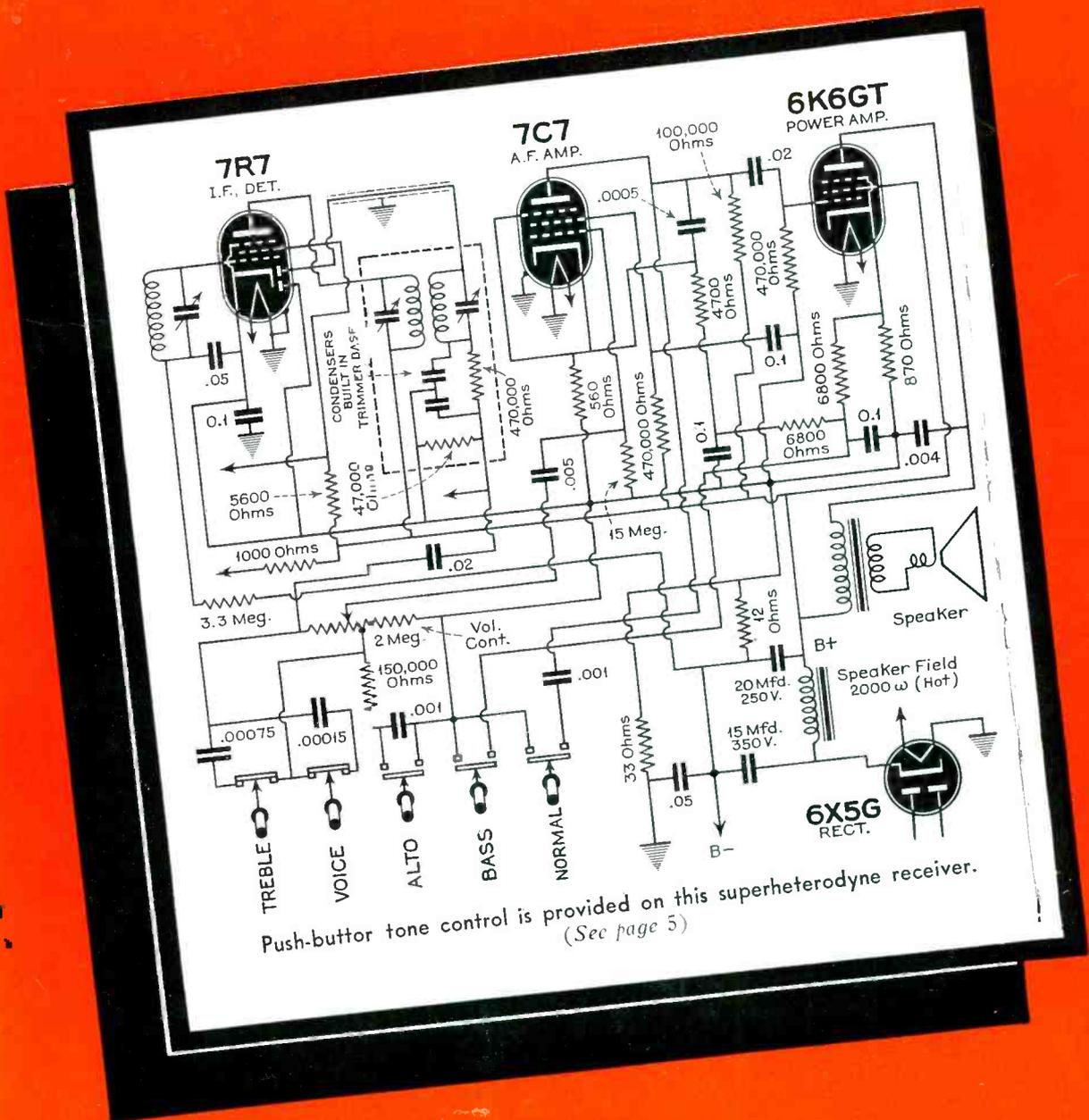
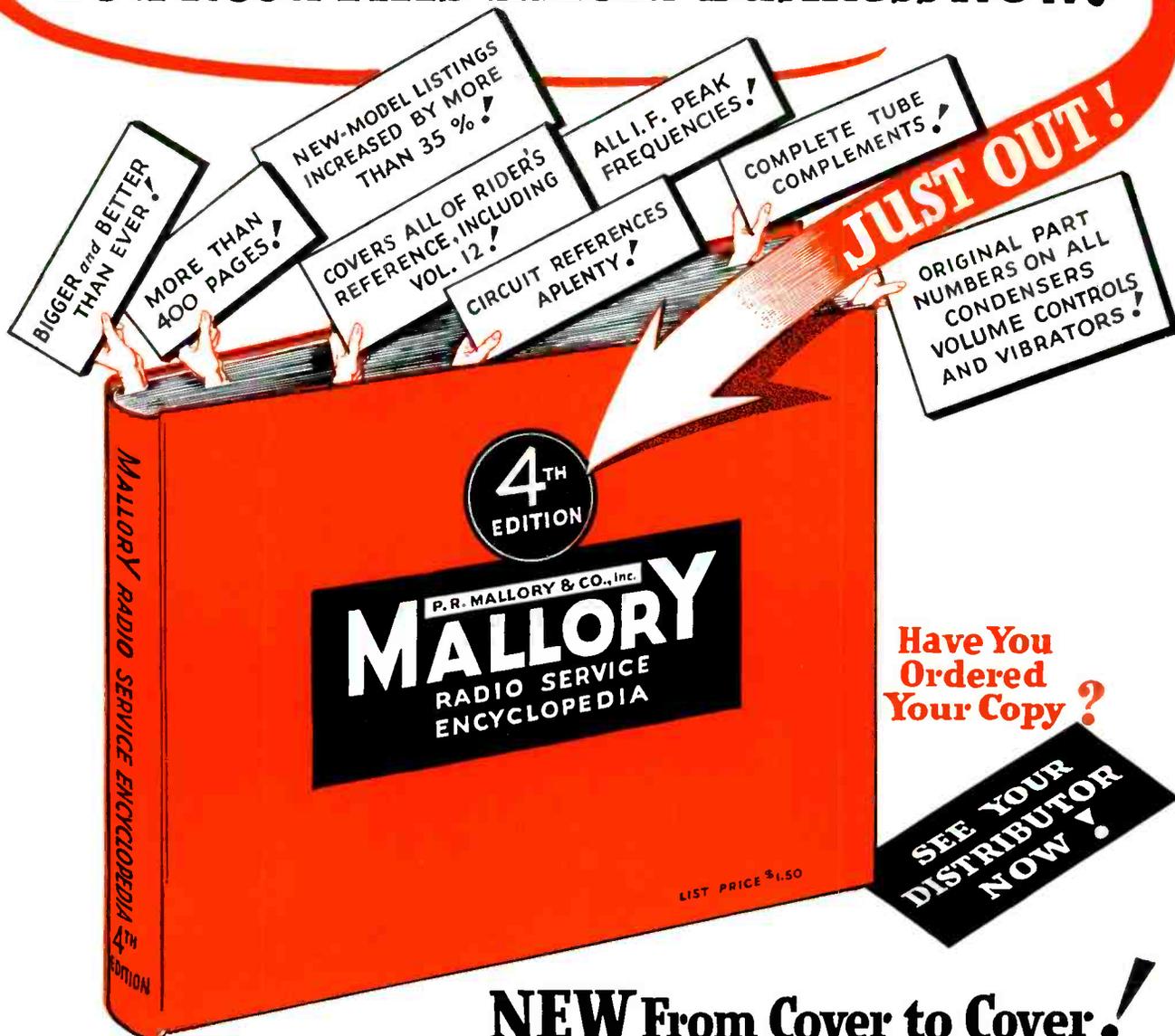


SERVICE



SEPT.
1941

You Need THIS In Your Business NOW!



Have You Ordered Your Copy?

SEE YOUR DISTRIBUTOR NOW!

NEW From Cover to Cover!

Here's a Volume Control That's *Something!*



... a real contribution to the speed and quality of your service work. New mechanical and electrical precision. Rugged! An A-C switch that snaps on and stays on. Quiet! Start using them *today!*

Mallory Replacement Condensers are Tops!



More service engineers are using more Mallory Replacement Condensers than ever! Save time and protect your reputation with Mallory Replacement Condensers!

Save your old Aluminum parts. It is patriotic to give them to National Defense.

You better order your copy of this new, 4th edition MYE *right this minute!* Because our Mallory distributors tell us that they're practically sold out. And, Mister, you're going to kick yourself, if you don't get a copy. You need this MYE in your business—and you need it NOW!

So *now* is the time to order. Pick up the phone and call your Mallory distributor . . . tell him you've GOT to have a copy of the new, 4th edition MYE!

P. R. MALLORY & CO., Inc., INDIANAPOLIS, INDIANA

More than ever —INSIST ON

P. R. MALLORY & CO. Inc.
MALLORY
APPROVED
PRECISION PRODUCTS

VIBRATORS • VIBRAPACKS • CONDENSERS •
VOLUME CONTROLS • ROTARY SWITCHES •
SINGLE AND MULTIPLE PUSH BUTTON SWITCHES
• RESISTORS • RADIO HARDWARE

Constant Voltage

FOR YOUR LABORATORY, YOUR PRODUCT, OR YOUR PRODUCTION LINE



STEAD I-VOLT



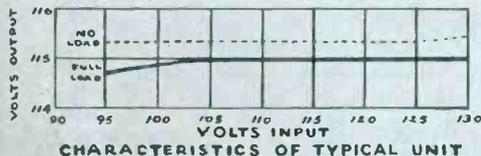
- * ACCURACY 1%
- * INDEPENDENT OF LOAD
- * NO MOVING PARTS
- * HIGH POWER FACTOR
- * HIGH EFFICIENCY
- * NEGLIGIBLE TIME CONSTANT
- * LOW DISTORTION
- * LOW TEMPERATURE RISE

AUTOMATIC VOLTAGE REGULATORS 95-130 VOLT INPUTS . . . 110, 115, 120 VOLTS OUTPUT \pm 1%

The UTC automatic voltage regulator is NEW. It involves no moving parts and effects instantaneous correction for either transient or chronic line voltage fluctuations.

STANDARD TYPES

Type No.	Capacity VA — 60 Cyc.	Net Price
AR-1	15	\$12.00
AR-2	30	15.00
AR-3	60	21.00
AR-4	120	28.00
AR-5	250	46.00
AR-6	500	67.00
AR-7	1000	110.00
AR-8	2000	200.00



CHARACTERISTICS OF TYPICAL UNIT

Designs for 220 volt service available at 25% increase in price; for 50 cycle units increase price 25%; for 42 cycles, 35% increase; for 25 cycles increase price 100%. Special secondary voltages available to customers' specifications at small increase in price.

SPECIAL UNITS

The unique design of these regulators makes possible the construction of special units with relative ease. The output can be arranged to provide filament and plate voltage, or any other special voltages that may be required. Write for details.



UNITED TRANSFORMER CORP.

150 VARICK STREET ★ NEW YORK, N. Y.

EXPORT DIVISION: 100 VARICK STREET NEW YORK, N. Y. CABLES: "ARLAB"



A Monthly Digest of Radio and Allied Maintenance
Reg. U. S. Patent Office

WE MAKE it a practice to spend plenty of time with Service Men at lectures, meetings and in their shops. Throughout such occasions we have attempted to determine, by judicious questioning, just which type of trade paper text is read most consistently. Surveys have been made at regular intervals toward this same end.

The answers were substantially the same; the large majority of Service Men being primarily interested in articles of a technical nature, describing the why and how of some new circuit, part or piece of equipment. Comparatively few preferred material on how to run their business or articles exclusively on merchandising.

In view of these findings, we limited the publication of this latter type of text. It was our duty to supply the subscribers of SERVICE with exactly the editorial content they preferred. However, we are open minded on the subject and would welcome suggestions and comments from our readers.



ON PAGE 33 of this issue you'll find a column headed "We Quote." From time to time we intend to publish, under this heading, a short but pertinent statement by persons of prominence in the industry who, because of their position, have developed a national viewpoint on matters pertaining to the Service Man and his everyday activities. We start the series rolling this month with statements from L. W. Teegarden of RCA Manufacturing Co., Inc., and Charlie Golenpaul of Aerovox Corporation.

	Page
Circuits. By Henry Howard	5
Echophone EC3 Communications Receiver. By Holmes Webster	20
Phase Inverters. By Robert G. Herzog	14
Radio and National Defense. By Lewis Winner	12
Service Men's Equipment Directory	23
Servicing the RCA "Magic Brain" Automatic Record Changer	18
Sockets. By John H. Potts	10
"We Quote"	33

Circuits

Air Chief S7350-2 R-F and Converter	6
Air Chief S7405-9 I-F Stage	8
Airline 14BR525A, 14BR526A	7
Airline 14BR573 Converter	6
Echophone EC3 Communications Receiver	21
Impedance-Coupled Push-Pull	14
Packard Bell 65A	9
Phase Inverters	15
Philco 42-842, 42-843, 42-844	8
RCA 24BT1, 24BT2 I-F Stage	7
RCA 26X4 (Chas. RC1014B)	6
RCA 28X5 (Chas. 1002A)	7
RCA CV42 Electrifier	9
Resistance-Coupled Push Pull	14
Screen-Grid Phase Inversion	14
Self-Balancing Phase Inversion	15
Signal Divider	15
Transformer Coupled Push Pull	14
Truetone D1124	5
Zenith 6R631 (Chas. 6B02)	Front Cover
Zenith 7S681, 7S682, 7S685 (Chas. 7B02)	5

Cover Diagram

Push-Button Tone Control (Zenith)	5
-----------------------------------	---

Index to Advertisers

	36
--	----

Manufacturers

Catalogs, Etc.	34
Expansion	34
New Products	16, 34
Personnel	34

Service Men's Equipment Directory

	23
--	----

Sound

Phase Inverters. By Robert G. Herzog	14
--------------------------------------	----

Copyright, 1941, Bryan Davis Publishing Co., Inc.

BRYAN S. DAVIS
President
PAUL S. WEIL
General Manager
JAS. A. WALKER
Secretary
Chicago Office:
608 S. Dearborn Street
C. O. Stimpson, Mgr.
Telephone: Wabash 1903

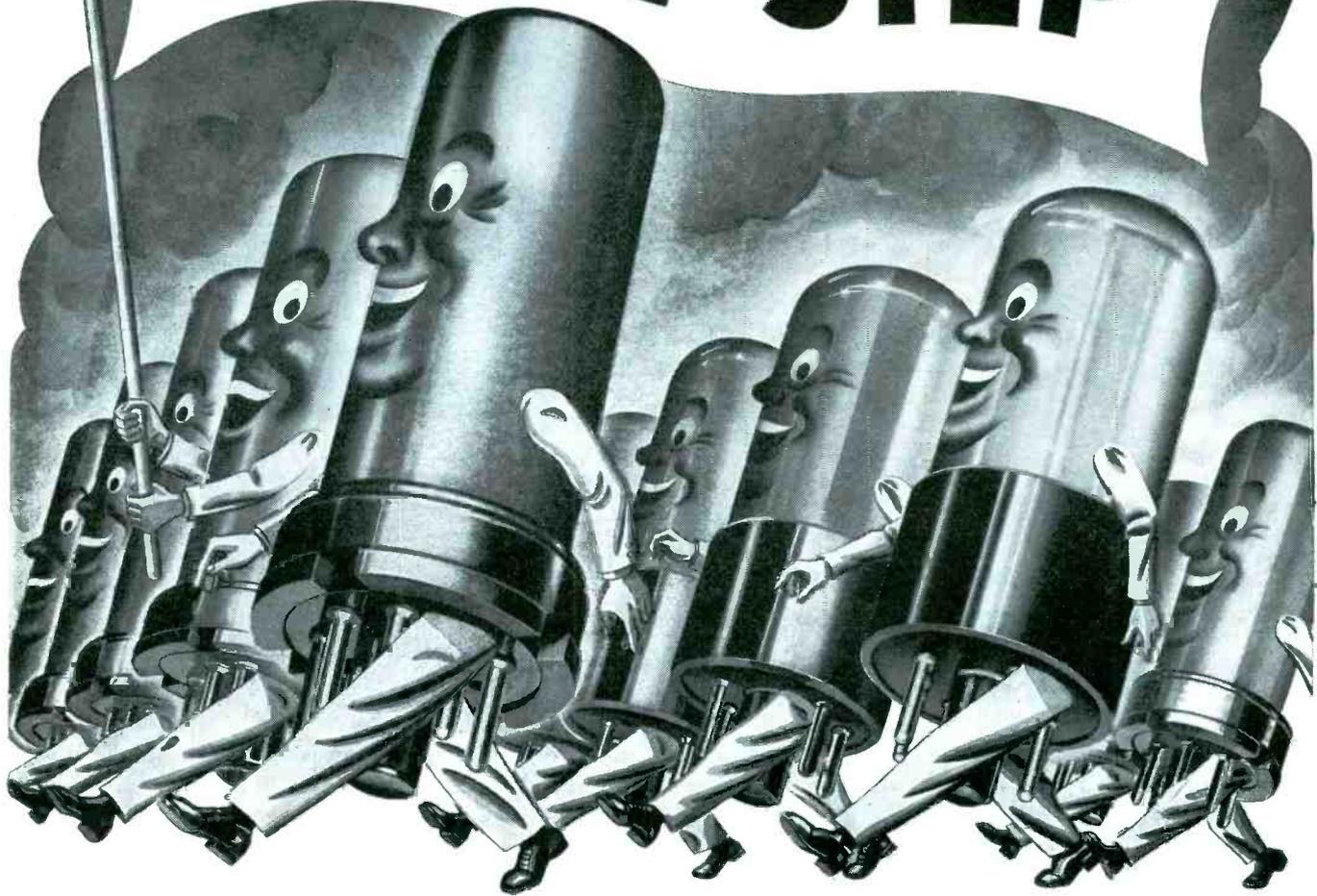
Published Monthly by the
**Bryan Davis
Publishing Co.**
Inc.
19 East 47th Street
New York City
Telephone: PLaza 3-0483



F. WALLEN
Advertising Manager
A. GOEBEL
Circulation Manager
Wellington, New Zealand
Tearo Book Depot
Melbourne, Australia:
McGill's Agency

Entered as second-class matter June 14, 1932, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Subscription price: \$2.00 per year in the United States of America and Canada; 25 cents per copy. \$3.00 per year in foreign countries; 35 cents per copy.

ALL IN STEP



You bet. We're in step with progress—with better listening and therefore quicker and more sales. Take us on, you wide-awake dealers. We'll repay you many times. And, we'll make lasting customers for you. Hundreds write us like this:

"The reception of my radio is much improved. There is less background noise and the foreign stations come in with greater clarity. I am very much pleased with the performance of these tubes."

KEN-RAD TUBE & LAMP CORPORATION, Inc., Owensboro, Ky.
Makers of Ken-Rad Radio Tubes and Ken-Rad Electric Lamp Bulbs

FOR BETTER TUBE BUSINESS RECOMMEND

KEN-RAD

DEPENDABLE

Radio Tubes



SERVICE, SEPTEMBER, 1941 • 3



Plotting the *Curves of* Progress

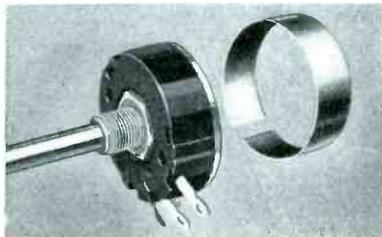
Old Man Centralab is not as old as his name would imply . . . he has a modern mind.

And, as new circuits come out of the laboratories, he is right there . . . abreast of the times with controls that say "uncle", and that fit into the tiniest places.

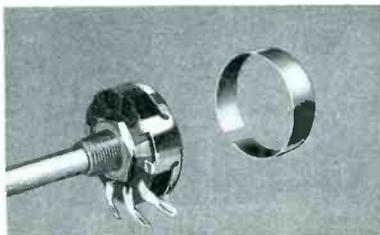
So when you run across a new job that needs a replacement control, you may be certain Old Man Centralab can fill the bill . . . and if it's an old "blooper" . . . there are any number of controls available that will make it "work like new". Old or new . . . there is invariably a CENTRALAB RADIOHM replacement that will do as well, or better than the original. "ALWAYS SPECIFY CENTRALAB".

CENTRALAB: Division of Globe-Union Inc.
MILWAUKEE • WISCONSIN

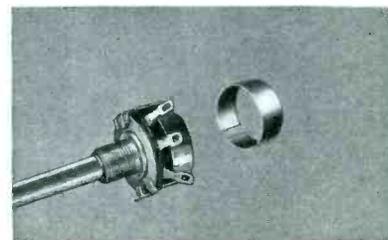
Centralab RADIOHMS



STANDARD: Wall type resistor hugs inner circumference of black moulded bakelite case. Exclusive non-rubbing contact band for quiet, smooth rotation and long life. 1 3/8" diameter x 9/16" deep. Available single, twin, or triple, plain or taped with one or two taps . . . with S.P.S.T., D.P.S.T., or S.P.D.T. Metal shaft extends 3 3/8" from case.



MIDGET: Companion to "Standard" . . . small size but large control efficiency. Available single, dual or triple . . . plain or one, two or three taps . . . with S.P.S.T., S.P.D.T., or D.P.S.T. Moulded bakelite case, 1 1/8" diameter, 1/4" metal shaft 3 3/8" long.



ELF: Small, but also features the long, straight resistor strip. Available plain or tapped with S.P.S.T. Switch . . . with or without dummy lug. Switch rated 2 Amps. 125 V. Underwriter's approved. Bakelite case 57/64" diameter, 17/32 deep (less switch) 25/32" deep with switch.

CIRCUITS

See Front Cover

By HENRY HOWARD

WE ARE glad to report what seems like a definite trend toward more r-f stages and, believe it or not, more 3-gang condensers to doll up those stages. The limited voltage pick-up on small loops gave the industry some excuse for cutting out one tuned circuit—the converter. However, there has been plenty of evidence that such a practise resulted in poor performance, especially when external antennas were used. The extra tuned circuit is definitely an asset. Some controversy has been aroused over the appearance of several cheap f-m receivers in which several sacrifices have been made to bring the sets within a popular price class. For one thing, the limiter stage has been omitted.

Zenith 6R631 (Chas. 6B02)

The audio portion of the Zenith 6R631 (Chassis 6B02) is shown on the front cover. What brings this 6-tube, small table model receiver to the cover is its tone which, unfortunately, can't be heard by all of you. Here is a 5-inch speaker job that has plenty of real bass and a

Fig. 1. (Below.) Zenith 7S681, 7S682, 7S685 (Chassis 7B02).

5-point tone control marked "Treble," "Voice," "Alto," "Bass" and "Normal." A type of audio regeneration is featured involving the a-f amplifier and power

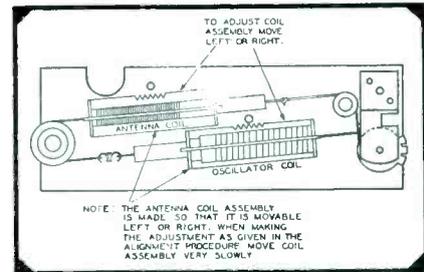
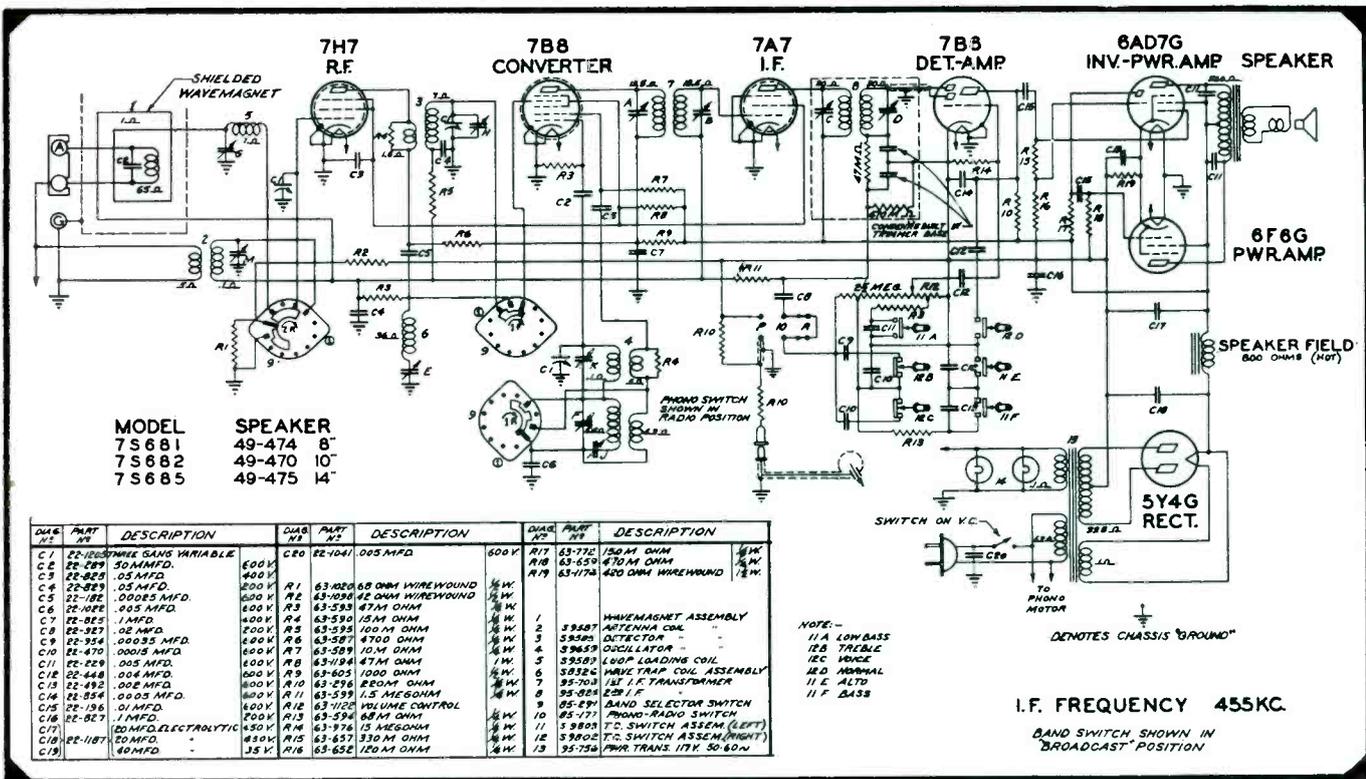
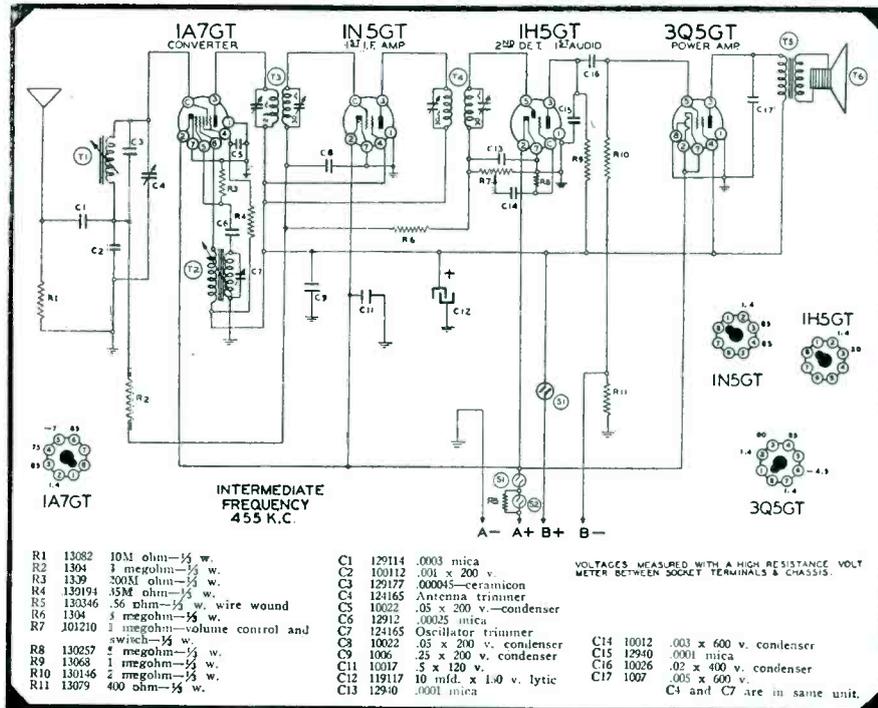


Fig. 4A. (Above.) Truetone D1124 permeability tuning mechanism. Fig. 4. (Below.) Truetone D1124.



New Tubes

New tubes are ever with us in this great age. Personal battery and line sets, such as Detrola's Model 3781, are utilizing the new 45Z3 rectifier which draws only 75 ma on the filament. A further advantage is its small size; it is of the same order as the 1.4-volt personal series.

Zenith 7S681, 7S682, 7S685 (Chas. 7B02)

The Type 6AD7G tube is a combination which includes a pentode power output tube equivalent to a 6F6 and a triode designed as an inverter. Fig. 1 shows this tube employed in the Zenith phonograph combinations Models 7S681, 7S682, 7S685 (Chassis 7B02). These

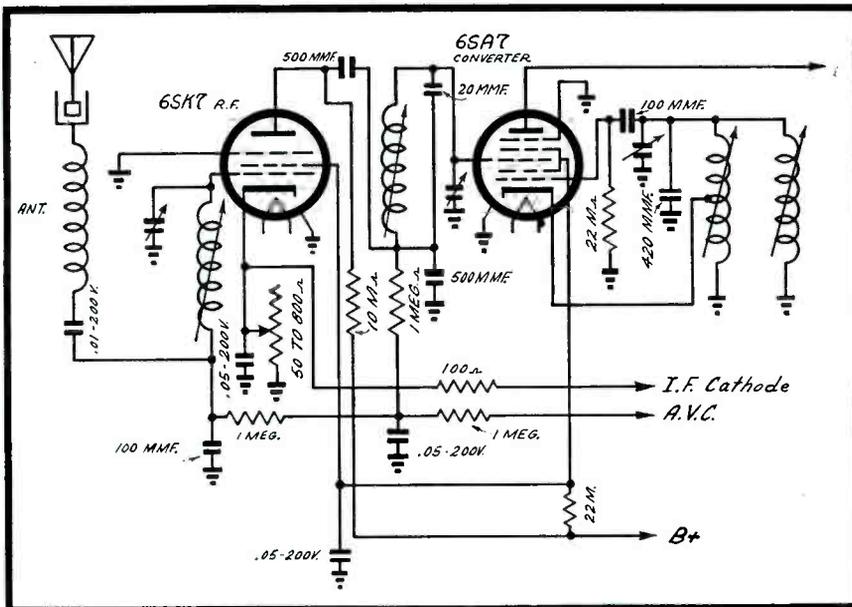


Fig. 3. Air Chief S7350-2.

amplifier cathodes in which a resistance-capacity "T" type low pass filter plays the major role.

A 7R7 diode-pentode serves as i-f amplifier as well as detector. This is necessary because the first audio pentode has its cathode hot and could not perform properly as a detector. Although the first audio cathode has a 560-ohm bias resistor, the grid is returned to ground thru a 15 megohm grid leak. The audio coupling condenser to this grid from the volume control is only 0.005 mfd.

This set uses a 2-meg volume control which is tapped as in the usual bass compensated designs. However, a condenser shunts the high side (from the

hot end to the tap) in addition to the usual resistance-capacity shunt on the low side. The "Treble" button changes the high side shunt from 0.0009 mfd to 0.00015 mfd, releasing plenty of highs. Next in order, the "Voice" control button allows 0.00075 mfd as the shunting value. The "Alto" button restores the original 0.0009 mfd but shorts the 0.001-mfd bass-compensation condenser, leaving a 15,000-ohm shunting the low side of the volume control. The "Bass" button shorts a 0.1-mfd cathode by-pass condenser acting as part of the low-pass filter while the "Normal" button shunts a 0.001 mfd from the first a-i plate to ground.

Fig. 2. RCA 26X4 (Chassis RC1014B).

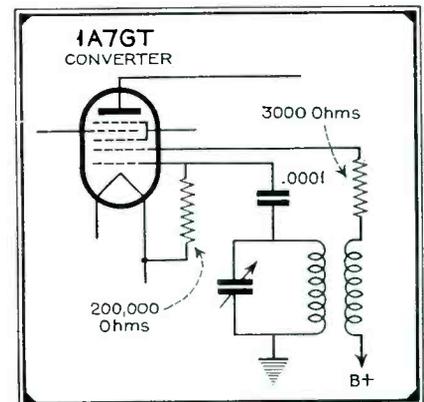
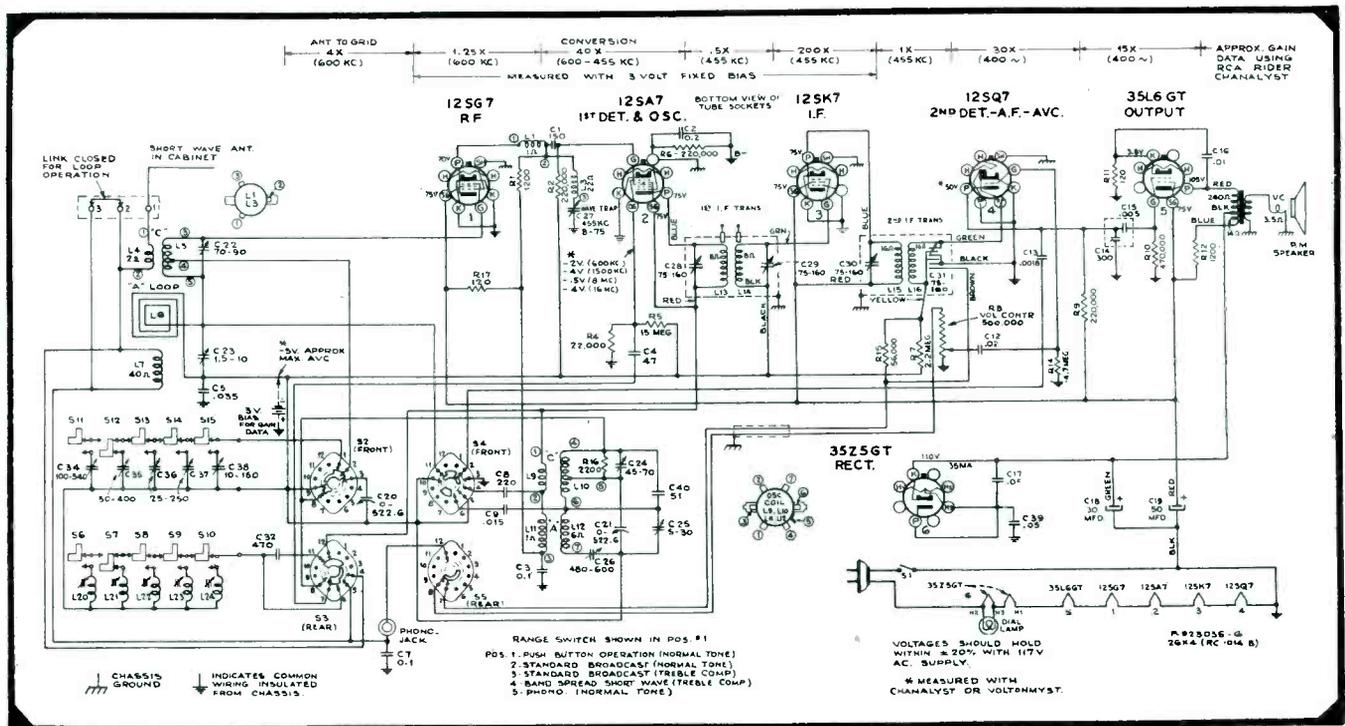


Fig. 7. Airline 14BR573A.

sets also feature a 6-position push-button tone control, similar to the circuit shown on the front cover, but somewhat more complicated. A 2.5 megohm volume



control, fitted with two taps, allows many variations in the frequency response.

RCA 26X4 (Chas. RC1014B)

A bandsread scheme long employed by amateurs and communication receiver makers has been worked out cleverly in the RCA Victor Model 26X4 (Chassis RC1014B), a 6-tube, two-band a-c-d-c job. On the short-wave channel, the tuning condenser is placed across only part of the coil in the first tuned circuit. This has the same effect as reducing the size of the tuning capacity, which is old stuff. However, on the broadcast band, this short-wave coil is placed in series with the loop, the tuning condenser remaining on the tap. The inductance of the coil is so low that it has little effect on broadcast tuning; the part of the coil from the low-poten-

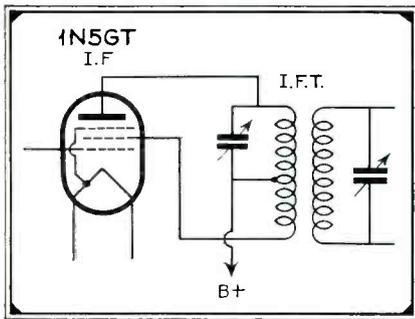


Fig. 8. RCA 24BT1, 24BT2.

tial end to the tap simply acts as a very small loading coil which actually increases the tuning range of the condenser slightly. See Fig. 2.

A novel wave-trap (L3-C27, Fig. 2),

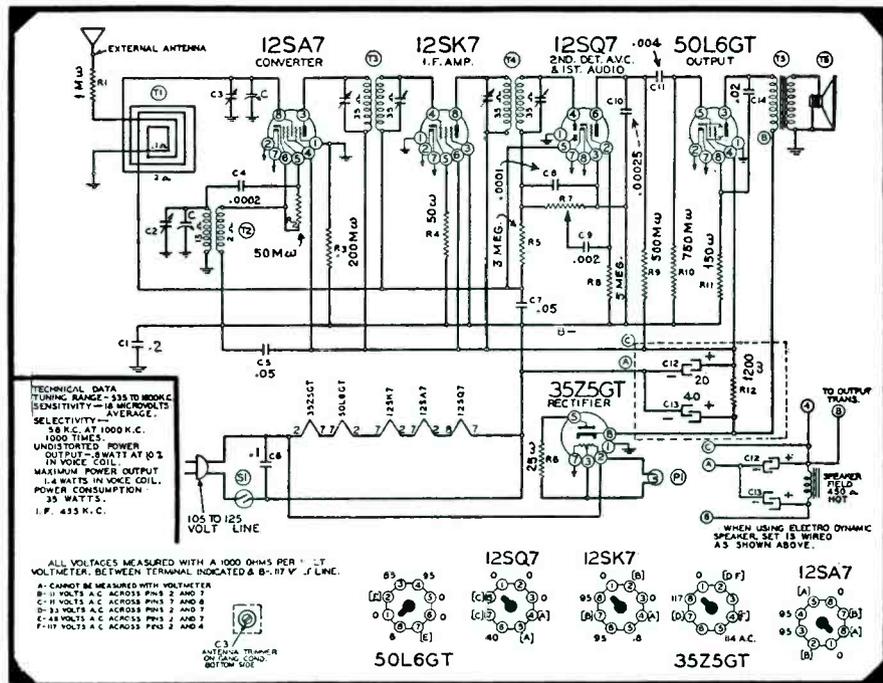


Fig. 5. Airline 14BR525A, 14BR526A.

and choke (L1, Fig. 2) are connected in the plate circuit of the 12SG7 r-f stage and help couple this stage to the converter. A saving is effected in the second i-f transformer by utilizing a combination diode-load by-pass condenser and i-f secondary padder.

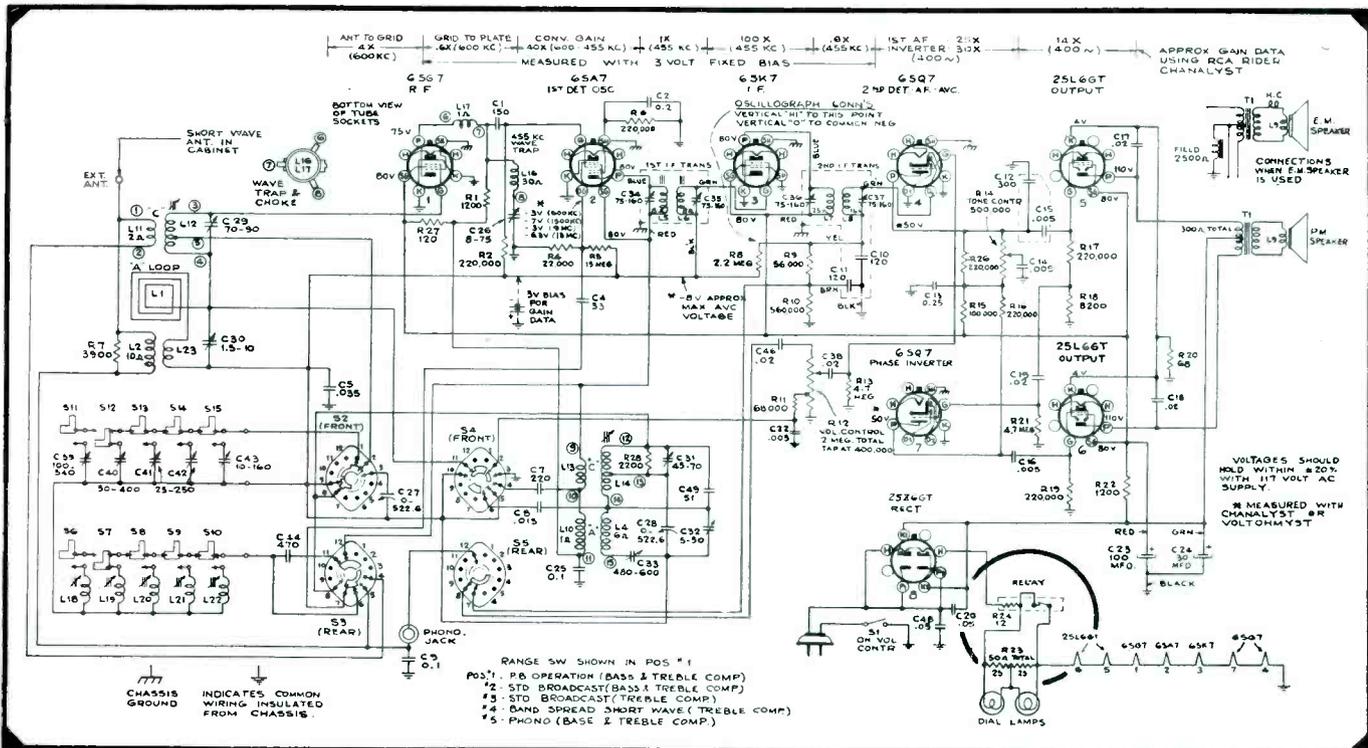
Another feature of this receiver is the hum bucking arrangement of the output transformer with a tapped primary. The tap is established at a point where the "ampere turns" of ripple in the direction of the output plate balances the "ampere turns" of ripple in the direction of the

screen and other plate circuits.

Air Chief S7350-2

Fig. 3 shows an unusual method of coupling a tuned r-f stage to a converter in a permeability tuned auto-radio receiver, the Firestone Air Chief No. S7350-2. Known as the Hazeltine coupling, the output of the r-f stage is placed across a 0.0005-mfd condenser in series with the coil of the converter stage, at the low end. Note the sensitivity control in the r-f cathode, a rheostat with a range of 50 to 800 ohms. It seems

Fig. 6. RCA 28X5 (Chassis RC1002A).



is the combination band switch and tone control.

Portables

Although the portable season would seem to be over, the a-c, d-c line operation with which most of the new sets are endowed carries them through the winter. Probably many of these pee-wees are doing duty in army barracks, as bed room or kitchen sets. Some of the trick switching schemes that we featured a few months back have become quite generally used. One of these allows the insertion of the plug on the power cord into a receptacle in the back to automatically switch the receiver to battery operation. Removal, switches to line power operation. Crosley Model 52PB (Chassis 71) has a three-point switch controlling the B plus and both A leads so operated. The popular door switches on some personal or camera type sets now have a dual nature, being required to switch both line and batteries.

Many of the large manufacturers have now standardized on the plug-in loop for difficult locations such as we described some time ago in Zenith models and, later, Sentinel. The act of plugging in the external loop disconnects the fixed loop. Some of these external loops are so flexible that they are ineffective unless opened to the correct area, or shape. In fact, many of them show an obvious optimum tuning area which the user should always try to obtain. Zenith, G. E., Philco and Sentinel are all using plug-in loops.

Airline 14BR573A

In order to secure the best performance from any superheterodyne the oscillator voltage injected into the converter should be pretty close to the recommended value. This is especially true in portables where a flat sensitivity curve is very necessary. In the usual oscillator circuit, as the condenser is gradually unmeshed towards the open, or high-frequency, position, the oscillator injection voltage increases. When this increase is too pronounced the converter is swamped, or deadened, which cuts down the conversion gain. Fig. 7 shows Ward's Airline Model 14BR573A which utilizes a 3,000-ohm resistor in

Fig. 11. RCA CV2 Electrifier.

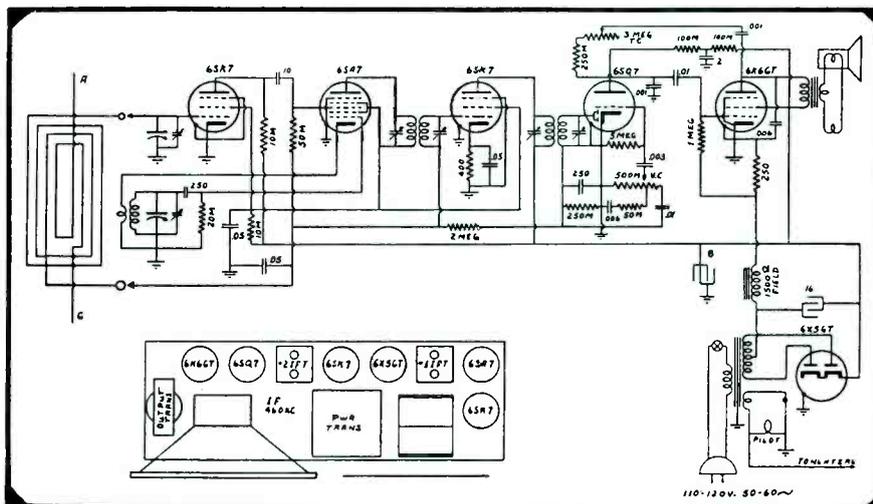
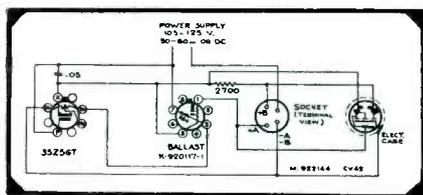


Fig. 12. Packard Bell 65A.

series with the plate tickler, or feedback coil, to limit the voltage rise. In other words, the resistor acts as an equalizer. This portable model also has an economizer consisting of a 20-ohm resistor in series with the A battery. Many portables are now featuring economizers the use of which is recommended when new A batteries are installed. The rule seems to be to allow about 5 ohms for every 1.5 volts of A battery for a 50 mil drain.

RCA 24BT1, 24BT2

Although dozens of portables seem to be standard in all respects electrically, we are lucky to pick a few here and there whose designers dared stray from the beaten path; which, of course, makes our lives more interesting.

RCA Victor's 24BT1 and 2, standard 4-tube battery table models, have a trick regenerative i-f circuit, shown in Fig. 8. The primary of the second i-f transformer is tapped for the B plus lead; the low end of the winding is connected directly to the screen grid. This resembles a Hartley oscillator circuit. The feedback, of course, is held to a value insufficient to permit oscillation. Other RCA portables have used this same system.

Air Chief S7405-9

No. S7405-9 Firestone Air Chief has the usual tube lineup with two 1N5GT i-f stages. However, the second i-f is resistance coupled to the diode detector. Plate and diode resistors are 25,000 and 50,000 ohms, respectively. (See Fig. 9.)

Philco 42-842, 42-843, 42-844

Philco battery-line Models 42-842, 42-843, 42-844 have 7 tubes including two Philco type 1LE3 triodes, one for oscillator, the other for converter. The method of coupling the oscillator to the converter is interesting. Using the familiar cathode-tap type Hartley oscillator with shunt feed, the oscillator fila-

ment is "hot"—at the oscillator frequency. The filament current is run through the coil from the low end to the tap. Then the filament is connected to the converter filament, in the usual series connection. However, the other leg of the converter filament must be choked in order that the r-f potential be maintained. Note the dual winding filament choke as well as the plate choke in Fig. 10.

RCA CV42

RCA Victor has a table model battery receiver (25BT2) that may be mated with a power unit for a-c, d-c operation. The power supply is known as the CV42 Electrifier, and is shown in Fig. 11. The Electrifier consists of a small steel chassis on which is mounted a 35Z5GT rectifier, ballast tube and electrolytic condenser. A line cord, cable socket and filter resistor complete the parts list. Power consumption is 22.5 watts.

Packard Bell 65A

Packard Bell Model 65A, a 6-tube a-c set, has a unique tone control. It is really a variable degenerative control consisting of a series feedback circuit from power amplifier plate to a-f amplifier plate. The control itself is a 3-meg rheostat which is in series with a 250,000 ohm fixed resistor and a 0.001-mfd condenser. See Fig. 12.

Truetone D1192

Plate to plate degeneration is featured in Truetone Model D1192, a 6-tube auto receiver. Here, a half meg resistor is connected from the driver plate directly to the first audio plate, serving as the voltage supply resistor as well. You might say, the degeneration is free. It seems odd that more sets don't take advantage of this circuit.

SOCKETS

By JOHN H. POTTS

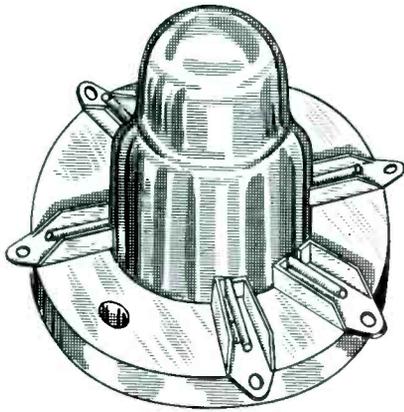
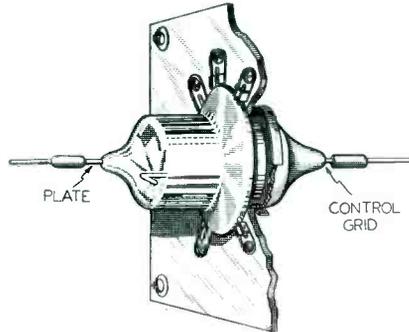


Fig. 3A. (Left.) Acorn tube and socket. The type shown can be used for either triode or pentode.

Fig. 3B. (Below.) Pentode type acorn tube and socket. Socket contains the screen by-pass condenser in its base.



SOCKETS have been pretty generally taken for granted. Usually they are mentioned only in connection with the tubes for which they were specifically designed, and then often merely the size designation and number of contacts are given. Meanwhile the sadly neglected tube receptacles have flourished and multiplied. No less than nine separate and distinct types of sockets are now in general use for receiver tubes alone. These sockets are available in various forms for each type, and various materials are employed in their manufacture. The characteristics of these materials influence the operation of the tube and circuit with which the socket is used, and careful selection of the proper socket for a given job often means the correction of obscure, recurrent troubles in radio apparatus.

The eleven principal socket types are shown in Fig. 1. The four, five, six, large and small seven, octal and loktal sockets have been on the market for quite some time and are therefore familiar to most of us. The miniature types—most of which are largely the result of the current popularity of personal receivers—are comparatively new and therefore merit more specific attention.

The largest of the miniatures—the Bantam Junior—is apparently a five-contact socket, but actually it accommodates either a five-prong or a six-prong tube, the center hole being used for the sixth prong. This socket was particularly designed for the Hytron HY113, HY115, and HY125 tubes, and others of similar construction.

Somewhat smaller than the Junior Bantam socket, the seven-contact miniature socket is designed for the new miniature tubes, types 1S4, 1S5, 1T4, 1R5. The five-contact miniature, smallest of all, is for the Raytheon types CK501, CK502, CK503, CK504 tubes. These are primarily hearing-aid tubes rather than receiver tubes, but they are

suitable for use in any small amplifier.

We drag in the tubes in the discussion of these miniature sockets because both are so new. There is one point which is of special importance in connection with these latter sockets; each has a center contact which is designed to be grounded. It matters not that no tube prong connects to the center contact; the purpose of the ground connection is to provide an electrostatic shield for the wiring and tube prongs. As can be seen, the sockets are so small that there is very little space between opposite contacts. Without interposing a ground, as shown in Fig. 2, coupling between opposite contacts may cause instability or oscillation in some circuits. This should be kept in mind when wiring-in replacements. Adjacent contacts are of course even closer to each other, but the arrangement of the tube pins is such that hot terminals are not side by side.

Fig. 2. The lug at the center of the miniature socket shown interposes a ground between the prongs.

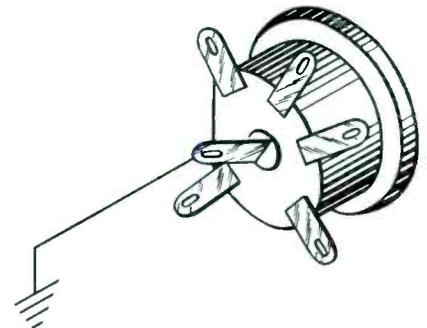
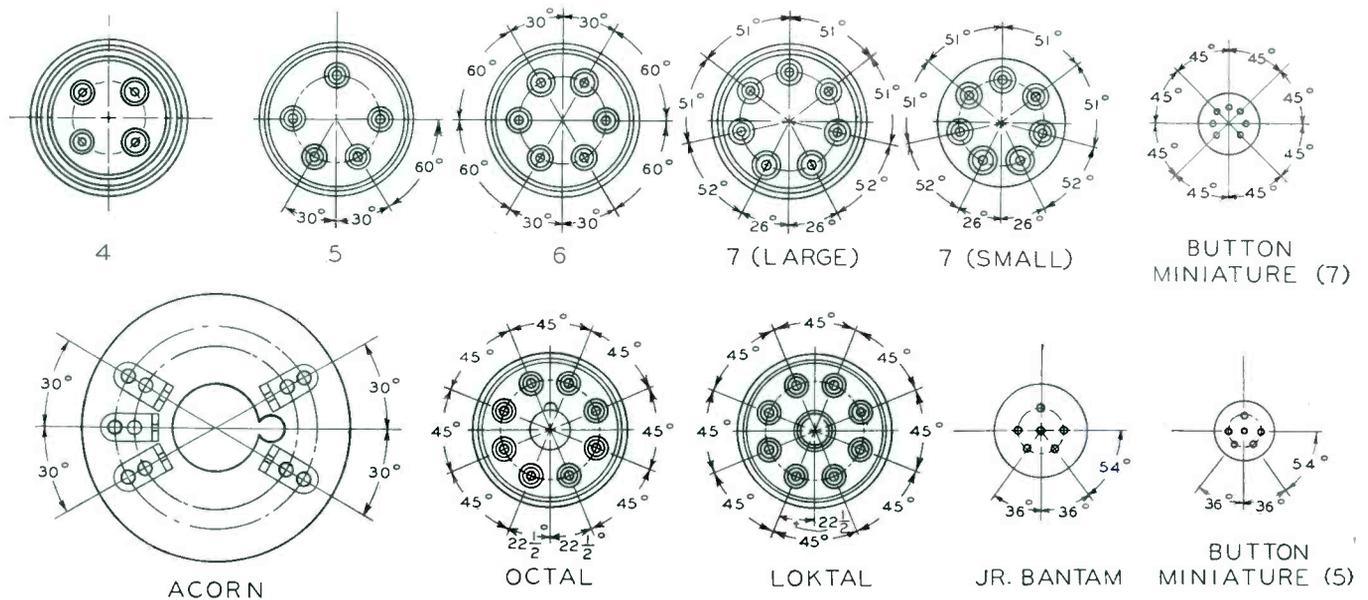


Fig. 1. The eleven principal tube socket types are shown in the illustration below.



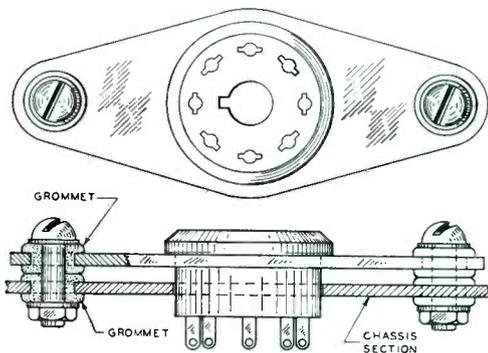
Acorn tubes and sockets have been on the market for some years, although they have never come into wide use in home receivers. There is a possibility however, that more and more receivers will be so equipped as commercial sets reach further into the ultra-high-frequency f-m and television ranges. It is just as well to become a little more familiar with this type of socket, if you are not already well acquainted with it.

Note that there are two varieties of acorn sockets, as illustrated in Figs. 3A and 3B. The socket in Fig. 3B appears to be similar to that of Fig. 3A, but actually it is suitable only for the pentode type of acorn tube, such as the 954, 956, etc., because contacts No. 3 and No. 4 are by-passed by built-in condensers, using mica insulation. This represents the ultimate in securing the shortest possible leads for bypassing purposes. Because contacts No. 3 and No. 4 correspond to the plate and grid, respectively, of the triode type of acorn tube, this socket with the built-in by-passes cannot be used with the triode.

In mounting the pentode socket, make certain that it is adequately insulated from its support, if it is mounted on metal. Special bushings are supplied for this purpose. In the event of short circuits in sets employing such a socket the first place to investigate is the socket mounting.

The acorn tube socket shown in Fig. 3A employs a plain base, without by-pass condensers, and may therefore be used with either type of acorn tube. Before we get off the subject, there is one point in connection with the pentode type of acorn tube which must be particularly emphasized. These tubes have their plate and grid terminals brought out to opposite ends of the tube, as illustrated. The plate terminal, you will note, is at the long end of the tube, while the grid is at the shorter end. Because it is possible to insert the tube in the socket so that either the long or short end fits into the plate or grid cap terminal, and because the tube may be ruined if the high plate voltage is applied to the grid, every precaution

Fig. 5. To prevent microphonics tube sockets can be mounted on grommets as shown.

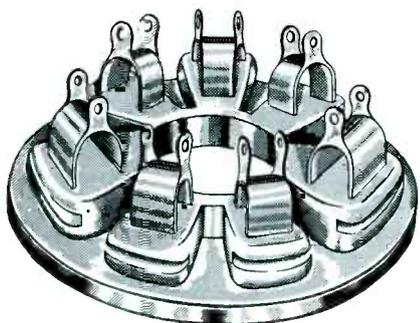


must be taken to make certain that this does not occur. One simple way of guarding against this error is to remember that "plate" is a longer word than "grid", and thus the plate terminal is associated with the longer portion of the tube body.

So much for the less familiar types of sockets. Now about the characteristics of sockets of all types, including those just discussed. Unquestionably the most important of these characteristics is what is known as the loss factor, which is indicative of the character of the insulating material used in the socket. An ideal socket would be one which, from an electrical standpoint, had such high insulation resistance at all frequencies and under all conditions of operation, that its effect upon the operation of the tube and circuit would be nil. *There is no such socket.*

This is true because the characteristics of practically all insulating materials change under different operating

Fig. 6. Lengthening the path among the several prongs of the tube socket improves the resistance between any two.



conditions. In some cases we may find that the resistance of an insulator may be extremely high at low frequencies, but decreases seriously at radio frequencies. Some materials are hygroscopic; that is they absorb water. In damp weather their resistance may become so low that they no longer function as insulators. Some materials cannot withstand high temperatures; not that their resistance changes, they simply melt. For example, perhaps the best of all insulators from the standpoint of constant high resistance over an extremely wide frequency range is ceresin wax. Naturally, no one would make a wax socket.

The choice of a socket for any given application, insofar as its electrical characteristics are concerned, should be based upon the ability of its insulating material to function at utmost efficiency under the conditions present in the apparatus and circuit in which it is to be used. Some insulating materials have extremely high resistivity and low loss factor used in dry air, but become unsatisfactory when the relative humidity is high. Usually when the resistance

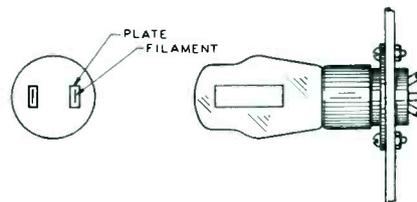
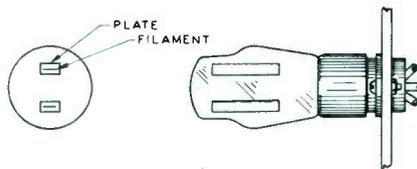


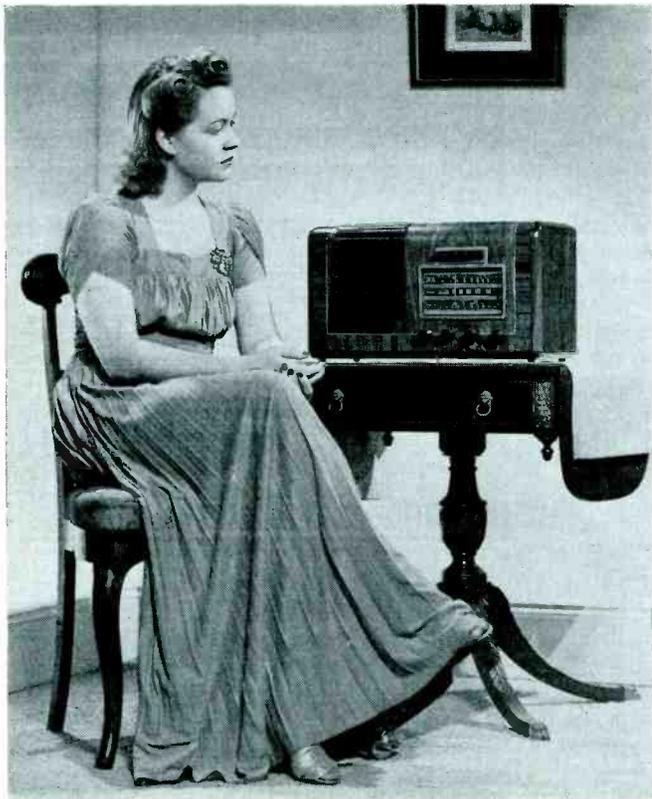
Fig. 4A (Above) and 4B (Below). When filament type tubes are mounted horizontally the filament must not be in a position to sag to the plate.



is given it is termed "volume resistivity", in referring to the resistance of the material in a straight line between two electrodes; this is the most favorable condition of measurement. Moisture, however, causes a great change in the effectiveness of the insulating material. Insofar as the volume resistivity is concerned, this will remain as before. The effect of the moisture appears only on the surface and renders many materials worthless for the purpose intended. The volume resistivity of any insulating material is useless as a criterion if the insulator absorbs moisture, even to a limited extent, since a relative humidity of 90% or more is by no means rare.

When the socket is to be used in a power-supply circuit, for instance, the resistance between the two high-voltage contacts (assuming that a full-wave rectifier is being used) should naturally be extremely high. But, further, there should be a barrier or gap between these two contacts in order to lengthen the path. The collection of dirt, moisture and other conducting media could very well render the socket insulation useless. In fact flashovers from this cause frequently occur, even in home sets where relatively low power-supply voltages are employed. In p-a apparatus, where the voltages are often higher, and the apparatus is frequently exposed to adverse weather conditions, even greater precautions are necessary. Since ceresin wax has very high insulation resistance under all conditions of operation, it has been found of value to coat sockets with this wax and thereby render them impervious to the effects of moisture. Further, it has been found that glass has serious surface leakage. By coating the bulbs of tubes with this wax, it is possible to eliminate leakage from this cause when the control grid is located at the top of the bulb. This stunt is also applicable to television rectifier tubes, in which the plate terminal is brought out

(Continued on page 32)



Radio and NATIONAL DEFENSE

By Lewis Winner

MARKET RESEARCH ENGINEER

When steel plate variables are used push buttons will either be absent entirely or will operate electrically or by means of a permeability tuning system.

receivers using steel condensers. For one thing, such receivers will not have mechanical push button tuning. The weight or torque of the plates prohibits this method. The operation of the tuning mechanism, in some instances, will require a bit more pressure. Of course, the metal itself is different in appearance and does not possess the light silvery coating of aluminum. With those condensers using aluminum end plates, which incidentally a majority will for some time to come, the comparison will be simple. The sizes of the sets does not determine what type of condenser is being used since the steel condensers are being made in all sizes, including ultra-midget.

ABOUT five months ago, the first of the priority orders directly affecting radio parts and receivers went into effect. Since then manufacturers have been exceedingly active in developing and producing a variety of substitute components. These have already found their place in receivers now on the dealer's shelves or about to be sent there within the next month or so. At the present writing approximately 75% of the receiver makers have included many of the substitute parts together with necessary electrical and physical changes. Of this group 15% have been quite thorough in their swing to substitutes. Others have not found it necessary to change completely, or change at all. This latter group have had a sufficient stock of parts on hand. They, too, will soon change over to substitutes.

The fact that the new variations, prompted by the present emergency, have not dulled purchase intent, but rather spirited acceptance, is quite evident from the recently compiled Federal Reserve statistics. In July, for instance, radio dealer sales in New York rose to 43% above July 1940. Outside Boston proper, the rise was 73%, with Boston itself offering an 18% increase. Other increases include Indianapolis with 51%; Los Angeles, 37% San Francisco, 66%, and Milwaukee with a surprise increase of 89%.

Probably the most important change that has been made in the new receiver involves the tuning system, which at the present time is divided between two camps of design. Many manufac-

turers have adopted the permeability method throughout the entire production, while others are using both variable condensers with steel plates in addition to the iron-core method of tuning. The belief is, at the present time, that inductive tuning will probably become standard next season, because of the increasing difficulties of procuring steel and brass; the latter, in some instances being used as tie bars.

The problems associated with steel condensers fortunately will not all have to be solved by the Service Man. Both the condenser and receiver manufacturer have accepted this duty. Thus microphonics, howling and other sundry odd effects, will seldom find a place in these new receivers. In addition to special treatment of the condenser material, mountings and placement of the condenser are receiving full attention. One manufacturer, having found it difficult to eliminate microphonics with the customary mounting for a steel plate condenser with aluminum end plates, had to resort to a special type of rubber as a mounting base. Still another, bothered by howling, had to change the entire coupling system. The greatest difficulties are encountered in tuning and band-spread systems in short-wave receivers. But, whatever they may be, the troubles are all being ironed out so that the Service Man won't have this headache; at least, not at the beginning. Any trouble that may follow later on in the life of the receiver can be cured with the customary treatments, familiar to Service Men.

It will be simple to identify most

There is one phase of servicing that will probably become quite a factor with the advent of the steel condensers, and that is, alignment. Although every effort is being made to eliminate the resiliency of the steel plates, it is impossible to destroy all of the spring. Accordingly, the tendency to shift back into original position will become quite a common factor. This point should be explained tactfully to the consumer. It isn't necessary to frighten the user of a receiver with such a condenser, but rather to advise as to the possibilities that such a condition may arise. For best results, therefore, a more frequent inspection may be suggested. It may be even wise to suggest a two or three time a year inspection to insure perfect results, with a low minimum charge as the incentive. Do not, however, overplay this role. Simply offer it as a suggestion with simple ethical explanations as the cue.

Receivers employing permeability tuning may also suffer from regeneration and microphonics due to the high-gain characteristics of the tuning unit. Extreme care in balancing should, therefore, be exercised here. In many models, both permeability and variable condensers are used, the permeability being used for push-button tuning and the variable condenser for manual tun-

ing. Thus the dual problem of balancing may be present. It will therefore be twice as important to watch this phase of the work.

In many of the new receivers, the trend toward loctal tubes, will be quite evident. Such a move has been prompted by the shortage of metal necessary for metal clad tubes and overall size of the glass tubes, which might prevail as a substitute. The loctal tubes seem to be the answer in most cases. These tubes, which in many instances are even smaller than the metal tubes, have extremely good internal and external shielding. There is a minimum of capacity between prongs, and the Gm is better. A greater variety of types are also available. To use this tube, it is only necessary to change the sockets. The circuits can remain the same, with probably slight modifications necessary to take care of possible varying tube characteristics. Because of the size of the tubes, and their suitable shielding properties, it will not be necessary to increase the size of the chassis—a problem that has caused plenty of worry. Of course, there may be other factors that will involve expansion of the small receivers, but such a move will not be as drastic as that which would have followed the use of larger glass tubes.

The chassis will, in most instances, be of either terne-plate or cold-rolled steel, rust-proofed by copper plating. The efficiency of the receiver is not affected by the use of either material, or any other form of steel plate that has thus far been accepted for use. The chassis itself does consume more metal than any other part or, in many instances, than the majority of parts in the receiver. Thus, it may become necessary to drastically change its pattern. Thus far, however, this move has not been found essential. Even for next season's equipment, this change seems unlikely. However, if the emergency demands we may see anything from self-mounting to mounting on thin coats of metal, either bonded, sprayed or sputtered on any acceptable sturdy base.

Electrolytic capacitors with metal containers, in some instances, have been shelved and replaced by cardboard types. No sacrifice in efficiency has been made. While it is true that the cardboard is hardly comparable to metal in many phases, these changes have been affected where the loss in results will be nil. It must be remembered that for a long time, a great many receivers used cardboard type condensers extensively, and with great satisfaction. Where the metal-clad unit was important, a necessary change in physical design of the receiver has been made in the newer receivers.

A problem concerning capacitors that

will require careful treatment is that of replacement of metal clad electrolytics by cardboard tube units. While many consumers will not require an explanation when such a change has been made, there will be those who will be curious. A suitable explanation will, of course, be necessary. This can take the form of a printed sticker, special letter, or message on the bill head. When replacing a metal clad unit, be sure that the voltage ratings of the cardboard unit are suitable to take care of surge. Be sure, too, that the unit is placed so, that a minimum degree of heat surrounds the condenser.

The paper capacitors have not been changed as yet. The larger lead-foil type condensers have not as yet been placed into receivers already shipped or about to be produced. Many months will elapse before these will be used in regular production. A definite increase in chassis size will be noticed when such a change will be made. As to the efficiency characteristics using such condensers, present tests show little variance. Another change in capacitors that has been introduced concerns the mica units, which are using polystyrene as the dielectric. This substitution has in no way, affected the efficiency. It will be well, though, to be certain to specify an exact duplicate of this item, when such duplication has to be made.

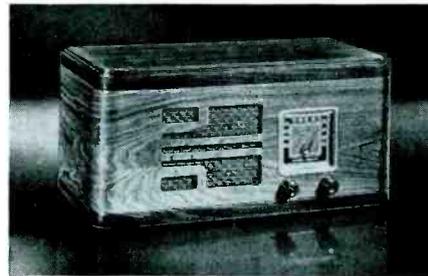
The shift to electrodynamics when permanent magnets were left hanging high and dry, by the curtailment of alnico, has introduced one of the few deficiencies of efficiency, in current receiver production. There will be less output on most receivers that have had to make this substitution. It is doubtful if the consumer will notice this, for sufficient power is present in most receivers. However, should an occasion arise during the repair of a receiver, where such a change has been made, and lack of power is the complaint, you may have to explain accordingly. Incidentally, recent allotments of alnico for use in permanent magnet speakers have made it possible to place p-m's back into sets that will be coming off the production line. The shortage of copper has also affected the electrodynamic production, so it will be a nip and tuck race, as to just which type of speaker will be used.

Speaking of the shortage of copper, we come to a serious problem that is prompting many changes in design and layout. Don't be surprised to see leads of iron and steel. These are being used, of course, in sections where there are no r-f currents to worry about. Direct contacts with lugs are also being introduced to save copper wire.

Mechanical tricks in mounting and tuning systems, to affect a saving in materials, will be found in abundance

in the new line of receivers. Gears and pulleys, are being replaced, for instance, with more direct methods of drive. In many instances, the tuning systems will actually be much simpler, with a minimum of parts to worry about. Bushings of brass are being replaced.

Thus far, both plastics and wood are



The attractive veneer effect obtained here with natural wood will either be simulated in plastic or film in the new sets.

being used with the customary degree of regularity in cabinet construction. The shortage of formaldehyde is effecting some of the cabinet construction, but there are so many other types of plastics that have wide acceptance that no problem should exist here. Even the recent priority ruling which covers the formaldehyde group, accordingly, will not seriously hamper cabinet construction. There have been difficulties in securing fancy veneers for wood cabinets. This has been caused by lack of skilled help and production facilities. Accordingly, a variety of methods have been adopted to offset this condition. Some of the methods used resort to the application of a film, with an attractive wood finish, to a gum wood base. This film is applied with a welding solution which eats into the laquer, that has already been sprayed onto the wood base. Thus the film that is firmly bonded onto the wood affords an appearance of the most attractive wood finish. With a special laquer that is sprayed on to this surface an unusual degree of toughness and resistance to scratches is maintained. Of course, this type of paneling requires little care or attention. If any polishing or repairing is required, be sure you inspect the panel carefully, so that the proper ingredients are used. The hardness of the simulated panel will quickly identify itself in a test.

According to the American Walnut Manufacturer's Association, there is sufficient walnut veneer in this country to take care of all demands until 1943. Thus, if the help and production will be made available, all the cabinets designed to take these veneers should be coming along. Approximately 100-million feet
(Continued on page 22)

PHASE INVERSION

By ROBERT G. HERZOG

EDITOR

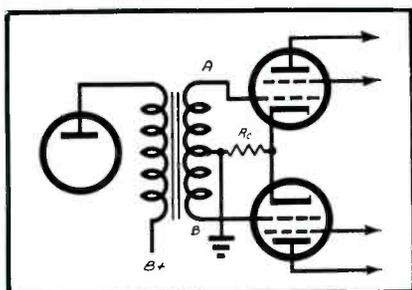


Fig. 1. Transformer with center-tapped secondary was earliest method of obtaining push-pull operating conditions.

IN THE earliest days of radio push-pull stages were almost unknown. Such stages were employed in telephone circuits, and even in the rare instances in which they were used for radio reproduction, telephone type tubes and circuits were utilized.

Early Methods

With the advent of special power tubes and a-c operation of receiver circuits, however, set builders sought to obtain the known advantages of push-pull operation,—the greater power handling capabilities,—the decreased distortion and hum.

In order to obtain push-pull operation certain requirements must be met. The signal to be amplified must be supplied to each branch of the push-pull circuit with the same amplitude and in opposite phase.

The earliest, and possibly the simplest, method made use of an input transformer with a center tapped secondary which supplies each grid with a signal of equal magnitude and opposite phase. (See Fig. 1.)

Fig. 6. Single tube can provide amplification and phase inversion through insertion of small resistance in screen circuit.

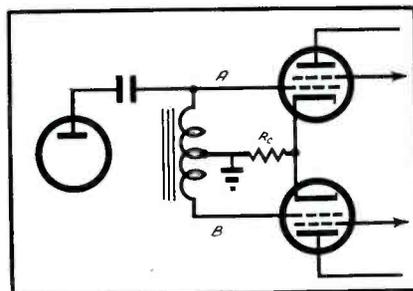
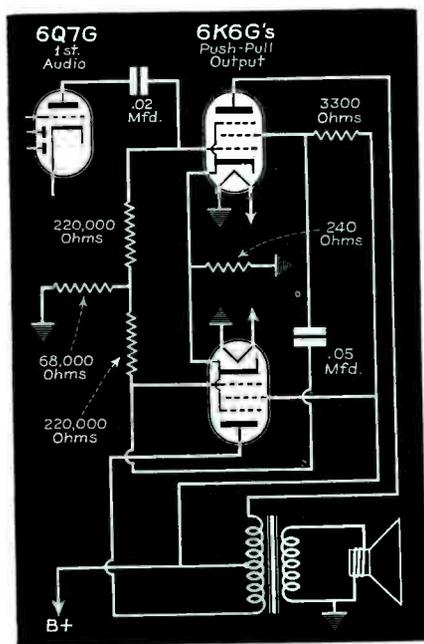


Fig. 2. Another simple method of obtaining push-pull conditions was by means of center-tapped choke.

Fig. 2 shows a similar arrangement which employs a center-tapped choke instead of the transformer. This latter method is commonly called "impedance coupling."

Resistance Coupling

An alternate method of obtaining push-pull operation is by resistance coupling and phase inversion. This method generally makes use of the fact that the signal at the output of an amplifier tube is exactly out of phase with the signal at the input. This method has many advantages and has practically eliminated the transformer and impedance coupled circuits in radio receiver and low-power amplifier design.

Chief among the advantages of the phase inverter, over the transformer method of obtaining the conditions for push-pull operation, are the ease with which the former method lends itself to resistance coupling and the consequent low cost and high-fidelity possibilities.

Because of the absence of coils and cores, resistance coupling not only reduces the cost of amplifier construction but also eliminates the possibility of hum coupling between amplifier and power-supply circuits. (See Fig. 3.)

Another advantage of resistance-coupled amplifiers, particularly favorable to construction of mobile and portable units, is their compactness and light weight.

Phase Inverters

Phase inverters may be divided into two classes: Those requiring two tubes and those requiring only one tube for proper phase inversion.

In early resistance-coupled phase in-

version circuits one grid of the push-pull stage was fed directly from the preceding tube which also fed an extra amplifier tube. This extra tube in turn fed the other grid of the push-pull stage. The signal as applied to the latter grid has passed through one more tube than the signal at the first grid and is consequently out of phase with it. In order

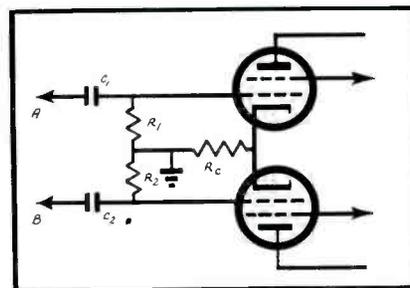


Fig. 3. Resistance coupling of push-pull stages provides noteworthy advantages.

to keep the signal voltages equal at both grids the extra or phase-inverter tube receives only the correct fraction of the full output of the preceding tube. (See Fig. 4.)

Another type of resistance-coupled push-pull amplifier has appeared in which the grid of one of the output tubes is connected in the usual manner to the preceding amplifier tube. The other output tube obtains its signal from the plate circuit of the first output tube. Upon analysis it becomes apparent that this is also a phase inversion circuit, one tube performing the dual role of output tube and phase inverter. This circuit enjoyed considerable popularity in early Loftin-White "direct-coupled" amplifiers.

Signal Divider

Fig. 5 represents an ordinary triode with resistor R1 connected between plate and B plus and resistor R2 between cathode return and B minus. Each resistor is approximately half the value of the plate resistor that would ordinarily be used with this tube in straight resistance coupling. R4 and C1 are the normal cathode bias resistor and condenser. If a signal is now applied between grid and cathode, it will be amplified and appear across each of the load resistors R1 and R2 with equal amplitude, but in exactly opposite phase. That this is so evident from

the following considerations. Since the current flowing through R1 and R2 is identical, and both resistances are equal in value, whatever voltages are developed across them must also be equal (providing of course that incidental capacities due to tube structure or wiring are kept to a negligible value, or are equalized). Also note that as the plate current decreases the voltage drop across both load resistors decreases. Accordingly the potential at the plate becomes more positive approaching B plus potential as a limit, while the potential at the cathode becomes less positive and approaches B minus potential as a limit. When the plate current increases, the opposite relations hold true, and plate and cathode approach each other in potential, with the theoretical limit that both can reach the voltage half way between B plus and B minus, or half the B supply voltage.

Perhaps a simpler way to look at the circuit is to regard the cathode-to-plate space as a variable resistance, Z, in series with R1 on one side and R2 on the other. As Z becomes large (due to the signal on the grid going further negative than the normal biasing volt-

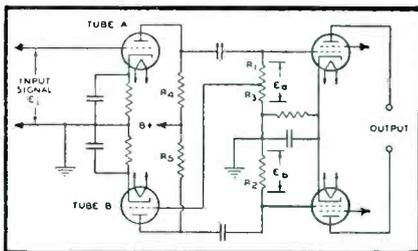


Fig. 4. Early methods of phase inversion employed tapped grid load resistor and extra tube.

age) the plate is crowded toward B-plus potential, while the cathode is crowded toward B minus. As Z becomes smaller (as is the case when the grid goes less negative) cathode and plate approach each other in potential. Evidently the potentials are always varying in the opposite directions and with equal magnitudes.

All that needs to be done now to obtain push-pull operation is to connect the plate and cathode to the respective grids of the next stage through coupling condensers, as indicated to the right of the dotted line in Fig. 5.

Screen Grid Inversion

A rather simple type of phase inversion appears in the Stewart-Warner Models 91-81, 98-81 and 910-81 receivers, and is also found in many of the 1940, '41 and '42 models of other manufacturers. In the Stewart-Warner circuit, shown in Fig. 6, a 3300-ohm resistor is inserted in series with the screen grid of one of the output pentodes. This means that part of the

audio output voltage is impressed across this resistor. The audio voltage is fed into the grid of the second output tube through a 0.05-mfd. coupling condenser. The value of the resistor has been chosen so that the audio voltage fed to the second output tube is equal to the incoming voltage to the first.

Since the signal fed to the second output tube has passed through one more tube than the signal fed to the first output tube, it is exactly out of phase with the latter. The outputs from the plates of both tubes can be fed to a common center tapped output transformer. The first output tube performs the dual function of output tube and phase inverter.

Self-Balancing Circuit

A self-balancing phase-inverter circuit that has been used more recently with good success is shown in Fig. 7. Resistor R_4 is connected between ground and point (a) and is common to the plate circuit of tube A and to the plate and grid circuits of tube B. Because of this common connection the magnitude of the signal voltage across R_3 , which is applied to the grid of tube B, depends on the difference between the values of output-signal currents of tubes A and B. Hence, the effects of variations in the value of R_3 or the effects of variations in the value of R_4 or the effects of possible variations between different tubes of the same type used in position B are very small. The circuit is degenerative, because a portion of the output of tube B is fed back to the input of tube B. Hence, the stability that is characteristic of degenerative amplifiers is obtained. It should be noted that the gain measured from the

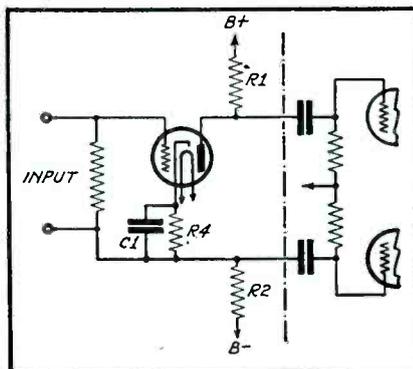


Fig. 5. Signal divider provides simple phase inverter with high-fidelity possibilities.

input (E_i) to tube A to the output (E_o) from the transformer's primary is only a few percent less than that obtained from the circuit of Fig. 4.

The ratio E_a/E_b cannot be made equal to unity with this self-balancing circuit by any adjustment of the value of R_3 , because of the degenerative action.

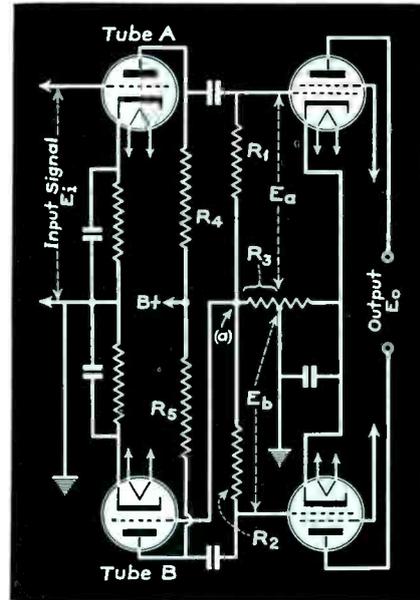


Fig. 7. This inexpensive self-balancing phase inverter permits wide degree of tolerance in circuit components.

However, with the values of resistors ordinarily employed in this circuit, E_a/E_b is approximately 1.1. A 10 percent unbalance in the push-pull output stage of a receiver can easily be tolerated. An analysis of the circuit shows that, as the gain of tube B is increased, the ratio E_a/E_b approaches unity.

Values and tolerances of resistors R_1 , R_2 , R_3 , and R_5 that are usually employed in the circuit of Fig. 4 may be used in the self-balancing circuit.

Tests were conducted in an amplifier using a 6Q7 (tube A), a 6F5 (tube B), and two 6V6's connected in push-pull in the output stage. The amplifier was connected as shown in Fig. 7. The values of R_1 , R_2 , R_3 , and R_5 were 0.25 megohm each, the value of R_4 was varied and corresponding values of E_i , E_a , and E_b were determined at a power output of 1 watt. The following table shows the performance of the circuit for two values of R_4 , 0.05 meg and 0.25 meg:

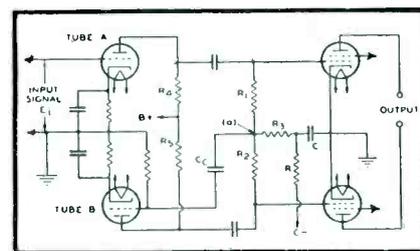
R_4 (meg)	E_i (mv)	E_a (volts)	E_b (volts)	E_a/E_b
0.05	83	3.35	3.17	1.06
0.25	81	3.30	3.30	1*

Note: Tolerance of resistors used throughout the amplifier was $\pm 10\%$.

*The measured value was slightly less than 1.

It will be noted that the change in
(Continued on page 34)

Fig. 8. Self-balanced phase inverter lends itself to fixed-bias arrangements.



New Products . . .

RECORDISC DISPLAY

The Recordisc Corp., 395 Broadway, New York City, has prepared an attrac-



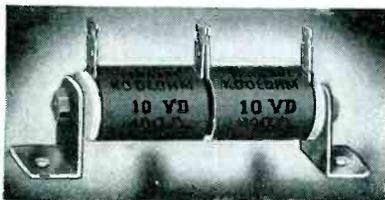
tive display fixture of wood construction, patterned to hold 3 sizes of home recording blanks as well as consumer literature. A double-wing poster in the background is devoted to the first of the recording promotion contests. This poster is interchangeable and will be replaced periodically with other display material. The display complete measures 20"x24"x7".

STOCK-BOY CABINET

A new olive green enameled metal cabinet base for radio tube stocks with provision for adding extra shelves is being made available to Service Men by the radio tube division of the Hygrade Sylvania Corp., 500 Fifth Ave., New York City. The base unit measures 34" by 22½" high by 12" deep, has two shelves and a bottom kick plate. The shelf "add-a-unit" measures 34" by 9¾" high by 12" deep. Each shelf will hold from 70 to 140 tubes, one row deep depending on carton size, or as many as 420 tubes by employing the full capacity of the shelf.

INDIVIDUAL KOOLOHMS

Type VD Koolohm resistors provide a handy answer to the problem of making up tapped resistors with any number of 10- or 15-watt sections of any required resistance values. Koolohms are equipped with ball and recess interlock feature which prevents turning and automatically connects the units electrically in series when mounted on a threaded steel rod provided. Mounting feet and ceramic end-spacers are also available. Several resistor sections can be connected in series and be mounted on the same tie rod and mounting feet with a similar assembly insulated from it electrically by means of ceramic spacers. Overall length of the 10-watt type VD Koolohm is 1½" and diameter is ⅝". The 15-watt



sections are 1 9/16" long x 11/16" diameter. The complete Koolohm catalog will be sent upon request. Sprague Specialties Co., North Adams, Mass.

NEEDLE SHARPENER

Duotone Co., Inc., 799 Broadway, New York City, have announced a new cactus



needle sharpener which utilizes the turntable of the phonograph motor for drive power.

UNIDYNE CARDIOID

Shure Brothers, 225 W. Huron St., Chicago announce that their Unidyne dynamic cardioid microphone is now available in a series of voice models for police and commercial radio, as well as for public address, paging, broadcasting and recording. The units are housed in modern case design with



satin chrome finish. Swivel head with standard ⅝"-27 thread for stand mounting, and built-in cable connector are furnished. Three models are available.

CABINET REPAIR KIT

All of the essentials for a satisfactory repair job are included in the General



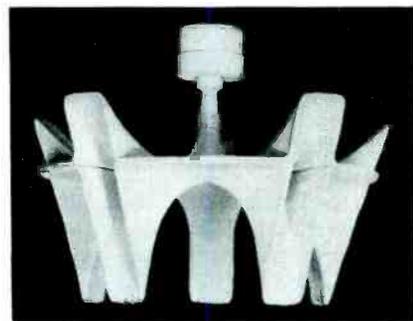
Cement 900 Master Deluxe Cabinet Repair Kit, it is said. Spirit stains, varnishes, and enamels are included. Wood cabinets, plastic cabinets, knobs, refrigerators, appliances, etc., can be repaired. General Cement Manufacturing Co., Rockford Ill.

MOLDED CARBON RESISTORS

Aerovox Corp., New Bedford, Mass., has announced smaller insulated molded carbon resistors to the trade. The new ½ and 1 watt units are considerably smaller than previous units bearing the same wattage ratings and type numbers. The size reduction is due to improvements in the resistance elements, and in no way reduces the load-handling properties of the units, it is said.

SPEAKER BAFFLE

A loudspeaker baffle projecting sound uniformly over a 360° area through five evenly spaced apertures arranged in a horizontal plane has been announced by George Ewald, manager of the Commercial Sound Division of the RCA Manufacturing Co., Inc., Camden, N. J., for use in paging and



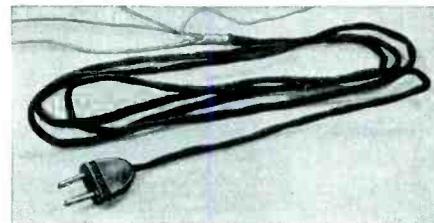
announcing in industrial plants. This new baffle, which operates from a single loudspeaker mechanism, is constructed of non-metallic non-vibratory acoustic material especially developed for this purpose. Its use releases a large quantity of aluminum, originally specified for the unit, for National Defense. The baffle is designed for operation with 5-, 10-, 12-, or 15-watt loudspeaker mechanisms, all of which are interchangeable. Special mounting brackets are provided for installation. It is 20" high, 20" deep and weighs 10 pounds.

MOLDED CONDENSERS

A new midget or "postage stamp" molded-in-bakelite mica capacitor, Type 1478, is announced by Aerovox Corp., New Bedford, Mass. This capacitor is an elongated version of the types heretofore offered in the "postage stamp" series—its body measurements are 1 1/16" long by 7/16" wide by 3/16" thick. Hot-tinned brass wire leads provide the connections. The same molded casing is used for Type 1479 with silvered mica section. Both types provide for higher capacity values at 500 d-c volt working. The standard mica Type 1478 is available in from 0.0001 to 0.002 mfd., while the silvered mica Type 1479 comes in 0.0001 to 0.001 mfd. capacity.

RESISTOR POWER CORDS

Despite the general and growing shortage of resistor power cords required as replacements for a-c, d-c radio set repairs, a dependable and adequate supply of such items is still claimed by Clarostat Manufacturing Co., 285-7 N. 6th St., Brooklyn, N. Y. A choice is offered as well as several universal types serving a wide variety of sets. These cords have three conductors enclosed in heavy braided covering, with a tie cord at the chassis end and a molded rubber plug at the other. The three conductors furnish



the necessary plate voltages for the rectifier tube and the reduced voltages for the tube filaments.

RADIART VIBRATORS

"come through" in the toughest test of VIBRATOR DEPENDABILITY

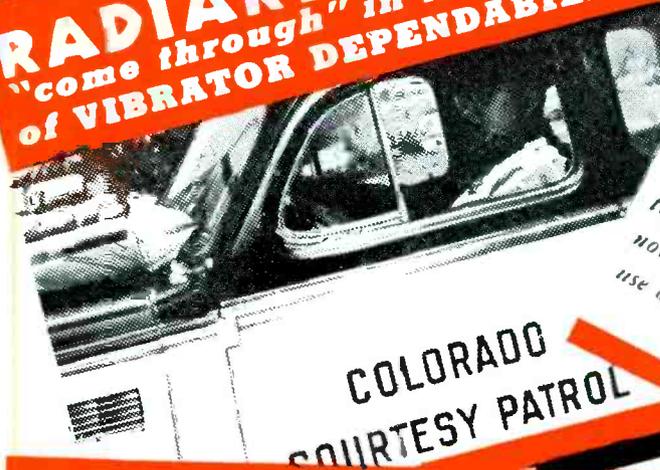
KANSAS CITY POLICE DEPARTMENT writes: "In 50 police cruiser cars on duty 24 hours a day, we have had very few replacements. Since replacing motor-generator units with Radiart Vibrators we've been very pleased"



Servicemen, too, report:

NO COMEBACKS when **RADIART VIBRATORS** are used!

RADIART VIBRATORS "come through" in the toughest test of VIBRATOR DEPENDABILITY



Lieut. A. A. KIRCHNER Chief Engineer GRAND RAPIDS POLICE RADIO BUREAU:

"We are well satisfied with Antennae, Vpowers and Vibrators of Radiart manufacture. Difficulties heretofore experienced have now been corrected with the use of Radiart Products."

RADIART VIBRATORS "come through" in the toughest test of VIBRATOR DEPENDABILITY

RADIART VIBRATORS "come through" in the toughest test of VIBRATOR DEPENDABILITY

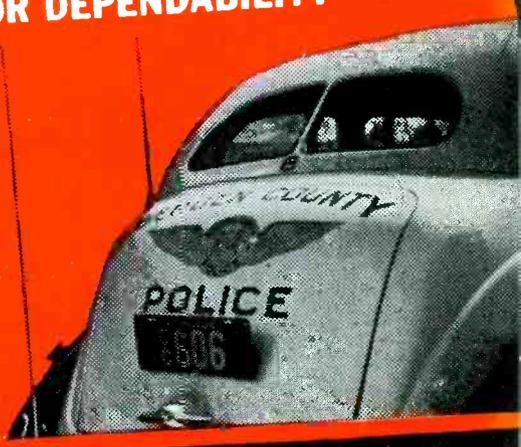
"We consider Radiart Vibrators exceptionally suitable for police squad car service." Supt. GINTHER, WPDS, St. Paul Police Radio, which has records of Radiart Vibrators in operation after 3000 hours.



RADIART VIBRATORS "come through" in the toughest test of VIBRATOR DEPENDABILITY

"In cars operated 24 hours daily, we have encountered no trouble for at least a year."

says J. STANLEY O'NEIL POLICE RADIO SPECIALIST Servicing police cars in New Jersey



- and **RADIART AERIALS** are a favorite with servicemen, because of easy installation and perfect performance. THE RADIART CORP. Cleveland, O.

RADIART VIBRATORS are EXACT DUPLICATE!



Servicing the RCA "Magic Brain" AUTOMATIC RECORD CHANGER

Record Shelf Timing

Records fail to drop at proper time: Place a 10-inch record on the shelves so that it contacts the front and rear record separator posts. With the changer out-of-cycle loosen the set screws (B) and turn the record separator shaft until the record separating knife is $\frac{3}{32}$ -inch away from the record edge. Position set screw collar bottom edge $1\frac{3}{32}$ -inch above the bottom plate. Tighten the zinc-plated screw, run through the cycle several times as a check, then tighten the copper-plated screw. Repeat the adjustment on the rear separating knife.

Tone Arm Position

Sapphire fails to land at proper point: Place a 10-inch record on the turntable and rotate the changer through cycle until the sapphire is just ready to land. Place a 0.005 feeler between the shoulder on the tone-arm pivot shaft and its ball bearing as shown. Loosen the set screws (C). Make certain that the tone arm return lever is against the record separator shaft and the pin on the trip lever is against the tone arm return lever. Move the tone arm to the point of proper landing, be sure the set screw collar is up against the tone arm pivot shaft bushing, then tighten the zinc-plated screw. Run through cycle several times as a check, then tighten the copper-plated screw. Remove feeler. The 12-inch landing is then automatically correct.

Spindle

Spindle fails to pick up the record or turntable fails to drop the record: Remove the counter-balance spring. Loosen set screws. Centrally locate the turntable with respect to the front and rear edges of the motorboard slot by sliding the turntable pivot shaft in its bearings. Mesh the sector and segment gears as shown. Holding them in this position, move the turntable assembly until the turntable is level. Tighten screws.

Turntable Vertical Position

Turntable does not return to proper position: Loosen turntable set screws. Set the counterweight as shown in accompanying illustration. Check to see that there is clearance between the two set screw collars and the turntable pivot shaft bearing. Tighten the zinc-plated screw, run through cycle several times as a check, then tighten the copper-plated screw. Replace the counter-balance spring.

Tone Arm Height

Sapphire fails to clear record on turntable: Rotate the changer through cycle until the tone arm has moved into its cycle position. Adjust the screw (F) until the sapphires are equidistant from the two sides of the record and tighten the locknut.

Record Post Spacing

Records will not fit properly on the three record posts: Turn the record support to the 10-inch position. Loosen the set screws "A." Move the front record separate post until its shaft is $\frac{1}{64}$ from the end of the motorboard slot. Turn the belt drum to take up the slack in the belt and tighten the zinc-plated screw, being certain to maintain the $\frac{1}{64}$ -inch spacing. Repeat the adjustment on the rear separator post. Check by placing a 10-inch record on the shelves posts and then tighten the copper-plated screws. Care should be taken to leave a small vertical clearance between the belt drum and the motorboard. The 12-inch position is automatically maintained.

Top Sapphire Pressure

Top sapphire jumps grooves or pushes too hard against record: Adjust the screw (G) in the rear of the tone arm until the pressure measured at the point of the top sapphire is approximately one ounce. A suggested means of making this check is shown in the accompanying sketch.

Bottom Sapphire Pressure

Bottom sapphire jumps grooves or pushes too hard against record: Adjust the eye screw and locknut (H) as shown until the pressure measured at the point of the bottom sapphire is approximately one ounce. With no-load setting of scale adjusted to read two ounces, bottom pickup should be pushed away from record by pressing down on it with the scale. Sapphire pressure should be adjusted to a scale reading of one ounce.

Feed-In Spring

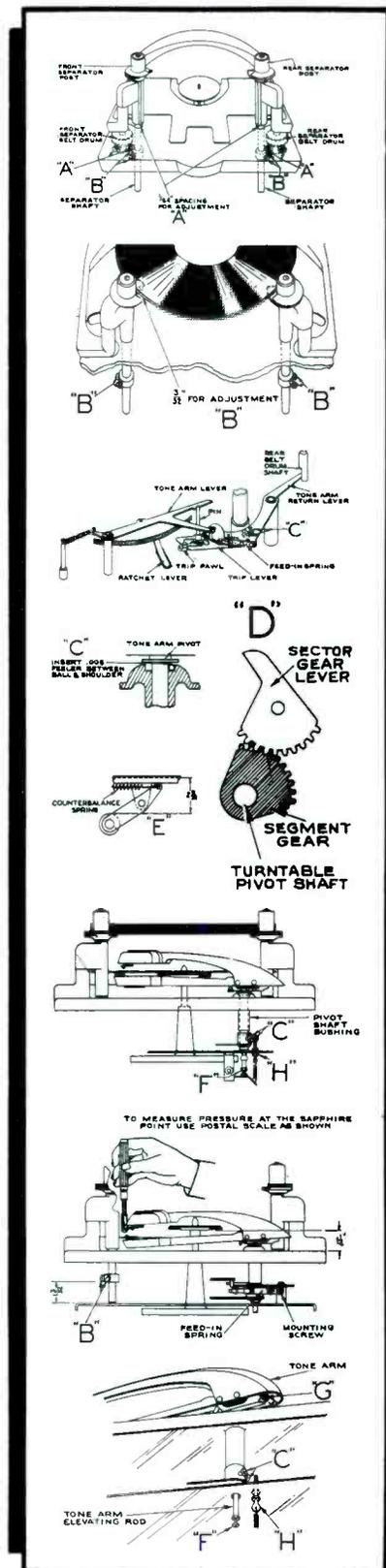
Sapphire lands properly but fails to feed into music grooves or feeds in too fast and jumps several grooves: Adjust the feed-in spring by means of the screw (I) until the sapphire feeds in smoothly without jumping grooves. Check to see that the spring clears the trip lever pawl and that the mounting screw is tight. Be sure to keep the viscoloid free from grease.

Turntable Height

Turntable too high or too low: Loosen locknut and adjust the turntable bottom bearing screw until the bottom of the turntable is above the motorboard. Tighten the locknut.

Reversing Switch Position

Motor fails to reverse at proper time: Loosen the reversing switch mounting screws. Rotate the changer through cycle until the main cam has forced the trip lever to its outermost position. Move the switch until the reversing cam has fully compressed the switch against the spring. Lock in position with the mounting screws.



WHERE YOU FIND
 NATIONAL UNION
 YOU FIND
 Better RADIO SERVICE



Granada Radio Service, 900 E. 14th St., Oakland, California
 (Mr. Fred Rock and assistant)

The National Union Equipment program has made it possible for me to have the best equipped shop in town.

NATIONAL UNION invites all radio service dealers to enjoy the benefits of the **N. U. SHOP EQUIPMENT PLAN**. The latest in tube testers and test equipment are available to you, immediate delivery. More than 50,000 completed deals prove the success of this plan. Investigate Now.

ADDITIONAL PRODUCTS . . .

PANEL LAMPS
 EXCITER LAMPS
 PHOTO ELECTRIC CELLS
 DRY BATTERIES

CATHODE RAY TUBES
 SOUND EQUIPMENT
 SOUND ACCESSORIES
 FLASH LIGHT BULBS

Ask Your N.U. Distributor or Write

NATIONAL UNION RADIO Corp.

57 STATE STREET
 NEWARK, N. J.



Radio Tubes

. . . More Radio Service Dealers use National Union than any other make . . . there must be a good reason why.



Condensers

Complete line . . . Same Super Quality as found in N. U. Tubes. Just try them.



Sound Extra Tubes

. . . a line of heavy duty radio tubes for sound work . . . an exclusive N. U. development.



Batteries

. . . The only line of Dry Batteries sold exclusively to the radio Trade . . . You can make more money.



Echophone EC3

COMMUNICATIONS RECEIVER

By Holmes Webster

Ample space is given the components of the EC3.

THE ECHOPHONE "Commercial" Model EC3 has been designed with ham communication service foremost in mind. It has, however, also found wide distribution among the general public as an economical means for direct reception of foreign short-wave war news—a means which provides a number of special circuit features required in critical short-wave reception but not found in the usual home-type of multi-band receiver.

Public and ham acceptance have also been influenced by the provision for a-c, d-c line operation, a provision which is quite unusual among communications type receivers. So far as is known this is the first communications receiver to incorporate this feature along with such others as electrical band-spread, automatic noise limiting, crystal filter, 4-position selectivity, continuous tuning range from 545 kc to 30.5 mc, headphone jack, beat-frequency oscillator with variable pitch adjustment, crystal phasing control for heterodyne suppression, etc.

As shown in the accompanying diagram, eight tubes are employed plus a plug-in resistor tube which includes pilot-light shunts. These tubes include a 6SG7 tuned preselector stage on all ranges; 6K8 r-f, oscillator and mixer; 6SK7 first i-f; 6SK7 second i-f; 6H6 detector, avc, automatic noise limiter and monitoring rectifier; 6SC7 beat-frequency oscillator, first audio stage and c-w monitoring oscillator; 25L6GT output stage; 25Z6 rectifier.

The tuning range is broken up into three bands: 550 to 2100 kc; 2.1 to 8.1 mc; and 8 to 30.5 mc. These bands are calibrated in frequency on the semi-circular scales traversed by the rotating pointer on the upper part of the combination dial. The lower part is the entirely separate band-spread tuning dial of the slide-rule type. This latter is controlled by the separate band-spread tuning knob and fly-wheel mechanism.

The band-spread is of the electrical type and may be used for critical tuning in any portion of the receiver's entire range. For this purpose its scales include a conventional 0 to 100 logging calibration. In addition, there are individually calibrated scales for the 80, 40, 20 and 10-meter amateur bands.

Automatic volume control voltage is applied to the r-f and i-f stages as well as to the mixer but may be eliminated completely by operating the bfo switch to the "on" position. Thus for c-w reception or for location of weak modulated signals by the heterodyne-beat method the full sensitivity of the receiver becomes available automatically but may be varied to any desired degree by means of the manual r-f gain control.

The 4-position selectivity switch provides two degrees of i-f selectivity without the crystal and two more with the crystal. The former two are obtained by means of varying the i-f coupling in two steps, the latter by switched changes which provide for broad and sharp functioning of the crystal circuit.

The 6H6 is made to do a man-sized job by a 5-gang switch which enables it to serve not only as detector, automatic volume control and automatic noise limiter but as monitoring rectifier as well. The 5-gang switch, controlled from the front panel as the conventional "send-receive" switch, is made unique by the addition of the third or "monitoring" position. The first section of the diode performs the detection and the avc functions. The automatic noise limiting is accomplished when strong noise impulses cause the second diode section to become conductive, shorting out the diode load for the duration of the individual noise impulse through the relatively large capacity C_{20} . During this short-out period no signal reaches the audio system. The duration of this action is so short, however, that the ear does not perceive the interruption of the signal.

The functioning of the c-w monitoring circuit is interesting because it is novel so far as modern receiver circuits are concerned. Its purpose is to enable the ham to monitor his own c-w transmissions without the necessity for keeping his receiver in the receive position while transmitting. As a matter of fact it would be useless to do this anyway because the close proximity to his transmitter would probably result in severe overloading and complete blocking of the receiver circuits.

In the monitoring position of the "send-receive" switch all stages except the two audio amplifiers are made inoperative by removal of their plate voltage. The signal of the transmitter is picked up by a short length of wire connected to the "monitor pick-up terminal" at the rear of the chassis. This signal is rectified in the second section of the 6H6. The rectified output serves as the plate voltage for one section of the 6SC7 which, through the medium of the audio coil L2, functions as an audio oscillator. Its audible tone is fed to the speaker (or headphones) through the second section of the 6SC7 and the 25L6GT. Obviously the audio oscillator functions only when the transmitter key is depressed and the tone at the loudspeaker is therefore heard in the form of dots and dashes corresponding to those of the transmitter.

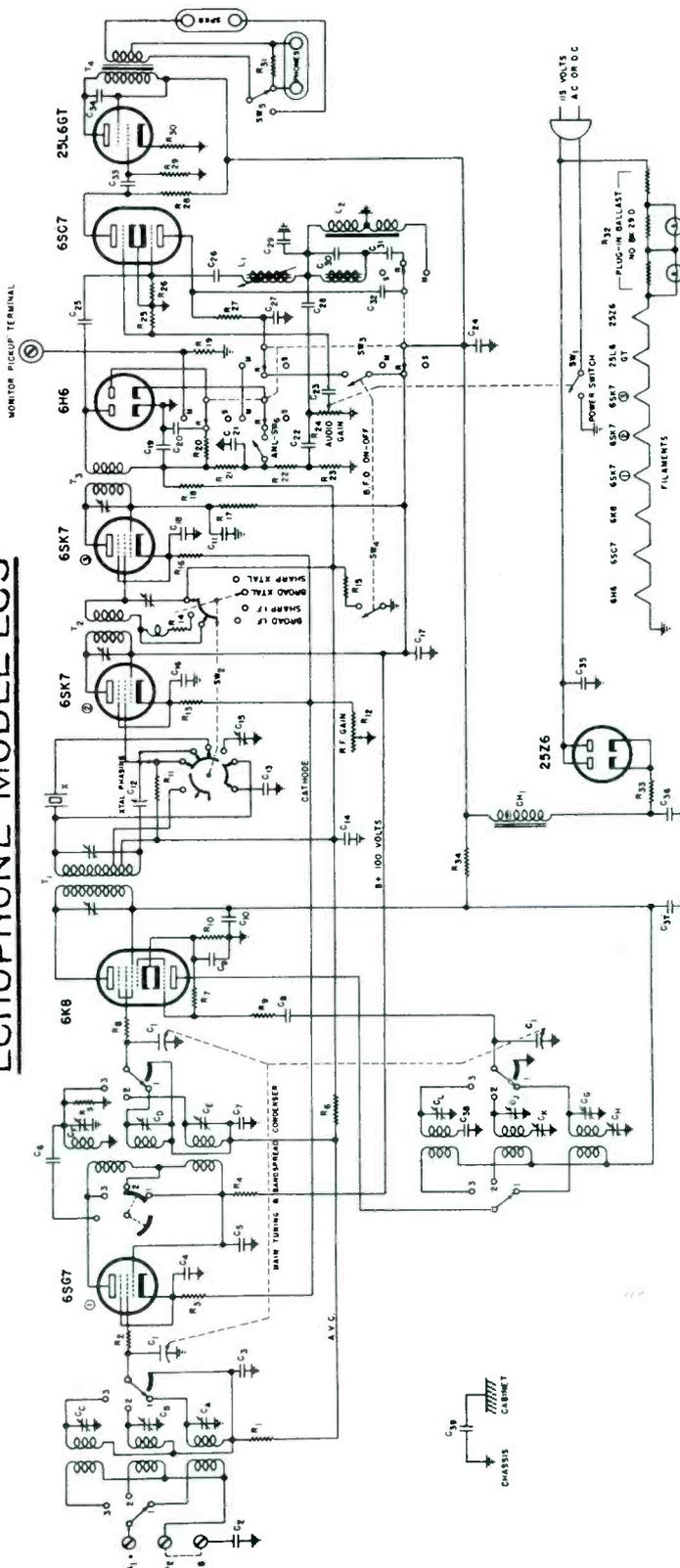
This arrangement is an ingenious one



An external speaker is used with the Echophone EC3.

which eliminates the need for a separate and usually critical monitor in c-w stations. A little experimentation determines the correct length of wire to use for the pick-up to provide the right amount of coupling to the transmitter. Too much pick-up will result in a raspy

ECHOPHONE - MODEL EC3



C1	Main Tuning & Bandspread	400	.01 mfd	400	50 mmf	400	Mica	RI	50,000	R18	2 meg
2		200	.05 mfd	200	.01 mfd	400	Paper	2	30	19	4,000
3		200	.05 mfd	200	.005 mfd	400	Paper	3	200	20	1 meg
4		200	.05 mfd	200	40 mfd	150	Paper	4	1,000	21	100,000
5		200	.02 mfd	200	Twisted Leads	200	Paper	5	10,000	22	250,000
6		200	5-6½ mmf	200	.02 mfd	200	Ceramic	6	50,000	23	250,000
7		200	.05 mfd	200	.02 mfd	200	Paper	7	50,000	24	500,000
8		200	.25 mmf	200	.0001 mfd	200	Paper	8	30	25	5 meg
9		200	.05 mfd	200	.0054 mfd	200	Mica	9	100	26	50,000
10		200	.05 mfd	200	.0005 mfd	400	Paper	10	300	27	10,000
11		200	.02 mfd	200	.0005 mfd	600	Paper	11	1 meg	28	250,000
12		Variable	.25 mmf	200	25 mmf	400	Mica	12	10,000	29	500,000
13		200	4-5 mmf	200	.05 mfd	400	Paper	13	400	30	150
14		200	.02 mfd	200	.02 mfd	400	Paper	14	200	31	300
15		Variable	.02 mfd	200	.05 mfd	150	Mica	15	100	32	Ballast Resistor
16		200	.05 mfd	200	30 mfd	150	Paper	16	300	33	15
17		200	.25 mfd	200	30 mfd	200	Paper	17	1,000	34	1,000
18		200	.05 mfd	200	.0054 mfd	200	Paper				
19		200	.05 mfd	200	.0054 mfd	200	Mica				
20		200	.05 mfd	200	.25 mfd	200	Paper				

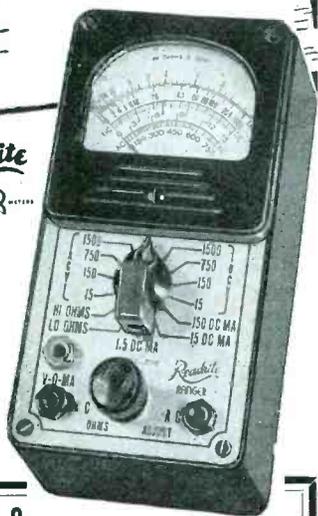
A "LAB" to fit your pocket

Readrite
RANGER

MODEL 739

\$10.89

Dealer Net Price



A. C. D. C. VOLT-OHM-MILLIAMMETER

Pocket Volt - Ohm - Milliammeter with Selector Switch. Molded Case. Precision 3-Inch Meter with 2 Genuine Sapphire Jewel Bearings. AC and DC Volts 0-15-150-750-1500; DC MA, 0-1-15-150; High and Low Ohm Scales. Dealer Net Price, including all accessories, \$10.89 MODEL 739. DC Pocket Volt-Ohm Milliammeter. Dealer Net Price \$8.25

WRITE FOR CATALOG
Section 917 College Drive

READRITE METER WORKS, Bluffton, Ohio

tone but this is easily avoided by reducing the pick-up length.

The cabinet construction employed in the EC3 simplifies the problem of alignment and servicing. The ends and front of the steel cabinet are shaped from a single piece of metal and the chassis is permanently suspended within this framework by means of insulated mountings which isolate the cabinet from the line. By removing the screws which attach the top and bottom to the cabinet, these and the back are removed and both sides of the chassis become accessible for alignment or any other servicing operations. This is illustrated in the inside view shown herewith. Not the least advantageous feature of this arrangement is that the live chassis is not allowed to come in contact with the bench, idle tools, etc., during servicing operations. Stood on one end, both the top and bottom of the chassis can be worked on with a minimum of handling.

RADIO AND NATIONAL DEFENSE

(Continued from page 15)

of walnut veneers, which is a third or better of the total cabinet woods veneer inventory, has been made available.

Whereas in the past, it has been customary to replace a defective part in

a motor, mechanical tuner or speaker, with a complete assembly; it will now be necessary to repair these pieces. Manufacturers of these parts are finding it more difficult, day by day, to maintain production of these items which require so many metals now on the full priority or critical list. Thus, they suggest, that time and money, too, will be saved, if every effort is made to repair these items, rather than ordering new ones. This, of course, does not apply to such parts as condensers, resistors, or the like, which must be replaced, if defective. But there are many parts in a receiver that have simple mechanical properties and can thus be repaired. It may be even wise to invest in some simple shop machines to take care of these repairs, as many have been doing for quite a time. With such a shop, it would also possible to serve other repair men who, might not be in a position to purchase such equipment.

As a result of these changes, servicing technique has had to change, involving in some instances extensive preparation and operation. But, as many Service Men have already said, the efforts have and will continue to be, more than worth while, assisting, as it does, in building more business, improving the standing of the Service Man, and lending a hand, too, in furthering the efforts of national defense.

Greater Production per Man Hour!

WITH THESE New RIDER BOOKS

EVERY one of these Rider Books, released during the past ten months, is on a "live" subject. Every one is designed to increase your efficiency—enable you to handle more jobs in less time—make more money. If you need additional help to turn out the work you are getting—you need these books. Order them NOW!



Aligning Philcos, Vol. II
Covers Philcos from 1937 to 1941 inclusive. Includes remote control and loop sets. 200 pages. \$1.60.



Frequency Modulation
Explains F-M transmission, as well as discussing the new F-M sets. 136 pages. \$1.00.



Oscillator at Work
Protect your investment in your present or future oscillator equipment by reading this book. 256 pages. \$1.50.



Vacuum Tube Voltmeter
Covers practical aspects and underlying principles of various types of v.t. voltmeters. 179 pages. \$1.50.



Meter at Work
Get the most from your present meters. Buy the proper ones. Read this book. 152 pages. \$1.25.



Abridged Rider Manual—Vol. I to V
2000 pages—\$12.50

If you want a complete set of Rider Manuals, but can't afford the early volumes, this Abridged Vol. I to V (although it doesn't contain ALL the information in the individual volumes I to V) covers the most widely sold sets made between 1930 and 1935



Rider Manual Volume XII
Released this past Spring, and containing "Clarified Schematics", this volume covers sets now coming to your bench. Volumes XII to VII—covering sets between 1936 and 1941—\$10.00 each. Individual Volumes VI to I—covering sets between 1920 and 1936—\$7.50 each.

OTHER RIDER BOOKS YOU NEED Now!

SERVING BY SIGNAL TRACING—360
pages—188 illustrations—\$2.00.
Also available in a Spanish edition of 385 pages at \$3.50.

AUTOMATIC FREQUENCY CONTROL SYSTEMS, 143 pages, 102 illustrations—\$1.00.

SERVING RECEIVERS BY MEANS OF RESISTANCE MEASUREMENT
203 pages, 94 illustrations, \$1

THE CATHODE RAY TUBE AT WORK
338 pages, 460 illustrations, \$2.50

JOHN F. RIDER PUBLISHER, INC., 404 Fourth Ave., New York City

HOUR-A-DAY-WITH-RIDER BOOKS ON RESONANCE AND ALIGNMENT ON AUTOMATIC VOLUME CONTROL ON D-C VOLTAGE DISTRIBUTION IN RADIO RECEIVERS ON ALTERNATING CURRENTS IN RADIO RECEIVERS
Stiff covers—only 60c each

SERVICE MEN'S EQUIPMENT DIRECTORY

AMPLIFIERS & SOUND SYSTEMS

Allied Radio Corp., 833 W. Jackson Blvd., Chicago.
(See adv. page 36)
American Communications Corp., 306 Broadway, New York City.
Amplifier Co. of America, 17 W. 20th St., New York City.
Bell Sound System, Inc., Essex Ave., Columbus, Ohio.
David Bogen Co., Inc., 663 Broadway, New York City.
W. C. Braun, Inc., 601 W. Randolph St., Chicago.
Chicago Sound Systems Co., 251 E. Grand Ave., Chicago.
Daniel Electrical Labs., 87 Walker St., New York City.
Erwood Sound Equipment Co., 223 W. Erie St., Chicago.
Fulton Radio Corp., 100 Sixth Ave., New York City.
John Gable Manufacturing Co., 1200 Lake St., Chicago.
General Communication Products Co., Lexington Ave. at Vine, Hollywood, Cal.
Thomas B. Gibbs & Co., 900 W. Lake St., Chicago.
Jefferson Electric Co., Bellwood, Ill.
Lafayette Radio Corp., 100 Sixth Ave., New York City.
John Meck Industries, 1313 W. Randolph St., Chicago.
Alies Reproducer Co., Inc., 812 Broadway, New York City.
Million Radio & Television Laboratories, 1617 N. Damen St., Chicago.
Montgomery Ward & Co., 619 W. Chicago Ave., Chicago.
Music Master Manufacturing Co., 508 S. Dearborn St., Chicago.
Ohio Sound Corp., 745 Door St., Toledo, Ohio.
Operadio Manufacturing Co., St. Charles, Ill.
Pacent Engineering Corp., 79 Madison Ave., New York City.
Philco Corp., Allegheny & A Sts., Philadelphia, Pa.
RCA Manufacturing Co., Inc., Camden, N. J.
(See adv. back cover)
Radio Receptor Co., Inc., 251 W. 19th St., New York City.
Ray-Lab, Inc., 517 Railroad Ave., Elmira, N. Y.
Regal Amplifier Manufacturing Corp., 14 W. 17th St., New York City.
Remler Co., Ltd., 2101 Bryant St., San Francisco, Cal.
Rowe Industries, Inc., 3120 Monroe St., Toledo, Ohio.
Setchell Carlson, Inc., 2233 University Ave., St. Paul, Minn.
Silcox Radio & Television Corp., 60 Wall Tower, New York City.
Smdt Engineering Co., 4757 Ravenswood Ave., Chicago.
Stromberg Carlson Telephone Manufacturing Co., Rochester, N. Y.
Talk-A-Phone Manufacturing Co., 1217 W. Van Buren St., Chicago, Ill.
Thordarson Electric Manufacturing Co., 500 W. Huron St., Chicago.
Transformer Corp. of America, 69 Wooster St., New York City.
United Transformer Corp., 150 Varick St., New York City.
(See adv. page 1)
Vibratone Manufacturing Co., 325 Miguel St., San Francisco, Cal.
Webster Electric Co., Racine, Wis.
Western Electric Co., 195 Broadway, New York City.
Webster-Rauland, Inc., 4245 Knox Ave., Chicago.
Western Sound & Electric Laboratories, Inc., 311 W. Kilbourn Ave., Milwaukee, Wis.

ANTENNA EQUIPMENT

Antenna Kits, etc.

Alpha Wire Co., 50 Howard St., New York City.
ABC Radio Labs., Indianapolis, Ind.
Alden Products Co., 117 Main St., Brockton, Mass.

THE ACCOMPANYING directory has been compiled as a practical and comprehensive "Buying Guide" prepared specifically for the radio Service Man. The companies listed are recognized sources for Service Men's supplies and equipment.

In presenting this data we have attempted to supply complete and accurate information in usable form. Any errors or omissions are unintentional and should be called to our attention.

Amy, Aceves & King, Inc., 11 W. 42nd St., New York City.
Belden Manufacturing Co., 4673 W. Van Buren St., Chicago.
Eirnbach Radio Co., 145 Hudson St., New York City.
L. S. Brach Manufacturing Corp., 55 Dickerson St., Newark, N. J.
(See adv. page 33)
Carron Manufacturing Co., 415 S. Aberdeen St., Chicago.
Consolidated Wire & Associated Corps., Peoria & Harrison Sts., Chicago.
Cornish Wire Co., 15 Park Row, New York City.
Eagle Electric Manufacturing Co., Inc., 59 Hall St., Brooklyn, N. Y.
Fishwick Radio Co., 423 Colorado Bldg., Washington, D. C.
M. M. Fleron & Son, 113 N. Broad St., Trenton, N. J.
Fowler Manufacturing Co., 9 Rutgers St., St. Louis, Mo.
General Electric Co., Bridgeport, Conn.
General Television & Radio Corp., 1240 N. Homan Ave., Chicago.
Insuline Corp. of America, Long Island City, N. Y.
Philco Corp., Tioga & C Sts., Philadelphia, Pa.
Premax Products Division, Chisholm-Ryder Co., Niagara Falls, N. Y.
RCA Manufacturing Co., Inc., Camden, N. J.
(See adv. back cover)
Stromberg Carlson Telephone Manufacturing Co., Rochester, N. Y.
Technical Appliance Corp., 17 E. 16th St., New York City.
Teleradio Engineering Corp., 484 Broome St., New York City.
Vertrod Manufacturing Co., 132 Nassau St., New York City.

Insulators, Etc.

American Lava Corp., Chattanooga, Tenn.
American Phenolic Corp., 1830 S. 54th Ave., Chicago.
Corning Glass Works, Corning, N. Y.
Eagle Electric Manufacturing Co., Inc., 59 Hall St., Brooklyn, N. Y.
Erie Resistor Corp., Erie, Pa.
M. M. Fleron & Son, Trenton, N. J.
Insuline Corp. of America, 30-30 Northern Blvd., Long Island City, N. Y.
Isolantite, Inc., 233 Broadway, New York City.
James Millen Manufacturing Co., Inc., 150 Exchange St., Malden, Mass.
National Co., Inc., 61 Sherman St., Malden, Mass.

Auto Antennae

ABC Radio Labs., Indianapolis, Ind.
American Injector Co., Detroit, Mich.
American Radio Hardware Co., Inc., 476 Broadway, New York City.
Amy, Aceves & King, Inc., 11 W. 42nd St., New York City.

L. S. Brach Manufacturing Corp., 55 Dickerson St., Newark, N. J.
(See adv. page 33)
Burton-Rogers Co., 857 Boylston St., Boston, Mass.
Consolidated Wire & Associated Corps., Peoria & Harrison Sts., Chicago.
Fishwick Radio Co., 423 Colorado Bldg., Washington, D. C.
Galvin Manufacturing Corp., 4545 Augusta Blvd., Chicago.
Insuline Corp. of America, 30-30 Northern Blvd., Long Island City, N. Y.
JFD Manufacturing Co., 4111 Ft. Hamilton Pkwy., Brooklyn, N. Y.
Noblitt-Sparks Industries, Inc., Columbus, Ind.
Philco Corp., Tioga & C Sts., Philadelphia, Pa.
Premax Products Division, Chisholm-Ryder Co., Niagara Falls, N. Y.
RCA Manufacturing Co., Inc., Camden, N. J.
(See adv. back cover)
Radiart Corp., W. 62d & Barberton Ave., Cleveland, Ohio.
(See adv. page 17)
Snyder, Inc., 813 Noble St., Philadelphia, Pa.
Tilton Electric Corp., 15 E. 26th St., New York City.
Ward Products Corp., 1523 W. 45th St., Cleveland, Ohio.

AUTO RADIO CONTROLS

Consolidated Wire & Associated Corps., Peoria & Harrison Sts., Chicago.
Crowe Name Plate & Manufacturing Co., 3701 Ravenswood Ave., Chicago.
Dual Remote Control Co., Wayne, Mich.
Galvin Manufacturing Corp., 4545 Augusta Blvd., Chicago.
Hunter Pressed Steel Co., Lansdale, Pa.
Noblitt-Sparks Industries, Inc., Columbus, Ind.
Philco Corp., Tioga & C Sts., Philadelphia, Pa.
F. W. Stewart Manufacturing Corp., 4311 Ravenswood Ave., Chicago.
S. S. White Dental Manufacturing Co., 10 E. 40th St., New York City.

AUTOMATIC RECORD CHANGERS

Capelhart, Inc., Ft. Wayne, Ind.
Farnsworth Television & Radio Corp., Ft. Wayne, Ind.
John Gable Mfg. Co., 1200 W. Lake St., Chicago.
Garrard Sales Corp., 296 Broadway, New York City.
General Industries Co., 3537 Taylor St., Elyria, Ohio.
RCA Mfg. Co., Inc., Camden, N. J.
(See adv. back cover)
Rock-Ola Manufacturing Corp., 867 N. Kedzie Ave., Chicago.
J. P. Seeburg Corp., 1500 Dayton St., Chicago.
Webster-Chicago Corp., 5622 Bloomingdale Ave., Chicago.

BALLAST AND PLUG-IN RESISTORS

Amperite Co., 561 Broadway, New York City.
(See adv. page 36)
Art Radio Corp., 115 Liberty St., New York City.
Clarostat Manufacturing Co., Inc., 285 N. Sixth St., Brooklyn, N. Y.
Hytron Corp., 76 Lafayette St., Salem, Mass.
Insuline Corp. of America, 30-30 Northern Blvd., Long Island City, N. Y.
JFD Manufacturing Co., 4111 Ft. Hamilton Pkwy., Brooklyn, N. Y.
RCA Manufacturing Co., Inc., Camden, N. J.
(See adv. back cover)
Micamold Radio Corp., 1087 Flushing Ave., Brooklyn, N. Y.
Muter Co., 1255 S. Michigan Ave., Chicago.

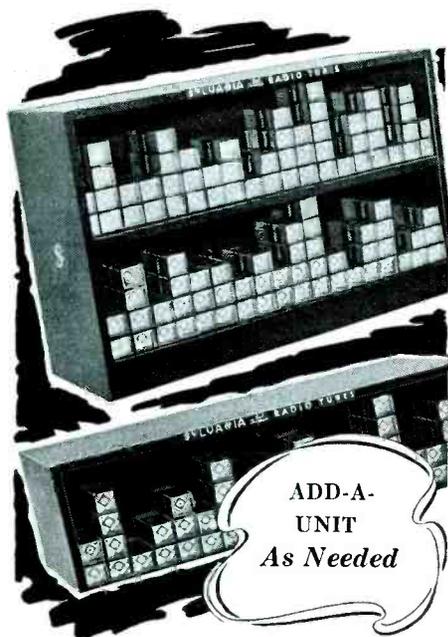
BAFFLES & SPEAKER CABINETS

Allison Baffle Co., 207 So. 86 St., Birmingham, Ala.
American Communications Corp., 306 Broadway, New York City.
Art Specialty Co., 1115 N. Franklin St., Chicago.
Atlas Sound Corp., 1449 Thirty-Ninth St., Brooklyn, N. Y.

Sylvania

SECTIONAL

"STOCK-BOY" CABINETS
HELP YOU SELL



INTRODUCING the new Sylvania Add-A-Unit "Stock Boy" — custom built for radio tube merchandising. You can—

Add shelf sections as needed.

Dress up your store.

Stock tubes for easy accessibility. Eliminate expensive store layout changes incurred by built-in shelves.

Heavy gauge steel . . . coated with rich olive enamel . . . surface will not crack, peel or chip . . . all joints welded . . . light weight.

Each shelf holds from 70 to 140 (one row deep) tubes, or as many as 420 tubes by using the full capacity of the shelf.

Ask your jobber how you can get them.

SYLVANIA SET-TESTED RADIO TUBES

HYGRADE SYLVANIA CORPORATION

EMPORIUM, PA.

BAFFLES & SPEAKER CABINETS

(Continued)

Cinaudagraph Speakers, Inc., 921 W. Van Buren St., Chicago.

(See adv. page 28)

Jensen Radio Manufacturing Co., 6601 So. Laramie Ave., Chicago.

Kainer & Co., 763 W. Lexington St., Chicago.

RCA Manufacturing Co., Inc., Camden, N. J.

(See adv. back cover)

Racon Electric Co., 52 E. 19th St., New York City.

Ray-Lab Inc., Elmira, N. Y.

Speak-O-Phone Recording & Equipment Co., 23 W. 60th St., New York City.

Stromberg Carlson Telephone Mfg. Co., Rochester, N. Y.

University Labs., 195 Chrystie St., New York City.

Utah Radio Products Co., 816 Orleans St., Chicago.

(See adv. page 25)

Vibracloc Manufacturing Co., 325 Miguel St., San Francisco, Cal.

Watterson Radio Manufacturing Co., 2608 Moss Ave., Dallas, Texas.

Wright-DeCoster, Inc., 2233 University Ave., St. Paul, Minn.

BATTERIES

Dry

Acme Battery Corp., 59 Pearl St., Brooklyn, N. Y.

Bond Electric Corp., New Haven, Conn.

Bright Star Battery Co., Clifton, N. J.

Burgess Battery Co., Freeport, Ill.

General Dry Batteries, Inc., 13100 Athens Ave., Cleveland, Ohio.

National Carbon Co., Inc., 30 E. 42nd St., New York City.

National Union Radio Corp., 57 State St., Newark, N. J.

(See adv. page 19)

Ray-O-Vac Co., 2317 Winnebago St., Madison, Wis.

Phileo Corp., Tioga & C Sts., Philadelphia, Pa.

United States Electric Manufacturing Corp., 222-228 W. 14th St., New York City.

Willard Storage Battery Co., Cleveland, Ohio.

Winchester Repeating Arms Co., New Haven, Conn.

Storage

Edison Storage Battery Div., Thomas A. Edison, Inc., West Orange, N. J.

Electric Storage Battery Co., Allegheny Ave. & 19th St., Philadelphia, Pa.

General Lead Batteries Co., Newark, N. J.

Globe Union, Inc., 900 E. Keefe Ave., Milwaukee, Wis.

Gould Div., National Battery Co., Depew, N. Y.

Jumbo Battery Manufacturers, Ellsworth, Iowa.

K. W. Battery Co., 3705 N. Lincoln Ave., Chicago.

Marko Storage Battery Corp., 100 Varick Ave., Brooklyn, N. Y.

National Battery Co., First National Bank Bldg., St. Paul, Minn.

Philadelphia Storage Battery Co., Tioga & C Sts., Philadelphia, Pa.

Prest-O-Lite Battery Co., 4500 W. 16th St., Indianapolis, Ind.

Universal Battery Co., 3410 S. LaSalle St., Chicago.

USL Battery Corp., 1725 Highland Ave., Niagara Falls, N. Y.

Western Cable & Light Co., Baldwin, Wis.

Willard Storage Battery Co., Cleveland, Ohio.

Air Cell

National Carbon Co., Inc., 30 E. 42nd St., New York City.

BATTERY CLIPS

American Radio Hardware Co., 476 Broadway, New York City.

Mueller Electric Co., 1563 31st St., Cleveland, Ohio.

(See adv. page 35)

BIAS CELLS

P. R. Mallory & Co., Inc., 3629 E. Washington St., Indianapolis, Ind.

(See adv. inside front cover)

CABINETS & BINS

Kennedy Manufacturing Co., Van Wert, Ohio.

Lyon Metal Products, Inc., Aurora, Ill.

CABLE—(See Wire)

CABLE CONNECTORS

Alden Products Co., 117 Main St., Brockton, Mass.

American Phenolic Corp., 1830 S. 54th Ave., Chicago.

American Radio Hardware Co., 476 Broadway, New York City.

Atlas Sound Corp., 1448 — 39th St., Brooklyn, N. Y.

Bud Radio, Inc., 2118 E. 55th St., Cleveland, Ohio.

Cannon Electric Development Co., 3209 Humboldt St., Los Angeles, Cal.

Hugh H. Eby, Inc., 4700 Stenton Ave., Philadelphia, Pa.

General Cement Mfg. Co., Rockford, Ill.

(See adv. page 36)

Insuline Corp. of America, 30-30 Northern Blvd., Long Island City, N. Y.

J.F.D. Mfg. Co., 4111 Ft. Hamilton Pkwy., Brooklyn, N. Y.

Howard B. Jones, 2300 Wabansia Ave., Chicago.

P. R. Mallory & Co., Inc., Indianapolis, Ind.

(See adv. inside front cover)

James Millen Manufacturing Co., 150 Exchange St., Malden, Mass.

Selectar Mfg. Corp., 21-10 49th Ave., Long Island City, N. Y.

CAPACITORS

Fixed

Aerovox Corp., New Bedford, Mass.

(See adv. page 34)

American Condenser Corp., 2508 S. Michigan Ave., Chicago.

Atlas Condenser Products Co., 548 Westchester Ave., New York City.

Condenser Corp. of America, S. Plainfield, N. J.

Condenser Products, 1375 N. Branch St., Chicago.

Consolidated Wire & Associated Corp., Peoria & Harrison Sts., Chicago.

Cornell-Dubilier Electric Corp., S. Plainfield, N. J.

Cosmic Radio Corp., 699 E. 135th St., New York City.

Tobe Deutschmann Corp., Canton, Mass.

Dumont Electric Co., Inc., 514 Broadway, New York City.

J. E. Fast & Co., 3101 N. Pulaski Ave., Chicago.

Girard-Hopkins, 1000 Fourtieth Ave., Oakland, Cal.

Illinois Condenser Co., 1160 N. Howe St., Chicago.

Industrial Condenser Corp., 1725 W. North Ave., Chicago.

Magnavox Co., Ft. Wayne, Ind.

P. R. Mallory & Co., Inc., 2029 E. Washington St., Indianapolis, Ind.

(See adv. inside front cover)

Micamold Radio Corp., 1087 Flushing Ave., Brooklyn, N. Y.

National Union Radio Corp., 57 State St., Newark, N. J.

(See adv. page 19)

The Potter Co., 1950 Sheridan Rd., North Chicago, Ill.

RCA Manufacturing Co., Inc., Camden, N. J.

(See adv. back cover)

Solar Manufacturing Corp., Bayonne, N. J.

(See adv. page 33)

Sprague Products Co., No. Adams, Mass.

Tilton Electric Corp., 15 E. 26th St., New York City.

Trimmer

Automatic Winding Co., Inc., E. Newark, N. J.

Bud Radio, Inc., 2118 E. 55th St., Cleveland, Ohio.

Centralab, Inc., 900 E. Keefe Ave., Milwaukee, Wis.

(See adv. page 4)

Erie Resistor Corp., Erie, Pa.

Edwin I. Guthman & Co., 400 So. Peoria St., Chicago.

Hammarlund Manufacturing Co., Inc., 424 W. 33d St., New York City.

Insuline Corp. of America, 30-30 Northern Blvd., Long Island City, N. Y.

Meissner Manufacturing Co., Mt. Carmel, Ill.

(See adv. page 29)

James Millen Manufacturing Co., Inc., 150 Exchange St., Malden, Mass.

J. W. Miller Co., 5917 So. Main St., Los Angeles, Cal.

National Co., 61 Sherman St., Malden, Mass.

F. W. Sickles Co., Chicopee, Mass.

Solar Manufacturing Corp., Bayonne, N. J.

(See adv. page 33)

Teleradio Engineering Corp., 484 Broome St., New York City.

Variable

American Steel Package Co., Defiance, Ohio.

General Instrument Corp., Elizabeth, N. J.

Hammarlund Mfg. Co., Inc., 424 W. 33d St., New York City.

Meissner Manufacturing Co., Mt. Carmel, Ill.

(See adv. page 29)

J. W. Miller Co., 5917 So. Main St., Los Angeles, Cal.

Oak Manufacturing Co., 711 W. Lake St., Chicago.

Radio Condenser Co., Camden, N. J.

Reliance Die & Stamping Co., 1260 Clybourn Ave., Chicago.

CATHODE—RAY TUBES

Allen B. DuMont Laboratories, Inc., Passaic, N. J.
Farnsworth Television & Radio Corp., Ft. Wayne, Ind.
General Electric Co., Schenectady, N. Y.
Hygrade Sylvania Corp., 500 Fifth Ave., New York City.

(See adv. page 24)

National Union Radio Corp., Newark, N. J.

(See adv. page 19)

Northern Manufacturing Co., 36 Spring St., Newark, N. J.

RCA Manufacturing Co., Inc., Camden, N. J.

(See adv. back cover)

Vacutron, Inc., 20 W. 22nd St., New York City.

Western Electric Co., 195 Broadway, New York City.

CEMENTS (See Finishes)

COILS

Aladdin Radio Industries, Inc., 501 W. 35th St., Chicago.

Victor J. Andrew, 6429 S. Lavergne Ave., Chicago.

Barber & Howard, Inc., Westerly, R. I.
Browning Laboratories, Inc., 750 Main St., Winchester, Mass.

Carron Manufacturing Co., 415 S. Aberdeen St., Chicago.

Consolidated Wire & Associated Corps, Peoria & Harrison Sts., Chicago.

General Manufacturing Co., 1255 S. Michigan Ave., Chicago.

General Winding Co., 254 W. 31st St., New York City.

Edwin I. Guthman & Co., 400 So. Peoria St., Chicago.

Hammarlund Manufacturing Co., 424 W. 33d St., New York City.

Insuline Corp. of America, 30-30 Northern Blvd., Long Island City, N. Y.

Leotone Radio Co., 63 Dey St., New York City.

Meissner Manufacturing Co., Mt. Carmel, Ill.

(See adv. page 29)

James Millen Manufacturing Co., 150 Exchange St., Malden, Mass.

J. W. Miller Co., 5917 So. Main St., Los Angeles, Cal.

National Co., Inc., 61 Sherman St., Malden, Mass.

Philco Corp., Tioga & C Sts., Philadelphia, Pa.

Radex Corp., 1322 Elston Ave., Chicago.

F. W. Sickles Co., Chicopee, Mass.

Teleradio Engineering Corp., 484 Broome St., New York City.

CONDENSERS (See Capacitors)

CONTROL HEADS (See Auto Radio Controls)

DIAL CABLES & BELTS

Bud Radio, Inc., 2118 E. 55th St., Cleveland, Ohio.

General Cement Mfg. Co., Rockford, Ill.

(See adv. page 36)

JFD Manufacturing Co., 4111 Ft. Hamilton Pkwy., Brooklyn, N. Y.

Walter L. Schott Co., 5264 W. Pico Blvd., Los Angeles, Cal.

(See adv. page 29)

DIALS & ESCUTCHEONS

American Emblem Co., Utica, N. Y.

Browning Laboratories, Inc., 750 Main St., Winchester, Mass.

Bud Radio, Inc., 2118 E. 55th St., Cleveland, Ohio.

Crowe Name Plate & Manufacturing Co., 3701 Ravenswood Ave., Chicago.

Gemloid Corp., 79-10 Albion Ave., Elmhurst, N. Y.

Hunter Pressed Steel Co., Lansdale, Pa.

Meissner Manufacturing Co., Mt. Carmel, Ill.

(See adv. page 29)

James Millen Manufacturing Co., 150 Exchange St., Malden, Mass.

J. W. Miller Co., 5917 S. Main St., Los Angeles, Cal.

National Co., 61 Sherman St., Malden, Mass.

DISCS (See Recording)

DISC RECTIFIERS

Benwood-Linze Co., 1805 Locust St., St. Louis, Mo.

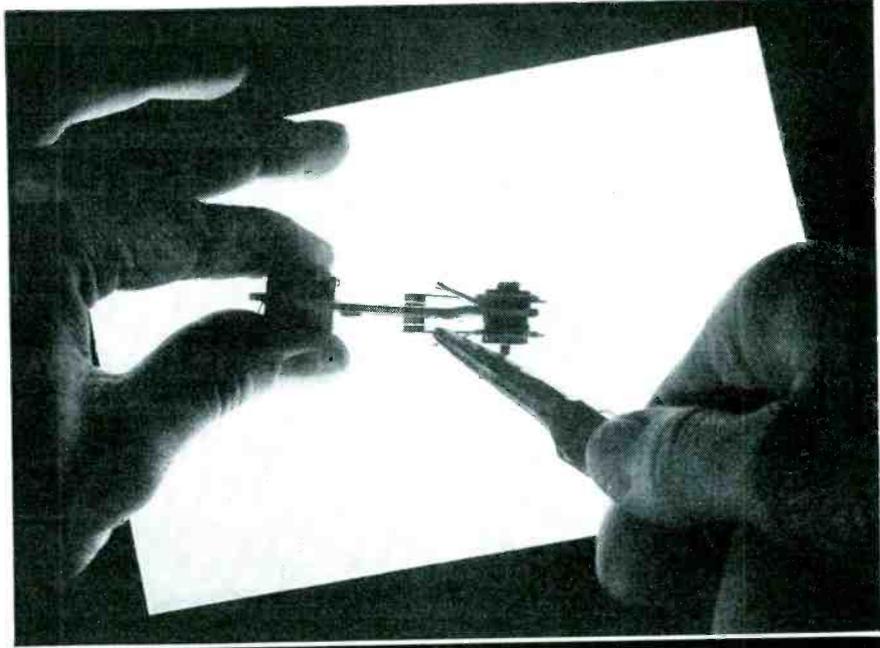
International Telephone & Radio Manufacturing Corp., 1000 Passaic Ave., East Newark, N. J.

P. R. Mallory & Co., Inc., 3029 E. Washington St., Indianapolis, Ind.

(See adv. inside front cover)

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark, N. J.



Heart Trouble Avoided by This Utah Operation

HANDS as skilled as any surgeon's perform this delicate operation in the Utah factory. This precision adjustment of the contact points in Utah Vibrators is responsible for their long life, correct electrical balance, current output and freedom from noise.

Because Utah contact points are adjusted to a specified clearance, with a variation of less than .0005 in., they eliminate the causes of failure so frequently found in ordinary vibrators. Pitted or locked points, unsatisfactory performance and short life are avoided.

Only high quality materials conforming to rigid standards are used in the manu-

facture of Utah Vibrators. The points, for example, are made of the best grade Tungsten, fully capable of standing up under the terrific punishment to which they will be subjected.

Write for information about the complete line of high-value, dependable Utah Vibrators. Utah Radio Products Company, 816 Orleans Street, Chicago, Illinois. Canadian Office, 560 King Street West, Toronto. In Argentina: Ucoa Radio Products Co., SRL Buenos Aires. Cable Address: Uтарadio, Chicago.



VIBRATORS

SPEAKERS • TRANSFORMERS • UTAH-CARTER PARTS

FINISHES & CEMENTS, ETC.

Alden Products Co., 117 Main St., Brockton, Mass.

American Phenolic Corp., 1830 S. 54th Ave., Chicago.

Bakelite Corp., 30 E. 42nd St., New York City.

Carron Manufacturing Co., 415 S. Aberdeen St., Chicago.

Celluloid Corp., 180 Madison Ave., New York City.

Henry L. Crowley & Co., 1 Central Ave., W. Orange, N. J.

General Cement Mfg. Co., Rockford, Ill.

(See adv. page 36)

Irvington Varnish & Insulator Co., Irvington, N. J.

JFD Manufacturing Co., 4111 Ft. Hamilton Pkwy., Brooklyn, N. Y.

Maas & Waldstein Co., 438 Riverside Ave., Newark, N. J.

Meissner Manufacturing Co., Mt. Carmel, Ill.

(See adv. page 29)

Walter L. Schott Co., 5264 W. Pico Blvd., Los Angeles, Cal.

(See adv. page 29)

Stromberg Carlson Telephone Manufacturing Co., Rochester, N. Y.

Zophar Mills, Inc., 112-26th St., Brooklyn, N. Y.

HARDWARE & MISCELLANEOUS PARTS

Accessories Manufacturing Co., 4612 N. Clark St., Chicago.

Alden Products Co., 117 Main St., Brockton, Mass.

American Phenolic Corp., 1830 S. 54th Ave., Chicago.

American Radio Hardware Co., Inc., 476 Broadway, New York City.

Birnback Radio Co., 145 Hudson St., New York City.

Bud Radio, Inc., 2118 E. 55th St., Cleveland, Ohio.

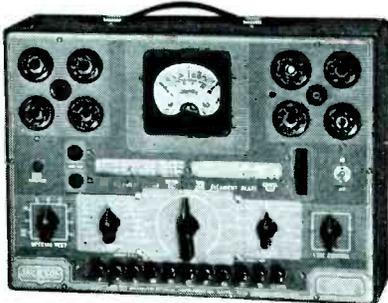
Hugh H. Eby, Inc., 4700 Stenton Ave., Philadelphia, Pa.

SERVICE, SEPTEMBER, 1941 • 25

"Take My Advice"



I have been through the mill in the Radio Repair game. First as apprentice, then as a repairman, now as owner of my own shop. I've tried every make of tube tester. Known 'em all! Take my advice: The Jackson Dynamic Tube Tester is clear tops for accuracy and dependability. It tests every element of the tube simultaneously—just as it would operate in a set. A Jackson will simplify tube testing and increase your tube profits.



Model 636B—Tube Tester



LAB UNITS

Jackson Service Labs enable faster handling of work, as various related instruments are grouped together in a rack. Every Jackson instrument is built to fit such a unit. Assembly shown is one of 24. It includes Audio Oscillator, Condenser Tester and Oscillator.

Write for free catalog.

The Jackson Electrical Instrument Co.

Dayton, Ohio



HARDWARE

(Continued)

Fahnestock Electric Co., 46-44 Eleventh St., Long Island City, N. Y.
 Federal Screw Products Co., 24-26 S. Jefferson St., Chicago.
General Cement Mfg. Co., Rockford, Ill.
 (See adv. page 36)
 Insuline Corp. of America, 30-30 Northern Blvd., Long Island City, N. Y.
 JFD Manufacturing Co., 4111 Ft. Hamilton Pkway, Brooklyn, N. Y.
 Howard B. Jones, 2300 Wabansia Ave., Chicago.
 Littlefuse, Inc., 4757 N. Ravenswood Ave., Chicago.
P. R. Mallory & Co., Inc., 3029 E. Washington St., Indianapolis, Ind.
 (See adv. inside front cover)
Meissner Manufacturing Co., Mt. Carmel, Ill.
 (See adv. page 29)
 J. W. Miller Co., 5917 So. Main St., Los Angeles, Cal.
 Muter Co., 1255 S. Michigan Ave., Chicago.
 Philco Corp., Tioga & C Sts., Philadelphia, Pa.
RCA Manufacturing Co., Inc., Camden, N. J.
 (See adv. back cover)
 Teleradio Engineering Corp., 484 Broome St., New York City.

HEADPHONES

Brush Development Co., 3318 Perkins Ave., Cleveland, O.
 C. F. Cannon Co., Springwater, N. Y.
 Carron Manufacturing Co., 415 S. Aberdeen St., Chicago.
 Chicago Telephone Supply Co., Elkhart, Ind.
 Connecticut Telephone & Electric Co., Meriden, Conn.
 Dictograph Products Co., Inc., 580 Fifth Ave., New York City.
 Insuline Corp. of America, 30-30 Northern Blvd., Long Island City, N. Y.
 Kellogg Switchboard & Supply Co., 6650 S. Cicero Ave., Chicago.
 Philmore Manufacturing Co., Inc., 113 University Pl., New York City.
 Stromberg Carlson Telephone Manufacturing Co., Rochester, N. Y.
 Telex Products Co., 1645 Hennepin Ave., Minneapolis, Minn.
 Tibbetts Labs., Camden, Maine.
 Trimm Radio Manufacturing Co., 1770 W. Ber-teau Ave., Chicago.
 Universal Microphone Co., Ltd., 424 Warren Lane, Inglewood, Cal.
 Western Electric Co., 195 Broadway, New York City.

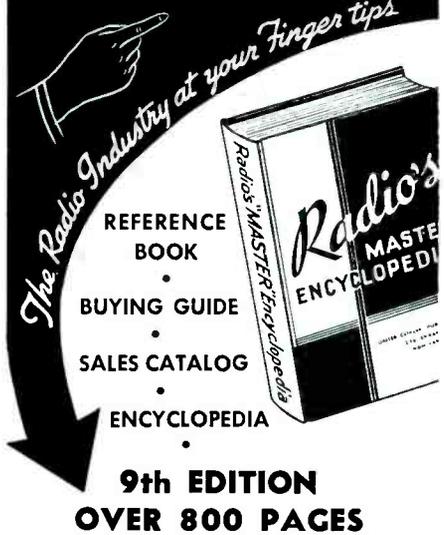
HEARING AIDS

American Earphone Co., 10 E. 43rd St., New York City.
 Aurex Corp., 2400 Sheffield Ave., Chicago.
 Crystal Ear, Inc., 2007 S. Michigan Ave., Chicago.
 Dictograph Products Co., 580 Fifth Ave., New York City.
 Gem Earphone Co., Inc., 47 W. 34th St., New York City.
 Godsend Hearing Aid Co., 4204 Davis Lane, Cincinnati, O.
 C. L. Holmann Corp., Pittsburgh, Pa.
 Mager & Gougelman Hearing Aids Co., Inc., 30 N. Michigan Ave., Chicago.
 Maico Co., Inc., 83 S. Ninth St., Minneapolis, Minn.
 E. A. Myers & Sons, 306 Beverly Rd., Mt. Lebanon, Pittsburgh, Pa.
 Montgomery Ward, Chicago.
 National Electric Research & Manufacturing Co., Hotel Commodore Bldg., Washington, D. C.
 Paraphone Corp., Cleveland, O.
 Sears Roebuck & Co., Chicago.
 Sonotone Corp., Elmsford, N. Y.
 Telex Products Co., 1645 Hennepin Ave., Minneapolis, Minn.
 Tibbetts Labs., Camden, Maine.
 Trimm Radio Manufacturing Co., 1770 W. Ber-teau Ave., Chicago.
 Universal Microphone Co., Ltd., 424 Warren Lane, Inglewood, Cal.
 Vacolite Co., 2003 N. Henderson Ave., Dallas, Texas.
 Western Electric Co., 195 Bway, New York City.

HORNS

Art Specialty Co., 1115 N. Franklin St., Chicago.
 Atlas Sound Corp., 1449 Thirty Ninth St., Brooklyn, N. Y.
 Cimaudagraph Speakers, Inc., 921 W. Van Buren St., Chicago.
 (See adv. page 28)
 Jensen Radio Manufacturing Co., 6601 So. Laramie Ave., Chicago.
 Kainer & Co., 763 W. Lexington St., Chicago.
 Oxford-Tartak Radio Corp., 915 W. Van Buren St., Chicago.
 RCA Manufacturing Co., Inc., Camden N. J.
 (See adv. back cover)
 Racon Electric Co., Inc., 52 E. 19th St., New York City.
 Sherron Metallic Corp., 1201 Flushing Ave., Brooklyn, N. Y.

Radio's MASTER ENCYCLOPEDIA



THE ONLY OFFICIAL RADIO PARTS AND EQUIPMENT MANUAL

It took six years and thousands of dollars to develop this "MASTER CATALOG" of the radio industry to its present size—yet it costs you only \$2.50.

Compiled in co-operation with and approved by the Radio Manufacturers Group as the industry's official source book.

GIVES THIS IMPORTANT DATA

Contained within the hard covers of this 800 page MASTER BOOK are the listings of the products of 90% of all Radio Parts and Equipment Manufacturers in the industry. In it you will find many thousands of items, such as electronic devices, transmitting and receiving sets, tubes, antennas, transformers, condensers, replacement parts, meters, laboratory test equipment, relays, plugs, coils, wire, and numerous other radio components. Thousands of clear illustrations with descriptions and specifications. —Yes, this is your "MUST HAVE BOOK".

• WHO USES IT? •

As the official source book of the radio industry it is constantly used by many American and Foreign governmental agencies, also industrial organizations, engineers, purchasing agents, laboratories, radio amateurs and service men, radio distributors, broadcast stations, schools, colleges, libraries, and by many others interested in Radio and allied fields.

SAVES TIME—SAVES MONEY

WHERE, WHAT AND HOW MUCH: Such information is instantly at your fingertips. This valuable RADIO MASTER eliminates the maintenance of bulky files. It is completely indexed for speedy reference.

If you buy, sell or specify you will find the RADIO MASTER an indispensable and handy book to have around at all times.

MONEY BACK GUARANTEE!

Order your copy today—look it over. You will find it to be an excellent investment; if not, return it to us in five days for full refund.

The price is only \$2.50 shipped anywhere in U.S.A. — \$3.00 elsewhere. We prepay transportation charges if remittance accompanies order.

UNITED CATALOG PUBLISHERS, Inc.

106A Lafayette St. New York, N. Y.

HORNS

(Continued)

Stromberg Carlson Telephone Manufacturing Co., Rochester, N. Y.
University Laboratories, 195 Chrystie St., New York City.
Vibratoc Manufacturing Co., 1273 Mission St., San Francisco, Cal.
Western Electric Co., 195 Broadway, New York City.
Wright-DeCoster, Inc., 2233 University Ave., St. Paul, Minn.

I-F TRANSFORMERS (See Coils)

INSULATORS (See Antenna)

INTERCOMMUNICATORS

Allied Radio Corp., 833 W. Jackson Blvd., Chicago.

(See adv. page 36)

American Communications Corp., 306 Broadway, New York City.
Autocrat Radio Co., 3855 N. Hamilton Ave., Chicago.
Banks Manufacturing Co., 5019 N. Winthrop Ave., Chicago.
Bell Sound System, Inc., Columbus, O.
David Bogen Co., Inc., 663 Broadway, New York City.
Chicago Sound Systems Co., 251 E. Grand Ave., Chicago.
Dictograph Products Co., Inc., 580 Fifth Ave., New York City.
Elkay Manufacturing Corp., 200 Fifth Ave., New York City.
Thomas B. Gibbs & Co., 900 W. Lake St., Chicago.
Intercall Systems, Inc., 610 Linden Ave., Dayton, Ohio.
Karadio Corp., 2233 University Ave., St. Paul, Minn.
Lafayette Radio Corp., 100 Sixth Ave., New York City.
Lake Manufacturing Co., 2323 Chestnut St., Oakland, Cal.
Montgomery Ward & Co., 619 W. Chicago Ave., Chicago.
Operadio Manufacturing Co., St. Charles, Ill.
Philco Corp., Allegheny & A Sts., Philadelphia, Pa.
Radolek Co., 801 W. Randolph St., Chicago.
RCA Manufacturing Co., Camden, N. J.
(See adv. back cover)
Ray-Lab Inc., Elmira, N. Y.
Regal Amplifier Manufacturing Corp., 14 W. 17th St., New York City.
Remler Co., Ltd., 2101 Bryant St., San Francisco, Calif.
Setchell Carlson, Inc., 2233 University Ave., St. Paul, Minn.
Sillox Radio & Television Corp., 60 Wall Tower, New York City.
Talk-A-Phone Manufacturing Co., 1217 W. Van Buren St., Chicago.
Transformer Corp. of America, 69 Wooster St., New York City.
Universal Microphone Co., Ltd., 424 Warren Lane, Inglewood, Cal.
Vibratoc Manufacturing Co., 1273 Mission St., San Francisco, Calif.
Webster-Rauland, Inc., 4245 Knox Ave., Chicago.
Webster Electric Co., Racine, Wisc.
Western Electric Co., 195 Broadway, New York City.
Western Sound & Electric Labs., Inc., Milwaukee, Wisc.
Zenith Radio Corp., 6001 Dickens Ave., Chicago.

JACKS, PLUGS, ETC.

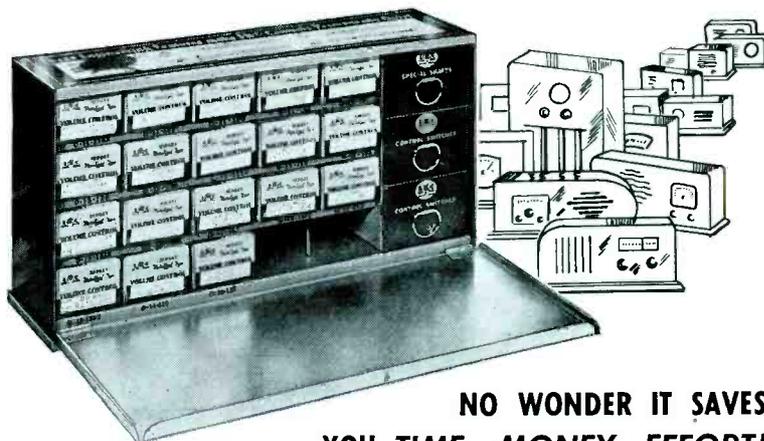
Alden Products Co., 117 Main St., Brockton, Mass.
American Radio Hardware Co., Inc., 476 Broadway, New York City.
Bud Radio, Inc., 2118 E. 55th St., Cleveland, O.
Hugh H. Eby, Inc., 4700 Stenton Ave., Philadelphia, Pa.
Insuline Corp. of America, 30-30 Northern Blvd., Long Island City, N. Y.
Howard B. Jones, 2300 Wabansia Ave., Chicago.
Kellogg Switchboard & Supply Co., 6650 S. Cicero Ave., Chicago.
P. R. Mallory & Co., Inc., Indianapolis, Ind.
(See adv. inside front cover)
Selectar Manufacturing Corp., 21-10 49th Ave., Long Island City, N. Y.
Stromberg Carlson Telephone Manufacturing Co., Rochester, N. Y.
Utah Radio Products Co., 816 Orleans St., Chicago.

(See adv. page 25)

KNOBS, ETC.

Alden Products Co., 117 Main St., Brockton, Mass.
American Insulator Corp., New Freedom, Pa.
American Radio Hardware Co., 476 Broadway, New York City.
Bond Products Co., 13139 Hamilton Ave., Detroit, Mich.

10,859 SET MODELS USE CONTROL TYPES INCLUDED IN THIS CABINET



**NO WONDER IT SAVES
YOU TIME.. MONEY.. EFFORT!**

By ACTUAL COUNT, 10,859 of the radio receiver models listed in the new IRC Volume Control Replacement Manual (Edition No. 3) call for one or more replacements that can be supplied from the 18 Type D Universal Controls, 6 switches and 5 extra Tap-in Shafts included in the IRC Control Cabinet. In other words, Cabinet owners are equipped for fast, accurate control replacement service on as high as 75% of all radio sets they are likely to be called upon to repair—and that isn't all!

Thanks to Tap-in Shafts, you can often use standard controls instead of more costly special replacements. What's more, Tap-in Shafts simplify installations, especially in crowded chasses where they avoid removing other parts in order to insert the control. And remember! Type D Universal Controls themselves are small enough to fit in anywhere—large enough for utmost dependability.

ASK YOUR JOBBER FOR THIS MANUAL!

If you haven't already received your copy of the new IRC Volume Control Replacement Manual (Edition No. 3) ask your IRC jobber today. It's a "must" for every serviceman who makes volume control replacements. Larger—more accurate—easier to use—contains more information and 35% more listings than ever before.



INTERNATIONAL RESISTANCE CO.

401 N. Broad Street, Philadelphia, Pa.

LOUDSPEAKERS

Bud Radio, Inc., 2118 E. 55th St., Cleveland, O.
Continental-Diamond Fibre Co., Newark, Del.
Crowe Nameplate & Manufacturing Co., 3701 Ravenswood Ave., Chicago.
Harry Davies Molding Co., 1428 N. Wells St., Chicago.
Hugh H. Eby, Inc., 4700 Stenton Ave., Philadelphia, Pa.
General Cement Manufacturing Co., Rockford, Ill.
(See adv. page 36)
General Electric Co., Plastics Dept., Pittsfield, Mass.
General Radio Co., 30 State St., Cambridge, Mass.
Kurz-Kasch Co., 1415 S. Broadway, Dayton, O.
P. R. Mallory & Co., Inc., Indianapolis, Ind.
(See adv. inside front cover)
Meissner Manufacturing Co., Mt. Carmel, Ill.
(See adv. page 29)
J. W. Miller Co., 5917 S. Main St., Los Angeles, Cal.
National Co., 61 Sherman St., Malden, Mass.
Philco Corp., Tioga & C Sts., Philadelphia, Pa.
Radio Knob Co., 43 E. Ohio St., Chicago.
Rogan Brothers, 184 N. Wacker Drive, Chicago.
Richardson Co., 57th & Lake Sts., Melrose Park, Ill.
Syracuse Ornamental Co., Syracuse, N. Y.

Arlavox Manufacturing Co., 430 S. Green St., Chicago.
Atlas Sound Corp., 1449 Thirty Ninth St., Brooklyn, N. Y.
Best Manufacturing Co., Inc., 1200 Grove St., Irvington, N. J.
Brush Development Co., 3318 Perkins Ave., Cleveland, Ohio.
Carron Manufacturing Co., 415 S. Aberdeen St., Chicago.
Cinaudagraph Speakers, Inc., 921 W. Van Buren St., Chicago.
(See adv. page 28)
Crescent Industries, Inc., 4140 Belmont Ave., Chicago.
Jensen Radio Manufacturing Co., 6601 S. Laramie Ave., Chicago.
Magnavox Co., Ft. Wayne, Ind.
Operadio Manufacturing Co., St. Charles, Ill.
Oxford-Tartak Radio Corp., 915 W. Van Buren St., Chicago.
Permoflux Corp., 4916 W. Grand Ave., Chicago.
Philco Corp., Tioga & C Sts., Philadelphia, Pa.
Quam-Nichols Co., 33d Pl. & Cottage Grove Ave., Chicago.

**Because these Linear Standard Speakers
are made of the Finest Materials
. . . Precision = Fidelity . . .**

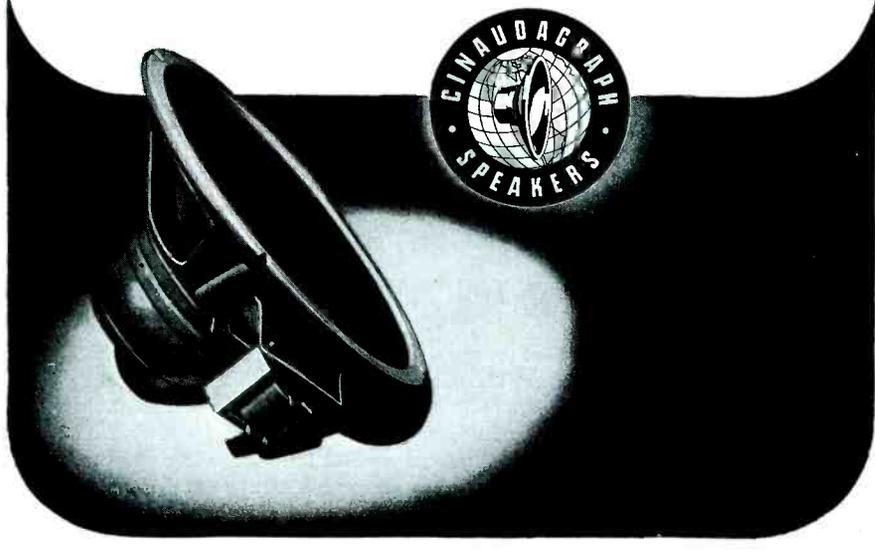
As definite as a Mathematical Formula is the fact that Fine Material plus Precision Workmanship, properly applied, invariably equals FIDELITY. . . The Linear Standard presents the Ultimate in that type of reproduction.

Small wonder that CINAUDAGRAPH SPEAKERS are being chosen by the discriminating buyer—are finding their way into more and more installations!

Write now for full description in the Fall Catalog, just out, listing this, and all other models.

CINAUDAGRAPH SPEAKERS, Inc.

Dept. SE, 921 West Van Buren Street, CHICAGO, ILL.



LOUDSPEAKERS

(Continued)

- RCA Manufacturing Co., Inc., Camden, N. J.
(See adv. back cover)
- Racon Electric Co., Inc., 52 E. 19th St., New York City.
- Radio Speakers, Inc., 221 E. Cullerton St., Chicago.
- Rola Co., Inc., 2530 Superior Ave., Cleveland, Ohio.
- Rowe Industries, 3120 Munroe St., Toledo, Ohio.
- Stromberg Carlson Telephone Manufacturing Co., Rochester, N. Y.
- University Laboratories, 195 Chrystie St., New York City.
- Utah Radio Products Co., 816 Orleans St., Chicago.
(See adv. page 25)
- Western Electric Co., 195 Broadway, New York City.
- Wright-DeCoster, Inc., 2233 University Ave., St. Paul, Minn.

**MANUALS
(See Service Manuals)**

**METERS
(See Test Equipment)**

MICROPHONES

- American Microphone Co., 1915 So. Western Ave., Los Angeles, Cal.
- Amperite Co., 561 Broadway, New York City.
(See adv. page 36)
- The Astatic Corp., 830 Market St., Youngstown, O.
(See adv. page 32)
- Brush Development Co., 3318 Perkins Ave., Cleveland, O.
- Carrier Microphone Co., 439 S. La Brea Ave., Inglewood, Cal.
- Electro-Voice Manufacturing Co., Inc., 1239 So. Bend Ave., So. Bend, Ind.
- RCA Manufacturing Co., Inc., Camden, N. J.
(See adv. back cover)
- Radio Receptor Co., Inc., 251 W. 19th St., New York City.
- Shure Bros., 225 W. Huron St., Chicago.
(See adv. page 30)

- Stromberg Carlson Telephone Manufacturing Co., Rochester, N. Y.
- Tibbetts Labs., Camden, Maine.
- The Turner Co., 906 Seventeenth St., N. E., Cedar Rapids, Iowa.
- Universal Microphone Co., Ltd., 424 Warren Lane, Inglewood, Cal.
- Western Electric Co., 195 Broadway, New York City.

MICROPHONE STANDS

- American Microphone Co., 1915 So. Western Ave., Los Angeles, Cal.
- Amperite Co., 561 Broadway, New York City.
(See adv. page 36)
- The Astatic Corp., 830 Market St., Youngstown, O.
(See adv. page 32)

- Atlas Sound Corp., 1440 Thirty-Ninth St., Brooklyn, N. Y.
- Eastern Mike-Stand Co., 56 Christopher Ave., Brooklyn, N. Y.
- Electric-Voice Manufacturing Co., Inc., 1239 So. Bend Ave., So. Bend, Ind.
- M. A. Gerrett Corp., 2947 N. 30th St., Milwaukee, Wis.
- National-Dobro Corp., 400 S. Peoria St., Chicago.
- RCA Manufacturing Co., Inc., Camden, N. J.
(See adv. back cover)
- Shure Brothers, 225 W. Huron St., Chicago.
(See adv. page 30)
- Stromberg Carlson Telephone Mfg., Co., Rochester, N. Y.
- Turner Co., Cedar Rapids, Iowa.
- Universal Microphone Co., Ltd., 424 Warren Lane, Inglewood, Cal.
- Western Electric Co., 195 Broadway, New York City.

NEEDLES (See Recording)

PANELS (See Racks)

PHONOGRAPH PICKUPS

- The Astatic Corp., 830 Market St., Youngstown, O.
(See adv. page 32)
- Audak Co., 500 Fifth Ave., New York City.
- Brush Development Co., 3318 Perkins Ave., Cleveland, Ohio.
- Electrical Research Products, Inc., 76 Varick St., New York City.

- Garrard Sales Corp., 296 Broadway, New York City.
- B. A. Proctor Co., 230 Park Ave., New York City.
- RCA Manufacturing Co., Inc., Camden, N. J.
(See adv. back cover)
- Shure Bros., 225 W. Huron St., Chicago.
(See adv. page 30)
- Tibbetts Labs., Camden, Maine.
- Universal Microphone Co., Ltd., 424 Warren Lane, Inglewood, Cal.
- Webster-Chicago Corp., 5622 Bloomingdale Ave., Chicago.
- Webster Electric Co., Racine, Wis.
- Western Electric Co., 195 Broadway, New York City.

PICKUPS (See Phonograph)

PILOT LAMPS

- Bond Electric Corp., New Haven, Conn.
- General Electric Co., Nela Park, Cleveland, O.
- Hygrade Sylvania Corp., 500 Fifth Ave., New York City.
(See adv. page 24)
- National Union Radio Corp., 57 State St., Newark, N. J.
(See adv. page 19)
- Raytheon Production Corp., 445 Lake Shore Drive, Chicago, Ill.
- Tung-Sol Lamp Works, Inc., 95 Eighth Ave., Newark, N. J.
- Westinghouse Lamp Division, Bloomfield, N. J.

PILOT LIGHT ASSEMBLIES

- Alden Products Co., 117 Main St., Brockton, Mass.
- Art Radio Corp., 115 Liberty St., New York City.
- Dial Light Co., of America, Inc., 92 West St., New York City.
- Drake Manufacturing Co., 1713 W. Hubbard St., Chicago.
- H. R. Kirkland Co., Morristown, N. J.
- Lenz Electric Manufacturing Co., 1751 N. Western Ave., Chicago.
- P. R. Mallory & Co., Inc., 3029 E. Washington St., Indianapolis, Ind.
(See adv. inside front cover)
- Philco Corp., Tioga & C Sts., Philadelphia, Pa.
- Signal Indicator Co., 140 Cedar St., New York City.
- Utah Radio Products Co., 816 Orleans St., Chicago
(See adv. page 25)

PLUGS (See Jacks)

POWER PACKS

- American Television & Radio Co., 300 E. 4th St., St. Paul, Minn.
- Electro Products Labs., 549 W. Randolph St., Chicago.
- P. R. Mallory & Co., Inc., 3029 E. Washington St., Indianapolis, Ind.
(See adv. inside front cover)
- Radiart Corp., W. 62d & Barberton Ave., Cleveland, Ohio.
(See adv. page 17)
- Raytheon Production Corp., 55 Chapel St., New York, Mass.
- Standard Transformer Corp., 1506 N. Halsted St., Chicago.

RACKS & PANELS, ETC.

- Bud Radio, Inc., 2118 E. 55th St., Cleveland, Ohio.
- Insuline Corp. of America, Long Island City, N. Y.
- Karp Metal Products Co., Inc., 120 Thirtieth St., Brooklyn, N. Y.
- Par-Metal Products Corp., 32-62 Forty-Ninth St., Long Island City, N. Y.
- Western Electric Co., 195 Broadway, New York City.

RECORDING EQUIPMENT

Cutting Heads

- The Astatic Corp., 830 Market St., Youngstown, Ohio.
(See adv. page 32)
- Audak Co., 500 Fifth Ave., New York City.
- Brush Development Co., 3318 Perkins Ave., Cleveland, O.
- B. A. Proctor Co., 230 Park Ave., New York City.
- RCA Manufacturing Co., Inc., Camden, N. J.
(See adv. back cover)
- Shure Bros., 225 W. Huron St., Chicago.
(See adv. page 30)
- Universal Microphone Co., Ltd., 424 Warren Lane, Inglewood, Cal.
- Webster Electric Co., Racine, Wis.

Discs

- Allied Recording Products Co., 21-09 43d Ave., Long Island City, N. Y.
- Arrow Radio Co., 900 W. Jackson Blvd., Chicago.
- Audio Devices, Inc., 1600 Broadway, New York City.

RECORDING EQUIPMENT

(Continued)

Carron Manufacturing Co., 415 S. Aberdeen St., Chicago.
Duotone Co., Inc., 799 Broadway, New York City.
 Electrovox Co., Inc., 356 Glenwood Ave., East Orange, N. J.
 Emeloid Manufacturing Co., Arlington, N. J.
 Federal Recorder Co., Elkhart, Ind.
 Hammermill Paper Co., Plastics Div., Erie, Pa.
Howard Radio Co., 1731 Belmont Ave., Chicago.
 Home Recording Co., 9 E. 19th St., New York City.
 Mirror Record Corp., 58 W. 25th St., New York City.
 Music Master Manufacturing Co., 508 S. Dearborn St., Chicago.
Presto Recording Corp., 242 W. 55th St., New York City.
RCA Manufacturing Co., Inc., Camden, N. J.
 (See adv. back cover)
 Radio Specialties Co., 1956 S. Figueroa St., Los Angeles, Cal.
 Radiotone, Inc., 7356 Melrose Ave., Hollywood, Cal.
 Rangertone, Inc., Newark, N. J.
 Recordisc Corp., 395 Broadway, New York City.
 Frank Rieber, Inc., 11916 W. Pico Blvd., Los Angeles, Cal.
 Sound Apparatus Co., 150 W. 46th St., New York City.
 Speak-O-Phone Recording & Equipment Co., 23 W. 60th St., New York City.
 Stangard Products Co., 4111 Ft. Hamilton Pkwy., Brooklyn, N. Y.
 Talking Devices Co., 4451 Irving Park Rd., Chicago.
 United States Record Corp., 1780 Broadway, New York City.
Universal Microphone Co., Ltd., 424 Warren Lane, Inglewood, Cal.
 J. J. Warner Co., 1244 Larkin St., San Francisco, Cal.
Wilcox-Gay Corp., Charlotte, Mich.

Needles

H. W. Acton Co., Inc., 370 Seventh Ave., New York City.
 Arrow Radio Co., 900 W. Jackson Blvd., Chicago.
 Audio Devices, Inc., 1600 Broadway, New York City.
Brush Development Co., 3318 Perkins Ave., Cleveland, Ohio.

Carron Manufacturing Co., 415 S. Aberdeen St., Chicago.
Duotone Co., Inc., 799 Broadway, New York City.
 Eldeen Co., 500 N. Water St., Milwaukee, Wis.
 Electrovox Co., Inc., 356 Glenwood Ave., East Orange, N. J.
 Federal Recorder Co., Elkhart, Ind.
Howard Radio Co., 1731 Belmont Ave., Chicago.
 Mirror Record Corp., 58 W. 25th St., New York City.
 Music Master Manufacturing Co., 508 S. Dearborn St., Chicago.
Permo Products Corp., 6415 Ravenswood Ave., Chicago.
 Phonograph Needle Manufacturing Co., Inc., 42-46 Dudley St., Providence, R. I.
Presto Recording Corp., 242 W. 55th St., New York City.
RCA Manufacturing Co., Inc., Camden, N. J.
 (See adv. back cover)
 Radiotone, Inc., 7356 Melrose Ave., Hollywood, Cal.
 Rangertone, Inc., Newark, N. J.
Recotone Corp., 21-10 49th Ave., Long Island City, N. Y.
 Recordisc Corp., 395 Broadway, New York City.
 Sound Apparatus Co., 150 W. 46th St., New York City.
 Speak-O-Phone Recording & Equipment Co., 23 W. 60th St., New York City.
 Stangard Products Co., 4111 Ft. Hamilton Pkwy., Brooklyn, N. Y.
Universal Microphone Co., Ltd., 424 Warren Lane, Inglewood, Cal.
Wilcox Gay Corp., Charlotte, Mich.

Recorders

Allied Recording Products Co., 21-09 43rd Ave., Long Island City, N. Y.
 Arrow Radio Co., 900 W. Jackson Blvd., Chicago.
 Audio-Tone Oscillator Co., 60 Walter St., Bridgeport, Conn.
 Bateman Sound Systems, 680 Johnston St., Akron, Ohio.
 Bell Sound System, Inc., 1185 Essex Ave., Columbus, Ohio.
 David Bogen Co., 663 Broadway, New York City.
 Herman A. DeVry, 1111 W. Center St., Chicago.
 Fairchild Aviation Corp., 88-06 Van Wyck Blvd., Jamaica, N. Y.
 Federal Recorder Co., Elkhart, Ind.
 General Industries Co., Elyria, O.
Howard Radio Co., 1731 Belmont Ave., Chicago.
Lafayette Radio Corp., 100 Sixth Ave., New York City.
 Magnavox Co., Ft. Wayne, Ind.
John Meck Industries, 1313 W. Randolph St., Chicago.
Meissner Manufacturing Co., Mt. Carmel, Ill.
 (See adv. page 29)
 Miles Reproducer Co., 812 Broadway, New York City.
 Music Master Mfg. Co., 508 S. Dearborn St., Chicago.
 Pacific Sound Equipment Co., 7373 Melrose Ave., Hollywood, Cal.
Presto Recording Corp., 242 W. 55th St., New York City.
 B. A. Proctor Co., 230 Park Ave., New York City.
RCA Manufacturing Co., Inc., Camden, N. J.
 (See adv. back cover)
 Radiotone, Inc., 7356 Melrose Ave., Hollywood, Cal.
 Frank Rieber, Inc., 11916 W. Pico Blvd., Los Angeles, Cal.
 Rek-O-Kut Corp., 173 Lafayette St., New York City.
 J. P. Seeburg Corp., 1510 N. Dayton St., Chicago.
 Sound Apparatus Co., 150 W. 46th St., New York City.
 Speak-O-Phone Recording & Equipment Co., 23 W. 60th St., New York City.
 Talk-A-Phone Manufacturing Co., 1217 W. Van Buren St., Chicago.
 Talking Devices Co., 4451 Irving Park Rd., Chicago.
Universal Microphone Co., Ltd., 424 Warren Lane, Inglewood, Cal.
 Vibraloc Manufacturing Co., 1273 Mission St., San Francisco, Cal.
 J. J. Warner Co., 1244 Larkin St., San Francisco, Cal.
 Western Sound & Electric Laboratories, Inc., Milwaukee, Wis.
Wilcox-Gay Corp., Charlotte, Mich.
 Zenith Radio Corp., 6011 Dickens Ave., Chicago.

R-F COILS (See Coils)

RECORD CHANGERS
(See Automatic)

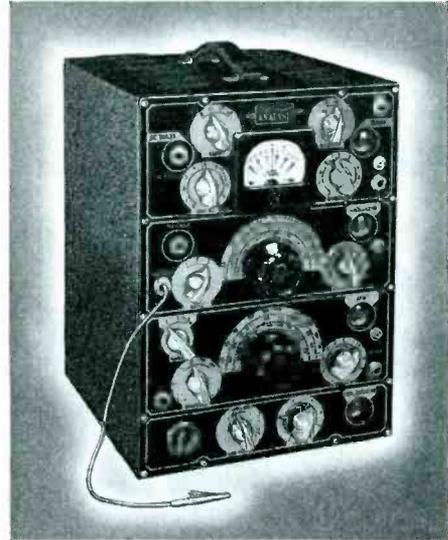
RECTIFIERS (See Disc)

REMOTE CONTROLS
(See Auto Radio)

CONVENIENCE

the NEW Meissner

ANALYST



-has it!

The NEW Meissner ANALYST, with Direct Reading Electronic Voltmeter, is designed for the Modern Service Bench. Built for SPEEDY trouble-shooting, its carefully planned convenience will save EXTRA time . . . when time counts! You can get those RUSH jobs out in really short order—and know they're right!

Convenience is built into the ARRANGEMENT of controls on the new panel! Each Channel has its own separate section, plainly marked, and every control is right where you would expect to find it! No groping around the panel (or back of the cabinet) for a switch or jack connection . . . it's right there on the panel . . . where it belongs!

For that matter, ALL controls and jacks are ON THE PANEL! If you want to mount this instrument in your wall rack . . . that's your business . . . you won't have to turn the ANALYST around after it's plugged in!

Complete with tubes . . . ready to operate Model 9-1040 ANALYST, Net . . . \$96.25

SEE YOUR JOBBER—TODAY!



the NEW
Meissner
"How to Build"
INSTRUCTION MANUAL
1941 EDITION

**NEW
INSTRUCTION
MANUAL**

F-M Data and valuable service information in addition to instructions on all Meissner Kits and equipment; 168 pages!

Only 50c Net

WRITE FOR FREE 48-PAGE CATALOG!

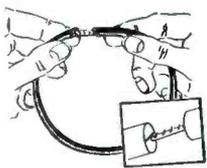
Dept. 5-9



SERVICE, SEPTEMBER, 1941 • 29

NECESSITIES FOR PROFITABLE SERVICING

WALSCO UNIBELT ADJUSTABLE DIAL BELT



The amazing new WalSCO Unibelt is adjustable to fit any dial. Comes open, so Unibelt can be put on without taking dial mechanism apart, thus does an hour's job in a few minutes. Zipper-like fastener gives instant connection.

Stretching and slipping are also eliminated. Ask your jobber to show you a sample.

WALSCO STAPLE DRIVER

Indispensable for every radio and P.A. man. Staples wires automatically—even in corners, behind pipes. Works also on brick and plaster walls. Staples for all wires up to 1/4" in diameter come in Ivory and Brown.



WALSCO RADIO CHEMICALS

Are among the finest obtainable. Cements for speakers, fabrics, cabinets are available in bottles or tubes. A new contact cleaner keeps pushbuttons, controls, switches, etc., noise free.

FOR MORE DETAILS ABOUT
WALSCO PRODUCTS

Ask Your Jobber or Write for
Free Catalog No 42E to

WALTER L. SCHOTT CO.

5266 W. Pico Blvd. Los Angeles, Calif.

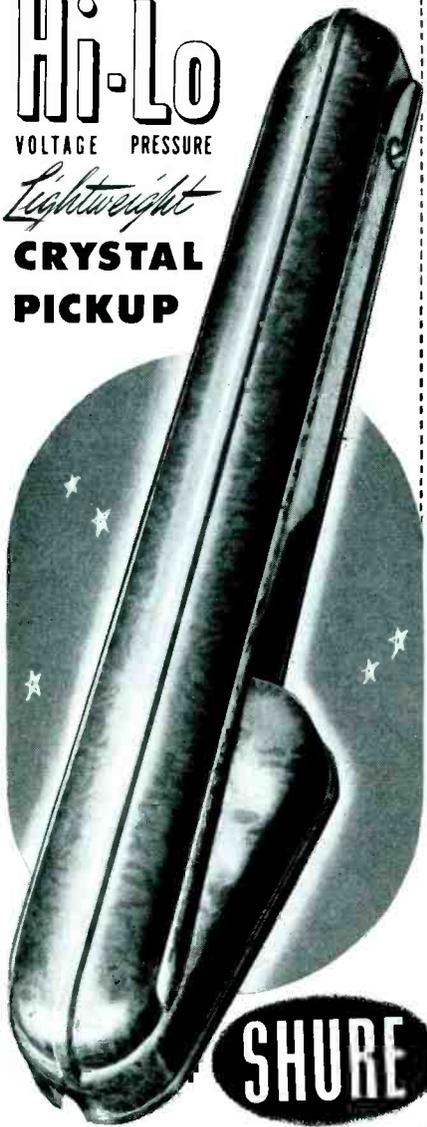
Increase Record Life
with the new Shure

Hi-Lo

VOLTAGE PRESSURE

Lightweight

**CRYSTAL
PICKUP**



Easier to sell! Easier to install! Only 1-ounce needle pressure with 1.4 volts output at 1000 cps—over twice the output of any other lightweight pickup. Uses permanent sapphire point needle. Improves reproduction—keeps records like new. Streamlined plastic arm in mahogany finish with offset head.

Model 97AN. Complete with permanent sapphire point needle.
List Price **\$6.50**

Model 97A. Same, less needle.
List Price **\$5.50**

Shure Patents Pending. Licensed under Brush Patents.

Ask Your Jobber or Send Coupon

SHURE BROTHERS
225 W. Huron St., Chicago, Ill.
Please send free Bulletin 212S

Name

Address

City..... State.....

Service—Sept. '41

RESISTORS—(CARBON & WIRE WOUND)

- Aerovox Corp., New Bedford, Mass.**
(See adv. page 34)
- Allen-Bradley Co., 1326 S. Second St., Milwaukee, Wis.**
- Atlas Resistor Co., 423 Broome St., New York City.**
- Centralab, Inc., 900 E. Keefe Ave., Milwaukee, Wis.**
- Clarostat Manufacturing Co., Inc., 285 N. Sixth St., Brooklyn, N. Y.**
- Consolidated Wire & Associated Corps., Peoria & Harrison Sts., Chicago.**
- Continental Carbon, Inc., 13900 Lorain Ave., Cleveland, Ohio.**
- Cutler-Hammer, Inc., 1401 W. St. Paul Ave., Milwaukee, Wis.**
- Daven Co., 158 Summit St., Newark, N. J.**
- Electro-Motive Manufacturing Co., Willimantic, Conn.**
- Erie Resistor Corp., 644 W. 12th St., Erie, Pa.**
- General Electric Co., Schenectady, N. Y.**
- Girard-Hopkins, 1000 Fortieth Ave., Oakland, Cal.**
- Globar Division Carborundum Co., Niagara Falls, N. Y.**
- Hardwick, Hindle, Inc., 46 Hermon St., Newark, N. J.**
- International Resistance Co., 401 N. Broad St., Philadelphia, Pa.**
(See adv. page 27)
- P. R. Mallory & Co., Inc., Indianapolis, Ind.**
(See adv. inside front cover)
- Muter Co., 1255 S. Michigan Ave., Chicago.**
- Ohmite Manufacturing Co., 4879 Flournoy St., Chicago.**
(See adv. page 31)
- Speer Carbon Co., St. Marys, Pa.**
- Sprague Products Co., No. Adams, Mass.**
- Stackpole Carbon Co., St. Marys, Pa.**
- Struthers Dunn, Inc., 1315 Cherry St., Philadelphia, Pa.**
- Utah Radio Products Co., 816 Orleans St., Chicago.**
(See adv. page 25)
- Ward Leonard Electric Co., Mt. Vernon, N. Y.**
- S. S. White Dental Mfg. Co., 10 E. 40th St., New York City.**
- Wirt Co., 5221-27 Greene St., Philadelphia, Pa.**

SERVICE MANUALS

- Radercraft Publications, Inc., 20 Vesey St., New York City.**
- Radio & Technical Publishing Co., 45 Astor Pl., New York City.**
(See adv. page 33)
- John F. Rider Publisher, Inc., 404 Fourth Ave., New York City.**
(See adv. page 22)

SHIELDS—(TUBE & COIL)

- American Radio Hardware Co., 476 Broadway, New York City.**
- Bud Radio, Inc., 2118 E. 55th St., Cleveland, O.**
- Goat Metal Stampings, Inc., 314 Dean St., Brooklyn, N. Y.**
- Edwin I. Guthman & Co., 400 So. Peoria St., Chicago.**
- Meissner Manufacturing Co., Mt. Carmel, Ill.**
(See adv. page 29)
- James Millen Manufacturing Co., 150 Exchange St., Malden, Mass.**
- J. W. Miller Co., 5917 N. Main St., Los Angeles, Cal.**
- National Co., 61 Sherman St., Malden, Mass.**

**SIGNAL GENERATORS
(See Test Equipment)**

SOCKETS

- Alden Products Co., 117 Main St., Brockton, Mass.**
- American Phenolic Corp., 1830 S. 54th Ave., Chicago.**
- American Radio Hardware Co., 476 Broadway, New York City.**
- Bud Radio, Inc., 2118 E. 55th St., Cleveland, Ohio.**
- Cannon Electric Development Co., 3209 Humboldt St., Los Angeles, Cal.**
- Cinch Manufacturing Co., 2335 W. Van Buren St., Chicago.**
- Continental-Diamond Fibre Co., Newark, Del.**
- Hugh H. Eby, Inc., 4700 Stenton Ave., Philadelphia, Pa.**
- A. W. Franklin Manufacturing Corp., 175 Varick St., New York City.**
- General Electric Co., Plastics Dept., Pittsfield, Mass.**
- General Radio Co., 30 State St., Cambridge, Mass.**
- Hammarlund Manufacturing Co., Inc., 424 W. 33d St., New York City.**
- Insuline Corp. of America, 30-30 Northern Blvd., Long Island City, N. Y.**
- Howard B. Jones, 2300 Wabansia Ave., Chicago.**
- P. R. Mallory & Co., Inc., Indianapolis, Ind.**
(See adv. inside front cover)
- Meissner Manufacturing Co., Mt. Carmel, Ill.**
(See adv. page 29)

- Micarta Fabricators, Inc., 4619 Ravenswood Ave., Chicago.**
- James Millen Manufacturing Co., 150 Exchange St., Malden, Mass.**
- J. W. Miller Co., 5917 S. Main St., Los Angeles, Cal.**
- National Co., 61 Sherman St., Malden, Mass.**
- Teleradio Engineering Corp., 484 Broome St., New York City.**

SOLDER

- Alpha Metal & Rolling Mills, Inc., 363 Hudson Ave., Brooklyn, N. Y.**
- L. S. Brach Manufacturing Co., 55 Dickerson St., Newark, N. J.**
(See adv. page 33)
- Gardiner Metal Co., 4820 S. Campbell Ave., Chicago.**
- Kester Solder Co., 4212 Wrightwood Ave., Chicago.**
- National Lead Co., 111 Broadway, New York City.**
- New York Solder Co., 15 Crosby St., New York City.**
- Paramount Wire Co., 98 Bleecker St., New York City.**
- Ruby Chemical Co., 68 McDowell St., Columbus, Ohio.**

SOLDERING IRONS

- L. S. Brach Mfg. Co., 55 Dickerson Ave., Newark, N. J.**
(See adv. page 33)
- Cole Radio Works, 86 Westville Ave., Caldwell, N. J.**
- Drake Electric Works, Inc., 3656 Lincoln Ave., Chicago.**
- Electric Soldering Iron Co., Inc., Deep River, Conn.**
- Ideal Commutator Dresser Co., Sycamore, Ill.**
- Sta-Warm Electric Co., Ravenna, Ohio.**
- Vannatta Manufacturing Co., 615 Monterey Ave., Ontario, Cal.**
- Vasco Electric Manufacturing Co., 4116 Avalon Blvd., Los Angeles, Cal.**
- Vulcan Electric Co., 600 Broad St., Lynn, Mass.**

**STORAGE BATTERIES
(See Batteries)**

SPAGHETTI TUBING

- Alpha Wire Co., 50 Howard St., New York City.**
- William Brand & Co., 276 Fourth Ave., New York City.**
- Irrington Varnish & Insulator Co., Irvington, N. J.**

**SPEAKER CABINETS
(See Baffles)**

**SPEAKERS
(See Loudspeakers)**

SWITCHES

- On-Off Switches**
- Aero Electric Co., 3167 Fulton Rd., Cleveland, O.**
- Utah Radio Products Co., 816 Orleans St., Chicago.**
(See adv. page 25)

Multiple and Band Switches

- American Phenolic Corp., 1830 S. 54th Ave., Chicago.**
- Centralab, Inc., 900 E. Keefe Ave., Milwaukee, Wis.**
(See adv. page 4)
- General Cement Manufacturing Co., Rockford, Ill.**
(See adv. page 36)
- P. R. Mallory & Co., Inc., Indianapolis, Ind.**
(See adv. inside front cover)
- Meissner Manufacturing Co., Mt. Carmel, Ill.**
(See adv. page 29)
- Oak Manufacturing Co., 711 W. Lake St., Chicago.**
- Ohmite Manufacturing Co., 4879 Flournoy St., Chicago.**
(See adv. page 31)
- Wirt Co., 5221-27 Greene St., Philadelphia, Pa.**

TEST EQUIPMENT, ETC

- General Service Bench Equipment**
- Approved Technical Apparatus Corp., 77 Washington St., New York City.**
- Clough-Brengle Co., 5501 Broadway, Chicago.**
- Carron Manufacturing Co., 415 S. Aberdeen St., Chicago.**
- Consolidated Wire & Associated Corps., Peoria & Harrison Sts., Chicago.**
- Dayton-Acme Corp., Cincinnati, Ohio.**
- General Electric Co., 1285 Boston Ave., Bridgeport, Conn.**
- Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland, O.**

TEST EQUIPMENT

(Continued)

Jackson Electrical Instrument Co., 129 Wayne Ave., Dayton, O.

(See adv. page 26)

Meissner Manufacturing Co., Mt. Carmel, Ill.

(See adv. page 29)

Million Radio & Television Labs., 1617 N. Damen Ave., Chicago.

Monarch Manufacturing Co., 3341 Belmont Ave., Chicago.

Philco Corp., Allegheny & A Sts., Philadelphia, Pa.

Precision Apparatus Co., 647 Kent Ave., Brooklyn, N. Y.

Radex Corp., 1322 Elston Ave., Chicago.

Radio City Products Co., Inc., 88 Park Pl., New York City.

(See adv. inside back cover)

Radiotechnic Lab., 1328 Sherman Ave., Evanston, Ill.

Readrite Meter Works, Bluffton, Ohio.

(See adv. page 22)

Simpson Electric Co., 5216 Kinzie St., Chicago.

Supreme Instruments Corp., Howard St., Greenwood, Miss.

(See adv. page 35)

Televiso Products, Inc., 2400 N. Sheffield Ave., Chicago.

Triplett Electrical Instrument Co., Bluffton, O.

(See adv. page 31)

Triumph Manufacturing Co., 4017 W. Lake St., Chicago.

Earl Webber Co., 4358 W. Roosevelt Road, Chicago.

Weston Electrical Instrument Corp., 612 Frelinghuysen Ave., Newark, N. J.

Cathode-Ray Oscilloscopes

Clough-Brengle Co., 5501 Broadway, Chicago.

Allen E. DuMont Laboratories, Inc., Passaic, N. J.

General Electric Co., Bridgeport, Conn.

General Radio Co., Cambridge, Mass.

Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland, O.

Jackson Electrical Instrument Co., 129 Wayne Ave., Dayton, Ohio.

(See adv. page 26)

RCA Manufacturing Co., Inc., Camden, N. J.

(See adv. back cover)

Sundt Engineering Co., 4757 Ravenswood Ave., Chicago. (Neon Oscilloscope)

Supreme Instruments Corp., Greenwood, Miss.

(See adv. page 35)

Triplett Electrical Instrument Co., Bluffton, Ohio.

(See adv. page 31)

Triumph Mfg. Co., 4017 W. Lake St., Chicago.

Earl Webber Co., 4358 W. Roosevelt Road, Chicago.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Condenser Testers

Aerovox Corp., New Bedford, Mass.

(See adv. page 34)

Clough-Brengle Co., 5501 Broadway, Chicago.

Cornell-Dubilier Electric Corp., S. Plainfield, N. J.

Jackson Electrical Instrument Co., 129 Wayne Ave., Dayton, Ohio.

(See adv. page 26)

Radio City Products Co., Inc., 88 Park Pl., New York City.

(See adv. inside back cover)

Radio Service Engineers, 110 W. Puckard St., Ft. Wayne, Ind.

Solar Manufacturing Corp., Bayonne, N. J.

(See adv. page 33)

Sprague Products Co., No. Adams, Mass.

Triplett Electrical Instrument Co., Bluffton, O.

(See adv. page 31)

Crystal Calibrators

Biley Electric Co., 200 Union Station Bldg., Erie, Pa.

Browning Laboratories, Inc., 750 Main St., Winchester, Mass.

Hallcrafters Inc., 2611 S. Indiana Ave., Chicago.

RCA Manufacturing Co., Inc., Camden, N. J.

(See adv. back cover)

Meters

Beede Electrical Instrument Co., Penacook, N. H.

DeJur Amisco Corp., Bridge St., Shelton, Conn.

General Electric Co., Schenectady, N. Y.

Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland, Ohio.

Hoyt Electrical Instrument Works, 857 Boylston St., Boston, Mass.

Marion Electrical Instrument Co., Manchester, N. H.

Readrite Meter Works, Bluffton, Ohio.

(See adv. page 22)

Sensitive Research Instrument Corp., 4545 Bronx Blvd., New York City.

Simpson Electric Co., 5216 Kinzie St., Chicago.

Sterling Manufacturing Co., 9205 Detroit Ave., Cleveland, O.

Triplett Electrical Instrument Co., Bluffton, Ohio.

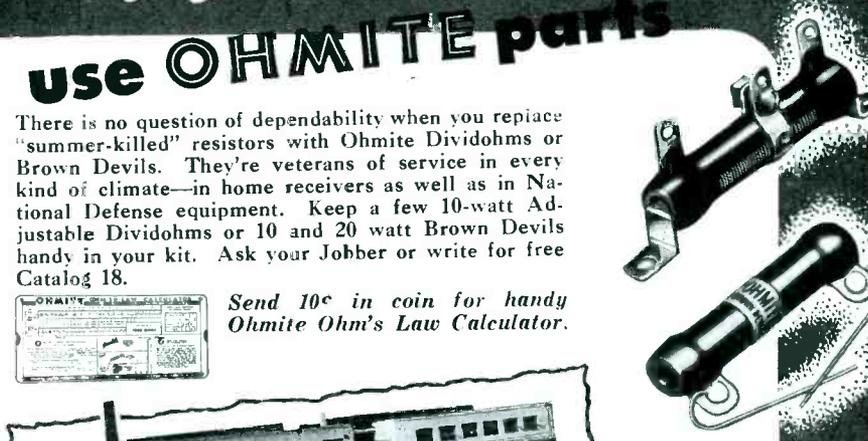
(See adv. page 31)

Safeguard your service work

use OHMITE parts

There is no question of dependability when you replace "summer-killed" resistors with Ohmite Dividohms or Brown Devils. They're veterans of service in every kind of climate—in home receivers as well as in National Defense equipment. Keep a few 10-watt Adjustable Dividohms or 10 and 20 watt Brown Devils handy in your kit. Ask your Jobber or write for free Catalog 18.

Send 10¢ in coin for handy Ohmite Ohm's Law Calculator.



OHMITE EXPANDS FACTORY FACILITIES

Here, at Ohmite, factory size has been doubled, production facilities have been greatly increased—everything possible is being done to provide Ohmite parts for everyone's needs.

OHMITE MANUFACTURING COMPANY
4879 Flournoy Street ★ Chicago, U. S. A.

BE RIGHT WITH OHMITE
Rheostats
Resistors
Tap Switches

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Weston Electrical Instrument Corp., 612 Frelinghuysen Ave., Newark, N. J.

Test Lights

Ideal Commutator Dresser Co., Sycamore, Ill.
Littelluse, Inc., 4757 N. Ravenswood Ave., Chicago.

TRANSFORMERS

Acme Electric & Manufacturing Co., 31 Water St., Cuba, N. Y.

American Transformer Co., 178 Emmet St., Newark, N. J.

Audio Development Co., 123 Bryant Ave., N., Minneapolis, Minn.

Chicago Transformer Corp., 3501 W. Addison St., Chicago.

James W. Doyle, Inc., 311 N. Desplaines St., Chicago.

Ferranti Electric, Inc., 30 Rockefeller Plaza, New York City.

Freed Transformer Co., 72 Spring St., New York City.

General Transformer Corp., 1250 W. Van Buren St., Chicago.

Haldorson Co., 4500 Ravenswood Ave., Chicago.

International Transformer Corp., 17 W. 20th St., New York City.

Jefferson Electric Co., Bellwood, Ill.

Kenyon Transformer Co., Inc., 840 Barry St., New York City.

New York Transformer Co., 480 Lexington Ave., New York City.

Norwalk Transformer Corp., S. Norwalk, Conn.

RCA Manufacturing Co., Inc., Camden, N. J.

(See adv. back cover)

Radex Corp., 1322 Elston Ave., Chicago.

Standard Transformer Corp., 1500 N. Halsted St., Chicago, Ill.

Stromberg Carlson Telephone Manufacturing Co., Rochester, N. Y.

Thordarson Electric Manufacturing Co., 500 W. Huron St., Chicago.

United Transformer Corp., 150 Varick St., New York City.

(See adv. page 1)

Utah Radio Products Co., 816 Orleans St., Chicago.

(See adv. page 25)

ANSWERS BY

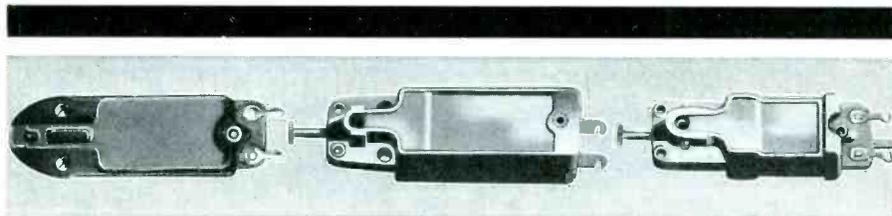
TRIPLET



The need for controlled processes and uniform quality in parts has been answered by Triplett in setting up manufacturing facilities that make the company practically self-sustaining in the fabrication of instrument and tester components.

Shown here is a view of one section of the automatic screw machine department in the modern Triplett plant where essential parts—some as minute as the smallest used in watches—are turned out 24 hours a day. More and more, Triplett has turned to wholly automatic fabrication of materials to speed up production and to eliminate any possibility of human error. To assure parts best suited for Triplett needs, company engineers have pioneered in the design and manufacture of countless fabricated materials including switches, bar knobs, resistors, jacks, special adapters, etc.—a complete service intended to give each user the fullest measure of satisfaction.

THE TRIPLET ELECTRICAL INSTRUMENT CO.
Bluffton, Ohio



TYPE "LP"

TYPE "L"

TYPE "M"

ASTATIC CRYSTAL PICKUP CARTRIDGES

for Replacement Business

Most electrical phonographs now in use are equipped with pickup arms using Astatic Crystal Pickup Cartridges. No other type cartridges are designed and constructed with more precision and skill for long and satisfactory service. Due to the vast number of these pickups manufactured, sold and used over a period of many years, it is natural to assume that there is a substantial cartridge replacement business. Check your stock to see that you have sufficient Astatic Crystal Cartridges on hand to meet prompt service demands.

Technical and detailed information concerning Astatic Cartridges is available upon request.



TYPE "B"



THE ASTATIC CORPORATION

YOUNGSTOWN, OHIO

Licensed Under Brush Development Co. Patents

In Canada: Canadian Astatic Ltd. Toronto, Ontario

TUBES—RECEIVING

General Electric Co., Bridgeport, Conn.
Hygrade-Sylvania Corp., 500 5th Ave., New York City.

(See adv. page 24)

Hytron Corp., 76 Lafayette St., Salem, Mass.
Ken-Rad Tube & Lamp Corp., Owensboro, Ky.

(See adv. page 3)

National Union Radio Corp., 57 State St., Newark, N. J.

(See adv. page 19)

Philco Corp., Tioga & C Sts., Philadelphia, Pa.
RCA Manufacturing Co., Inc., Camden, N. J.

(See adv. back cover)

Raytheon Production Corp., 445 Lake Shore Drive, Chicago.

Tung-Sol Lamp Works, Inc., 95 Eighth Ave., Newark, N. J.

TUBE TESTERS

(See Test Equipment)

TUBE SHIELDS (See Shields)

VIBRATORS

American Television & Radio Co., 300 E. 4th St., St. Paul, Minn.

Electronic Labs., Inc., 122 W. New York Ave., Indianapolis, Ind.

P. R. Mallory & Co., Inc., 3029 E. Washington St., Indianapolis, Ind.

(See adv. inside front cover)

Meissner Manufacturing Co., Mt. Carmel, Ill.

(See adv. page 29)

Oak Manufacturing Co., 711 W. Lake St., Chicago.

Radiart Corp., W. 62d & Barberton Ave., Cleveland, Ohio.

(See adv. page 17)

The Turner Co., 906 Seventeenth St., N. E., Cedar Rapids, Iowa.

Utah Radio Products Co., 816 Orleans St., Chicago.

(See adv. page 25)

VOLUME CONTROLS

Allen-Bradley Co., Milwaukee, Wis.
Art Radio Corp., 115 Liberty St., New York City.

Centralab, Inc., 900 E. Keefe Ave., Milwaukee, Wis.

(See adv. page 4)

Clarostat Manufacturing Co., Inc., 285 N. Sixth St., Brooklyn, N. Y.

Consolidated Wire & Associated Corps., Peoria & Harrison Sts., Chicago.

Electro Products Labs., 549 W. Randolph St., Chicago.

International Resistance Co., 401 N. Broad St., Philadelphia, Pa.

(See adv. page 27)

P. R. Mallory & Co., Inc., Indianapolis, Ind.

(See adv. inside front cover)

Meissner Manufacturing Co., Mt. Carmel, Ill.

(See adv. page 29)

Ohmite Manufacturing Co., 4879 Flournoy St., Chicago.

(See adv. page 31)

Stackpole Carbon Co., St. Marys, Pa.
Utah Radio Products Co., 816 Orleans St., Chicago.

(See adv. page 25)

Wirt Co., 5221-27 Greene St., Philadelphia, Pa.

WIRE & CABLE

Acme Wire Co., 1255 Dixwell Ave., New Haven, Conn.

Alpha Wire Co., 50 Howard St., New York City.

Anaconda Wire & Cable Co., 25 Broadway, New York City.

Belden Manufacturing Co., 4673 W. Van Buren St., Chicago.

Birnbach Radio Co., 145 Hudson St., New York City.

Boston Insulated Wire & Cable Co., 65 Bay St., Boston, Mass.

Consolidated Wire & Associated Corps., Peoria & Harrison Sts., Chicago.

Cornish Wire Co., 15 Park Row, New York City.

Crescent Insulated Wire & Cable Co., Trenton, N. J.

General Cable Corp., 420 Lexington Ave., New York City.

General Electric Co., Schenectady, N. Y.

Holyoke Wire & Cable Corp., 720 Main St., Holyoke, Mass.

Lenz Electric Manufacturing Co., 1751 N. Western Ave., Chicago.

Phelps Dodge Copper Products Corp., 40 Wall St., New York City.

John A. Roebling's Sons Co., Trenton, N. J.

SOCKETS

(Continued from page 11)

at the top of the bulb.

For radio-frequency use, particularly

at ultra-high frequencies, special insulating materials are employed. These are known by many trade names, such as micalex, ultra-calcan, steatite, polystyrene, etc. Each of these is characterized by a lower loss factor than bakelite, although in other respects they have disadvantages, principally as to increased cost, difficulty of machining or, in the case of polystyrene, inability to withstand high temperatures. By "loss factor" is meant the product of the dielectric constant and the power factor of the insulating material at a given frequency.

The advantages of these low-loss sockets have been so often extolled that it is needless to consider them again here. A certain amount of horse sense should be used in connection with these sockets, however. Obviously, we can expect no marvelous increase in circuit efficiency by substituting a low-loss socket for a standard type if the base of the tube with which the low-loss socket isn't low loss as well. Most certainly there will be leakage, when conditions are such as will cause leakage, only the leakage will be across the base of the tube rather than the socket itself. Insofar as the performance of the circuit is concerned, however, it naturally makes no difference where the leakage occurs . . . it's just there.

When radio apparatus is to be used under conditions of high humidity, low-loss sockets, because of their extremely low moisture absorption, offer advantages over other types. For ordinary conditions in our climate, however, standard bakelite sockets will serve very satisfactorily for radio frequencies up to about 30 mc. At higher frequencies losses become appreciable, and such sockets suffer in comparison with low-loss types, especially when tubes, such as the acorn types with inherently low losses at high frequencies, are used.

One point in replacing sockets which is often overlooked when horizontally mounted tubes are employed is the need for so placing the socket that the tube filament or heater will not tend to lean over and short to the grid or plate. This is particularly important in the case of many rectifier types. The proper form of mounting is illustrated in Fig. 4A. What happens when the socket is improperly set is shown in Fig. 4B. Many cases of short tube life result from just such seemingly minor points.

Frequently it is necessary so to mount the socket that vibration is not transmitted to the tube, thus avoiding or minimizing microphonic conditions. A simple way of accomplishing this is illustrated in Fig. 5. The normal mounting holes are simply widened, as shown, and soft, live rubber grommets inserted in the holes. When the socket is reassembled in its mounting, it is then completely suspended on rubber.

"We Quote"

"There will be no shortage of radio parts generally. Of that much you can be sure. But already there are shortages in specific types and values. Which is but another way of saying that the serviceman from now on will have to be ingenious, adaptable and cooperative if he intends to stay in business during the trying days of intensified National Defense.

... if you can't get one type or value of part you will have to get along with some other type or value or even a combination of units. This is a day of substitution, improvisation, downright ingenuity. Rest assured that there will always be something that can be used for any set repair even if usual replacement types are not momentarily available. The OPM will undoubtedly see to it that essential parts and materials are made available to servicemen so that America's 50-odd million radio sets are kept working. This indispensable link between our people and their leaders assumes colossal proportions today.

"During the coming months you servicemen will be faced with unavoidable substitutions and changes in the parts you get. Sizes will be changed; terminals may be different; mountings may be altered; certain values may be unobtainable. Don't squawk about it. No one can help it. There will certainly be a second or other choice—another way of doing the same job. Parts manufacturers will see to that.

"Your job in this emergency is to accept these unavoidable substitutions or changes. Display your ingenuity and adaptability in fitting other units when usual replacements are momentarily unobtainable. Cooperate with your jobber and his manufacturer, by using what is available. Such will constitute our joint contribution towards National Defense."

Charles Golenpaul, Sales Manager
AEROVOX CORPORATION

"Every indication points to a reduction in the number of new radio receivers to be manufactured during the coming months. This means that the repair and maintenance of receivers already in operation in the homes of the public will assume greater importance than ever before. In my opinion, this offers a challenge to better radio service men to increase their efficiency and ingenuity. Upon the radio service man will evolve the responsibility for maintaining an important link in the Defense Program—the dissemination of information through the medium of radio broadcasting.

"Therefore, the radio service industry is on the doorstep of opportunity to enjoy, not only an increased volume of business, but what is even more important, an opportunity to perform a definite and important public service."

L. W. Teegarden, Manager
RADIO & TUBE DIVISIONS
RCA MANUFACTURING CO., INC.

A good, well equipped service bench is vital to successful servicing. Read SERVICE each month for the latest developments.

JUST OFF THE PRESS!

A. A. Ghirardi's REVISED and ENLARGED (New 2nd Edition) RADIO Trouble-Shooter's HANDBOOK



40% Bigger!
The service man's most helpful Handbook! Thousands of repair shops have used the old edition daily in their work—this new one is 40% BIGGER and BETTER than ever.

New from Cover to Cover!
Every page completely revised and brought up to date—and 202 pages of additional new material added.

Send for Trial Copy
For the sake of your own business see a copy of this new Handbook without delay. Use the coupon. Our Money-Back Guarantee protects you.

QUICK FACTS ABOUT IT FOR BUSY SERVICE MEN:
1. Trouble "Case Histories" for 4,600 Receivers and Record Changers (largest compilation ever published)
2. Alignment Data for 20,000 sets
3. 60 pages of Auto-Radio Servicing data
4. Battery Replacement Charts for 1,200 Portable Sets
5. 37 Pages of Tube Data Charts (Covers every tube ever made)
6. 59 other invaluable Charts and Data compilations
7. All data carefully arranged and indexed for INSTANT REFERENCE

NOW increased to

710 Big MANUAL-SIZE PAGES!

CHECK FULL OF VITAL TIME-SAVING DATA FOR 1942 SERVICING

THIS COUPON BRINGS IT TO YOU!

MAKE MORE MONEY BY BEING A FASTER TROUBLE-SHOOTER!

Ghirardi's New HANDBOOK is equal to reams of magazine clippings, service notes, manuals, catalogs, and thousands of hours of trouble-shooting experience when it comes to finding and remedying troubles quickly. You will do your trouble-shooting and repair work EASIER — BETTER — FASTER with its help.

Be a master of radio trouble-shooting and diagnosing.

CLIP OUT — mail TODAY!

RADIO & TECHNICAL PUBLISHING CO. (Dept. S-91)
45 Astor Place New York, N. Y.

Please send the books checked below. My satisfaction is guaranteed!

RADIO TROUBLE SHOOTER'S HANDBOOK \$3.50 GHIRARDI'S MODERN RADIO SERVICING \$4 BOTH BOOKS AT MONEY-SAVING Combination Price \$7

NAME CHECK HERE FOR FREE CIRCULARS!

ADDRESS

CITY STATE

YOUR MONEY BACK IF NOT COMPLETELY SATISFIED

BRACH Antennae

Automobile
Home — All types
F-M Systems
Television
Police • Marine
Multiple Systems
Complete Kits
Accessories

Made by World's Oldest and Largest Manufacturers of Radio Aerial Systems

L. S. BRACH MFG. CORP.
55 DICKERSON STREET
NEWARK, N. J.

SOLAR CONDENSER Quick-check Analyzer

MODEL QCA

- ✓ Measures Capacity
- ✓ Indicates Leakage
- ✓ Shows Insulation Resistance
- ✓ Indicates Power Factor
- ✓ Affords Dynamic Checking for OPENS ... SHORTS INTERMITTENTS
- ✓ Acts as Continuity Meter
- ✓ Indicates R. F. Impedance

Model QCA-1-60 \$24.90
Complete Analyzer, ready to operate . . . ONLY \$24.90

SOLAR MFG. CORP., Bayonne, N. J.

PHASE INVERSION

(Continued from page 15)

gain of the amplifier and the change in the ratio E_a/E_b is negligible throughout the 5-to-1 change in the value of R_3 .

Another test using a 6C5 in place of the 6F5 was conducted. The results of this test were similar to those shown in the table, except that the gain and balance of the amplifier were somewhat more critical to changes in the value of R_3 . Other tests of this circuit in typical receivers indicate that a good value of R_3 is 0.25 meg for any of the tubes ordinarily used in phase-inverter circuits. It should be noted, however, that it may be necessary to use a lower value of R_3 in order to satisfy recommendations for the maximum value of grid resistor for the output tubes.

The output tubes in the self-balancing phase-inverter circuit shown, are self-biased. When the bias for these tubes is obtained from a fixed or partial-fixed-bias source, it is necessary to couple the grid of tube B to point (a) through a suitable condenser (C_c), as shown in Fig. 8. In addition, a hum filter (R and C in Fig. 8) may be required. Because most partial-fixed-bias sources contain appreciable hum voltage, any hum voltage appearing across the grid resistor of tube B is amplified

by tube B and by one of the output tubes.

Bibliography

"The Signal Divider," by Nathan I. Daniel, *SERVICE*, June 1936, p. 260.

"Phase Inversion," *SERVICE*, September 1938, p. 23.

"Self-Balancing Phase-Inversion," RCA Application Note No. 97.

"Self-Balancing Phase-Inversion," *SERVICE*, November 1938, p. 14.

Catalogs, etc. . . .

• • • • Allied Radio Corp., 833 W. Jackson Blvd., Chicago, have issued their 212 page 1942 catalog. Included in the book are fifty Knight 1942 radio models, p-a amplifiers and equipment, parts and accessories.

• • • • Clough-Brengle Co., 5501 Broadway, Chicago, have issued their 24-page 1942 catalog of "Precision Laboratory & Maintenance Instruments for the Radio and Allied Communications Fields."

• • • • Among new literature available from Jensen Radio Manufacturing Co., 6601 S. Laramie Ave., Chicago, are: condensed catalog No. 125 which describes new Hypex projectors, coaxial speakers and reproducers with high frequency control; form No. 126, a treatise on "Hypex Horns" by Dr. Vincent Salmon; form No. 127, "Loudspeakers for Speech and Music Reproduction" by Ralph P. Glover, analyzing the requirements for speech and music reproduction; and data sheet No. 123 describing Hypex projectors employing the improved new formula non-exponential "Hypex" horn and "Annular" driver unit.

Expansion

• • • • The Electrovox Co., Manufacturers of Walco discs and needles, have moved into larger quarters at 356 Glenwood Ave., East Orange, N. J., in order to increase all manufacturing facilities.

• • • • Plans for a new building to be erected by the General Electric Co., Schenectady, N. Y., for the manufacture of radio tubes, have been announced by Dr. W. G. R. Baker, manager of G. E.'s radio and television department.

Personnel

• • • • A. E. Akeroyd, formerly assistant manager, will succeed Mr. Earl Dietrich as manager of the replacement tube division of the Raytheon Production Corp.

• • • • S. N. Shure of Shure Brothers and Jerome J. Kahn of Standard Transformer Corp., have been elected chairman and vice-chairman, respectively, for the ensuing year by the Sales Managers Club, Western Group. They succeed John J. Robinson of Crowe Name Plate and Manufacturing Co., and W. S. Hartford of Webster-Chicago.

NEW PRODUCTS

(Continued from page 16)

IRC CONTROL CABINET

It is said that the IRC "Master Radio-trician's Volume Control Cabinet" will handle from 60% to 75% of all control replacements. A total of 10,859 set models listed in the "IRC Volume Control Replacement Manual (Edition No. 3)" specify controls included in this cabinet. All such

replacements are indicated by an asterisk in the manual.

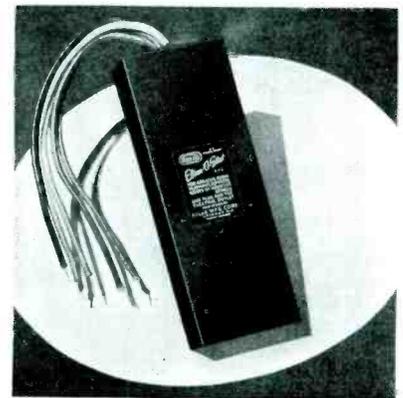
The cabinet is of all-metal construction and has individual, marked compartments for the controls. Three drawers accom-



modate switches, special shafts and other spare parts. The hinged front cover snaps shut for carrying, or may be removed entirely for shop use. The cabinet is 14½" long, 7¾" high and 4½" wide. It is supplied with the controls at no extra cost.

ELIM-O-STAT

Solar Manufacturing Co., Bayonne, N. J., announce the latest addition to their line of



Elim-O-Stat radio noise suppressors, the Type AFL, designed to eliminate the radio interference created by fluorescent lighting equipment. It is supplied in a small, narrow metal case for channel mounting.

MULTI-RANGE TESTER

Precision Apparatus Co., 647 Kent Ave., Brooklyn, N. Y., announce their Model 834, an all-purpose tester and troubleshooter meter which combines 31 ranges of a-c and d-c measurements in a minimum of space. The instrument offers 18 a-c and d-c volt-



age ranges, at 1,000 ohms per volt; 4 current ranges, 3 resistance ranges to 5 megs and 6 decibel ranges. All connections lead from only two pin jacks, with the exception of the 1,200 and 6,000 volt ranges. A 400 microampere rectangular indicating meter, and wire-wound multipliers are employed.

*Ask
your jobber
about this*

absolutely FREE!

The **AEROVOX**
Research Worker
month after month

- LATEST PRACTICAL DATA RIGHT FROM THE LAB
- NEW APPLICATIONS, CIRCUITS, TECHNIQUES
- CHARTS, FORMULAE, TABLES, REFERENCE DATA

For FREE Subscription
ask us about the

AEROVOX
CORPORATION
NEW BEDFORD, MASS.
IN CANADA AEROVOX CANADA, Limited, Hamilton, Ont.

YOU SAVE \$ 1 00

by using the
**Group
Subscription Plan**

OUR GROUP SUBSCRIPTION PLAN enables you and three or more of your co-workers to subscribe to SERVICE at one-half the regular yearly rate. In other words it will cost you and your friends only \$1.00 each for twelve issues of SERVICE. The G-S-Plan low rate only applies when 4 or more subscriptions are ordered at one time. (Foreign \$2.00.)

Speak to three or more of your friends . . . let them sign up with you and then you can remit for the whole group. (Renewals or extended subscriptions are acceptable as part of a group.)

TEAR OUT AND MAIL

SERVICE—19 E. 47th St., N. Y. C.

Please enter annual subscriptions (12 issues) for each of the undersigned for which payment is enclosed at the rate of \$1.00 each; foreign \$2.00. (This rate applies only on 4 or more subscriptions when occupations are given.)

Name
Address
City-State
Occupation
Employed by
State whether Employer is a Service Organization, Dealer, Jobber
or Manufacturer

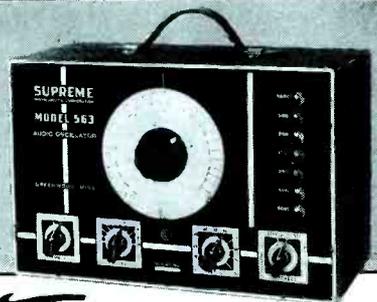
Name
Address
City-State
Occupation
Employed by
State whether Employer is a Service Organization, Dealer, Jobber
or Manufacturer

Name
Address
City-State
Occupation
Employed by
State whether Employer is a Service Organization, Dealer, Jobber
or Manufacturer

Name
Address
City-State
Occupation
Employed by
State whether Employer is a Service Organization, Dealer, Jobber
or Manufacturer

SUPREME

Presents
A NEW



Beat Frequency
Audio Oscillator

The SUPREME Beat Frequency Audio Oscillator has many important service applications. Provides an ideal source of test voltage for signal tracing in radio A.F. amplifiers, locating cabinet booms and speaker rattles, running frequency response curves, adjusting pick-ups and cutters, modulating of standard test oscillators for fidelity tests on R.F. and I.F. stages. It provides three output impedances of 250, 500 and 5,000 ohms; output frequency of 30 to 15,000 cycles; ± 1 db. from 30 to 10,000 cycles; down 2 db. at 15,000 cycles. Power output is 125 milliwatts; distortion less than 5% RMS over entire range; hum level -60 db. below maximum output; large ratio dial, calibrated scale over 12" in length; tube complement of 2 type 6SK7, 2 type 6C5, and 1 6X5; power consumption 35 watts—fuse protection. The Model 563 will meet the most exacting requirements wherever an accurate control source of audio voltage is needed. See your jobber, or write direct for full information.

**SUPREME INSTRUMENTS CORP., DEPT S-8
GREENWOOD, MISSISSIPPI**

**HAVE YOU EVER SEEN ALL THE CLIPS
THAT MUELLER OFFERS?**
Special Clips for Every Use



Solid Copper Clips



Insulated Clips



Send for Free Samples and Catalog 980

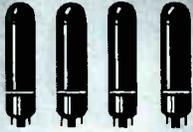
MUELLER ELECTRIC CO.

1573 East 31st Street

CLEVELAND, OHIO

**WHEN YOU CHANGE
YOUR ADDRESS**

Be sure to notify the Subscription Department of SERVICE at 19 E. Forty-seventh St., New York City, giving the old as well as the new address, and do this at least four weeks in advance. The Post Office Department does not forward magazines unless you pay additional postage, and we cannot duplicate copies mailed to the old address. We ask your cooperation.



4 STANDARD TYPES
of Amperite Regulators replace over 400 types of AC-DC Ballast Tubes now in use.

Amperites are real REGULATORS... have patented Automatic Starting Resistor which prevents initial surge and saves pilot lights... Ask Your Jobber.

AMPERITE

THE *Simplest* WAY TO REPLACE **BALLASTS**

WRITE FOR REPLACEMENT CHART
AMPERITE Co. 561 BROADWAY, NEW YORK, N. Y.

GET YOUR NEW 1942 ALLIED RADIO CATALOG!

212 PAGES—BIGGEST EVER!

NOW..AS EVER..SAVE ON EVERYTHING IN RADIO!

Get ALLIED'S FREE 1942 Catalog—the biggest ever. 212 Pages—Service—special sections for Dealers, Servicemen, and Sound Men. Radio's greatest Buying Guide—more complete than ever! Big PA Section—new Sound Systems—7 to 60 watts—for all approval! 15-Day Trial Offer: new features, applications; easy Time-Payment Plan; lowest prices! Servicemen—all the new test equipment, tools and service replacement parts. New Bargain Section—More than 15,000 replacement parts. New Bargain Section—real "buys" in brand-new merchandise! 50 New Radios—new styling, new models, and make wonderful "leaders" and profit-builders. Now, more than ever before, you need the 1942 ALLIED Radio Catalog!

FREE ALLIED RADIO CORP.
833 W. Jackson Blvd.
Chicago, Ill., Dept. 19-J-1
Rush me your FREE new 212-Page 1942 Radio Catalog.

Name
Address
City State

Index to Advertisers

A	
Aerovox Corp.	34
Allied Radio Corp.	36
Amperite Co.	36
Astatic Corp., The	32
B	
Brach Mfg. Corp., L. S.	33
C	
Centralab	4
Cinaudagraph Speakers, Inc.	28
G	
General Cement Mfg. Co.	36
H	
Hygrade Sylvania Corp.	24
I	
International Resistance Co.	27
J	
Jackson Electrical Instrument Co.	26
K	
Ken-Rad Tube & Lamp Corp.	3
M	
Mallory & Co., P. R. Inside Front Cover	
Meissner Mfg. Co.	29
Mueller Electric Co.	35
N	
National Union Radio Corp.	19
O	
Ohmite Mfg. Co.	31
R	
Radiart Corp., The.	17
Radio City Products Co. Inside Back Cover	
Radio & Technical Publishing Co.	33
RCA Mfg. Co., Inc. Back Cover	
Readrite Meter Works.	22
Rider Publisher, Inc., John F.	22
S	
Schott Co., Walter L.	29
Shure Bros.	30
Solar Mfg. Corp.	33
Supreme Instruments Corp.	35
T	
Triplett Elec. Inst. Co., The.	31
U	
United Catalog Publishers, Inc.	26
United Transformer Corp.	1
Utah Radio Products Co.	25
Y	
Yaxley Mfg. Division. Inside Front Cover	

GENERAL CEMENT

NEW! PRODUCTS



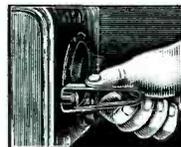
DIAL CABLE RACKS

"Free with assortments"
New easy way to handle cable. Hang rack on wall and measure off what you need on metal rule on rack. Each spool rolls separately.

No. 7A-25—Most Popular Cable
Net Price \$2.95
No. 7B-25—Less Popular Cable
Net Price \$2.76

NEW KNOB PULLER

Removes knobs easily with the new knob puller. Slip puller behind knob and pull off. Saves time, knob, and cabinet.



FELT-KOAT KIT

"New Flock Finish"
Complete kit for applying felt-like flock to phono-turntables, cabinets, testers, compartments, bases, grilles, etc. Colors: Brown, Blue, Taupe.



HAMMER FINISH KIT

Easy to apply kit that produces new hammered metal effect finish now popular on panels, chassis, test equipment, etc. Very fast drying.



Listed are only a few of many new G-C Service Aids now shown at your jobbers. Ask your jobber or write us for complete new catalog listing over 1000 Service Aids.

GENERAL CEMENT MFG. CO.
ROCKFORD, ILL., U.S.A.



hurry!

Make your advertising space reservation within the next few days for the **BIG OCTOBER FALL BUYING ISSUE** of

SERVICE

A Monthly Digest of Radio and Allied Maintenance

Reaches the trade right at the peak of the servicing season.

FINAL FORMS CLOSE
OCTOBER 11th

There's more
SERVICE
in every one!

RCP dependable **TEST** instruments

and the cost
is a whole
lot less!

GLANCE AT THE SPECIFICATIONS of any RCP test instrument for proof of great value. Each is designed to do more service-work . . . each is equipped with new features no other test equipment combines in a single, compact counter model or portable carrying case. RCP prices, moreover, are considerably less right down the line.

With a performance record few can match

at any price (which tells you all you need to know about RCP value), it's no wonder servicemen everywhere are doing more, earning more and *saving more* . . . no wonder the trend of the trade is to Radio City Products—money can't buy better test equipment value!

SERVICE FASTER, more accurately and increase your profits, prestige and goodwill

with this revolutionary new RCP Electronic MULTITESTER. Make many tests impossible with ordinary meters. Model 661 is designed to perform complete tests on any AM, FM or television circuits while the circuit is operating, and without disturbing circuit constants. Compare these ranges with those of any other meter on the market . . . then get the one meter a Service Engineer simply can't afford to be without!

RCP-661 Electronic MULTITESTER

DC VACUUM TUBE VOLT-METER—DIRECT READING
Sensitivity: 160 megohms (high ranges), 16 megohms (low ranges)
Ranges: 0/6/30/150/600/1500/6000.
Measures all voltages without affecting circuit constants.

Complete
\$34.95



AC VACUUM TUBE VOLTMETER—DIRECT READING

Input capacity only .00005 mfd., input resistance 160 and 16 megohms.
Ranges: 0/6/30/150/600/1500/6000.
Measures signal and output voltages, etc.

VACUUM TUBE OHMMETER—DIRECT READING

From the lowest scale division .1 ohm to 1,000 megohms. Ranges: 0/1000/10,000/100,000/1 meg./10 meg./100 meg./1000 meg. No test leads to short. No resetting when changing ranges.

VACUUM TUBE CAPACITY METER—DIRECT READING
Accurate measurements from .00003 to 1000 mfd. Ranges: 0/0.001/0.01/0.1/1/10/100/1000.
No danger of shock on low capacity measurements.

It's a real vacuum tube AC and DC voltmeter. And only \$34.95! See your local jobber TODAY! Have him show you RCP Model 661 . . . see if you don't agree this MULTITESTER is the standout performer and test equipment buy of the year!

RCP-417 Appliance TESTER for AC-DC

Measures volts, amperes, watts quickly and accurately. Test any household electrical appliance, electric signs and industrial equipment up to 6000 watts.

LOOK AT ALL THESE USEFUL RANGES!

All measurements of AC and DC on 4 easily read scales

VOLTS AC AND DC—0/250.
AMPERES AC & DC—0/1/5/25.
WATTS AC AND DC—0/30/120/600/3000, at 120V 0/60/210/1200/6000, at 240V.

Dealer Net Price
(In portable, hinged cover
carrying case \$11.95)

\$10.75



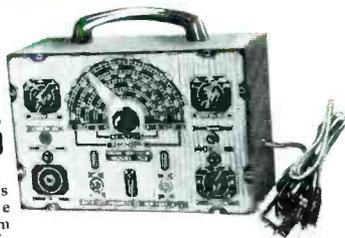
Furnished with power-factor classification chart and correction curves for power-factor and line voltage.

Order from your distributor TODAY!

RCP-702 Signal GENERATOR

Most economical top-quality oscillator on the market. Only instrument of its kind offering all the latest improvements in circuit and mechanical design at this low price. Extremely wide all-wave coverage continuously variable, from 95 kc to 100 mc. Accurately calibrated direct reading. Output modulated or unmodulated, at will. Effective accurate attenuation. Highly attractive appearance. Everything, in fact, that a fine signal generator ought to be, except expensive. Good news, too, right now, just when you need such an instrument. AC operated.

Complete
\$25.45



IN THESE TIMES Uncle Sam gets first call on vital materials used in test equipment assembly. Shortages mean lower output, higher prices. To date RCP has absorbed the greater part of this increased cost. But with prices continuing to rise and defense priorities delaying delivery, it will pay you to order now.

ORDER FROM YOUR JOBBER

RCP-309C DYNOPTIMUM Test Circuit

Tests new miniature and Bantam, Jr., tubes and all other new and old receiving tubes as well as all ballast tubes. Provides for tubes up to full line voltage. Tests at RMA specified plate voltages and loads. Hot interelement short and leakage test between all individual elements. Hot cathode leakage test. Noise test—indicates noisy tubes that would otherwise test "good." Spare socket for future tubes with new base arrangements.

\$17.95



Adjustable for all line voltages 105-135 with line voltage indication directly on meter. Direct reading. Model 309P, combination portable-counter type \$19.95

RCP
dependable
TEST
instruments

RADIO CITY PRODUCTS CO., INC.

88 PARK PLACE

NEW YORK CITY

**IT PAYS TO
PUSH THE SET
THAT SELLS
ITSELF!**



Radiola 526

HUNDREDS of alert servicemen have learned a new, more profitable way to call on service customers . . . they never go out without taking a RADIOLA 526 with them!

It pays. Leaving a RADIOLA with your customer, while you cart their "big set" to your shop, always builds good will. But that's not all. For you'll usually find that RADIOLA nine-tenths *sold* when you return!

It's only natural—for RADIOLA Models are especially designed for Servicemen to sell . . . and that's par-

ticularly true of the 526, with American and Foreign reception! The price is right. The performance is right. Features and appearance are "Preferred Type" all the way! Dual-purpose tubes and Magnetite-Core I-F transformers give it the sensitivity of a much larger instrument . . . the 5 RCA Preferred Type Tubes give *seven-tube* performance and value . . . and there's a full margin of profit for you!

Try the 526 for yourself . . . see how *easily* you can put extra money in your pocket!



Preferred Type

FEATURES

from Antenna to Speaker

- 2-Band American and FOREIGN Reception
- STATION-SPREADER Dial on 25 and 31 Meters
- Built-in Tuned Loop Antenna
- Magnetite-Core I-F Transformers
- Rich Brown Plastic Cabinet
- Convenient Carrying Handle

All Radiola Models
are Equipped
Exclusively with
RCA Preferred
Type Tubes

Radiola *Preferred Type Radios*

Made by RCA Manufacturing Co., Inc., Camden, N. J., U. S. A.
A Service of the Radio Corporation of America
In Canada, RCA Victor Company, Ltd., Montreal