



radio
service
dealer

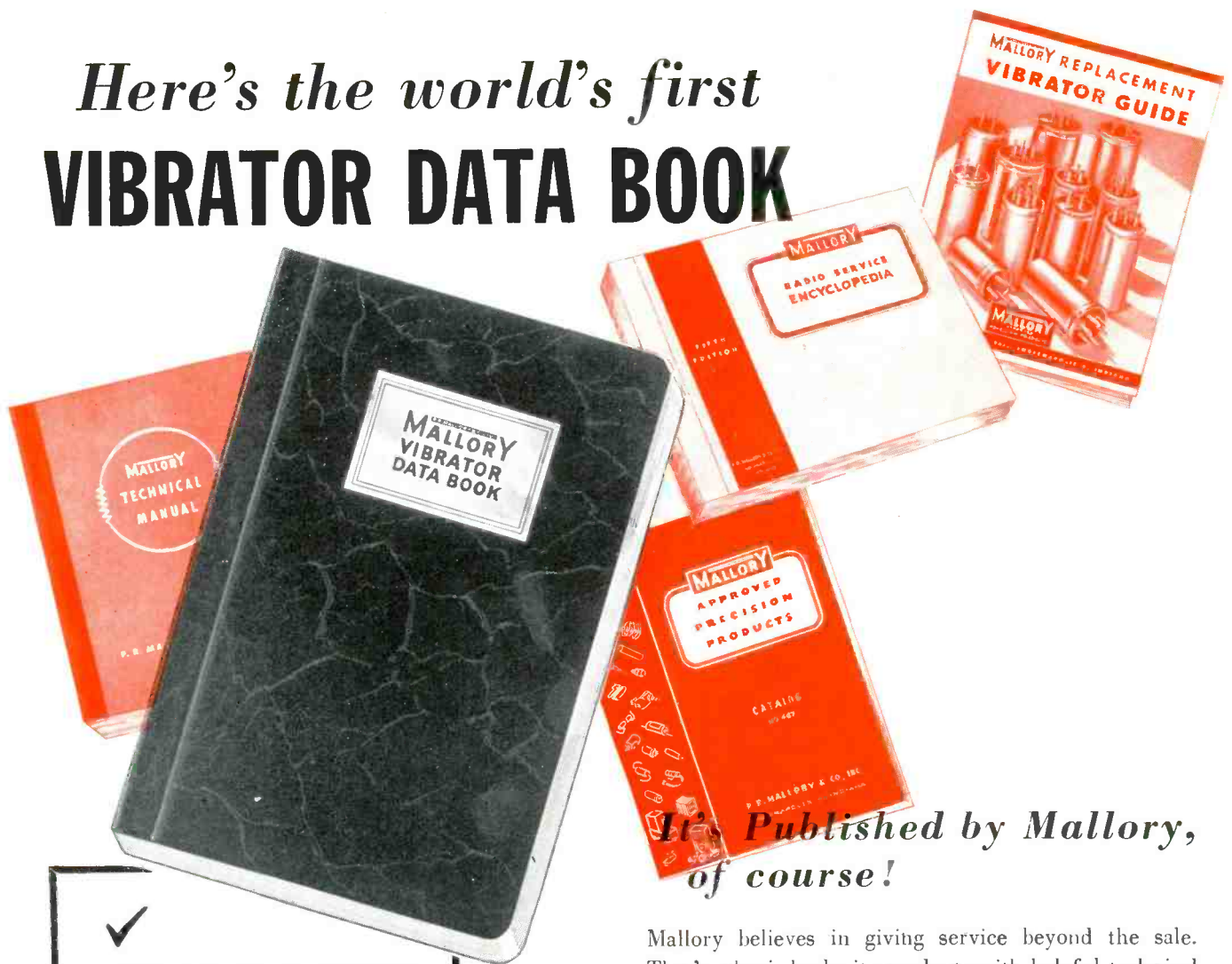
MAY, 1947



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OSCILLATOR & POWER SUPPLY TROUBLES
A SIMPLE, LOW-COST FM-TELEVISION ANTENNA
ION TRAP IN C-R TUBES
PA SYSTEM DESIGN

Here's the world's first VIBRATOR DATA BOOK



*It's Published by Mallory,
of course!*



CHECK THIS LIST OF CONTENTS

Basic Vibrator Structures
Mallory Standard Vibrator
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High Frequency Vibrator Power
Supply
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Considerations
Design Practices and Methods
of Interference Elimination
Vibrator Power Supply Circuits
Vibrator Inspection Procedures

Mallory believes in giving service beyond the sale. That's why it backs its products with helpful technical literature—outstanding books like the Mallory Technical Manual, the Radio Service Encyclopedia and others.

Now comes another important Mallory publication: the first of its kind in the world. It's the Vibrator Data Book, a comprehensive manual that tells you everything about vibrator power supply systems that Mallory has learned in sixteen years of building better vibrators and vibrator power supplies. Does your shop service auto radios? The Vibrator Data Book is an absolute *must* for you. Do you handle other types of equipment powered from a DC source? This volume very definitely belongs on your work bench.

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1947 Replacement Vibrator Guide*

P. R. MALLORY & CO. Inc.
MALLORY

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VOLUME CONTROLS . . . SWITCHES . . . RESISTORS
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the designs that make transformers
the profitable part of your business



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IN CHICAGO AT ELSTON, KEDZIE AND ADDISON

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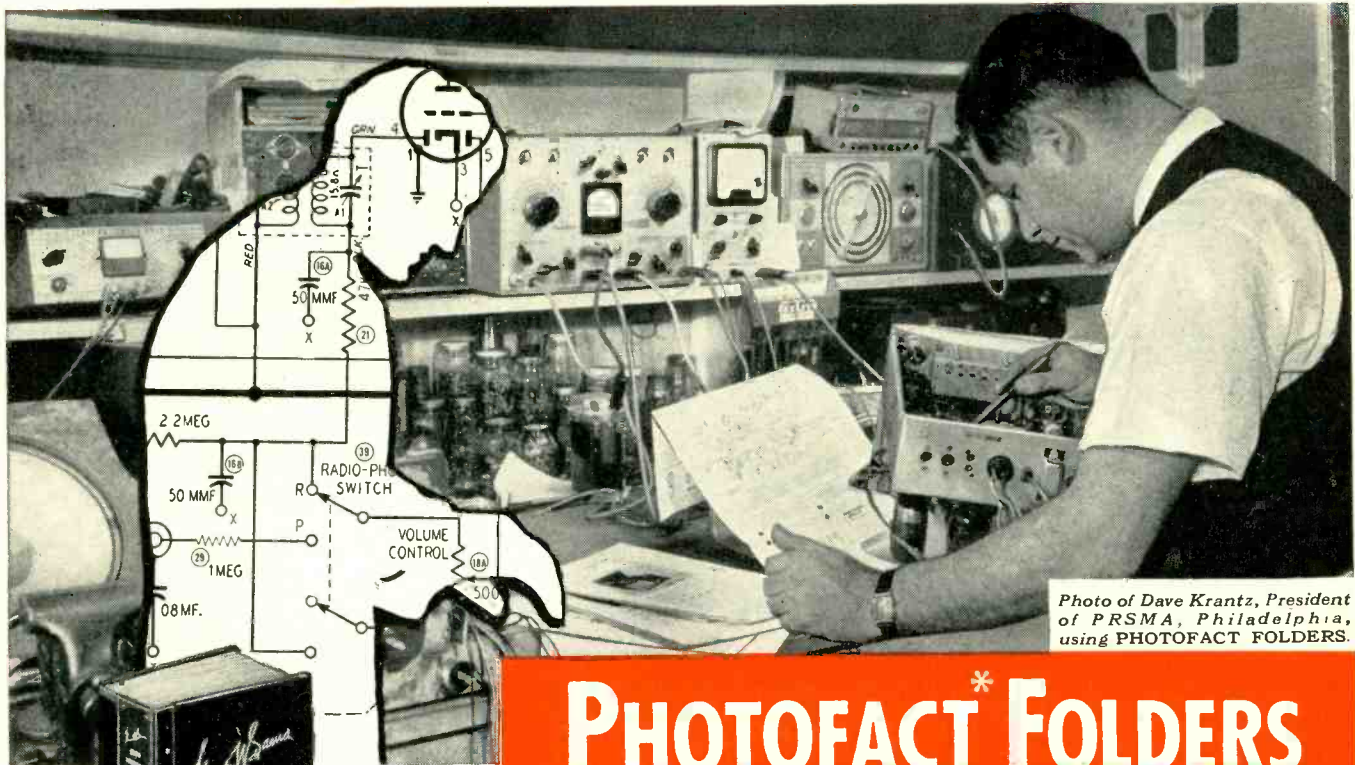


Photo of Dave Krantz, President of PRSMA, Philadelphia, using PHOTOFACT FOLDERS.

PHOTOFACT* FOLDERS

HELP YOU EARN MORE MONEY..

Cost less than 9¢ a day



VOLUME 1, containing first ten sets of PHOTOFACT FOLDERS in de luxe binder, \$18.39. Individual sets Nos. 1 to 10, \$1.50 each. De Luxe Binder alone, \$3.39.

COMPLETE ✓

Everything you need in one handy, unified form—large schematics, pictorials keyed to parts lists and alignment data, complete listings of parts values and replacements, alignment, stage gain, circuit voltage and resistance analysis, *coil resistances*, dial cord stringing, disassembly instructions, record changer analysis and repair.

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All sets are actually taken apart and analyzed by experts in the Sams Laboratories. Every part is measured, tested and triple-checked for accuracy. All data is original. This means the data you get is *right*.

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PHOTOFACT FOLDERS are issued twice monthly, as the new receivers come off production lines. You don't have to wait for information. As receiver changes are made, you get correction and addition sheets for your files. Your data is always up to the minute.

READY TO USE ✓

All diagrams and pictures are coded to numbered parts lists. Everything is positively identified for fast work. All folders are set up in uniform, easy-to-follow style: big type, big illustrations—no hunting, guessing or eye strain—no more loss of time and temper.

"Like having an extra man in my shop" . . . "The kind of 'specialist' I need" . . . that's what hundreds of radio servicemen say about PHOTOFACT FOLDERS. Yet this indispensable "hired help" *actually costs less than 9 cents a day!*

Here are the straight facts: PHOTOFACT FOLDERS offer the *best information ever prepared for radio servicemen*—complete, accurate, up-to-the-minute, easy to use. They save you hours of time and effort because they place at your fingertips ALL the information you need to do a better job. And that means you can earn MORE MONEY.

The information in PHOTOFACT FOLDERS is *right* because it is based on *actual analysis of sample sets* right in our own laboratories. It is *complete and current*, too, because it covers *all* radios, phonographs, record changers, recorders, communications systems and power amplifiers as they reach the market.

PHOTOFACT FOLDERS come to you in sets of 30 to 50 at only \$1.50 per set. Low as this price is, it also includes membership in the Howard W. Sams Institute.

Set No. 19 will be ready for mailing May 10th. Set No. 20 on May 25th. Sets Nos. 11 to 18 inclusive, also priced at \$1.50 each, are available for immediate order.

Actually, PHOTOFACT FOLDERS cost you nothing since they pay for themselves again and again. They're ready to help you *now*—at the most difficult time in servicing history. See your distributor or write us today. In Canada, address A. C. Simmonds & Sons, 301 King Street East, Toronto, Ontario.

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HOWARD W. **SAMS** & CO., INC.

2924 EAST WASHINGTON STREET, INDIANAPOLIS 6, INDIANA

PHOTOFACT SERVICE

"The service that pays for itself over and over again"

EDITORIAL

Show Report

This is drafted just prior to the opening of the Radio Parts Industry Show being held at Chicago May 10th-17th. A complete report of Show doings, new products, highlights, etc., will be carried in our next issue.

Sub Rosa

In a few months (Fall, 1947) the one year free service period given to buyers of many electronic devices, electronic blankets in particular, will expire. Experience shows that the bulk of the units needed several service jobs during their first three months to one year in use. We have contacted several electronic blanket manufacturers, and makers of similar electronic devices that have been on the market for up to a year and have asked them what their service policy will be after their one year warranty period expires. They all say they haven't established a policy yet, but they are giving the matter consideration.

Naturally, we believe that Radio Service Dealers are the logical ones who should be called upon to handle the maintenance of all electronic devices which may require servicing after the factory service guarantee period runs out. Service Dealers have the technical know-how—they are located in every community where such devices are in use—and they can do service work more quickly, at a profit, and yet at lower rates than manufacturers' factory service depots can or would.

So, we are trying to get the manufacturers of electronic blankets and devices to establish post-warranty policies that will soon open a very great potential repair business for Service Dealers. We'll keep you posted on developments.

Beware Of Overstocking

Some manufacturers are going along with the "Newburyport Idea" of dropping prices, others are holding price levels firm. A service-dealer, in a fluctuating market, can best protect himself by keeping a fluid position, having not too great, and not too small an inventory.

More Big Sets

There's a rumor that many large mid-West furniture manufacturers have had to curtail production because their dealers are fast becoming over-stocked. If that is true the furniture people need not look very far for customers. Most radio set manufacturers need ten times as many console cabinets as they are now obtaining. The demand for big radios is greater than ever before. In fact, we believe that the shortage of big cabinets is a prime reason for the relatively small production of F-M and phono-combination receivers. These are the sets that represent better profits for retailers and greater installation and subsequent service fees for repairers so we're all for anything that will contribute to an increased production of large radios.

S. R. COWAN, Publisher



Member of the
Audit Bureau of
Circulations



VOL.
8
No.
5

SANFORD R. COWAN
Editor & Publisher

SAMUEL L. MARSHALL
Asst. Technical Editor

May, 1947

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SILVER

EXPERTS CHOOSE



"VOMAX" is the overwhelming choice of experts because it's the finest, perfected v.t.v.m. . . . because greatest demand makes greatest production and lowest cost to you.

"VOMAX" gives you a total of 51 ranges to directly measure d.c., a.c., a.f., i.f. and r.f. volts up through hundreds of megacycles, six resistance ranges covering 2 10's ohms through 2,000 megohms, three output meter-decibel ranges rcm -10 through +50 db., six direct current ranges measuring from 50 microamperes through 12 amperes. Most important is the absolute stability, complete freedom from u-a. grid current errors . . . and its astronomical input resistance . . . an honest 6.2 megohms upon d.c., a.f., i.f. and r.f.; 51 and 126 megohms upon d.c. Voltage ranges measure from . . . through 3000 vch. d.c., .1 through 1200 volts a.c.

If you want to guard your meter dollar investment . . . to make it only once for many years to come . . . then "VOMAX" at its present low \$59.95 net price is your logical choice . . . as thousands more wise technicians like you self have proved to their profit.

Let's look at this matter of what meter you buy seriously . . . for your choice of this, the service technicians basic instrument, can spell either peace and profit . . . or annoyance and loss to you. You must have the best meter to meet "smart" competition. And "smart" competition overwhelmingly uses "VOMAX." The reason is simple. Other manufacturers have had to copy "VOMAX" inventions to try to satisfy your demand for a modern, post-war, obsolescence-proof universal meter. Yet, "VOMAX," the perfected v.t.v.m., stands head and shoulders above all other meters. This is proved by its heavy purchase and use by the Bureau of Standards in Washington, by Western Electric, G. E., Westinghouse, university after university, by top-ranking industrial laboratories, F.C.C., C.A.A., Veterans Administrations, schools, colleges . . .

NEW IMPROVED "SPARX"



Thousands of technicians today rely on "SPARX" dynamic signal tracer to save time . . . increase efficiency . . . cut their costs. It lets you hear and see signals . . . traces signal right on thru every receiver circuit from antenna thru voice-coil . . . is shop test speaker, too. Continuous laboratory research has now improved "SPARX" immensely . . . created the Improved Model . . . tremendously increased sensitivity . . . greatly expanded general usefulness. And the SILVER policy of protecting your dollar investment pays out handsomely . . . a free bulletin tells every user how to convert his "SPARX" into the new, Improved Model in a jiffy . . . goes to prove that for the really serious, profit-conscious technician there's no substitute for SILVER, that "SPARX" costing you only \$39.90 is outstandingly the world's best signal trace. "SPARX" will earn you, too, more profits in less time than any other instrument you can buy.

906

Thanks for your patience. Model 906 Signal Generator is now flowing to your favorite jobber. And what an instrument . . . 90 kc. through 170 mc. on fundamentals . . . 8 air-trimmed bands . . . variable % 400 ~ amplitude modulation . . . built-in variable electronic FM sweep . . . laboratory triply adjustable attenuator . . . metered microvolts . . . output 1/2 microvolt to over 1 volt . . . multiply shielded . . . strays lower than \$500.00 laboratory generators! Yet all this costs you only \$89.90 net. Better order your 906 now for demand far exceeds production capacity on this precision instrument for months to come.

Send Post Card for Catalog of new measuring equipment, communication receivers, transmitters, kits, parts. See them at your favorite Jobber.

OVER 36 YEARS OF RADIO ENGINEERING ACHIEVEMENT

McMurdo Silver Co., Inc.

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Trade Notes

Olson Gives Cigarettes

It is estimated that at the time of this writing over one-quarter million cigarettes (Camels, Chesterfields and Lucky Strikes) have been distributed by Olson Radio Warehouse in connection with the recent campaign in



Irving J. Olson

which cigarettes were given to customers. The gift of free cigarettes to radio service men is the first of a series of gifts which will be known as THE-GIFT-OF-THE-MONTH CLUB. Each month, it is planned to give cooperating radio service men a gift when they send an order to Olson's. Future gifts-of-the-month will be announced at 30-day intervals.



David J. Finn, newly appointed General Sales Manager, RCA Victor Record Department. Formerly, Renewal Sales Manager of RCA Tube Department.

FM Adapter

Numerous inquiries following Stromberg-Carlson's initial announcement of the Driscoll FM adapter, a low cost device designed to convert pre-war FM sets to the new FCC band, have prompted Lee McCanne, company vice-

[see page 37]

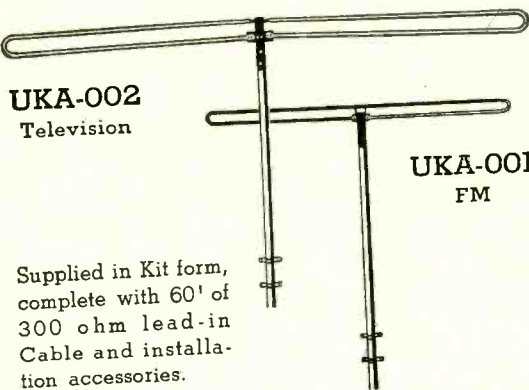
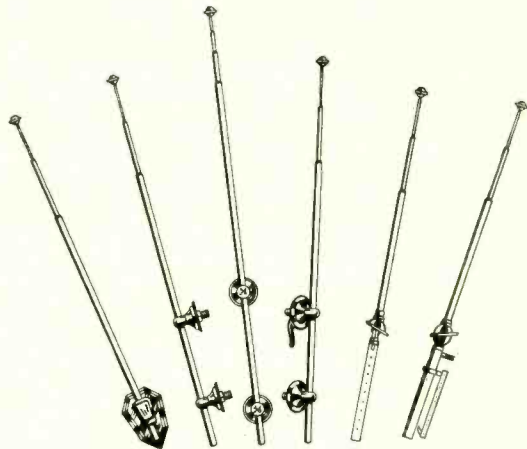
TUNE IN TO MORE PROFITS* WITH GENERAL ELECTRIC ANTENNAS

AUTO ANTENNAS

New cars are rolling off the lines . . . older cars are taking to the road . . . both mean more car radios in service. But car radio reception can only be as good as the antenna that picks up the program. That is why G-E quality antennas are your best bet in getting this business.

General Electric auto antennas are easy to install, bring a big return for labor, have features that will appeal to every motorist and give satisfaction in operation.

*SUGGESTION TO DEALERS—Keep in touch with new and used car dealers for leads to more business.



UKA-002
Television

UKA-001
FM

Supplied in Kit form, complete with 60' of 300 ohm lead-in Cable and installation accessories.

FM & TELEVISION ANTENNAS

New FM and television stations are being erected. Receiver stocks are being built up by dealers and public enthusiasm is at a high pitch. Cash in on this market—grow with it . . . specialize in General Electric FM and Television antennas.

Simple in construction and highly efficient, General Electric antennas are designed to assure maximum reception.

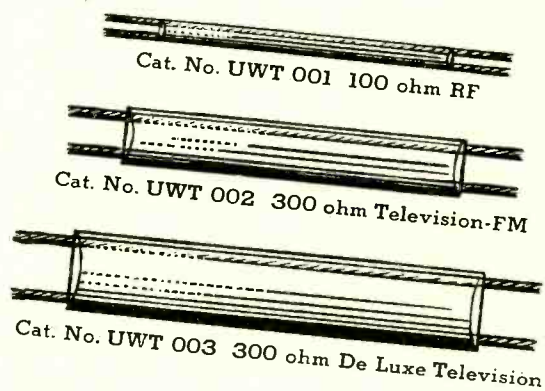
Be first in the field—first to realize the profit in this rapidly expanding field.

G-E LOW-LOSS LEAD-IN CABLE

G-E polyethylene lead-in cables have been especially designed to provide better reception in FM and television installations. They assure that energy received by the antennas is transmitted with minimum loss.

Radio amateurs may also use this cable with transmitters, and instrument engineers have found it excellent for special purpose wiring. Selling these additional markets can mean additional profits for you.

For complete information on these products, write: *General Electric Company, Electronics Department, Syracuse 1, New York.*



Cat. No. UWT 001 100 ohm RF

Cat. No. UWT 002 300 ohm Television-FM

Cat. No. UWT 003 300 ohm De Luxe Television

160-F4

GENERAL ELECTRIC

RACONS do more
at lower cost than
ordinary reproducers

ACOUSTIC & STORMPROOF MATERIAL

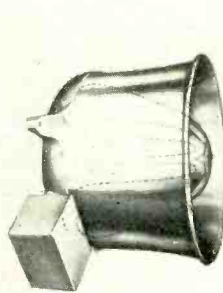
Only RACON makes speakers with Racon Acoustic Cloth which is processed by a patented method giving a non-vibratory wall, thereby increasing the output of the horn without loss due to wall vibration. Supplied as a part of all re-entrant horns, and on all straight horns when so ordered. Stormproof types are guaranteed for life in all kinds of weather and temperature, regardless of climatic conditions.

ADVANCED ENGINEERING & DESIGN

RACON'S leadership in sound reproducer engineering has been recognized for almost three decades. RACON driver units have a rated output for peak and continuous performance far in excess of any other brands — continuous operating capacity 30 watts, peak capacity 60 watts. RACON speakers and driving units require less energy input yet they deliver more efficient sound reproduction output. All claims made by RACON as to cutoff frequencies and acoustic lengths of speakers, power handling capacity, efficiency and frequency range of driver units are substantiated by tests made at laboratories recognized as the foremost in the industry.

COMPLETE LINE TO CHOOSE FROM

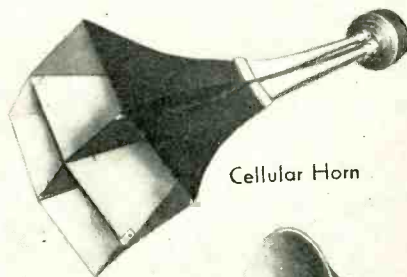
There is a RACON driving unit, trumpet or speaker for every conceivable sound application — also the accessories (brackets and housings) that may be required for special purposes. Soundmen know that it pays to choose and use a speaker line that is complete. Yes — RACON makes every kind of sound reproducer from the giant 7 foot length auditorium horn down to the small 4 inch intercom cone speaker — from the super giant P.M. driving unit to the tiny driver for paging horns.



Marine Speaker



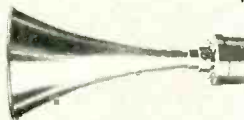
P-M Unit



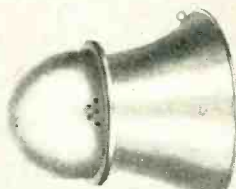
Cellular Horn



Re-entrant Trumpet



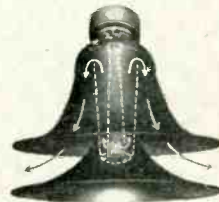
High Frequency Speaker



Armored Projector



Paging Horn



Radial Re-entrant



Straight Trumpet



Dwarf Re-entrant



RACON

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Name

Address

City & State

Radiart

MANUFACTURERS OF
QUALITY
VIBRATOR EQUIPMENT
SINCE 1932

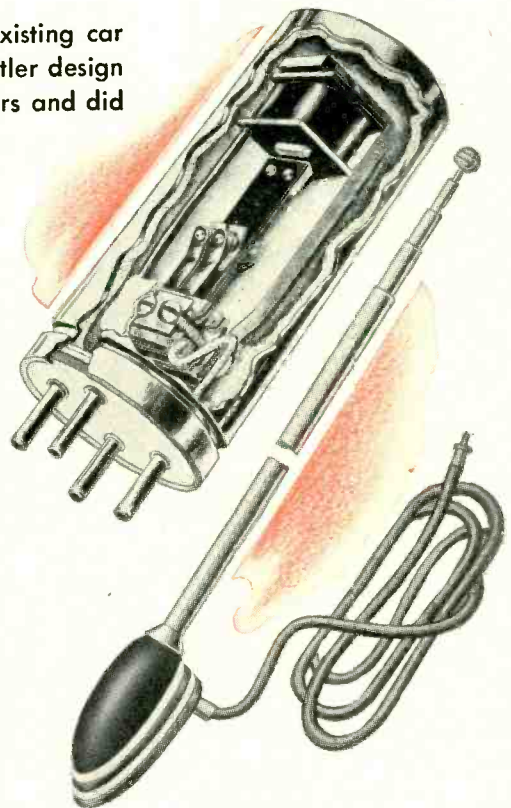
From the very beginning, the history of Radiart has been closely allied with modern vibrator development. Back in 1932 this company, foreseeing the need for a complete line of correct replacement vibrators, was the first to design such a line and to place it on the market. Radiart pioneering may also be credited with many revolutionary changes in vibrator design. Floating center reeds, all-riveted assembly and hermetic sealing through the famous Red Seal process... all are exclusive innovations which came into being through Radiart research. Today over 76% of all popular replacements are serviced by 12 Radiart vibrators and more than six million of these units have been sold.

In 1936 Radiart developed the first streamlined aerial to match existing car contours. The first truly waterproof aerial; the first all-metal anti-rattler design and the new Plasti-Loom Lead were all evolved by Radiart engineers and did much to increase public acceptance for this type of equipment.

There has never been any change in Radiart's original policy of quality manufacture. The same high standards still govern Radiart production and are your assurance of obtaining a product which is as perfect as modern methods of engineering and manufacture can make it.



RADIART, CLEVELAND, OHIO



**ELECTRONIC DISTRIBUTOR AND
INDUSTRIAL SALES DEPARTMENT**

Radiart

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EXPORT SALES DIVISION • SCHEEL INTERNATIONAL INCORPORATED
4237-39 N. LINCOLN AVENUE, CHICAGO 18, ILL. U.S.A. CABLE ADDRESS—HARSHEEL



A SIGN OF SUCCESSFUL SERVICING



Witte has all fifteen RIDER MANUALS

Anyone in Philadelphia's radio-service circles can tell you of the high reputation and efficiency of the servicing department of Witte Radio and Television Co. And, Witte has one thing in common with other successful shops; it recognizes the time-saving value of Rider Manuals, by maintaining a set of all fifteen volumes.

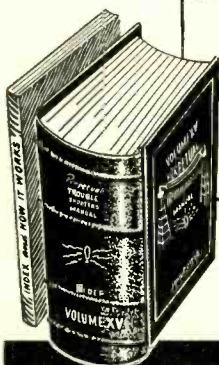
You, too, need this servicing data on American made receivers made between 1920 and 1947. You, too, need the facts to quickly diagnose troubles in any and all receivers that come to you for repair. You, too, need all fifteen Rider Manuals. For, from no other single source is this complete service available; receiver schematics, voltage data, alignment data, resistance values,

chassis layouts and wiring, and trimmer connections. Dependable, authoritative information.

Volume XV, covering sets issued during 1946 and some unpublished pre-war models, is full of features resulting from "Sixteen Years of Continuing Service for the Radio Servicing Industry." For example, "clarified-schematics", which break down the composite diagrams of hundreds of complicated multiband receivers into individual schematics of each circuit as it exists with each turn of the wave band or equipment switch.

With each copy of Volume XV is the 181 page "How It Works" book, a guide to the theory of operation of the new technical features in the latest receivers. Volume XV, also includes all popular "Ham" communication receivers, Scott receivers, Magnavox RA combinations and record player combinations.

Rider Manuals are an investment which keeps pouring out profits for you. Those who bought Volume I, 17 years ago, are still benefitting from it. Be sure your shop has the Sign of Successful Servicing—be sure it has all fifteen Rider Manuals.



VOL. XV JUST OUT!

2000 pages, plus 181 page "How It Works" Book. \$18.00 complete

Volumes XIV to VII (each volume).....	\$15.00
Volume VI.....	11.00
Abridged Manuals I to V (one volume).....	17.50
Record Changers and Recorders.....	9.00

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MEAN SUCCESSFUL SERVICING

ENTER THE RIDER MANUAL CONTEST

224 OPPORTUNITIES TO WIN!

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CASH PRIZES

AND SERVICING EQUIPMENT

JUST TELL WHY (in 100 Words or Less)

"RIDER MANUALS MEAN SUCCESSFUL SERVICING"

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DON'T PUT IT OFF. WRITE IT DOWN!

Send in your entry **NOW!**

JOHN F. RIDER
Publisher, Inc.

404-4th AVE., N. Y. 16, N. Y.

Export Division,
Rocke-International Corp.,
13 E. 40th St., New York City
Cable ARLAB

SYLVANIA NEWS

RADIO SERVICE EDITION

MAY

Prepared by SYLVANIA ELECTRIC PRODUCTS INC., Emporium, Pa.

1947

RADIO SERVICEMEN! GET EXTRA SERVICE SALES WITH NEW PROMOTIONAL CAMPAIGN!

Powerful Advertising Drives Opening Wedge...
Effective Mail Pieces Help Clinch Sales!



Advertisements in such national magazines as Collier's, the Saturday Evening Post and Life are examples of Sylvania's tremendous campaign which tells millions of people about your radio service. This hard-selling campaign naturally helps to bring customers into your store.

These inexpensive, attention-getting mailing pieces remind *your* customers to bring their "Radio Service" work to *your* store... remind them, too, that you carry the finest line of radio tubes made.

Month after month, Sylvania's nationwide advertising pounds home the same message to your customers.

Month after month it tells them the advantages of having their radios serviced by competent radio servicemen. You'll find that you'll get the best results from this selling effort by supplementing it with your choice of the sales aids illustrated above... which clinch the sale by directing customers to your store.

ORDER FROM YOUR SYLVANIA DISTRIBUTOR or write SYLVANIA ELECTRIC PRODUCTS INC., EMPORIUM, PA.

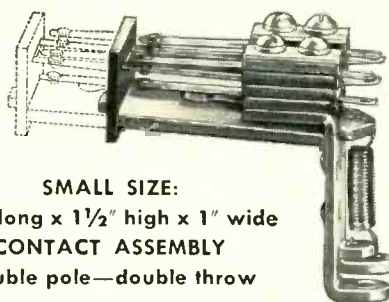
SYLVANIA ELECTRIC

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

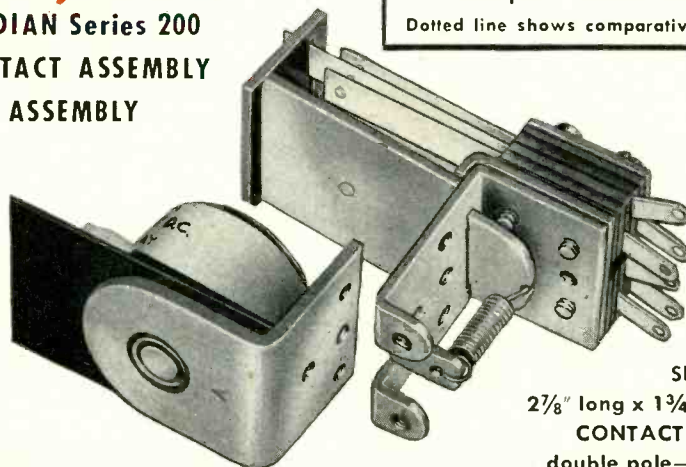
GUARDIAN

presents...

a new **MIDGET**
CONTACT ASSEMBLY
Interchangeable
with the GUARDIAN Series 200
STANDARD CONTACT ASSEMBLY
AND COIL ASSEMBLY

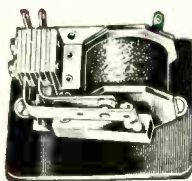


SMALL SIZE:
1 5/8" long x 1 1/2" high x 1" wide
CONTACT ASSEMBLY
double pole—double throw
Dotted line shows comparative size



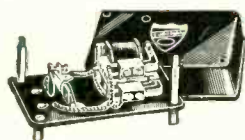
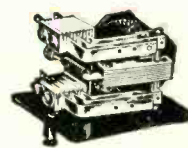
SIZE
2 7/8" long x 1 3/4" high x 1" wide
CONTACT ASSEMBLY
double pole—double throw

Popular RADIO RELAYS in the GUARDIAN line:



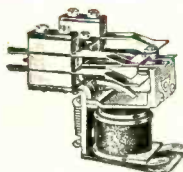
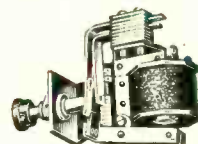
K-100 Keying Relay For low voltage control of high voltage transmission. Guardian Series K-100 Relay will follow key or bug at highest WPM rate attainable. High speed response, strong magnet and return spring give clean make and break, produce best CW note. Coils: 5 to 16 v., A.C.; coils for other voltages on specifications.

B-100 Break-in Relay For break-in operation on amateur transmitters. The Guardian B-100 Relay has laminated field piece and armature. Fine 1/4" silver DPDT contacts, capacity to 1500 watts, 60 c., non-inductive A.C., and in A.C. primary circuit of any inductive power supply delivering up to 1 KW, inclusively.



T-100 Time Delay Relay In radio transmitter circuits, Guardian's T-100 Time Delay Relay prevents damage of rectifiers and tube filaments by preventing plate current before filaments are sufficiently heated. Laminated field piece and armature. Mounted in dust-proof metal box.

L-250 Overload Relay Provides accurate, fixed overload protection against current surges and continuous overloads. Guardian's L-250 Relay replaces expensive, time-wasting fuses. Attracts armature on 250 mils. Max. drop across coil—10 v. Guardian's L-500 Relay attracts armature at 500 mils. Max. drop across coil—5 volts. Ideal for experimenters on new circuits.



A-100 Antenna Relay A low loss AISiMag insulated relay. For single wire fed installations specify the A-100-C, SPDT unit. Two A-100-C in place of one A-100 in open wire line systems will avoid possible impedance mismatch. A very popular relay with radio amateurs.

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OSCILLATOR & POWER SUPPLY TROUBLES

by C. C. ROBERTS

Repairing faults in oscillator and power supply circuits is greatly simplified when this pattern of trouble-shooting and correctives is applied.

RECEIVER trouble originating in the rectifier or oscillator stages of a receiver can be quickly identified because of their limited effect on overall performance. No signal-tracing is necessary inasmuch as a few quickly made tests can localize the trouble to these stages. The isolated, operational position of these stages in respect to the overall path of the received signal is the underlying reason for the limited effects they produce on the overall performance. To be explicit: A failure in the oscillator stage will result in a "dead" receiver or, a receiver that operates over only a portion of the frequencies of the broadcast-band, but will *never* result in hum, distortion, lack of selectivity or sensitivity in the receiver. A failure in the rectifier stage will result in a "dead" receiver, or very weak receiver-output, and hum, but will *never* result in a lack of sensitivity or selectivity. Rectifier troubles are particularly easy to identify because they affect the overall performance of the receiver and impair the operation of R.F., I.F. and audio stages *equally*.

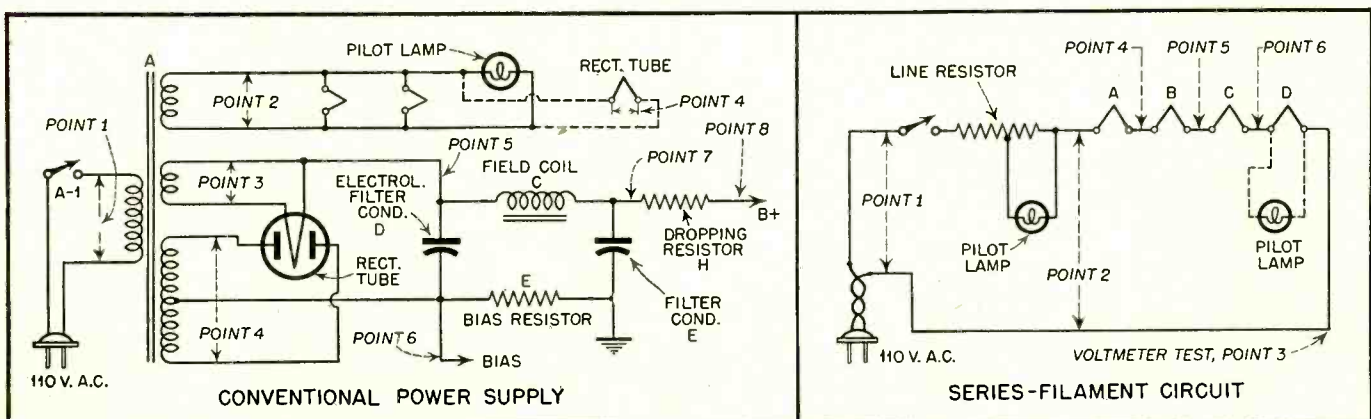
Figure 1 represents a typical power supply. The power supply can fail in two ways and affect an inoperative receiver. First it can fail to supply A.C. voltage, and second, it can fail to supply D.C. voltage.

A failure to supply A.C. voltage is made obvious by the absence of filament voltage on the tubes. If the pilot light and all the tubes in the receiver fail to light, the trouble must be in either the power transformer (Ref. A, Figure 1) or the A.C. cord and plug. The presence of voltage at point 1, Figure 1 would indicate a defective power transformer. A continuity check with an ohmmeter should be made to make certain that the transformer primary is defective. If the pilot lamp and some of the tubes light, but the rectifier tube does not light, or the rectifier tube lights but the pilot lamp and some of the other tubes do not, the trouble is in the power transformer. A voltage check at points 2 and 3, Figure 1, will locate the difficulty. The dotted lines in Figure 1 represent the circuit used for some types of rectifier tubes. In the latter case, a voltage check at point 4 should be made. The presence of voltage at point 1, and the absence of voltage at either points 2, 3 or 4 indicates the power transformer as being defective. If voltage is present at all these points, yet the pilot lamp or some

tube fails to light, the trouble can exist only in the wiring, tube socket or tube or lamp filament itself. The possibility of shorts has been eliminated from the discussion because the effect of a short is not only different, but very obvious. In brief, a short in the primary of the transformer will blow the house fuse, a short in any of the secondaries of the transformer will cause the transformer to overheat, a short in the filament line, tube sockets, tube or wiring will not only cause the transformer to overheat, but will cause the wiring itself to scorch or burn *between* the point of the short and the power transformer.

Most of the smaller receivers use a series-filament circuit which eliminates the necessity of a power transformer. Figure 1-A represents a typical series-filament circuit. In this type circuit, a defective line resistor or a defective tube will result in *none* of the tubes or the pilot lamp lighting. A voltage check at point 1, Figure 1-A, should be made to eliminate the A.C. plug as a cause of the lack of filament voltage. If voltage is present there, a check should be made at point 2.

Figure 1



The absence of voltage at point 2 indicates a defective line resistor. (NOTE: The line resistor may be incorporated in the A.C. cord in which case examination of the cord and plug will reveal its termination at the receiver.) If voltage is present at point 2, *Figure 1-A*, yet none of the tubes light, the trouble *must* be a defective tube. The defective tube can most quickly be located by connecting a voltmeter between points 3 and 4. An absence of voltage at this point indicates that tube "A" is defective. If voltage is present between points 3 and 4, connect the voltmeter between points 3 and 5. Absence of voltage here indicates that tube "B" is defective. Absence of voltage between points 3 and 6 indicates that tube "C" is defective, etc. In this type circuit, practically the only short that can occur is within a tube. The effect of a shorted tube, i.e., filament shorted, is to cause the remaining tubes to light up brighter than normally (due to an increase of voltage on the remaining tubes), while the tube which is shorted does not light at all.

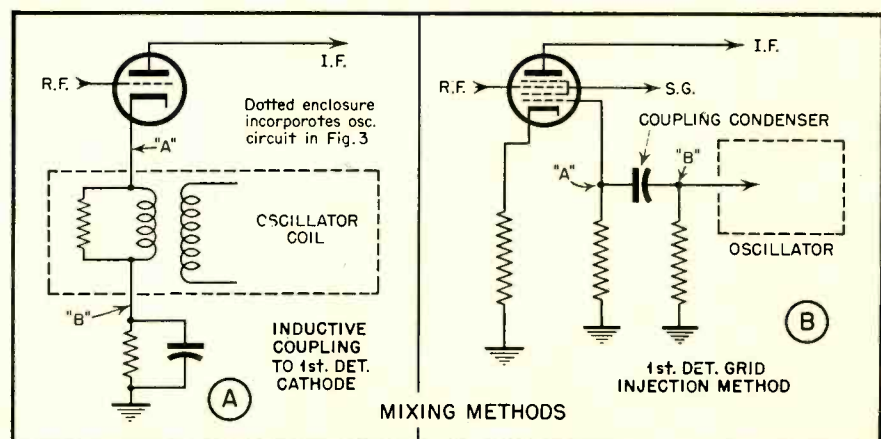
Failure of the rectifier to supply any D.C. voltage to the receiver results in a "dead" receiver. Failure of the rectifier to supply sufficient D.C. voltage to the receiver results in a weak output from the receiver. (A weak output that is caused by the rectifier is characterized by the fact that the magnetic field around the speaker field and filter chokes is very weak). If the receiver is inoperative or "dead" and the trouble is indicated as being in the rectifier stage by the fact that there is *no* magnetic field around the speaker field coil or the filter chokes. (NOTE: the magnetic field may be quickly checked by holding a steel object close to the pole piece of the speaker field or filter choke), the cause of the failure must be either a short or an open circuit. A short in the rectifier can have two effects: First, if the short is in A.C. supply to the rectifier tube, there will be an absence of A.C. voltage at point 4, *Figure 1*, and the power transformer will overheat very rapidly; thus, if the receiver is "dead" and the tubes *all* light but the power transformer becomes very hot, the trouble is undoubtedly in the power transformer, rectifier tube socket, rectifier tube or wiring. If the previous conditions are noted, except that the output of the receiver is weak, the same conclusions can be drawn, namely, that the power transformer, rectifier tube socket, rectifier tube or wiring is defective. Of course, the reason the receiver is not completely "dead" is that the short is not direct enough to cut off all

A.C. voltage to the rectifier tube; Second, if the short is in the D.C. output of the rectifier, the rectifier tube plates will show a red glow and if the short is sufficiently direct, the rectifier tube will burn out due to overloading. A continuity check is the best method of locating the short *to ground* which may be in the speaker field (or filter choke), the filter condensers or the wiring. As an example, if filter condenser "D", *Figure 1*, develops a direct short, the rectifier tube plates will glow bright red and the tube will burn out within a very few seconds, but if filter condenser "E" develops a short, the rectifier tube plates will glow a duller red *and also* the speaker field coil "C" and most noticeably bias resistor "E" will overheat. Due to the nominally high voltage involved, most shorts in the rectifier section are of low resistance; however, if liquid-type electrolytic filter condensers are used, the short may gradually decrease in resistance the longer the receiver is operated. In this case, the cause is easily recognized by the fact that the faulty filter condenser overheats.

If there is no D.C. voltage output from the rectifier, indicated by the absence of magnetic "pull" at the speaker field (or filter choke) and the power transformer and rectifier tube are not overheated, there must be an open somewhere in the rectifier stage. The cause can best be found by making d-c voltage checks as follows: Between points 5 and 6, *Figure 1*, the absence of voltage indicates a defective rectifier tube; between point 5 and ground, the absence of voltage indicates an open bias resistor (reference "E", *Figure 1*); between point 7 and ground, the absence of voltages indicates an open speaker field (or filter choke) reference "G", *Figure 1*; between point 8 and ground, the absence of voltage indicates an open dropping resistor (reference "H", *Figure 1*).

If there is low D.C. voltage output from the rectifier, indicated by a weak magnetic pull at the speaker field (or filter choke) and the power transformer and rectifier tube is not overheated, the trouble can only be a weak rectifier or a partial, high-resistance open in the speaker field coil (or filter choke or dropping resistor). A continuity check with a good ohmmeter will reveal the defect if it is in the dropping resistor or in the speaker field coil. If the low voltage is accompanied by a hum, however slight, the cause of the condition can only be an open or partially open filter condenser. Generally, the condenser-input type filter shown in *Figure 1* is used in most receivers because of the D.C. voltage gain obtained with this type of filter. As a result, if the input filter condenser, reference "D", *Figure 1*, opens partially or fully, the D. C. voltage at point 5 will be substantially lowered. This will also impair the filtering action and, as a result, the output of the receiver will show the presence of a hum, as well as being very weak. The best way to check the condition is to shunt a good condenser of the same value across the input condenser and note whether the output increases and the hum disappears. If that happens, the input capacitor is defective. The second filter condenser, reference "E", *Figure 1*, will affect the voltage but slightly; however, a hum will be present in the receiver output. It may be checked in the same way as the input condenser. With either condenser, the effects will be in proportion to the amount of capacity remaining in the defective condenser if it is only partially open. Depending upon the type receiver, the effects of open conditions in these condensers, will cause, in addition to the effects already mentioned, regeneration (See Article "Resonance Testing" in the October 1945 issue of RADIO SERVICE DEALER. With the exception of the

Figure 2



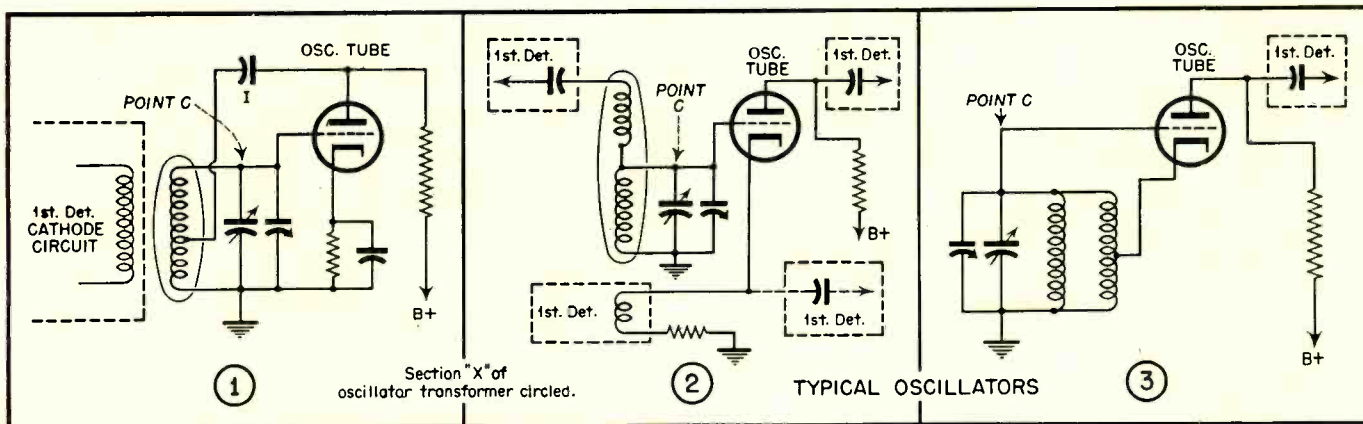


Figure 3

troubles inherent in the power transformer, the effects, causes and locational procedure just described are applicable to the A.C.-D.C. type receivers.

Any receiver trouble that is the result of a failure of the oscillator can be recognized by the fact that the receiver is seemingly "alive", yet no signal can be tuned in. If noise, antenna clicks (made by contacting the antenna or loop with a metal object) or a strong I.F. signal can be forced through the receiver and yet no broadcast signal can be tuned in, the trouble lies in the oscillator stage. As was previously stated, the oscillator can cause the receiver to either go completely "dead" or "dead" over only a portion of the broadcast band. If the cause of the signal failure of the receiver has been identified as oscillator trouble, a method of signal tracing and identification procedures can be followed which will result in the speedy location of the trouble with the oscillator circuit. Figure 2 shows the two most common methods of mixing the oscillator signal with the incoming broadcast signal, as well as the signal paths of the oscillator signals. Figure 3 shows some of the more common types of oscillator circuits with the points at which they connect to the injector circuits (shown in Figure 2) indicated. Before an attempt is made to trace the oscillator signal, the signal generator and the receiver must be set-up and tuned. The receiver-tuning-dial should be set at the broadcast frequency of some nearby powerful broadcast station, and the volume control turned fully on. The signal generator lead should be connected through a 1.0 megohm resistor (or a .005 rfd condenser) to point "A", Figure 2. The ground lead of the signal generator may be left disconnected. The attenuator on the signal generator should be turned fully on, and the output control of the signal generator set in the unmodulated position. (Most signal generators have

some switch or control for their modulation). The signal generator should then be tuned to a frequency equal to either the sum of the I.F. and the frequency to which the receiver is tuned or the difference between the two. As an example, if the receiver were tuned to a broadcast station whose frequency is 1000 Kc., and the I.F. of the receiver is 450 Kc., the signal generator must be tuned to $1000 - 450 = 550$ Kc., or else, $1000 + 450 = 1450$ Kc. Unless it is known whether the oscillator of the receiver was designed to operate at the sum of, or the difference between, (i.e. on the high or low side of the incoming signal) the oscillator and incoming signal frequencies, that fact must be determined by trial. This can be done by first tuning the signal generator to 550 Kc. and noting whether a receiver-output signal is present and then retuning the signal generator to 1450 Kc. and again noting whether an output signal is present. Whichever frequency setting of the signal generator gives a receiver output is the frequency at which the receiver oscillator operates. If no signal is heard in either case, the trouble can only be in the mixer tube itself. Once the frequency of the receiver's oscillator has been established, the signal generator should be left tuned to this frequency, and the oscillator circuit checked as follows: Move the signal generator lead to point "B", Figure 2. If no output-signal is heard from the receiver, the injector condenser or coupling coil, (See Figure 2) is open. In the case of the circuit shown in Figure 3-3, the oscillator section of the tuning condenser and the oscillator high-frequency trimmer should be checked for shorts with an ohmmeter, as a short in either case would ground the oscillator signal at this point. If an output signal is heard at this point, the signal from the signal generator should next be applied to point "C" Figure 3. If a signal is heard at this

point, the oscillator plate and feedback circuit is O. K. (i.e. condenser number I and section "X" of the oscillator transformer, see Figure 3). If no signal is heard at this point the oscillator tube, transformer, tube voltages and condensers must be checked as follows: The oscillator tube should be checked by replacing it with one known to be good. The oscillator tube voltages should be checked with a good voltmeter, and the cause of any abnormal voltage indications ascertained and corrected in the usual manner. The by-pass, tuning, trimming and coupling condensers in the oscillator circuit (other than those eliminated by the results of the foregoing signal tracing procedure) should be checked with an ohmmeter (after disconnecting one side of the condenser) using an 0 to 1 megohm scale, or better, for shorts or leakage. These condensers should also be checked for open circuit conditions. Due to the effects of body capacity on the critical oscillator circuits, the best way to check these condensers for "opens" is to temporarily solder a good condenser in place and observe results. The possibility of the oscillator tuning condenser or trimmers going "open" is very remote, due to their physical construction; hence, there is no necessity to check them for "opens"; however, it is advisable to make a visual inspection of the soldered leads, ground connections and the mechanical connections to the plates in order to eliminate them as the cause of the oscillator failure. The oscillator transformer should be checked for continuity with an ohmmeter. A low resistance scale should be used, preferably 0 to 10 ohms or less. The oscillator transformer should be disconnected in order to eliminate false indications due to paralleled components, such as wave-band switches, short wave shunts, etc., and the continuity checks on the oscillator coil show it to be O.K., the oscillator sections of the wave-band switch (if the

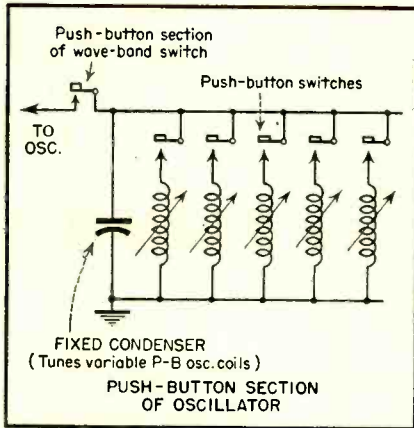


Figure 4

receiver has short-wave bands) should be checked for shorts between contacts before the oscillator transformer is reconnected. The wave-band switch should be left in the broadcast position (if it is the broadcast band that is inoperative). In addition the resistance of all contacts should be checked in order to see that no corrosion has introduced a high resistance into the oscillator circuit through these contacts. If the receiver in question is a modern one with short-wave bands and push button tuning, the problem of localizing the cause of the oscillator failure is simplified by making the following observations: If the oscillator is dead only when the receiver is switched to push-button operation, the oscillator tube, oscillator injector and oscillator feedback (regeneration) circuits are alright, and the trouble exists in the components shown in Figure 4. If the oscillator is operative when the receiver is switched to push-button but dead on the manual broadcast position, the oscillator tube, oscillator injection and oscillator feedback (regeneration) circuits are alright and the trouble exists in the components shown in Figure 5. If the oscillator is operative when the receiver is switched to the push-button and manual broadcast positions but is inoperative on the short wave positions, the trouble lies in the components shown in Figure 6. If the oscillator is inoperative on all positions, the tube, voltage and component checks given in the preceding paragraph should be followed.

The preceding procedures and checks for diagnosing the trouble with oscillator circuits are in the main similar to those used for any other stage in the receiver. The same troubles with the individual components may occur in the oscillator

circuit of a receiver as in any other stage. If none of these checks, or the diagnostic procedure given, is successful in locating the trouble with the oscillator stage, it is because the oscillator trouble is one of those that are particularly characteristic of oscillators. These troubles may be divided into two groups; those resulting from moisture absorption and those resulting from excessive extraneous resistance in the circuit. If the trouble persists after the preceding diagnostic procedure and checks have been made, the following causes and effects can be helpful in locating the trouble. Moisture, absorbed by the insulating material of the oscillator tube socket, the oscillator transformer coil form, the high and low frequency padders or the tuning condenser, will cause the oscillator to fail over a portion or all of the tuning band. Moisture is absorbed mostly by the fibre insulation of the tuning condenser, tube socket, mounting forms of the high and low frequency trimmers and the coil form of the oscillator transformer. The cause of the moisture absorption is either faulty glazing of the fibre surface, and excessively porous fibre, or leaky impregnation. There is no method of testing for this condition available to the average serviceman, and the only way the trouble can be quickly located is by considering the probabilities and replacing the parts most likely to cause the trouble first. Generally, moisture absorption can be recognized as being responsible for the trouble by virtue of the fact that the receiver will operate over a portion of the tuning range. (If the condition is allowed to continue for a month or so, the receiver may become inoperative over the entire tuning range). Moisture absorption is most common in the oscillator transformer; hence, the oscillator transformer should be replaced first, if this condition is suspected. Moisture

Figure 5

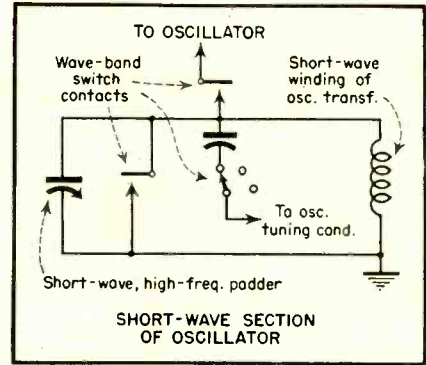
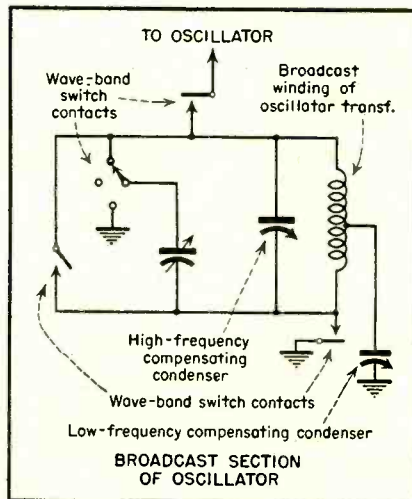


Figure 6

absorption is found in the high-frequency oscillator trimmer and the oscillator-tuning condenser. The condition can nearly always be recognized by the fact that the receiver fails to operate at the higher frequencies. Occasionally the low-frequency oscillator trimmer and the oscillator tube socket will develop this trouble. In any case, where moisture absorption is suspected, the most convenient and easiest method of correcting the difficulty is to bake the entire receiver chassis in an oven. If an oven is not available, the chassis can be placed over some source of heat (such as a large soldering iron) and covered with a box. Care should be taken that the heat does not reach a temperature high enough to melt the sealing and impregnating compounds of the various components of the receiver. The degree of temperature is not as important as the drying process; hence, time is an important factor. Four to six hours are usually sufficient. In many cases where the parts necessary to check the suspected components by substitution are not on hand, the baking process will prove the quickest and most convenient method of correcting the trouble.

In any oscillator circuit, a very low extraneous resistance can be sufficient to quench the oscillations over a portion or even all of the tuning range of the oscillator. This is particularly true at the higher frequencies. The extraneous resistance can occur in three ways; a dirty or corroded wave-band switch contact, a high-resistance soldered connection or a high resistance mechanical connection. If the trouble is due to resistance caused by dirty or corroded switch contacts, it can be identified by the fact that movement of the switch (either by jiggling the switch lever or by prodding the individual switch contacts with an insulated alignment tool) causes the oscillator to resume operation, momentarily. The extraneous resistance in the switch can be eliminated by clean-

[see page 34]

A Simple, Low-Cost, FM-Television Receiver

The Engineering Dep't of Federal Telephone & Radio Corp. offers a new idea to FM installers

A simple, low cost FM and television receiving antenna requiring only between 5 and 10 feet of co-axial line, depending on the frequency, provides a perfectly matched folded dipole and lead-in for FM and television and eliminates the need of an outside or roof aerial installation.

As indicated on *Fig. 1* this antenna, a "T" match type, consists of a 300 ohm cable which is a half wave length long, is shorted at both ends and has a one conductor cut in the center as the input or lead-in point. The entire construction takes between fifteen and twenty minutes and requires only three stripping and soldering operations.

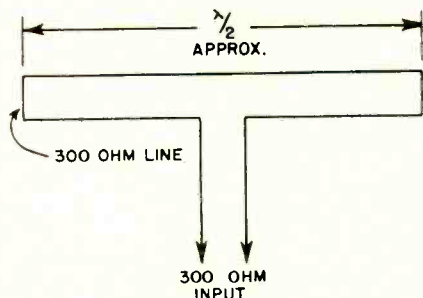


Figure 1

First the cable is shorted at both ends by stripping the insulation for a short distance and twisting the two conductors together. Then they are soldered and an insulating lacquer

spread over them to weatherproof the connection. These shorted ends also provide a means of supporting the antenna without effecting the characteristics of the transmission line

Then the lead-in is connected to the midpoint of one conductor. This operation requires a little more caution since the width of the cut must exactly equal the conductor spacing of the lead-in. The cut is made just clear of the inside of one conductor exactly at the midpoint. Sufficient insulation is removed from the two ends of the conductors thus provided so as to enable the lead-in to be connected to them. The connections are soldered and lacquered and the assembly is now ready for mounting.

The antenna is mounted by simply suspending it on to an insulating material, such as wood, using the two exposed short circuited ends as means of support. For maximum signal pick-up the antenna should be as high off the ground as possible. However when an outdoor antenna is either impractical, (due to climatic conditions), or unnecessary, the antenna—due to the flat ribbon construction of the 300 ohm line—can

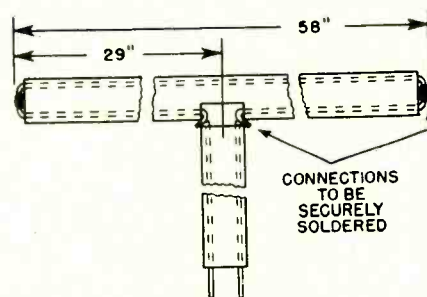
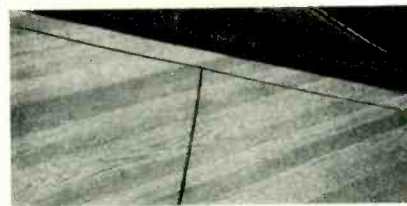


Figure 2

conveniently be placed under the rug or behind a piece of furniture.

The antenna shown on *Figure 2* was designed for FM reception and is therefore 58 inches long. Since, as any folded dipole, it has an impedance of 300 ohms when removed from ground, and since the conventional input impedance of a FM or television set is 300 ohms, it provides a perfectly matched system.

It lies under the rug.



Since the specifications of certain cathode-ray tubes mention an ion trap, the question arises: What is the ion trap and what does it do? The answer is now forthcoming from the engineers of Allen B. Du Mont Laboratories, as follows:

It will be recalled that certain pre-war television cathode-ray tubes acquired large brown areas on their screens. These areas were caused by ion bombardment of the screens and were particularly prevalent in tubes employing electrostatic focus and magnetic deflection. The reason was that the cathode of any tube emits electrons

and, unfortunately, also a small amount of ions. The ions are very much heavier than the electrons. In all electrostatic tubes the ions are deflected equally with the electrons, and thus there is no evidence of ion burns. In magnetic deflection tubes, however, the ions are not materially deflected with the electron beam.

This permits the ions to hit the screen in a relatively small area at

the center of the screen, with a resulting disintegration of the center area. This trouble is very serious in tubes employing magnetic deflection and electrostatic focus since the ions are concentrated by the focus anode and beamed at the center of the tube in a small area at all times when the tube is in operation. With all-magnetic

[see page 34]

PA SYSTEM DESIGN

By CHARLES CHILTON

PART I

MANY radio service-dealers feel that there is a good possibility of increasing their income by engaging in public address activities. This feeling is well founded, and with a thorough knowledge of the principles of the art, a profitable sideline can be built up with relatively little expense of the service-dealer. Among the many ways in which a radio service dealer can start into the public-address business, it is perhaps the simplest for him to commence with a small system which is usable for portable work—one which he can install in less than an hour for the weekly meeting of the Friday Morning Club luncheon, or for a Saturday night dance given by a school sorority.

While many systems are readily available in built-up form from a number of manufacturers, a service-dealer should become familiar with the requirements as to the microphones, amplifiers, and speakers that go together to make a complete sound system. Not all microphones are suitable for all applications; not all amplifiers have sufficient gain or power output; and not all speakers are suitable for all uses. Before any planning can be done as to the exact equipment which is to be used, the entire system must be designed and the requirements of each of the components of the system understood thoroughly. With this in mind, we will cover the design of a portable system for smaller inside rooms, halls, and so on, which might well be the

Practically all types of PA systems — and guidance as to selling, installing or renting them are covered in this series of authoritative articles.

starting point for a service-dealer in his PA business. After that, we will assume that he has sold an installation requiring medium-sized equipment to a restaurant to be used for the reproduction of music during the dinner hour.

His prowess as a PA-man having spread, our hypothetical operator is called upon next to design and install a system in the local opera house for reinforcement of musical presentation, as well as for the voices of visiting orators. In addition, this installation demands that the local radio station be supplied with the program material, picked up by the same microphones. The fourth and largest installation will be for a baseball field seating 10,000 fans.

15-WATT PORTABLE SYSTEM

Assuming that the service-dealer has decided to go into the PA business, he may well start with the assembly of sufficient equipment to supply a small portable system to local dances, or to a luncheon club to provide good, intelligible sound reinforcement so the speaker can be heard throughout the room. Even though a PA operator may have a dozen systems for rental purposes, this type will certainly be represented.

For the application at hand, then, we will assume that the system is to accommodate two microphones and a turntable for input sources, and that

it be capable of supplying three loudspeakers. These speakers should be sufficiently large to give good reproduction over a fair frequency range, yet small enough to be easily portable. For this type of system, they should be capable of easy erection at the required positions, and reasonably directional.

To fulfill these requirements, we must lay out a block diagram of the entire system, showing the various inputs and outputs, with the gain necessary for each. In order to make such a diagram, a level diagram is first necessary.

A level diagram for this type of system is shown in Fig. 1. By definition, a level diagram is a plot of the "level" or sound volume, generally measured in db, as the sound passes through the system. The volume range of a full orchestra is as great as 70 db, while for speech it is somewhat less. We shall assume for this application that the volume range is 40 db, knowing that the action of the gain control can reduce the greater input range so that the output volume range will be only about 30 db, which is sufficient for satisfactory reproduction of speech, and quite adequate for dance band use. A reasonable minimum output from a microphone of fair quality is -80 ve, which means 80 db below a zero level of 1 milliwatt. With a volume range of 40 db, the range from the microphone is thus seen to be from -80 to -40 vu. Inasmuch as we desire a volume range from the speakers of only 30 db, we will have to reduce the input volume range by means of the gain controls to this amount; that is, the low passages may have to be raised, and the high passages lowered.

At the other end of the system, we must consider the output. Having decided on a 15-watt system, it is necessary to determine the output level

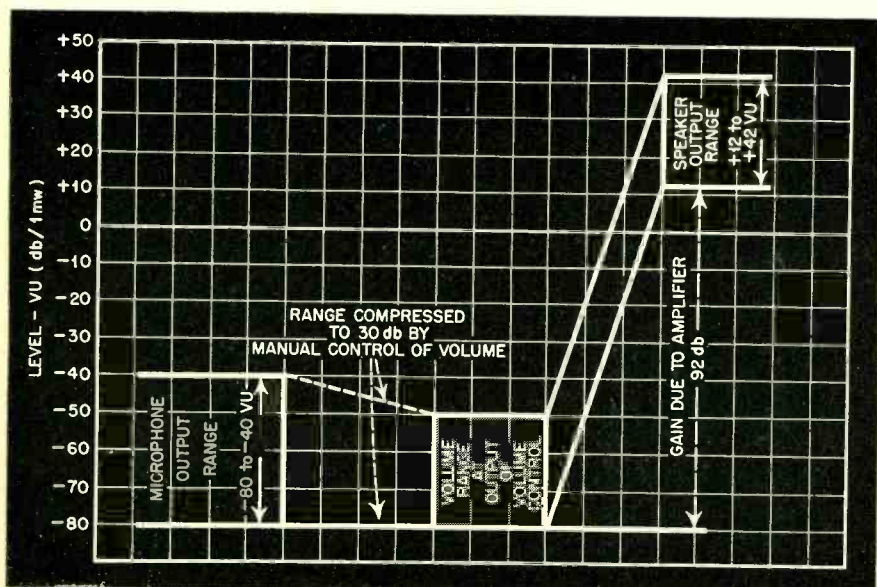
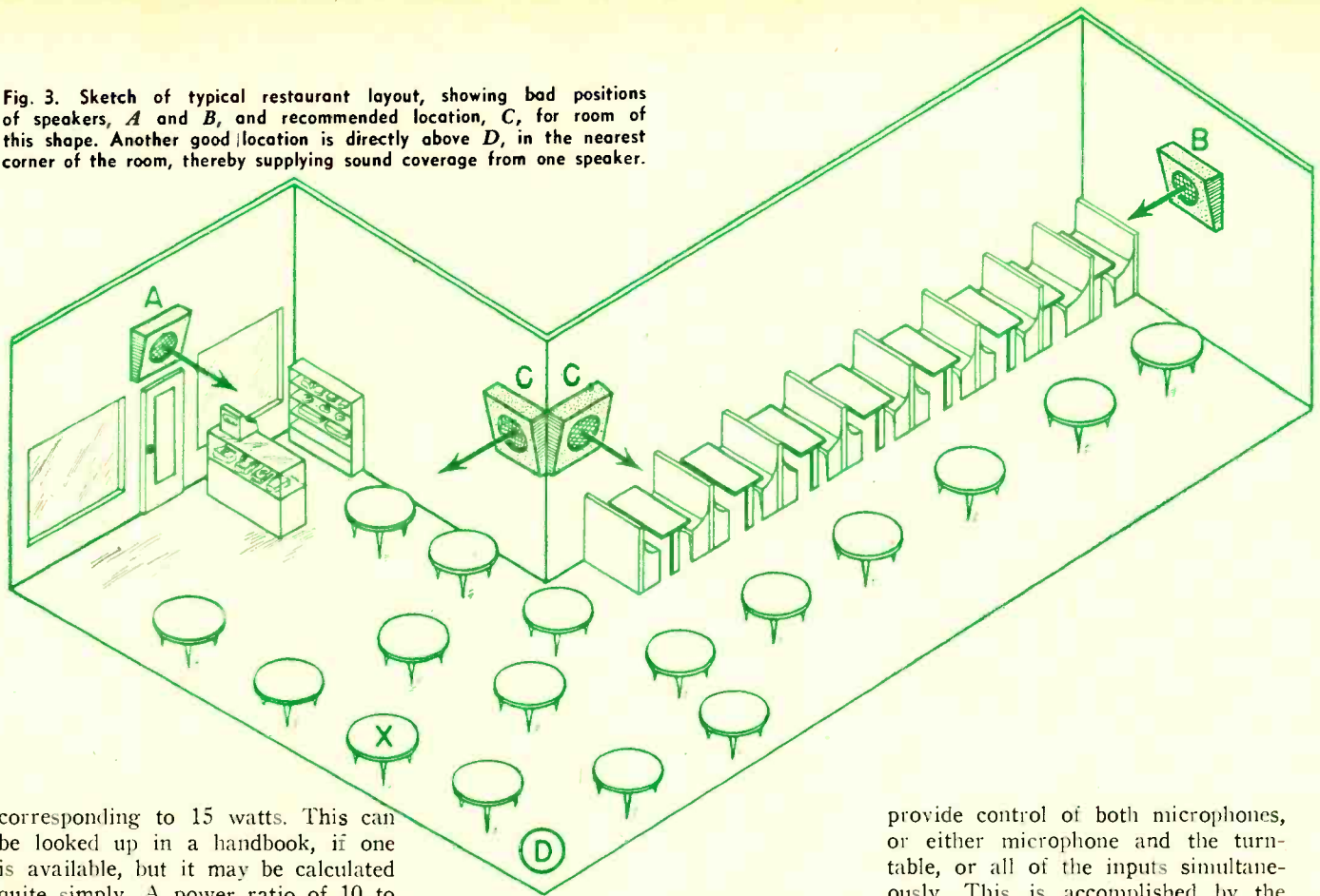


Fig. 1. Simple form of level diagram, showing range of sound volume at input of system, compression by use of volume control to 30-db range, and range of volume at speaker, after adding gain due to amplifier.

Fig. 3. Sketch of typical restaurant layout, showing bad positions of speakers, A and B, and recommended location, C, for room of this shape. Another good location is directly above D, in the nearest corner of the room, thereby supplying sound coverage from one speaker.



corresponding to 15 watts. This can be looked up in a handbook, if one is available, but it may be calculated quite simply. A power ratio of 10 to 1 represents a gain of 10 db. (A *voltage* ratio of 10 to 1 represents a gain of 20 db.) Therefore, using 1 milliwatt, or 0.001 watts, as the reference point known as "zero level", we see that a power of 10 times 0.001 watts, or 0.01 watts, indicates a level of +10; a power of 10 times 0.01 watts, or 0.1 watts indicates a level of +20; 1 watt is +30; 10 watts is +40, and so on. Doubling the power adds three db, so 20 watts represents a level of +43. If these values are plotted on a semi-logarithmic graph paper, with level in db plotted on the linear scale and the power in watts on the logarithmic scale, a level of 15 watts will intersect the curve at approximately +42. (When so plotted, the "curve" is a straight line.)

By means of these calculations, we have arrived at an output level of +42 vu for our maximum speaker output, and this output must be supplied from a microphone input of -50 vu. Subtracting algebraically, the gain necessary from the amplifier is equal to:

$$\text{Gain (db)} = 42 - (-50) = 92 \text{ db.}$$

While a gain of 92 db would suffice for such an installation, it is well to operate with some leeway, and preferably with a minimum of 10 db loss in the volume controls. Allowing 10 db in the volume control setting and 10 db for a factor of safety, the total gain from the amplifier is:

$$\begin{aligned} \text{Gain (db)} &= 92 + 10 + 10 \\ &= 112 \text{ db.} \end{aligned}$$

This figure must be kept in mind when the amplifier is selected.

Figure 2 can now be constructed. This is the system block diagram, and shows the microphone inputs, the turntable input, the amplifier, and the speakers. No refinements in the way of switching, indicator lights, volume indicators, equalizers, or filters are provided, although the modern PA amplifier in this class is generally equipped with tone controls. This also should be remembered when the amplifier is selected.

In such a simple system, the controls should provide control over the volume of the two microphones and the turntable separately, yet should

provide control of both microphones, or either microphone and the turntable, or all of the inputs simultaneously. This is accomplished by the master volume control with which most amplifiers are equipped. As previously mentioned, tone controls are generally built into the amplifier.

The amplifier itself must have a gain of approximately 112 db, as we have shown, and should be capable of reasonably good quality up to its rated output of 15 watts. The matter of housing the amplifier should be left up to the individual operator, suitable forms of the amplifier being a matter of taste and preference.

The power supply for a portable system is worth some consideration. The term "portable" is not meant to convey the same meaning as "mobile," a term used to designate equipment which is so constructed that it may be used independently of line power supply. Equipment of this type may be powered by batteries, or for higher powered applications, by means of gas-driven generators. For most uses to which the portable system under consideration is to be used, it may be assumed that a source of 115-volt 60-cps A. C. will be available. For convenience, the power supply for such an amplifier should best be integral with the amplifier itself.

For auxiliary equipment, it will be necessary to select microphones which will be suitable for general use, and which have a sufficiently high output level. Since the requirements for a portable installation are not usually severe, the use of high impedance microphones, feeding directly to the grids, is recommended, thus avoiding the additional expense of input transformers in the amplifiers, or the neces-

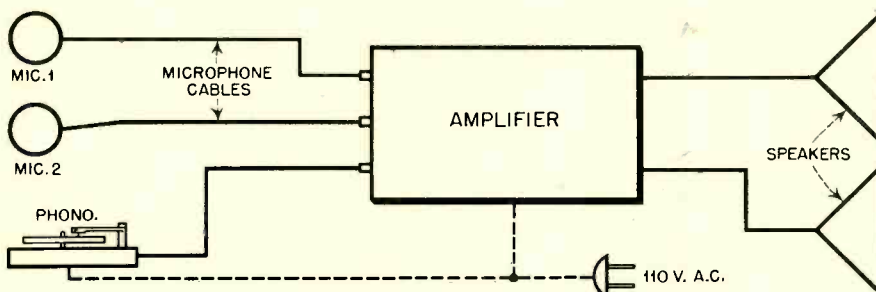


Fig. 2. Simplest type of system as shown in block diagram form. Diagrams of this type aid in laying out any sound equipment.

sity of using transformers designed to be connected in the line between the microphone and the amplifier.

For the turntable, a small portable motor and pickup should be selected, although if much use of record reproduction is contemplated, it is possible that the need would be best served by planning on a combination unit in which the amplifier and turntable are assembled in one unit.

Wiring for a portable unit will generally be composed of a set of cables, preferably rubber covered, which can be run to the necessary locations when the equipment is set up. In order to avoid excessive losses either in gain or of high-frequency response in high-impedance microphone circuits, the microphones and the amplifier should not be used at separations of greater than about 50 feet maximum, and less than 30 feet is better still. To avoid excessive power losses in the speaker lines, they should be composed of several sections, each approximately 30 feet in length. When the speakers are to be used close to the amplifier, a single section of cable can be used, with very low losses. As the distance between speakers and amplifier is increased, additional sections of cable can be added, thus keeping the loss at a minimum for the particular installation.

With this description of the small 15-watt portable system, it will be apparent that the problems are not difficult, but that the considerations of design must be kept in mind during the assembly of the various components in order that the entire system will function together as a whole.

25-WATT RESTAURANT SYSTEM

After having made several successful appearances with the small system, our PA operator gets an inquiry from a restaurant proprietor about a system which will entertain his customers with music during the dinner hour, and which can be used as a paging system to call customers to the phone when necessary. This type of system can be designed in approximately the same manner, with the same considerations as regards gain, output power, and controls. Some further thought must be given to the equipment necessary for the automatic playing of a series of records, as it is improbable that the owner will want an installation that requires an employee to change records every three to five minutes.

Most of the conditions governing this type of system are of the same order as in the 15-watt portable system. However, with the use of the equipment for reproduction of music

almost exclusively, the speakers should be of better quality than in the smaller system. The paging microphone is to be located by the cashier's booth, and should be ready for use at any time, preferably cutting out the music, or at least dropping its level so as not to prevent the announcement from being heard.

Let us assume that the restaurant is "L" shaped, as in Fig. 3. The problem of speaker placement becomes of importance in such a location. If the speakers are located at A and B, a customer sitting at point X will hear the sound from the two speakers at slightly different times, and it will not be pleasing due to the interference which will be set up. For such a restaurant floor-plan, the logical place-

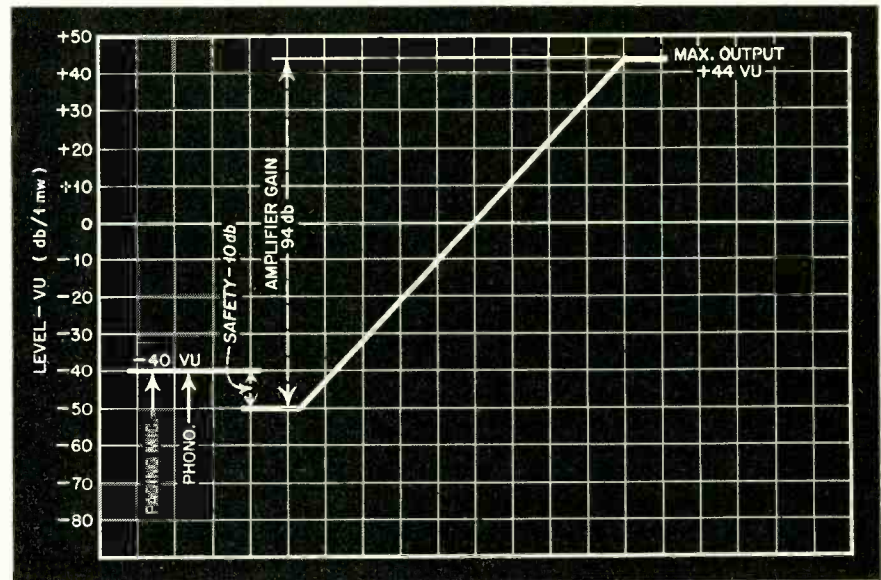


Fig. 4. Level diagram for restaurant installation, when used with high level microphone for paging purposes. Output level of this type of microphone is well above high quality units.

ment of speakers is at C, which becomes the only source of sound for all the listeners, and there will be no interference between the different speakers. The arrows on the diagram indicate the direction in which the speakers are pointing.

After determining the logical placement of the speakers so that there is no phase difference of the reproduced sound to the variously situated listeners, some thought must be given to the speakers themselves. For all practical purposes, the speakers in any PA system should be of the permanent magnet type, and for good reproduction of music, they should be of fairly large size. The use of 12-inch speakers is standard practice in such installations. If the restaurant clientele is such as to warrant the additional expenditure, it might be well to employ any of the duplex or co-axial speakers, which are capable of much higher quality of reproduction than the average single-cone speaker.

We now come to the layout of a system of this type. The level diagram is essentially the same as that required for the 15-watt system, although the input from the paging microphone is apt to be higher than the type of microphone used as the principal source for the smaller system. Figure 4 shows the revised level diagram for this system, with a microphone level of -40 vu, and a phonograph input level of -40 vu.

The level from the microphone can be obtained from the catalog sheets on the type of microphone to be used. For the phonograph pickup, the output level was determined by noting the output voltage as stated by the manufacturer of the better quality pickups and converting it to power level. For

example, the pickup output may be given as 0.85 volts, and this may be assumed to be the voltage developed across a load resistor of 0.5 megs. The power in the circuit is then given by the formula, $P = E^2/R$.

This gives a power of .00144 milliwatts. With a power of 1.0 milliwatts corresponding to a level of 0 vu, we determine the difference between the two power levels from the formula

$$db = 10 \log P_1/P_2$$

where P_1 and P_2 represent the power in the circuit under the two conditions being compared. The interchangeable use of the terms "db" and "vu" may seem confusing. Db is a power ratio; vu indicates a specified number of db above (or, if preceded by a minus sign, below) a reference level of 1.0 milliwatts. Vu further means that the level is measured on program material, not on a constant tone, and it means further that the measurement is made with a meter which has certain characteristics with respect to speed, cir-

cuit loading, etc., all of these conditions being standardized.

Returning to the calculations, we find that P_1 is 1.0 mw, and P_2 is .00144 mw. The ratio is therefore numerically equal to 1.0/0.00144, or 695, and the logarithm of 695 is 2.84. The difference in the two power levels is therefore 10 times 2.84, or 28.4 db. The output of the pickup, then, may be stated as -28.4 vu. Crystal pickups require a certain amount of high-frequency equalization to obtain good quality of reproduction, the loss in the low- and middle-frequency ranges being approximately 12 db. Adding this loss to the calculated output level for the pickup of -28.4 vu, we find that the useful output from this type of

be used during the playing of a record, some means should be provided to reduce the output from the pickup during the time the microphone is being used. While it is not within the realm of possibility to design an amplifier that would do this automatically, it is doubtful if there is such a device readily available. Figure 5 shows a simple means for accomplishing this. When the button is pressed on the microphone, a shunt is simultaneously placed across the pickup. C-1 and R-1 represent the coupling condenser and grid leak for the pickup circuit. C-2 and R-2 are the equalizing network for the crystal pickup. C-4 is selected to reduce the output of the pickup so the music does not interfere with the an-

With the requirement of operating in a small hall, seating 600 people, it is desirable to provide approximately 40 watts of power. This is for the operation of the loudspeakers for program reinforcement only, and additional facilities must be provided to monitor the program when necessary, as well as to feed the line to the broadcast station.

The provision that reproduction must be of high quality will extend to the entire system, from microphones to speakers, and include amplifiers, mixing and control circuits, monitor facilities, and on occasion, may require acoustic treatment of the auditorium itself.

Sufficient input lines must be provided from the stage to take care of any necessary microphone placement, and in addition, a line must be provided from a small enclosed room looking out into the auditorium from which commentators may fill in during intermissions, etc.

Facilities which will permit the use of the equipment as a remote pick-up for the radio station need not be elaborate, but modern broadcasting practice demands that they be good. One circuit that should be provided is the "cue" circuit which is an audio line from the control room at the station over which cues may be fed to the PA operator to enable him to get his program under way at the exact time, and without unnecessary delay.

During rehearsals, it may be very convenient to be able to talk to the stage from the control position, so the talk-back system is provided. In order that the talk-back system may also serve as a spare channel or part of the main system in case of failure, it is advisable that the same quality of equipment be used for both purposes.

The idea of having the PA system operator located in the auditorium, so that during a performance he may actually hear the output of the speakers, is a very sensible one. Unless the operator is able to hear audience noise and reactions, he will be unable to keep the volume of sound at the right level to be good reinforcement, rather than letting it drop to unintelligibility at times or letting it become just another "blatting" PA system. However, there may be some times, as when feeding the radio station, that he is better located in a soundproof monitor booth, so he will hear only what the radio listener is hearing. Keeping both PA and radio requirements satisfied will demand a considerable amount of co-ordination from the operator, but it is possible.

[see page 36]

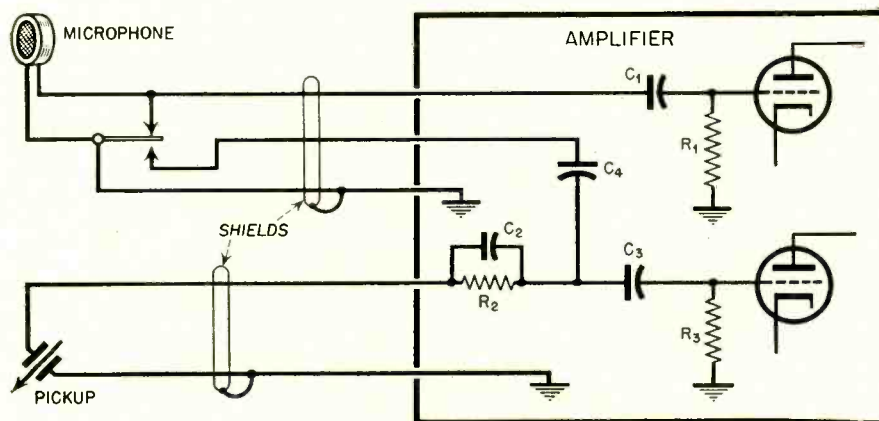


Fig. 5. Simple method of connecting microphone and pickup to an amplifier, with a switch for reducing volume of phonograph while making announcements. This circuit does not open any connections, resulting in clicks. Control may be placed far from amplifier.

pickup is approximately -40 vu. Again allowing for a volume control range of 10 db above the maximum normally required, we must assume that the minimum input level (for maximum output response) should be considered as about -50 vu.

By calculation, we determine that the level corresponding to an output power of 25 watts is +44 vu, making a necessary gain of 50 + 44, or 94 db in all. It will be noted that while we used both the upper and lower levels in our consideration of the level diagram for the 15-watt system, we have used only the maximum output level of the system and the maximum output levels from the sources in these calculations. It is not probable that the minimum output from the microphone or phonograph pickup will be reproduced at the maximum output of the amplifier, and the simplification of the diagram to this form makes it easier to handle.

PLACING CONTROLS

As to control equipment, it should be sufficient to have the controls for volume from either the microphone or phonograph on the amplifier itself. In order that the paging microphone may

announcements. The value of C-4 should be in the order of .01 to 0.1 mfd.

40-WATT SYSTEM SPECIFICATIONS

Now that we are familiar with the methods involved in the design of the smaller systems, it will be easier to follow the design of a more elaborate system. For the 40-watt system, let us assume that we have been given the following specifications:

*System to be used in small hall
High quality of reproduction
Input sources from microphones,
turntables, remote line from local
local radio station
Facilities to be provided to feed
program originating in hall to
local radio station
Talk-back amplifier must be provided
to permit control operator
to talk to stage when necessary
Control facilities to be located so
that operator can hear output of
system, yet when necessary can
be shut off from auditorium and
monitor the output on a good
loudspeaker when the system is
used to feed the radio station.*

TESTING PHASE INVERTER CIRCUITS

A knowledge of practical testing of phase inverter circuits is invaluable to the serviceman who suspects faulty operation of this stage in a receiver or an amplifier. The most prevalent reason for unsatisfactory operation is due to mismatched output tubes, that is tubes which draw unequal plate currents for the same applied terminal voltages.

Referring to Fig. 1, it can be seen that if unequal plate currents are present in the windings that make up the primary of the output transformer, two conditions will result which will tend to neutralize the beneficial effects of push-pull action. The first is an increase in magnetizing current in the output transformer. Secondly, the second harmonic components are no longer equal in both tubes and therefore do not cancel each other.

Therefore, if an amplifier or a receiver lacks its usual depth of tone, and the phase inverter stage is suspected, the first check to be made is the plate currents drawn by both output tubes. This is best done on the job itself by inserting a milliammeter in the points marked "X", as shown in the figure.

Another test on phase inverters that might be worth making is the relative amplitude of the signals appearing at the grids of the output tubes. This check is made with a V.T.V.M., as shown in the figure. An audio oscillator, or the output of a frequency test record may be used as the source of signal input. Phones, or a rectifier type of output meter may also be used as indicating devices.

Unequal signal voltages at the grids of the output tubes are usually indicative of faulty input tubes. The output of a phase inverter is approximately equal to: $E_1/E_2 \times G$, where E_1 is the signal voltage appearing at the grid of the output tube, T_1 , E_2 is the portion of this signal voltage fed to the grid of the phase inverter tube, and G is the gain of the phase inverter stage. Therefore, any change in the operating characteristics of the input tube or phase inverter tube will reflect itself in unequal voltages at the grids of the following push-pull tubes. Other possible causes for this condition are resistors that have changed value, or defective coupling condensers.

G. I. PHONE MOTORS AND TURNTABLES

The grease packed in the turntable spindles of some G.I. motors is rather heavy, so that very often the turntable rotates too slowly, or with a rumbling noise. A little kerosene applied with an eye-dropper will thin the grease sufficiently to permit satisfactory operation with adequate lubrication.

While on the subject of phono motors and turntables it might be worth while mentioning that the rim of the turntable is driven by a rubber-

SHOP NOTES

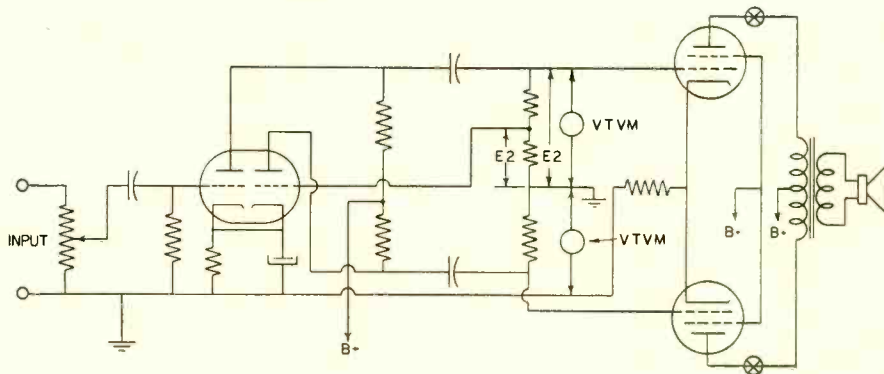


Figure 1

tired pulley which in turn is driven by a small metal drive. If the motor is not used for any length of time, this drive will cause a permanent depression in the rubber rure, resulting in a definite wow when it is again put in operation. It is advisable to educate owners of record players that they should turn the turntable occasionally so that the point of contact of the tire against the drive is varied from time to time.

ELIMINATING WHEEL AND TIRE STATIC

Wheel and tire static occurs while the car is in motion, and can be recognized by the fact that the characteristic intermittent rasping and clicking occurs even though the ignition is turned off. It is caused by the accumulated static charges which collect in the tires or on metal wheels which are insulated from the chassis by grease and oil. When these charges attain sufficient potential they discharge into the body thereby causing the noises just described. Wheel static can be distinguished from tire static by applying the brakes. If the noise disappears the source of disturbance is wheel static.

Wheel static may be eliminated by removing the hub caps and the grease caps, and inserting a cone spring static eliminator into the hub cap, whereupon the grease caps and hub caps are pressed back into position again. These springs will provide contact between the axle and the wheel, thereby eliminating the source of trouble. Contact between the wheel and the brake housing will also be effective, utilizing the same cone springs.

Tire static may be reduced by a number of methods. First, the tire

casings should be removed, and the insides buffed thoroughly with a wire brush and then cleaned and dried with a suitable grease removing fluid. Then, tires with vulcanized patches should be checked as possible causes. Finally any isolated metal members on the tire should be checked, and if possible, bonded to the rim of the wheel.

MODULATION

Hum occurs when station is tuned in. Check for .05 mfd. 400 volt condenser between the plate of the 25Z6 GT rectifier and B—. Add this capacitor if necessary. Its purpose is to by-pass R.F. signals around the rectifier tube.

EMERSON PORTABLE FU SERIES 424-427-428

Receiver does not work. Apparent oscillator trouble, sometimes intermittent. Due to defective 117P7 which supplies filament current for rectifier. If insufficient current flows only the oscillator is affected.

PHILCO 38-116 AFC USING MAGNETIC TUNING

Stations pop out the instant they are tuned in. This is due to improper alignment of the AFC circuit which causes an actual rejection of the received signal.

R. C. A. VICTOR K80

Hum Modulation and Howl—Tendency of occasional receivers towards hum modulation and howl may be alleviated by:

- (a) Rubber mounting the loud speaker by means of rubber grommets.
- (b) "Rigid-izing" loop antenna by taping winding in six places using cellulose tape. (2 each side, 1 top, and 1 bottom).

RECORDING TECHNIQUE

Emerson is responsible for this excellent exposition on recording. Careful attention should be paid to the actual groove as it has been cut in the blank. This can best be accomplished by means of a reading glass or low power microscope. The depth of cut, which is determined by the needle pressure on the blank, should be such that the width of the groove is approximately the same as that of the width between grooves. The importance of the depth of the cut cannot be over-emphasized, since too light a cut, or too heavy a cut will tend to give distortion and generally poor results. Too light a cut is particularly evidenced by the fact that the playback needle tends to climb out of the groove, while too heavy a cut will tend to produce change in pitch ("wows") due to slowing down the speed of the turntable, and will tend to allow the needle to cut completely through the side walls.

Figure 2-A shows a groove which is cut too deep, and Figure 2-B a groove of approximately fifty-fifty cut, which is generally preferred. When the cutter is actually recording sound or music, the needle has a sidewise movement and the result is to cut or modulate the side of the groove. Under a reading glass or microscope this shows up as an irregular "wavy" groove. The irregularities in the groove are determined by the pitch and volume of the sound being recorded.

Figure 2-D shows a properly modulated groove. The volume at which the sound is recorded becomes particularly important—because, at too low a level the music will appear thin and weak when it is played back. If the

recording level is too high, the needle will tend to cut completely through the side walls from one groove to the next, producing distortion and eventually allowing the playback needle to jump completely through the groove wall and into the next groove. This condition is known as "over-cutting" and is shown in Figure 2-C. Careful adjustment of the depth of cut and the recording level (or loudness of recording) are absolutely essential; attention to these details is just as important as the settings of a fine camera for the best results.

After further experience with the equipment is gathered, such adjustments as the depth of cut, or needle pressure, will probably be best determined by an inspection of the thread cut out of the blank. This thread, for normal cut, should have the approximate consistency of course human hair and should not be crinkly. An experienced operator can tell by the inspection of the thread whether the depth of cut adjustment is correctly set and can gain a good idea of the condition of the cutting needle during the actual process of cutting. Under proper conditions, the thread should throw approximately 1/16" away from the needle toward the "inside" of the blank and, as the recording head nears the inside, the needle will be forced to continually push the accumulated cutting toward the center of the turntable. Should the thread have a tendency to pile up or tangle immediately ahead of the recording needle, loosen the set-screw and retighten; the resulting minute change in the angular position of the needle will probably correct the trouble.

PRESS-TIME NEWS FLASHES

Booklet CRPS-102, 16 pages of useful technical information including tabular data and terminal diagrams about 113 types of RCA phototubes cathode-ray and special tubes is now available at RCA tube distributors for 10c a copy or may be had direct from the Commercial Engineering Tube Dep't of RCA, Harrison, N. J., for a dime. National Union reenters export field by appointing Rocke International Corp. of New York City to handle all N.U. products. Zenith's H. C. Bonfig states, "We do not intend to drop and we hope we won't have to raise any prices." Wilcox-Gay is conducting regional meetings to teach distributors the educational and entertainment advantages of having a home recording instrument such as Recordios. Pyramid Elec. Co., capacitor manufacturers, have moved all operations to a larger plant at 155 Oxford St., Paterson, N. J.

Ward Products Corp., Cleveland manufacturer of auto aerials announces a new display unit called the Aerial Bar which effectively acts as a floor self-serve merchandiser. It holds eight dozen assorted Ward aerials. Westinghouse now makes available to all its dealers a complete, compact, background departmentalized display unit which handles 3 consoles and 4 table models. Built in are necessary electrical outlets. U. S. Television Mfg. Corp., announces a "Big Picture" FM-AM television model listing at \$1,995 including excise tax. Radio Manufacturers Ass'n. and National Ass'n. of Broadcasters have entered a joint drive to culminate in National Radio Week at the end of October with the theme "A Radio in Every Room." Bond Geddes, Exec. V-P of RMA, declares, "Those who confine themselves to one radio in the home miss a great deal . . . deprive other members of their family from great entertainment." Surveys just completed show that now one out of every three homes has two radios.

Hoffman Radio Corp. of L.A. report 1947 sales up 50% over last year's and that present prices will not be reduced. Brush Development Co. of Cleveland demonstrates that its new BR-903 PN crystal pickup cartridge withstands heat and humidity so effectively that the units can be held in boiling water for 10 minutes without affecting their efficiency.

[see page 36]

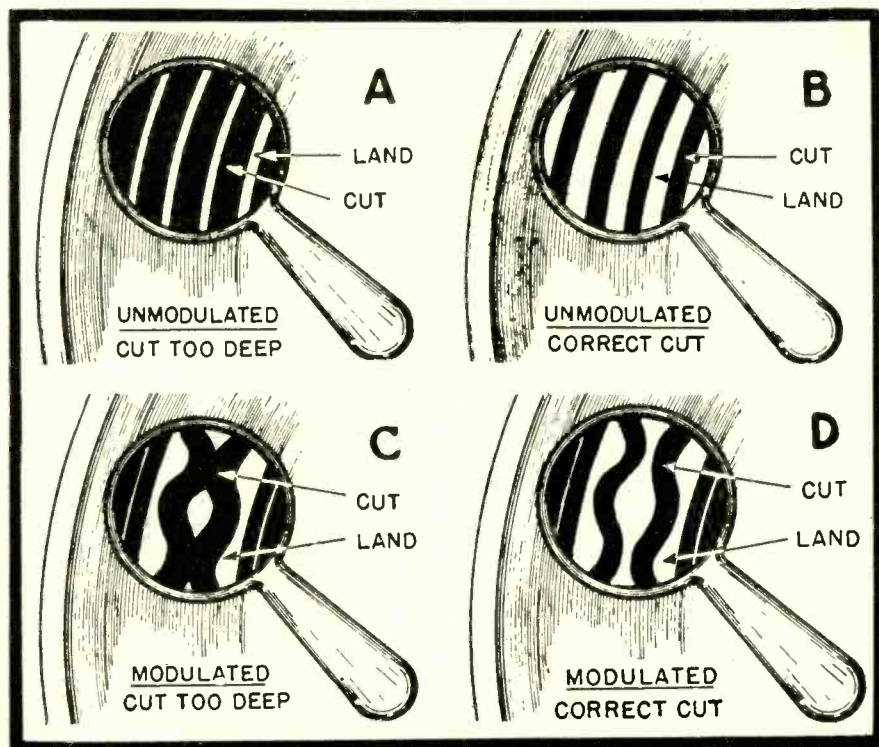


Figure 2-A-B-C-D

MERCHANDISE PRE-VIEWS

Webster Phonograph

A new table model phonograph complete with automatic record changer is now arriving at radio, music and department stores from Webster-Chicago Corporation. It is attractively designed and housed in an all metal cabinet of hammered gold finish to blend with all surroundings.



Known as Model 60, it features a full range tone control and master switch which enables the user to "warm-up" the amplifier before starting the record changer. The unit retails at \$49.50 and comes equipped with the new Webster Nylon sapphire-tip needle.

Amplitone Phonograph

Amplitone, Inc., Philadelphia, Pa., announces the "Amplitone Upright," an automatic phonograph developed during the war and placed on the market for the first time in 1946. Electrically operated and equipped



with automatic record changer, its compact designs make it readily portable and at the same time provides reproduction qualities found in larger sets. Tone range is from below 30 to over 10,000 cycles frequency and push-pull amplification equal to that of much larger radio-photograph combinations.

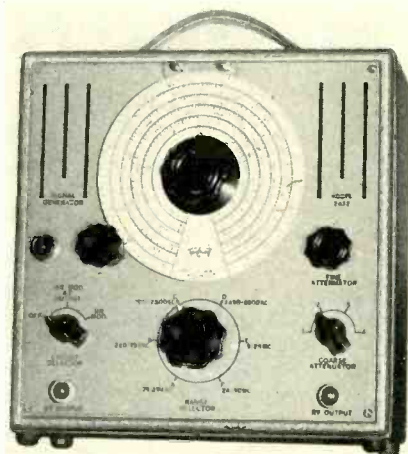
The "upright" design makes possi-

ble the use of large speaker and baffle in a tilted vertical position. The phonograph mechanism is hinged so that when opened to a playing position it lies flat and approximately at right angles to the upright speaker.

Triplet Sig. Gen.

Another new member of the Triplet "Square Line" of matched units, this new Signal Generator, Model 2432, embodies features customarily found only in "custom-priced" units.

Frequency Coverage—Continuous and overlapping 75 KC to 50 MC. Six bands. All fundamentals. *Turret Type Coil Assembly*—Six-position turret type coil switching with complete shielding. Coil assembly rotates inside a copper-plated steel shield. *Attenuation*—Individually shielded and adjustable, by fine and coarse controls, to zero for all practical purposes. *Stability*—Greatly increased by use of air



trimmer capacitors, electron coupled justed coils. *Internal Modulation*—Approximately 30% at 400 cycles. *Power Supply*—115 Volts, 50-60 cycles A.C. Voltage regulated for increased oscillator stability. *Case*—Heavy metal with tan and brown hammered enamel finish. The Triplet Electrical Instrument Co., Bluffton, Ohio.

Sylvania 'Scope

A new cathode ray oscilloscope featuring portability, low cost and practical design for radio set servicing and general service applications is announced by the radio tube division, Sylvania Electric Products Inc., 500 Fifth Avenue, New York 18, N. Y. Weighing only 18 pounds, it is mounted in attractive steel gray crackle finished cabinet measuring 10 $\frac{3}{4}$ " high, 8 $\frac{1}{8}$ " wide and 13 $\frac{3}{4}$ "

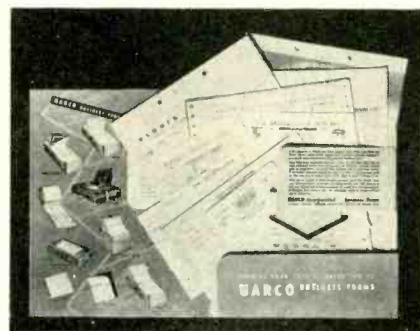
deep. Signal frequency range from 15 to 40,000 cycles is provided with a five range selection control and a fine frequency control which permits close adjustment to any desired frequency. Visual study of wave form is provided by a 3" cathode ray tube designed for 650 volt deflection plate operation.



Sweep circuit of Sylvania type 131 oscilloscope is built around a type 884 gas triode oscillator. Tube complement includes 3AP1 cathode ray tube; 5Y3GT/G rectifier; 7Y4 rectifier; two 707 amplifiers; and the 884 gas triode oscillator. The oscilloscope is rated at 105/125 volt; 50-60 cycle; 40 watt input.

Forms for Your Business

To make it possible for firms in radio equipment and servicing industry to examine cost-reducing systems used by comparable business organizations for



consolidating and simplifying writing operations, Uarco Incorporated, of Chicago, manufacturers of continuous business forms, is making available a series of new sample portfolios. Containing an extensive array of business forms utilized throughout this industry,

[see page 30]

CIRCUIT COURT

AIRKING Model 4604

An unusual IF coupling system is found in the Airking Model 4604. A partial schematic, shown as *Figure 1*, indicates details of the single, 455KC IF stage of this six tube AC operated instrument.

The first transformer, between the 7H7 mixer and the 6SK7 amplifier, is the normal, dual-tuned type. The plate of the 12SK7, however, feeds a triple-tuned, three coil transformer. The output of the transformer feeds the diode plates (in parallel) of the 7B6 second detector, AVC, first audio tube.

The use of such a three-coil unit permits realization of high gain and good selectivity without instability or excessive side-band cutting. Alignment instructions indicate normal procedure working forward from the diode circuit.

LEARADIO Model 565

An example of a tuning system and antenna coupling method which appear to be growing in favor is shown in *Figure 2*, the schematic of the mixer stage of the Lear Model 565. This is a five tube, AC/DC instrument employing a conventional tube layout. The mixer-oscillator tube is a 12SA7.

High-frequency alignment is accomplished by the use of trimmers C_1 and C_2 . The signal frequency coil L_1 is tuned by a movable iron core. The oscillator circuit, operating at a frequency 455 Kc higher than the signal, is tuned by a movable core in coil L_2 .

Feedback in the oscillator is derived from the mutual coupling in the dual

Figure 2

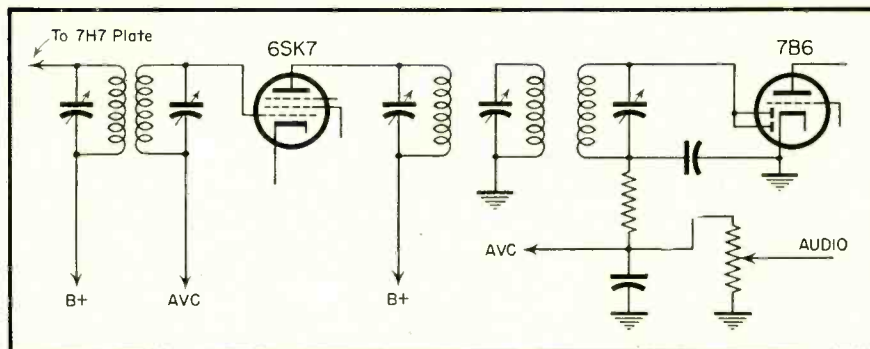
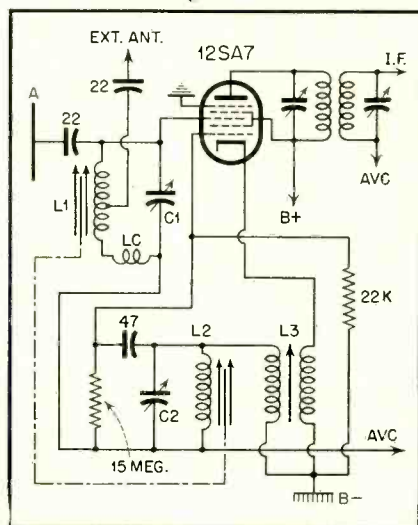


Figure 1

coil designated as L_3 . The adjustable iron core in this coil provides low-frequency padding. Coils L_2 and L_3 must be designed so that their parallel connection results in the proper inductance for the desired frequency.

A capacity-type pick-up is provided at the head of the cabinet, and, having low efficiency, is coupled directly to the mixer grid via the 22 mfd capacitor. Provision is made for additional signal input by the use of an extended wire antenna. This lead connects, via another 22 mfd capacitor, to a tap on the grid coil. Note that the full grid inductance is not tuned, a portion being indicated by loading coil LC. This provision insures most effective tracking.

AIRLINE Model 64WG-1052A

Use of the recently developed selenium rectifier is illustrated in the power supply circuit of the Airline model 64WG-1052A. The particular unit employed in this instance is a five-section affair.

The instrument, whose partial schematic is shown as *Figure 3*, is a portable set made to operate on line power

or a built-in battery pack. The power requirements are 9 volts A and 90 volts B.

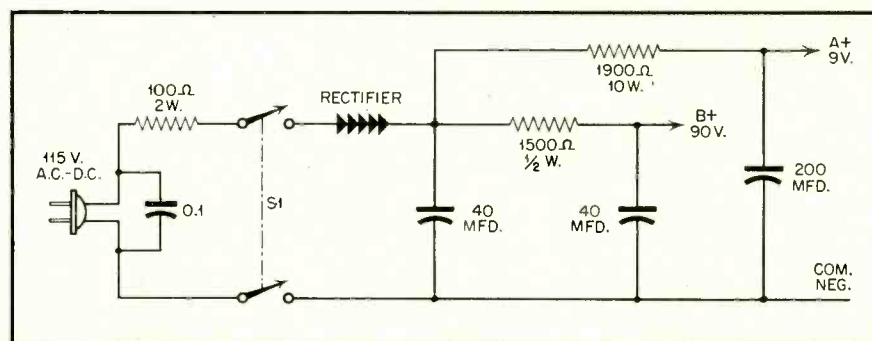
A four-section, three-position switch is used to provide OFF-AC/DC-BATT. selection. The sections of the switch which open and close the power line circuit are shown, marked S_1 . A 100 ohm, 2 watt resistor serves to limit the surge through the rectifier and across the first filter capacitor.

A 1500 ohm resistor and two 40 mfd capacitors form the π type filter for the B voltage. Voltage for the series filament string is supplied through a 1900 ohm, 10 watt, plug-in type of resistor. This is followed by a 200 mfd, 35 volt capacitor. Considerable heat is developed in both the rectifier and the plug-in resistor. Both are mounted in perforated, protective shields, permitting air circulation but preventing contact with other material.

ANSLEY Model 41 (Paneltone)

A novel and interesting mechanical layout for a receiver is found in the Ansley Model 41. This set, called a [see page 28]

Figure 3



SPRAGUE TRADING POST

SWAP — BUY OR SELL

FOR SALE—T-53 dynamic mut. con. tube tester, counter model, modernized to 100 V. fls. Good shape \$30 11175A combination sig. gen and VOM in port. carrying case, battery operated, \$25. All letters answered. Bill Hagara, Box 224, Slickville, Pa.

WANTED—Kider's Manuals 1, 2, 8, 9, 11, 15; also a good condenser analyzer. W. E. Linscott, 925 Linden Ave., Zanesville, Ohio.

SELL OR SWAP—Simpson tube tester; voltmeter; capacity meter; 180 new tubes; sig. gen.; filter cond.; by-pass and coupling cond.; speakers; resistors; etc. Wholesale value \$450. C. F. Hyde, 1597 Bloomington, Bernerton, Wash.

WANTED—RCA Victor model Q44, 11-tube and magic eye—8-band super. State price. E. P. Riffle, 462 Elm St., Ludlow, Ky.

SELL OR SWAP—Hallcrafters S-20R communications receiver, 5 months old. Want tube checker or sig. generator. A. F. Jacobs, 297 Rosemont Gardens, Lexington, Ky.

TRADE—New 1947 Emerson table radios, worth \$38.75 for any of these items; large tent; binoculars; outboard motor; casting outfit or .22 cal. automatic pistol. Bob's Radio Shop, 73 3rd St., Laurium, Mich.

SWAP—A good capacity tester, or what have you for bicycle in perfect condition, also bicycle parts. J. Bazewick, 3000 N. Christiana, Chicago 18, Ill.

FOR SALE—Sacrifice—PM/TM sig. gen., with variable audio freq. from 15-15000 cycles. Supreme 561 worth \$133.87 now, in perfect condition. First \$50 M.O. takes it. Ed. Christner, 313 Crawford St., Middletown 12, Ohio.

FOR SALE—Used, 2 wks. old, Hallcrafters S-33, \$45; multi-tester 101, \$20; small Windcharger 6 V., 20 amp. used 30 days, \$25; arc-welder, 110 V. a-c, \$15. Warren H. Perkins Radio Service, Cincinnati, N. Y.

TRADE—Argus C3 camera complete, other photo equipment for vol-ohmmeter; tube tester; sig. gen.; only first class equipment—or what have you? R. J. Pinkerton, 155 E. Columbia, Alliance, Ohio.

SWAP—Supreme 599 tester for Silver Vomag. Selz Radio Service, 2705 Clifton, St. Louis 10, Mo.

FOR SALE—Radio tubes: 11N7; 25Z5; 50L6 etc. Interchangeable tube manual 25¢. Will ship tubes C.C.C., 20% off list; also small, 5-tube Meck Radios, \$19.95. Worden Radio Shop, 121 Maple St., Friend, Neb.

WANTED—Sig. gen. in good condition; any used test equipment in fair or good order; tubes 485, 182, 183. Bob's Radio Service, 815 W. Virginia, Peoria, Ill.

WANTED—Typewriter in good condition. Will trade \$75 worth of tubes and parts, all brand new. Edward C. Punt, 397 Melrose St., Brooklyn 6, N. Y.



Replacing Wets IS ONLY THE BEGINNING!

Sprague Type WR Capacitors are especially designed can type dry electrolytics having very high voltage formation. They'll stand high surges or peak voltages. They'll handle the strong a-c ripples that often cause ordinary 450v. dry electrolytic capacitors to break down. In short, they're absolutely "tops" for replacing ANY wet electrolytic capacitor in a radio set — and a lot more besides!

Actually, they're "just what the doctor ordered" for JUKE BOXES, television sets or any application where ordinary condensers have the annoying habit of breaking down to cause a whale of a lot of trouble — not to mention dissatisfied customers. Buy them from Sprague distributors in 8, 16 and 25 mfd. sizes — to fit standard "wet" mounting holes — and CONSERVATIVELY rated at 500v. D.C. working voltage and 600v. surge! Ask for Sprague Type WR!

SWAP—Movikon 8mm camera. Carl Zeiss f 2.7 Tessar lens, var. focus, automatic timer, etc. in perfect condition, cost over \$300. Can use 150 watt phone transmitter of KW components, or what have you to offer. Ray S. Thomas, Route 1, Box 1134, Los Gatos, Calif.

FOR SALE—National SW-3AC complete with power supply, tubes, 20-40-80 mtr band spread coils, A-1 condition \$25; Transmitter 6L6 osc. pair 6L6 final, 40 watts, complete, power supply 40-80 meter crystals, tubes \$35. Frank Bou, c/o Bot. Dept., U. of Penna, 38 Woodland Ave., Philadelphia 4, Penn.

FOR SALE—T.T.I. television chassis with 7" tube, fair working condition. Sell for less than parts cost \$80, cash or C.O.D. J. I. Freeman, 5025 Arch St., Philadelphia 39, Penna.

SWAP—Movie projectors 8, 9½, 16, 35mm; auto, home radios; rotary converters; RCA radio course; magazines; other items. Want garden tractor; gas engine; 35mm still camera; movie camera; test equipment; sewing machine. Joseph Leeb, 1380 Merriam Ave., Bronx 52, N. Y.

FOR SALE—600 watt phone transmitter, class B mod, P.P. final. Complete with separate speech amplifier and ECO, 10-20-80 mtr coils, in 66½" deluxe gray enclosed cabinet. Write for photo, particulars. \$500 f.o.b. W8S0X R. O. Klemetti, Box 157, Roscommon, Mich.

FOR SALE—Hallcrafters SX-24 Skyrider Dehart, excellent condition \$65; Millen exciter 90800 never used, complete with coils and tubes for 10 mtrs. \$35. Don. M. Culler, 116 S. Main St., Hicksville, Ohio.

WANTED—Receiver such as S-19R, S-20R or SX-24. Bill Puskas, 17 Orchard St., Garfield, N. J.

SELL OR SWAP—Have Scott 15 tube receiver in excellent condition. Want Scott 30 tube receiver, will pay difference in cash, boy, or will sell my receiver. Donald Newbold. Gallaher Drug Co., Mt. Vernon, Ohio.

WANTED—Muter Candohm resistor 00R-162. George Mashek, R. 2, Marissa, Ohio.

FOR SALE—Weston and IRC precision wire wound resistors; Weston 301 OT0 50 microampere meter, bakelite case; Brush crystal speaker; Garrod english 2-speed phonograph motor; output transformer. J. Holway, Box 133, Haddonfield, N. J.

WANTED—Boys to join radio club ages 15-17. True interest in radio all that is needed. Jerome Hamerling, 1562 Vyse Ave., New York 60, N. Y.

WANTED—Power transformer 1750 V. c.t., 1750 V., or 2000 V. c.t. 2000 V.; 300 to 500 ma. chokes to match. C. Leverington, 5328A Maple Ave., St. Louis 12, Mo.

SELL OR SWAP—860 and 865 transmitting tubes, new. Sell or trade for radio parts or Rider Manuals, any or part of the above. W. H. Miller Electric Shop, Trevorton, Pa.

WANTED—Technical manuals for BC-375-E. Glenn Krebs, 109 Union Ave., Dover, Ohio.

FOR SALE—UTC SA7 1500 V., 300 ma. plate transformer; Pair 866 and fl. transformer; T240 and fl. trans; 4 mfd. 3000 V. condenser. What have you? R. Simonsen WOCHV, 612 16th St., Des Moines, Iowa.

FOR SALE—NC-46 Speaker, used 10 months; old model DB-20 in good condition. \$110 takes all. W31NV, 5526 Malcolm St., Philadelphia 43, Penna.

SWAP—RCP 802 N tube and set tester for Hallcrafters S-38 receiver, or other good communications receiver. Arthur M. Jones, RT 2, Covington, Ga.

FOR SALE—Silvertone 5-tube, 3-way portable; a-c d-c and battery. Perfect condition. Eugene Zimmer, 44 Lincoln Ave., Mount Ephraim, N. J.

FOR SALE—Abbott DK-2 portable or fixed station transceiver, complete with tubes, batteries but less mike and antenna. Excellent condition. Will sell for \$25 or what have you? J. H. Hurst, 22 June St., Fall River, Mass.

FOR SALE—32 V. windcharger complete with batteries and 65' tower. Fine for rotary antenna mast. \$75. Marlin J. Hert, Route 2, Springville, Ind.

FOR SALE—NC-46 and speaker, \$88. Harold Ingraham, W2MMN, 315 Lyons Ave., Fairlawn, N. J.

FOR SALE—\$100 takes my NC-100-A, less speaker. 80, 40, 20, 11, 10 meters, and 30 mc. Joseph V. Oliveri, W21XT, 447 S. Ocean Ave., Patchogue, L. I. N. Y.

FOR SALE—60% off list price. Television tubes: 1851, 1852/6A07, 1853/6A07, 2X2/879, 879; also 2A3, 2A6, 6Y6/G, and 5Z3. Not in original carton, but meter tested perfect. S. S. Schoetfeld, 1669 Grand Ave., New York 53, N. Y.

FOR SALE—Hallcrafters Sky Buddy with good ear phones \$50; Hallcrafters Sky Courier, s.w. and regular portable, \$55. Edward W. Lemanski, 2005 W. Sample St., South Bend 19, Ind.

WANTED—S-20 Gon set, or good 10-meter converter. Cash or will trade good 6 X 30 binoculars with case, or other sporting or radio gear. W8YPR, 212 Kirk St., Princeton, W. Va.

WANTED—New or 2nd hand 3-5, or 4-6 power transformer; radio trading 3-way circuit tuner for .0005 mf condenser; Hammarlund ML23, 23-plate var. condenser. Write price to Berton Edw. Brasseur, Madison Place, Apt. 28, Boston 18, Mass.

WANTED—Data and plans for carrier freq. intercom. Parts, coils, kits or assembled units. Crosby Chatabox, full list, price, etc. C. J. Seymour, Los Angeles, San Duarte, Calif.

FOR SALE—SW-3 receiver with coils, without power-pack, \$14. Matt Surofka, W9KYK, 5031 Homerlee Ave., East Chicago, Ind.

FOR SALE—12 V., 10 Amp. filtered D-C power supply. Operates D-C equipment from 115 V. A-C line, \$34.50. Other voltages available. J. E. Reidel, 1523 41st St., Brooklyn 18, N. Y.

SWAP—Transmitter tuning unit Sig. C. VT-9-B, range 7700-10,000 KC for what do you have? Need 6N6 and battery operated signal generator. John A. Williams, 1145 Clarkson St., Denver 3, Colo.

FOR SALE—3-tube portable phono, \$15; Hammarlund 5 prong isolantite socket 20¢; National 4" vernier dial & plate, 25¢; Garrod 0003 var. cond., isolantite insul. 10¢ James S. Messler, 835 Berkeley Ave., Trenton 8, N. J.

FOR SALE—Howard communications receiver 450A, 12 tubes, 6 bands with crystal. Has speaker cabinet, no speaker, takes 8" P.M. dynamic. Receiver in very good condition. \$50. Cameron McCall, 12131 Lirlden Rd., Linden, Mich.

YOUR OWN AD RUN HERE FREE

The Sprague Trading Post is a free advertising service for the benefit of our radio friends. Providing only that it fits in with the spirit of this service, we'll gladly run your own ad in the first available issue of one of the six radio magazines in which this feature appears. Write CAREFULLY or print. Hold it to 40 words or less.

Confine it to radio subjects. Make sure your meaning is clear. No commercial advertising or the offering of merchandise to the highest bidder is acceptable. Sprague, of course, assumes no responsibility in connection with merchandise bought or sold through these columns or for the resulting transactions.

Send your ad to Dept. RSD-57
SPRAGUE PRODUCTS COMPANY
North Adams, Mass.

(Jobbing distributing organization for products of the Sprague Electric Co.)

ASK FOR SPRAGUE CAPACITORS and *KOOLOHM RESISTORS by name!

*Trademark Reg. U.S. Pat. Off.

SERVICE DATA

FOR

RCA RADIOLA

MODELS 61-6—61-7

Specifications

Frequency Ranges

Standard Broadcast ("A" Band) 540-1.680 kc (555-178 m)
 Short Wave ("C" Band) 4.7-18.2 mc (63.8-16.5 m)

Intermediate Frequency 455 kc

RCA Tube Complement

- (1) RCA Radiotron-12SA7 1st Detector-Oscillator
- (2) RCA Radiotron-12SK7 I-F Amplifier
- (3) RCA Radiotron-12SQ7 2nd Detector, A.V.C., and
A-F Amplifier
- (4) RCA Radiotron-50L6GT Power Output
- (5) RCA Radiotron-35Z5GT/G Rectifier

Power Supply Rating

105-125 volts D.C. or 50-60 cycles A.C. 30 watts

Power Output Rating

Undistorted 1 watt
 Maximum 1.5 watts

Loudspeaker (92510-2)

Type 5-inch Round Permanent-Magnet Dynamic
 Voice Coil Impedance 4 ohms at 400 cycles

Tuning Drive Ratio 18 to 1

Dimensions (Inches)

	Width	Height	Depth
Cabinets (Outside)	10 ³ / ₁₆	6 ¹ / ₁₆	6 ¹ / ₁₆
Chassis Base (Outside)	9 ³ / ₁₆	1 ¹ / ₁₆	4 ³ / ₄
Chassis Overall	9 ³ / ₁₆	6 ¹ / ₁₆	7

Weight Net 6 lbs. Weight Shipping 7¹/₂ lbs.

PRECAUTIONARY LEAD DRESS

1. Dress output plate capacitor and output transformer leads down next to chassis.
2. Dress 12SQ7 grid resistor down next to chassis, and away from power ground wire to switch.
3. Dress lead from 2nd I-F transformer to volume control down to chassis and away from adjacent parts.
4. Keep grid end of R1 as short as possible.
5. Keep body of C1A slightly away from chassis.

POWER SUPPLY POLARITY.—For operation on d-c, the power plug must be inserted in the outlet for correct polarity. If the set does not function, reverse the plug. On a-c, reversal of the plug may reduce hum.

Replacement Parts

STOCK No.	DESCRIPTION	STOCK No.	DESCRIPTION
CHASSIS ASSEMBLIES			
RC-594D			
71387	Capacitor—Adjustable, 1.6-18 mmf. (C37)	12928	Resistor—3.3 megohms, 1/4 watt (R2)
70367	Capacitor—Mica trimmer, 2.10 mmf. (C7)	30992	Resistor—10 megohms, 1/4 watt (R6)
39622	Capacitor—Mica, 56 mmf. (C4)	70369	Shaft—Tuning knob shaft
39636	Capacitor—Mica, 220 mmf. (C1A, C17)	37605	Socket—Tube socket, moulded
71392	Capacitor—Mica, 450 mmf. (C5B)	31418	Spring—Tension spring for drive cord
70627	Capacitor—Tubular, .005 mfd., 600 volts (C1, C16, C18)	71384	Switch—Range switch (S1)
70612	Capacitor—Tubular, .025 mfd., 400 volts (C10, C20)	70361	Transformer—First I-F transformer (L8, L9, C8, C9)
70615	Capacitor—Tubular, .05 mfd., 400 volts (C23)	70362	Transformer—Second I-F transformer (L10, L11, C12, C13, C14, C15)
70617	Capacitor—Tubular, 0.1 mfd., 400 volts (C11)	71398	Transformer—Output transformer (T1)
39152	Capacitor—Electrolytic, comprising 1 section of 50 mfd., 150 volts and 1 section of 30 mfd., 150 volts (C30, C30A)	33726	Washer—Retaining washer for tuning shaft
71396	Coil—Antenna coil (L1, L2)	SPEAKER ASSEMBLY	
37962	Coil—Antenna loop coupling coil (L3, L5, R20)	92510-2	
70359	Coil—Oscillator coil (L6, L7)	70372	Speaker—5-inch PM speaker complete
70366	Condenser—Variable tuning condenser (C2, C3, C5, C6)	NOTE: If stamping on speaker in instrument does not agree with above speaker number, order replacement parts by referring to model number of instrument, number stamped on speaker and full description of part required.	
38406	Control—Volume control and power switch (R4, S2)	MISCELLANEOUS ASSEMBLIES	
32634	Cord—Drive cord (approx. 37 inches long)	37362	Clamp—Dial clamp (1 set)
70392	Cord—Power cord	71324	Decal—Trade mark decalcomania
70365	Core—Adjustable core and stud for oscillator coil	71369	Dial—Dial scale
16058	Grommet—Rubber grommet for mounting speaker—3 required	37831	Fastener—Push fastener for back cover (1 set)
37068	Indicator—Station selector indicator	35121	Knob—Range switch knob for Radiola 61-6
71397	Loop—Antenna loop (L4)	35123	Knob—Range switch knob for Radiola 61-7
70364	Nut—Speed nut to mount oscillator coil	36722	Knob—Volume control or tuning knob for Radiola 61-6
70368	Plate—Dial back plate complete with pulleys less dial	70414	Knob—Tuning or volume control knob for Radiola 61-7
36230	Pulley—Drive cord pulley	35126	Spring—Retaining spring for range switch knob
30880	Resistor—150 ohms, 1/2 watt (R7)	30900	Spring—Retaining spring for volume control or tuning knob
30152	Resistor—1000 ohms, 1 watt (R9)		
30685	Resistor—39,000 ohms, 1/4 watt (R1A)		
30787	Resistor—47,000 ohms, 1/4 watt (R3)		
14583	Resistor—220,000 ohms, 1/4 watt (R19)		
30648	Resistor—470,000 ohms, 1/4 watt (R8)		
30649	Resistor—2.2 megohms, 1/4 watt (R1)		

[see next page]

[Continued]

SERVICE DATA RCA RADIOLA MODELS 61-6 — 61-7

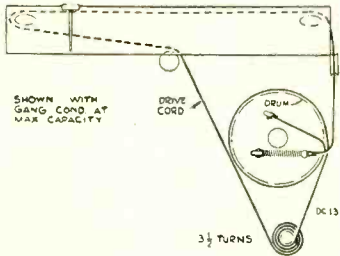
Alignment Procedure

Calibration Scale.—The glass tuning dial may be removed from the cabinet and mounted above the pointer for easy reference during alignment. The extreme left hand mark of the Standard Broadcast scale must be in line with the left hand mark on the dial backing plate.

Dial Pointer.—With the gang condenser in full mesh the dial pointer should be set to the left hand mark of the Standard Broadcast scale.

Test-Oscillator.—For all alignment operations, connect the low side of the test-oscillator through a .01 mfd. capacitor to the receiver chassis, and keep the oscillator output as low as possible to avoid a-v-c action.

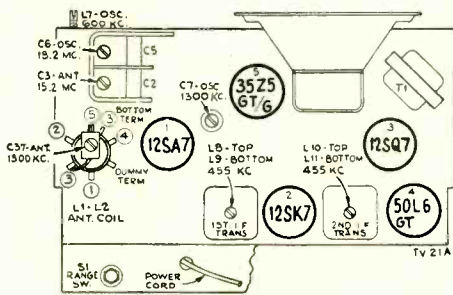
For additional information refer to booklet "RCA Victor Receiver Alignment."



Dial Indicator and Drive Mechanism

Cathode-Ray Alignment is the preferable method. Connections for the oscilloscope are shown in the schematic drawing.

Output Meter Alignment.—If this method is used, connect the meter across the voice coil, and turn the receiver volume control to maximum.



Tube and Trimmer Locations

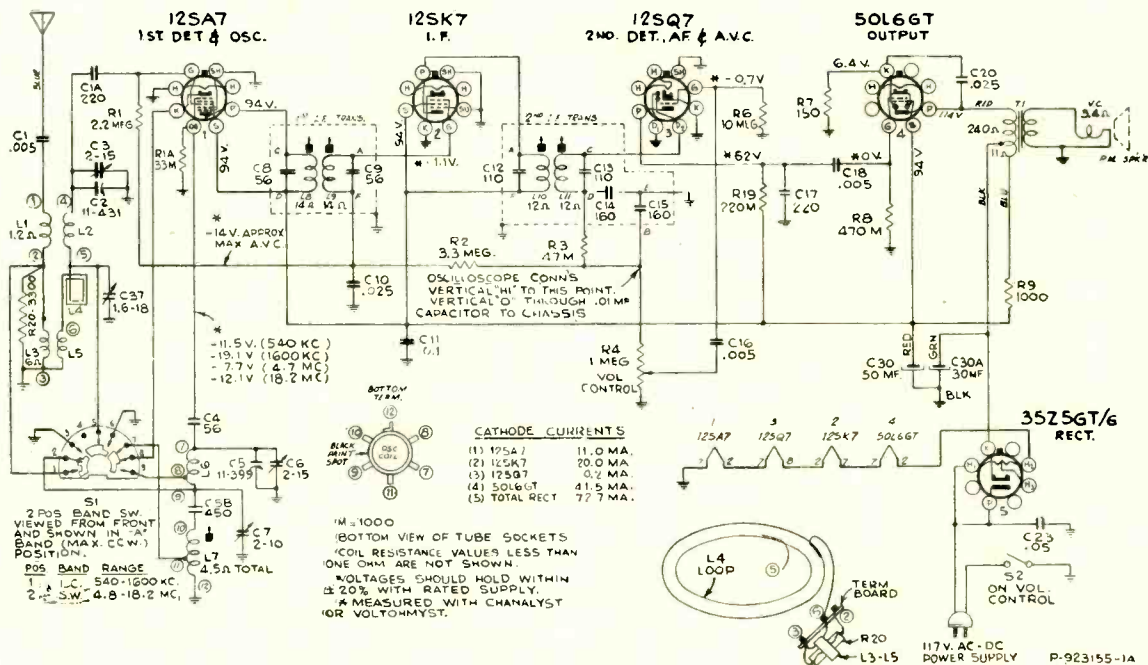
Steps	Connect high side of test osc. to—	Tune test osc. to—	Turn radio dial to—	Adjust following for max. output—
1	12SK7 I-F grid through 0.1 mfd. capacitor			L11-L10 (2nd I-F Trans.)
2	Stator of gang cond. C2 (rear) through 0.1 mfd.	455 kc	B. C.; 1600 kc quiet point	L9-L8* (1st I-F Trans.)
3	Antenna lead through 300 ohm resistor	18.2 mc	S. W.; gang condenser open	C6 (osc.)**
4		15.2 mc	S. W.; maximum signal rock gang	C3 (ant.)***
5		600 kc	B. C.; 600 kc	L7 (osc.)
6	Antenna lead through 200 mmf. capacitor	1300 kc	B. C.; rock gang at 1300 kc	C37 (ant.) C7 (osc.)
7		600 kc	B. C.; rock gang at 600 kc	L7 (osc.)
8	Repeat steps 6 and 7			

* Do not readjust L10 or L11 when test oscillator is connected to C2.

** Use minimum capacity peak if two peaks can be obtained.

*** Image signal of lesser amplitude should occur at 14.3 mc.

NOTE.—Oscillator tracks above signals on both bands.



Schematic Diagram



**RCA's
NEW SPEAKER
LINE BOOSTS
SOUND SALES**

3 1/2-foot
Re-Entrant Trumpet

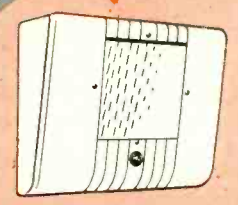
**A full line of Speakers for
your sound installations**

Now you can select the right speakers for your sound systems. This RCA speaker line provides high-quality distribution of voice and music . . . indoors and outdoors . . . to cover large or small areas effectively.

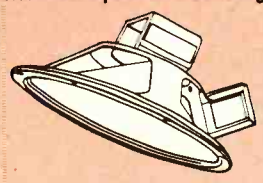
RCA's Package Sound Line also includes a wide variety of microphones, amplifiers and turntables . . . precision-matched with these speakers. Also available is the popular ECA Two-Station Intercom System. Together these units represent a beautifully balanced line which you can purchase

complete through one source—RCA. The line is built right and priced right for a steady volume of profitable business.

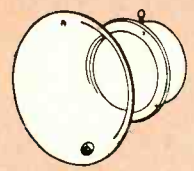
Get this new speaker folder, and its companion folders on microphones, amplifiers and intercoms. They contain specific information on RCA package sound items . . . just printed and waiting for you. Address: Dept. 88E, Sound Equipment Section, RCA, Camden, New Jersey.



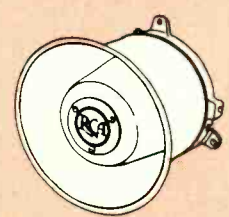
Molded Speaker Housings



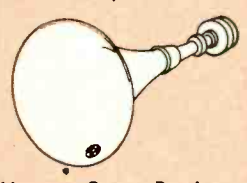
Alnico 5 PA Speakers



Directional Sound
Projectors for
Cone-type Speakers



6 in. Re-Entrant Horn
(including 5-watt
mechanism)



Narrow Beam Paging
Baffles



Complete line of Speaker
Mechanisms for all
trumpets and baffles



**SOUND EQUIPMENT
RADIO CORPORATION of AMERICA
ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.**

In Canada: RCA VICTOR Company Limited, Montreal

CIRCUIT COURT

[from page 23]

Paneltone, is designed to be built into the wall and its dimensions are appropriate for the intended use.

Among the circuit features of the seven tube, AC powered set, is an unusual phono-radio changeover arrangement. Instead of using a panel-operated switch, as is more common, a telephone-type jack is employed. In addition to the function of connecting a pick-up into the grid circuit of the 6SQ7 first audio tube, additional contacts provide for disabling the radio circuits.

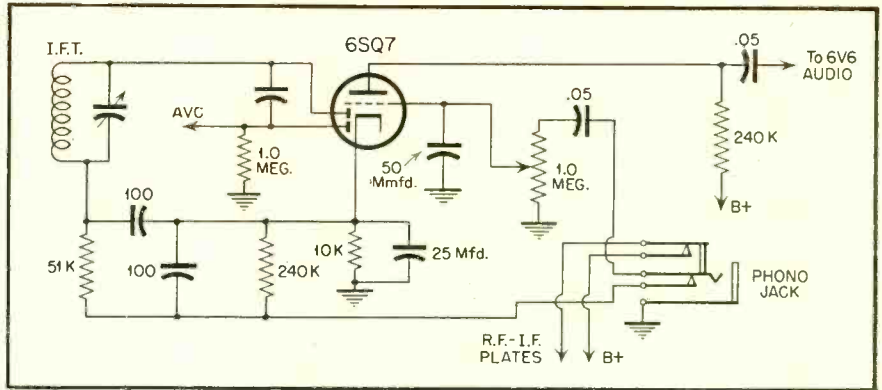


Figure 4

A reference to the partial schematic, Figure 4, will reveal that insertion of the plug will raise the tip-contact

spring and open the circuit from the diode return to the audio grid. At the same time the output of the pick-up will be connected to the grid.

Another pair of contacts, normally closed, as shown, and insulated from the audio contacts, opens when the plug is inserted and disconnects the B supply source from the RF₁ converter and IF tubes.

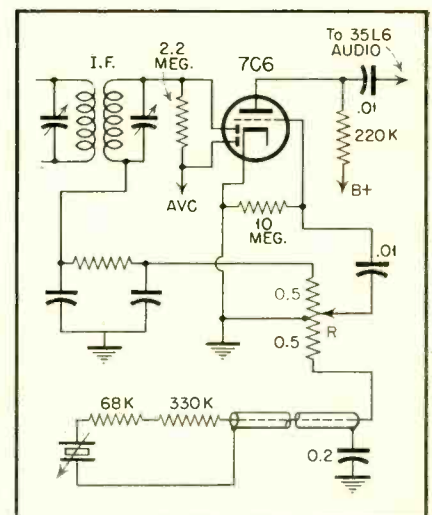
PHILCO Model 46-1201

Among the most simple and effective, radio-phono changeover systems yet to be employed is that found in the Philco Model 46-1201.

A portion of the schematic of this five tube AC operated instrument is shown as Figure 5. The functions of second detector, AVC and first audio are performed by a 7C6 tube. The grid of the triode section derives its signal from a double, 1 meg. volume control. A tap near mid-point is at ground potential, while the radio output connects to one end and phono pick-up to the other.

This system of audio selection eliminates switching in the signal circuits. A switch serves to make the radio operative at the appropriate time and closes the motor power circuit when needed.

Figure 5



NEW! MASCO BUILT

MODERN DESIGN 1947 STYLING

GREAT POWER WITHOUT DISTORTION

LIGHT WEIGHT EFFICIENT

QUALITY COMPONENT PARTS

FRONT

BACK

5 STAR VALUE

MODEL MAP-105 PORTABLE MUSICAL AMPLIFIER ... 5-WATTS

This compact system with its 5 watts of power is MASCO's answer to the needs of the musical student. Its two mike inputs for voice or instrument make it adaptable to P.A. work such as Chamber of Commerce and American Legion functions, auction rooms, small night spots, etc. Self-contained in a two-tone carrying case with top mounted panel control for convenient operation. Safety fused circuit, on-off switch, pilot light, heavy duty 8" Alnico V P.M. speaker.

List price less tubes	\$44.65
Kit of Matched Tubes, list	\$5.30

Add 5% West of Rockies

Contact your local Masco distributor for immediate delivery. For descriptive literature or other information write direct to factory. Write Dept. E

MASCO

MARK SIMPSON MANUFACTURING CO., Inc.
32-28 49th Street, Long Island City 3, N.Y.

SOUND SYSTEMS and Accessories

RAvenswood 8-5810-1-2-3-4

Illuminated NEWS-AD DISPLAY

makes crowds stop at your doors!



*Shoppers read
the
Human-Interest
Newspictures
... see
your AD
your NAME
your WINDOWS
your STORE*

Eye-catching Newspictures Grip Everyone—young and old—unfold the story of our times . . . daily as it occurs . . . give quick graphic news from *all over the world!*

Modern Fluorescent Light . . . standard equipment on each display . . . gives you a silent salesman that works *24 hours every day!*

Big assortment of Plastic Letters Furnished—including figures and symbols . . . extra big letters for headings or name. Letters easily inserted in accurately spaced grooves—text can be changed in a few minutes, *by anyone!*

Newspictures Changed in an Instant—simply by *dropping them in from the top* . . . no opening up screws or removing back!

Fine, Sturdy Construction—frames made of selected hardwood by expert craftsmen. Strong back with glass firmly and permanently fixed in frame. Fitted for hanging, if desired. *Lasts many years!*

Attractive Appearance—frames beautifully finished in Hand-rubbed Walnut, Mahogany, Natural Blonde,

Timely Events, Inc.

Publishers of Newspictures

236 N. Clark St., Chicago 1, Ill. Ran. 1644-5

Rich Bronze, French Silver and Burnished Gold! Message panel covered with durable, jet-black all-wool felt! *Brightens, enhances windows!*

Economical Advertising—successfully used by many firms of all types!

BUILDS BUSINESS — AT LOW COST!

ALL THIS! { 1. Handsome 22" x 40" Display
2. Daily Newspictures
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Everything complete
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PER WEEK

SEND NO MONEY!

ATTRACT MORE CUSTOMERS! MAIL ORDER NOW!

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Forward display and mail Timely Events Newspictures postage prepaid daily for 24 months. Display remains subscriber's property.
Firm _____
Address _____
City & State _____
Signature & Title _____

PRE-VIEWS

[from page 22]

the portfolios will suggest innumerable time-reducing and cost-cutting methods of streamlining records and procedures.

Your portfolio may be obtained without any obligation by addressing the Systems Department, Uarco Incorporated, 5000 South California Avenue, Chicago 32, Illinois.

Thordarson P. A. Amplifiers

The Thordarson Electric Manufacturing Division of Maguire Industries,

Inc. announces a new line of audio amplifiers for public address systems. Included are 8, 25, 50 watt amplifiers, a pre-amplifier and a booster.

The 8 watt unit amplifier, (10" x 6" x 7 1/2", weight 14 3/4 pounds), provides two input circuits: One a high impedance microphone channel giving 115 db gain and the other a high impedance phono-channel with 72 db gain (both values based on 100,000 ohm input impedance). The tone control, of the high frequency attenuator type, will satisfactorily eliminate needle scratch or objectional highs—at maximum position it will give 22 db atten-

uation on 10,000 cycles. Whereas on normal operation the frequency response within 1 db from 50 to 10,000 cycles.

The 25 watt amplifier provides three input circuits, all of which may be electronically mixed to feed the output circuit. Individual treble and bass tone controls make possible the elimination of unwanted highs in recordings or lows which would tend to interfere with crisp speech output. With tone controls in the normal positions characteristic "Tru-Fidelity" output, with frequency response flat within 1 db from 30 to 15,000 cycles is obtainable.

FOR FM AND AM SERVICING



**TYPE
YGS-3**

SIGNAL GENERATOR

SERVICE men, research technicians and design engineers find this new General Electric Signal Generator an extremely valuable aid in their work.

Four basic units have been combined to form one compact, labor-saving, portable equipment which is simple in construction and easy to operate.

The General Electric Signal Generator, Type YGS-3, con-

sists of an RF oscillator (fundamental frequency range 10 kc to 150 mc); an FM oscillator (center frequencies of 1, 20 and 50 mc and frequency deviations of ± 20 , ± 300 and ± 750 kc); a 1 mc crystal calibrator and a variable frequency audio oscillator. This combination of units enclosed in a single case will help to simplify and speed up FM and AM receiver analysis.

NOTE FOLLOWING DISTINCTIVE FEATURES:

- Economical and convenient to use.
- Constant output impedance attenuator.
- Extremely wide sweep deviation.
- Wide Frequency range.
- Reference level indicator for output.
- Lines up any FM or AM receiver, stage by stage by visual alignment methods.

New free booklet on FM servicing available.

Write: General Electric Company, Electronics Department, Syracuse 1, New York.

GENERAL  ELECTRIC



The hum level is 65 db below rated output. An all-steel streamlined cabinet provides fully enclosed construction with the three input circuit controls as well as the base and treble tone control knobs protected by a recessed, sloping front panel.

The 50 watt model is designed for large stadia and roller skating rinks. This rating is extremely conservative since the unit is capable of 65 watt peak output. The five input channels (three microphone and two phono) are equipped with individual controls. The Thordarson Dual Tone Controls permit nine extreme individual response curves.

New N. U. Set

Commuter Model G-613 3-way portable, now being released under National Union's radio merchandising



plan for service engineers. 6 tubes: NU-1A7GT converter; 2NU-1N5GT

[see page 32]

The most
complete
line of
Loud Speakers
and Reproducers
is illustrated
and described
in the new
Jensen
catalog



JENSEN MANUFACTURING CO.
6619 SOUTH LARAMIE
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Please send me a copy of the 1947 Jensen catalog as
soon as it comes from the press.

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★ for replacement of worn pre-war changers
 ★ for constructing your own radio-phono combination
 it's
WEBSTER
 best known name in
RECORD CHANGERS

When you replace your old, worn changer, or construct your own radio-phono combination — do as so many others have wisely done — choose Webster. Known for their high fidelity of reproduction, precision-made parts, and smooth, dependable performance, Webster Changers are truly "The Choice of Music Lovers."



Model 56

Shuts itself Off after the last record has played! Plays "inside-out" or home recordings when in manual play position. Cushioned spindle protects records, Webster 4-pole, shaded pole motor, improved rim drive, feather-touch pickup, and simplified changer mechanism for long dependable service. All parts heavy gauge, copper or plated steel. Plays ten 12-inch or twelve 10-inch records. Dimensions: 14" x 14" x 9" overall (6½" above main plate, 2½" below.)



Model 50

Compact, Efficient, Model 50 is designed for use in smaller units where space is limited. It has the Webster two-tier bonded construction of changer mechanism, cushioned spindle, manual play position, improved rim drive, and feather-touch pickup. All parts are heavy gauge, copper-plated steel, and built for long dependable service. Plays ten 12-inch or twelve 10-inch records. Dimensions: 12" x 12⅞" x 9" overall (6½" above main plate, 2½" below.)



The choice of music lovers

WEBSTER CHICAGO
 5610 BLOOMINGDALE AVE.
 CHICAGO 39, ILLINOIS

PRE-VIEWS

[from page 30]

I. F.; NU-1H5GT detector; NU-3Q5GT power amplifier; 117Z6 rectifier. Batteries: 2NU-A835, 4½ v. "A"; 2NU-B862 45 v. "B"—or equivalents: Eveready 746,482; Burgess M30, G3; Ray-O-Vac P-7830, P-83A. Superhet circuit; 2-gang condenser tuned; built-in high gain plug in loop antenna; automatic volume control; 5-inch plug-in PM speaker; case in simulated leather; recessed controls; weight with batteries, approx. 15 lbs.

Crosley Tele-Sets

A new television receiver, incorporating five exclusive features, is the first model to be presented by the Crosley Division of the Aviation Corporation, Chicago, Ill. Outstanding among features is a swivel tube mounting, absolutely new in the television industry, which pivots over a 60 degree angle and thus permits viewing from either right or left as well as straight on. When not in use, the tube swivels into the cabinet so that no controls or tubes are visible.

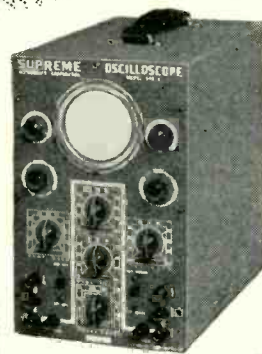
Flexible antenna arrangements allow for combinations of separate antennas to be automatically obtained



without auxiliary or external switching. To avoid future obsolescence of the set, the channel selector units incorporate complete R. F. and oscillator circuits and provide means to change the tuning range of the receiver to higher frequencies, if necessary.

The radio set operates on the standard AM band (540—1600 k.c.); band spread shortwave band (9450 to 11,950 k.c.); FM band 88-108 m.c.; and any eight of the 13 television channels from 44 to 216 m.c. The set contains 23 to 27 television tubes depending on number of channel selector units) including the 10-inch cathode ray picture tube, plus three

WHAT IS THE
Second Necessity
 FOR PROFITABLE
 RADIO SERVICE?



Of course, the first requirement for profitable radio service is a good service man. The second necessity is good equipment. A good service man with poor equipment is a losing combination. Supreme test equipment has been proved accurate, dependable—"Supreme by Comparison" for nearly 20 years.

SUPREME MODEL 546-A OSCILLOSCOPE, above, is one of the more popular instruments in the complete new Supreme line. Ask your nearest Supreme jobber to show you and demonstrate this finer radio test equipment.

SUPREME



WRITE FOR
 NEW
 CATALOG

SUPREME INSTRUMENTS CORP., Greenwood, Miss., U.S.A.

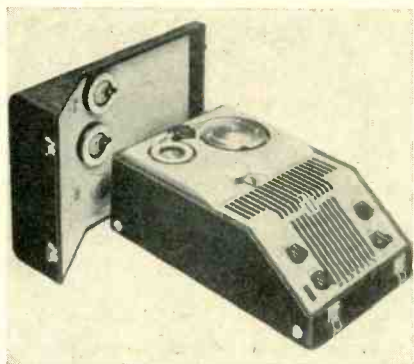
Export Department: THE AMERICAN STEEL EXPORT CO., Inc.,
 1347 Madison Ave., New York 17, N. Y., U.S.A.

rectifiers; and nine radio tubes plus one rectifier. The automatic record changer will hold twelve 10-inch records, or ten 12-inch records, and has two four and a quarter inch storage bins. The cabinet stands 44 $\frac{1}{4}$ inches high, 37 $\frac{1}{2}$ inches wide and is only 18 inches deep.

New Wire Recorder

Employees of Webster-Chicago Corporation, 5610 Bloomingdale Avenue, were given a sneak preview recently of its new wire recorder.

Demonstrations were made in every division of the plant and the employees took turns talking and singing before the microphone of the recorder. The workers were given an additional thrill when they heard their voices as an almost immediate playback was made. The preview was made in conjunction with a plant-wide contest to select a name for the recorder. Six cash prizes are being offered.



The new recorder will record 50 minutes of music and speech continuously. Company officials say it will be in the low cost class and will be self contained, portable, and particularly designed for home use. Another feature is that a new record may be made over an old one. The new one 'wipes out' or erases the old as it is recorded. In this manner, the same wire may be used over and over again, or the old recording may be retained for years for playing back any number of times.

\$4,325 Rider Manual Contest

To find out which of the many features contained in Rider Manuals are proving of greatest value to radio servicemen, John F. Rider, Publisher, Inc., is opening on June first a \$4,325 contest.

Mr. Rider believes that servicemen who have been profitably using his Manuals as part of their day-in-day-out operation—some for as long as 17 years—have ideas worth hearing. Prizes will be awarded for the best letters of one hundred words or less on why "Rider Manuals Mean Successful Servicing". There will be two

hundred and twenty-four (224) cash and servicing equipment prizes, the first of which will be five hundred dollars (\$500) in cash. Jobbers designated by the first ten prize-winning servicemen will also receive cash awards. Nothing need be bought to enter the contest which closes September 15, 1947.

The contest rules have been kept easy. Entries, however, must be submitted on the sheets provided for that purpose, which are part of the official entry blanks available from radio parts jobbers (or from John F. Rider, Publisher, Inc., 404 Fourth Avenue, New York 16, N. Y.). These official contest forms also contain complete details about the prizes.

This is one contest where spelling,

grammar and writing style will not be factors in judging the awards. The prize-winners will be selected on the basis of completeness, compactness and originality of expression demonstrating the value of Rider Manuals to the radio servicing industry.

New Clock

A new deluxe General Electric alarm clock finished in butler silver has been announced by R. O. Fickes, manager of the Company's clock division, Bridgeport, Conn. Called the "Morning Glory," the clock has a melodious bell alarm. Its satin-silver finish is accented by gold-colored fluted feet, numerals and hands. It will retail at \$17.95 plus federal excise tax.



THE NAME OF GROWING IMPORTANCE IN SOUND EQUIPMENT

THE MASCO line has earned a unique position in the sound field.

Standard component parts of nationally advertised manufacturers are used in the manufacture of Masco equipment . . . the same parts that you regularly merchandise . . . none but the finest!

Superior engineering and precision manufacture are the key to Masco performance. High factory morale, extensive inspections and executive know-how play their role in maintaining Masco quality.

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Compare Masco values with those of ANY other line.

MASCO

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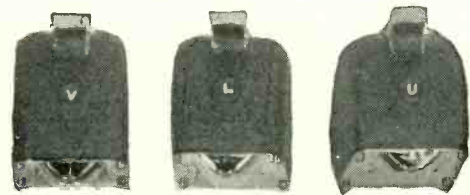
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The PARA-FLUX REPRODUCER, completely assembled and ready for use, with either Universal, Lateral, or Vertical reproducer head, embodies advanced design and features. Plug-in-head, either Universal, Lateral, or Vertical, uses same Arm and Equalizer. All three types are interchangeable with the Model A-16 Arm and Model EL-1 Equalizer illustrated opposite.



Vertical Only Reproducer Lateral Only Reproducer Universal Reproducer

Here's the perfect Reproducer that meets the demand of your customers with custom-built radios. It can be readily installed into big assemblies to suit individual requirements. It's the tops for sound installation—high class, high fidelity set-ups.

Available through Authorized Jobbers

Descriptive, illustrated Bulletin PR 11, upon request

AVAILABLE IMMEDIATELY

RADIO-MUSIC CORPORATION
East Port Chester, Connecticut

**ION-TRAP IN
C-R TUBES**

[from page 15]

tubes the trouble is considerably less since ions are more widely dispersed.

In order to eliminate burning of screens, an ion-trap gun has been developed and is employed in certain Du Mont tubes such as Type 10BP4. The ion trap functions by separating the ions from the electrons by means of combined electric and magnetic fields. Then, by means of an additional magnetic field, the electron beam is coaxially aligned in the gun so as to be centered in the focusing and deflecting systems as well as up on the screen.

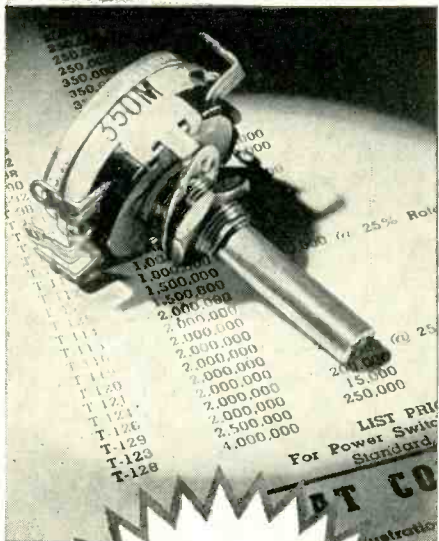
The magnetic fields used in this application are furnished by a small coil and lamination assembly that is placed over the neck of the tube behind the focus coil. Current for the ion-trap coil is furnished by the low-voltage supply of the television receiver.

In the case of the larger tubes — 15-inch diameter and over — it has not been necessary to incorporate this ion trap since the dispersion of the ions is such that no ion disintegration of the screen is in evidence at the comparatively high (10-15KV) accelerating voltage normally used throughout the life of such tubes.

**OSCILLATOR AND
POWER SUPPLY
TROUBLES**

[from page 14]

ing the switch contacts with carbon-tetra-chloride or Xylene. If the trouble is due to a high-resistance soldered connection, the trouble can most quickly and easily be eliminated by resoldering all the soldered joints in the oscillator circuit. When the trouble is due to high-resistance mechanical connections, the trouble is most generally found in one of two places; either in the tuning condenser or in the plate feed-back condenser. The tuning condenser should first be eliminated as the cause of the trouble by making the following checks and observations. If the oscillator is dead over a portion of any band, particularly the low frequency ends of the tuning ranges, check for a resistance between the tuning condenser shaft and ground. This may be accomplished simply by using a screwdriver and shorting between the shaft and the chassis. If the receiver starts to operate, the trouble has been identified. To clear the trouble, clean the end bearings and ground wiper contacts of the rotor shaft with Xy-



GEARED
to Service Needs

★ Composition or wire-wound . . . tapped or tapered . . . with or without switch . . . right shaft — that's what we mean when we say that Clarostat replacement controls are geared to your service needs. Best of all, you can install Clarostat controls and forget them. They won't let you down.



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Use this Clarostat Replacement Control Selector. Tells at a glance the Clarostat replacement for the type being replaced. Ask our jobber for your Selector and latest Clarostat catalog. Or write us . . .



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check should next be made for the lene or carbon-tetra-chloride. A presence of resistance between the wiring solder lug to the tuning condenser stator plates and the stator plates themselves. Generally, this solder lug is fastened to the stator plates by either screws or rivets. All that is necessary to correct the trouble is to tighten the screws or rivets as the case may be. In the case of the push-button oscillator assembly the tuning condenser is a fixed condenser. The same effects will be produced as in the case of the variable tuning condenser when resistance is present. Loose rivets and the impregnation of the condenser often combine to cause resistance between the solder lug and the actual plates of the condenser. This will cause inoperation on the push-buttons controlling the lower frequency coils and, in some cases, all the push-buttons. In addition the above mentioned fault may produce "drifting" which necessitates constant resetting of the push-buttons. The comparable condition existing in the variable tuning condenser will also cause "drifting". The remedy is, of course, to replace the condenser (In the case of the variable tuning condenser tightening, and resoldering all connections to the tuning con-

denser, trimmers, etc. will remedy the condition.) See Figure 4. "Drifting" and also operation over a portion of the tuning range can be caused by resistance due to the mechanical connection between the high-frequency padder plates and the tuning condenser stators in some assembly types. As a general rule, tightening the rivets or screws of all components of the oscillator section of the tuning condenser will eliminate extraneous resistance in the tuning condenser as a possible cause of the oscillator failure. A resistance caused by faulty mechanical connections inside the plate feed-back condenser can produce the effect of partial band operation. Usually this defect will not show up by any test and the component must be checked by temporary substitution.

Due to the limited number of components involved in the oscillator circuits of a receiver, the serviceman should not have too much trouble finding the cause of any oscillator failure. A comprehensive study of the foregoing analysis and the application of the preceding procedures will, however, save a great deal of time. As in all radio problems, the possibility of a trouble not covered by the foregoing discussion must also be considered.

new

CONCORD Radio Catalog



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HAM GEAR • AMPLIFIERS • TESTERS**

It's here—the new 1947 Concord Catalog—a vast, complete selection of everything in Radio and Electronics. See these value-packed pages showing thousands of items available for IMMEDIATE SHIPMENT—hundreds of them now available for the first time—featuring new, latest 1947 prices. See new LOWER prices on finest-quality RADIO SETS, PHONO-RADIOS, RECORD CHANGERS, RECORD PLAYERS, PORTABLES, AMPLIFIERS, COMPLETE SOUND SYSTEMS, TESTERS. See latest listings of well-known, standard, dependable lines of radio parts and equipment—tubes, condensers, transformers, relays—available for IMMEDIATE SHIPMENT from huge stocks in CHICAGO and ATLANTA. Mail coupon NOW!

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Your customers will be delighted with the high-quality home recordings they can make on this GI Dual-Speed Home Recording and Phonograph Assembly. Equipped with ample *Smooth Power* for recording or reproducing, it's simple as ABC to operate. It's sturdily built to stand up under hard use . . . and it's remarkably low-priced for volume sales.

Send for details on this fine unit, and for complete information on the complete *Smooth Power* line of Phonomotors, Recorders and Combination Record-Changer Recorders.

 **THE GENERAL INDUSTRIES co.**
DEPT. MS • ELYRIA, OHIO

NEWS FLASHES

[from page 21]

Sylvania Electric has entered into a participation agreement with *Howard W. Sams & Co.* in connection with servicing information contained in *Sams Photofact Folders*. Test equipment supplied by *Sylvania* will also be used in clinical service work conducted by the *Howard Sams Radio Servicing Institute*. It is announced by *Bendix Radio* that current prices of the radio line will be held until the end of this year at least. *Motorola* sectional meetings are now being held around the country. Developments in car heater and car radios are also being covered. Canadian and U. S. members of the *RMA* held meetings April 24-25 to discuss mutual problems. *RCA* has demonstrated a new console television set showing a picture 15 by 20 inches, said to be two and a half times brighter and clearer than previous big screen pictures. This makes it ideal for bars, schools and auditoriums. *Miriam Simpson*, sales manager of *Mark Simpson Mfg. Co.*, sound equipment makers, reports finding unusual uses of P.A. and sound equipment in a recent trip through the West. In Texas ranch crews repairing fences talked to one another over long distances by having amplifiers mounted on jeeps. In California planes flying over fair grounds soundcasted announcement of events while *Good Humor* wagons used catchy records to draw attention instead of the old bell-jingling system.

PA SYSTEM DESIGN

[from page 19]

For the speakers in a small auditorium such as this example, it should be sufficient to use two efficient, high-quality units, and to place them in suitable enclosures directly above the proscenium arch, tilted down sufficiently to cover the entire seating section. If the speakers are sufficiently high above the footlight trough (where microphones are often located for stage performances) and if the speaker enclosures have some directional properties, there should be little trouble from feedback, but after the equipment is installed, that problem may have to be solved.

Having outlined the requirements of the 40-watt system, we will leave you to think about the methods of fulfilling them. In the next issue, we will proceed with the discussion of these methods, with a complete description of the general layout and design.

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Specially designed Television Antenna
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Pre-tuned R-F unit
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Operates on 110V.; 50-60 cycles A.C. Price: complete with ALL tubes, \$159.50 (fair traded)

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We believe that the comparative quality of this set is superior to other available sets. It has been acclaimed by major television schools.



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DEALERS! Cash in on this Kit! Ideal for making your own Custom-Built Television Receiver.

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385 North Ave.—New Rochelle, N. Y.

TRADE NOTES

[from page 4]

president and general manager, to release further details. The company's primary interest in the device, Mr. McCanne stressed, is to extend the usefulness of Stromberg-Carlson pre-war FM receivers. A secondary purpose is to provide an audience quickly for the new high band FM transmitters.

Before the recent announcement was made, company engineers had tested the Driscoll FM adapter in a number of localities served by FM stations. The results were universally good on all Stromberg-Carlson pre-war FM sets, McCanne revealed, but until the results of further field tests now being conducted by company distributors are evaluated, the firm is reluctant to make claims it is not certain it can back up.

"Our engineers have developed the Driscoll FM adapter from the standpoint of mathematical dimensions for what we believe will prove to be optimum results over the full range claimed for it, 88 to 104.1 megacycles," Mr. McCanne, himself a radio engineer, explained.

"Already we have had reports that engineers and service men testing this device for particular FM broadcasting stations have altered the construction in such a way as to favor reception of their own station at the expense of others. Therefore, we're not anxious to release circuit details which would encourage further experimentation with uncertain results until we're assured that the adapter, as we furnish it, gives good results on all Stromberg-Carlson pre-war FM receivers when installed according to directions," he said.

The company has filed patent claims and after distributor field tests are completed, Stromberg-Carlson expects to invite other manufacturers to test the adapter and help develop installation instructions for their own models. "In general, it appears," McCanne said, "that the device should work well on any receiver having a 4.3 megacycle IF. One or two reports have indicated that, while the adapter works on pre-war FM receivers employing different IF, the tuning range is narrower. The range to be claimed under these circumstances has not yet been determined."

New Service Manual

General Transformer Corp., 1262 W. Van Buren St., Chicago, Ill., has prepared the first complete service manual and parts list covering every

[see next page]

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**ALLIED'S
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in Radio for the
Serviceman . . .

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This perfect pair for personal portables, the new No. 2R "A", (left) made expressly for personal portables and No. XX45, 67½ volt "B" battery, give more listening pleasure and mean more sales and profits for you. Order your stock today.



Bright New Package

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NEW! The Vacation Kit!

Sell a whole vacation's listening pleasure—6 No. 2R "A" batteries and 1 No. XX45, 67½ volt "B"—in an attractive kit which packs easily into the vacation suitcase. A big seller to thousands of vacationists, as well as "stay-at-homes", teenagers and traveling men. Ask your distributor for this new profit-package.

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Clark Is Rep

Roger Clark, formerly manufacturers field sales for Shure Bros., is now associated with Oren H. Smith, manufacturers' rep, 225 West Huron St., Chicago, Ill.

Controls and Resistors

Just issued Clarostat Catalog No. 46 lists various resistors, controls and resistance devices. There are wire-wound power resistors and glass-insulated flexible resistors; composition-element and wire-wound rheostats and potentiometers; tapped and tapered controls and switches; constant impedance input and output controls and attenuators; tube-type wire-wound resistors, automatic line voltage regulators and replacement line ballasts; power rheostats; and the unique power resistor decade box. A copy of this catalog may be had from any Clarostat jobber, or by writing direct to Clarostat Mfg. Co., Inc., 285-7 N. 6th St., Brooklyn, N. Y.



Burton Browne, president of Aero Needle Co. helping Miss Pat Harmony prepare for her role as Aeropoint's "Miss Red Devil." The occasion, the recent Coin Machine Show, at Chicago's Hotel Sherman.

Air King Ups Lucas

Eugene B. Lucas has been appointed sales manager of Air King radios, announces David H. Cogan, president of Air King Products Company, Inc., Division of Hytron Radio & Electronics Corporation, manufacturers of radios, radio-phonograph combinations and magnetic wire recorders. Mr. Lucas will head radio sales through the company's nation-wide distributor setup. Prior to his advancement Mr.

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RENUALL Iron cement. Guar. 1 year. Package of 6	\$3.12
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Hot plate bricks 5/8" diameter. 6 for	1.62
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Ribbon element heating wire. Std. size. 100 ft.	.75
Percolator elements. Universal. Flat type. 1 Year guar. 2 for	1.20
Element cement. Withstand 3000° F. 1 lb. package	1.00
Lead wire. Asbestos covered heater hook-up wire. 10 ft.	1.00
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E. B. Lucas

Lucas was advertising and sales promotion manager.

In making his announcement, Mr. Cogan stated that Mr. Lucas will formulate the company's plans to meet the coming buyers market. Before joining the company in April, 1946, Mr. Lucas was sales manager of the Cabinet Division of the Plymold Corporation of Lawrence, Massachusetts. He is well known in the radio industry, having served with such radio manufacturers as General Electric, Colonial and Bendix. A native New Yorker, Mr. Lucas attended Columbia University.

Show Newcomb Audio Products

At Los Angeles' annual West Coast Electronic Manufacturers Association show, Newcomb Audio Products Company displayed a complete line of amplifiers and accessories. (See illustration).



The five standard model (H-Series) amplifiers are at the left and the four deluxe (K-Series) models are on the right. Assembly in the center with phonograph turntable is a typical racked arrangement for industrial and large commercial installations. Portable cases house varying-power complete sound systems. Charts above the amplifiers indicate performance possibilities.

Robert Newcomb, president of the company, displayed and demonstrated the complete line, with several new additions, at the Radio Parts and Electronic Equipment Show in Chicago, May 12 to 17.

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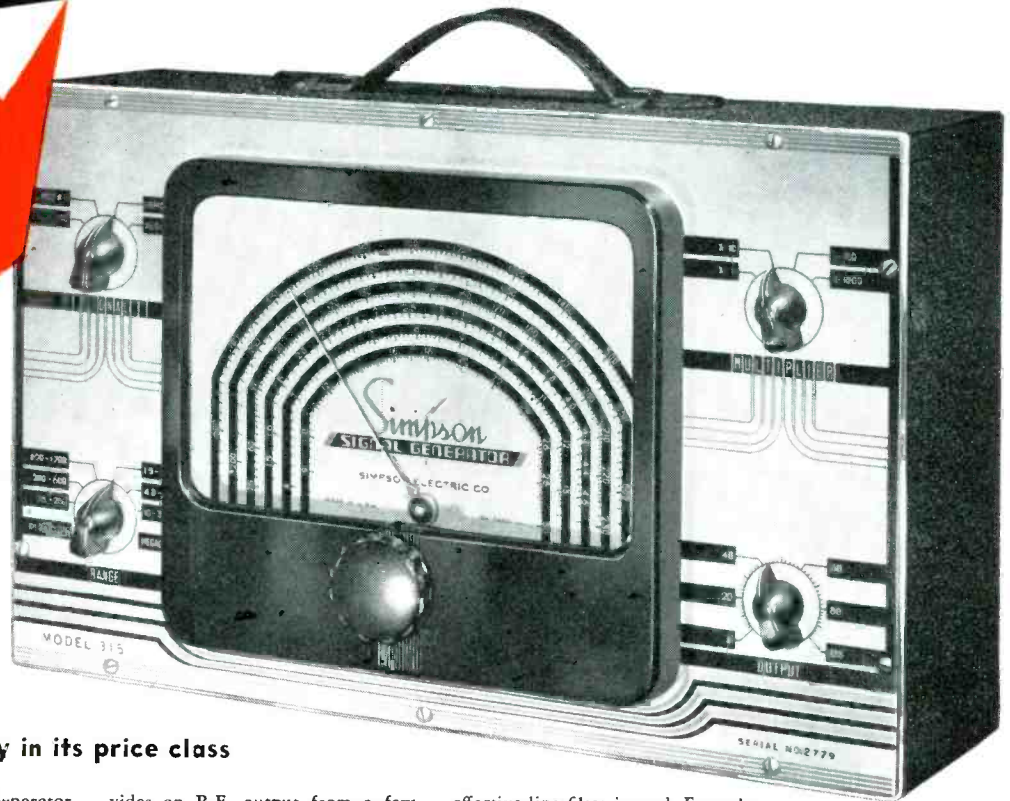
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