each **$19.95.**

V-M 400, twin post automatic record changer, will intermix 10" and 12" records. Scoop price, each **$19.95.**

Famous Triple Post Seeburg intermix automatic changer, will play 10" and 12" records together. Net price, each **$29.95.**

Leatherette covered bases designed to fit any of the above changers **$1.95** extra. Specify type of changer when ordering base.

### DUAL SPEED AUTOMATIC CHANGERS

**V-M Model 800-A** plays both 33⅓ and 78 RPM records. Base size 13½x14". Furnished with two permanent needles. Net price **$23.95,** 2 for **$46.00.**

**V-M Model 400-C** Deluxe model, dual speed changer. Intermixes 10" and 12" records. Base size 13⅞x12¼". Net price **$33.95** each, 2 for $63.46.

**Webster-Chicago Model 256,** dual speed; for the regular and microgroove records. Base size 14x14". New "Filt-O-Matic" cartridge. Net price **$33.91.** Webster-Chicago standard model 246, dual speed automatic changer for the micro-groove, or standard records. Base size 12x13½". Net price **$29.25.**

Webster 156 changer. Equipped with variable reluctance cartridge. Brand new, but have been removed from new radios to be replaced with twin speed changers. Show slight mounting marks. Guaranteed perfect. Net price **$22.95.**

### Wagner Nichols Micro-Groove Recorder $111.95

Now you can buy a Micro Groove Recorder. Made by Wagner-Nichols. Cuts 500 lines to the inch. A 15 minute record may be made on a 4" thin plastic disc. Good tone quality, powerful playback amplifier. This is the recorder of the future. Amplifier has connections for external speaker. Priced complete with microphone and 12 recording blanks. Net Price $111.95. Extra blanks $1.39 per dozen. Wagner-Nichols Micro Groove Recorder Stock No. WN-34. Net **$111.95.**

### Our Leader Magnetic Tape Recorder $250 List—Net $149.50

Magnetic tape recorder of nationally known manufacturer, complete ready to operate. Has AC transformer type amplifier for recording and playback. Housed in an attractive leatherette case, with microphone. Makes a 30 minute recording from standard magnetic tape. Made to sell for $250.00 list. McGee's scoop price **$149.50.** Circular sent on request.

### Webster Racine V.R. and Pre-amp Scoop Price $5.95

New Webster cartridge, with removable permanent needle. Response second to none. Offered with a pre-amplifier (6SC7) ready wired and tested. A scoop at **$5.95,** complete.

Webster M1-VR cartridge only, **$4.41 net.**

New General Electric V. R. cartridge No. RPX-040, with removable needle. Net **$5.85.**

General Electric V.R. cartridge RPX-041, for micro-groove records. Net **$5.85.**

Our 6SC7 type pre-amplifier with either RPX-040 or RPX-041 cartridge. Net **$7.95.**

## WORLD'S BEST VALUES IN SPEAKERS

Following Speakers listed are latest production No-Factory throwouts made by the largest factory who furnish the original equipment to America's biggest Radio Factory. Every speaker guaranteed.

| | |
|---|---|
| 3" PM 1 Oz. Alnico 5 Magnet | $0.99 |
| 4" PM 1 Oz. Alnico 5 Magnet | .99 |
| 4" PM 1½ Oz. Alnico 5 Magnet | 1.19 |
| 5" PM 1 Oz. Alnico 5 Magnet | .99 |
| 5" PM 1½ Oz. Alnico 5 Magnet | 1.19 |
| 6" PM 1½ Oz. Alnico 5 Mag., Square | 1.49 |
| 6" PM 2.13 Oz. Alnico 5 Mag., Square | 1.98 |
| 6" PM 3.16 Oz. Alnico 5 Mag., Square | 2.49 |
| 6¼" PM 1.5 Oz. Alnico 5 Mag., Round | 1.69 |
| 4x6" PM 1.5 Oz. Alnico 5 Magnet | 1.49 |
| 6x9" PM 3.16 Oz. Alnico 5 Magnet | 2.98 |
| 7" PM 3.16 Oz. Alnico 5 Magnet | 2.98 |
| 8" PM 3.16 Oz. Alnico 5 Magnet | 2.98 |
| 10" PM 4.64 Oz. Alnico 5 Magnet | 3.98 |

### Hot Buys in PM's—With Trans.

| | |
|---|---|
| 4" PM 1 Oz. Alnico 5 2500 ohm Trans. | $1.49 |
| 4" PM 1 Oz. Alnico 5 10M ohm Trans. | 1.49 |
| 5" PM 1 Oz. Alnico 5 2500 ohm Trans. | 1.69 |
| 5" PM 1 Oz. Alnico 5 10M ohm Trans. | 1.69 |
| 5¼" PM 1 Oz. Alnico 5 2500 ohm Trans. | 1.89 |
| 6" PM 1.5 Oz. Alnico 5 2500 ohm Trans. | 1.99 |
| 6" PM 1.5 Oz. Alnico 5 7000 ohm Trans. | 1.99 |
| 6" PM 3.16 Oz. Alnico 5 7000 ohm Trans. | 2.49 |
| 6" PM 3.16 Oz. Alnico 5 10M ohm Trans. | 2.98 |

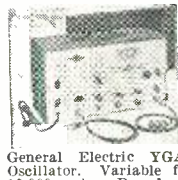
### Hot Buys in Field Spkrs. With Trans.

| | |
|---|---|
| 5" PM 450 ohm Utah—2500 ohm Trans. | $1.98 |
| 5" PM 450 ohm Utah—7000 ohm Trans. | 1.98 |
| 6" PM 1500 ohm Utah—7000 ohm Trans. | 2.29 |
| 8" PM 450 ohm Utah—7000 ohm Trans. | 2.98 |
| 8" PM 1000 ohm Utah—Less Trans. | 2.49 |
| 10" PM 1000 ohm Utah—Less Trans. | 3.98 |
| 12" PM 450 ohm Utah RCA, Less Trans. | 4.98 |
| 12" PM 1000 ohm Magnavox, Less Trans. | 4.98 |

### Famous Magnavox Speakers

| | |
|---|---|
| 6" Auto Spkr—4 ohm | $2.49 |
| 7" Auto Spkr—4 ohm | 2.98 |
| 8" Auto Spkr—4 ohm | 2.98 |
| 5" 8 Oz. Alnico 3 PM | 1.79 |
| 8" 12 Oz. Alnico 3 PM | 2.98 |
| 10" 21 Oz. Alnico 3 PM | 4.98 |
| 12" 21 Oz. Alnico 3 PM | 5.98 |

## SAVE ½ ON G.E. TEST EQUIP.



**AUDIO OSCILLATOR $29.95**

General Electric YGA-4 Audio Oscillator. Variable from 25 to 16,000 cycles. Brand new. Weight 31 lbs. Regular price $49.50. Sale price **$29.95.**

**SINE OR SQUARE WAVE GENERATOR**

SALE PRICE **$59.95**

General Electric YGA-2 Sine or Square Wave Generator. Variable from 20 to 20,000 cycles. Accurate to one cycle below 33 cycles. Weight 43 lbs. Regular price $150.00. Brand new Sale price **$59.95.**

# McGEE RADIO COMPANY

**ORDER FROM THIS AD PRICES F.O.B. K.C.**

***SEND 25% DEPOSIT — BALANCE C.O.D.***
***1225 McGEE ST., KANSAS CITY, MISSOURI***

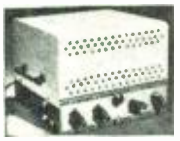
# 100 ASSORTED 600-VOLT STANDARD BRAND TUBULAR BY PASS CONDENSERS FOR $6.95

### GET YOUR GLASSES AND LOOK THESE OVER

40 ft. No. 16 Leadin, rubber covered and stranded. Special ..... 19c
I.C.A. Universal AC-DC line cords. $1.00 value. Special ..... 49c
8 ft. G.E. AC line cord and plastic coated plug ..... 24c
10 for ..... $2.00
6½ ft. G.E. AC line cord and plastic bakelite plug .. 16c
10 for ..... $1.50
2 gang condenser, 2 I.F.'s, loop, and oscillator coil, matched. Special ..... $1.29
Finest 456 I.F. transformers. Matched. You can't beat this. Each ..... 49c
Pee Wee Iron Core 456 I.F.'s. A hot value. Each ... 39c
10 watt wire wound resistors, all sizes ..... 19c
25 watt wire wound resistors, all sizes ..... 25c
67½ volt "B" wafer cell, best quality ..... $1.39
5 for ..... 6.50
High grade Grill Cloth, brown or grey, 48" wide, 1 yd. ..... 1.49
Spaghetti tubing, ½" bundle ass'td 9" long. Special .. 19c
3 or 4 wire oscillator coils, 456 special ..... 15c
Bronze dial cable, as used on old sets. Spec. 100 ft .. 99c
2 watt Neon lamp. Standard base, 35c value, spec .. 19c
10 for ..... $1.50
Hi-impedance Army head phones. Civilian type band and cord, special ..... $1.49
Loop antennas. Small, medium and large. All late production. Special ..... 29c
38/62 Solder. Made by Division Lead Co. Good quality. Special ..... 49c
80 MA. AC-DC chokes, 39c; 75 MA. ..... 59c
50L6 output transformers, 3Q5 outputs, 39c; 10 for $3.50
4 watt universal output transformers ..... 75c
8 watt universal output transformers ..... 95c
12 watt universal output transformers ..... $1.25
60 MA Stancor flush-mounting 6.3v, 5v transformers, for 5 and 6 tube sets ..... $2.49
60MA Uprite transformers 6.3v, transformers, special ..... 1.95

### PORTABLE P.A. $39.95

18 watt complete portable public address system. Has inputs for a crystal or dynamic mike and phono pickup. Has push-pull 7C5 tubes in output. Attractive leatherette covered split type case. Priced complete with two 10" PM speakers. This is a complete public address system wired ready to play. Stock No. RC-18. Net **$39.95.** Priced complete with crystal mike and desk stand.
Amplifier chassis only with tubes, less speaker, case and mike; in kit form. Diagram furnished, Stock No. AC-18. Net, **$10.95.** AC-18 amplifier wired and tested. Net **$14.95**



### 30 WATT AMPLIFIER $32.95

Atomite 30 watt amplifier, with 6 tubes: 2—6SC7, 1—6N7, 2—6L6, 1—5U4G. 2 microphone and phonograph input. Output transformer tapped for 2, 4, 8, 15 and 500 ohms. Two tone wrinkle finish nicely finished case. Stock No. P112-25. Net price ..... **$32.95**

### 1948 MODEL—MIKE-BROADCASTER ONLY $7.95

Broadcasts 800 to 1500 KC from either a Phonograph pick-up or a crystal or dynamic mike. Makes any radio receiver a P.A. system, record player or recording amplifier. Gives broadcast quality. Has fader control from mike to record, simulating a regular broadcast station. This is a powerful model; using 2—35Z5, 12SJ7 and 35W4 tubes. Priced with tubes and connecting instructions. Works on 110 volts AC-DC. Crystal mike and desk stand $4.95 extra. Model DE-5 truly a de-luxe mike-phono oscillator.

**DE-2X Phonograph Oscillator.** Broadcasts from 800 to 1500 KC gain for any crystal pick-ups. A new, powerful circuit has variable gain control. Priced complete with 2 tubes and connecting instructions ..... Net. **$3.95**

### SUPERHET BROADCAST TUNER $7.95

Broadcast superhet tuner for connection to any phono amplifier or P. A. system. Built on a small compact chassis with dial plate and tuning knob furnished. Requires only three connections to amplifier. Uses three miniature tubes. Loop antenna and instructions are included. Specify when ordering, whether tuner is to be used on AC-DC or AC type amplifier. If you don't specify we will ship tuner for AC type amplifier. Stock No. PAT-3. Net Price ..... **$7.95**

### 8-WATT AMPLIFIER WITH P.P. 50B5 $9.95

4 tube, plus rectifier, AC-DC amplifier. Push-pull 50B5 output tubes, with 12SJ7 (Gain for mike or G.E. variable reluctance pick-up), 12SL7 (Gain for conventional crystal pick-up) and phase inverter. This is a nice small audio amplifier, with tone and fader control, plus inverse feedback. Furnished wired and tested, complete with tubes, 8 watts output. Ready to play. Weight 6 lbs. Model TM-5. Net price **$9.95.**
Crystal mike and desk stand $4.95 extra. 8" PM speaker $2.95 extra. G.E. variable reluctance pick-up cartridge $4.69 extra.

### SCOOP SALE ON RADIO CHASSIS; 6 TUBES, 3-WAY $14.95

Chassis Model 819-A. A deluxe broadcast 3-way; 110 volt, AC or DC or battery pack radio chassis, complete with 6 tubes, 6" slide rule dial and 6" PM speaker. Size 12 x 6 x 7 inches. Made by a No. 1 manufacturer for a top mail order house. Has tuned RF stage; giving high sensitivity and selectivity. A $25.00 value for only ..... **$14.95**

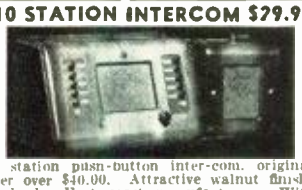
### 8-TUBE A.C. CHASSIS $24.95

Chassis Model 828. 8 tubes with push-pull 7C5 output tubes. An AC transformer type radio with pre-selection (3 gang condenser). Receives broadcast 550 to 1600 kc and foreign shortwave, 5.5 to 18 mc. Furnished with tubes and 10" speaker. Size 11 x 6 x 8 in. A $59.50 value. This is all the radio anyone should want. Scoop price ..... **$24.95**

### 6-TUBE AC-DC CHASSIS $14.95

Chassis Model 810. A deluxe 6 tube AC-DC superhet with 3 gang tuning condenser. Receives broadcast and foreign shortwave bands. Complete with 5" slide rule dial and 4 push buttons, tone control. Priced complete with tubes, 7B7, 14Q7, 7B7, 7C6, 50A5 and 35Y4 and 6" speaker. This is a better chassis than offered in mantle sets selling for $40.00. Only a few to sell at .. **$14.95**

### 10 STATION INTERCOM $29.95



This 10 station push-button inter-com. originally cost the dealer over $40.00. Attractive walnut finished cabinet; made by East coast manufacturer. With tubes 14F7, 50L6 and 35Z5. Master and one sub-station, net **$29.95.** Extra sub **$5.95** each.

Red hot values in new light weight crystal pick-ups. Only 1 oz. needle pressure—curved arm construction. Available in two type normal voltage output and high output type 3½ volt normal output pick-up.
Stock No. W-1 ..... Net, **$2.29**
High voltage pick-ups—Stock No. W-2 ..... Net **2.29**

### WEBSTER 56 CHANGERS $19.95

Brand new Webster 56 record changers with crystal cartridge of normal output voltage. These are new changers but have been removed from new radios to be replaced with dual speed models. A regular $26.66 dealers' net item offered for only ..... **$19.95**

### LP RECORD PLAYER ATTACHMENT $14.95

Model LP-38 Single record attachment for playing new microgroove or standard records. You get a readycut walnut base. DM General Industries 33⅓ and 78 RPM phono motor. LI' pickup for micro-groove records.
Net price ..... **$14.95**
With additional pickup made by Shure for playing standard 78 RPM records, as pictured.
Net price ..... **$16.95**
NEW L.P. Pick Up with Needle ..... 3.95

### GAROD 9-TUBE AM-FM CHASSIS WITH 12" SPEAKER $59.95

McGee's monthly special Garod 9 tube broadcast and FM chassis. Powerful transformer type. Twin lited plastic dial. Full 12 in. dynamic speaker. This is not a cheaply built chassis but a full grown radio. The same chassis is incorporated in receivers selling for $300.00. Why not install this in your old cabinet? Compact construction makes this chassis acaptable to most all console or chairside cabinets. Stock No. LA-91 net with tubes and 12 in. speaker .. **$59.95**
24" Cables per pair $1.50 extra.

### FM-TUNER

Top quality FM tuner for 88 to 108 MC. This is a ratio detector type. A full superhet, not a regenerative gadget. This one works or your money back. Stock No. FR-88.
Net Price ..... **$20.49**

### UNIVERSAL UNDER DASH CONTROLS $3.98

Attractive Under Dash Remote Control with choice of drive ratios. 8, 10, 12, 16, or 20 to 1. To find the ratio that you need, count the turns from min. to max. of the condenser gang and double. Specify ratio when ordering. If on-off switch in remote control, add $1.00 to the price.

### HEAVY DUTY VIBRATOR

Made for 6-110 volt amplifiers. Freq. 60 CPS. Scoop price. **$1.99**
135 ma 6-110 volt conventional power transformer, with all windings; will run phono motor. **$5.95**
(Use with above vibrator)

### DON'T PASS UP THIS 100 COND. DEAL. 100 OF YOUR CHOICE $6.95

All these condensers are first run and of nationally known manufacture. Standard size, branded and rated 600 working volts. These prices are down to earth. Less than jobbers' cost. Every condenser guaranteed. Pick types you want from list below or just order 100 assorted. We will give you some of each size.
.001, .002, .005, .01, or .02 ..... **6c** each
.05, **7c** each; .1, **8c** each; 100 for ..... **$6.95**
Buffer condensers 1600 volts rating.
.001, .005, .008, .01, .02, **17c** each: 10 for ..... **$1.50**

### EQUIPMENT TYPE BYPASSES

Popular sizes of famous brand equipment type 400 volt rated tubular condensers. C.D., Solar or equal. Ideal for replacements in AC-DC sets, etc. We sell these to our dealers by the hundred for $5.00.
.01 400 volt, .05 400 volt, .1 400 volt **6c** each; 100 for **$5.00**; 25 400 volt **10c**; .5 400 volt ..... **12c**

### SAVE 50% FAMOUS-BRAND 600V. PLASTICS

Newest molded 600 volt condensers. The best there is. High temperature plastic construction; moisture resistant. Made by a renowned builder of condensers whose name you are familiar with. Save over half on these sizes.
.001, .002, .005, .01, .02. **10c** each; .05, **11c** each; .1 mfd ..... **12c** each

### STANDARD BRAND ELECTROLYTICS
**Twist Mounting Small Aluminum Cans**

We made a lucky purchase of 25,000 small aluminum can (twist mounting) FT type electrolytic condensers. All are 1" and 1⅜" x 2" and 3" height. Same type used in original equipment, by manufacturers. All carry a one-year guarantee to you. Priced at up to 70% off regular dealers' net. Order a good supply now.

| | |
|---|---|
| 40 x 20 150 volt Alum. can | $.39 |
| 40 x 40 150 volt Alum. can | .49 |
| 40 x 40 150v, 20 25v Alum. can | .49 |
| 40 x 20 x 20 150v Alum. can | .59 |
| 25 x 25 mfd 25 volt Alum. can | .19 |
| 50 x 30 150v, 20 mfd 50v, 100 10v Alum. | .59 |
| 40 x 40 150v, 40 x 40 25v Alum. can | .59 |
| 40 x 20 150v, 200 mfd 6 volt Alum. can | .59 |
| 10 mfd. 450v Alum. can | .29 |
| 20 mfd. 450v Alum. can | .39 |
| 40 mfd. 450v Alum. can | .49 |
| 10 x 10 x 10 mfd 450v Alum. can | .49 |
| 10 x 10 mfd 450v Alum. can | .49 |
| 30 x 15 x 10 450v Alum. can | .69 |
| 40 x 40 450v, 25 mfd 25v Alum. can | .69 |
| 20 x 20 mfd 450v, 25 mfd 25v Alum. can | .59 |
| 15 x 10 mfd 350v, 25 mfd 25v Alum. can | .49 |
| 30 x 15 mfd 350v, 20 mfd 25v Alum. can | .49 |

### TUBULAR ELECTROLYTICS WITH LEADS

Popular standard brand tubular electrolytics, in paper tubes, with leads. These sizes fulfill 95% of all your replacement requirements. All name brands. Guaranteed for one year. Up to one-half off of regular dealers' net.

| | |
|---|---|
| 25 mfd 25 volt tubular cond. | $.19 |
| 20 mfd 150 volt tubular cond. | .29 |
| 40 mfd 150 volt tubular cond. | .39 |
| 10 mfd 250 volt tubular cond. | .19 |
| 25 mfd 250 volt tubular cond. | .29 |
| 20 mfd 350 volt tubular cond. | .39 |
| 30 mfd 350 volt tubular cond. | .49 |
| 40 mfd 350 volt tubular cond. | .49 |
| 50 mfd 350 volt tubular cond. | .59 |
| 8 mfd 450 volt tubular cond. | .29 |
| 16 mfd 450 volt tubular cond. | .39 |
| 8 x 8 mfd 525 volt tubular cond. | .49 |
| 30 mfd 450 volt tubular cond. | .49 |
| 16 mfd 525 volt tubular cond. | .49 |
| 10 x 10 x 10 mfd 450 volt tubular cond. | .49 |
| 20 x 20 mfd 150 volt tubular cond. | .29 |
| 20 x 20 x 20 150 volt tubular cond. | .35 |
| 40 x 40 150 volt tubular cond. | .39 |
| 50 x 30 150 volt tubular cond. | .39 |
| 50 x 30 150 volt, 20 mfd 150 volt tubular cond. | .49 |
| 50 x 30 mfd 150 volt, 20 mfd 25 volt tubular cond. | .49 |

### BUY VIBRATORS FROM McGEE FOR LESS

Standard size 4 prong, 6 volt vibrator. Made and branded by the Number One builder of auto set vibrators. Regular non-sync type, but has 8 points for heavy duty use. Buy these vibrators with confidence. These vibrators are tops.
Scoop price. **$1.29** each: 10 for ..... **$11.95**

**Every Vibrator Guaranteed Best Values in U. S.**

| | |
|---|---|
| Replacement sync vibrator unit | $0.99 |
| Standard 5 prong sync vibrator | 1.49 |
| 6 prong reversible sync vibrator | 1.99 |
| 7 prong reversible sync vibrator | 1.99 |
| 7 prong, 2 volt G.E. vibrator | 1.99 |
| 4 prong, offset Delco vibrator | 1.49 |
| 5 prong sync vibrator | 1.49 |
| 4 prong vibrator for Ford | 1.49 |

### SAVE OVER HALF on VOLUME CONTROLS

Regular manufacturers type with 2½" shaft that is split and knurled. These controls fit 90% of all radio sets.

| | | | |
|---|---|---|---|
| 500,000 ohm with SPST switch | 39c | 10 for | $3.50 |
| 500,000 ohm with DPST switch | 39c | 10 for | 3.50 |
| 1 megohm midget with SPST switch | 39c | 10 for | 3.50 |
| 500,000 ohm less switch | 29c | 10 for | 2.50 |
| 1 megohm midget, less switch | 29c | 10 for | 2.50 |

Regular 3" shaft, Jobbers stock controls at scoop prices.

| | | | |
|---|---|---|---|
| 5,000 ohm with DPST switch for battery radio sets and portable | 49c ea., | 10 for | 4.50 |
| 1 megohm tapper, with SPST switch | 49c ea., | 10 for | 4.50 |

### SOLAR WET ELECTROLYTICS

Genuine Solar Screw Mounting Wet Electrolytics. Latest 1948 production. Use Solar wets when you want a filter for those tough jobs.

| | |
|---|---|
| 8 mfd 500 volt wet. Solar | $0.78 |
| 16 mfd 500 volt wet. Solar | 1.15 |
| 20 mfd 500 volt wet. Solar | 1.23 |
| 8 mfd 600 volt wet. Solar | 1.23 |
| 16 mfd 600 volt wet. Solar | 1.64 |

### WORLD'S BEST MIKE VALUES

**SHURE CRYSTAL MIKE** with 20 Ft. Cable.

| | |
|---|---|
| $25.00 List | $10.95 |
| 33X Crystal Mike with 20 Ft. Cable, worth ½ more | 10.95 |
| 33D Dynamic Mike with 20 Ft. Cable, Scoop Price | 12.95 |
| Top quality Xtal mike & stand—recording type | 4.95 |
| Crystal hand mike for the service bench | 2.98 |

## McGEE RADIO COMPANY

ORDER FROM THIS AD
PRICES F.O.B. K. C.

SEND 25% DEPOSIT—BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

# The AARS Now Reinstated as MARS

***The radio amateur has again been recognized as being indispensable to the military and to national defense.***

THE Office of the Secretary of Defense announced on November 26th, 1948 the implementation of the Military Amateur Radio System, (MARS), a joint project of the Air Force and the Army under the direction of Major General Frances L. Ankenbrandt, Director of Communications, Department of the Air Force and Major General Spencer B. Akin, Chief Signal Officer, Department of the Army.

MARS is, in effect, the reactivation of the Army Amateur Radio System, (AARS), under the joint direction of the Army and the Air Force. AARS, so familiar to the older amateurs, went out of business on December 7th, 1941.

An advisory committee will be appointed to advise the Chief Signal Officer and the Director of Communications on matters of policy pertaining to MARS. This committee is to be composed of not more than eight military personnel, including the Chiefs MARS, Army, and Air Force, and three civilians. At the time of this writing the military members had not met to nominate the civilian advisors. It is anticipated, however, that one of the representatives will be a member of the League and one a member of the FCC.

Cognizant of the fact that the amateur is indispensable to the Military and to National Defense in the event of an emergency, the scope of MARS has been broadened to encompass every amateur activity and interest to lend encouragement to furthering his operating proficiency.

To be sure, the very first act of MARS was to reinstate the c.w. nets of the Army and the Air Force on 3497.5 and 6997.5 (up 7½ kc.) with the addition of 14,405, 20,995 and 27,995 kc., which have been cleared by the Interdepartmental Radio Advisory Committee for operation within the United States. Clearance is now under way for the use of these frequencies to communicate with amateurs attached to military units at bases in American possessions and leased bases outside the United States.

Crystals for these frequencies will be supplied to the membership in one-half inch (FT-243) holders. Fundamentals will be in the three megacycle band for 3497.5, 6997.5 and 14,405 operation and in the six megacycle band for operation on 20,995 and 27,995 kc.

These nets carry a three-fold purpose. First, the indoctrination of the amateur into joint procedures and increasing his proficiency in the handling of c.w. traffic; second, to provide a channel for handling quasi-official traffic; and third, to provide an emergency military network.

Time on the nets is divided equally between the Army and the Air Force with ample time left on all frequencies for free net operation. Suitable certificates of award for *"WAAFB"* and *"WAAP"* meaning, of course, *"Worked All Air Force Bases"* and *"Worked All Army Posts"* will be given.

The nets will be integrated at certain levels between Army and Air Force and with the League's Amateur Emergency Corps. Top level net control stations are WAR (K4USA in the Amateur Bands) for Army and AF4AF for the Air Force (K4AF in the Amateur Bands). These stations are located at the Pentagon Building, Washington 25, D. C. Weekly broadcasts every Monday on c.w. on 6997.5 and 14,405, simultaneously, concerning net activities will be made over WAR at 0100 and 0400 GMT.

A considerable quantity of surplus electronics equipment has been allocated to MARS from excess Signal Corps and Air Force stocks and some has been obtained from War Assets Administration. The great bulk of this material is useful only for its components, although some complete transmitters and receivers will be made available to active and reserve units. Supply procedures are outlined in the joint directive and the MARS monthly bulletin will carry lists of available equipment.

In addition to carrying lists of equipment available for MARS stations, the bulletin, which will be issued monthly to its members, will contain operating notes on its nets, some new ideas on modification of GI gear for amateur operation, a construction article or two and a smattering on propagation and antennas. It will have a forum section where members can air their gripes or make suggestions. Direct communication with Chief, MARS, USAF 4 C1067 and Chief, MARS, Army, Sigca-6, 3 B 337, Pentagon Building, Washington 25, D. C. is authorized.

MARS will enter the East Coast teletype net on 147.96 mc. in the near future with a pretty husky final and a 6-element beam. This will provide an alternate for W3OGQ in the Wash-

## INVERTERS

PE 218: Input: 25-28 VDC @ 92 amps. Output: 115 volts @ 1500 volt-amps, 380-500 cycles. New. Herm Sealed (as shown) ..... $49.95
Used. Ex. Cond. $35.00
PE 206-A Input: 28 VDC @ 38 amp. Output: 80 volts @ 500 volt-amps, 800 cycles. Leland. New, complete with enclosed relay filter, instruction book..... $12.50
GE #5D21NJ3: Input: 27 vdc, 35 amp. Output: 115 v, 485 VA, 400 cy, 1PF. New..... $49.95

## POWER EQUIPMENT

Step down transformer: Pri: 440/220/110 volts a.c. 60 cycles, 3 KVA. Sec. 115 v. 2500 volt insulation. Size 12"x12"x7"..... $40.00
PLATE TRANSFORMER. Pri: 117 v, 60 cy. Sec. 17,000 v. @ 144 ma. with choke. Oil immersed. Size: 26"x 29"x14" Amertran..... $120.00
FIL. Trans. UX6899 Pri: 115 v. 60 cy. Sec: Two 5V 5.5A windings 29 KV Test..... $24.50
Voltage Reg. Transtat "Amertran" type PH 2KVA load. Input 90/130 v, 50/60 cycle output 115 v..... $40.00
KS 8767: Fil. Xfmr. Pri: 115 v. 60 cy. Sec: 2 wdgs 5v. at 5 amp each. 15,000 v. ins..... $15.00

## COMBINATION TRANSFORMERS

T2G167, 650 v, 2 ma; 650 vct 65 ma; 6.4 v, 4 amp; 6.4 v, .6 amp; 2.5 v, 1.75 amp. (Ideal for panadapter applications)..... $5.25
#5104, 800 vct, 150 ma; 5 v, 3 amp; 6.3 v, 6 amp..... $6.95
KS 8041, 585 vct, 86 ma; 5 v, 3 amp; 6.3 v, 6 amp..... $4.25

## OIL CONDENSER STANDARD BRANDS

| | |
|---|---|
| .1 mfd, 10 KVDC #14F191 | $15.00 |
| .06 mfd, 15 KVDC, 25F585-G2 | 8.70 |
| 1.5 mfd, 6000 vdc | 12.50 |
| .25 mfd, 20,000 vdc | 17.50 |
| 10 mfd, 1000 VDC | 1.79 |
| 3x10 mfd, delta connected synchro-capacitor, 90 v, 60 cycles | 4.95 |
| .1 mfd, 6000 vdc, 25F509G2 | 6.50 |

## AN/ARC—3 AUDIO TRANSFORMERS

T-102, #55545 T-104, #55547 T-206, #55530
T-103, #55546 T-105, #55554
95c each

## VARISTORS W.E.

| | | | | | |
|---|---|---|---|---|---|
| D-171631 | $.95 | D-171528 | $.95 | D-166271 | $2.50 |
| D-167176 | .95 | D-163298 | .95 | D-162356 | 1.50 |
| D-168687 | .95 | D-168549 | .95 | D-161871A | .95 |
| D-171812 | .95 | D-162482 | 3.00 | | 2.85 |

## THERMISTORS—W.E.

| | |
|---|---|
| D-167332 (tube) | $ .95 |
| D-170396 (bead) | .95 |
| D-167613 (button) | .95 |
| D-166228 (button) | .95 |
| D-164699 FOR MTG, in "X" Band Guide | 2.50 |
| D-167018 (tube) | .95 |

## COAX CONNECTORS

| | | | | | |
|---|---|---|---|---|---|
| 831SP | $.35 | UG 21/U | $.85 | UG255/U | $1.25 |
| 831AP | .35 | UG 86/U | .95 | UG146/U | 1.00 |
| 831HP | .15 | UG 254/U | .75 | UG85/U | 1.25 |

Homedell male to type "N" male adapter..... $1.25
D-166366 Baby "N"..... .85
Adapter Cable Ass'y, Type "N" Male to Type "N" Female..... 2.25
Adapter Cable Ass'y, Sperry Male to Type "N" Male..... 2.25
Connector, #49579 for RG 18/U..... 1.80

## COAX CABLE

RG 17/U, 52 ohm imp..... $.50/ft.
RG 18/U, 52 ohm imp, armored..... .51/ft.
RG 23/U, twin coax, 125 ohm imp, armored..... .50/ft.
RG 28/U, 50 ohm imp, pulse cable. Corona min. starting voltage 17 KV. .50/ft.
RG 35/C, 70 ohm imp, armored..... .50 ft.
RG 57/U, 95 ohm imp, twin coax..... .35/ft.

## TELETYPEWRITERS

Original TELETYPE, with standard keyboard, DC motor. 110 vdc, type 5BY 36A1, 1/30 hp, 1725 RPM. Units are slightly used in excellent condition, as illustrated..... $110.00

## GREAT TUBE VALUES

| | | | | | |
|---|---|---|---|---|---|
| 01-A | $ 0.45 | 12A6 | $ 0.35 | 843 | $ 0.59 |
| 1B24 | 4.85 | 12K8Y | .65 | 860 | 15.00 |
| 2C21 | .69 | 12SF7 | .49 | 861 | 40.00 |
| 2C22 | .69 | 12SR7 | .75 | 874 | 1.95 |
| 2J21-A | 25.00 | 15R | 1.40 | 876 | 4.95 |
| 2J22 | 25.00 | 28D7 | .75 | 1005 | .35 |
| 2J26 | 25.00 | 30 (Spec.) | .70 | 1619 | .21 |
| 2J27 | 25.00 | 45 (Spec.) | .59 | 1624 | .85 |
| 2J31 | 25.00 | 39/44 | .49 | 1629 | .35 |
| 2J32 | 25.00 | 35/51 | .72 | 1961 | 5.00 |
| 2J38 | 35.00 | 227A | 3.85 | 9002 | .65 |
| 2J39 | 35.00 | 225 | 8.80 | 9004 | .47 |
| 2J55 | 35.00 | 268-A | 20.00 | CE072 | 1.95 |
| 3J31 | 55.00 | 355A | 19.50 | EF 50 | .79 |
| 2x2/879 | .69 | 417A | 25.00 | E-1148 | .75 |
| 3BP1 | 2.25 | 530 | 90.00 | F-127 | 20.00 |
| 3C24 | .60 | 531 | 45.00 | FG258A | 165.00 |
| 3C30 | .70 | 532 | 3.95 | FC 271 | 40.00 |
| 3D6 | .79 | 559 | 4.00 | GL 562 | 75.00 |
| 3CP1 | 3.50 | 562 | 90.00 | GL 623 | 75.00 |
| 3D21-A | 1.50 | 615 | .89 | GL 697 | 75.00 |
| 3DP1 | 2.25 | 703-A | 7.00 | ML 100 | 60.00 |
| 3EP1 | 2.95 | 704-A | .75 | OK59 | 65.00 |
| 3FP7 | 3.85 | 705-A | 2.85 | OK60 | 65.00 |
| 3Q5 | .79 | 707-B | †20.00 | OK61 | 65.00 |
| 5BP1 | 1.95 | 714AY | 25.00 | OK62 | 65.00 |
| 5BP4 | 4.95 | 715-B | 12.00 | RCA 932* | .65 |
| 5CP1 | 3.75 | 720BY | 50.00 | VR 91 | 1.00 |
| 5FP7 | 3.50 | 721-A | 3.60 | VR 130 | 1.25 |
| 5JP2 | 6.00 | 723-A/B | 12.50 | VR 135 | 1.25 |
| 5J30 | 39.50 | 724B | 1.75 | VR 137 | 1.25 |
| 6G | 2.00 | 725-A | 25.00 | VU 120 | 1.00 |
| 6L6GA | 1.00 | 726-A | 15.00 | VU 134 | 1.00 |
| 6SC7 | .70 | 860 | 2.25 | WL532 | .75 |
| 7C4 | 1.00 | 801-A | 1.10 | WN 150 | 3.00 |
| 7E5 | 1.00 | 804 | 9.95 | WT 260 | 5.00 |
| 7E6 | .72 | 815 | 2.50 | † With Cavity. | |
| 10Y | .60 | 836 | 1.15 | * Photocell. | |
| | | 837 | 1.95 | | |

## TYPEWRITER DESK WELLS

Mounted on Steel Panel for Standard Rack Mtg. 10½" H x 19" W x ⅛" Thick. Well is 22" Wide, 20" Deep, Affording Full Working Space. Grey Crackle Finish. New. ea. $9.90

## MAGNETRONS

| TUBE | FRQ. RANGE | PK. PWR. OUT. | PRICE |
|---|---|---|---|
| 2J31 | 2820-2860 mc. | 265 KW. | $25.00 |
| 2J21-A | 9345-9405 mc. | 50 KW. | 25.00 |
| 2J22 | 3267-3333 mc. | 265 KW. | 25.00 |
| 2J26 | 2992-3019 mc. | 275 KW. | 25.00 |
| 2J27 | 2965-2992 mc. | 275 KW. | 25.00 |
| 2J32 | 2780-2820 mc. | 285 KW. | 25.00 |
| 2J38 Pkg. | 3249-3263 mc. | 5 KW. | 35.00 |
| 2J39 Pkg. | 3267-3333 mc. | 87 KW. | 35.00 |
| 2J40 | 9305-9325 mc. | 10 KW. | 60.00 |
| 2J49 | 9000-9160 mc. | 58 KW. | 85.00 |
| 2J55 Pkg. | 9345-9405 mc. | 50 KW. | 35.00 |
| 2J61 | 3000-3100 mc. | 35 KW. | 65.00 |
| 2J62 | 2914-3010 mc. | 35 KW. | 65.00 |
| 3J31 | 24,000 mc. | 50 KW. | 55.00 |
| 5J30 | | | 39.50 |
| 714AY | | | 25.00 |
| 720BY | 2800 mc. | 1000 KW. | 50.00 |
| 720CY | | | 50.00 |
| 725-A | 9345-9405 mc. | 50 KW. | 25.00 |
| 730-A | 9345-9405 mc. | 50 KW. | 25.00 |

Klystrons: 723A/B $12.50; 707B W/Cavity 20.00

## MAGNETRONS MAGNETS

| GAUSS | POLE DIAM. | SPACING | PRICE |
|---|---|---|---|
| 4850 | ¾ in. | ⅝ in. | $12.50 |
| 2500 | 1¾ in. | 1 11/16 in. | 12.50 |
| 1500 | 1⅝ in. | 1½ in. | 12.50 |

## TUNABLE PKG'D "CW" MAGNETRONS

QK61 ....2975-3200 Mcs QK62 ....3150-3375 Mcs
QK60 ....2800-3026 Mcs QK59 ....2675-2900 Mcs
EACH $65

## DYNAMOTORS

| Type | Input Volts | Input Amps | Output Volts | Output Amps | Radio Set | Price* |
|---|---|---|---|---|---|---|
| BD 77KM | 14 | 40 | 1000 | .350 | BC 191 | $20.00N |
| | | | | | | 14.00LN |
| PE 73 | 28 | 19 | 1000 | .350 | BC 375 | 24.50N |
| DM 21 | 14 | 3.3 | 235 | .090 | BC 312 | 3.45N |
| DM 21CX | 28 | 1.6 | 235 | .090 | BC 312 | 3.45N |
| DM 25 | 12 | 2.3 | 250 | .050 | BC 367 | 2.49LN |
| DM 28R | 28 | 1.25 | 275 | .070 | BC 348 | 8.95N |
| DM 33A | 28 | 7 | 540 | .250 | BC 456 | 5.50N |
| DM 42 | 14 | 66 | 515 | .110 | SCR 506 | 6.50LN |
| | | | 1030 | .050 | | |
| | | | 2/8 | | | |
| PE 55 | 12 | 25 | 500 | .400 | SCR 245 | 5.25LN |
| PE 86 | 18 | 1.25 | 250 | .060 | RC 36 | 3.95 |
| PE 101C | 13/26 | 12.6/ | 400 | .135 | SCR 515 | 5.25N |
| | | 6.3 | 800 | .020 | | |
| BD AR 93 | 28 | 3.25 | 375 | .150 | | 4.95N |
| 23350 | 27 | 1.75 | 285 | .075 | APN-1 | 3.50N |
| 35X045B | 28 | 1.2 | 250 | .060 | | 3.50N |
| ZA .0515 | 12/24 | 4/2 | 500 | .050 | | 3.95N |
| B-19 pack | 12 | 9.4 | 275 | .110 | Mark H | 9.95N |
| | | | 500 | .050 | | |
| D-104 | 12 | | 225 | .100 | | 14.95N |
| | | | 400 | .200 | | |
| DA-3A* | 28 | 10 | 300 | .260 | SCR 522 | 8.95N |
| | | | 150 | .010 | | |
| | | | 14.5 | .5 | | |
| #5053 | 28 | 1.4 | 250 | .060 | APN-1 | 3.95N |
| DA-7A | 26.5 | | 1100 | .400 | TA-2J | 25.00N |
| CW 21AAX | 13 | 12.6 | 400 | .135 | | 17.50N |
| | 26 | 6.3 | 800 | .020 | | |
| | | | 9 | 1.12 | | |
| PE 94 | 28 | 10 | 300 | .260 | SCR | 15.00 |
| | | | 150 | .010 | 522 | |
| | | | 14.5 | .5 | | |

*For PE 94: Less Filters & Relays.
N—New. LN—Like New.

## TELEPHONE EQUIPMENT

### F.T. & R. 101-A APPLIQUE

Provides necessary balancing facilities for four wire repeater when used on two wire lines which may be voice-frequency telephone lines of open wire, or non-loaded or loaded cable. Std. 19" channel iron rack mtg. Price, new, complete with tech manual..... $54.00

### SB-19/GT CONSOLE

Provides facilities for patching and monitoring network of lines for telephone intercom, radio reception, telegraph reception, recording, etc. Complete central office supervising position..... $350.00

### EE-89A REPEATER

Extends range of field telephone apparatus, such as EE-8 up to 25 miles, when inserted in a line. New, with spare tube and instruction manual, less standard type batteries..... $21.50

### BC 686 LINE AMPLIFIER

With magneto ringer: 3-tube 25L6 amplifier. For local point-to-point telephone operation, remote operation of Phone Xmtr. remove reception of receiver output, monitoring facility. Requires only 24 vdc for tube "B" plus supply for full operation.
New, less tubes, in wooden chest..... $18.50
Per pair for 2-way pt-to-pt operation..... $35.00

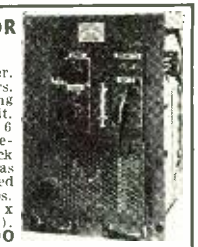
### F.T. & R. 102-B REPEATER EE-99

May be used as Terminal or Intermediate Repeater. 20 cycle ringing & DC Telegraph. Applicable on simplex operations. Monitoring facilities, equalizing facilities. Dry or storage battery operation. New..... $55.00
Telephone switchboard lamp holders: 10 lamp holders per strip..... $4.25
LAMPCAPS FOR TELEPHONE SWITCHBOARDS: GREEN, RED, WHITE..... $.05 ea.
Large quantities available.

## CROSS POINTER INDICATOR

Dual 0-200 microamp. movement in 3" case. Each movement brought out to 6-term receptacle at rear. Originally used in ILS equipment. New..... $5.50

## MASTER OSCILLATOR UNITS



M.O. units designed for oper. in 2-18 mc TBK transmitters. Flexible plug in units using Type 860 Tube in ECO circuit. Tunes 2000 to 4565 kc in 6 bands. Freq. Determining elements are enclosed in shock mounted oven assembly, and has freq. monitor PU link coupled to output. Net Wt.: 138 lbs. Dim.: 21 in. d x 14½ in W x 25½ in. H. New (with tube)..... $150.00

## MICROWAVE TEST EQUIPMENT

THERMISTOR BRIDGE: Power meter 1-203-A. 10 cm. mfg W.E. Complete with meter, interpolation chart, portable carrying case..... $72.50
Bell Labs. Dual Mount mixer-beacon assemblies. 2 complete mixer-beacon mounts on gold-plated waveguide section..... $50.00
Slotted Line, Bell Labs. 1¼" x 5/16" guide, gold plated..... $150.00
TS-238 GP. 10 cm. Echo box with resonance indicator and micrometer adjust cavity. 2700 to 2900 Mcs calibrated..... $85.00
TS 108-AP dummy load..... 65.00
W. E. 1 138. Signal generator, 2700 to 2900 Mc range. Lighthouse tube oscillator with attenuator & output meter. 115 VAC input, reg. Pwr. supply. With circuit diagram..... $50.00
3 cm. wavemeter: 9200 to 11,000 mc transmission type with square flanges..... $15.00
3 cm. stabilizer cavity, transmission type..... 20.00
3 cm. Wavemeter, Micrometer head mounted on X-Band guide. Freq. range approx. 7900 to 10,000 Mc..$75.00

## MICROWAVE PLUMBING

### 10 CENTIMETER

"S" BAND CRYSTAL MOUNT, gold plated, with 2 type "N" connectors..... $12.50
POWER SPLITTER, 726 Klystron input, dual "N" output..... $5.00
MAGNETRON TO WAVEGUIDE coupler with 721-A duplexer cavity, gold plated..$27.50
10 CM WAVEGUIDE SWITCHING UNIT, switches 1 input to any of 3 outputs. Standard 1¼"x3" guide with square flanges. Complete with 115 vac or d.c. arranged switching motor. Mfg. Raytheon. CRP 24AAS New and complete..... $150.00
Waveguide directional coupler, 27 db. Navy type CABV-47AAN, with 4" slotted section..... $42.50
Sq flange to rd choke adapter, 18 in long OA. 1¼ in x 3 in guide type "N" output and sampling probe..... $32.00

DEHYDRATING UNIT, 60 lb. capacity, 115 v, 60 cy operation, 2'x22"x15". New and complete..... $425.00

### 3 CENTIMETER PLUMBING

(STD. 1" x ½" GUIDE, UNLESS OTHERWISE SPECIFIED)

"X" BAND PREAMPLIFIER consisting of 2-723A/B local oscillator-beacon feeding waveguide and TR/ATR Duplexer section, including 60 mc. IF amp..... $47.50
RANDOM LENGTHS of waveguide, 6 in. to 18 in. long..... $1.10/ft.
WAVEGUIDE RUN, 1¼"x½" guide, consisting of 4 ft. section with rt. angle bend on one end and 2", 45 deg. bend other end..$8.00
WAVEGUIDE SECTION, 1¼" x ½" choke to choke, 4 ft. long..... $ 6.75
DUMMY LOAD, TS 332/UP..... 22.50
"X" Band pressurizing gauge section, with 15-lb. gauge and pressurizing nipple....$18.50

### 1.25 CENTIMETER

"K" BAND FEEDBACK-TO-PARABOLA HORN with pressurized window..... $30.00
MITRED ELBOW cover to cover..... 4.00
TR/ATR SECTION choke to cover..... 4.00
FLEXIBLE SECTION 1" choke to choke. 5.00
KBAND Rotary joint..... 45.00
ADAPTER, rd. cover to sq. cover..... 5.00
MITRED ELBOW and S sections choke to cover..... $4.50

## PULSE EQUIPMENT

### MODULATOR UNIT BC 1203-B

Provides 200-4,000 PPS. Sweep time: 100 to 2,500 microsec. in 4 steps, fixed mod. pulse, suppression pulse, sliding modulating pulse, blanking voltage, marker pulse, sweep voltages, calibration voltages, fil. voltages. Operates 115 vac. 50-60 cy. Provides various types of voltage pulse outputs for the modulation of a signal generator such as General Radio #804B or #804C used in depot bench testing of SCR 695, SCR 595 and SCR 535.
New as shown..... $125.00

## PULSE NETWORKS

G.E. #25E5-1-350-50P2T, 25 KV, 5 sections. "E" circuit, 1 microsecond pulse length, 350 PPS, 50 ohms impedance..... $45.00
G.E. #6E3-5-2000-50P2T, 6KV, 3"E" circuit, 3 sections, .5 microsecond, 2000 PPS, 50 ohms impedance..$6.50
G.E. #3E (3-84-810; 8-2,24-405) 50P4T; 3KV. "E" CKT Dual Unit; Unit 1, 3 Sections, .84 Microsec. 810 PPS, 50 ohms imp.; Unit 2, 8 Sections, 2.24 Microsec, 405 PPS, 50 ohms imp..... $6.50

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PHONE DIGBY 9-4124

ington area and an endeavor will be made to push the net on south to Norfolk or Richmond. This move is not to be construed as the military moving into the ham bands, rather it is an effort to help the League accelerate interest in FSK teletype by aiding and abetting this newly established activity.

A number of facsimile machines are under procurement and request is being processed to use A-4 emission on 20,995 and 27,995 kc. Due to the limited number of machines requested, they probably will be issued on a temporary loan basis upon request to the Chiefs MARS at Headquarters USAF and Office of the Chief Signal Officer levels.

Brigadier General Tom C. Rives, present chief of Electronics Subdivision of the Engineering Division, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, founded the old AARS in 1925 when he was a Captain in the Signal Corps. General Rives believes that members of MARS can be of great assistance in prosecuting the radio research and development program of the Air Force and proposes to ask for their help on unclassified projects such as propagation studies, ultra-high frequency communications problems, etc. From the great number of amateurs interested in radio research and development, the General anticipates many worthwhile contributions to the art. It is hoped some method can be worked out to suitably reward those members of MARS whose work is of outstanding merit.

MARS callsigns will carry an "A" prefix for Army and an "AF" prefix for Air Force with the numerals following the FCC districting. Thus K4AF becomes AF4AF when operating on MARS frequencies or W9USA will become A9USA when it enters the regular Army net.

Allocation of blocks of "K" calls has been made for MARS stations with "K" numeral FAA through FZZ for the Air Force and K numeral WAA through WZZ for the Army. To date these calls have been assigned only to stations making applications on FCC form 602.

Membership in MARS is open to any individual in the military service, active Organized Reserve Corps, National Guard, or Officer's Reserve Corps who possesses a valid amateur radio license issued by the Federal Communications Commission.

Applications for membership in MARS will be similar for Air Force and Army participants with the exception that in certain Air Force Major Commands (FEAF, USAFE, SAC, AMC, ATC, AND ATRC) applications will follow command channels, addressed to the Commanding General of the particular command to which the applicant is attached, marked to the attention: Chief, MARS.

In all other Air Force units in the ZI and in the Army nets the applicant will be governed by his geographical

location, sending his application to the Commanding General of the Army Area or the Commanding General of the numbered Air Force which is contiguous to the Army Area in which he lives. The command to which the application should be sent is shown, by states, below.

Hams residing in New York, Vermont, New Hampshire, Maine, Massachusetts, Connecticut, New Jersey, or Delaware should apply to:

First Army Headquarters
Commanding General, First Army
Governor's Island
New York, New York,
Attn: Signal Officer
or:
Commanding General
Headquarters, First Air Force
Fort Slocum, New York,
Attn: MARS, Air Force Director

Amateurs whose residence is located in Pennsylvania, Indiana, Ohio, Kentucky, West Virginia, Maryland, Virginia or the District of Columbia, should send their applications to:

Second Army Headquarters
Commanding General, Second Army
Fort George G. Meade, Maryland,
Attn: Signal Officer
or:
Commanding General,
Headquarters 14th Air Force
Langley Air Force Base
Langley Field, Virginia,
Attn: MARS, Air Force Director

If you live in Tennessee, North Carolina, South Carolina, Mississippi, Alabama, Georgia or Florida and want a MARS ticket, you should apply to:

Third Army Headquarters
Commanding General, Third Army
Fort McPherson, Georgia,
Attn: Signal Officer
or:
Commanding General, 9th Air Force
Greenville Air Force Base
Greenville, North Carolina,
Attn: MARS, Air Force Director

Those who live in Oklahoma, Texas, New Mexico, Arkansas or Louisiana will send their applications to:

Fourth Army Headquarters
Commanding General, Fourth Army
San Antonio, Texas,
Attn: Signal Officer
or:
Commanding General,
12th Air Force
Brooks Air Force Base
San Antonio, Texas,
Attn: MARS, Air Force Director

Amateurs who reside in Wyoming, Colorado, Kansas, Nebraska, Missouri, Iowa, North Dakota, South Dakota, Minnesota, Wisconsin or Illinois should send their applications to:

Fifth Army Headquarters
Commanding General, Fifth Army
Chicago, Illinois,
Attn: Signal Officer
or:
Commanding General,
10th Air Force
Fort Benjamin Harrison
Indianapolis, Indiana,
Attn: MARS, Air Force Director

Amateurs who are residents of

Washington, Oregon, California, Nevada, Arizona, Idaho, Montana or Utah should send their applications to:

Sixth Army Headquarters
Commanding General, Sixth Army
San Francisco, Calif.,
Attn: Signal Officer
or:
Commanding General,
Fourth Air Force
Hamilton Air Force Base
Hamilton Field, Calif.,
Attn: MARS Air Force Director

Upon receipt of an inquiry for enrollment in MARS, the Signal Officer of the Army Area or the MARS Air Force Director will forward application blanks to the applicant. When these are processed, a MARS callsign and net allocation will be made at the proper command level and a MARS certificate will be sent to adorn the walls of the "shack" alongside the FCC ticket. —30—

## EASTERN AND MIDWESTERN TELEVISION NETS JOINED

WHEN the Eastern and Midwestern television networks were joined on January 11th, the Bell System video channels completed the link from the Atlantic to the Mississippi River.

The existing 3400 miles of intercity television network channels is to be tripled within the next two years. During this period, 21 cities will be added to the present 13 cities linked by the networks.

Many of the video channels to be added are on the existing main routes of the two television networks. Under the 1948-1950 program, television channels will also be extended to additional nearby cities while other cities, located on the chief television routes, will be connected to the networks.

By the end of 1950, additions along the present Bell System video net will increase facilities so that a total of 5 television channels will be in service between New York and Boston, between New York and Washington, Philadelphia and Cleveland, Cleveland and Chicago, and Detroit and Toledo. Two video channels link Chicago and St. Louis.

Both coaxial telephone cable and radio relay facilities are employed for transmitting intercity television programs.

—30—

## TV ANTENNA INSTALLATION

BY CHARLES H. KUNDE

AFTER considerable testing of the merits of various types of antennas and arrays recommended for television, I have found that to obtain a clear picture in the upper and lower groups of channels requires the use of separate antennas.

In installations in the Chicago area one company cuts the antenna to Channel two and uses a straight dipole with suitable reflector, claiming that the antenna is cut to this frequency as it has a better response to all channels in the group running from 54 through 82 megacycles.

However, it seems, under certain conditions, to be asking too much of this antenna to produce a good picture in the higher frequencies of the 7th through 13th channels which cover from 174 through 216 megacycles. Adding a folded dipole with reflector cut to match some upper channel and attaching it to the mast does not give a clear picture because the proximity of one antenna to the other is an important factor in the final result.

A separate antenna cut to Channel ten (arbitrarily) with suitable reflector and set no nearer than eight feet from the original antenna gives the elements an opportunity to do their work without interference. Then too, the directivity pattern for Channels one to six requires that the antenna be broadside to the transmitter while the pattern for the upper channels (7 through 13) demands that the antenna be 25 to 35 degrees away from broadside to the transmitter. (Note: Chicago stations now in operation are transmitting on Channels 4, 5, 7 and 9).

Rather than have two lead-ins of 300 ohm twin-lead flapping around in the wind, install a Leach relay to handle the changeover. One such unit is available with a d.p.d.t., 110 volt relay with a weatherproof cover. The only other item needed would be wire and a switch to control relay current.

The one I am using now has withstood the weather for four months without any interruption. I am using a discarded i.f. can to house the relay which is fastened to one of the antenna masts. The 110 volt line to the roof makes a much better looking installation than could be expected from a twin-lead and will stand up a lot longer. With a single antenna lead-in, you reduce the possibility of antenna trouble caused by the twin-lead rubbing against the building, etc.

Orientation of the antenna is one of the main problems in securing a good picture. This can be accomplished more easily when using two antennas, for a direction or location that is suitable for one station may produce ghosts or other difficulties when another channel is tuned in. It is also very true that a location three feet one way or another can produce or eliminate undesirable images on the screen.

When dealing with the high frequencies found in the upper channels of television, a folded dipole must be used rather than a straight dipole. The leads coming from the relay must be kept separated. This can be accomplished by using some form of dielectric to separate the lines and hold them firm for a length of five inches or until they clear the vicinity of the relay and proceed on their separate ways to the two antennas and the video set.

The measurements used in erecting the elements were taken from the May issue of RADIO NEWS from an article on page 180 by Edward M. Noll.

The system described here should be very helpful in crowded metropolitan areas where several television stations are on the air and where the signal received may be strong on one station but weak on another. This system can be amplified as the need arises because any number of arrays can be controlled by relays and fed through a single lead-in. —30—

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**75c Ea.**

0Z4, 2A3, 2A7, 2A5, 3A4, 3Q4, 3Q5GT, 3S4, 3V4, 6A3, 6A6, 6A8G, 6AC5GT, 6AC7/1852, 6AG5, 6AG7, 6AL5, 6AQ5, 6AT6, 6AU6, 6AV6, 6B4G, 6B8, 6B8G, 6BA6, 6BE6, 6BJ6, 6C4, 6C5GT, 6C6, 6C8G, 6D6, 6F5GT, 6F6GT, 6F8G, 6J5, 6J6, 6J7, 6J8G, 6K6GT, 6K7, 6K8G, 6L6G, 6N7, 6P5GT, 6Q6, 6Q7, 6R7GT, 6S8GT, 6SA7, 6SA7GT, 6SC7, 6SG7, 6SH7, 6SJ7GT, 6SN7GT, 6SQ7GT, 6SR7, 6T7G, 6U6G, 6U6GT, 6U7G, 6V6, 6X4, 6Y6G, 6Q7, 12A8GT, 12AT6, 12AU6, 12BA6, 12BE6, 12F5GT, 12J5GT, 12J7GT, 12K8, 12Q7GT, 12SA7GT, 12SF7, 12SH7, 12SJ7GT, 12SN7GT, 12SR7, 12SF5GT, 14A7/12B7, 14X7GT, 19T8, 24A, 25A7GT, 25AC5GT, 25L6, 25Z5, 25Z6GT, 26, 27, 56, 30, 31, 35, 35B5, 35L6GT, 35W4, 35Z5GT, 36, 37, 38, 39/44, 40, 41, 42, 43, 47, 50, 51, 57, 58, 70L7, 71A, 76, 77, 78, 80, 83, 84/6Z4, 85, 89, 117L7, 117P7, 117Z3, 182B, 183, 482B, 483, 2050, 2051

**BATTERIES** Battery type BA-38, 103.5 Volts, used in Handie-Talkie BC-625 mine detector, or for any purpose where low current drain is required. Size 1"x1"x11½" long. Out-dated but tests okay. Unused ..... **$3.00**

Battery BA-41, delivers 4½, 60, 25½ Volts. Used with BC-620 Transceiver, for bias supply, or portable equipment. Size 2"x2¼"x3½". Outdated but tests okay. Unused ..... **25c**

Battery BA-32. 144, 4½ and 3 Volts positive and 13½ Volts negative. Used with BC-222 Walkie-Talkie Transceiver. Size 5"x8"x7" ..Ea. **$3.50**
Husky and has long life. Outdated but tests okay.
Unused ..... **3 for $9.95**

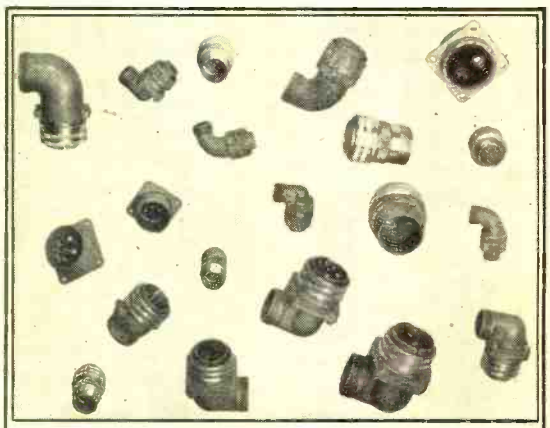
**ALUMINUM BOX** with lid. Size about 3"x3"x2½" with pointed end at top. Ideal for meter case, switch and fuse box, control box, for holding loose parts. Brand new.....Ea. **60c**

**PHILLIPS SCREWDRIVER** 6¾" overall length. Blade 3" long. Insulated non-slip handle ⅞" diameter. Brand new.....Ea. **25c**

**PORTABLE TRANSMITTER** Navy Department Model MI-2462 (made by RCA). Sound powered microphone transmitter with push-to-talk switch. Metal formed chestplate with adjustable strap for support about operator's neck. Pivot adjustment for placing of microphone. Has 7-wire color-coded rubber covered heavy duty cable, 20 ft. long. Units will work up to several thousands of feet apart, no batteries or external power supply needed. Several units may be connected together on same circuit. Indispensable for television antenna installation, electrical wiring work, plumbing contractors and other point to point work. Brand new.....Ea. **$7.50**

**GLASS TELEPHONE-POLE INSULATORS** Hemingway size 680. Fits ¾" wooden crossarm pin. Overall height 5", diameter 4". Will hold two single steel wires, or two pair of stranded wire cables. Brand new. Ea. **60c**

**PHONOGRAPH TURNTABLE and MOTOR** Turntable, felt covered, 9" diameter, rim drive, sturdy 110 Volt 60 cycle AC motor, speed 78 rpm, for continuous duty. Offset tone arm with crystal pickup. Metal mounting base 11"x11¼" with shock-mount grommets. Microswitch stops turntable at finish of recording. Shielded pickup output lead and plug. 4-prong plug and wires for 110 Volt control circuit. Brand new. Ea. **$5.50**



## CABLE CONNECTORS AND PLUGS

| Manufacturer | Type | Price |
|---|---|---|
| Amphenol | AN3101-16-10P | each 50c |
| Amphenol | AN3101-18-18S | each 70c |
| Amphenol | AN3101-22-5S | each 60c |
| Amphenol | AN3102-22-15P | each 60c |
| Amphenol | AN3102-28-10P | each 60c |
| Amphenol | AN3102-32-5P | each 60c |
| Amphenol | AN3106-18-11S | each 65c |
| Amphenol | AN3106-18-18P | each 65c |
| Amphenol | AN3106-24-6S | each 80c |
| Amphenol | AN3106-24-7P | each 90c |
| Amphenol | AN3106-32-5S | each 90c |
| Harwood | AN3108-14S-* | each 65c |
| Aero | AN3108-14S-2S | each 65c |
| Cannon | AN3108-14S-2S | each 65c |
| Amphenol | AN3108-14S-2S | each 65c |
| Amphenol | AN3108-18-12P | each 80c |
| Amphenol | AN3108-22-5S | each 80c |
| Cannon | AN3108-22-5S | each 80c |
| Amphenol | AN3108-24-6P | each 90c |
| Amphenol | AN3108-24-16S | each 80c |
| Cannon | AN3108-24-16S | each 80c |
| Amphenol | AN3108-32-5P | each 90c |
| Amphenol | AN3108-28-10P | each 90c |

**McCLELLAN SADDLES** Brand new. U. S. Army surplus. Top grade cowhide. 12" seat, hair girth. Has straps for blanket roll and knapsack. Gunboot and sabre loops. A bargain only made possible because of it being war surplus. Shipping weight 15 lbs. Brand new.....Ea. **$22.50**

**ELECTRIC WATER HEATER** Made by Sodak, Model 107, 15-gallon capacity, gravity feed. 110 Volt 60 cycle operated, 800 watts. Thermostatically controlled. Entirely automatic in operation. Has drain valve. Withstands 100 lbs. gauge pressure. Sets on 3 legs. Overall height 3'8", diameter 16". With AC cord and plug..... Ea. **$49.50**

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# LETTERS from our readers

## NEW HAMS

"AS a hopeful future ham, I wish to say fine business on that editorial in the December issue of RADIO & TELEVISION NEWS. I know that many of the guys in our high school would take a real interest in ham radio if they knew what it was all about and just what is expected to obtain a ticket.

"Up to a few months ago I was a contented SWL with a fine little post out in a double garage For several years I tuned the BC short-wave bands and when nothing else was on went into the ham bands. But after seeing WØGQL's basement rig I got bit by the bug but good.

"Now we are up to theory and code practice every evening. But as I work in the morning before school and after school and sometimes after supper as well as Saturdays my time is all but used up. So when I do get a little time for study I want to get the most out of it. For myself and other young OM's I think some helpful articles would be any answer to our prayers.

"I think that if ham radio is made a little more attractive many OM's and YL's would be glad to do a little study to get that ticket."

Walt Berry
Madrid, Iowa

*One answer to the problem, Walter, is to follow Bob Hertzberg's articles. Note to club secretary nearest Madrid —Here's a group of lads who should be given some help.*

"I AM and have been a reader of RADIO & TELEVISION NEWS for many, many years. I read with interest your editorial in the December issue of the magazine on getting new blood into amateur radio.

"I am 39 years of age and since I was in my teens I have dabbled in radio. I never got around to getting my ham license as no one I knew could teach me the code. During the past few years I have made renewed efforts to get one by learning the code —still to no avail. I tried several ham clubs and found they gave code lessons to members. On several visits to these clubs no one even approached me to advise me what to do to become a member and I was left alone for the length of the meeting.

"On many occasions the clubs did not start their meetings on time, but were considerably late necessitating eliminating such activities as code practice. If these clubs want members they certainly do nothing to encourage anyone joining.

"I then bought a tape code practice machine and worked on it at home but found I could not get over 8 words a minute as I had no one to advise me. I contacted several schools in the city but found none giving code practice at night, the only time I could spend at it.

"I then started a home study course in radio, as I felt I needed some background in theory. At the present I've spent a great deal of time, money, and effort—not to mention years, trying to get into amateur radio and have gotten nowhere as far as learning the code is concerned.

"Perhaps others are kept out of ham radio by similar circumstances.

"Yours for a solution to problems such as this."

John G. Morrice
Staten Island, New York

*Here's another prospect that needs code training!*

"IN your editorial 'For the Record' in the December issue you asked for suggestions for a program to encourage a new influx of youngsters into ham radio.

"I have been a ham since 1935 but recently I have stayed off the air and could have had just about as much enjoyment without my license due to the fact that the bands are swamped with high power boys who have a lot of money to spend on equipment. A lot of money in this case means that they have more than I do. Now to follow this back, I have probably more than the youngsters we would like to attract, but what do we have to offer them. They sweat out a nice little rig, putting it on the air is like trying to navigate a rowboat in the wake of the 'Queen Mary.' I hope you get what I mean.

"I think we should quarantine the high power boys (over 100 to 200 watts) to a portion of any of the bands which would be restricted to high power only. Even if no ham could use over 100 watts we would still have everything we have now as far as any useful purpose is concerned and the parts people would sell a lot more parts.

"This is my gripe, if the majority ruled I think it would be done away with."

J. L. Hannon, W3OJL
Pittsburgh, Pa.

*The u.h.f. and v.h.f. bands are one solution and are growing in popularity.*

## HELP! HELP!

"I NOW trouble you with a second letter—this time to thank you for being so helpful in publishing my first letter.

"Since your August issue appeared a flood of radio books rolled this way. The postman is tired carrying them, there are piles of books around the house and I spend most of my spare time acknowledging letters and books.

"This all goes to show the widespread circulation RADIO & TELEVISION NEWS enjoys. It also speaks very well for the generosity of Americans and the 'helping hand' spirit that exists among radio enthusiasts.

"Thanks to you and your readers, I can now look forward to several months' pleasant reading."

Charles A. Farrell
Dundalk, Ireland

*Thanks to our readers for responding so nobly to Mr. Farrell's original request.*

### PARLEZ-VOUS FRANCAISE?

"I BEG to ask you to kindly send me a sample copy of your magazine RADIO & TELEVISION NEWS.

"Furthermore, as I am looking for pen-friends in the U.S.A., I want to ask you to insert, if this is possible for you, in your magazine the following: 'Maurice Boye, a member of the Network of French Broadcasters, 39, Rue Marceau Perrutel, Carcassonne (Aude), France, is looking for pen-friends 18 to 22 years old, in foreign countries, outside France, to exchange questions pertaining to radio. Correspondence French.'

"Meanwhile, I remain . . ."

Maurice Boye
Member of the Society of
Radio-Electricians
Carcassonne, France

*Here's a chance to dust off those high school French books and try your hand at discussing radio with Maurice.*

### TAKE A BOW, MR. KIVER

"WE would like to take this opportunity to commend you on the fine articles on television appearing in RADIO & TELEVISION NEWS, written by Milton S. Kiver.

"In twenty years of radio, I have never read a more clearly comprehensive work. Please continue to publish articles such as these."

Mendel Maskewitz
Mendel's Radio Laboratory
Barre, Vermont

*Thank you for your nice letter. You can be sure that we will continue to bring you the best possible material on television.*

### NO CADILLACS

"MUCH injustice has been done to the radio serviceman by the distortion of facts in the yellow 'sensation sheets.' Lies may sell papers—but the misinformation fed to the public is harmful to all who read and believe.

"I will try to show you why I think the radio serviceman is not a 'skunk,' 'racketeer,' or unfair in his charges. How many radio servicemen do you know who drive Cadillacs, or have

much to show in the way of profit at the end of the year? I struggled with a shop for 23 years and have known many radiomen, big and little, who eventually quit because they couldn't make ends meet.

"The fact is one must get a new customer each time. Figuring the average repair job will last a year, radio entertainment costs the customer far less than any form of amusement in which he can indulge.

"The case history of the average repair job, charges based on 1 year's outlay of cash for upkeep per customer, is less than 2 cents a day. That allows $7.20 per set, and charges will not average that.

"The average factory laborer can net $65.00 a week for 40 hours with no investment, books, training, etc. That is why I do labor in a factory instead of what I'd rather do. With overhead hitting the sky today it's impossible to make a living from radio service.

"In most cases a city, county, state license is required costing $65 a year up, also a personal property tax, on top of the rest of the overhead.

"Government licensing will not help, organizations of servicemen will not cure the trouble, but education of the public will cure everything and instill in the mind of the customer the idea that the serviceman is not a tinkerer or handyman but a skilled technician and worthy of his pay.

"I have $850 invested in radio test instruments, in storage, which were purchased from factory wages and not servicing radios. I've tried a shop twice since the war but the overhead was too much so went back to the security of $65 every Friday instead of worrying about when the next customer was coming in.

"In brief, is 2 cents a day too much for the customer to pay for the upkeep of his radio?"

G. M. Wilson
Dearborn, Michigan

*Readers' Digest—take note!*

### 150 MILE TV RECEPTION

"I HAVE just read with interest Mr. Gootée's article '1948—Year of Television Progress' in the December issue and I thought it might interest you to know that there are a known 33 television sets within a 20-mile radius of Lafayette, Indiana.

"I have a *Motorola* receiver and have had very reliable service from WBKB and WNBQ (Chicago) which are 150 air miles away. Excellent reception is also had from WLWT in Cincinnati, 160 miles away.

"A highly directional antenna is used, as both WLWT and WBKB are on channel 4. The antenna height is 47 feet.

"It was feared that with the cold air of winter this tropospheric reception might disappear, but it seems better than ever!"

Richard Cochran
Radio Station WASK
Lafayette, Indiana

—30—

## International Short-Wave

(*Continued from page 63*)

EST); the station believes these hours give best reception in America. (Dallmeier, N.Y.)

QRA for the Tel Aviv s.w. outlet is Radio Kol-Yisrael Broadcasting Station, P.O. Box 661, Tel Aviv, Israel. (Bluman, Nor. Afr., via Radio Australia)

*New* QRA of Broadcasting Corporation of Japan is No. 2, 2-Chome Uchisaiwaicho Chiyoda-ku, Tokyo, Japan; veries signed by R. H. Nigno of the Liaison Section. (DX Bulletin, N.Z.)

Address of Bucharest Radio is Radio Dacia Romana, Societates Romana de Radiodifuziune, Str. Gen. Berthelot 41, Bucharest, Roumania. XLRA verified from Hankow Broadcasting Station, 168 Victory Street, Hankow, China, via airmail from C. L. Cheng, director; asked for further reports. (DX Bulletin, N.Z.)

"The Finnish Broadcasting Corporation, Helsinki, Finland, is eager to receive reception reports, particularly on its *new* 100 kw. transmitter (15.190).

Address of Forces Broadcasting Station on Cyprus is announced as Station Commander, Forces Broadcasting Service, Cyprus. (Pearce, England)

* * *

### This Month's Schedules

*Albania*—Simonian, Mass., reports ZAA, 7.852, Tirana, heard 1300-1600.

*Algiers—Radio Algiers*, 9.57, is a fair signal to 1630 in New York, best around 1520-1525; uses French. (Schild)

*Anglo-Egyptian Sudan—Radio Omdurman*, "the wanderer," has been an excellent signal here in West Virginia recently in the 31-m. band 2315-2345 with native-type program; frequency varies from day to day; at the time this was compiled was heard on 9.555; at 2330 announces *"Huna Omdurman"* quite distinctly. Also reported by Stark, Texas, Driver, Ohio.

*Angola*—Driver, Ohio, reports *Radio Clube de Angola*, 9.475, signing off 1600 with "A Portugesa," good signal.

Pearce, England, has received a QSL card from Radio Clube de Angola, Luanda, for the 8.090 station which the station said is CR6RN on 37.09 m. Verified in both Portuguese and *English*.

*Argentina*—LRU, 15.290, Buenos Aires, heard 1515-1600 sign-off. (Peddle, Newfoundland) *Radio Splendid* has moved frequencies of two of its s.w. outlets—LRS, 9.320, moved to 9.340 and LRS1, 5.985 is now on 6.065; LRS2 remains 11.840; sign-off 2200; fair signals on all channels in New York, but 11.840 and 6.065 outlets have QRM. (Beck, N.Y.)

*Australia*—The German program from *Radio Australia* is scheduled 1200-1315 on VLA8, 11.76, VLB2, 9.65; 1230-1315, VLC11, 15.21, which has replaced VLC8, 7.24, for this beam to Europe.

VLG6, 15.23, ABC, Melbourne, heard in Newfoundland 1515-1600 sign-off.

*Azores*—Driver, Ohio, reports CSX2, 4.845, Ponta Delgada, with fair signal signing off 1900 with clock chimes and "A Portugesa;" bad QRN, aircraft QRM, and CWQRM.

*Belgian Congo—Radio Congolia* has been heard on 9.210 signing off 1330; languages French and Flemish; signal fair in Australia. (Gillett). Signs on 1300 with march. Announces, *"Ici Congo Belge."* (Pearce, England)

Elizabethville, 7.200, carries mostly classical music with announcements in French, 1130-1215. (Swedish DX Broadcast)

*Belgium*—Ruyselede, 17.845, 5 kw., is scheduled 1100-1200, 1600-1700 (sometimes runs later for traffic); Sundays there is only one transmission, beginning 1330 and lasting as long as necessary. (Worris, N.Y.). Is beamed to Leopoldville, Belgian Congo.

*Brazil—Radio Jornal do Comercio* lists current schedules as PRL6, 780 kc., 0600-2100; ZYK2, 15.145, 0600-1400; ZYK2, 6.085, 1600-2100; ZYK3, 9.565, 0600-1200, 1400-2100. It was stated that Radio Station Jornal Do Comercio of Pernambuco is the only station of South and Central America which possesses eight frequencies that are used at definite hours of the day or night in accordance with climatic seasons of the year. Station Jornal do Comercio transmits simultaneously daily on five frequencies, by means of its five transmitters—one on medium-wave, two on short-wave, and two on frequency modulation. (McPheeters, La.)

Peddle, Newfoundland, reports PRL7, 9.720, Rio de Janeiro, 2130-2300; ZYN8, 15.165, Fortaleza, 1530-1600 sign-off; ZYK3, 9.565, ZYK2, 15.145, and 6.082 all in parallel, Recife, 1730-2100 sign-off.

*British Guiana*—ZFY, Georgetown, has escaped the piled-up QRM on 6.000 by moving to approximately 5.980; news 1945, sign-off between 2000-2015, good level. (Beck, N.Y.) Noted with BBC news 0600, good signal.

*British New Guinea*—I have heard Port Moresby's VLT7, 9.52, Papua, with good level signing off 0300; reopens 0315 over VLT5, 7.28, which is usually good level in East to closing around 0800. At times, VLT7 is inaudible when BBC is using both 9.51 and 9.525.

*Bechuanaland*—ZNB, 5.900, Mafeking, heard with recorded music to 1430 sign-off with "God Save the King." (Gillett, Australia)

*Cameroons*—Peddle, Newfoundland, hears FIA, 9.160, Douala, 1430-1600 fade-out; may sign off 1601 and some days may run to *only* 1400.

*Canada*—Here is information prom-

## NEW PORTABLE TRANSCEIVERS FOR CITIZENS RADIO SERVICE

**ONE of the first portable transceivers for use in the 465 megacycle Citizens Radio Service is now in pilot plant production at the Citizens Radio Corporation of Cleveland, Ohio.**

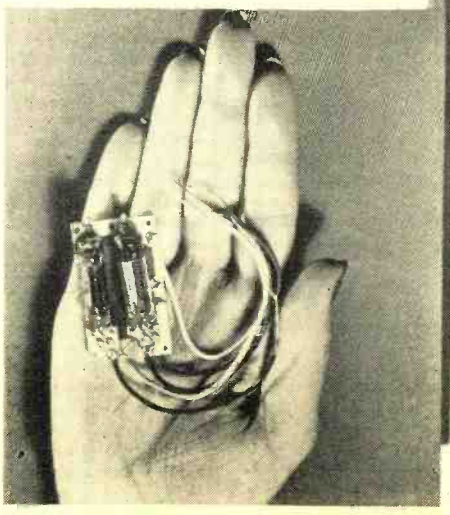
**This equipment, which has received FCC approval, incorporates several new techniques including subminiature tubes and printed circuits.**

**Experimental units have been given exhaustive field tests between automobile and home; home and office; boats and shore; planes and ground; and person-to-person on city streets.**

**The transceiver, two of which are required for person-to-person air contact, is housed in a tiny case measuring only 6" x 2⅞" x 1¼" topped by a small folding antenna. This pocket-sized station includes all necessary equipment except the headphone and batteries which are carried in a separate case about the size of a miniature camera.**

**The Model 100-B unit is designed for Class B stations only, operating at 465 mc., tolerance .4 mc.; input 3 watts; emission A-3 with 30% maximum modulation. The transmitting section uses a Sylvania 6K4 subminiature oscillator and the receiver is a super-regenerative unit using three Sylvania 1V5 subminiature tubes. The transceiver weighs only 11 ounces including antenna and total station equipment, including batteries, weighs only two and one-half pounds.** —30—

Receiver's audio section embodies printed circuits and uses 1V5 subminiature tubes.



The new 465 mc. transceiver in operation. External batteries and headset are used.

**ANNOUNCING!**
THE OPENING OF OUR NEW LARGER QUARTERS AT 189 GREENWICH ST., N. Y. 7 (STREET LEVEL STORE)

# R·H·S
SPECIALS OF THE MONTH

**ANNOUNCING!**
Greater Values Than Ever Before In Our New Larger Store At 189 Greenwich St., N. Y. 7 (Formerly at 63 Dey St.)

## 1 K.W. POWER SUPPLY KIT

2500-0-2500 Volts @ 500 MA
or
2000-0-200 Volts @ 500 MA
*(oil-filled Xformer from BC610)* . . $39.95

| | |
|---|---|
| 1—Swinging choke | 14.95 |
| 1—Smoothing choke | 7.95 |
| 1—Filament Xformer | 9.95 |
| 2—2 Mfd.—3000v Condensers, each | 3.45 |
| 2—872A Tubes each | 1.95 |
| 2—Plate Caps for 872A each | .20 |
| 2—Sockets for 872A each | 1.19 |
| 2—Hash Filter Chokes pr. | .79 |

*All Parts New! Reduced to* **$79.50**

## SELENIUM RECTIFIERS
### Full Wave Bridge Type

| INPUT | OUTPUT | | |
|---|---|---|---|
| up to 18v AC | up to 12v DC | ½ Amp. | $0.98 |
| up to 18v AC | up to 12v DC | 1 Amp. | 1.95 |
| up to 18v AC | up to 12v DC | 5 Amp. | 4.45 |
| up to 18v AC | up to 12v DC | 10 Amp. | 7.45 |
| up to 18v AC | up to 12v DC | 15 Amp. | 9.95 |
| up to 18v AC | up to 12v DC | 30 Amp. | 14.95 |
| up to 36v AC | up to 28v DC | 1 Amp. | 3.45 |
| up to 36v AC | up to 28v DC | 5 Amp. | 7.45 |
| up to 36v AC | up to 28v DC | 10 Amp. | 12.45 |
| up to 36v AC | up to 28v DC | 15 Amp. | 18.95 |
| up to 115v AC | up to 100v DC | .25 Amp. | 2.95 |
| up to 115v AC | up to 100v DC | .6 Amp. | 6.95 |
| up to 115v AC | up to 100v DC | 5 Amp. | 19.95 |
| up to 115v AC | up to 100v DC | 3 Amp. | 12.95 |

## OIL CONDENSERS
### NATIONALLY ADVERTISED BRANDS
### All Ratings D. C.

| | | | | | |
|---|---|---|---|---|---|
| 2x.1mfd. | 600v | $0.35 | 1mfd. | 2000v | $0.95 |
| .25mfd. | 600v | .35 | 2mfd. | 2000v | 1.75 |
| .5mfd. | 600v | .35 | 4mfd. | 2000v | 3.75 |
| 1mfd. | 600v | .35 | 15mfd. | 2000v | 4.95 |
| 2mfd. | 600v | .35 | 4mfd. | 2500v | 3.98 |
| 4mfd. | 600v | .60 | 2mfd. | 2500v | 2.49 |
| 8mfd. | 600v | 1.10 | 1mfd. | 2500v | 1.25 |
| 10mfd. | 600v | 1.15 | .25mfd. | 2500v | 1.45 |
| 3x.1mfd. | 1000v | .45 | .5mfd. | 2500v | 1.75 |
| .25mfd. | 1000v | .45 | .05mfd. | 3000v | 1.95 |
| 1mfd. | 1000v | .60 | .1mfd. | 3000v | 2.25 |
| 2mfd. | 1000v | .70 | .25mfd. | 3000v | 2.65 |
| 4mfd. | 1000v | .90 | 1mfd. | 3000v | 3.50 |
| 8mfd. | 1000v | 1.95 | 12mfd. | 3000v | 6.95 |
| 10mfd. | 1000v | 2.10 | 2mfd. | 4000v | 5.95 |
| 15mfd. | 1000v | 2.25 | 1mfd. | 5000v | 4.95 |
| 20mfd. | 1000v | 2.95 | .1mfd. | 7000v | 2.95 |
| 24mfd. | 1500v | 6.95 | 3mfd. | 4000v | 6.95 |
| .1mfd. | 1750v | .89 | 2mfd. | 3000v | 3.45 |
| .1mfd. | 2000v | .95 | 2x.1mfd. | 7000v | 3.25 |
| .25mfd. | 2000v | 1.05 | .02mfd. | 12000v | 9.95 |
| .5mfd. | 2000v | 1.15 | .02mfd. | 20000v | 11.95 |

## HIGH CAPACITY CONDENSERS

| | |
|---|---|
| 10,000 mfd.—25 WVDC | $6.95 |
| 2x3500 mfd.—25 WVDC | 3.45 |
| 2500 mfd.—3 VDC | .39 |
| 3000 mfd.—25 WVDC | 2.49 |
| 2x1250 mfd.—10 VDC | 1.25 |
| 1000 mfd.—15 WVDC | .99 |
| 200 mfd.—35 VDC | .59 |
| 100 mfd.—50 WVDC | .49 |
| 4x10 mfd.—400 VDC | .89 |
| 4000 mfd.—18 WVDC | 1.95 |
| 4000 mfd.—25 WVDC | 2.95 |
| 4000 mfd.—30 WVDC | 3.25 |

## FILTER CHOKES
### HI-VOLTAGE INSULATION

| | | | |
|---|---|---|---|
| 8 hy @ 550 ma. | $7.95 | 325 hy @ 3 ma. | $3.45 |
| 8 hy @ 300 ma. | 3.95 | 1 hy @ 800 ma. | 14.99 |
| 25 hy @ 160 ma. | 3.49 | 10 hy @ 250 ma. | 2.45 |
| 12 hy @ 050 ma. | 2.25 | 10 hy @ 200 ma. | 1.98 |
| 30 hy @ 70 ma. | 1.39 | 10/20 @ 85 ma. | 1.59 |
| .05 hy @ 15 amps. | 7.95 | 15 hy @ 125 ma. | 1.49 |
| .1 hy @ 5 amps. | 6.95 | 15 hy @ 100 ma. | 1.39 |
| 4 hy @ 600 ma. | 5.95 | 3 hy @ 50 ma. | .29 |
| 200 hy @ 10 ma. | 3.49 | 30 hy Dual @ 20 ma. | 1.49 |
| 600 hy @ 3 ma. | 3.49 | 8/30 hy @ 250 ma. | 3.50 |
| .065 hy @ 2.5A. | 2.49 | 10 hy @ 100 ma. | 1.29 |

# RADIO TUBES
### NEW! STANDARD BRANDS!

| | | | | | |
|---|---|---|---|---|---|
| 1B24 | $4.75 | 726A | $4.50 | 1Q5GT | $ .95 |
| 1B26 | 4.95 | 800 | 1.69 | 1R5 | .79 |
| 1B29 | .89 | 801A | .49 | 1S4 | .69 |
| 1N21 | .59 | 802 | 2.95 | 1S5 | .59 |
| 1N23 | .59 | 803 | 3.75 | 1T4 | .59 |
| 1N34 | 1.59 | 805 | 3.95 | 3Q4 | .59 |
| 1P24 | .89 | 807 | 1.19 | 3Q5 | .69 |
| 2AP1 | 2.39 | 808 | 1.95 | 3S4 | .59 |
| 2C22 | .19 | 809 | 1.98 | 5Y4GT | .49 |
| 2C26 | .29 | 810 | 4.89 | 6A7 | .59 |
| 2C40 | .74 | 811 | 1.49 | 6A8GT | .59 |
| 2C44 | .69 | 812 | 1.39 | 6AG5 | .79 |
| 2C46 | 3.75 | 813 | 5.25 | 6AG7 | .98 |
| 2D21 | 1.19 | 814 | 2.75 | 6B4G | .95 |
| 2J21 | 12.45 | 815 | 1.45 | 6BG6G | 1.49 |
| 2J22 | 12.95 | 816 | 1.10 | 6C6 | .49 |
| 2J26 | 9.95 | 826 | .49 | 6D6 | .49 |
| 2J31 | 11.49 | 829B | 2.89 | 6F5GT | .49 |
| 2J32 | 14.75 | 832A | 2.49 | 6F6GT | .49 |
| 2J36 | 24.95 | 833A | 29.50 | 6F6 | .59 |
| 2J37 | 18.95 | 836 | .79 | 6H6GT | .39 |
| 2J38 | 14.75 | 837 | 1.19 | 6J5GT | .42 |
| 2J39 | 18.95 | 838 | 2.95 | 6J5 | .55 |
| 2J40 | 18.95 | 841 | .50 | 6J7GT | .55 |
| 2J46 | 18.95 | 843 | .39 | 6K6GT | .49 |
| 2J49 | 26.95 | 845 | 3.29 | 6K7GT | .55 |
| 2J51 | 69.50 | 851 | 12.95 | 6L6G | .95 |
| 2J54B | 18.95 | 860 | 1.98 | 6L6 | 1.23 |
| 2J55 | 18.95 | 861 | 11.95 | 6L7 | .79 |
| 2K25 | 24.95 | 865 | .79 | 6Q7GT | .55 |
| 2K28 | 6.95 | 866A | .98 | 6SA7GT | .49 |
| 2V3G | .79 | 866JR | 1.10 | 6SC7 | .55 |
| 2X2 | .27 | 869B | 18.75 | 6SF5GT | .59 |
| 3AP1 | 2.39 | 874 | .69 | 6SH7 | .49 |
| 3BP1 | 1.39 | 876 | .39 | 6SJ7GT | .49 |
| 3B22 | .59 | 878 | 1.29 | 6SK7GT | .49 |
| 3B24 | .69 | 884 | .79 | 6SL7GT | .59 |
| 3B26 | .89 | 885 | .78 | 6SN7GT | .59 |
| 3CP1 | 2.95 | 902P1 | 5.95 | 6SQ7GT | .49 |
| 3C22 | 19.95 | 905 | 4.95 | 6V6GT | .59 |
| 3C23 | 2.49 | 923 | .69 | 6X5GT | .59 |
| 3C24 | .29 | 954 | .24 | 7A8 | .69 |
| 3C30 | .59 | 955 | .35 | 7B7 | .69 |
| 3C31 | 1.49 | 956 | .45 | 7C5 | .59 |
| 3DP1 | 2.25 | 957 | .24 | 7C6 | .59 |
| 3D21A | 1.50 | 958 | .35 | 7F7 | .49 |
| 3E29 | 3.39 | 1611 | .98 | 7Y4 | .49 |
| 4B24 | 2.25 | 1613 | .58 | 12A8GT | .63 |
| 4E27 | 12.95 | 1616 | .75 | 12AT6 | .49 |
| 5AP4 | 4.75 | 1619 | .21 | 12AU6 | .75 |
| 5BP1 | 1.10 | 1622 | 1.59 | 12BA6 | .59 |
| 5BP4 | 2.45 | 1624 | .85 | 12BE6 | .59 |
| 5CP1 | 1.98 | 1625 | .29 | 12J5GT | .49 |
| 5D21 | 18.95 | 1626 | .25 | 12J7GT | .49 |
| 5FP7 | .85 | 1629 | .29 | 12K7GT | .49 |
| 5JP1 | 11.95 | 1630 | 1.98 | 12Q7GT | .59 |
| 5J29 | 18.95 | 1638 | .49 | 12SA7GT | .49 |
| 5J30 | 18.95 | 1654 | 1.98 | 12SF5GT | .49 |
| 5LP1 | 11.95 | 1851 | .69 | 12SF7GT | .59 |
| 5R4GY | .89 | 2050 | .68 | 12SJ7GT | .49 |
| 5T4 | .69 | 2051 | .45 | 12SK7GT | .49 |
| 5U4G | .45 | 8005 | 1.98 | 12SQ7GT | .49 |
| 5V4 | .72 | 8011 | .65 | 12SR7GT | .49 |
| 5X4 | .59 | 8012 | 1.39 | 14A7 | .69 |
| 5Y3 | .35 | 8013 | .89 | 14B6 | .69 |
| 5Z3 | .55 | 8014 | 3.98 | 14Q7 | .69 |
| 5Z4 | .79 | 8016 | 1.39 | 24A | .49 |
| 6AB7 | .85 | 8020 | .89 | 25L6GT | .49 |
| 6AC7 | .59 | 8025 | 3.45 | 25Z5 | .47 |
| 6AK5 | .89 | 9001 | .39 | 25Z6GT | .45 |
| 6AL5 | .59 | 9002 | .35 | 26 | .45 |
| 6C4 | .19 | 9003 | .35 | 27 | .49 |
| 6D4 | 1.29 | 9004 | .29 | 30 Spec | .39 |
| 6J4 | 5.49 | 9005 | .39 | 32L7GT | 1.19 |
| 6J6 | .79 | 9006 | .29 | 35/51 | .59 |
| 6Q5G | 1.25 | CK1005 | .29 | 35A5 | .59 |
| 7EP4 | 17.95 | CK1006 | .69 | 35L6GT | .49 |
| 10Y | .19 | CK1090 | 1.49 | 35W4 | .39 |
| 12A6 | .25 | EF50 | .50 | 35Y4 | .69 |
| 12DP7 | 13.95 | F123A | 8.95 | 35Z3 | .57 |
| 12GP7 | 12.95 | F127A | 17.50 | 35Z5GT | .39 |
| 15E | .89 | F128A | 39.50 | 36 | .79 |
| 15R | .89 | FG60 | 39.50 | 41 | .52 |
| 75TL | 2.49 | FG81A | 3.95 | 42 | .49 |
| 100TH | 9.95 | FG105 | 8.75 | 43 | .52 |
| 211 | .35 | FG238B | 29.50 | 45 | .52 |
| 227A | 3.75 | GL146 | 7.95 | 47 | .74 |
| 231D | 1.49 | GL605 | 39.50 | 50A5 | .89 |
| 249C | .75 | GL697 | 29.50 | 50B5 | .59 |
| 250TH | 19.49 | HY75 | 1.25 | 50L6GT | .49 |
| 304TL | .72 | HY615 | .39 | 50Y6GT | .59 |
| 304TH | 3.39 | ML100 | 19.95 | 56 | .54 |
| 316A | .35 | ML101 | 39.50 | 59 | .95 |
| 327A | 4.95 | ML502 | 39.50 | 70L7GT | 1.29 |
| 350B | 1.95 | VR75 | .89 | 71A | .59 |
| 368AS | 1.79 | VR90 | .65 | 75 | .52 |
| 371B | .99 | VR105 | .65 | 76 | .49 |
| 450TH | 29.95 | VR150 | .65 | 77 | .49 |
| 527A | 4.89 | VT127A | 2.49 | 78 | .49 |
| 531 | 2.50 | VU111 | .49 | 80 | .35 |
| 559 | .75 | 024 | .59 | 81 | 1.55 |
| 703A | 2.95 | 1A5GT | .49 | 82 | .89 |
| 705A | 1.49 | 1A7GT | .59 | 83 | .89 |
| 706CY | 18.95 | 1H5GT | .54 | 83V | .89 |
| 714AY | 5.95 | 1N5GT | .59 | 84 | .59 |
| 715B | 7.89 | 1LA4 | .95 | 89 | .69 |
| 715C | 18.95 | 1LA6 | .95 | 117L7GT | 1.15 |
| 717A | .59 | 1LB4 | .95 | 117P7GT | 1.15 |
| 721A | 1.59 | 1LC6 | .95 | 117Z3 | .49 |
| 723A/B | 5.49 | 1LD5 | .95 | 117Z6GT | .69 |
| 724A/B | 1.75 | 1LE3 | .95 | | |
| 725A | 7.45 | 1LH4 | .79 | | |
| | | 1LN5 | .79 | | |

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# RADIO HAM SHACK Inc.
## 189 GREENWICH STREET . NEW YORK, N. Y.

ised last month on CHNS, Broadcasting House, Halifax, Nova Scotia, recently returned to the air. M. Forrest, secretary, informs: "The short-wave station went on the air in 1934 with call-letters VE9HX, 50 watts power. In 1938, location was changed from Halifax to Bedford (10 miles outside Halifax), call-letters became CHNX, power increased to 500 watts. It was off the air 1940 to October 1948, as equipment was being used by the army. Only change in present set-up is location of transmitter, which has been moved to Rockingham (5 miles outside Halifax), where our medium-wave transmitter, CHNS, is now located. Antenna is as always—a center-fed dipole, 50 feet above the ground, with power of 500 watts. We are particularly interested in receiving reports of reception, all of which are verified. IRC should be enclosed." Hours of operation (6.130, relaying full schedule of medium-wave CHNS, in *English*) were listed Monday through Saturday 0600-2315, Sunday 0800-2315; newscasts 0700, 0800, 0930, 1130, 1200, 1700, 1755, 2300.

In verie-letter, CKFX, 6.080, Vancouver, British Columbia, listed power of only 10 watts; is officially listed 100 watts. (Stein, Calif.)

*Ceylon—Radio SEAC* has been handed over to the Government of Ceylon and now is known as *Radio Ceylon.* Schedule appears to remain about the same. However, Sunday beam of the Forces Broadcasting Service to the United Kingdom is now 1130-1330 on 15.12, 17.77 to British Isles, with 6.075, 3.395 beamed to India-Pakistan and other parts of Asia (9.520 may be used also on occasion). The 15.12 channel is best in U.S.

*Chile*—CE11900, Valparaiso, 11.900, is heard 2200-2300 sign-off. (McPheeters, La.)

*China*—XGOY's 19-m. outlet listed 15.170 has been measured 15.172. (Schild, N.Y.) Is seldom heard now in East, but when audible has news 0700; Oslo's 15.17 QRM's.

When this was compiled, XGOA, Nanking, appeared to have replaced 15.105 and 11.88 channels with 9.605 and 7.500V (sometimes low as 7.480, others high as 7.550) for Overseas Service to 0915 or later, news 0900; the 7.500V channel has been best here in East, widely reported. The 5.985 and 9.73 outlets still carry Home Service and are said to run later, probably to 1015 or 1030. The 15.105 channel was coming through nicely in East nightly when this was compiled, scheduled 2100-2300, news 2115, 2230; best Mondays when HCJB is vacationing (15.115).

Some days, XGAF, 7.100, Nanking, is heard with fair signal around 0800. (Rosenauer, Calif.)

*Colombia*—Bogota's HJKB, 6.000, and HJKF, 9.520, are heard 2100-2200 and later. (Peddle, Newfoundland) HJCF, 6.240, Bogota, signs on 0650, off 2100. HJDE, 6.145, Medellin, heard signing off 0145, signs on 0715. (McPheeters, La.)

*Costa Rica*—TIGPH, 5.870, San Jose, signs off 2300. (Beck, N.Y.)

*Cuba*—Chavez, Cuba, writes—"There is no such station in Cuba as COBA; *'Radio Cadena Suaritos'* does operate COBL on 9.833, using call-sign CMBL for medium-wave 850 kc.; also operates CM-21-L in FM band; QRA is Calle 25 No. 1111, Vedado, Havana, and has regular daily program 0735-0000, *all in Spanish.* COCH, 9.437, *'Union Radio,'* operates with *all-Spanish* programs 0630-2300; medium-wave outlet is CMCF, 910 kc., and QRA is Pasea de Marti No. 107, Havana."

*Cyprus*—Sharq-al-Adna is heard with poor to good signals signing on 2255 on 9.650, 6.170. (Beck, N.Y.) The 6.135 channel is heard in England at 1430 with Arabic music, gives call 1500, and has news in Arabic, then closes around 1510-1515; heard in parallel on Sundays at 1300-1513 were 6.135, 6.790, 6.170; the 6.790 channel has been heard at 1100 with news in Arabic. (Pearce)

The Forces Broadcasting Station is at Lokatamia, *not* Niciosa as previously believed. Transmitter is *Hallicrafters* BC-610 just under 1 kw. on 7.220, and *Marconi* G.36, 1 kw., on 1320 kc.; uses a half-wave dipole. Weekdays schedule is 2330-0130, 0430-1600; Sundays 2330-1600. Relays several programs from BBC and also runs three half-hour programs in Greek each week; recorded programs and live shows for the most part originate in Forces Theater in Lokatamia; opens with trumpet fanfare and closes with "London Bridge" or the Ted Lewis recording of "Goodnight Waltz"; chief announcer is Leslie A. W. Diamond. Report by Kary was first one from America. Test transmissions are sent Saturdays 1700-1900 and at 1600. R. N. Joyce answers listeners' reports in program called "Reports Received." No call-letters have been assigned as yet.

This particular station on Cyprus was formerly JCLA at Haifa, Palestine. Ex-JCKW was moved to Malta where it is being readied for operation *(may be on the air again by now).* JCJC, Cairo, is reported moved to Kabrit in Suez Canal Zone (medium-wave *only),* although Rubens Villela, Brazil, has reported a JCJC, Cairo, heard with c.w. on 7.220.

Verie-cards will be sent as soon as they are printed.

*Denmark*—QRA of Danish Information Office in U.S. is 15 Moore Street, New York 4, New York.

Copenhagen is now sending out this general outline of programs of OZF (operating on 9.520 to North America daily—*except Sundays*—in Danish and *English* at 1900-2030, 2130-2300, 2300-0030)—"Every transmission begins with the chimes from the Town Hall in Copenhagen, followed by a Danish popular melody and the news in Danish. Every day we will give you Danish music and songs and a talk on various aspects of Danish culture and activity and the broadcasts will also include a brief summary in *English* of home news and a short resume of the

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**Popular GT Miniature and Loctal Tubes. All individually cartoned and branded. Guaranteed best quality. Available at this low price and may be assorted. THE FIRST REAL SCOOP FOR THE SERVICE DEALER.**

**FREE!** $20.00 worth of condensers—(list value), ten 20-20 @ 150V—free with each 100 tubes ordered.

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|---|---|---|---|---|---|
| 7Y4 | 5U4G | 6D6 | 6U7GT | 12SR7GT | 43 |
| 7Z4 | 5V4 | 6F5G | 6V6GT | 19T8 | 44 |
| 7B6 | 5X4G | 6F6GT | 6X4 | 20 | 45 |
| 7E6 | 5Y3GT | 6F8G | 6X5GT | 2050 | 46 |
| 7E5 | 5Y4G | 6G6 | 6Y6G | 2051 | 47 |
| 7C4 | 5Z3 | 6H6GT | 9T8 | 24A | 50 |
| 14X7 | 6A7 | 6J5GT | 10 | 25L6GT | 50B5 |
| 1A5GT | 6B6 | 6J6 | 12A8GT | 25Z5 | 50L6GT |
| 1A7GT | 6B7 | 6J7GT | 12A6 | 25Z6GT | 56 |
| 1B4 | 6C8G | 6K6GT | 12A7 | 26 | 57 |
| 1C4 | 6AC5GT | 6K7GT | 12AT6 | 27 | 58 |
| 1H5GT | 6A3 | 6L6G | 12AU6 | 30 | 70L7GT |
| 1L4 | 6A8GT | 6P5GT | 12C8 | 31 | 71A |
| 1N5GT | 6AK5 | 6Q7 | 12BA6 | 32L7GT | 75 |
| 1P5 | 6AQ5 | 6Q6GT | 12BE6 | 35 | 76 |
| 1Q5 | 6AQ6 | 6R7 | 12F5 | 35/51 | 78 |
| 1R4 | 6AT6 | 6S8GT | 12H6 | 37 | 80 |
| 1R5 | 6AU6 | 6SA7GT | 12J5 | 38 | 81 |
| 1S4 | 6BA6 | 6SC7GT | 12J7GT | 35B5 | 83 |
| 1S5 | 6BE6 | 6SD7GT | 12K7GT | 35L6GT | 84/6Z4 |
| 1T4 | 6BH6 | 6SF5GT | 12K8G | 35W4 | 85 |
| 1U4 | 6BJ6 | 6SF7 | 12Q7GT | 35Z5GT | 112A |
| 1V | 6C5GT | 6SG7GT | 12SA7GT | 37A | 89 |
| 2A3 | 6C6 | 6SH7 | 12SH7GT | 38 | 117L7GT |
| 2A5 | 6AG5 | 6SJ7GT | 12SG7 | 39 | 117P7GT |
| 2A7 | 6AJ5 | 6SK7GT | 12SJ7GT | 39/44 | 117Z3 |
| 2B7 | 6AK5 | 6SL7GT | 12SK7GT | 40 | 182B |
| 3A4 | 6AL5 | 6SN7GT | 12SN7GT | 41 | 183 |
| 3Q4 | 6C4 | 6SQ7GT | 12SQ7GT | 42 | 482B |
| 3S4 | 6C8G | 6SR7GT | 12SR7 | | 483 |

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.001 mfd, 600V.— ea. 6c
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.01 ..... ea. 6c
.02 ..... ea. 6c
.05 ..... ea. 7c
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10" ..... ea. 4.25
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60-60 mfd, 150V ..... ea. 39c
**(Small size, low price, use in place of 60-40, 50-30, 50-50, 40-40, 30-30, etc.).**
20 mfd, 150V ..... ea. 25c
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8 mfd, 450V ..... ea. 21c
8-8 mfd, 450V ..... ea. 43c
10-10 mfd, 450V ..... ea. 43c
20-20 mfd, 450V ..... ea. 39c
25 mfd. 25V ..... ea. 17c

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For: 6V6, 6F6, 3Q5, 42, 41, 43, 45, 50, 71A, 12A5, 25A6, 25A7, 6N7, 6A6, 25N6, 25B5, 117L7, 117M7, 117N7, 117P7, 35A5, 6L6, 6AH5, 6AL6 ..... each **49c**

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*"Clear heads order from CLEAR-VAC"*

evening's talk. The last 30 minutes will to a great extent be directed to *English-speaking* listeners, and the programs will consist of short items of Danish music and highlights on Denmark with regard to her agricultural, industrial, and social activity." (Worris, N.Y., Gaynor, Calif.)

Is now announcing as "OZF." (Worris, N.Y.)

*Dominican Republic*—Beck, N.Y., says a *new* station is heard on 9.525 (is *not* Bogota, 9.520!); location is Ciudad Trujillo; heard afternoons and evenings late as 2230; HI1J, 6.025, San Pedro De Macoria, signs off 2255, has heavy hum; HI3T, 9.740, HI4T, 5.970, in Spanish *only* 0700-0000; HI1Z, 6.115, here from 6.315, runs 0700-2245, is *"Broadcasting Nacional";* (I note harmonic of this one, good level around 0730, on approximately 12.230); HI1N, 6.050, now runs 1030-2315. (Beck, N.Y.)

*Dutch Guiana*—Here are schedules for *Prinz Bernhardt* transmitters in Paramaribo, Surinam, PZH5, 5.757.5, 0830-1000 (except Sundays when is 0830-1200), on air daily 1600-2100; PZC, 15.405, 1730-2100 daily. (Worris, N.Y.)

*Ecuador*—Peddle, Newfoundland, hears HCJB's *new* 17.890 channel 1500-1600 sign-off on Thursdays, to Europe. *This is probably Tuesdays through Thursdays or Fridays.* I have heard one on occasion at 1200.

HC1AC, 6.210, Quito, heard signing off 2330, announcing return 0830. (McPheeters, La.)

*Egypt*—Simonian, Mass., says SUX, 7.863, Cairo, is heard 1400-1370 in Arabic—*no English.*

*El Salvador*—YSUA, 6.250, San Salvador, signs off 0000 (some days may sign-off 2330); YSR, 6.265, signs off 0000 with "Star Dust." (Hankins, Pa.)

*England*—GVS, 11.700, GWU, 15.210, Wooferton, are used 1430-1500 to relay *"America Calling Greece"* program. (Fern, Hawaii)

*Ethiopia*—Swedes confirm that *Radio Addis Ababa* still operates daily on 9.620; runs to at least 1100 and has some *English.*

*Finland*—Helsinki's *new* 100 kw. transmitter on 15.190 was officially inaugurated November 30 by the President of Finland. Has tested 0345-0600, 0715-0730, and irregularly, with aerials beamed on North America; announces news for 0715, 1925 (latter inaudible here due to Canada on that spot); signal has been improving as has modulation which was quite poor during first few days of tests. At the time this was compiled, transmissions seemed irregular and it may be some time yet before definite regular daily schedules are effected. Asks for reports to The Finnish Broadcasting Company, Helsinki, Finland.

The 2300-0000 period on 15.19 consists of foreign speech (presumably Finnish), with choir and organ music; church bells ring approximately 2330, 2345. (Fargo, Ga.) This period also heard on 9.500, 6.120. (Beck, N.Y.)

*Formosa*—XURA, 7.223, Taipeh,

Taiwan, is again being heard mornings on West Coast, good level. (Rosenauer, Calif.) Last schedule listed by station was 0330-0740.

*France*—Paris has made some recent changes; 9.680 still runs 1500-1645; 9.550 is 1700-1835; 9.680 runs 1845-1900 in experimental period to Fr. Guiana, Fr. West Indies, St. Pierre, Miquelon; 9.550 runs 1915-1930 to Latin America; 9.550, 11.700 are used for two transmissions to North America—1945-2000, 2100-2130; uses 9.615 at 2300-2315; 0000-0015 is on 9.550 and 6.200 to North Africa; 0030-0130 on 9.550 to Tahiti, Marquesas, and French Pacific; at 0145-0245 is on 15.240. (Beck, N.Y.)

*French Equatorial Africa—Radio Brazzaville* informs Worris, N.Y., it has no call-sign. Promises half-hour English programs soon.

The 17.840 channel runs to 1600, signing off after news which starts 1545, good signal; 11.970, good level, and 9.440, poor, continue to Europe to 1700, then to North America 1705-1825; to South America 1830-2000; after 1705, both 11.970 and 9.440 have excellent signals. (Beck, N.Y.)

*French Indo-China—"The Voice of Viet Nam,"* 11.974, clandestine outlet of the Communist-controlled Republic of Viet Nam (Indo-Chinese insurgents), is heard 0630-0800 with poor quality. (Fern, Hawaii) Major, W. Australia, reports Saigon heard on *new* frequency of approximately 7.210, carrying same program as 11.78, 6.165; 7.210 leaves air 0830 after "La Marseillaise;" the 7.210 outlet has been heard weak in California by Dilg, but at the time (0645) was *not* in dual with 6.165 which had Chinese then; does appear in dual with 6.165 *after* 0700, Dilg says.

*French Morocco*—Peddle, Newfoundland, says CNR3, 9.082, has been dropped and he presumes this goes also for 16.66. The *new* 6.005 channel of Network B, Rabat II, *Radio Maroc*, has been substituted and is in parallel with 868 kc. medium-wave. Rabat I is usually all-Arabic on 601 kc.; Peddle hears 601 kc., 1600-1800 or later; 868 kc. and 6.005 on s.w. in Arabic 1530-1600, in French 1600-1630 and later. The s.w. outlet has interference from CJCX and OLR2A (latter is Prague, 6.010). Pearce, England, reports the 6.005 channel to sign-off 1835 with march and "La Marseillaise," following news summary in French; heard clearly and with strong level from around 1500 on 12.010, which is evidently a harmonic of 6.005.

*French West Africa—Radio Dakar*, 11.898, heard by Peddle in Newfoundland from 1330 to after 1700.

*Germany*—Frankfurt, 6.190, fair signal signing on 0000; Munich, 6.160, heard signing on 0000, also fair. Another German station heard as early as 2330 on 7.290 with powerful signal is probably Nordwestdeutscher Rundfunk, Hamburg. (Beck, N.Y.)

*Gold Coast*—ZOY, Accras, was recently heard on 7.275 closing 1800 with "God Save the King;" good signal in Australia. (Gillett) A station on 4.915

at 1245-1300 in *English* is believed to be Accra. (Swedish DX Broadcast)

*Greece*—I have had vague reports of a *new* Greek s.w. outlet of 1 kw. operating on 42 meters from Larrissa. *Does anyone have details?*

*Radio Athens* signs on with theme at 0030 on about 9.605, then has news in Greek, is badly QRM'd. (Fargo, Ga.) Heard as late as 0300. (Beck, N.Y.)

Bouras, Greece (formerly of Michigan), lists *Radio Athens* schedules as morning transmission 0015-0235, 9.606; mid-day transmission, 0500-0800, 9.606; evening transmission, 1100-1630, 7.301; and to USA, 1730-1830, 15.361 (evidently for 15.345); channels were furnished in meters and do not convert exactly to listed frequencies.

*Guatemala*—The special transmission to the U.S. runs 0000-0030 every night on TGW, 640 kc., TGWA, 9.760, TGWB, 6.400, and TGWC, 1520 kc. It consists of talks on Guatemala, music (including marimba numbers), interviews with Americans who give their impressions of Guatemala, information on the Guatemalan diplomatic and cultural group touring various cities of the U.S. (this group has a marimba band with it). Besides this *daily* program, there is another on Thursday *only* 2300-0000 on TGWA, TGWB—thus making it a full hour broadcast that day. TGOA, 6.100, signs off 0000 now instead 0100; TGLA, 6.295, signs off now 2230. (Beck, N.Y.) TG2, 6.620, Guatemala City, signs on 0930, off 2130; *Radio Oriental*, Zacapa, 6.665, signs on 0900, off 2245. (McPheeters, La.)

*Haiti*—HHYM, 6.000, Port-au-Prince, Haiti, has informed Kary, Pa., that it is *not* "Radio Phillips." It was stated—"A short term intense publicity campaign made by this station to introduce the 1947 models of radios made by the *Phillips Company* was so efficient that several listeners abroad thought that this outfit is a 'Radio Phillips' which it is definitely *not*. We have moved to new quarters and due to limited air space of the new location, we have not been able yet to put up an efficient antenna. We are now operating with a ¼-wave radiator at insufficient height. We expect to improve not only this antenna situation but also the equipment and the service as a whole by the beginning of 1949." It was mentioned that construction of the projected high-power stations at Leogane has been "suspended." Also it was noted that Haitian calls are to be changed. (Kary, Pa.) Beck, N.Y., reports HHYM recently moved from 6.000 to 6.402, signs off 2030, and that HHCM, also Port-au-Prince, has moved from 6.402 to 6.165.

HH2S, 5.95, heard with *English* 1915-1930 a recent Saturday. (Alcock, Ky.) Signs on 0630, off 2200; gives call-letters in Spanish, French, *English*, when signing off. (McPheeters, La.)

*Holland*—Improved signal is noted from PCJ, 15.22, Sundays, Wednesdays 1030-1200 in *"Happy Station Program."*

*Honduras*—HRN, listed 5.884, Tegu-

(*Continued on page* 138)

# AFCA NEWS

*This Association is a patriotic non-profit organization, with chapters in most of the larger cities, dedicated to developing and maintaining efficient personnel, commissioned, enlisted, civilian, for the supply (including design and development), installation, maintenance and operation of communications and electronic equipment for Army, Navy and Air Force and their supporting civilian activities. It publishes a magazine "SIGNALS" at its national headquarters in Washington. Every American interested in any way in communications is eligible and invited to join. Further details may be obtained by addressing the secretary at 1624 Eye St. N.W., Washington 6, D. C.*

## AFCA News

### Industry-Army Day

The annual meeting at which Army leaders describe to the leaders of industry the defense plans and requirements for material will be held at Boston's Hotel Statler, February 4. General Omar Bradley and the Vice Chief of Staff, General J. Lawton Collins, will be the principal speakers. Each of the several military associations will be authorized to invite a limited number of its members to purchase tickets. At least 1500 of the nation's top industrialists from all over the United States will be on hand. AFCA has been allotted 100 tickets for sale at $15 each. Members desiring further information should communicate with National Headquarters.

### Expansion

The recommendations of the Gary committee for building up our membership and making the Association more helpful to the armed services were submitted too late to be published here. One thing is certain—the committee will emphasize the need for hard work and lots of it by local chapter membership committees. If we are going to make AFCA a powerful influence for better communications in the Army, Navy, and Air Force, the recruiting must be decentralized. Names and addresses sent to National Headquarters will receive attention. We should have as members, for example, 10% of the 400,000 men and women in military communications during World War II. If each current member will recruit a new one, we'll be well on our way toward that goal soon!

### AFCA Awards

Here is the list of special annual awards being offered this year for the first time:

1. Excellence in military training in communications ROTC units. A special medal and scroll to the winner in each of the fifteen college units.

# OUTSTANDING VALUES NOW AVAILABLE

# INVENTORY CLEARANCE SALE!

## THREE-WAY PORTABLE SPECIAL

AC-DC AND BATTERY. The quality of this set will compare favorably with any on the market. COMPLETE WITH BATTERIES IN A VERY ATTRACTIVE CABINET.

WHILE THEY LAST! **$19.95**

## SUPER 25 WATT HI-FI AMPLIFIER KIT

Including all parts, schematic and layout diagrams, enabling you to easily build this fine, deluxe amplifier.

FEATURES:

- Ready punched chassis
- Multi-impedance output transformer 2-4-8-16-500 ohms for use with any PM speaker
- 2 mike inputs, 1 phono input
- Push pull phase inverter driver for low hum and distortion
- Separate bass and treble control
- 110-120 volt AC operation, on fuse UL approved line cord
- 6 tubes: 2—6SJ7, 6SC7, 2—6L6G, 5Y3
- Attractive, well-constructed steel chassis and cover. Baked hammerloid finish
- Indirect lighted panel


Nowhere can an amplifier of comparable features be had for twice the price. This amplifier, designed from the famous Clark Amplifier, will fill 90% of all sound uses.

**$22.95** COMPLETE WITH TUBES

## ALL PARTS LISTED ARE NEW, AND OF THE FINEST QUALITY. ALL STANDARD BRANDS ——— ALL GUARANTEED

### CONDENSERS

20 mfd—150 V.....25¢
10 for $2.25

40x20 mfd—150V 25 mfd—25V.....32¢
10 for $2.75

40x40 mfd—150V.....37¢
10 for $3.25

40x20 mfd—150 V Separate negative...45¢
10 for $4.25

20 mfd—150V 50 mfd—35V.....29¢
10 for $2.50

50x50 mfd—150V.....54¢
10 for $4.50

8 mfd—450V.....38¢
10 for $3.50

10x10 mfd—450V.....54¢
10 for $4.50

20 mfd—450V 40 mfd—400 V.....69¢
10 for $6.50

.5 mfd—100V.....10¢
10 for $.75

### SPEAKERS

2" PM Alnico V Magnet.....89¢
3" PM Alnico V Magnet.....89¢
4" PM Alnico V Magnet.....99¢
5" PM Alnico V Magnet.....99¢
6" PM Alnico V Magnet.....$1.49
8" PM Heavy Alnico V Magnet..... 3.25
10" PM Heavy Alnico V Magnet..... 3.95
12" PM Heavy Alnico V Magnet..... 4.95

Any of the above speakers supplied with 50L6 outputs 25¢ extra.

Radio Cabinet Attractive Mahogany Finish Dimensions 14"x6"x8".....$1.95
Crystal Pick-Up Arms Hi-Gain.....ea. 2.25
3 tube phono amplifiers—high quality parts.....ea. 2.98
With tubes 50L6, 35Z5, 12SQ7..... 4.98
Constant speed phono motor with 8" turntable..... 2.95

100 ma Selenium Rectifiers.....69¢
10 for $6.50

75 ma Selenium Rectifiers.....59¢
10 for $5.50

6-ft. AC cords with molded rubber plug...19¢
10 for $1.50

500,000-ohm volume control with switch...39¢
10 for $3.50

500,000-ohm volume control less switch....29¢
10 for $2.50

10,000-ohm volume control less switch....19¢
10 for $1.50

Vulcan Standard 100-Watt Soldering Iron.....ea. $1.49
Attractive all-metal Fluorescent Desk Lamp with heavy base—complete with tube..ea. $4.49
2-Burner Three-Heat Hot Plate. Very attractive in appearance.....$4.95
Heavy-Duty 12" PM 46 0 Utah Alnico Magnet.....$8.95
12" PM Medium Alnico 5 Magnet..... 3.95

## LONG-PLAY RECORD PLAYER

For Micro-groove records, the finest in record reproduction. RA133, complete in attractive carrying case. Featuring ASTATIC LP playing arm with micro-groove pickup. ALLIANCE 33⅓ constant speed silent running motor. 3-tube amplifier, 5" PM speaker.

NOW **$17.95** EACH

## RA233 DUAL-SPEED RECORD PLAYER

For micro-groove and standard records. Includes all the features of the RA133 above, plus standard playback arm and a two-speed motor, running at 33⅓ RPM and 78 RPM.

ONLY **$22.95**

## AMPLIFIER FOUNDATION CHASSIS

Amplifier Foundation Chassis and Covers presented again BY POPULAR DEMAND. AMPLIFIER MEN and BUILDERS—constructed of high-grade steel, hammerloid finish, sloping panel. Used by top manufacturers. Size 15"x9"x3".

PRICE NOW ONLY **$2.75** Each

IN LOTS OF THREE **$2.49** Each

**Radio Parts Company, 614 RANDOLPH ST., CHICAGO 6, ILL.**

2. Excellence in electronics at the two service academies. An *Eastman* "Kodak" will be the prize.

3. The best essay on "Communications and Military Security." A set of books to be chosen by the winner.

ROTC units to be eligible must apply to AFCA National Headquarters.

4. The chapter-of-the-year award. A scroll that goes to the AFCA chapter that shows the most improvement as an active chapter for the year ending May 1, 1949.

**Annual Meeting**

The third annual meeting of our Association in Washington will be sponsored jointly by the U. S. Navy and the Washington chapter of AFCA, probably on April 4 and 5. Members received full information in special letters mailed January 1. The Navy will display the latest in communications and photographic equipment.

**New National Officers**

Our present board of directors and Council, which includes representatives from each chapter, submitted nominations for replacements for President and Vice President and 5 Directors on February 1st. Members desiring to suggest nominees should submit the names to their chapter secretary. —30—

## 3-Tube Receiver

(*Continued from page* 46)

the output. In the reflex amplifier, the amplified audio and the amplified i.f. signals are common to the plate circuit and cannot be readily isolated. In spite of this seemingly difficult condition, the minimum volume effect can be circumvented by removing the volume control from its customary location in the detector, and placing it in one of the following locations: (*a*) in series with the converter screen; (*b*) shunting one of the i.f. transformers; or (*c*) shunting the loop antenna.

In all of the previously mentioned arrangements the audio gain is fixed at maximum level. In order to prevent hum pickup, careful layout and good power supply filtering are essential. Method (*c*) is generally the best and is used in the circuit shown in Fig. 2. The ideal method would be to use a two-gang volume control, one section shunting the loop antenna and the other section in the conventional location in the detector output. However, this elaboration is unnecessary if the audio system is inherently incapable of high-fidelity response (as is the case in most a.c.-d.c. receivers).

Another troublesome condition frequently encountered in reflex amplifier circuits is microphonics. In addition to microphonic conditions generally encountered in conventional receivers, the reflex amplifier tube and particularly the second i.f. transformer must be mechanically sturdy and free from vibration.


# SPECIAL SURPLUS BROADCAST OF OUR SUPER SPECIALS!!!

## Amertran "Transtats" Voltage Regulator

11.5 KVA 50/60 cy. Commutator range 0-115 V. Max. Amps. 100. Reconnection diagram available for 230V, 50A operation, B R A N D NEW. Factory Cases.....**$75.00**

**AMERTRAN TRANSTAT**—115 VAC 60 Cy. .25 KVA @ 2.17A 103-126 V.....**$9.45**

**AMERTRAN TRANSTAT**—115 VAC 400 Cy. .5 KVA 5.5A 92-115 V.....**$2.50**

**GENERATOR**—Mfd. by Bendix, Model 3975, used in "Gibson Girl," input 28 VDC 175 MA Output 300 VDC 40 MA 5000 RPM. 5"L x 3"D.....**$1.00**

**SOUND POWER HANDSETS**—Type 10G, RCA. Complete with 6 ft. cord and alligator clips. Brand new. **$29.95 pr.**

**INVERTERS—PE 206A.** Leland. Input 28 VDC 38A. Output 80VAC 500VA 800cy. Completely filtered. Brand New.....**$10.00**

**PE 218D**, G. E. and Leland. Input 25/28VDC. 100A. Output 115VAC 1500VA 380/500Cy.....**$15.00**

**BLOWER MOTORS**—115 VAC 60 Cy. Mfd. by Radex Corp. Model 6765 RPM 5000 Cont. Duty. 1-R #2 Blower and Impeller. 4" L. x 3½" Dia. Price.....@ **$5.95**
Mfd. by John Oster #C-2P-IL. 28 VDC @ 8 Amps 1/100 HP. Cont. Duty. 7000 RPM. 1-R #2 Blower and Impeller. 4¼" L. x 4" Dia. Price.....@ **$3.50**

**TRANSFORMERS PRI 115 V 60 CY**—Electric Specialty Autotrans 21P1. Output 2.3 Amps. 6 Volts @ .2 Amps. 150 Volts 1.6 Amps. Test Volts 1780 RMS 5" x 3" x 4½". Hermetically Sealed. Price.....**$1.25**

Raytheon Plate and Fil. U8164. Output 4200 @ .002 Amps: 5 Volt @ 3 Amps; 6.3 V @ .6 Amps. Price.....**$7.50**

Raytheon Fil. CRP30452. Output 7.5 V @ 2.5A; 10VCT @ 6.5 Amps. 20 V @ 13 Amps.....**$4.95**

Raytheon Fil. U8964. Output 2.9 Volts @ .19 Amps.....**95c**

Raytheon Plate and Fil. U8848. Output 600 VCT @ .135 AMPS; 6.3 Volts @ 5 AMPS; 5 VCT @ 3 AMPS.....**$3.75**

Raytheon G. P. U8844A. Outputs #1 and #2. 200 Volt @ .35 AMPS. Output: #3 and #4. 20 Volt @ .01 AMPS. Price.....**$3.50**

Sub Sig Co. Plate U7412, SEC #1 and #2. 300 Volts @ .5 AMPS.....**$7.95**

Raytheon Plate and Fil U3508A. Outputs 640V @ 80 MA; 6.3 V @ 3.2 AMPS; 5 V @ 3 AMPS. Price.**$3.00**

Raytheon Plate and Fil U8824. Outputs 770 V @ .07 AMPS; 5 V @ 3 AMPS; 5 V @ 6 AMPS; 2.5 V @ 10 AMPS. Price.....**$3.95**

Raytheon Plate and Fil. U7420. SEC. 225 V @ 180 MILS.....**$2.25**

Plate and Fil U8379. Outputs 750 VCT @ .113 AMPS; 6.3 Volts @ 5 Amps; 5 Volts @ 3 AMPS.**$3.95**

## RETARD CHOKE COILS

**AMERTRAN.** Disc Type. Line voltage 15,000; ripple freq. 120. Contains six gal. oil; .020A DC @ 9001H @ 48% ripple, 52A DC @ 25H @ 48% ripple. Case 17"x17"x22" w/terminals 10" above the case. 40° C temp. rise.**$34.00**

**ELECTRIC DRILLS**—¼" Chuck. 110V AC-DC. 2250 RPM. Portable.....**$17.95**

**COMPASS CORDS**—For BC-433, MN26. CD365A—Links receiver to compass loop ant.....**75c**

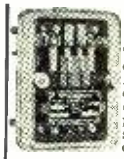
**EMERGENCY TRANSMITTER**—Emergency Transmitter—Mfg. by Fed. Tel. Co. Type TPC 119. Power Output—5 Watts. Emission A2. Freq.—500 Kcs. originally made for lifeboat emergency operation. Can be used either for Manual CW "SOS" and "SSS" Automatic Operation. Battery operated. Portable.....**$13.50**

**McMURDO SILVER MODEL 905 "SPARX" SIGNAL TRACER**—Dynamic signal tracer provides an audible means of following a signal from the antenna to the speaker. The magic eye furnishes a visual means of measuring circuit gain or loss.....**$35.00**

**SPARE PARTS BOX**—Wood Construction. Ideal storage box, 20" H. 26" W. 30" L. Metal handles on sides; metal latch on front.....**$3.00**

## SCR625 MINE DETECTORS

**Portable.** Detects metallic objects (ferrous or non-ferrous) to a depth of approx. 6 ft. Find outboard motors on the bottom of lakes, locate underground piping, treasure, metallic fragments in lumber, etc. Brand New, complete with instruction book. $65.00. Used but like new $45.00. The small mine detector. AN/PRS-1. Brand New.....**$29.95**



## Westinghouse AUXILIARY RELAYS

Type MC, Style PH 8082-1, 115 VAC 60 cy. cont. rating. Electromagnet Coil. 10 Amp. Contacts. 4PST. Coil resistance 70 ohms. Used to operate a number of circuits from one control circuit or for tripping circuit breakers. Glass top. Dimensions: 6½"x4½"x4½". Brand new in original cartons.....**$7.95**

**ELECTRIC TIMER 115 VAC**—Cramer—Model T E C, DT, adjustable 0-15 minutes.....**$12.95**

Cramer—Model TC60S. 60 Sec. Delay. 10A. SP ST N/o.....**$4.95**

Cramer—Model C45S Set 3 SEC. SPST N/O 10. AMPS.....**$4.95**

**EAGLE TIMER**—Metal frame, bakelite cover, motor operated. Set for 1 minute, but can be adjustable, motor actuates a N.O. micro. switch, completing circuit. 4½" x 3" x 3".....@ **$4.95**

**Synchron Clock Motors**—115 VAC 60 Cy 1 RPM..**$1.95**

**EDISON THERMAL**—Time Delay Relays 6.3 VAC 150-210 SEC. SPST N/C **$2.25**; 115 VAC N/O 45 Sec.**$1.75**

**Ward Leonard Resistor Assembly**—4 "RIBFLEX" 150 Watt Resistors connected in series Totaling 1.6 Ohms. @ 15 Amps.....**$2.50**

**Weston Multitester Model 655**—Ranges AC and DC volts 1000/500/250/100/25/10/5/2.5/1 sensitivity 1000 ohms/volt. Current Ranges: 500/250/100/50/25/10/5/2.5/1 MADC. LN.....**$35.00**

**Telephone Interrupter**—Cardwell Model RZ-7A. Single carbon mounted against diaphragm. When circuit is made via battery 1000 Cy note is produced.....**50c**

## SELECTOR SWITCHES

Heavy duty, specially built for the U. S. Navy to control any type of multi-circuit devices. Removable contacts enabling any combination of closed and open circuit. The following are available: 5 section-5 pole; 10 section-20 pole; 15 section-15 pole; 15 section-30 pole. $1.50 ea. Case lot of (5) $5.00 or (5) cases, special..**$17.50**

**Panel Light Assemblies**—Dialco. Clear Jewel. Bay. 10 **$1.45**
same as above, but with red Jewel.....10/ **1.90**
Dialco, Polarized. Green Jewel..Bay. **29c**; 10/ **2.50**
Dialco, 1" Frosted. Polarized Jewel.
Bay. 49c; 10/ **4.00**

**Auto Radio Angle Suppressors**—L Type.
5c ea.: 10/**40c**; 100/**$3.50**

**RF CHOKES**—2.5 M. H. Single Pie...**17c ea.**: 10/**$1.20**
Hammarlund RFC 85, 85MH.....**85c ea.**

**Isolantite Forms**—2½" L. x 1½" Dia.
12c ea.: 10,**$1.00**

**Ceramic Coil Forms**—w/36 turns silver wire. 4⅞"x2".
25c ea.: 10 **$1.75**

**Super Pro 2nd Det. Shield Coil**.....**25c ea.: 10 $1.75**

**Jones #141 Terminal Strips**—
2 Term. **13c** ea.: 7 Term. **23c** ea.

**Anti Capacity Switches**—DPDT. Neutral Ctr....**66c ea.**

**Phantom Antenna**—A62 used W/SCR 508/SCR 528.
**$1.50 ea.**

**Leg Irons**—Harvard Lock Co. Regulation police type. Supplied with two keys.....**$1.09**

**AN80 Antenna**—Half wave length 470 MC. Ant. Blade 5" long mounted in isolantite form with Amphenal connector.....**75c ea.**

**Amplidyne Control Amplifier**—W5999179 List 7. 115V 60CY. Designed to supply DC to amplidyne control windings in selsyn operated amplidyne servo system.....**$21.00**

Model 5AM45DP20 Input: 115-volts, 1 phase, 60 cycles, 5 amps. Output: 250 VDC, .6 amp. 150 watts. cont. duty. 40°C. Temp. Rise, 3450 RPM. New....**$53.50**

**BC 429 Aircraft 5 Tube Superhet Receiver**, complete w/5 Tuning units. 201KC-7700 KC.....**$15.95**

**Westinghouse Fluorescent**—Lamp 360 B1-2. White, 4 W.....**25c ea.**

**Variable Condensers**—Radio Condenser Co. Dual, 365MFD.....**$1.55**

**MICA CAPACITORS**

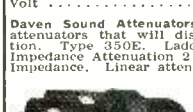
Cornell Dubilier TYPE 246-6LF, .001 MFD @ 5000 Volt.....**85c**

Cornell Dubilier TYPE 272-6LS .0005 MFD @ 5,000 Volts.....**85c**

Cornell Dubilier TYPE 857-15LS. .0015 MFD @ 3,000 Volts.....**59c**

Cornell Dubilier TYPE 1100-6LS .12 MFD, 500 Volt.....**35c**

**Daven Sound Attenuators**—Compact constant impedance attenuators that will dissipate 10 Watts in any position. Type 350E. Ladder network. 250/250 OHMS Impedance Attenuation 2 DB. Type 350A 30/30 OHMS Impedance. Linear attenuation. Your choice....**$2.50**



## GENERAL ELECTRIC AMPLIDYNES

Model 5AM 49AB7. Input 440 V. 60 cy. 3 Ph. 1A. Output 250VDC 1.5A 375W. 3450 RPM. New.....**$75.00**

## INTER-COMMUNICATION Sets Manuf. by Dictograph

Designed to bring to homes and offices the convenience of two-way conversation without the use of telephone, household electric current, or radio. Operates efficiently up to 800 feet off flashlight batteries. NEW. Can be hooked up for multiple circuits. Pair....**$9.95**

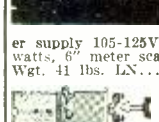
## B. C.—604 F. M. TRANSMITTER

Wide or narrow-band FM. 30 watt power output. Excellent possibility for ten or eleven meter exciter. Range 20-27.9 MC. Working space permits modification. Complete with tubes but less power supply and xtls. LN.....**$11.50**

**Raytheon Pulse Transformer WX5137**—PRI—4 KV, 1 MU. SEC.: 16 KV 16 Amps. Fil. Trans. Pri. 115 V 60 CY.....**$2.00**

**Signal Flags**—Red and White. Ideal for Scouts or for the sea-going man. **$2.00** per pair. Yellow—Ideal for rear of trucks, etc.....**$1.50 per pair**
**Jones Cable Connectors**—4 Prong Male/Female **35c** per set.

## R C A AUDIO FREQUENCY METERS



Type 306A. Direct reading 0-50,000 Cycles in ten ranges. Input voltage 1 to 200 volts RMS. Input impedance 25,000 OHMS. Recorder output 5.0 MA 1000 OHMS max. Accuracy 2%. Regulated power supply 105-125V 50-60 cy. Power consumption 70 watts, 6" meter scale. 8⅜" H. x 19" W. x 13⅝" D. Wgt. 41 lbs. LN.....**$75.00**



## BECKMAN HELIPOTS

Model A, 10 turns, 3600° rotation, 20,000 ohms resistance, 5 watt 0.5 guaranteed linearity 5% resistance tolerance. With aluminum stop as pictured $5.00. Without stop.....**$4.50**

## Potentiometers and Rheostats

**#5097:** 10K/10K 4W Screw Shaft W.W.....**3/$1.00**
**#5073:** 15K 4W 1½" Shaft W.W.....**4/$1.00**
**#5149:** 5K 4W Screw Shaft W.W.....**4/$1.00**
**#5039:** 5K 4W 1" Shaft W.W.....**4/$1.00**
**1001:** 5K 2W 1" Shaft Carbon.....**4/$1.00**
**1002:** 2Meg 2W 3" Shaft Carbon.....**3/$1.00**
**1003:** 75 Ohms 3W ½" Shaft W.W.....**4/$1.00**
**1004:** 6K 6K 3W ½" Shaft Carbon.....**4/$1.00**

**50 Watts**—25 Ohms, 40 Ohms, 50 50 Ohms, 300/300 Ohms, 400/400 Ohms, 10K Ohms: 1" Shafts. Your choice.....**ea. 75c**

**25 Watts**—2 Ohms, 25 Ohms, 50 Ohms, 225 Ohms, 350 Ohms, 500 Ohms, 3000 Ohms, 5000 Ohms, 20K Ohms: W.W. Your choice.....**ea. 50c**

The above are only a few representative samples of the many THOUSANDS we have in stock. Let us quote you on your requirements.

## Oil Filled Capacitors

**CN1:** 2 X .1Mfd 7000WVDC.....**$2.45**
**CN35:** 2Mfd 600WVDC Bathtub.....**71c**
**CN38:** 1Mfd 600WVDC Bathtub.....**49c**
**CN42:** 2 X .64Mfd 600V Bathtub.....**30c**
**CN61:** 3 X .1Mfd 600V Bathtub.....**15c**
**CN72:** 1Mfd 500V.....**55c**
**CN65:** .01Mfd 600V Bathtub.....**15c**
**CN95:** 1Mfd 200V Bathtub.....**20c**
**CN103:** 100Mfd 25WVDC Plug-In.....**35c**
**CN104:** .02Mfd 200 WVDC Tubular.....**10c**
**CN113:** 3 X .22Mfd 600V.....**15c**
**CN120:** .046/.055Mfd 600V Bathtub.....**15c**
**CNX01:** .2/.035Mfd 500V.....**15c**
**CNX02:** 3 X .05Mfd Cylindrical.....**15c**

**BATTERY CHARGER**, input 110VAC output 7.5V 6 Amps. selenium type.....**$8.25**

**BENDIX** IFF. MP-28BA Power Supply & Audio Amplifier.....**$11.75**

**DELUXE STREAMLINED CABINET RACKS**, Chrome decorated, hinged door on top w/catch and hinged door on back. Amateur or W.E. notched panels fit. Black crackled 28⅛" high. 18" deep. Panel space 26¼". LN.....**$15 ea.; 2/$27**

## Relays

**R521:** 24VDC SPST, 2A G.E. #55837.....**ea. 25c**
**R568:** 6VDC 3PDT, 15A G.E. #B100J4.....**ea. 50c**
**R565:** 24DVC DPST. 15A. Allied BO4D32.....**ea. 30c**
**R572:** 24VDC SPST, 200A. Guardian #87B.....**ea. 75c**
**R561:** 24VDC SPST, 15A Allied BO13D35.....**ea. 25c**
**R563:** 24VDC SPST, 200A. A.B. #X89309.....**ea. 75c**
**R533:** 24VDC DPDT, 15A. G.E. #CR2791.....**ea. 25c**
**R552:** 24VDC DPDT, 15A. Leach #1054.....**ea. 30c**
**R566:** 24VDC DPDT. 15A. GM #13013.....**ea. 30c**
**R567:** 24VDC DPDT, 15A. Allied.....**ea. 30c**
**R559:** 24VDC 4PDT, 15A. GM #13016.....**ea. 35c**
**R564:** 32VDC, SPST. 75A. Leach #7220-32.....**ea. 70c**
**R526:** 75VDC DPST, S-D N O 30A.....**ea. $1.35**
**R571:** 115VDC DPDT, Price #311, 1900 ~.....**ea. 70c**
**R522:** 115VAC 3PST, 6A, S.D. #1CNX100.....**ea. $1.75**
**R534:** 115VAC DPDT, Thermal Time delay 40 Sec. 2A.....**ea. $1.00**
**R512:** 20VAC Annunciator Drop Type SPST 6 Amp.....**ea. 20c**
**R100:** 115VAC 10A 3PDT Allied #D0X1.....**ea. $2.25**

## Heavy Duty Resistors

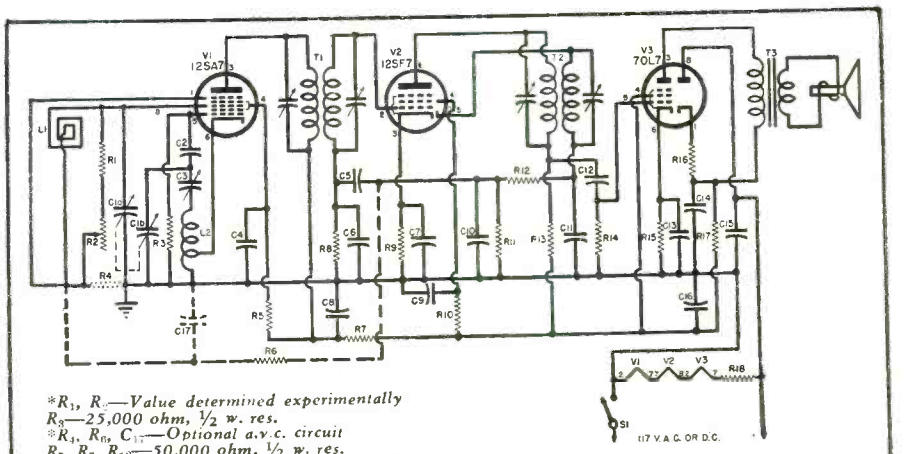
**.52 OHMS** 1000 Watts. Air Wound.....**$1.00**
**10 OHMS** 1000 Watts. Air Wound.....**$1.00**

**Amer. Trans:** Pri. 115V 60 Cy., Sec: 5V 5.0A. 5V 10.0A. Test Volts 35000.....
**Longan #2140:** Pri. 115V 60 Cy., Sec: 11V 150MA. **65c**

All items new except items notated LN (meaning like new). If not rated 25% with order, balance C.O.D., F.O.B. Boston. Let us quote on your requirements. Write for our Catalog. **Minimum order $3.00.**

# ESCO ELECTRO Sales Co.

**DEPT. R2, 110 PEARL ST., BOSTON 10, MASS....Liberty 2-5589...HAncock 6-5069**




*$R_1$, $R_2$—Value determined experimentally
$R_3$—25,000 ohm, ½ w. res.
*$R_4$, $R_6$, $C_{17}$—Optional a.v.c. circuit
$R_5$, $R_7$, $R_{12}$—50,000 ohm, ½ w. res.
$R_8$—500,000 ohms to 1 megohm, ½ w. res.
$R_9$—600 ohm, ½ w. res.
$R_{10}$—1 megohm, ½ w. res.
$R_{11}$—750,000 ohm, ½ w. res.
$R_{13}$—200,000 ohm, ½ w. res.
$R_{14}$—20,000 ohm. ½ w. res.
$R_{15}$—250 ohm. ½ w. res.
$R_{16}$—50 ohm. ½ w. res.
$R_{17}$—3000 ohm, ½ w. res.
$R_{18}$—150 ohm, 20-25 w. wirewound res.
$C_{1a}$, $C_{1b}$—160-420 μμfd., 2-gang var. cond.
$C_2$—50 μμfd. mica cond.
$C_3$—400 μμfd. padder cond.
$C_4$—500 μμfd. mica cond.
$C_5$, $C_{12}$—.02 μfd., 200 v. cond.
$C_6$, $C_{10}$, $C_{11}$—250 μμfd. mica cond.
$C_7$—25 μfd., 25 v. elec. cond.
$C_8$—.001 μfd., 400 v. cond.
$C_9$—8 μfd., 150 v. elec. cond.
$C_{13}$—50 μfd., 25 v. elec. cond.
$C_{14}$—50 μfd., 150 v. elec. cond.
$C_{15}$—.05 μfd., 400 v. cond.
$C_{16}$—30 μfd., 150 v. elec. cond.
$S_1$—S.p.s.t. sw. (on $R_2$)
$L_1$, $L_2$—To match gang-cond. $C_{1a}$, $C_{1b}$
$T_1$, $T_2$—456 kc. i.f. trans. (high quality)
$T_3$—Output trans. Pri. 2000 ohms; Sec. to match voice coil
* Note: Although actual values are determined experimentally, a good approximation of the components is as follows: $R_1$—1000 ohm; $R_2$—100,000 ohm pot.; $R_4$ and $R_6$—1 megohm; and $C_{17}$—.05 μfd. Resistors should be ½ w. and the condenser a 200 v. rating.

**Fig. 2. Circuit diagram of the low-cost receiver. Padding condenser $C_3$ is not required providing oscillator coil $L_2$ matches cut-plate section of gang as specified in parts list.**

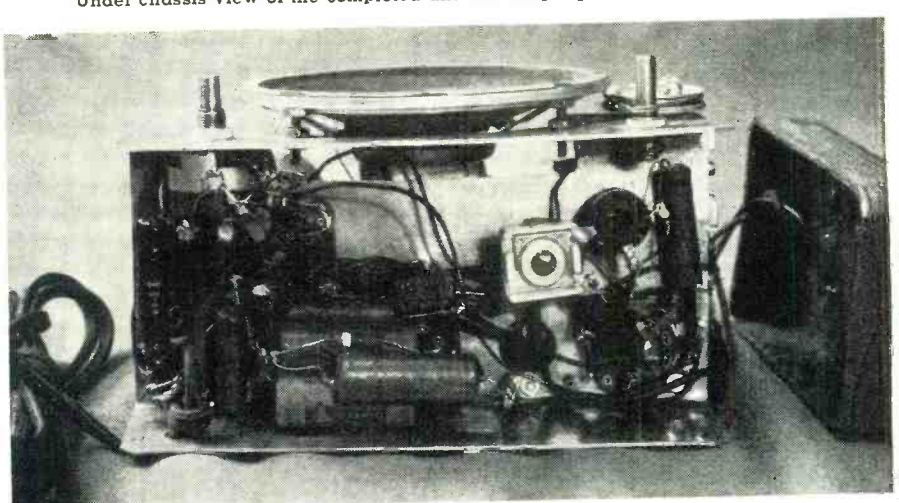
Since both the distortion and the minimum volume effect become worse as the bias voltage approaches the curved portion of the control grid characteristic, it is evident that the use of a.v.c. in the reflex amplifier is detrimental. However, a.v.c. developed by the detector can be applied to the control grid return of the converter section.

The three-tube broadcast receiver shown in Fig. 2 illustrates the relatively simple type of set that may be designed around a reflex circuit. The set was wired on a chassis 3½" by 8" and employed a 4" speaker with a 1½ oz. slug. No a.v.c. was used. Performance compared very favorably with receivers using four and five tubes. It may be found desirable to substitute a 50L6 (or a similar type) and a 75 ma. selenium rectifier in place of the 70L7.

The reflex circuit does not readily lend itself to portable, low drain, battery application because of the lack of suitable diode-pentodes employing 1.4 volt 50 ma. filaments. The older types such as the 1K7 and 1F7 perform fairly well but are difficult to obtain, quite expensive, and necessitate the use of battery-consuming filament shunting resistors when used in conjunction with other, more modern tubes. If size and a minimum number of components are at premium, the possible use of a crystal diode such as the 1N34 in conjunction with a pentode offers interesting possibilities. The much larger selection of straight pentodes undoubtedly will provide a satisfactory tube.

—30—

**Under chassis view of the completed unit showing layout of component parts.**



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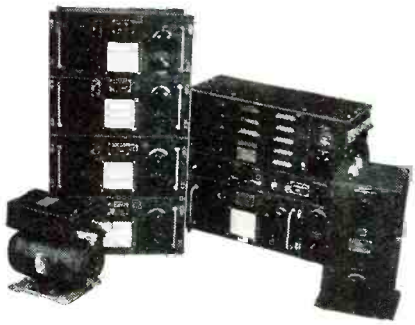
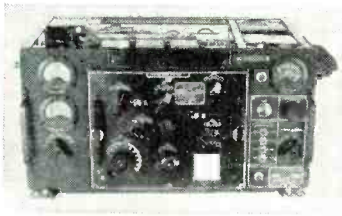


** Payment with order—shipped F.O.B. from Ariz. or Okla. warehouses (which are being closed)*

We're closing 2 warehouses—hence this great war surplus bargain. With thousands of usable standard radio parts, it's just the thing for beginner or old-timer. 5 tubes, 5 tuning units, xmtr. designed to operate from 200 kc to 12 mc (less BC band). With antenna tuning unit BC-306-A—variometer and tap switch; Dynamotor (PE-73-C) complete with relay, fuses and filter. Weight approx. 275 lbs.



### GP-7 NAVY TRANSMITTER

125 watt xmtr., self-contained AC, 400 cycle power supply; uses suppressor grid modulation for phone, VFO controlled, 803 in final; built of std. parts. **$14.95**

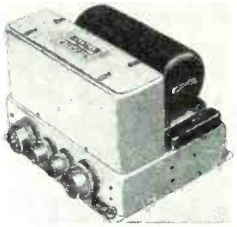
### CONVERSION BOOKS

**$2 each**

***Limited Quantity***

Diag. and Conversions: BC-348, SCR-522, BC-375, SCR-274, SCR-274-10 meter mobile.

Diagrams for: BC-221, ART-13 Collins Xmtr., APN-1, APN-4, SCR-718.

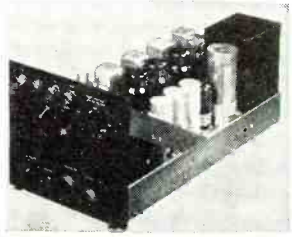


### SPEECH AMPLIFIER

**Modulator for Transmitter**

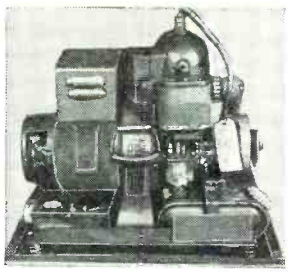
*High Volt. DC Power Supply* Model unit, BC-456-A or B with dynamotor DM-33-A, plugs and tubes. Approx. wt. 17 lbs. Tube line-up, 12J5GT, 1625, VR150, and many other parts make this ideal purchase for spare parts alone.

**$2.00**



### APN-4 RCVR—'SCOPE POWER SUPPLY

4 switch-selected screw-driver tuned RF channels; IF freq. 1050 kc, bandwidth 45-60 kc; RF freq. 16 2000 kc. Tubes: (2) 2Y2, (3) 6B4, (4) 6SK7, (1) ea. 5U4, 6SU7, 6SA7, 6H6, VR150. Makes fixed tuner for med. freq. police calls or PA system. Has power supply for 5" scope, with 400 cycle trans. Electronic-controlled low v. supply; delivers 260 vdc. 150 mils reg. to .01%. Power supply alone worth more than price..... **$8.95**



### THE FAMOUS "PUTT-PUTT" Gasoline Generator (HRU-28)

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Single cylinder, 2-cycle gasoline engine with generator that is rated at 2,000 watts direct current, 70 amps. Has unlimited use around a farm; useful as field day power supply. More literature upon request.

## 25 WATT FM-TRANSMITTER-RECEIVER

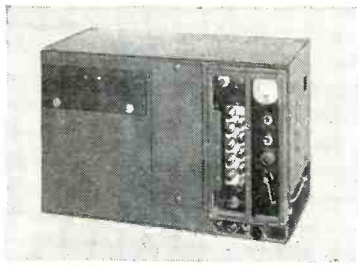
**$29.50 *for special combination***

For mobile or fixed station use; easy conversion to 10 and 11 meters.

**Schematic diagram and information—how to convert to 110 v. AC and amateur use.**

### BC-603 RECEIVER *(alone)* $14.95

10 tube, superhet FM receiver; Foster Seely discriminator, 10 channel; pretuned, push-button selector; optional manual tuning; adjustable squelch control; speaker mounted in receiver; freq. range 20 to 27.0 mc. Small change in RF trimmers will cover 10 & 11 meter bands. POWER REQUIREMENTS — Receiver 260-280 v. at .08 amps DC, 14 v. at 3.5 amps. AC.



### BC-604 TRANSMITTER *(alone)* $19.50

10 channel, crystal controlled, selected by push button. Xmtr. has 7 1619 (2.5v 6L6's) for exciter and FM modulator; 1 1624 (2.5v. 807); final amplified 35 watts; crystal oven for 10 crystals, freq. range 20—27.9 mc. 1 0-100 MA meter measures grid, plate, and ant. current. Price excludes crystals.
POWER REQUIREMENTS — Transmitter 500 VDC at .22 amps. DC, 14 VAC at 4 amps. AC.

**12 v. Dynamotor for receiver $9.95**
**12 v. Dynamotor for Xmtr. $12.50**

1 box of 80 crystals for above, when purchased with trans., $10.00 per set.

**ALL EQUIPMENT F.O.B.**

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## R&M RADIO COMPANY

1426 N. QUINCY ST. DEPT. RN-29 ARLINGTON, VIRGINIA

# NEW RECEIVERS for Winter Market

### "THE NEW YORKER"

One of the recently-introduced *Stewart-Warner Corporation* models has been designated "The New Yorker," the Model AVC-1.

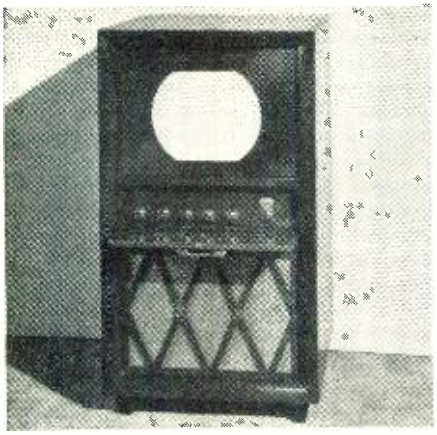
This unit has been designed as a "companion piece" to harmonize with

the console radio-phonograph receivers in the *Stewart-Warner* line. The new model provides television and TV sound only. It also features the company's new "Photo Mirror Screen." The "photo mirror" is mounted on the underside of the lid and reflects the image without distortion. A magnifying lens can be used between the tube and the mirror. Its companion combination is "The Manhattan," an AM-FM set with standard or two-speed changer.

For full details on "The New Yorker" or other television receivers in the company's line, write direct to *Stewart-Warner Corporation*, 1826 Diversey Parkway, Chicago 14, Illinois.

### UST CONSOLETTE

*United States Television Mfg. Corp.* has just released the Model CFM 12823P, a compact television consolette



designed for small homes and apartments.

The new model features a Zetka 12½ inch television tube with an ion trap which eliminates ion stain. Housed in a period mahogany cabinet, the new set eliminates the need for any extra furniture on which table models must be placed. The brass controls are concealed behind a door. The consolette is 41½ inches high so that the television image can be seen easily by a seated spectator. It is 22 inches wide and 22¾ inches deep.

High fidelity FM radio is included in the unit which has 21 tubes plus 2 rectifiers. The television tuner brings in all 12 channels. There are four stages of picture i.f. amplification and two stages of sound i.f. amplification.

The new model has automatic synchronizing control as well as the company's "no-fog" contrast and crystal picture detection features.

For further information on the CFM 12823P write to *United States Television Mfg. Corp.*, 3 West 61 Street, New York 23, New York.

### "WAKEMASTER"

*Jewel Radio Corporation* of New York has recently introduced the Model 920, the "Wakemaster."

This 5-tube superheterodyne re-

ceiver includes a *Telechron* automatic clock and alarm. This new receiver is available in either a walnut or ivory plastic cabinet which has been designed to harmonize with either modern or traditional settings.

Full details on the Model 920 "Wakemaster" are available on request from *Jewel Radio Corporation*, 583 Avenue of the Americas, New York 11, New York.

### I.T.I. "CENTURY"

*Industrial Television Inc.* of Clifton, New Jersey is currently in production on a home television receiver, the Model 221 "Century."

This new console utilizes a 12" direct-view picture tube which supplies a 72 square inch picture. A plastic curved picture tube protector eliminates reflections from room lighting and increases picture realism, according to the company.

All 12 commercial channels are covered by this receiver. Only four adjustment knobs are provided, i.e., channel selector and fine tuning, "off-on" and tone control, volume control, and contrast control. The automatic frequency control of the horizontal circuit is of an improved type which eliminates the need for a front panel control. Automatic gain control simplifies tuning by eliminating critical adjustments of contrast while switching from station to station.

This receiver is available in either dark mahogany in period styling (the

Model 221D) or in bleached Philippine mahogany of modern design (the Model 221L). The cabinet measures 25½ x 23 x 39 inches.

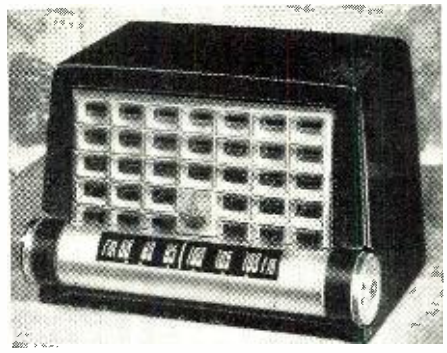
Full details are available from *Industrial Television Inc.*, 359 Lexington Ave., Clifton, New Jersey.

### NEW FM SET

*Emerson Radio and Phonograph Corporation* has recently released a table model FM receiver known as the "Conqueror," FM radio Model 602.

The "Conqueror" which will retail in the low-price class, is housed in an acoustically constructed cabinet featuring a new application of maroon plastic in combination with new style translucent gold-backed slide-rule dial and integrated control knobs and three dimensional grille. The complete FM band is covered with an improved superheterodyne circuit which will operate on a.c. or d.c.

There is an internal FM powerline antenna which eliminates the necessity for an external antenna in local



reception areas. Provision is made for connecting an external antenna should it be required.

For full details on the Model 602,

## Light Collapsible ALUMINUM MAST

5 ft. 6 inches extended, 13" collapsed. Sections lock up positively in the extended position. May be used as mast for light arrays, camera unipod, canoe sail-mast, or pup tent pole. Other uses will suggest themselves. Large section 1¼" dia. small section 5/8" dia. with 1-5/8" dia. mounting plate. Net weight 14 ounces.

STOCK NO. CB-9B _____ 98¢

## Push Button ON-OFF SWITCH

Used in conjunction with a relay for controlling motors, generators, etc. Heavy duty contacts. Complete with indicator lamp. Overall dim: 3" x 3¼" x 8¼" high. Net weight 18 oz.

STOCK NO. B-772B ___ $1.95

## TOTAL HOUR METER

For recording operating time of transmitting tubes, machinery, electrical equipment, etc. Resets at 9999.9 hours. Flush panel mtg. bakelite case - flange dia. 3½", body dia. 2¼". Operates on 115V 60CY. Net wt. 12 oz.

STOCK NO. C-251B _____ $5.95

## Molded Black Bakelite CABINET

For housing intercom, code oscillator, monitor, small receiver, 5" speaker, etc. Dim: 5" deep, 6" wide, 6-5/8" high. Net wt. 1 lb.

Stock No. B-878B $1.49

## SCR-274N Transmitter and Receiver COMPONENTS

| | | |
|---|---|---|
| BC-458 | 5.3 to 7 mc. Transmitter, Brand new | $5.95 |
| BC-458 | 5.3 to 7 mc. Transmitter, Used | 4.95 |
| BC-457 | 4 to 5.3 mc. Transmitter, Used | 4.95 |
| BC-454 | 3 to 6 mc. Receiver, Used | 5.95 |
| BC-455 | 6 to 9.1 mc. Receiver, Used | 5.95 |
| BC-456 | Modulator with plugs & dynamotor, Used | 2.95 |
| BC-456 | Modulator less plugs & dynamotor, New | 2.95 |
| BC-450 | 3-section Receiver Control Box, Used | .98 |
| BC-451 | Transmitter Control Box, Used | .49 |
| FT-220 | 3-section Receiver Rack, Used | .98 |
| FT-226 | 2-section Transmitter Rack, Used | .98 |
| B-785B | Brass Spline for tuning receivers | .09 |
| MC-215A | Flexible Tuning Shafts, 140" long | 1.49 |
| MC-215B | Flexible Tuning Shafts, 220" long | 1.49 |
| C-822B | 6 to 9.1 mc. RF Coil Set #6234 | .98 |
| A-809A | 1415 KC First I.F. #7274 | .49 |
| A-809B | 1415 KC Second I.F. #7275 | .49 |
| C-252B | 2830 KC First I.F. #7277 | .29 |
| B-693B | 50 ma. 3 hy. Filter Choke #5634 | .19 |

*All used components are in good condition and guaranteed to be satisfactory to you.*

| | | |
|---|---|---|
| B-400B | 6-Conductor Rubber Covered Shielded Cable, 100 ft. rolls. Shipping weight 15 lbs. | $3.95 |
| B-543B | 100 ohm, 150 watt Potentiometer 4" Diameter: Excellent for heat control of soldering irons. | .98 |
| C-226B | 6½ ft. 2-conductor Rubber Covered Phone Cord with plug, PL-55, and Connector Block JB-47. | .39 |
| C-253B | Piano Type Hinge, 13/16" wide x 13-3/16" long. Chrome plated. | .39 |
| C-988B | T-17B Carbon Hand Mikes. | 1.49 |
| B-738B | Utah 9200 ohm Headphones with canvas covered headband. | 2.49 |

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## 5-Section Oil Filled CONDENSER

Has three 4-Mfd, one 1-Mfd and one 2-Mfd sections, all with one side common and rated 600 VDC. By paralleling sections you can obtain any capacity from 1 to 16 Mfd in steps of 1-Mfd.

Accurate to 1 percent - it is excellent for experimental laboratories and for power factor correction of motors. Case 4½" sq. x 3½" high, housed in 4-3/4" x 6¼" x 4-5/8" metal box with removable top, 8-terminal strip and conduit fittings. Net Weight 5½ lb.

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## SELECTOR SWITCHES

All have ¼" dia. shafts and 3/8" dia. bushings. Lengths specified are less shaft and bushings.

STOCK NO. C-58B -Bakelite - 4 decks, each 1 pole 11 positions. Length 4". . . . . 69¢

STOCK NO. A-686B - Bakelite -5 decks, two with 1 pole 12 positions. Length 2-3/8". . . . .69¢

STOCK NO. A-682B - Ceramic-5 decks, two with 1 pole 11 positions. Length 2-3/4". . . . .69¢

STOCK NO. A-687B - Bakelite-4 decks, two have 1 pole 19 positions. Length 1-5/8". Diameter 2-5/8". . . . . $1.59

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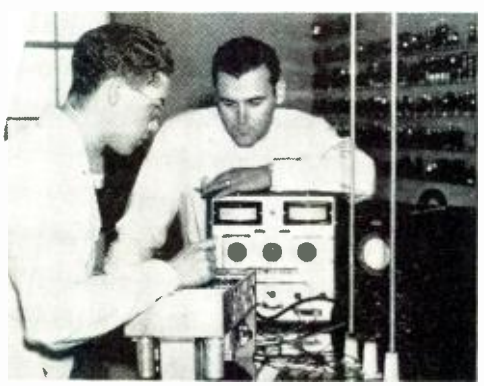

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write to *Emerson Radio and Phonograph Corporation,* 111 8th Avenue, New York, New York.

### "THE LANCHESTER"

A radio-phonograph-television unit which is housed in an 18th Century Regency cabinet is a recent addition to the *Stromberg-Carlson* line.

Known as the Model TV 12 PM, the

new receiver has a 12 inch picture tube, FM, AM, and short-wave coverage in addition to a duo-speed intermix record changer. The phonograph will handle both standard and Microgroove records and shuts off automatically as soon as the last record has been played.

A tuning eye has been included for easy and accurate station selection. The set uses a 12 inch electromagnetic speaker cushioned in live rubber. Push-button tuning is provided on the standard broadcast band.

*Stromberg-Carlson Company,* Rochester 3, New York will supply further information on request.

### OLYMPIC CONSOLE

*Olympic Radio & Television Inc.* has recently introduced a new deluxe 5-way console which features the "Magic Mirro-Scope," a new method for casting images on the screen.

According to the company, the "Magic Mirro-Scope" makes the images

flicker-free, without glare or eyestrain. The screen folds out of sight when not in use.

Also contained in the 18th Century period cabinet is a 10 tube FM-AM

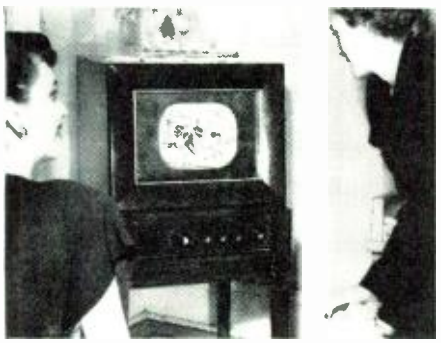
receiver plus a new *Webster* dual-speed record changer which can play both standard and Microgroove recordings.

Designated the Model TV-928, the new console is available in mahogany only. It can be supplied with a standard rather than a dual-speed record changer if desired.

For further information on the Model TV-928 write direct to *Olympic Radio & Television Inc.*, Long Island City, New York.

### TV CONSOLETTE

Of particular interest to apartment-dwellers is the new Model 1040 television consolette added recently to *Philco*



*Corporation's* line of home receivers.

This compact 10 inch direct-view receiver is a junior version of the company's Model 1240, with automatic tuning and level control. The set is equipped with a built-in socket for the *Philco* Microgroove record player. It has 21 tubes plus three rectifiers and the 10 inch tube. The cabinet is of mahogany veneers.

*Philco Corporation*, Philadelphia, Pa., will supply full details to those requesting them.

### ANDREA VIDEO SET

*Andrea Radio Corp.* of North Long Island City has a new television receiver on the market which has been designated the Model T-VK12.

The set features a built-in socket and switch for a record player, a seven inch picture tube, and a 26 tube chassis plus 3 rectifiers.

All television channels can be received with this set, plus AM and FM broadcasts. The receiver is housed in a modern design cabinet.

Further information on the Model T-VK12 may be secured by writing to *Andrea Radio Corp.*, 2701 Bridge Plaza, North Long Island City, New York.

### LOW-PRICED TV CONSOLE

A television console which incorporates a 10" picture tube and retails in the low-price class has been added to the *General Electric Company's* line of home instruments.

The Model 811 is equipped with an automatic clarifier and automatic stabilization circuit which controls picture synchronization and enhances picture detail. A separate circuit for each of the 12 broadcast channels makes possible the reception of any station, according to reports from the company.

In addition to the picture tube, the Model 811 has 18 tubes plus 3 rectifiers

and has a permanent magnet Alnico 5 speaker.

The set is housed in a mahogany finished cabinet of contemporary design. Control knobs are mounted on a receded metal escutcheon. A large speaker grille of woven metal with brass finish is enhanced by acoustically correct grille cloth.

*General Electric Company*, Electronics Park, Syracuse, New York will supply further data on the Model 811 on request.

—30—

## Phono Equalizer

(*Continued from page 62*)

quency characteristic can then be analyzed and a made-to-measure equalizer constructed for each in order to eliminate the most annoying troubles.

By designing the equalizers as pure resistance-capacity filters, these fixed tone controls can be made inexpensively and small sized.

Undoubtedly, enemy No. 1 of recorded music is scratch. All tone controls are designed to eliminate this disturbance, with varying degrees of success. Only a certain definite setting of two separate tone controls, as

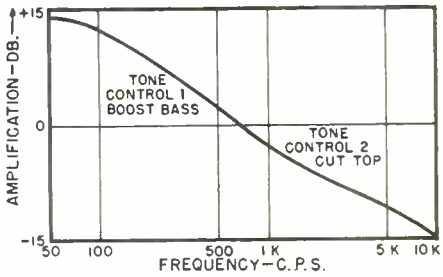


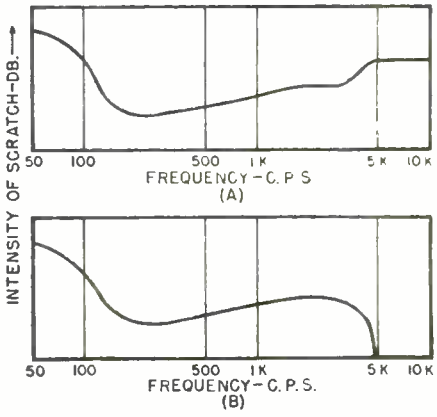

**Fig. 2. Two variable tone controls have to remain in this fixed setting in order to provide effective de-emphasis.**

indicated in Fig. 2, would achieve the same result as a fixed equalizer but in that case the tone controls would have to be left at this setting and could not be used to compensate for other frequency response defects. This means that they would lose their character as variable controls.

For the amplifier fan who has constructed his own tone control circuit and likes to twist the knobs until he can distinguish the "bass" and "top," here is the inside story of equalization.

Scratch or noise is comprised not of high frequencies alone, as is commonly believed. In Fig. 3A, the volume versus frequency characteristic of scratch on phonograph records shows a slight increase of volume at low frequencies. This means that a frequency discriminating instrument (not the human

**Fig. 3. (A) Scratch on records is composed of sounds of all frequencies. (B) What a tone control set for "top cut" does to the frequency characteristic of scratch.**



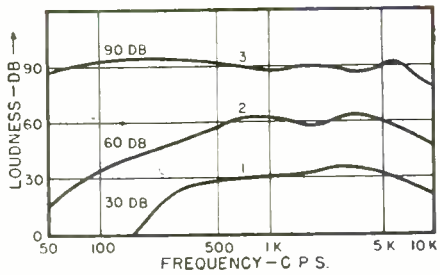




**Fig. 4. Tones of all frequencies are fed to the human ear at a volume of 30 db., 60 db., and 90 db. respectively, above the minimum intensity required to hear a 1000 c.p.s. note. It is seen from the curves how loud tones are heard at these varying intensities.**

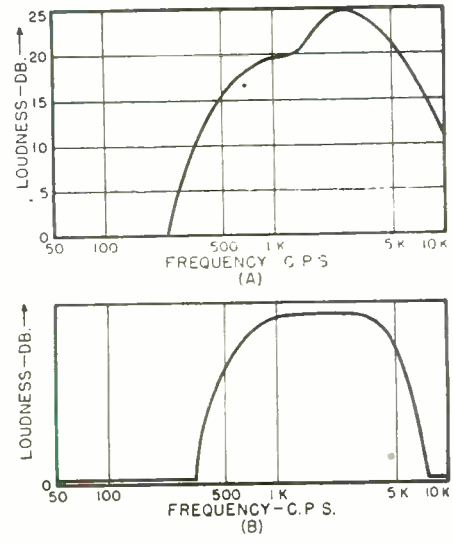
ear!) would register a high volume of scratch if the instrument were made sensitive to bass frequencies exclusively. The instrument would, however, indicate the presence of scratch at all frequencies.

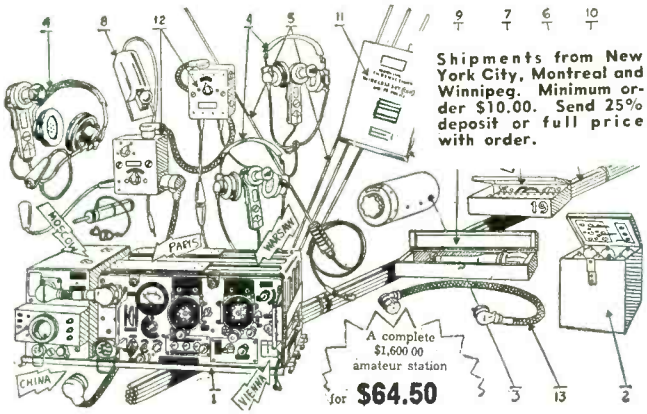
Fig. 3B shows what happens if the tone control of an amplifier is set to cut the top frequencies. The volume reproduced by the loudspeaker (or indicated by a test instrument) drops for the high frequencies. If a record is played with this tone control setting, the high frequencies of the scratch are reproduced in the loudspeaker with less volume but the bass frequencies of the scratch, which are its stronger component, still remain and are propagated by the loudspeaker at the same volume.

How is it possible, then, that the scratch diminishes considerably when the tone control is set for "top cut"?

Fig. 4 shows the loudness-frequency characteristic of the human ear. If a program is received at an intensity of 30 db. above the level at which a 1000 c.p.s. tone is just audible (Curve 1), tones below a frequency of 150 c.p.s. are not heard at all; at 800 c.p.s. a loudness equal to the intensity of 30 db. is reached and up to 500 c.p.s. all

**Fig. 5. (A) Loudness vs. frequency characteristic of the human ear for an over-all intensity of 20 db. above the threshold of hearing at 1000 c.p.s. (B) Loudness vs. frequency characteristic of scratch attenuation by tone control set for "top cut."**



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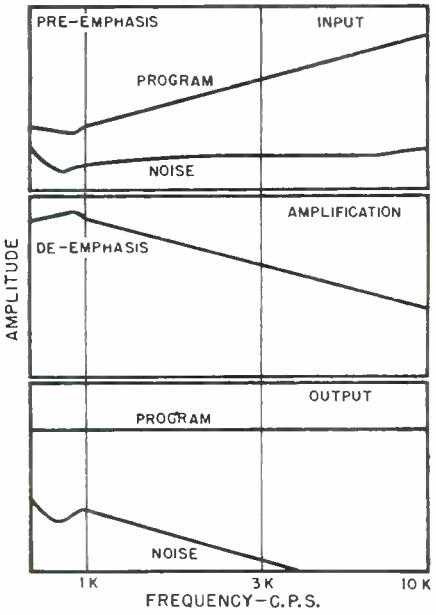
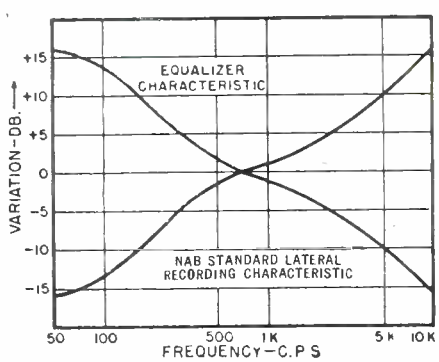



**Fig. 6. The program which is pre-emphasized and the noise which is not, enter the input of the amplifier whose response is set for de-emphasis (exact image of pre-emphasis curve). The result is a flat frequency characteristic for the program and the elimination of the loudest noise frequencies.**

tones sound louder than they are in volume. Then the loudness drops off at 10,000 c.p.s. to a level such as if the intensity were only 20 db. above minimum audibility. This means that at an intensity of 30 db. only tones from 150 to 10,000 c.p.s. are audible with a peak loudness at from 800 to 5000 c.p.s. For a program played at an intensity of 60 db. above minimum audibility, the ear is already sensitive to tones of 50 c.p.s. (see Curve 2), though weakly. Again, tones from 600 to 5000 c.p.s. are heard at full intensity. A program reproduced at an intensity of 90 db. (above the threshold of hearing at 1000 c.p.s.) is, however, heard over the full range of frequencies with a loudness equal to the intensity of 90 db. and even louder up to 6000 c.p.s., but slightly weaker above that frequency. See Curve 3.

Briefly, the human ear is sensitive to the middle and higher frequencies at all intensities at which the program may be played, but at low intensity some of the bass frequencies get lost. This characteristic gives rise to the well-known automatic bass

**Fig. 7. NAB standard equalizer characteristics.**



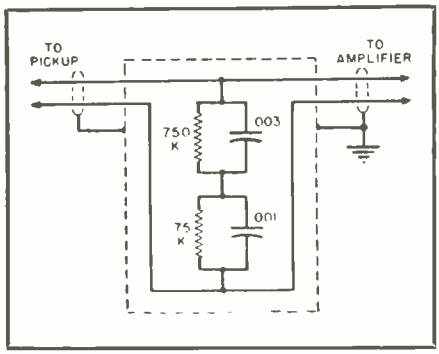



Fig. 8. Diagram of super-simple equalizer.

compensation at low volume used with some volume controls.

Assuming that whenever a record is played at average volume some scratch appears at an intensity of nearly 20 db. above the threshold of audibility, it can be seen from Fig. 5A that if all frequencies of which the scratch is composed impinge on the ear with the same intensity of 20 db., none of the sounds below 250 c.p.s. will be heard. Most intolerable are the scratch frequencies between 1000 to 5000 c.p.s. but the higher frequencies also share in the disturbing effect. Therefore, although all frequencies of which scratch is composed are reproduced with equal volume, they are heard by the human ear with unequal loudness—the high frequencies sounding louder than the bass frequencies. Now, if a tone control is set to cut out the high frequencies, the human ear eliminates the component of the scratch that sounds the loudest and is able to tolerate the remaining low frequency component of the noise which makes only a negligible impression of loudness on the ear although it is actually stronger in volume. See Fig. 5B.

So much for the effect of cutting high frequencies on the loudness of scratch, but as the high frequencies are cut off from the program on the record, the reproduction suffers for the music sounds "bass-y" and loses its brilliance.

In order to preserve the high frequencies in the program material and yet override the noise, the pre-emphasis/de-emphasis circuit was devised. Before the program material is transmitted or recorded, the high frequencies are pre-emphasized or increased in volume, according to a rising characteristic as shown in Fig. 6. Since the noise does not originate together with the program material, it is not pre-emphasized but enters the radio receiver or appears on the record at its normal volume. If the high frequencies are now de-emphasized in the amplifier, i.e., decreased in volume or amplification, according to a falling characteristic which is a true image of the pre-emphasis characteristic, the high frequencies of the program (which were pre-emphasized and de-emphasized the same amount) appear with original loudness while the high frequency component of the noise, which was only de-emphasized, appears less loud. Thus the brilliance of

the music is preserved and the noise is made more tolerable.

This feature is the main difference between a tone control and an equalizer circuit in that the latter has a definite frequency characteristic which counteracts some other frequency characteristic of a complex nature. The de-emphasis curves and their counterparts, the pre-emphasis curves, are not chosen at random like tone control settings but are carefully determined by considerations of recording technique. Their main purpose, however, is the elimination of scratch by utilizing the sensitivity characteristic of the human ear.

Fig. 7 shows the *NAB* standard frequency characteristic for lateral recordings. This is the pre-emphasis curve recommended in recording. Note the flat portion at the low end. It is meant to pre-emphasize the program against motor rumble and power line hum. The part of the curve with least deviation from normal level (next to the crossover at 650 c.p.s.) comprises the frequencies at which most programs contain the bulk of their sound energy. The slope of the characteristic, on the rise, corresponds to the decrease in amplitude when the velocity of the recording needle is kept constant.

If records made to this characteristic are played on a flat frequency response system, the bass frequencies sound weak and the highs are accentuated with abnormal hiss. This is usually the case and the tone control is then set for top cut in order to compensate for this defect. In order to get a satisfactory reproduction from such records an equalizer must be introduced which will counteract the recording characteristics by its exact opposite part. Every frequency that was increased in amplification when the record was made ought to be decreased by the same amount when the record is played and vice versa. See Fig. 7. The amplification characteristic for the reproduction of records, in order to take advantage of the pre-emphasis/de-emphasis feature, should be a true image of the standard recording characteristic above a straight level line. Since the reproducing amplifier is supposed to have a flat frequency response, it needs an equalizer to achieve the image effect or de-emphasis characteristic.

The design of an equalizer requires calculations involving the manipulation of scores of numbers but the author has reduced the process to the simple circuit of Fig. 8. The attenuation characteristic of this resistance-capacity arrangement follows the image of the *NAB* standard lateral recording characteristic with a maximum deviation of ± 1.8 db. The equalizer should be connected between the pickup and the amplifier input. Two precautions must be observed. First, the amplifier should have enough gain to compensate for the insertion loss of the equalizer and, second, adequate shielding must be provided throughout.

The four components are mounted on a insulating strip and enclosed in a small metal box with shielded connections. The average insertion loss of the equalizer is 22.5 db. (if matched to high impedances). If the phono input of the amplifier does not provide enough gain, the mike input may be used instead.

Most records are made to the *NAB* or a similar characteristic and will lose much of their scratch and will sound more "lifelike" when played with an equalizer in the circuit. The builder will have the satisfaction of having improved his amplifier, at the cost of a few cents, by the methodical investigation and understanding of acoustical principles. —30—

## What's New in Radio

(*Continued from page 84*)

of 300, 500, and 800 cycles are accommodated and the high frequency control permits adjustment to any of six response curves, ranging from flat response down to slightly more than *NAB* slope-off. The amplifier measures 8¼ by 2⅞ by 6 inches over-all

and can be mounted on a 3 inch relay rack panel or in the phonograph compartments of most cabinets.

Where power for the preamplifier is not available from the main amplifier chassis, the Model P6-300 d.c. power supply provides d.c. for the tube heater as well as the plate supply. The power supply which is only slightly longer than the preamplifier can be accommodated on the same 3 by 19 inch relay rack panel.

*Brociner Electronics Laboratory*, 1546 Second Avenue, New York 28, New New will supply full details and prices on request.

### "TENNA-ROTOR"

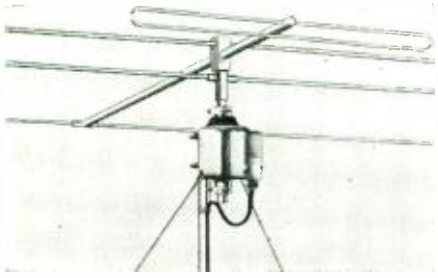
An electric antenna rotator designed to rotate beam antennas in FM, television, and other high frequency radio applications, has just been announced by *Alliance Manufacturing Company* of Alliance, Ohio.

The rotator unit can be quickly and inexpensively installed on most TV and FM antennas. This unit is connected to a plastic control box which is located adjacent to the receiver. A three-position switch starts rotating the antenna clockwise or counter-clockwise through 360 degrees. When the switch is turned to the center, or neutral, position, rotation is stopped.

The "Tenna-Rotor" provides positive, instant control of rotation and selects the exact point on the compass for optimum or "peaked" reception.

When the limit of travel is reached in either direction, a small screen on the control panel is illuminated.

The motor in the rotator unit operates on 24 volts at 60 cycles supplied through a step-down transformer in the control box. Components in the rotator are cadmium plated and the rotor is moisture sealed to provide maximum resistance against corrosion.



For complete details on the new "Tenna-Rotor," write *Alliance Manufacturing Company*, Alliance, Ohio.

### RECORDING DISCS

A new professional instantaneous recording disc has been announced by *Sonic Recording Products, Inc.* of Freeport, Long Island.

Designed to provide consistent performance, exceptionally low surface noise, controlled chip throw, freedom from static, unusual durability, and high fidelity, the new blanks are available in both double and single face and in three grades. The "Supersonic" blank is for critical reproduction, the "Ultrasonic" has been designed for general and school use while the "Transonic" is for reference work.

A four-page booklet describing these new recording discs is available on request from *Sonic Recording Products, Inc.*, 50 Mill Road, Freeport, Long Island, New York.

### RADIO CHEMICALS

*Radio Research Products* of Chicago is currently introducing two new radio chemicals to the trade, a cone patch cement and a voice coil solution.

The solution has been tradenamed "Voicoil" and can be used to stop rubbing, hum, and other annoying faults caused by warped, dry, and brittle voice coil cores and cones.

The cone patch cement is a non-warping cement for repairing cracked or torn cones and for cone replacement.

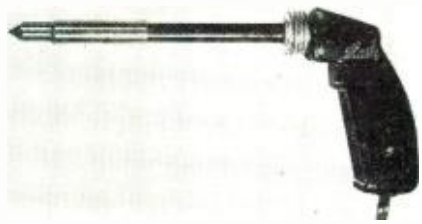
Full details on either or both of these items is available on request to *Radio Research Products*, 6417 Harper Ave., Chicago 37, Illinois.

### SOLDERING IRON

Three new soldering iron models have been introduced by *Phillips Manufacturing Company* of Minneapolis.

The three models, the "200," the "75," and the "300" work off 110 volts a.c. or d.c. and employ Nichrome V heating elements. The units are rated at 60, 75, and 100 watts, respectively.

One unique feature of these soldering irons is a heating element which is located at the end of the barrel with its heat concentrated at the tip. Such an arrangement results in more heat where it is needed and less unnecessary heat dissipation.



Complete information on these new low-priced "Flash" soldering irons is available from *Phillips Manufacturing Company*, 2816 Aldrich Avenue, South. Minneapolis 8, Minnesota.

### CONNECTORS AND ADAPTERS

*Workshop Associates* is currently introducing a complete line of high frequency, silver-plated, solderless coaxial connectors and adapters which have been specifically designed for television applications.

According to the company, the new connector completely eliminates the problems which arise when it is necessary to perform soldering operations out-of-doors or on the roof. The silver-plating provides permanent electrical contact, protected from the weather by a plastic element support head.

*Workshop Associates*, Newton Highlands, Massachusetts has full details which are available on request. —30—

## Signal Tracer

(*Continued from page* 61)

easily available without the necessity for having a cumbersome record player on the bench.

*5. Phonograph pickup tester*

Switch "*A*" is in the No. 2 position, Switch "*C*" in the No. 1 position, the voice coil switch is closed, and the probe is not plugged in.

If the phono pickup terminates in the usual phono plug, this can be plugged into the phono jack on the converted receiver and the pickup tested with the turntable and record. If there is no phono plug, the pickup may be connected with test leads to pin jacks "*X*" and "*Y*" and tested in the same manner.

*6. Test speaker*

If it is suspected that the speaker cone on the receiver being serviced is defective, causing distortion, rattles, noise, etc., this can easily be verified by opening the voice coil switch and connecting the output transformer of the receiver being serviced through test leads to the voice coil pin jacks. One lead from the output transformer to the speaker coil on the receiver under test should be opened. If the trouble clears up when heard through the test speaker on the converted set, then the speaker cone or voice coil on the faulty receiver is bad.

To test for an open voice coil (set dead) simply place the test leads on the output transformer leads of the set under test. If the program is heard, the voice coil is open.

*7. Gain measurements*

Switch "*A*" should be in the No. 2 position, Switch "*C*" in the No. 1 position, the voice coil switch is closed (or open if signal generator squeal is annoying), and the probe should be plugged in.

Connect an a.c. output meter between pin jack "*Y*" (chassis) and the pin jack going to the plate of the output tube (*CAUTION:* If the a.c. meter used is without a built-in blocking condenser, then the connection to the pin jack going to the plate of the output tube should be made through a suitable blocking condenser.)

Connect the modulated output of a signal generator to the input (antenna and ground) of the receiver being tested and tune the receiver so that the modulation note is heard. Place the probe point in the same place that the hot generator lead is connected (antenna) and connect the probe ground lead to the chassis. Regulate the reading of the output meter by adjusting the controls on the signal generator and the volume control on the converted set until some nominal reading, such as .5 volt or 1 volt, is secured. Without touching any controls move the probe point to the output of the section being measured (for instance, the grid of the first tube) and note the new reading on the output meter. The gain is determined by

dividing the second reading by the first reading. This is not the gain in volts, but is the ratio of gain. For instance, if the first reading was 1 volt and the second reading 5 volts, then the section has a gain of 5. This can be repeated for any section or stage by merely adjusting the reading obtained with the probe at the input to the stage or section to some nominal value as before and then dividing the second reading which was obtained by moving the probe to the output of the stage or section by the first reading. The usual precautions in making gain measurements should be observed.

*8. Antenna and ground source*

Inasmuch as the receiver I used required an antenna and ground, I brought the leads out to the terminals on the front of the panel and connected the antenna to the receiver through a switch.

Other uses for this instrument might include a readily-available power supply for the experimenter. This can be secured by bringing the power supply leads out to switches and pin jacks, as well as the filament leads. In this way a source of power is always available without going to the trouble and expense of building a power pack for each piece of apparatus the experimenter is developing.

The speaker testing function could be extended by substituting a universal output transformer, making the speaker match various loads, etc.

Additional uses will, undoubtedly, suggest themselves as the user gains familiarity with the instrument. —30—

## YOUNGEST HAM

**THE ham fraternity has recently been "invaded" by the kindergarten set when ten-year-old Jane Bieberman was granted her FCC license and was assigned the call letter W3OVV.**

**Jane's interest in amateur radio was fostered by her father, Jesse Bieberman, who has been an enthusiast for many years. Mr. Bieberman operates his station under the call W3KT.**

**Jane admits that she did have a "little trouble" with some of the radio circuit diagrams but that the code was easy and the written part not "too hard."**

**W3OVV is being operated from the Bieberman home at 21 Dartmouth Road, Bala-Cynwyd, Pennsylvania.**

—30—

"This telecast was transcribed last night at the Club Morocco!"

## Spot Radio News

(*Continued from page* 18)

said that as long as the number of TV channels is so limited that an insufficient number of stations may be built in many cities, it seems obvious that some compromise well short of complete freedom from interference must be accepted. Whether 150, 175 or 200-mile separation is selected, will depend upon, he continued, the weight given to the desirability of competitive broadcasting and the availability of multiple program services. Analyzing the permanent allocation problem, Lodge said that it is not feasible to appraise a very-high frequency allocation plan from the long-range point of view until it is known whether or not the very-high channels are to remain available to television for an extended period of time. Lodge pointed out that if for any reason no guarantee of permanence can be given then the industry should be so advised since even this will inevitably affect the compromise to be made between the number of stations and freedom from interference. As to the inclusion of the ultra-highs in any plan, Lodge felt that if the ultra-high channels are to be used in conjunction with the present channels, this will obviously have an effect on how the two-to-thirteen channels could best be used to serve the public. Color was also brought into the thinking behind his plan, Lodge indicated, since it may be necessary to first determine whether color television is to be provided for, and if so, on what frequencies.

The use of the ultra-highs also appeared in a plan involving a new type of broadcasting, *polycasting,* proposed by Raymond M. Wilmotte and Paul A. De Mars, Washington consulting engineers, in which a number of low-powered transmitters would be used to service an area. The ghosts which might prevail if such a multiple-transmitter approach were used in the present channels, would be eliminated on the ultra-highs by the use of directional antennas at the receiving point or by separating on the basis of intensity differentiation, if FM modulation were used. According to Wilmotte an area of 10-mile radius could be covered with a 200-watt transmitter using a 200-foot antenna with a gain of about twenty. The proposal revealed that if a 6-megawatt transmitter could probably serve nearly 3000 square miles, then about ten or fifteen low-powered units could do the same job. Comparing the polycast system to the satellite approach, Wilmotte and De Mars stated that their system is directly opposite to the satellite idea, the satellite being located so it offered a minimum of interference, while the polycast station provided an overlap service.

**THE ALLOCATION MEETING** was deemed so important that FCC chair-

man Wayne Coy commented on it extensively during a luncheon address at the annual TBA meeting in the Waldorf-Astoria in New York City. Reviewing some of the solutions offered, Coy declared that the Kell idea which it was believed would roll up the venetian blind effect of interference, might be employed to improve TV by adding more stations at the present rate of 150-mile separation between co-channel stations, or by keeping the present number of stations but improving the picture, or by a combination of both measures. On the other hand, he said, if some method of synchronization is not used, we will have to move the co-channel stations farther apart than 150 miles, or we will have to settle for a much smaller service area for the stations. Coy also indicated that he was very much interested in the polycast method, which incidentally would use FM as the carrier for the picture. His address also revealed that a new committee had been set up to evaluate the results of the allocation meeting, and it was hoped that their findings would be available soon.

Coy also commented on the engineering and philosophical aspects of the allocation problem, declaring it was just as essential to consider the technical problems as the social and economic, and perhaps a compromise might be necessary. He also viewed the ultra-high and very-high aspects as a knotty affair, and one which might require simultaneous solution before a long-term allocations plan could be adopted. It was hoped, said Coy, that the solutions would be available and that the freeze which has been in effect for some time might be lifted in the early Spring months.

**THE TBA MEETING** at the Waldorf was also the scene of many illuminating talks on TV, one of the most interesting of which was delivered by Robert L. Coe, of WPIX, on television station interference problems. Coe reported that the problems of television reception fall into two general categories: The receiver itself, its location, installation, and adjustment, and the design and location of the transmitting station.

Coe then went on to say that there are certain steps that the broadcaster can take to contribute toward the early elimination of most of the reception complaints. One of these was by broadcasting a test pattern or program during the majority of the normal working hours of the average serviceman, so that service people would have an opportunity to properly adjust sets. Station operators should also maintain a close liaison with distributors, retailers, and servicemen, Coe indicated, so that these people who understand the problems of the station and its operation would be able to refute some of the fantastic stories that seem to get started in even the best of circles.

Commenting on the role of the

manufacturer in TV, Coe said: "There has been considerable difference of opinion apparently among manufacturers as to how television receivers should be installed and serviced, and I don't think it is necessary for us to take any sides in this argument. But, we are certainly warranted in continually emphasizing our belief that all manufacturers of television receivers have a very definite responsibility to make certain that their receivers are installed and adjusted so that they will operate as advertised."

Turning to the high-band and low-band problems of transmission and reception, Coe said that there is absolutely nothing inherent in higher band operation which prevents good reception. Operation on the higher bands may require a little more care in the installation of the antenna and a little more careful alignment of the receiver, or perhaps a better receiving antenna installed properly, he said.

Coe also told his audience that RMA is planning a series of short film programs designed to acquaint not only the public, but the serviceman with the facts concerning the proper installation of the receivers and what may be expected from them. He also covered the recent allocation sessions, saying that the need for more power for all stations, at least in the larger communities, will rapidly become apparent.

"I believe that two or three years from now," continued Coe, "many of us will be using 50-kilowatt transmitters instead of the standard 5-kilowatt now available, because as receiver distribution becomes more general, it will be necessary for us to provide good service, even in abnormally poor locations."

Commenting further on power, Coe said that TV station operators should adopt some uniform system of advertising and listing the power of the stations. He declared that the present situation must be extremely confusing to the advertiser, because on one hand . . . "he is told power means nothing; one station talks about 50,000 watts, another refers to its 5000-watt transmitters, and still another refers to the effective radiated power. None of them really represents any adequate measuring stick of the actual coverage of the station."

**THE GREAT SPORTING EVENT OF** '48, the Olympic Games, was the scene of one of the largest broadcasting setups of the year, involving eighty-five lines leading to the BBC house in London, fifty-two transmission circuits to the sites of the games, sixteen lines from the local studios, multiple intercom lines, etc.

In an intriguing report from Geneva, the International Broadcasting Union has disclosed how the BBC operated this giant network from the Wembley Olympic Stadium, where were located listening booths for checking recordings, a record library, a room for correspondents of American and European

stations, and thirty-six studio-type program control desks.

Fifty-two reporting positions were provided in the stadium, with lip microphones and two pairs of headsets at each station. In the studios, of which there were eight, partially sound-proofed, there were ribbon microphones and dual turntables with vernier groove indicators. These studios could be transformed into auxiliary broadcasting sites through the use of lip mikes. Six trucks and twenty fixed positions were used for disc recording work. The fixed points were equipped with reproducing heads for checking records during recording. To enable reporters to listen to their recordings, eleven special playback booths were provided.

The room for the foreign and local correspondents, with provision for 150, was a novel one, with every convenience provided, including ten telephone booths, a special manual telephone board for international traffic, and outlets from the control desks of the stadium so that any broadcast could be audited.

Television, which played quite a role during the games, was covered extensively by BBC, with two mobile units each equipped with three cameras.

**THE FIRST MONTH OF THE** new year was quite an historic one for TV, the New York-to-Pittsburgh-to-Cleveland coax circuit being activated and providing a link to Cleveland, Toledo, Detroit, Chicago, Milwaukee, and St. Louis. January 11, the memorable day when the East-West coax link was opened, was a gala day for the three nets using the service, with headline programs being piped from key cities in the Middle West and East coast. The industry paid justifiable tribute that day to the remarkable ingenuity of the coax engineers who converted what was only a remote idea on the drawing board into a brilliant actuality, demonstrating once again the resourcefulness of the American scientist. This work is continuing to go forward as word comes that even now plans are being made to extend the network to the West Coast and further expand the existing network facilities. . . . . L.W.

## Feedback Amplifier
(*Continued from page 39*)

plifier (Fig. 2) is the use of feedback over both stages, from the plate of the 7C5 to the cathode of the 7B4. This latter tube, a high-mu triode, was chosen to provide sufficient gain to permit a good deal of feedback to be used; a 6SF5 could be substituted with no change of circuit values. $C_2$ is simply a blocking condenser to keep the plate voltage of $V_2$ off the cathode of $V_1$. Its value is not critical but it should be of fairly large capacity. Reducing the capacity of $C_2$ will reduce the amount of low-frequencies fed back to $V_1$ and will result in a bass boost, with a slight increase of distortion. The value given, in combination with $R_4$, gives only a small bass boost which was considered desirable with the speaker and cabinet used. If perfectly flat response is desired, $C_2$ can be increased to .1 μfd. or larger.

The cathode resistor of $V_1$ must, of course, be left unbypassed; this results in some further degeneration, with additional reduction in distortion.

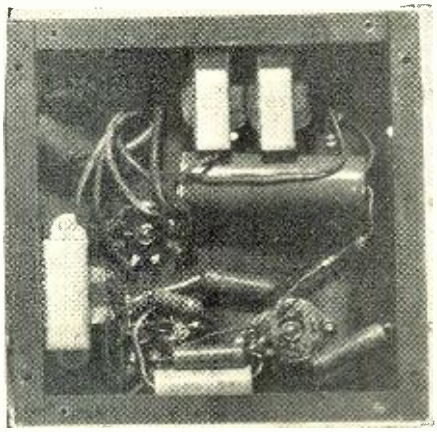
$R_1$ can, of course, be a volume control if desired; in this particular case, it was found preferable to add a volume control to the *Pilotuner,* since the amplifier was to be enclosed in the loudspeaker cabinet.

### Adjusting Over-all Gain

Since the feedback is taken over both stages, the percentage of the output voltage fed back need not be very high to overpower the input signal completely, especially since the first stage will have a gain of nearly 60. For example, since the voltage gain of $V_2$ will be on the order of 12 (150 volts in 5000 ohms = 4½ watts with 12.5 volt input signal peak) the amplifier without feedback will drive to full output with a peak input signal of .2 volts.

There is, however, some loss of gain in $V_1$ due to the unbypassed cathode resistor, and it appeared simpler to determine the value of $R_1$ by cut-and-try methods rather than by calculation. The value given in the table (.27

**Fig. 3. Under-chassis view of amplifier. Note that filter chokes and output transformers were mounted underneath base. The large condenser next to chokes is $C_7$.**



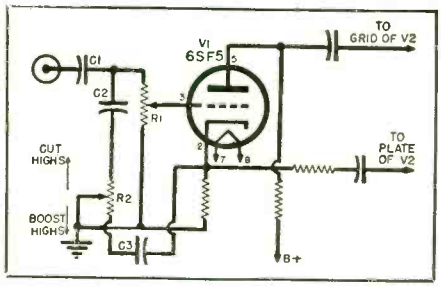



Fig. 4. Tone control circuit for treble control only. "Flat" position is at the approximate center of the control.

megohm) in the model as built leaves sufficient gain for comfortable volume level with either the *Pilotuner* or a *Philco* Microgroove record player, with a 1-megohm volume control turned up about half-way.

Individual adjustment of the value of $R_1$ can be made to suit the particular input to be used, with higher values increasing the gain of the amplifier, and lower values reducing it.

### Tone Controls

No tone control was built into the original amplifier since the quality of the received signal with the *Pilotuner* was deemed satisfactory at normal volume levels.

However, for some purposes, a tone control may be desired for additional adjustment of high-frequency response. A typical interstage tone compensation circuit will not operate with this circuit, as the compensating action of the feedback loop will cancel out most of the effect of a tone filter. However, a condenser across the input circuit will produce a satisfactory reduction of high frequency response.

Where a boost of highs is desired, a simple way of obtaining it is to place a small condenser across the cathode resistor of $V_1$. This condenser will bypass the high-frequencies fed back from $V_2$ directly to ground, thus reducing the amount of feedback at the upper end of the tone scale, and increasing the high-frequency response of the amplifier.

This will, of course, lose the effect of the feedback loop as far as cancellation of distortion of these frequencies is concerned. This is not, however, a serious effect, as the upper frequencies account for only a small part of the power handled by the tubes, and the original distortion of the highs is less than that of middle and low frequencies. In addition, if the starting point of the high boost is chosen fairly well up in the scale, any harmonics generated will be at even higher frequencies, and the third and higher harmonics will be beyond the frequency response range of most speakers.

Both treble cut and treble boost may be combined in a single tone control as shown in Fig. 4. Here the tone control is a 1 megohm potentiometer, and the "normal" position will be found somewhere around the center. Moving the arm down places the condenser $C_3$ across the cathode resistor of $V_1$ and cancels high frequency feed-

back, resulting in a high boost; moving up puts $C_2$ across the volume control, bypassing the high frequencies around it and results in a treble cut.

Suggested values for the tone control circuit are: $C_2$—.001 μfd., $C_3$—.01 μfd., and $R_2$—1 megohm pot.

Radio servicemen should find a ready market for inexpensive custom-built FM radios using this amplifier and any of the small FM adapters at present on the market. In its own right, it is a highly satisfactory small phono-amplifier as well. By comparison with a push-pull 25L6 unit, it has the merit of equally low cost, 3 tubes against 4, simplicity in wiring since no phase inverter is needed, and the resulting amplifier without tone control contains only 7 resistors and 7 condensers. —30—

## Operation TV

(*Continued from page* 41)

show's format was that at no time could the *Leyte* maneuver so that the superstructure of the ship would come between the transmitter aboard the carrier and the top of the Empire State Building where the signal was to be received.

After these preliminaries were taken care of it had to be decided where the cameras should be placed to pick up a maximum of action and yet provide maximum coverage. The show had to be complete even though there was the ever-present problem of a camera failure. The pitch and roll of the ship made it imperative that the cameras be anchored to their positions in some way. At this point Navy ingenuity came through and the carrier crew constructed three excellent platforms to handle the cameras. One was built on the catwalk opposite the island and next to the deckside plane elevator, a second extended from the bridge, while the third was perched at the air defense station, five levels above the flight deck and to the rear of the island.

At this point one of the most interesting problems in TV programming history arose. The Navy pointed out, in no uncertain terms, that all three of these positions might prove extremely dangerous to the cameraman. If a plane went out of control it might well smash into a camera position. Bob Long, who operated the elevator side camera, worked in a life jacket with a safety line tied around his midsection. The line was then secured to the ship. If a plane headed for Bob his only chance of escape would be to dive off the side of the ship (approximately the height of a six-story apartment house). Fortunately, and a great tribute to Navy efficiency, not even a minor mishap took place during the four consecutive days of work aboard the ship.

Long's camera, located about midship and at flight deck level, could be rotated a full 360 degrees and was

capable of covering all of the action from prow to stern. Despite the fact that Long was continually being whiplashed by the air blasts from the whirling propellers, he was able to present a graphic picture of the constant danger crewmen face, even during routine operations, in the deckload of spinning blades.

The second camera, built on a platform near the bridge, was in the hands of Bill Waterbury. He could look down on the planes and was in a particularly advantageous spot to record take-offs as well as televise the skipper, Captain Charles Coes, as he issued the necessary orders to keep the complicated operation under full control. Lee Shaw handled the third camera in air defense aft and covered all of the landing operations. He was able to get many fine shots of the planes being caught as they landed. A fourth camera was located below decks in the "ready room" and was used to "eavesdrop" on the briefing of the pilots before take-off.

The briefing of the *NBC* announcers covering the telecast also required special handling because narrator Rad Hall and announcers Bob Stanton and Ray Forrest had never been aboard a carrier before and the Navy has a distinct aversion to having its "ships" called "boats." Sequences were set up and the important parts of each operation were outlined to insure complete coverage. The briefing paid off richly when the show went on the air. The announcers were able to anticipate the action, a point which proved to be very important during the actual telecast as it turned out cues were impossible to hear when the approximately 100,000 horsepower cut loose on the flight deck.

With the preparations as complete as possible, the *Leyte* was lying off Ambrose Lightship, twenty miles from the Empire State Building on Sunday morning. The microwave antenna was tested and homed to its receiver on the building. After the contact had been completed, the carrier slowly moved out to a point twenty-six miles from the receiver. The carrier started to fade! To avoid overheating the transmitter, the unit was shut down at 2:30 p.m. After being turned on again in preparation for the 4:00 p.m. telecast, it was found that the signal was not clear enough for transmission. Three minutes before air time the signal was still unsatisfactory. Suddenly the condition cleared and word was flashed that the show was on. Trouble started almost at once, two of the cameras above deck went out as the planes were preparing to take-off. Immediate repairs were made, however, and the show proceeded on schedule.

It took five months of preparations, the building of special equipment, and many hours of work, but the success of the show more than repaid its originators.

"Operation TV" was a success!

—30—

## International Short-Wave

(*Continued from page* 112)

cigalpa, apparently uses 5.890/5.895 in mornings and 5.875 in evenings. (Stark, Texas) Signs off 2300. HRA, 5.915, *"Radio Lempira,"* signs off 2325. (Beck, N.Y.)

*Iceland*—Swedes still report TFJ, 12.175, Reykjavik, Sundays *only* 1615-1645. (Swedish DX Broadcast)

*India*—The 0730 news from Madras, 4.920, comes through nicely here in East; following AIR news relay, around 0740 a man continues with Madras news *(English)*.

Boice, Conn., has received airmail letter from Delhi, verifying his report on European experimental broadcasts on 15.16. Letter stated—"As you are perhaps aware, the broadcast which you picked up was part of our experimental service to Western Europe, and as such your comments have had a very special significance for us. We do hope that you will listen in again and favor us with your remarks." Schedule for these experimental transmissions to Western Europe were listed 0230-0245, news and music, on 17.83, 15.16, 21.51, 15.35; 1000-1115, news and music, on 9.670, 15.16, 17.83, 21.51, 15.35; 1400-1500, music, on 9.565, 11.76.

Current AIR schedules, just received airmail from Delhi, effective to March 15, are:

*Delhi*—VUD2, 10 kw., 7.290, 2130-2330; 9.630, 0200-0400 (0200-0430 on days of educational broadcasts); 7.290, 0630-0800; 3.495, 0815-1230. VUD3, 5 kw., 9.670, 2040-2250; 17.760, 0200-0400; 15.290, 0715-0745; 7.270, 0800-0835; 15.290, 0845-1100; 6.110, 1115-1230. VUD4, 10 kw., 11.850, 2040-2250, 0200-0400, 0715-0835, 0845-1230. VUD5, 100 kw., 11.790, 2040-2230; 15.190, 0030-0215; 17.830, 0230-0315; 15.190, 0430-0530, 0600-0630; 9.590, 0830-1100; 11.790, 1130-1230. VUD7, 100 kw., 15.160, 2030-2145, 0030-0215, 0230-0315, 0515-0800, 0830-0900, 1000-1045; 6.190, 1110-1315. VUD8, 7.5 kw., 21.510, 2100-2245, 0430-0530, 0630-0700, 0745-0800; 9.570, 1000-1045, 1110-1315. VUD9, 7.5 kw., 15.350, 2100-2245, 0230-0400, 0500-0700; 11.870, 0800-0900, 1000-1045, 1110-1315. VUD10, 20 kw., 11.830, 2030-2200; 17.830, 0030-0215; 21.510, 0230-0315; 17.830, 0430-0500, 0515-0800; 11.830, 0900-0930; 17.830, 1000-1045; 15.130, 1130-1230. VUD11, 20 kw., 9.630, 2040-2200, 2230-2245; 15.290, 0030-0145, 0530-0630; 9.630, 0715-0745, 0800-1100, 1110-1315.

*Bombay*—VUB2, 10 kw., 7.240, 2100-2300; 9.550, 0130-0400; 7.240, 0500-0845; 4.880, 0900-1230.

*Calcutta*—VUC2, 10 kw., 6.010, 2030-2230; 9.530, 0200-0430; 7.210, 0600-0800; 4.840, 0815-1200.

*Madras*—VUM2, 10 kw., 7.260, 2030-2230; 9.590, 0200-0430, 0530-0630; 4.920, 0700-1200.

*Indonesia*—*"Radio Gelora Pemoeda,"* 11.112, Soerakarta, is believed scheduled 0500-0830. (Fern, Hawaii)

A Batavia publication, *Pedoman*

*Radio Gids,* lists these Indonesian s.w. outlets—Batavia Oosters, 2.240, 4.910, 11.770; Batavia Westers, 2.600, 4.865, 10.365; Batavia Gemengd en Buitenland, 7.270, 15.150, 17.630, 19.345; Bandoeng Oosters, 4.945, 6.170; Bandoeng Westers, 3.040; Sourabaya Ooosters, 4.370, 7.295; Sourabaya Westers, 3.240, 4.840; Semarang, 2.510, 11.030; Pontianak, 8.090; Medan, 7.210; Padang, 3.270; Palembang, 4.855; Makassar, 5.030, 9.550, 11.084; Menado, 9.800; Ambon, 3.380. (Gillett, Australia)

*Iran—Radio Tabriz* is again off frequency, heard on 6.100 although listed 6.090. (Bluman, Nor. Afr., via Nattugglan, Sweden) EPB, 15.100, Teheran, has fair to strong signal with news 1440, signs off 1500. (Beck, N.Y.)

*Iraq*—Baghdad I, 7.092, operates 2300-0030, 0800-1400 in Arabic; Baghdad II, 7.062, operates 1000-1300 in Kurdish, 1300-1400 in *English.* (Short Wave Listener, London, via Fern, Hawaii)

*Italy*—Rome is received with good signals from around 1300 daily on 11.81, 9.630; news 1345 or 1350; is directed to Africa. (Fargo, Ga.)

*Japan*—JKC1, 9.69, JVW, 15.225, heard recently 2300; JVW, 15.225, heard again evenings with strong signal, and JVW3, 15.235, is in parallel. (Balbi, Calif.)

*Korea*—The station on 7.784 in parallel with 4.400 has been a good signal recently here in East early mornings; *no English heard.* Fern, Hawaii, says this is *new* North Korean transmitter at Pyongyang, scheduled 0300-0900, 1600-1730, 2200-2330.

*Lebanon*—Bluman, Nor. Africa, says Radio Beirut, *(announced)* 8 036, and medium-wave 730 kc. are on the air 0000-0130, 0500-0730, 1000-1630 with *English* 1000-1100; French 0045-0100, 0630-0730, and 1400-1515. (Radio Australia) Peddle. Newfoundland, says *Radio Beirut* has improved signal at 1345 to after 1600. Pearce, England, says signature tune for *English* period ending 1100 is "Pack Up Your Troubles."

*Madagascar*—Bromley, Ontario, reports Tananarive's 6.064 outlet heard 0553 with old musical selections, occasional speech (French) by woman announcer, seems to leave air 0600 or 0605. Dilg, Calif., reports the 6.064 and 9.694 outlets are readable 0920-1400, but at the time this was compiled he had not yet heard the 10.614 one. However, Peddle, Newfoundland, hears the 10.614 outlet weak at 1330 to 1400 sign-off. Gillett, Australia, confirms that Tananarive is operating on a *new* frequency of 7.375 in parallel with others.

*Malaya*—Desouza, Singapore, reports Kuala Lumpur has started experimental transmissions 1900-2100 on 6.025, 1013 kc., and 1203 kc.; Sundays continues after 2100 when relays programs from Singapore. (Radio Australia) *Radio Malaya,* 4.780, heard 1000-1100 sign-off, news 1100. Rosenaurer, Calif.) The Blue Network program was heard in England from around 0930 on 4.825 with 4.785

(approx.) in parallel for a time, off at 1105 after news summary; on Sundays runs to only 1035; more recently not heard on 4.785. (Pearce, England)

*Mauritius*—Bluman, Nor. Africa, reports a s.w. outlet on 7.340 operating from this island 1000-1215, using French *only,* but some days does play BBC recordings around 1100; following French news, station signs off 1215 with "God Save the King." (Radio Australia) Is believed to identify as *"Ici le Poste de l'ile Maurice."*

*Mozambique*—Frequencies recently registered by Lourenco Marques include CR7BK, 759 kc., CR7BO, 730 kc.; CR7AA, 6.137; CR7AB, 3.490; CR7BD, 15.240; CR7BE, 9.715; CR7BF, 11.835; CR7BG, 15.285; CR7BH, 11.718; CR7BI, 17.915; CR7BJ, 9.645; CR7BM, 3.440; CR7BP, 6.035; CR7BQ, 21.700; CR7BU, 4.925; CR7BV, 4.835; CR7BW, 2.330; CR7BX, 2.430; CR7BY, 2.490; CR7BZ, 3.320; CR7CA, 3.400; CR7CB, 6.160. (Legge, via NNRC)

CR7BJ is heard with fair to good signal at 1500 sign-off; under *Sharq-al-Adna* in 0000-0100 transmission; frequency appears 9.653. (Beck, N.Y.)

A recent Sunday, CR7BE, 9.707 (approx.), was good level with *English* at 1000-1100; acknowledged reports from listeners, gave QRA as P.O. Box 594, Lourenco Marques.

*English* programs run weekdays 0000-0300, 0700-1100 (Sundays 0200-1100) on 9.705; daily 1100-1600 on 4.932, 3.490. (Swedish DX Broadcast) The 4.825 channel is heard in England 1300. weak, in Portuguese. (Pearce)

*Nicaragua*—YNBH, 6.540, *Radio Panamericana,* has good signal evenings to 2300 sign-off. *Radio Mundial,* Managua, has excellent signal on 6.462 evenings. (Beck, N.Y.)

*Northern Rhodesia*—ZQP, 9.710 or slightly higher, Lusaka, is being heard in California daily 1000-1130 and Sundays 1030-1130. (Rosenauer) I recently heard this station with weak level at 1030-1115 (fade-out) on a Sunday, not readable, except for a few moments at a time.

*Norway*—Worris, N.Y., says Oslo's nightly transmission for overseas listeners. 2000-2100, is now on LKQ, 11.735 (100 kw.), LLG, 9.610, LLI, 6.185 (both 8 kw.).

Oslo now has a *new* broadcast for Europe in Norse and *English*—similar to the one to North America—at 1400-1500 on 15.170, 11.850, 9.610, 7.210 (Tromsoe); 15.170 (100 kw.) signs off 1500 but 11.850 and 9.610 are heard until sign-off at 1700 (Home Service). (Beck, N.Y.) The 15.17 outlet has been heard in New York with *English* at 1000. (Schild) *"Hier Oslo"* is heard in England on 11.850 mornings and afternoons on 6.185; heard on 19.220 which seems harmonic of 9.610; 9.540 listed frequency appears actually 9.55; also heard on LLR, 7.240, Fredrikstad, scheduled 0530-0740, 1100-1700 (Sundays 0000-1700); LLQ, 21.730, is listed 10 kw., daily 0800-0830 in parallel LLG, 9.610. LLN, 17.825. (Pearce)

*Pakistan*—Swedes report *Radio Pakistan* as evidently operating on two

frequencies—heard in Sweden on 6.062 with news in *English* 2130, and audible there on 6.210 around 1030. (Swedish DX Broadcast) This Karachi station is heard in Hawaii on 6.225 with fair signals to 1116 sign-off; *English* 1010-1020; announces as either *"Azad Kashmir Radio" ("Free Kashmir Radio")* or *"Radio Pakistan,"* but two announcements are seldom used together; programs 1009-1043, 1100-1116 are announced as *"Azad Kashmir Radio,"* at 1045-1059 as *"Radio Pakistan";* closes with slogan *"Azad Kashmir Zindabad!"* (Fern, Hawaii) The slogan translates *"Victory to Free Kashmir!"*

*Palestine*—Bluman, Nor. Africa, has logged *Radio Negev* on approximately 6.700 (44.8 meters); scheduled 0500-0530, 1230-1300, news at start of each transmission. (Radio Australia)

*Panama*—HP5A, 11.700, Panama-Colon, heard 0530, news in Spanish 0545; HP5H, 6.122, Panama, "The Voice of the Crossroads," heard with what it called test transmission consisting of request tunes for "stateside listeners," 2300-0000. (McPheeters, La.)

*Philippines*—Rex Gillett, Australia, reports—"A Filipino which had me tricked for a few weeks is the 12th harmonic of the BCB station WVTM; the frequency of 15.600 is almost continuously covered by code, but after listening diligently for several 'nights,' I found it was *'WVTM, serving the Forces on Luzon, 1300 on your dial';* WVTM leaves the air 1000 with 'Star-Spangled Banner.' "

*Poland*—A second report by an Eastern DX-er to *Radio Polskie* on its 9.530 frequency heard several months ago, resulted in card verification; accompanying letter stated tests on 9.530 had been run by the technical department and that at the time, the Foreign Liaison Section had no knowledge the tests were being carried out!

*Portugal*—Peddle, Newfoundland, reports Emissora Nacional, Lisbon, 6.350, 1830-1900 sign-off; CS2MA, 6.374, 1900-2030 sign-off; CS2ME, 9.730, 1900-2030 sign-off; CS2MK, 11.027, 1500-1700; CS2MQ, 15.100, 1500-1700, 0700-0715 (fade-out).

*Portuguese Guinea*—Bissau's CQM-4, 7.943, is being heard in Ohio with good to fair signal to closing 1800 with "A Portugesa;" sometimes has bad CWQRM. (Driver)

*Portuguese India*—Bluman, Nor. Africa, reports a station operating from this country on 7.230 daily to 1000 when signs off with Portuguese National Anthem, "A Portugesa;" Monday through Saturday, programs are Indian type but Sunday uses Portuguese. Location is Goa, and call *may* be GOA. (Hutchins, Radio Australia)

*Roumania*—Peddle, Newfoundland, hears Bucharest, 9.250, with *English* 1500-1530. The 6.200 outlet is in parallel. (Pearce, England)

*Siam—Radio Bangkok,* 6.010, is heard 0845-1000 sign-off, irregularly as late as 1030, fine signal on West Coast,

NBC-like chimes, all-native programs. (Balbi, Calif.) When I heard what I believe was this station at 0615 with *English* news some time ago, the woman announcer in signing off at 0630 said what sounded like "Voice of Thailand." *Can anyone confirm this announcement?* It is likely that the 6.010 channel is an alternate for regular 5.595V; former alternate was 6.125. Dilg, Calif., reports that one day the 6.010 station appeared to sign off 0955 but "after some tinkling bells, continued at dictation speed until 1040."

*South Africa*—Cape Town, 9.607, has been heard in New York with strong signal to as late as 1000, BBC news 0800. (Schilf) Johannesburg, 4.895, is heard in England around 1300-1330. (Pearce)

*Spain*—Madrid's 9.369 channel is quite strong in East at 1500; current schedule is 1300 French; 1330 German; 1345 Italian; 1400 Portuguese; 1420 Russian; 1500 English; 1530 Arabic; 1545 Spanish; 1615 Arabic, to 1630 sign-off; and to Spanish-America, 1845-2200, in Spanish. (Worris, N.Y.)

FET, Alicante, listed 7.944V, is often off frequency; noted recently 1700 on 7.915, with CQM-4, Bissau, Portuguese Guinea, on 7.940, and HLKA, Korea, on 7.93. (Pearce, England)

*Sweden*—A *Radiotjanst* official wrote Worris, N.Y., "We hope that audibility will improve considerably as soon as the two short-wave stations of 100 kw. each can begin their transmission, approximately 1950."

The Home Service in Swedish is heard signing on weekdays 0015 on SBO, 6.065, and SBU, 9.535. (Beck.)

*Syria—New* schedules for Damascus, 6.000, 7.500, 12.000, are listed 0000-0100, 0630-0730, 1100-1545; power 500 watts and language Arabic. (Swedish DX Broadcast)

*Tahiti*—A station heard Tuesdays and Fridays 2300-2350 sign-off, announcing in French, is believed to be FO8AA, Papeete. (Rosenauer, Calif.)

*Trinidad—Radio Trinidad,* 9.625, has an exceptionally fine signal 0600 when relaying BBC news. (Driver, Ohio)

*Turkey*—On a recent Mailbag Program from Ankara (Sundays 2130 on TAP, 9.465), it was stated that when the new 100 kw. short-wave station open soon, the Mailbag Program may be lengthened. TAP, 9.465, is heard in New York by Beck to 1715 sign-off after program in Turkish.

*USSR*—Balbi, Calif., reports "USSR outlets are all over the bands 2100-2215, such as 15.23, 11.72, 11.88, 9.60, 7.29, 7.38, 6.290, with 15.23 best on West Coast." This beam is in English to North America. Dilg, Calif., lists Kiev on 6.020 from about 0850 to 1300, best around 0900 on West Coast.

Komsomolsk, 9.564, and 9.724 (location of this one unknown), are heard 1558-1725 with Soviet Far Eastern Service in Japanese, Korean, and Mandarin Chinese. Moscow's service to India is heard on 9.690 at 0600-0800, *English* 0630-0700 (except Sundays). (Fern, Hawaii) I hear this one here in West Virginia.

Moscow's 15.230 and others in parallel evenings give the next day's North American schedules at 2215. (Hankins, Pa.)

Soviets begin Home Service on 6.020 in Russian 2245; other Moscow stations in parallel are 9.660, 6.050, 11.960, 15.390, 15.360, 15.320; Leningrad runs the European Service with news in German 0200 and in *English* 0230, very good signal on 11.630. Home Service in Russian ends 2100 on 7.200, 7.270; 6.140 is heard after 2300; 15.270 and 11.710 sign on 2330, 15.250 on at 2345, all in Home Service; the transmission to North America at 2100-2215 is good on 7.300, 11.720, with other transmitters inaudible in New York. (Beck, N.Y.)

*United States*—The National Bureau of Standards, Washington, D.C., says of W8XAL, the unmodulated carrier operated by *Crosley Broadcasting Corporation,* Cincinnati, Ohio, for the Bureau:

"It is not possible to select another frequency for our experimentations. If there were any clear channels available, a change of frequency would be highly undesirable from our point of view. Field intensity records of W8XAL (6.080) have been made continuously by this Laboratory from June 1937 to the present. In order to study ionospheric absorption, data must be taken in all seasons and during all phases of the sunspot cycle. A change of frequency would decrease the usefulness of the data in such studies. During World War II, W8XAL was one of the stations used to determine a daily character figure of ionospheric absorption for the information of the armed services.

"W8XAL is at present our best indicator of sudden ionospheric disturbances (SID). These data are published regularly in the CRPL-F series. At the request of the armed services, a warning service on the likelihood of occurrence of SID was inaugurated in the summer of 1947. Continuous data on W8XAL were used in setting up the prediction methods for this service . . . Thus, you may see, operation of W8XAL has contributed and is contributing much vital information on radio propagation phenomena. I believe that this information is doing sufficient good to outweigh the inconveniences occasioned those who desire to listen to foreign broadcasts on nearby frequencies."

*Vatican*—HVJ now broadcasts on 9.640 at 1415-1515 (to 1530 on Thursday, Sunday); moved from 11.680; fair signal in New York. (Beck)

*Venezuela*—The 15.180 Caracas signal seems to be a harmonic of 5.060; another harmonic is believed to be just below Haiti's 10.135 outlet. (Stark, Texas)

* * *

**Last Minute Tips**

So ships bringing immigrants to Australia may have a wider coverage of news—particularly between Colombo and Fremantle—it has been decided to alter the aerial bearing of the

VLG11 transmitter during Transmission 8 from *Radio Australia;* the transmitter layout for this beam 2330-0045 EST is VLA5, 15.32, VLC9, 17.84, to North America; VLG11, 15.20, to ships at sea, and VLB5, 21.54, to Africa.

The East Coast "evening" beam from *Radio Australia* is now on 11.900 but continues to use call-sign VLA8 (formerly 11.76 for this transmission); is 100 kw. and is good level but has bad CWQRM. Time is 1643-1815, news 1645, 1745.

Watch for minor changes to *Radio Australia* schedules shortly after February 1. Long-range predictions indicate that minor alterations will be necessary around that time, station officials say.

Stark, Texas, reports a station on about 5.943 at 1745 with what appears to be a Scandinavian language; last few minutes is singing; fades in around 1710; not heard Sundays. This may be Godthaab, Greenland, scheduled around 1630-1745 or later.

Bluman, Nor. Africa, informs *Radio Australia* he has heard *Radio Monte Carlo,* Monaco, testing 0900-1000 on 9.460; this may be the *new* transmitter long projected.

The owner of HHYN, Port-au-Prince, Haiti, informs that the station has *new* call of 4VM. (Kary, Pa.)

Czechoslovakian DX-ers report an interesting clandestine station operating in the 47-m. band calling itself *"The Voice of Free Slovakia,"* location unknown; announcements are in Slovak *only,* and station announces it is operating in the 19-, 25-, 31-, 47-, and 51-m. bands. (Swedish DX Broadcast)

Latest "clue" on the projected Fernando Po, *"Radio Atlantic"* station(s) comes from *Short Wave News,* London, which reports that *"Radio Atlantic"* has been heard on approximately 14.400 at 1658 giving news in German, by woman, followed by announcements by man and woman in French, closed down with organ solo 1703; signals 4-8 with deep QSB to R3; woman gave address (when requesting reports on reception) as "British Port Office, Tangier," but due to rapid QSB the full QRA was not readable. A British listener heard this one in August, but not since. *Does anyone have further details?*

Palestine and Cyprus have reverted to Standard Time (GMT plus 2 hours). With this change, *Kol-Yisrael,* Tel Aviv, 6.817, has adjusted schedule to 0000-0100, 0500-0530, 1015-1530; Saturdays the last transmission runs 1015-1600, final half-hour being dance music. The low-powered s.w. outlets in Palestine are gradually being replaced by medium-wave outlets. Thus, 6.950 has been replaced by 751 kc. for relay of *Kol-Yisrael;* Jerusalem, 8.100, has been replaced by 574 kc.; Haifa, 6.500, has been replaced by 789 kc. Jerusalem and Haifa take only the news relays from *Kol-Yisrael* now. *Radio Galilee,* 6.920, and *Radio Negev,* 6.700 (approx.), were still on s.w. when this was compiled but it is presumed these will shortly be replaced by me-

dium-wave channels. (Bluman, Nor. Afri., via Radio Australia) *Kol-Yisrael* now has *English* news 1500; announces frequency of 6.8 (43.9 m.) and medium-wave 651.6 kc. (460.3 m.). (Pearce, England)

ZQP, Lusaka, Northern Rhodesia, has adjusted frequency from 9.710 to 9.715, presumably to avoid interference from CR7BE, 9.705, Lourenco Marques, Mozambique; ZQP operates now 1000-1302; newscast at start and end; usually is off the air by 1305. (Bluman, Nor. Afr., via Radio Australia)

New BBC frequencies and calls used for *"Voice of America"* relays are GWE, 7.200, 1300-1400, 1400-1415, 1430-1500. 1530-1730; GWY, 9.700, 1145-1230, 1300-1415, 1530-1630; GWU, 15.210, 1145-1230, 1430-1500. (Cushen, N.Z.)

*Radio France,* 6.190, Hanoi, Fr. Indo-China, has Chinese to 0700, then news in French; Chinese news 0620-0630; uses "Merry Widow Waltz" as signature tune; good strength in New Zealand. (Cushen) Also heard early mornings in Eastern U.S. and on West Coast even later.

A Swedish DX broadcast lists *Viet Nam,* 11.974, Fr. Indo-China, at 1630-1800. (McPheeters, La.)

Bangkok, Siam, has been heard on about 6.010 to 0630 sign-off, announcing *"You are listening to the Overseas Station of Siam operating on 49 meters;"* signal weak in California; commentary 0545-0550, news 0615-0625; returned to the air 0730 with native program, seems best 0800-0900. (Rosenauer)

In an airmail report, Dorothy Sanderson, Australia, lists XORA, 11.868, Shanghai, 0500 with *English* news and commentary, fair signal but some QRM; XPTA, 11.65, 0515, Chinese news; XLRA, 11.50, 0530, Chinese news, then Western music; XMMR, 7.097, 0600 with Chinese news and Western music; XNCR, 9.39, 0600, Chinese news and music; XAET, 12.700 0630, Chinese news and music; XMTA. 12.217, 0600, Western music and Chinese news; XGOE, 9.868, 0430, Chinese news, music; ZBW-3, 9.525, Hong Kong. 0445 with news in Chinese; XKPB, 12.12, 0645 with Western music; Rangoon, 6.035, 0700 with news in Burmese but announcement in *English;* H8SPD, 6.000, Bangkok, 0615 with *English* news; KZPI, 9.50, 0445, *English* news; KZMB, 6.005, 0545 with sponsored program of music, news; KZBU, 6.10, 0545, musical program and news; KZOK, 9.69, 0500 with musical program and news; KZFM, 11.84, 0445; *Radio Sario,* 9.84, at 0700, bad QRM, weak.

The *new* station on 9.525 was heard at 1700 announcing *"La Voz del Tropicos,"* Ciudad Trujillo, Dominican Republic. (Stark, Texas)

Canada has changed from its 19-m. outlet to CKLO, 9.63, for the *English* period 2145-2215. (Hiatt, Ohio)

Late tips from Balbi, Calif., include CKOB, 6.09. Canada, is in use Sundays *only* to Alaska with CKLO, 9.63, 2300-2350; CBFX, 9.61, Montreal, has re-

placed 9.63 at 2030-0000 sign-off; XMAG, 4.275, Nanking, is heard occasionally now at 0900 with news; HER6, 11.865, Berne, is heard between the hours of 1430-1530.

XGT3-XGT5 has been heard testing around 0422 on a frequency around 7.4. (Gaynor, Calif.)

A recent morning at 0410 on 6.065 an Argentinian station was heard, announcing LR1, *Radio El Mundo,* Buenos Aires; however, only LRS1, *Radio Splendid,* is listed there, and since these are two competitive networks it is rather doubtful that *Radio Splendid* would be relaying *Radio El Mundo;* had fair signal in Pennsylvania, some QRM from U. S. outlet 6.060. (Kary, Pa.)

Hans Leven, Sao Paulo, Brazil, has just airmailed us these items concernings some South American stations: "Each of the three s.w. outlets here in Sao Paulo has an output of 25 kw. They are ZYB-7, 6.095, ZYB-8, 11.765, and ZYB-9, 15.155. They belong to 'Emissoras Associadas,' which owns several medium-wave and s.w. stations all over Brazil along with the 'Diarios Associados' (associated newspapers), publishers of a great number of daily, weekly, and monthly papers. Two more medium-wave stations also belong to 'Emissoras Associadas' of Sao Paulo—PRF-3 on 960 kc., power 5 kw., *Radio Difusora Sao Paulo* (which is likewise the official name of the 3 s.w. outlets), and PRG-2 on 1040 kc., power 25 kw., *Radio Tupi de Sao Paulo.* ZYB-7 transmits daily from 0900 to about 2200 in parallel with PRF-3; ZYB-8, weekdays from 0500-0600, and daily from 0900-2200 in parallel with PRG-2. ZYB-9 is the newest of the three. The station has very modern equipment, by *RCA,* and experimental transmissions are made in parallel with PRG-2 and ZYB-8, mostly during the evening period (1600-2200). I've heard it also at other times, irregularly (around 0600, Sundays at 0900, and so on). ZYB-7 and ZYB-8 were built during the war by a Brazilian technical organization, and has a north-south directional antenna. Programs of both stations include music (mostly popular), radio theater, studio programs in the evening period (location of the studios is at what they call 'Radio City,' while the five transmitters are located some miles from Sao Paulo), many commercial announcements, few news broadcasts and talks. Only Portuguese is used. Another s.w. outlet that is showing great activity these days is Ceara Radio Club at Fortaleza, Ceara, ZYN-6 and ZYN-7 being the *new* calls assigned to the old PRE-9, which remains only for the medium-wave outlet on 1200 kc. ZYN-6 transmits on 6.105 with 5 kw., Monday-Friday at 0900-1200, 1600-2000; Saturdays 0900-2000; Sundays 0700-2030; signals here in the South are QSA-3 to 4 during the evening broadcast. ZYN-7 would be of greater interest to you because it transmits on 15.165 Monday-Friday at 1400-1600 an *'International Program'* designed for overseas listen-

ers, consisting of music and announcements in Portuguese, *English*, Spanish, French. They ask for reports to Ceara Radio Club, P.O. Box 222, Fortaleza, Ceara, Brazil.

*Radio Journal de Comercio* is now transmitting 1400-2100 on 9.565 instead of 11.825, with much improved signal here; on 11.825 they were badly QRM'd by CXA-18, Montevideo, Uruguay (11.835), and the BBC beamed to Brazil (11.820). Later in the evening they are completely free of interference in 31-m. band. On 6.085 they are not heard so well because of interference from ZYB-7 on 6.095, some Argentine stations, and others.

"LRX-1, *Radio El Mundo*, Buenos Aires, is scheduled now daily 0900-1200, 1600-2200; LRU (25 kw.) continues with powerful signals here, while LRX, 9.660, is quite inaudible until late evening. LRX-1, 6.120, is heard all evening with increasing strength (incidentally, this outlet is listed to have power of only 1 kw.); uses Spanish only; another Argentine station with fine signals in Brazil is *Radio Belgrano* (medium-wave outlet is LR-3 on 950 kc.), on s.w. in parallel being LRY, 9.545 and 9.455, and LRY-1, 6.090; I believe former is actually on 9.545 at 0500-1705 and on 9.455 at 1705-1700 (daily); Sunday sign-off may be a little later."

* * *


**Acknowledgement**

Thanks for the FB cooperation. Keep it up, fellows!.....K.R.B.


## RPEES BOOTHS ASSIGNED

**MORE than one hundred persons representing companies which plan to exhibit at the 1949 Radio Parts Show gathered recently at the Waldorf-Astoria in New York for the drawing for preferred display space at the Show.**

**Operadio Manufacturing Co. of St. Charles, Illinois, won first choice and selected Booth 87. James Millen Mfg. Co. of Malden, Mass., selected Booth 140. V-M Corporation of Benton Harbor, Michigan, won a third choice of Booth 42. All 160 available booths were assigned by lot.**

**By coincidence, Burgess Battery Co. of Freeport, Illinois, which won the first choice for the 1948 show, wound up with last choice at this year's drawing.**

**At the Board meeting held before the drawings, the Show Corporation directors voted to return to Chicago for the 1950 Show, to be held the week of May 21st at the Stevens Hotel. Earlier action by the directors had indicated the 1950 show might be held in New York.**

**Kester Solder Co. of Chicago won first choice of display room space, allotted for the first time at the 1949 Show on the fifth and sixth floors of the Stevens. Walter L. Schott Co. of Beverly Hills, California, won the second spot in the drawing. Wilcox-Gay, of Charlotte, Michigan; Electro-Voice, Inc. of Buchanan, Michigan; and Stromberg-Carlson of Rochester, New York, were other organizations who drew first choice rooms.**

—30—

## Television Receivers


(*Continued from page* 68)


quency amplifiers include *Fada, Crosley, Admiral, DeWald, Air King, Emerson, Andrea, Garod, Industrial Television,* and the older *United States Television* models.

In *General Electric* television receivers, we find several variations from the preceding circuits. In the early sets of Model 801 and in the more recent Model 803, the video system contains a single video-frequency amplifier with direct coupling between the video detector and the cathode-ray tube. See Fig. 5. Because there are no coupling condensers to remove the d.c. component of the video signal, no special d.c. restorer tube is required. Another special feature of this system is the application of the video signal to the cathode of the image tube rather than the control grid. There is, of course, no reason why either element cannot be used, but it must be remembered that the signal phase is positive when applied to the grid and negative when fed to the cathode. This has been mentioned before. In later models of the 801, and in the 802, 803 and 901 and 910 *G.E.* television receivers, a coupling condenser is inserted between the video amplifier and the cathode-ray tube with the addition of a d.c. restorer tube. *Rembrandt, Farnsworth, DuMont,* and *Stromberg-Carlson* also employ a single stage of video-frequency amplification.

The two-stage video-frequency amplifier system of *Belmont* Models 22A21-22AX21 and 22AX22 is shown in Fig. 6. The first video amplifier uses a 6AU6 which is biased only by the negative video detector currents flowing through the contrast control. Note that this contrast control is employed here in exactly the same manner as the volume control in a sound receiver. It has no control over the gain of the video i.f. amplifiers, as is true in many of the other television receivers. The latter is controlled by an a.g.c. voltage developed by a special diode connected to the video second detector.

The 6AU6 supplies signals to both the sync amplifier and the video output tube. The video detector voltage biases the 6AU6 at the proper contrast level so as to clip off noise peaks appearing in the sync pulses. The 6K6 output tube uses grid-leak bias in order to re-establish the d.c. level of the video signal lost while passing through $C_1$. This method of bias, together with d.c. coupling to the grid of the cathode-ray tube, provides the proper d.c. restoration. The usual peaking coils and low-frequency coupling networks are found in this circuit.

The *Tele-King* receiver, Model 2315, uses the two-stage video amplifier circuit shown in Fig. 7. High-frequency peaking is still accomplished through a combination of series and shunt peaking, but the series peaking coil,

$L_1$, is inserted after the load resistor circuit rather than before, as in previous diagrams. The video output tube, a 6AG7, receives a combination of cathode and grid-leak bias, the latter serving to reintroduce the missing d.c. component removed by the coupling condenser, $C_1$. This d.c. component, once reinserted, remains with the signal because the d.c. path between the plate of the 6AG7 and the grid of the 15AP4 is continuous. The output arrangement is a little unusual in that it presents a d.c. path through the 750,000-ohm resistor from $L_2$ to $L_1$ and yet, because of this high resistance, very little of the a.c. component of the video signal passes through here. Instead, the latter component appears across the contrast control and is tapped off by the center arm and fed through $L_1$ to the grid of the cathode-ray tube. Thus, this circuit neatly separates the d.c. and a.c. components of the video signal at point $A$ and then recombines them again at $L_1$. In this way we can utilize whatever portion of the a.c. component we desire without, at the same time, causing the removal of the necessary d.c. component.

A two-stage video amplifier system designed around a 6SN7 is shown in Fig. 8. The signal is fed into one triode, amplified and then transferred to the second triode where it is amplified again before application to the control grid of the cathode-ray tube. In arrangements of this type, a low-valued plate resistor is used for the first triode and peaking coils placed in the output circuit of the second triode since these connecting leads (between the output of the final video frequency amplifier and the cathode-ray tube) are longer and consequently possess more shunting capacity. The more recent *United States Television* sets and the smaller *RCA* models use this form of video amplification.

There is one additional video-frequency amplifier system of interest and this is the one employed in *Philco* television receivers. See Fig. 9. In the plate lead of the first video amplifier (6AG5), there is a 4.5 mc. parallel resonant circuit. Its purpose is to remove whatever 4.5 mc. voltage may develop in the video second detector. This will occur if an appreciable amount of audio i.f. voltage is permitted to reach the video second detector. Since every detector is essentially a converter, the audio and video i.f. signal voltages will mix here, producing a difference frequency voltage of 4.5 mc. (This, it will be remembered, is the frequency difference between the video and audio carriers in all television signals.) The 4.5 mc. voltage, reaching the cathode-ray tube, will produce narrow lines across the screen, running upward at an angle from left to right. By placing the 4.5 mc. trap in the circuit, we effectively remove whatever 4.5 mc. voltage there may be at this point.

The contrast control in the *Philco* circuit is a cathode bias resistor in the 7C5 video output circuit. The ampli-

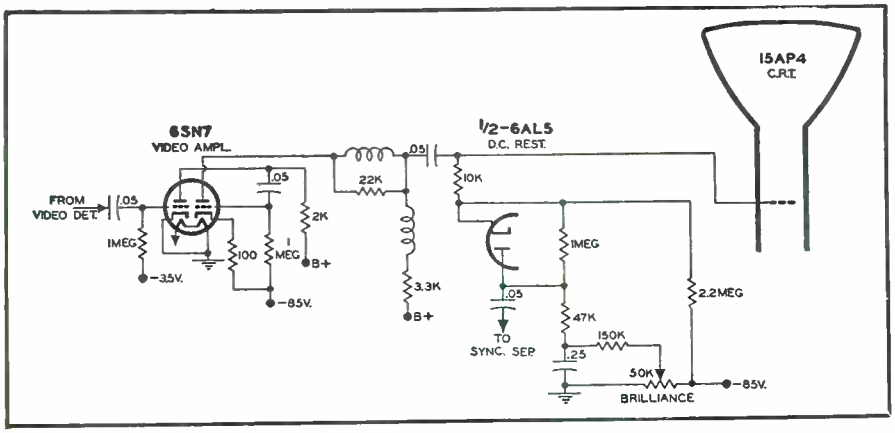



Fig. 8. A two-stage video amplifier designed around a 6SN7 tube.

fication afforded by the video i.f. stages is under the control of an a.g.c. system which was previously described.

We have to this point in our series considered two servicing packages of the seven originally postulated for television receivers.* The first servicing package consisted of the r.f. section of the receiver plus those i.f. amplifiers which dealt with both types of signals. It was noted then that any failure in this section would make itself evident by affecting both outputs. The serviceman, noting this, would immediately confine his attention to this section of the circuit. The second servicing package consisted of the audio i.f., audio detector, and audio amplifiers. Any difficulty arising here affected only the audio output and a comparison of the audio output with the video output immediately served to acquaint the serviceman with its location.

We come now to the third servicing package and this consists of the video i.f. amplifiers, the video detector, and the video-frequency amplifiers. (By video i.f. amplifiers, we refer only to those i.f. stages which handle the video signal exclusively. Composite i.f. stages, which handle both audio and video voltages, are consigned to service package No. 1.) Failure in the video system will cause the image to disappear from the screen, but it will not affect the audio system and consequently sound output should be normal. Also, in spite of the failure, a scanning raster will be visible on the screen because the synchronizing circuits are self-oscillating. It is useful to remember that the appearance of a raster (but no image), accompanied by normal sound output from the loudspeaker reveals the following about the set.

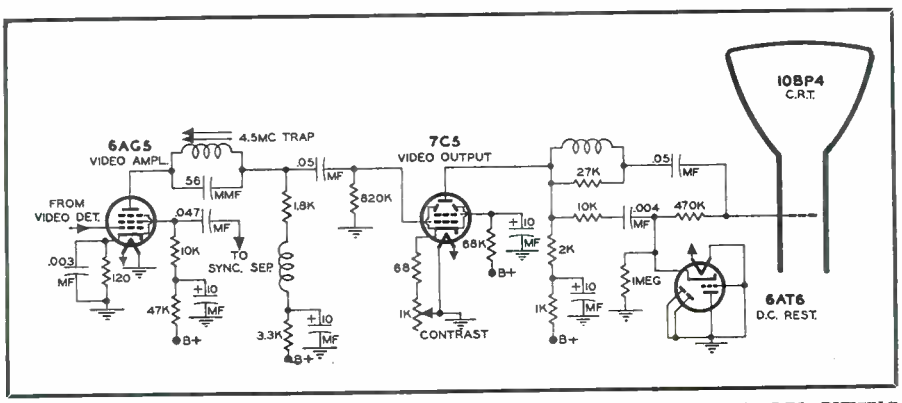
1. The r.f. stages (r.f. amplifier, mixer, and oscillator) are functioning properly.
2. All composite i.f. stages are OK.
3. The complete sound system is operating normally.
4. The vertical and horizontal sync systems are operating.
5. The low and high-voltage power supplies are OK.

This leaves, then, only the video i.f. system, the video second detector, and the video amplifiers as possible sources of trouble. On the other hand, if the lack of image is accompanied by no sound (even though the set is tuned to a station known to be operating), then the r.f. stages should be inspected first.

Misalignment of any of the trap circuits in the video i.f. stages will manifest itself by the appearance of interference patterns on the face of the screen. Sound voltages reaching the cathode-ray tube appear as black and white horizontal bars, varying in width and intensity with the audio modulation. Interference from adjacent channels does not produce any definite pattern but generally manifests itself by one or two of the following:

*Television receiver servicing can be considerably simplified if the receiver is broken down into definite servicing divisions. By noting the appearance of the image and the output of the loudspeaker it is readily possible to localize the defect in one of these sections.

Fig. 9. The video frequency system employed extensively by Philco.



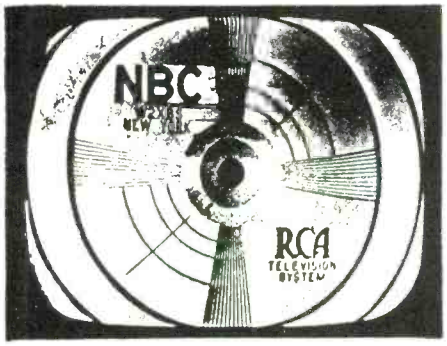



Fig. 10. Smearing in an image due to poor low-frequency and phase response.

1. Unstable horizontal and vertical synchronization.

2. Black and white ripples across the screen (if the interference is due to the audio carrier of the adjacent channel).

3. The appearance of two images, (if the interference is due to the video carrier of the adjacent channel).

If the misalignment of the trap circuits is suspected, it can be verified by switching the receiver to another local channel. Since it is highly improbable that adjacent channel interference exists in this channel, too, the appearance of a stable picture will immediately indicate that this is the source of the trouble.

Microphonic tubes in the video system produce a "bouncy" picture. The picture "bounces" whenever the set is jarred. The trouble may be so acute that even traffic passing by the house will disrupt the image. To locate the defective tube, replace the tubes in the set with ones known to be good. The best way to test a tube for microphonics is to place it in a set which is operating normally. If slight jarring of the set—by tapping the chassis or the tubes—does not affect the image, then the tube is non-microphonic. Microphonic tubes will not be revealed by the ordinary tube tester.

When no image is visible on the screen and the sound output tells us that the trouble must lie in the video system, then the first servicing step is to test all the tubes in this system. This can be done by replacing each tube with one known to be good without removing the chassis from the cabinet. Checking all the tubes will take about 10 minutes. If this does not clear up the trouble, indicating that the tubes are not at fault, then the chassis will have to be removed from the cabinet and the following tests undertaken.

Apply a 400-cycle audio signal, obtained from an audio signal generator, across the load resistor of the video second detector. Alternate black and white bars will appear across the screen if the video amplifiers are working. If the screen remains blank (i.e., it shows only the scanning raster), move the audio generator toward the cathode-ray tube, one stage at a time, until the defective amplifier is found. Voltage and resistance checks will

then quickly reveal the defective component.

If the test signal can pass through the video detector and video-frequency amplifiers, the next test is made on the video i.f. amplifiers. For this we need an AM signal generator having a frequency range that includes the video i.f. frequencies. Set the generator to any frequency within the video i.f. range (except the trap frequencies), turn the modulation on and apply the modulated signal to the control grid of the first video i.f. tube. If the circuit is functioning, black and white horizontal bars will appear across the face of the screen. If there is no indication on the screen, start at the final video i.f. amplifier and move the generator back stage-by-stage until the point of failure is located.

Unless a video frequency amplifier becomes completely inoperative, in which case no image at all is obtained on the screen, indications of other defects will be evident only by their effect on the image. With regard to a video-frequency amplifier tube and its circuit, the following defects may occur:

1. A defective low-frequency compensating network.
2. A defective high-frequency compensating network.
3. Improper voltages at the tube electrodes.
4. An inoperative tube or a defective component.

When the low-frequency compensation network is defective, the background shading of the image becomes darker and the larger objects in the image "smear." See Fig. 10. Check bypass condensers, load, dropping and cathode resistors. Condensers are very vulnerable and they usually become open. The fastest method of checking open condensers is by shunting them with another condenser, of equal value, known to be good.

Smearing can also occur when the improper bias voltage is used. Hence measure the grid voltage of each video amplifier tube. Low plate and screen voltages produce smearing because the tube, under these conditions, is readily overloaded. Smearing due to this latter defect can be recognized by rotating the contrast control counterclockwise, which will reduce or eliminate the extent of the smearing.

A more difficult defect to detect is the loss of fine detail due to poor high-frequency response of the video stages. High-frequency compensation is achieved chiefly by series and shunt peaking coils in the video amplifiers. If the coils open up and the "B +" voltage must pass through them to reach the plate of the tube, the stage will become inoperative. However, with open series coils, $L_1$ and $L_3$ of Fig. 3, an alternate path exists through the shunting resistors. In these instances, the intensity of the image will decrease, in addition to the loss of fine detail. This loss is best seen when a station test pattern is being received. (See page 38 of last month's issue for a discussion of television test patterns.)

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*(To be continued)*

## IMPROVED VOLUME INDICATOR for TAPE RECORDER

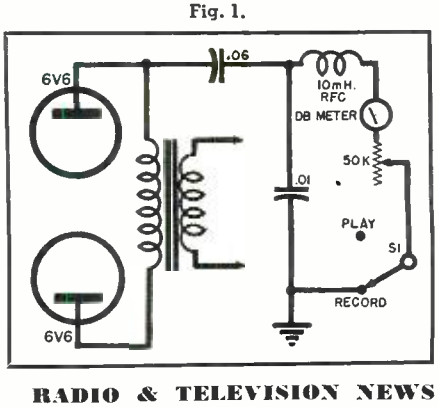
By LLOYD B. HUST

**SINCE publication of the article, "Build Your Own Magnetic Tape Recorder," by Lloyd Hust, in the February, 1948, issue of RADIO & TELEVISION NEWS, the author has received many requests for an improved type volume indicator circuit to be used in the construction of the above tape recorder. The new indicator uses a surplus —10 to +5 decibel meter. Meters of this type are listed frequently in advertisements in RADIO & TELEVISION NEWS. They are also listed in the catalog of Herbach & Rademan, 522 Market St., Philadelphia. The Catalog number is MM132 and the price is $2.95. Suitable also in this application are the meters listed in this same catalog as MM136 and MM137. The price on these is $3.95.**

**The circuit itself is relatively simple and is shown in Fig. 1. The 10-millihenry r.f. choke is necessary in order to keep any of the supersonic bias from entering the meter and indicating a false reading. The 50,000-ohm variable resistor is necessary to adjust the maximum swing of the meter needle to indicate the proper volume level for the type of tape being used. The switch $S_1$ is one section of the Play-Record switch, or it may be a separate single-circuit switch. The switch is necessary because the change of load in the output circuit, when playing back, will cause too much current to flow through the meter.**

**This volume indicator works much better than the one originally specified for the recorder. Much more accurate results will be obtained when using it. Once the 50,000-ohm variable resistor is set, it need not be changed unless a different type of tape, one using a different recording level, is used.** —30—

**Fig. 1.**



## 10-Meter Converter

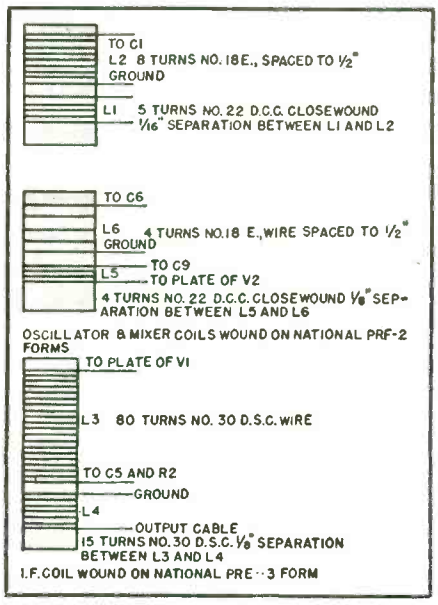
(*Continued from page 45*)

The oscillator and mixer tuning condensers are not ganged. From this one might be led to expect that the old bugaboo of pulling the oscillator circuit when the mixer is tuned through resonance might pop up. When the converter was first completed there was a very slight "pulling" at the high frequency end. A small shield, 1½ inches square slipped under the mixer coil, completely eliminated every trace of "pulling" while leaving adequate oscillator injection.

### Construction

The converter is housed in a 4"x5"x 6" metal utility box. In the bottom view of the unit, from top to bottom, can be seen the oscillator tuning condenser and its ceramic trimmer, the oscillator coil, oscillator tube socket, and the VR150 socket. Partially hidden under the toggle switch is the mixer tuning condenser and mica trimmer, mixer coil with shield in place, mixer tube socket, and the i.f. output coil. This coil is not mounted on the back partition but on a small "L" bracket and fastened to the top of the chassis. In this way all metal work and practically all of the wiring can be done on the top chassis panel as a unit before it is fastened to the case. Before the tuning condensers are mounted to the front partition, two-inch pieces of #14 tinned wire should be soldered to the rotors of each unit. In the oscillator condenser, this lead goes directly to pin #8 of the oscillator tube. The ground end of the oscillator coil is soldered midway between. In the mixer condenser, this lead goes to a soldering lug under the front bolt of the mixer tube socket. The ground end of the mixer coil also goes to this lug. Pin #4 on the VR150 socket is used as a tie-point for the "B plus" lead of the

Coil winding data for 10-meter converter.



oscillator coil and $R_3$ and $C_9$. The antenna leads from the mixer coil go to a *National* FWG assembly on the back partition. The oscillator and mixer coils are spaced 2½ inches apart center-to-center. The placement of the rest of the parts is apparent from the photograph. A "handy" dial pointer can be made from an L-shaped piece of #14 tinned wire. It is held in place by the left hand top panel screw.

### Tuning Up

Any small power supply capable of supplying 200 to 300 volts at from 20 to 40 ma. and 6.3 volts at .6 ampere may be used. The converter draws approximately 10 ma. A 10,000-15,000 ohm, 2 w. resistor, depending on the power supply voltage, should be connected in series with the "B plus" lead of the converter. A two-foot length of RG-50-U coaxial cable is used to connect the converter to the receiver. The receiver used as the i.f. channel should now be tuned to 1600 kc. Next the converter oscillator trimmer should be tuned to the center of the band on the dial. This may be done by using a signal generator or an amateur signal of known frequency. With the mixer condenser at half-scale, the mixer trimmer should now be peaked on a weak signal.

For test purposes three different receivers were used in conjunction with this converter; a 5-tube a.c.-d.c. set of 1938 vintage, a BC-348-Q, and a SX-43. The SX-43 is in itself a pretty fair performer on 10 meters but with the converter a gain of from 3 to 4 "S" units was readily apparent. Images were eliminated with the converter in the circuit. New Zealand, Africa, Australia, Japan, England, and Scotland were logged on all three receivers. Requests for verification were sent out to the stations in the aforementioned countries and should be received in the near future.

The antenna used was a simple folded doublet 15 feet above the ground.

While this converter isn't offered as proof of the existence of any "superior" piece of equipment, it does go to show what can be accomplished with good quality parts, short leads, and a little "common sense engineering." —30—


"Oops! Wrong kit . . . I do a little plumbing on the side, you know!"

# Technical BOOKS

**"RADIO FUNDAMENTALS"** by Arthur L. Albert. Published by *McGraw-Hill Book Company, Inc.,* New York. 583 pages. Price $4.50.

Those who have studied and profited by the author's book "Electrical Fundamentals of Communication" will find the same clear presentation of subject matter in this text as characterized his previous book.

As the title implies, this is a basic text on radio written for beginning students, radio technicians, and radio amateurs. As far as possible the author has avoided the use of involved mathematical operations and has substituted diagrams and complete explanations instead.

The text covers such subjects as fundamentals of acoustics; electrical fundamentals; series and parallel resonant circuits; power transfer and impedance matching; transmission lines, cables, and networks; vacuum tubes; rectifiers; voltage amplifiers; power amplifiers; oscillators; modulation and demodulation; radio transmitters; antennas and radio transmission; and radio receivers.

The serious student will find this book entirely suitable for self instruction in radio or it can be equally well adapted to regular classroom instruction.

* * *

**"SERVICING THE MODERN CAR RADIO"** by A. L. Hurlbut. Published by *Murray Hill Books, Inc.,* New York. 688 pages. Price $7.50.

That there has long been a need for a text dealing exclusively with the subject of auto radios goes without saying, but that it should have taken so long for such a book to appear is a modern mystery.

Since practically every car that rolls off the production lines is equipped with a receiver, it is obvious that the demand for good servicemen to handle this work will grow by leaps and bounds.

Auto radio servicing is a specialized field and while the well-trained home receiver technician does have the advantage over his less experienced brethren the fact remains that the problems encountered in auto radio servicing are unique and as such require special handling.

The book is divided into two main parts. Part one covers such general and diversified subjects as entering the car radio field, the principal differences between mobile and home radios, automobile antennas, antenna input circuits, typical circuit features, setting up the car radio service station, vibrator maintenance, etc.

Part two covers circuit and alignment data on car radios manufactured by fifteen different companies. While all makes and models of car radios are not covered the author has made his

selection in order to provide the serviceman with the widest possible diversity of receiver types. From these typical circuits, the skilled technician should be able to secure enough "know-how" to handle similar circuits as he encounters them.

This book is written clearly and in easy-to-understand language. Instructions are detailed and complete. Technicians in the auto radio service business will undoubtedly find themselves relying more and more on this text.

* * *

**"POST WAR AUDIO AMPLIFIERS AND ASSOCIATED EQUIPMENT"** by The Sams Staff. Published by *Howard W. Sams & Co., Inc.*, Indianapolis. Price $3.95.

With more and more servicemen taking advantage of the financial boon custom installation work offers, this book provides timely assistance in the selection and installation of audio amplifiers, FM and AM tuners, and recorders.

Sixty-seven audio amplifiers are described along with complete specifications and data which the custom-builder will require not only to install the unit but to select the proper piece of equipment to be installed. Eleven tuners are included along with two recorders.

Circuit diagrams and complete parts lists are given for each unit. Top chassis and under chassis views show the location of all important components. Where applicable, dial stringing instructions are provided.

For the man who services high grade sound equipment as well as the technician who caters to those requiring custom installation work, this book is a necessary adjunct to his servicing library.

* * *

**"RADIO SERVICING: THEORY AND PRACTICE"** by Abraham Marcus. Published by *Prentice-Hall, Inc.*, New York. 752 pages. Price $5.95.

This is a practical handbook for the radio serviceman, the maintenance man, and the intermediate student. Written in easy-to-understand language, the text has been presented with a minimum of mathematics.

The book is divided into sixteen chapters covering such subjects as electrical and radio theory, components and parts, the electron tube, the electron tube as a rectifier, the electron tube as a detector, the electron tube as an amplifier, practical amplifiers, the electron tube as an oscillator, special tubes used in radio, control circuits, radio receivers, power supplies, instruments used for servicing, servicing procedures, servicing techniques, and repair, placement and readjustment.

In addition to providing a fairly comprehensive discussion of each of these points, servicing notes are appended to each chapter to assist the serviceman in tracking down suspected circuit faults.

Servicemen should find many occasions to refer to this text in the course of their daily work. —30—

## Mac's Service Shop

(*Continued from page 54*)

pens inside the condenser, but the effect is a loud scratching sound that may or may not be accompanied by a noticeable increase in hum. Usually, if you bridge the defective condenser with a good one, the surge that takes place will cause the noise to stop abruptly; and ordinarily the noise will not start immediately when the good condenser is removed. Sometimes it will not commence again for several days. Often this noise will be radiated and can be picked up by other sets in the same room, which will fool you if you leave the defective set on while you try another set to see if it is noisy, too.

"If you suspect this condition, turn the set off and clip a good condenser across the suspected unit; then, after the set is playing, gently remove the good condenser and see if the noise begins. In this way, you will not 'cover up' the condition you are trying to locate—as you are almost certain to do if you employ the usual method of bridging filter condensers while the set is playing.

"Another very common noisy condition with a.c.-d.c. sets is caused by noisy rectifier tubes such as the 35Z5's, 35Z3's, and 35Y4's. Something happens inside these tubes so that an annoying scratching sound is heard every time they are jarred ever so slightly. This sound is not present when the volume is turned off or when the r.f. and i.f. tubes are disabled; so it must be picked up by the antenna. In fact, I have noticed that the noise is much worse in sets in which the loop antenna is near the rectifier tube. Just the vibration caused by the sound from the speaker will make the rectifier give forth with this annoying sound. The cure, of course, is a new tube."

By this time Mac had the phone jack installed, and he began to replace the recorder in its cabinet.

"An intermittent hum," he went on, "naturally causes you to suspect the filter condensers first, and that is right; but the filter condensers are not always at fault. Cathodes that develop partial or complete shorts to the filaments as the tubes reach a certain critical temperature are fairly common, especially in the a.c.-d.c. sets. A grid that is left floating by a defective coil or resistor will introduce a hum that can be spotted by observing that as the hand is brought near the floating grid the hum will increase greatly. A hard-to-locate hum will occasionally show up in a.c.-d.c. sets that do not *normally* connect one side of the line to the chassis if the line becomes shorted to the chassis, say through poor insulation in a dial-lamp socket."

Mac paused briefly to try out a pair of phones in the new jack. Then he continued:

"Finally we come to those sets that start playing quite well at first but

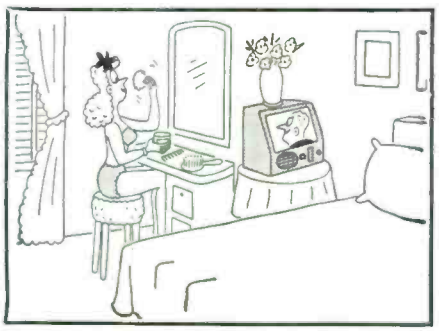
gradually develop a progressively worse distortion. The first thing to suspect is a leaky coupling condenser that is lowering the bias on an audio tube. The leakage of a condenser is often dependent on its temperature, and that is why it may take some time for the distortion to show up. Measuring the grid bias with a v.t.v.m. is the quickest way to check on a leaky coupling condenser. There are times, though, when you can cut the coupling condenser entirely loose from the grid and the grid will still read positive. What is more, no positive voltage will be found at the cold end of the coupling condenser. In that case, you have a tube that is suffering from 'secondary emission.' Such a tube will gradually draw more and more plate current and will cause more and more distortion. If the grid resistor of such a tube is discovered to be at its rated value, the only thing to do is to replace the tube. A too-high grid resistor will aggravate or even cause this condition."

Mac paused, and Barney broke in hopefully:

"Is that all there is to know about intermittents?"

"Not by a long shot!" Mac said. "We have just hit the high spots of what *I* know on the subject, and I am still learning something new about intermittents nearly every day."

Barney heaved a big sigh as he put away his notebook and slid from the bench. "The nice thing about you, Mr. McGregor, is that you make radio servicing sound so-o-o-o easy!" he said bitterly. —30—



## KEEP PARTS TOGETHER

A PACKAGE of paper lunch bags is easily carried in the service kit and will save time in the long run.

Instead of leaving knobs and chassis screws lying in the chassis and hoping they will be there when needed, such parts may be placed in a paper bag and tucked away in the cabinet or given to the customer for safe keeping . H.L.

## TV Pitfalls

(*Continued from page 59*)

of medium sized spade or ring lugs. These not only make for good contact, quickly and easily attached, but also help take the strain off the wire at the joint, as the ribbon (if such is the lead-in used) can be trimmed down on both wires of the lead-in and the first set of tips of the lug folded down over it.

Another item not getting the attention it deserves is the manner in which the lead-in is brought down from the aerial and into the receiver. First off, there should be no strain on the joint at the elements. Some slack must be left in the lead-in from the joint to the first point at which the lead-in is secured. This means, too, that the first security point must not be too far away from the joint. Even several yards of lead-in flapping in the wind can cause unnecessary movement of the picture.

In most installations taping the lead-in to the mast several feet down from the elements would probably do no harm. But I have seen enough cases where tape on the lead-in and the close proximity of the lead-in to the mast raises such hob with reception as to make this practice highly undesirable. The most satisfactory procedure is to drill and tap the mast at the desired point and use an eyelet insulator, now made especially for ribbon lead-in. When the lead-in is inserted into the slit of the rubber insert of such an insulator and the eyelet pinched, the rubber grips the lead-in firmly and holds it securely against even severe strains.

Such eyelet insulators should be used liberally along the run of the lead-in. Simply dropping the lead-in to the window or other point of entrance into the house is the worst kind of practice. I have seen runs of even six stories from roof to apartment with not one point of security for the lead-in except perhaps where it leaves the roof and enters a window And again, pinching each eyelet after inserting the lead-in secures the ribbon and keeps it from slipping out of the rubber insert. Such an eyelet insulator is shown in Fig. 5.

Another common oversight on the part of many technicians is proper protection of the lead-in wherever it might rub against an edge, such as the point where it drops over the roof or travels around a corner. The best procedure in such cases would be eyelet insulators on each side of the edge and as close to it as possible, with the ribbon between each stand-off left slack so that it need not rub against the edge. If such is not feasible, one or two layers of friction tape where the ribbon rubs should not be harmful in most cases.

We have come to regard somewhat mechanically the maxim that the lead-in be as short as possible. Often the

shortest run is not the best run. Objects the lead-in meets on its way to the receiver can be sources of trouble. Metal objects such as fancy iron work on roof, sheeting, large pipes up the side of a house, all can be causes of ghosts, other video and even sound disturbances (see Fig. 4). Before securing the lead-in its position with respect to quality of reception should be checked. Even a slightly weaker signal due to a longer run of lead-in, if it is ghost-free, is preferable to a stronger one beset by ghosts.

Each one of these details, in itself, can make the difference between good and poor reception, between a jerry-built installation which has to be redone within six months and one that will stand up under all weather conditions and for many years. There are no "minor" details in television installation. —30—

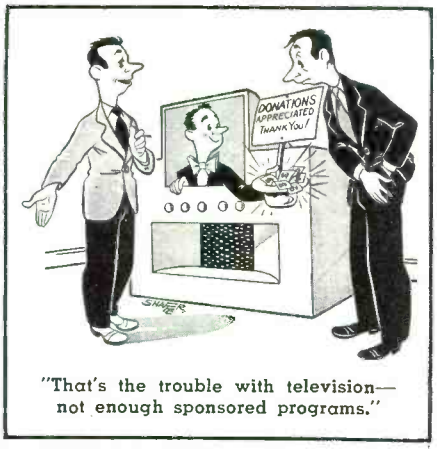
## Home Recorders

(*Continued from page* 49)

mulated notes on maintenance and improvement of these recorders, especially so to the engineering department of WKRC, where reconstruction work was carried out on almost every existing type of magnetic tape, magnetic wire, and disc recorders, including the *Brush* "Magnetone," *Brush* BK-401 and BK-403, *General Electric*, *Webster-Chicago* Model 80, *RCA* MI-12875, and *Presto* K-8.

Many special applications of the "Soundmirror" and other recorders will suggest themselves to the serviceman. For instance, an automatic *Telechron* timer can be added and preset to start and stop the recorder, thus cutting any desired portions of radio programs fed from a regular receiver for playback at any time.

The above notes should suggest extra means of contacting old customers for "extra" service as well as adding "new" business. There are quite a few home recorders already in the field; more are coming on the market daily. Most of these recorders, particularly the earlier models, can be greatly improved without much expense. The discriminating customer will appreciate these refinements and is willing to *pay* for them. —30—




"That's the trouble with television—not enough sponsored programs."

# Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

### STANCOR TV COMPONENTS

*Standard Transformer Corporation* has just issued a four-page bulletin covering its line of television components for replacement applications.

Included in the new line, and discussed in the bulletin, are vertical output transformers, vertical blocking oscillator transformers, horizontal blocking oscillator transformers, filter chokes, plate and filament transformers, deflection yokes, and focus coils.

Part numbers, prices, and other pertinent data is included for each of these items.

For a copy of the publication "Television Components," write *Standard Transformer Corporation,* Elston, Kedzie, and Addison, Chicago 18, Illinois.

### EQUIPMENT CATALOGUE

*Test Equipment Sales Co., Inc.* of Philadelphia is currently distributing copies of its Bulletin 2610 covering linear amplifiers, cathode-ray oscilloscopes, test equipment, meters, dynamic measuring equipment, and linear variable transformers and accelerometers.

Photographs and complete technical data are supplied on each of these products. *Waterman, RCA, Simpson, Philco, Trimount,* and *Schaevitz* items are included in the listings.

For a copy of this 12-page catalogue, make your request direct to *Test Equipment Sales Company., Inc.,* 216 North Twelfth Street, Philadelphia 7, Pennsylvania.

### CONVERSION DATA

The Office of Education, Federal Security Agency, Washington, D. C. now has available mimeographed copies of a bibliography of articles concerning conversion of war surplus equipment for civilian and school use.

Prepared by Willis C. Brown, Assistant Specialist for Aviation, this 4-page listing should prove to be a valuable source of conversion data for servicemen, amateurs, hobbyists, and experimenters.

The mimeographed list is available free of charge and may be secured by writing to Office of Education, Federal Security Agency, Washington 25, D. C. Ask for the "Bibliography of Articles Concerning Conversion of War Surplus Equipment for Civilian and School Use."

### "SILICONE NOTEBOOK"

*Dow Corning Corporation* has just announced the availability of its new "Silicone Notebook, Fluid Series No. 3."

Included in this comprehensive publication is information on the properties and behavior of the DC 200 Silicone fluids. These semi-inorganic fluids are characterized by their heat stability, shear resistance, relatively constant viscosity over a wide temperature range, lubricity, water repellency, and good dielectric properties.

This 30-page booklet carries data on chemical structure, applications, general properties, viscosity-temperature relation, shear stability, oxidation resistance, heat and flame resistance, water repellency, dielectric properties, chemical behavior, solubility, lubricity, surface tension, specific heat, thermal conductivity, effect of temperature on volume, compressibility, light transmission, sound transmission and physiological characteristics of DC 200 fluids.

For copies of this publication write direct to *Dow Corning Corporation,* Midland, Michigan.

### WAVEGUIDE ASSEMBLIES

A comprehensive catalogue listing all types of waveguide assemblies and component parts has been issued by *Carl W. Schutter* of Rockville Centre, New York.

The catalogue is divided into twenty sections and covers various sized waveguides and flanges, choke and plain flanges for waveguide coupling, coaxial connectors and adapters, and other related items.

The items listed in the catalogue are standard units, many of which are available from stock in limited quantities. Custom work is also handled by the company.

For further information on this new catalogue, write to *Carl W. Schutter,* Rockville Centre, New York.

### DATA SHEET

Details on two pieces of service test equipment are given in a data sheet recently released by *General Electronic Distributing Co.* of New York.

A full description is provided on the company's Model 88-A combination signal generator and signal tracer including specifications and performance data. The unit is illustrated.

Also included are details on the company's Model 777 tube and set tester which is a new item with *General Electronic.* Complete specifications on this unit are also given.

For a copy of this data sheet, write to *General Electronic Distributing Co.,* 98 Park Place, New York 7, New York.

### RMA STANDARDS

A further extension of the task of modernizing engineering standards for the radio manufacturing industry is evidenced in the series of 13 new and

revised recommended standards just released by the Engineering Department of the Radio Manufacturers Association.

While most of the recently issued standards apply to radio and television components, rather than to complete equipment, two of them have to do with television and result from the rapid expansion of the television industry.

One of these recommended standards covers completely the requirements for television relay facilities, while the other brings up-to-date the designation system for cathode-ray tubes.

A listing of the new standards is available from Radio Manufacturers Association, 1317 F. Street, N.W., Washington 4, D.C.

### "SOLDERING TIPS"

Of interest to servicemen and others who perform soldering operations is the new 20-page booklet "Soldering Tips" recently released by *Weller Manufacturing Co.* of Easton, Pa.

Designed to instruct beginners and refresh the memories of professionals, the new booklet reduces the soldering operation to easy steps.

A copy of "Soldering Tips" is available for 10 cents in coin from *Weller Manufacturing Co.*, Packer Street, Easton, Pa.

### SPEECH CLIPPER

*Electro-Voice, Inc.* has just issued its Bulletin No. 145 covering the company's Model 1000 speech clipper.

The bulletin tells why and how the speech clipper contributes to articulation, and holds modulation at 100 percent in amateur radio and emergency communications services.

The data sheet further explains the action of the clipper and how it increases the ratio of consonant-to-vowel intensity so that the transmitted voice becomes clearer and more intelligible.

A copy of Bulletin 145 can be obtained by writing to *Electro-Voice, Inc.*, Buchanan, Michigan. —30—

Casimir F. Woods, left, receives the September Hytron award from Herbert H. Friedman (right) the Hytron representative as Stanley Dudek of Variety Electric Company watches the proceedings. Mr. Woods is attending a technical school at the present in order to prepare himself for the television business he plans to open shortly.

## Custom Installations
(*Continued from page* 58)

string quartette or a piano in the next room for ideal listening conditions. So, it winds up as a compromise. In any event, it must be remembered that in order properly to reproduce frequencies out to 8000 cycles per second, it is probably necessary to have inherent characteristics in the system capable of going out to 15,000, even though the speaker location is such as to absorb the higher frequencies before they are heard. This decision is a matter of judgment in a particular installation.

There are several interesting methods of placing two or more speaker enclosures so as to create virtual sources of sound that appear to spread over a large area. These arrangements will vary considerably for different room dimensions and depend on angular arrangements for reflecting the energy from the walls. A new loudspeaker system is under development that takes advantage of these effects to achieve depth and perspective in the reproduction pattern.

Where a closet is available, an excellent speaker installation may be made either in the door, behind the door or in the wall, if the rear of the closet faces the proper room. If the speaker is installed on the door itself, there is always the danger of leakage around the edge of the door which may greatly reduce good low frequency response. In some cases, it may be possible to use only the lower portion of the closet and, if it is not sufficiently large, to provide a large vent through the floor into the basement. This allows the space above to be used efficiently for record storage. If the installation is made in the rear of a hall closet that fortunately is directly behind the listening space, it may still be practical to use the closet for a cloakroom. The loudspeaker should be protected in the back by a suitable skeleton wood structure covered with light-weight cloth. Basement stairways sometimes pass behind the desired wall, in which case the speakers may be mounted in the wall with little difficulty. Whenever the speaker is installed in a manner that includes a cavity behind it that is enclosed and may be subject to resonance within the audio range, it is imperative that the space be thoroughly damped with acoustical material on the walls. These should consist of heavy pads preferably covering the entire surface. They may be too thin, but there is no danger of making them too thick. Two inches is usually very satisfactory.

Now, having the speaker location determined, it is necessary actually to install it and then, if you do the job right, run some curves on the over-all result. One of the reasons for tone controls on an amplifier is to permit compensation for room and speaker enclosure characteristics. While a fre-

quency record may be satisfactory for making rapid listening checks, particularly after you have become familiar with the record, it is not satisfactory for tuning the port of a speaker enclosure or for similar purposes. The principal reason for this is that at 50 c. p. s. there will almost certainly be considerable harmonic content on the record. Often the harmonics will be stronger than the fundamental, and you wind up making adjustments for optimum reproduction at 150 c. p. s. instead of 50. So, you connect an oscillator and start listening. First of all, you establish a high level of loudness and slowly sweep through the frequency range listening for rattles. After eliminating any rattles that appear (including decorative dishes on the nearby shelves), you set the tone controls for flat electrical response, reduce the volume to a tolerable point, and then very, very slowly slide through the response range from 50 to 10,000 cycles or higher. There will always be peaks and valleys. It is of the utmost importance to attempt to eliminate any serious peaks, particularly those resulting from resonance in the speaker enclosure. Perhaps you thought two-inch pads were unnecessarily heavy, so now you put in the other inch of padding.

In most installations it is worthwhile to allow for a bass reflex port, but also allow for sliding boards to vary its size. Tune the oscillator to 50 cycles and, if necessary, boost the bass until you can hear it and set the size of the port for maximum loudness. Now try closing the port completely. Having made this adjustment for most desirable conditions at 50 c. p. s., run through the first few hundred cycles again and make sure you haven't introduced any serious resonance at a higher frequency. This is not a rigorous procedure, and while it might be desirable actually to make sound pressure measurements with a microphone and suitable indicating equipment, the listening method is reasonably satisfactory and perhaps in some ways superior. The next procedure is to adjust the tone controls, not for electrical flat response, but for reasonable flat acoustical response in the room. In most installations, it will be necessary to make some compensation at the low end, usually in a boosting direction. Rarely will it be desirable or necessary to boost highs unless the speaker is inherently deficient, and if this is so, there is considerable danger of distortion from excessive high frequency boosting (which automatically means boosting the harmonic distortion components). The tone controls may then be set so that the straight up position corresponds to the flat acoustical response of the system. It should be explained to the customer that this is for his convenience in having a constant reference and that it does not necessarily correspond to the center of mechanical rotation. It is important that the wire used for connecting the output of the amplifier to the

speakers be large in diameter so as to avoid losses, lowered efficiency and possible effect upon the low frequency response.

In some cases it will be necessary to place the record changer (or manual turntable) at a considerable distance from the amplifiers. When this is done, it is important to use low-capacity cable. In many cases it will be desirable to use two-wire cable or two shielded wires with the shields connected only at the amplifier end so that hum picked up in the shield will not appear in series with the pickup across the input of the amplifier. Even six feet of high capacity shielded cable may be sufficient to introduce a serious peak in the high frequency range, increasing noise and distortion intolerably, when using magnetic pickups.

Installation of the turntable or record changer is mostly a matter of convenience. However, it is well worthwhile to take the time and trouble to make sure that the turntable is level. If a record changer is used, the relationship of the arm to the turntable is fixed except for adjustment of the cartridge. In many changers the cartridge must be adjusted with thin washers or shims under one of the mounting screws in order to avoid an undesirable tilt of the stylus with respect to the record surface. Failure to do this will cause increased record and stylus wear and will also introduce distortion. In certain changers it is necessary to counter-balance the tone arm in order to reduce pressure when using magnetic pickups with built-in styli. This may often be accomplished quite easily by inserting a small roll of solder in the end of the arm behind the bearing and fastening it in with whatever method is convenient. It is easy to adjust such a weight accurately and, in general, this should be done by deliberately over-shooting so that the changer mechanism does not operate properly, then backing off as far as necessary to insure proper operation of the changer trip mechanisms. If a manual turntable is used (and this may be increasingly the case, at least as accessory equipment since the advent of the long-playing Microgroove records), then it is important to establish rigidly the relationship between tone arm and turntable, the best method being to use a heavy aluminum plate for mounting both. Once in a while a customer will say that he doesn't mind using a manual turntable. When this is the case, never try to talk him out of it. You will always be able to give him better reproduction with a really good manual turntable than with the finest record changer available. It is also likely that you will be able to sell him a changer later for playing background music, but have the advantage of his owning the manual turntable for serious listening. This will be more practical now that the long-playing records are becoming available.

Installation of the amplifier and tuner is again a matter of convenience

to a large degree. If possible, it should be arranged so that the controls are easily available from a comfortable chair. Book shelves are often not deep enough for usual chassis mounting, but sometimes it is practical to make such an installation with the controls in the shelf and the chassis supported with the tubes projecting into the shelf. There are only two critical considerations—temperature and the angle at which the rectifier is rotated. The latter point is easily adjusted, if necessary, and consultation of the tube manual will indicate whether the tube may be mounted in any position satisfactorily. It is really important to provide adequate ventilation. This is true not only because of shortened tube life if the ambient temperature rise is too great, but also because the control panel and knobs will become uncomfortably hot. It is not always necessary to have the entire back open. Chimney effects are often the most satisfactory method of ventilation. This may be accomplished by providing a few large openings near the bottom of the enclosure and a row of one-inch holes all along the top. It is important that the top holes be higher than the tubes so that an air pocket of high temperature will not be formed.

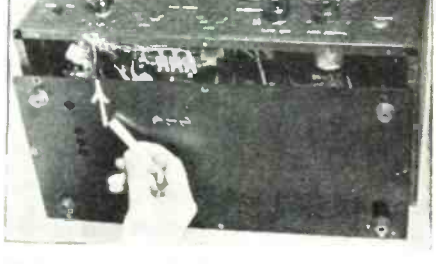
The most important consideration is to see to it that every installation is really good and is kept in good working order, and that every customer is reasonably well briefed in the proper operation of the equipment. One or two really well done installations in any community will inevitably lead to more sales, and the business will develop like a chain letter. Try to learn to explain technical problems in layman's language. This will not only help you to sell equipment, but will also strengthen your own understanding of the problems because you will be forced to think about them clearly and in simple terms. Don't over-charge your customer, but be *sure* you make a profit.

-30-

## MARK CHASSIS PLATE

**BOTTOM chassis plates on communications types of receivers have openings for adjusting condenser trimmer and other adjustments.**

**If arrows are marked with chalk on the bottom plate and the panel edge at time of plate removal, the replacement will be made easily and in the proper manner. . . . . H.L.**



## Within the Industry

(*Continued from page 28*)

associated with *Solar Manufacturing Company*, as works manager of *Andrea's* Long Island City plant.

* * *

**FRANK M. FOLSOM** was named president of *Radio Corporation of America* by action of that company's board of directors.

Mr. Folsom succeeds David Sarnoff who has been serving in the dual role of president and chairman of the board. Mr. Sarnoff will continue as chairman of the board, and chief executive of the company.

Mr. Folsom, as executive vice-president in charge of the *RCA Victor Division*, has administered the production and merchandising activities of *RCA* for the past five years.

At the same meeting, John G. Wilson, vice-president and general manager in Camden, was elected executive vice-president in charge of the *RCA Victor Division*, succeeding to the post vacated by Mr. Folsom.

* * *

**DALCO APPLIANCE CO.** of San Francisco has been named distributor for the *United States Television Mfg. Corp.* in that area.

The company, which maintains offices at 685 Seventh Street, handles the full line of *UST* video receivers in addition to acting as distributor for many other nationally-known lines.

The *UST* line ranges from a direct view 10" table model to a deluxe projection model with automatic record changer, AM, FM, and short-wave radio.

* * *

**LES A. MORROW**, well-known figure in the radio industry, has been appointed sales representative for *Newcomb Audio Products Co.* of Hollywood, California.

Mr. Morrow will represent the company in Ohio, Kentucky, Western Pennsylvania and West Virginia. He received his electronic training at Fern College in Cleveland and has since been associated with various phases of the industry.

He is a member of "Radio's Old Timers," an organization whose membership is limited to men who have been in the radio field at least twenty years.

* * *

**INTERNATIONAL TELEVISION CORPORATION** has announced the formation of a wholly-owned subsidiary, *Television Equipment Corporation* of New York.

John B. Milliken, president of the parent company, has also been named president of the new corporation.

The new organization will engage in development and manufacture in the fields of television pickup and transmission and military electronics. The company will market a low cost television camera for industrial and studio use. It has set up development laboratories and production facilities at 238 William Street, New York.

* * *

**DR. COURTNAY PITT** has been elected to the newly-created post of vice-president of finance of *Philco Corporation*. In this capacity he will serve as the chief financial officer of the company.

Dr. Pitt joined *Philco* in 1941 where he served in positions of increasing responsibility, and in January, 1947, was appointed economist in charge of the Division of Economic Research.

* * *

**HECTOR A. CASTELLUCCI** has been named general sales manager of the *Wagner Recorder Manufacturing Corporation* of New York.

He is well-known throughout the radio industry in which he has been active for twenty years. In accepting this new appointment, Mr. Castellucci left the post of director of advertising and sales promotion for *Farnsworth Television & Radio Corporation's* New York regional office. He also served *Farnsworth* as assistant sales manager for two years, working out of the Fort Wayne headquarters.

* * *

**PHILCO DISTRIBUTORS, INC.** has announced the removal of its sales and administrative offices from 565 Fifth Avenue to 47-51 33rd Street, Long Island City, New York.

Strategically located in the heart of Long Island City's business center, the new *Philco* building occupies an entire city block with 180,000 square feet of floor space. In addition to a large parking lot, the plant has a spacious loading area with 18 covered platforms. Storage facilities are ample and deliveries are expected to be expedited by this new move.

* * *

**JOSEPH H. MOSS, JR.** has been named to the post of district manager of receiver sales for *Allen B. Du Mont Laboratories, Inc.'s* Chicago territory.

Mr. Moss will maintain headquarters at the company's offices at 919 North Michigan Avenue, Chicago. He has been associated with *Du Mont* receiver sales since 1947 and has been representing the company in the Midwest during the last few months.

Included in the Chicago district are Milwaukee and Minneapolis-St. Paul as well as those areas in Illinois, Wisconsin, and Minnesota being served by television stations.

* * *

**LOUIS G. PACENT, JR.**, has been appointed vice-president in charge of manufacturing at *Radio Speakers, Inc.* of Chicago.

*Radio Speakers, Inc.* is a subsidiary of *Emerson Radio and Phonograph*

*Corporation.* Mr. Pacent was formerly plant manager of the company and prior to that was manager of production services at *Emerson Radio* in New York City.

* * *

**FREED RADIO CORPORATION** has entered the television field with a line of *Freed-Eisemann* video consoles, table models, and television-radio-phonograph combinations.

Direct view 12½ and 16 inch television tubes are used and all models incorporate AM and FM radio as well as the video facilities.

The new line was designed under the active supervision of Joshua Sieger, the company's director of research and development.

* * *

**E. A. NICHOLAS,** president of *Farnsworth Television & Radio Corporation* of Fort Wayne, Indiana, was named chairman of the board of directors at a recent meeting of that body. Mr. Nicholas will continue as president of the company, a post he has held since 1939.

Also announced was the appointment of Abe Fortas as a director of the company. Mr. Fortas was formerly Undersecretary of the Department of Interior and at the present time is a partner of the firm of *Arnold, Fortas and Porter,* Washington attorneys.

Philo T. Farnsworth, who is a director of the company and who has been conducting special research for the company, was elected a vice-president.

* * *

**RALPH HACKBUSCH,** vice-president and general manager of *Stromberg-Carlson, Ltd.* of Toronto, has been elected president of the Canadian Radio Technical Planning Board.

Mr. Hackbusch headed the radio division of *Research Enterprises, Ltd.* when that body was organized as a government owned industry in 1940 to undertake the research and manufacture of radio, optical glass, and other war equipment. He was later elected vice-president and director.

—30—

### ERRATUM

**An error occurred in the coil winding data table appearing on page 52 of the November issue. In the article "A Compact Superhet Tuner," the designations $L_1$ and $L_2$ should be interchanged in the coil table in order to coincide with the coils as shown in the circuit diagram.**

* * *

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RIDER'S Manuals. Volumes One to Thirteen, inclusive, used, like new. R.C.A. #150 Frequency Generator, good. Will consider reasonable offer. D. L. Spurr, 824 Monroe, Stillwater, Okla.

BARGAINS: New and reconditioned Hallicrafters, National, Collins, Hammarlund, RME, Meissner, other receivers, tuner, television receivers, transmitters, amplifiers, speakers, etc. Lowest wholesale prices. Terms. Shipped on trial. Liberal trade-in allowances. Write. Henry Radio, Butler, Mo., and 11240 W. Olympic, Los Angeles, Calif.

HALLICRAFTER SX-42 with R-42 Speaker. Good condition, $250. Ted Welsh, R#5, Box 368, Kingsport, Tenn.

SELL B.C.342, with O.S.T. revision, good condition, $50.00. F.O.B. Raleigh R. Mitchell, 821 Sewanee St., Harriman, Tenn.

2-VOLT Storage battery & home charger for portables, etc. Both only $4.95; guaranteed. Special quantity prices available. Modelectric Products, Asbury Pk., N. J.

COAXIAL Cable, identical characteristics as RG-58/U. Send dime for 3 foot sample. Satisfaction guaranteed. Harry H. Van Dick, Box 236, Little Falls, N. J.

NEW cartoned tubes 39c each. 1A5gt, 1L4, 1R5, 1S5, 1T4, 3S4, 3V4, 5Y3gt, 6AJ5, 6AK5, 6AQ5, 6AQ6, 6AT6, 6BA6, 6BE6, 6BH6, 6BJ6, 6C5gt, 6J5gt, 6K6gt, 6SA7gt, 6SK7gt, 6SQ7gt, 6V6gt, 6X4, 7E5, 12AT6, 12BA6, 12BE6, 12A8gt, 12SL7gt, 25L6gt, 31, 32L7gt, 35B5, 35W4, 47, 50B5, 70L7gt, 80, 89, 117L7gt, 117P7gt, 117Z3. Write for bargain flyer. Henshaw Radio Supply, 3619 Troost, Kansas City 3, Mo.

GRILL Cloth, Celanese, light and dark pieces. 1000 square inches for $1 bill. Write for list of lowest priced national brand parts in nation. Bursma Radio, Route 5, Grand Rapids, Mich.

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NEW, Fisher Dynamic Noise Suppressor Amplifier. Unable to use, not licensed for our business, $200 cash. You pay transportation. Wired Program Service, 221 Williams Street, Watertown, N. Y.

HEARING Aids. Zeniths, others. All used but working. Make miniature transmitters or receivers. Complete with cords, ear piece, $20 ea. Shelby Instrument, 321 W. 7th, Long Beach, Calif.

12B8 & 25B8 TUBES. Adapter unit using 2 miniature tubes (6AT6 & 6BA6 for 12B8, and 12AT6 & 12BA6 for 25B8). Takes less space than original tube, nothing else to buy, just plug in and it works. Money-back guarantee. 12B8 or 25B8 unit complete: $2.49 each, 10 units for $22.50. Send 25% deposit, balance C.O.D. Write for free parts catalog. Commercial Radio, 36 Brattle St., Boston, Mass.

G. E. SATURABLE Reactors 6 KVA 460 VAC, or 3 KVA 265 VAC, $35. GL8020 Tubes, $2.50. 10 HP Motor-Generator 60-120 cycle Converter, $100. G. E. Motor-Compressor with complete freezing unit, unit cost $200, only $30. 110V 700W Motor-Generator DC-AC Converter, $30. 400 Mfd. 120 VAC Condensers, $1. Satisfaction guaranteed. DuPont Smith, 106 Verbena, Oak Ridge, Tenn.

NO more wires. Learn Printed-Circuit Methods. An important new aid in building, testing, and repairing modern electronic circuits. Paint working circuits over your rough sketches or any nonconductor. High instruction value for colleges. Kits $3 and $5, contain conducting and resistance paints plus free manual. Manual separately 25c. Free literature. Microcircuits Co., Dept. 4E, New Buffalo, Mich.

PORTABLE suitcase size radio shop. Build it and double your income. Carry it in your car and be ready for ready cash. Send $2 for complete specifications or write for literature. Grand Federal, Argentine Box 57, Kansas City 3, Kans.

## WANTED

WANT to buy a few BC-654 Transmitter-receiver sets or complete SCR-284A sets. Must be new or good clean-used condition. Write giving condition of set or sets available with listing of components and price asked. W. H. Gilman, 2144 S. Kedzie Ave., Chicago 23, Ill. Phone BIshop 7-6340.

WANTED: APR-5A, APR-4 Receivers and Tuning Units, Antennas, Radar Scanners, VHF-SHF Gear, Laboratory and Test Equipment of all types. Also quantity stocks of all types of surplus materials for marketing. Engineering Associates, Farhills Branch Box 29N, Dayton 9, Ohio.

BC348 AND other used Receivers in trade on new Receivers. Henry Radio, Butler, Mo.

WESTERN Electric CF-1, CF-2, CF-3, CF-4, CF-5, CF-6, H, H-1 Carrier, EE100, EE101A ringing equipments. All models teletype. All models RCA Marine transmitters. Box 477, % Radio & Television News, 185 N. Wabash Ave., Chicago 1, Ill.

TRC1 EQUIPMENT T14 Transmitters, R19 Receivers, AM & Amplifiers, PP13 Power Units. Box 476, % Radio & Television News, 185 N. Wabash Ave., Chicago 1, Ill.

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COLLEGE Graduate with B.S. degree in Radio Engineering desires position. 8 yrs. experience in Radio. Write to Box 26, Dunnell, Minn.

SELECTED group of men, graduates of well-known trade school, desire employment in Radio Field. Will travel anywhere. Qualified in radio servicing, installation, test instruments, circuit operation, etc. Contact Placement Dept., Eastern Technical School, 888 Purchase Street, New Bedford, Mass.

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## PATENT ATTORNEYS

LANCASTER, Allwine & Rommel, Registered Patent Attorneys. Patent practice before U.S. Patent office. Validity and Infringement investigations and opinions. Booklet and form "Evidence of Conception" forwarded upon request. Suite 414, 815 15th St., N.W., Washington 5, D. C.

## MISCELLANEOUS

LEARN Morse Code. Visual Signal device used by Armed Forces, $1.00. Charles Pullen, Belleville, Michigan.

"RADIOBUILDER" for Crystal, 1-tube Experimenters. 3 issues, 25c. Laboratories, Eye-H, San Carlos, Calif.

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RADIO Diagrams AM, 30c; SW & FM, 60c; Television $1.00. State manufacturer and model number. Kramer's Radio Service, 36 Columbus Ave., New York 23, N. Y.

PHONOGRAPH records cheap. Catalogue free. Paramount, BN-313 E. Market, Wilkes-Barre, Pa.

RADIOMEN, Servicemen, Beginners. Make more money, easily, quickly. $250 weekly possible. We show you how. Information free. Merit Products, 216-32R 132 Ave., Springfield Gardens 13, N. Y.

# INDEX OF *Advertisers*

FEB. 1949

## Beginning Amateur

(*Continued from page 38*)

can put together a respectable if not very fancy ham receiver for less than $20; it will produce signals from all over the world, you'll learn a lot from its construction and you'll be very proud of it. A month or so later, after you've acquired code speed and are ready for the license exam, figure on putting out not more than $25 for an effective and not too low-power CW transmitter, complete with antenna. One good thing about ham radio is that the parts can be used over and over, from one receiver or transmitter to a bigger and better one. In fact, half the fun is tearing down a rig, after you are satisfied that it works, so that you can make another that will work better.

Maybe you've read or heard somewhere that amateur transmitters use high voltages and are dangerous. They do use relatively high voltages and they *are* dangerous, and let's not pretend otherwise. However, if ham rigs are dangerous, how do you classify the car in the garage, the bread knife in the kitchen drawer, the bottle of iodine in the medicine chest, or for that matter, the bathtub upstairs? You don't deliberately drive the car off a cliff, or slice your arm with the knife, or guzzle the iodine, or slip and break your neck in a soapy tub; you don't if you're in your right mind. If you drive carefully, you'll also keep your fingers off bare wires with 500 volts on them.

(*To be continued*)

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| Type | Price |
|---|---|
| 01A | $0.50 |
| 1B22 | 5.55 |
| 1R4/1294 | .85 |
| 2J22 | 14.85 |
| 2J31 | 14.85 |
| 2J32 | 14.85 |
| 2J38 | 18.95 |
| 2J48 | 16.55 |
| 2J158 | 9.85 |
| 5J23 | 14.85 |
| 5J29 | 14.95 |
| 2C26 | .55 |
| 2C26A | .70 |
| 2C34 | .46 |
| 2C44 | 1.25 |
| 2E22 | 1.35 |
| 2X2/879 | .75 |
| 3C24/24G | .49 |
| 3AP1/906P1 | 2.75 |
| 3BP1 | 2.75 |
| 3CP1 | 2.75 |
| 3E29/829B | 3.95 |
| 3FP7 | 2.95 |
| 3HP7 | 2.95 |
| 5AP1 | 3.75 |
| 5BP1 | 2.85 |
| 5BP4 | 3.95 |
| 5GP1 | 6.55 |
| 5HP4 | 5.95 |
| 12HP7 | 10.95 |
| 6A6 | .90 |
| 6B7 | .99 |
| 6C21 | 19.95 |
| 6H6 | .52 |
| 6J5 | .52 |
| 6SL7 | .65 |
| 6U5/6G5 | .70 |
| 7A7 | .70 |
| 7C4/1203 | .45 |
| 7H7 | .75 |
| 7Q7 | .70 |
| 10 | .52 |
| 10Y | .55 |
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| FG17 | 2.95 |
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| 33/VT33 } Talkies | .95 |
| 34 | .35 |
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| 39/44 | .34 |
| 41/VT51 | .55 |
| VT52/45SPEC | .55 |
| 46 | .85 |
| 76 | .55 |

| Type | Price |
|---|---|
| 77 | $0.55 |
| 78 | .55 |
| 83 | .85 |
| 83V | .95 |
| 100R | 3.45 |
| EF50/VT250 | .65 |
| VR78 | .68 |
| VR90 | .70 |
| VR92 | .65 |
| VR105 | .70 |
| VR150 | .70 |
| VT127 ENGLISH | .35 |
| VT127A TRIODE | 2.55 |
| 211 | .65 |
| 217C | 5.95 |
| 218 | 4.45 |
| 282B | 4.35 |
| 250R | 7.85 |
| 304TH | 6.55 |
| 304TL | .90 |
| 305A | 12.45 |
| 305B | 6.75 |
| 316A | .55 |
| 350A | 2.75 |
| 350B | 2.55 |
| 371A | 2.55 |
| 371B | 2.55 |
| 388A | 6.45 |
| 417A | 19.85 |
| GL434 | 2.95 |
| 446A | 1.55 |
| 446B | 1.55 |
| GL471A | 2.95 |
| 481 | 4.50 |
| WL530 | 24.95 |
| WL531 | 19.95 |
| 532A | 3.55 |
| GL559 | 3.75 |
| WL681 | 19.95 |
| 700B | 9.95 |
| 700C | 9.95 |
| 700D | 9.95 |
| 702A | 2.95 |
| 707B | 23.25 |
| 708A | 6.55 |
| 710A | 2.15 |
| 714AY | 9.95 |
| 715B | 7.95 |
| 717A | .90 |
| 721A | 3.95 |
| 721B | 3.95 |
| 724B | 4.25 |
| 725A | 19.95 |
| 726A | 19.95 |
| 726C | 19.95 |
| 801A | .80 |
| 803 | 7.75 |

| Type | Price |
|---|---|
| 805 | $5.75 |
| 807 | 1.20 |
| 810 | 7.95 |
| 813 | 7.85 |
| 814 | 3.75 |
| 826 | .49 |
| 828 | 4.55 |
| 829B | 3.95 |
| 830B | 3.75 |
| 832 | 2.75 |
| 832A | 3.50 |
| 837 | 1.25 |
| 838 | 3.25 |
| 841 | .55 |
| 843 | .55 |
| 860 | 2.55 |
| 861 | 34.50 |
| 864 | .55 |
| 865 | 2.55 |
| 869 | 24.95 |
| 869B | 28.95 |
| 872A | 2.45 |
| 874 | 2.15 |
| 878 | 2.15 |
| 884 | 1.50 |
| 885 | .85 |
| 930 | 1.10 |
| 954 | .55 |
| 955 | .55 |
| 956 | .55 |
| 957 | .55 |
| 1005 | .45 |
| 2050 | .75 |
| 1148 | .40 |
| 1201/7ES | .95 |
| 1616 | 1.25 |

| Type | Price |
|---|---|
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| 1624 | 1.25 |
| 1625 | .45 |
| 1626 | .45 |
| 1629 | .45 |
| 1641/RK60 | .65 |
| 2051 | .95 |
| 7193 | .35 |
| 8011 | 2.55 |
| 8012 | 4.35 |
| 8020 | 3.25 |
| 9001 | .70 |
| 9002 | .65 |
| 9003 | .55 |
| 9004 | .55 |
| 9006 | .55 |
| CEQ72 | 1.55 |
| FG105 | 10.95 |
| KU610 | 7.45 |
| RK20A | 4.95 |
| 12X825 2 AMP TUNGAR | 2.95 |
| RK34 | .45 |
| GL471A | .95 |
| EF50 | .70 |
| HY615 | 1.25 |
| 704A | 1.55 |
| 705A | 2.15 |
| 707A | 19.95 |

### Neon Bulbs for Radio Use

| | |
|---|---|
| NE-15 Price Ea | $0.06 |
| NE-48 | .24 |
| NE-16 | .24 |
| NE-51 | .06 |

## Pilot and Flashlight Bulbs

| STOCK NO. | MAZDA NO. | VOLTS | WATTS | BULB | BASE | EA. PRICE |
|---|---|---|---|---|---|---|
| 350-40 | 64 | 6-8 | E 3 CP | G-6 | DC Bay | $0.07 |
| 350-50 | 1820 | 28 | .1 Amp | T-3½ | Min Bay | .12 |
| 350-31 | 57 | 12-16 | 1.5 CP | G4½ | Min Bay | .08 |
| 350-42 | Spec. | 12 | 6 Watts | S-6 | Cand Scr | .13 |
| 350-20 | 1446 | 12 | .2 Amp | G-3½ | Min Scr | .07 |
| 350-14 | 49 | 2 | .06 | T-3¼ | Min Bay | .06 |
| 350-15 | 3S6 | 120 | 3 Watts | S-6 | Can Bay | .11 |
| 348-22 | PR-10 | 6 | .5 Amp | B-3½ | Min Flang | .05 |
| 350-18 | 1477 | 24 | .17 Amp | T-3 | Min Scr | .16 |
| LB-101 | 323 | 3 (AIRCRAFT) | | T-1½ | 953 | .22 |
| 350-19 | Proj. Bulb | 120 | 500 W | T-20 | Med Pf | 1.45 |
| LB-103 | 44 (Ruby) | 6-8 | .25 Amp | T-3½ | Min Bay | .04 |
| LB-102 | 1195 | 12-16 | .50 CP | RP-11 | DC Bay | .14 |
| LB-104 | 313 | 28 | .17 Amp | T-3½ | Min Bay | .11 |
| LB-105 | 1816 | 13 | .33 Amp | T-3½ | Min Bay | .12 |
| LB-106 | 12A | 12 | .09 Amp 11 | T-2 | Tel Base | .18 |
| LB-107 | 24-A2 W E | 24 | .75 Amp 105 | T-2 | Tel Base | .18 |
| LB-108 | S 14 ARGON | 105 | 2½ Watt | Med | Screw | .22 |

**Cut Out This Page for Ready Reference**

**Distributors: Our standard jobber arrangement applies. Order directly from this ad.**

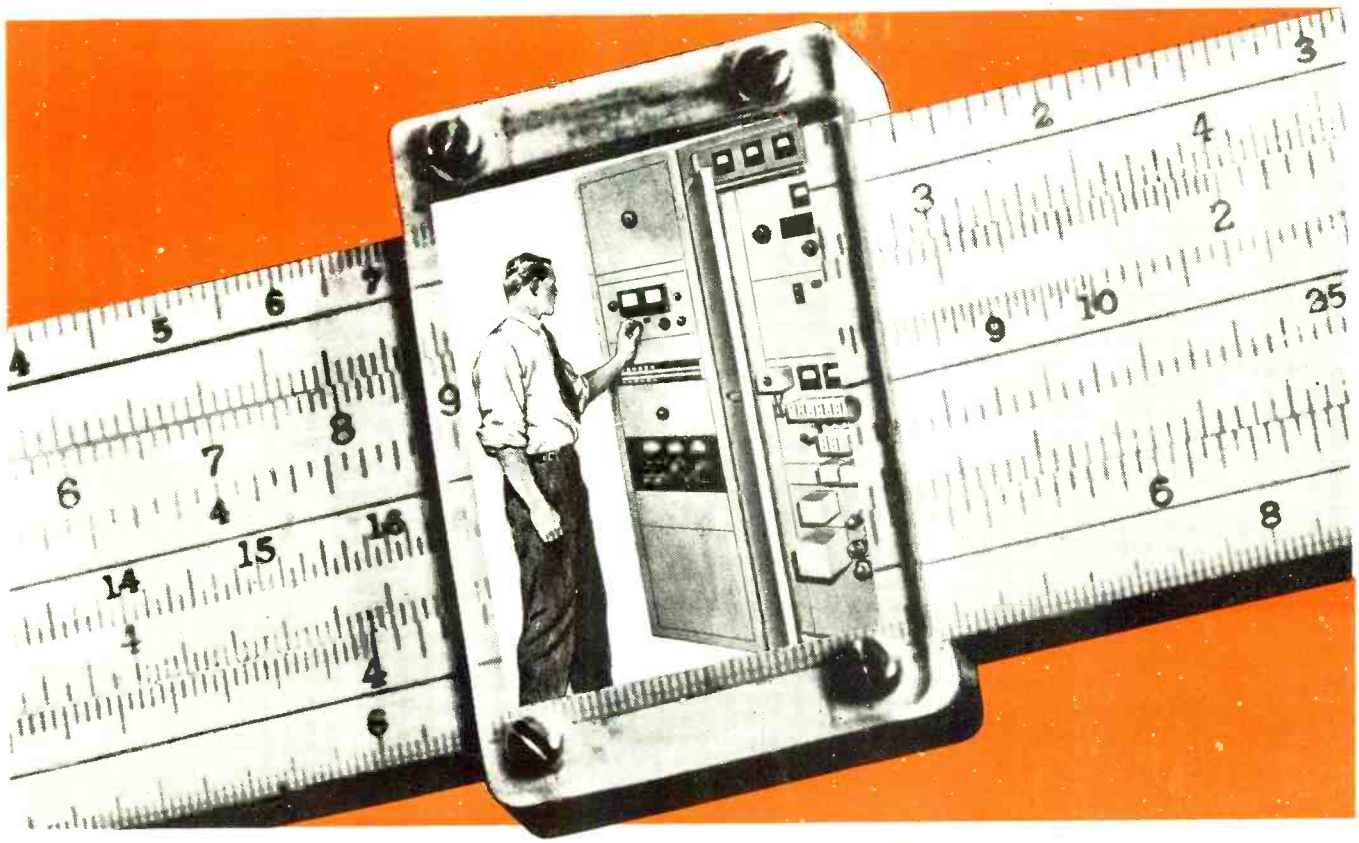
**Manufacturers: Write for quantity prices.**

**WELLS SALES, INC.**

**320 N. LA SALLE ST., DEPT. R-2, CHICAGO 10, ILL.**

(PRINTED IN U.S.A.)

Capitol Radio Engineering Institute—Pioneer in Radio Engineering Instruction Since 1927



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**Send for, and read, our new catalog and course outline. *It explains our self-improvement program, courses and what CREI can do for you. It will give you a good idea how practical and easy-to-understand our training is, and why many thousands have enrolled for CREI courses since 1927.***

**VETERANS! CREI TRAINING AVAILABLE UNDER G. I. BILL**

If you have had professional or advanced amateur experience and want to make more money, let us prove to you we have the training you need to qualify for a better radio job. To help us answer intelligently your inquiry—*please state briefly your background of experience, education and present position.*

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*An Accredited Technical Institute*

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*Check field of greatest interest:*

☐ PRACTICAL RADIO-ELECTRONICS ☐ PRACTICAL TELEVISION
☐ BROADCASTING ☐ AERONAUTICAL RADIO ENGINEERING
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☐ I AM ENTITLED TO TRAINING UNDER G. I. BILL.

# CHICAGO TRANSFORMER

## *the Complete Line*

**No. BO-6**
**List Price $23.00**

### Response within .2 db 30 to 20,000 cycles

**Full Frequency Range Output Transformer**

**No. BO-6.** For use in high fidelity amplifiers. Couples push-pull 6L6's (7500 ohms, C-T) to 6/8 or 16/20-ohm voice coil. Center-tapped tertiary winding provides 15% inverse feed-back to reduce harmonic distortion to a minimum. In drawn steel case, 4⅝" x 3⅞" x 3¹¹⁄₁₆", with mounting studs and convenient pin-type terminals.

### HIGH Q CHOKES for Dynamic Noise Suppression Circuits

Two precision-built chokes with inductance values of .8 and 2.4 henrys respectively—accurate to within ± 5% with up to 15 ma d-c. Units have a minimum Q of 20. Remarkably compact, 1¹¹⁄₁₆" x 2⅜" x 1⅞".

| No. | Inductance | List |
|---|---|---|
| NSI-1 | .8 h | $10.00 |
| NSI-2 | 2.4 h | 10.00 |

## Famous "Sealed in Steel" New Equipment Line

### *The "Engineer's Transformer"*

Chicago Transformer's New Equipment Line offers transformer engineering *ahead* of the trends in circuit design. It's the transformer line preferred by experts in the P.A., ham, communication and experimental fields, and by broadcast stations and manufacturers.

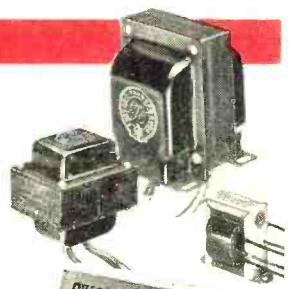
Check these features—*drawn steel cases* to provide compact, streamlined mounting; *conservative ratings* that meet all RMA and FCC recommendations; *precision characteristics* for stable, uniformly excellent performance—these and many others. Check the prices—and you'll learn how little more these advanced units cost over conventional transformers.

Included in the New Equipment Line are Power Transformers and exactly matched Chokes, Filament and Bias Transformers, and complete listings of high fidelity audio units to meet the requirements of the three important frequency ranges. Get the complete facts now on the "Engineer's Transformer."

**Write for Complete "New Equipment" Catalog Today**

## New Replacement Transformer Line

### *Premium Quality—Yet They Cost No More*



The new CT Replacement Line provides servicemen with a wide range of standard ratings that fit the most frequent power and audio transformer requirements. These units are backed by CT's 20 years of manufacturing experience. Yet CT quality *costs no more*. Just check these typical listings:

**Power Transformer No. PH-708.** 350-0-350 v. a-c, 70 ma d-c; filaments 5 v., 3 amps and 6 v. C-T, 2.5 amps; horizontal shield mounting.....List Price, **$7.30**

**Filter Reactor No. R-650.** 6 henrys, 50 ma d-c, 300 ohms d-c resistance; clamped frame mounting.....List Price, **$1.65**

**Universal Output No. RO-303.** Single or push-pull plates (2500 to 14000 ohms) to 2/4/6/8/15-ohm voice coil; 40 ma pri. d-c; 8 audio watts output; clamped frame mounting.....List Price, **$2.75**

*Write for Complete Descriptive Catalog and Prices*

## Television Transformers *to fit today's leading TV circuits*

Because Chicago Transformer is the largest single supplier of transformers to the Television industry, you gain the advantages of "Original Equipment" components when you buy Chicago TV Transformers. Available now, the three units described here are part of a complete new line, soon to be announced.

**Vertical Blocking Oscillator Transformer No. TBO-1.** 60-cycle unit for creating the vertical sweep "saw-tooth" voltages required in conventional circuits.

Pri. Inductance: 1.15 hy ± 20% at 3 v., 1000 cycles
Pri. Leakage Inductance: 8 mh + 25%, −15%
Ratio, Primary to Secondary: 1 to 4.2

*Exact equivalent to R. C. A. Part No. 208T2.* List Price, **$3.10**

**TV Power Transformer No. TP-365.** Designed to supply 405 volts d-c with two 5U4G's to an 80 mfd condenser input. Copper shorting band around core reduces external magnetic field; cuts image distortion to a minimum.

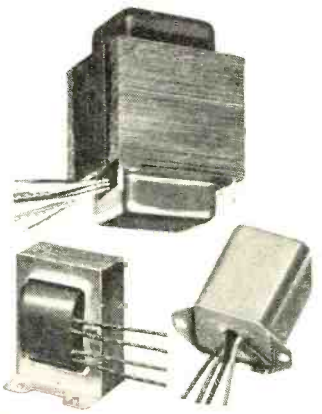
Pri.: 115 v., 60 cycles — Fil. No. 1: 12.6 v., 5 amps, C-T
H.V. Sec.: 362-0-362 v., a-c, .295 amps d-c — Fil. No. 2: 5 v., 2 amps
Fil. No. 3: 5 v., 6 amps

*Exact equivalent to R. C. A. Part No. 201T6.* List Price, **$26.00**

**Vertical Scanning Output Transformer No. TSO-1.** Couples vertical output tubes to picture tube deflection yoke.

Pri. Impedance: 19,000 ohms at 30 v., 60 cycles, 13 ma d-c
Ratio, Primary to Secondary: 10 to 1

*Exact equivalent to R. C. A. Part No. 204T2.* List Price, **$5.90**



*Write for Descriptive Literature*

CHICAGO TRANSFORMER — TRADE MARK REG.

# CHICAGO TRANSFORMER

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