# SERVICE

—

## A MONTHLY DIGEST OF RADIO AND ALLIED MAINTENANCE

He likes Physics . . .
(See page 50)

PER COPY
15 CENTS

FEBRUARY
1933

# SERVICE BOOKS

## By JOHN F. RIDER

### RADIO SERVICE QUESTIONS AND ANSWERS

***(2 Volumes)***


HERE are two volumes which strike right to the bottom of your servicing operations! . . RADIO SERVICE QUESTIONS AND ANSWERS (2 Volumes) is a compilation of radio service questions and answers as compiled over a period of years by Rider. Your problems and the solutions and the problems and solutions submitted to thousands of other Service Men are placed at your disposal.

RADIO SERVICE QUESTIONS AND ANSWERS (2 Volumes) covers all types of radio receivers, speakers, tubes, amplifiers, power packs, public address systems—everything with which you as a Service Man may come in contact.

These two volumes contain no theory. . . . Everything is narrowed down to practical information—right to the point—and clearly explained. . . . No wasted words.

Here are two books which you can place into use the day they reach your hands. At no time do they become obsolete. Year after year you will be able to find data of value—of immediate financial return—information which will save your time—your effort. One answer in this series may bring you enough of a return to repay the total cost of both volumes.

The value of these two volumes is found in the fact that they cover old and new systems alike. Questions about old type tubes and the latest pentodes are included—the old receivers as well as the new receivers—the old eliminators as well as the new power packs—the old speakers as well as the permanent magnet type dynamics.

*Type set; well illustrated; cloth bound. Sold with a Money-Back Guarantee.*

PRICE VOLUME NO. 1, $1.00 POSTPAID. PRICE VOLUME NO. 2, $1.00 POSTPAID.

### SERVICING RECEIVERS by means of RESISTANCE MEASUREMENT


RESISTANCE measurement as the basis for service operations offers many advantages. It removes the various disadvantages which are associated with voltmeter and current meter methods of analyzing troubles. The reason for this statement is that, the ultimate test in every radio receiver is resistance measurement. Accordingly it is most logical to start right in with such measurement and save a great deal of time and guesswork.

Of course the voltmeter will still have its uses in connection with servicing—but resistance measurement is gradually becoming the basis for radio service operations.

SERVICING RECEIVERS BY MEANS OF RESISTANCE MEASUREMENT has been written to explain just how this method is applied. The contents of this book is of extreme value because it explains the usual resistance networks in receivers and thus prepares you for service operating methods which recognize no limitations. When you check a receiver by measuring the resistance between any two points you can immediately locate the unit at fault—and thus eliminate all waste of time—all but one tolerance, namely that of the resistances. When you understand how this method can be applied—it is possible to locate the trouble in a radio receiver without removing the chassis from the cabinet.

*203 pages; type set; cloth bound; well illustrated. Sold with a Money-Back Guarantee.* PRICE $1.00 POSTPAID.

### SERVICING SUPERHETERODYNES


THE superhet receiver differs in many respects from the conventional tuned radio frequency type of receiving system. If you take service work seriously—it is absolutely essential that you be familiar with each and every type of superheterodyne—with each and every difference between this receiver and the t-r-f receiver. You actually owe this type of information to yourself—because you are earning your own livelihood at your own expense.

SERVICING SUPERHETERODYNES tells you just what you should know about this type of receiver and more so. It gives you all valuable information in a language which you can understand. There is nothing left to guesswork. As a matter of fact, it takes into consideration special circuits employed by the different receiver manufacturers.

Each type of receiver receives special discussion and description. Then the difference between the superhet and the t-r-f receiver is considered. This is followed by a complete breakdown of the receiver so that you learn to understand the workings of the different tubes and sections of the finished receiver. With this information in your possession, the exact type of superheterodyne receiver which you must service does not present any problem—simply because you know the function of the different parts and you can easily understand the different combinations.

*Type set; bound in cloth cover; 163 pages; profusely illustrated. Sold with a Money-Back Guarantee.*

PRICE $1.00 POSTPAID

*Buy from Your Local Dealer or Use This Coupon.*

---

RADIO TREATISE CO., INC., 1440 BROADWAY, NEW YORK, N. Y.

Enclosed find $..... Please rush, postpaid, the following books:

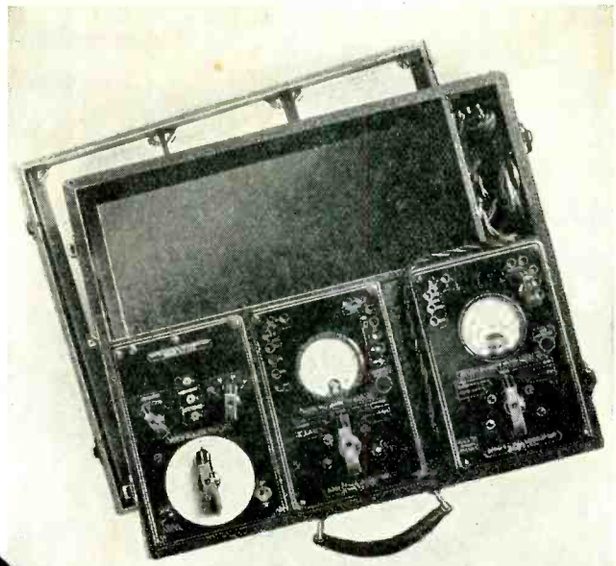
.....Radio Service Questions and Answers, Volume 1. ($1).
.....Radio Service Questions and Answers, Volume 2. ($1).
.....Servicing Receivers by Means of Resistance Measurement. ($1).
.....Servicing Superheterodynes. ($1).

*NAME* .....

*ADDRESS* .....

*CITY*..... *STATE*.....

Oscillator, Tubechecker, Analyzer. For Analyzer method.



Oscillator, Volt - Ohmmeter, Capacity Meter. For Point-to-Point method.

# 2 Profit Producing Service Kits

## *See Them at Your Jobbers*

CONVENIENCE and accuracy have been combined in these two modern combinations of Weston Standardized Service Units. They are business builders. Either combination quickly and surely gets at the root of the trouble.

For the ANALYZER-TUBECHECKER method Weston offers the combination of Model 660 Analyzer, Model 661 Tubechecker and Model 662 Oscillator. For those preferring the POINT-TO-POINT method, Model 663 Volt-Ohmmeter, Model 664 Capacity Meter and Model 662 Oscillator provide the ideal combination.

Every service man should get all the facts about these two combinations of Standardized Service Units. Mail the coupon for complete information.

Weston Electrical Instrument Corporation, 604 Frelinghuysen Avenue, Newark, New Jersey.

# WESTON·JEWELL *Radio Instruments*

Model 677 Weston Tube Seller.

Pattern 444 Set Analyzer.

Pattern 540 Portable Tube Seller.

WESTON ELECTRICAL INSTRUMENT CORPORATION
604 Frelinghuysen Ave., Newark, N. J.

Please send me further information on Weston-Jewell Service Equipment.

*Name* .....

*Address* .....

.....

# SERVICE

A Monthly Digest of Radio and Allied Maintenance

FEBRUARY, 1933
Vol. 2, No. 2

EDITOR
John F. Rider

MANAGING EDITOR
M. L. Muhleman


# Editorial Contents




***Advertising Director***

ROBERT N. MANN
1440 Broadway, N. Y. City
Telephone: CHickering 4-4542

*Published monthly by*

John F. Rider Publications, Inc.
1440 BROADWAY
NEW YORK, N. Y.

***Officers***

JOHN F. RIDER, President and Treasurer
M. L. MUHLEMAN, Vice-President
J. SCHNEIDER, Secretary

# In All the World—No Unit Like This

*Laboratory Accuracy*

HICKOK

Low-Priced
Volt-Ohm-Meter
Model 4855 A.O.

NEW—ALL NEW!

•

**READABLE**

One Ohm to a Million
and Up to Ten Million
One Volt to
Six Hundred (D. C.)
with
Special Leads to Insert
into Tube Sockets

•

**RUGGED**

For Lasting Service

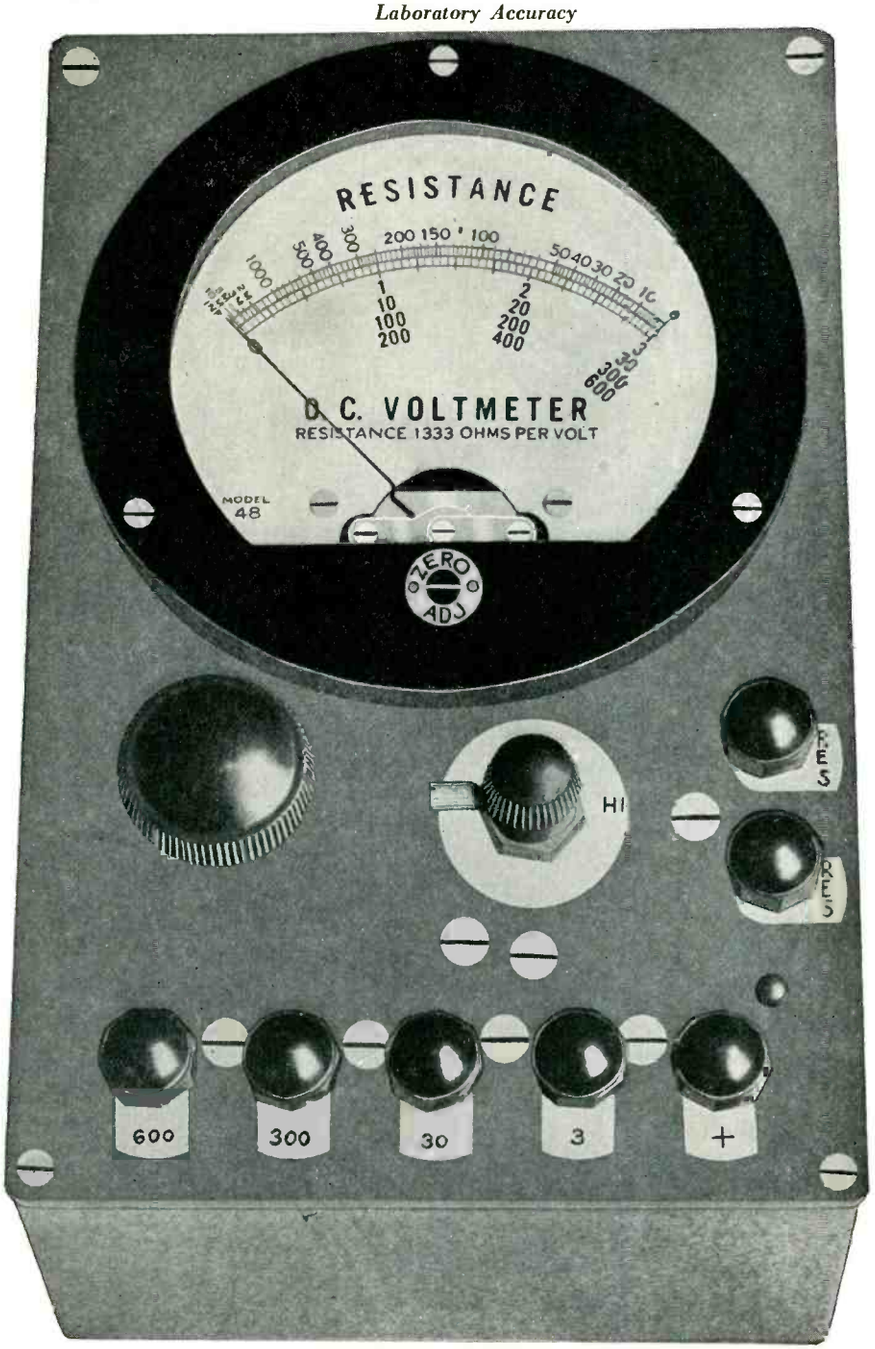
•

**KNIFE-EDGE POINTER**

For Easy and Accurate Reading

•

**APPROVED GUARANTEED**




Size 4½" x 7" x 3¼" high

Large size meter, accurately calibrated, 3½" body diameter, 4¼" flange, bakelite case, finished in two-tone walnut. Resistance, 1,333 ohms per volt.

Accuracy 1%—All parts of the highest type possible to build. Scale ranges are: Volts: 0-3, 0-30, 0-300, 0-600 D.C. Ohms: 0-10,000, 0-1,000,000. *Readable from one ohm to one million and up to ten million.*

Mounted in metal case, black velvet finish, with bakelite panel and meter flange finished in two-tone walnut, with binding posts, knobs, etc., to match. Handsomely trimmed in chrome and provided with voltage adjuster to calibrate meter to batteries.

Model 4855 A.O., as shown: List price $39.00. Net to Dealers and Service Men $23.40.
Also furnished in Kit of all parts with full instructions, less case, binding posts and leads as Model 4844 A.O. Knock-Down Kit (not shown). List price $30.00. Net to Dealers and Service Men $18.00. Order special resistor to read 10 megs. Dealers' net price $1.50 extra. *Prices west of Denver slightly higher.*

THE HICKOK ELECTRICAL INSTRUMENT CO.

10514 DUPONT AVENUE CLEVELAND, OHIO

# THE ANTENNA...

## EDUCATION

LET'S talk about service instruments. The first thing we are going to do, is to push the use of oscillators. There are altogether too many Service Men and organizations functioning in the service field without adequate test oscillator apparatus. Whether you build or buy—the fact remains that you need such equipment and you're going to need it more and more each day. The days of "hit and miss" methods of servicing are gone. Yes, you still come in contact with some of the old and simple receivers but the public is asking for better work—faster operation. To accomplish these two ends, without any reference to the problems of the more recent receivers, you must have the proper test equipment. Analyzers, diagnometers, set testers, ohmmeters, tube checkers, etc., are selling aplenty, but the use of oscillators has not reached its proper proportions. Once again, whether you buy or build, bear in mind that you need an oscillator.

• • •

NOW for a few words about technical knowledge. Beyond all doubt, the service field can use more advanced radio information. By this we do not mean an engineering education. Far from it. There is a wide gulf between a thorough grounding in the art of radio as applied to radio receivers and related service work and design engineering knowledge. What we class as a thorough grounding is a good knowledge of the fundamentals sufficiently well absorbed so that it can be interpreted into the reasons for the use of apparatus in the manner they are commonly employed, and sufficiently well absorbed so that the power of analysis as related to radio receiver problems in general is developed to its proper extent. By power of analysis we are not referring to service analysis only. We are vitally concerned with the ability to view a problem from various angles—with the ability to correlate all associated considerations; with the ability to recognize cause and effect and to apply this knowledge to the servicing of a radio receiver or associated apparatus.

With this in mind, it is the intention of the editors of SERVICE to present radio information in a manner which will be of definite value to each and every man who is interested in augmenting his scope of radio knowledge. No, it shall not be in the form of a course.

• • •

TALKING about schools, we cannot help but reiterate a statement made by the writer during the recent I.R.S.M. Convention in Chicago. The time has arrived when the educational forces functioning in the radio industry must consider the present members of the radio service group and cease enticing new men from other non-competitive fields by presenting a glamorous picture of the possibilities to be found in the radio service field. Money can be made in the service field—perhaps not so much today, but it will be there in the future. However, that money should go to the men now in the field—to the individuals who have been plugging and fighting for their existence during these troublesome days.

The service field is overcrowded. There is no more room for new men. There is plenty of room for educational activities by the radio schools now in existence, but these activities should be devoted to the improvement of the men now actively engaged in service work. In plain words, there is plenty of room for reasonably advanced courses offered to the experienced Service Man. Some schools are making such offers and the rest should fall in line.

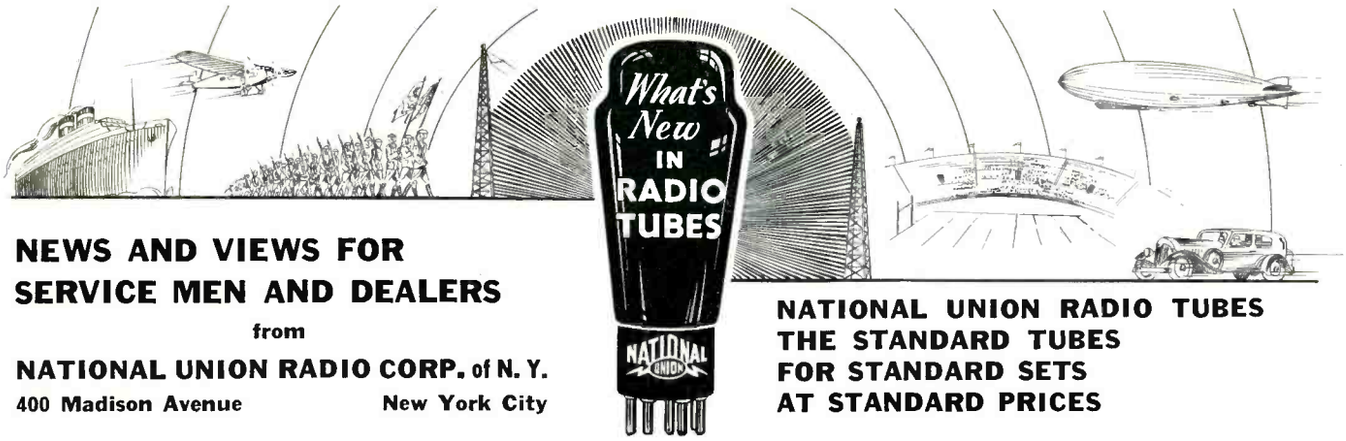
The extent of the sales of radio receivers during the past decade is not great enough to absorb all of the men now associated with the service field. More new men will harm rather than benefit those in the field—those just entering and the industry itself. As a matter of fact the schools themselves will suffer because the graduates will be unable to secure employment. We recognize that the schools have financial investments which they wish to keep intact. However, there is every danger of sinking rather than saving the ship by augmenting an already overcrowded field. It is our opinion that the service industry as a body will support advanced courses and those schools offering advanced courses, rather than those which offer both.

• • •

CHECK this issue closely. We are proud of the fact that we can give so much information relative to point-to-point resistance measurement. This method of service analysis is growing by leaps and bounds. Each day we hear of another receiver manufacturer embarking upon the production of service data along resistance measurement lines. RCA in their 60 Series manuals and the makers of Majestic receivers pioneered in such manuals, although it is true that RCA changed the structure of their manuals by omitting continuity test data, (which is the way they showed point-to-point data) and now show the d-c. resistance of every inductor and resistance. Majestic is continuing, as a matter of fact going a step further. Recent service data received by this magazine shows the entire Majestic manual predicated upon resistance analysis. U. S. Radio and Television are also going in for such work. The Clarion manuals, published by the Transformer Corporation of America, likewise give point-to-point data. Philco, Fada, Howard and many other receiver manufacturers are swinging into line.

One pertinent item has been brought to our attention. This is the necessity for the statement that tolerance values must be recognized when applying the point-to-point resistance measurement method of analysis. We take this opportunity of mentioning this fact in this editorial because it is the opening gun in the campaign and because it will be spoken of consistently.

*John F. Rider.*




**NEWS AND VIEWS FOR SERVICE MEN AND DEALERS**

**from**

**NATIONAL UNION RADIO CORP. of N. Y.**

**400 Madison Avenue** **New York City**

**NATIONAL UNION RADIO TUBES**
**THE STANDARD TUBES**
**FOR STANDARD SETS**
**AT STANDARD PRICES**

# VOLTAGE DOUBLED BY TYPE 25Z5 RECTIFIER

## NATIONAL UNION LABORATORIES DESCRIBE TUBE—NEW CODING

Among the many tubes developed in the National Union Laboratories during the past few months, the 25Z5 is of particular interest because of its unusual adaptability and applications. Type 25Z5 was brought from the laboratory stage and put into regular production in National Union factories late in January. The recent trend toward transformerless radio receivers of either the universal or A.C. operated type occasioned the development of the tube. It is a full wave, high vacuum rectifier of the heater cathode type for use in circuits especially designed to supply D.C. power from an A.C. power line.

In universal type receivers, the 25Z5 may be used as a half wave rectifier, while in the A. C. operated type it may be used as a voltage doubler. In the latter application it provides about twice the D. C. output voltage obtainable from the half wave arrangement.

The ready adaptability of the 25Z5 to two-fold application is made possible by the means of a separate base pin for each cathode. To facilitate its economical operation in series with the heaters of other tubes in the radio set, the heater of the 25Z5 has been specially designed. The construction of a receiver having reduced heat dissipation in the fixed series resistor has been made possible by the employment of a 25-volt heater. Further, close electrode spacing and high rectifying efficiency are provided in the heater cathode design.

The minimum of space for installation is required as the 25Z5 is constructed compactly in a small, dome-top bulb.

### TENTATIVE RATING AND CHARACTERISTICS

| | |
|---|---|
| Heater Voltage | 25 Volts |
| Heater Current | 0.3 Ampere |
| AC Plate Voltage per Plate (RMS) | 125 max. Volts |
| DC Load Current | 100 max. Milliamperes |
| Maximum Overall Length | 4¼" |
| Maximum Diameter | 1 9/16" |
| Bulb | ST-12 |
| Base | Small 6-Pin |

### NEW TYPE NUMBER SYSTEM

It is interesting to note that the 25Z5 has been assigned this type number under the new officially recognized system of numbering tubes. Briefly, this system will operate as follows:

In the new type designation there will be a numeral or numerals followed by a letter of the alphabet and then followed by another numeral.

The numeral before the letter gives us a clue to the filament voltage of the tube, 25 for instance, indicating that the 25Z5 is a 25-volt tube. The letter "Z" indicates that the tube is a rectifier as rectifier types will be lettered from the end of the alphabet and detectors and amplifiers lettered from the beginning of the alphabet. The number after the letter indicates the number of usable elements in the tube, 5 in the case of the 25Z5 in spite of the fact that there are 6-pin connections on this particular tube. (The filament of the tube as one of the usable elements is necessarily brought out in 2-pin connections.)

This system will not affect tube types already numbered but will apply to new types developed.

If this brief description is not clear National Union will gladly supply further information upon request.

### SEATTLE SERVICE MANAGER LAUDS NATIONAL UNION

Alert to the savings made possible through National Union's Free Equipment offers, Fred P. Price Radio Service of Seattle, Washington, has seized the opportunity to take advantage of a number of deals.

In a recent letter, Mr. E. R. Rice, Service Manager of this progressive organization, states: "As your records will show, we have Service Manuals Vol. 1 and Vol. 11, National Union Oscillator, 1,000 Tester and Unameter. We find them all valuable in our service work. We would like to express our appreciation of National Union's attitude in helping the service man with these service aids. As a whole, we find the quality of National Union tubes unsurpassed."

This is an example of the way thousands of live wire service men throughout the country are tying up with National Union for profit. Service men who would be leaders in their community in intelligent service work must be well equipped. National Union makes necessary equipment available at no cost.

### BENCH KIT FREE!

No need to play hide and seek with nuts, bolts, screws, resistors and other small radio parts when you own this handsome, sturdy, metal parts box.

This box was manufactured specially for National Union by one of the country's leading steel companies. It is beautifully finished in green and golden yellow and contains 31 compartments scientifically arranged.

Don't let elusive parts waste your time and hold you up on jobs.

National Union gives you this metal parts container, Free, no deposit, with a small purchase of National Union tubes.

Write for complete details at once.

**Ask Your Jobber's Salesman**

# SAVE MONEY—GET FREE EQUIPMENT

Of course you need modern equipment to carry on an intelligent profitable service business. Conserve your cash. Don't invest money in expensive equipment when you can own it without cost—the easy National Union way. Which of the items listed below do you need? They are Free—Get details. Send coupon.

• • •

**TWO SERVICE MANUALS** by John F. Rider: Volume I—more than 2000 diagrams—1000 pages. Includes chassis wiring diagrams, voltage data, electrical values, color coding, socket layouts, peculiarities of radio receivers, etc. Volume II—absolutely non-duplicating. Over 700 pages covering new sets up to 1932 Radio Show. Point to Point resistance data. Each in handsome green imitation leather, gold stamped binder. Free with small tube purchase.

• • •

**READRITE TUBE TESTER:** For home or store tube testing. Efficient. Neat. Compact. Fabricoid covered case. Pilot light illuminates dial. Free with small tube purchase. Small deposit.

• • •

**OSCILLATOR AND OUTPUT METER:** Full broadcast range plus intermediate frequency range covered by leading types of superhets. Rugged construction. Sturdy fabricoid covered carrying case. Free with small tube purchase and small deposit.

• • •

**THE UNAMETER:** Most modern tube tester. Tests over 50 types. No adapters. Dials scaled in color. Easy reading. Fool-proof meter protection. Finished in gold and colors. Efficient convincing tests. Portable or Counter models. Free with small tube purchase and deposit.

• • •

**THE READRITE 1000 TESTER:** Precision instrument designed for newest method of testing continuity, capacity and voltages without pulling chassis. Tests through set sockets the resistance of voltage dividers, series resistors, transformer primaries—secondaries, filter chokes, speaker fields, capacities paper-mica type condensers, voltage of tube circuits. Valuable asset for profitable service work. Free with tube purchase and deposit.

• • •

**HICKOK OHM CAPACITY-VOLTMETER:** Accurate thorough tests of component parts of a radio set old, new or future models. Tests continuity of circuits. Resistance up to 30 megohms. D. C. Voltages up to 600 volts. Capacity of electrolytic and paper condensers up to 15 Mfd. Leakage or dielectric strength of paper condensers and insulation. FREE with tube purchase and deposit.

NATIONAL UNION RADIO CORP. OF N.Y.
400 Madison Avenue, New York City

Sirs: I am interested in following equipment: Readrite Tube Tester ☐ Oscillator & Output Meter ☐ Readrite Resistance Tester ☐ Volume I ☐ Volume II ☐ Unameter ☐ Ohm Capacity ☐ Bench Kit ☐

S2

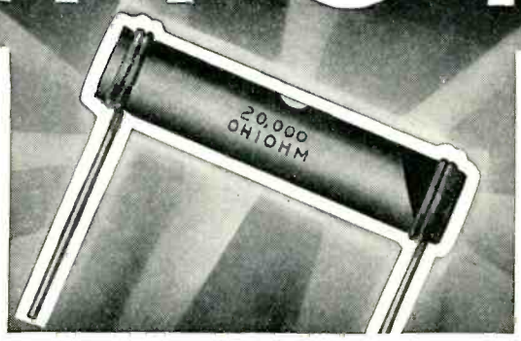
NAME .....

ADDRESS .....

CITY .....STATE.....

# OHIOHM

PROTECT-O-PACKED




RESISTORS

# 10 GOOD REASONS WHY YOU SHOULD "SERVICE" WITH OHIOHMS

- Accuracy—resistance value within 10% tolerance.
- Permanency—value unchanged by age.
- Absence of noise.
- Low Heat Coefficient.
- Freedom from Capacity Effect.
- Unaffected by Humidity.
- Low Voltage Coefficient.
- Mechanical Strength—ability to withstand rough handling.
- Appearance—straight wire leads, good paint finish, etc.
- Color Coded, Printed Values, Trade-Marked.

## SPARK SUPPRESSOR SETS

**For eliminating ignition interference on radios installed in Automobiles.**

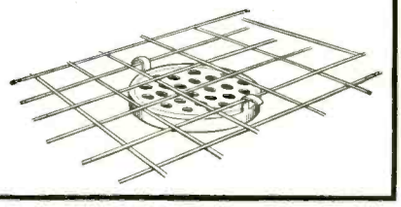
Sets are furnished for 4, 6 and 8 cylinder cars. Furnished complete with Condenser designed to withstand unusual conditions of temperature and vibration . . . also, necessary spark suppressors enclosed within glazed porcelain tube eliminating accumulation of dirt. Made of special non-moisture absorbing material to prevent shorting. • The life of an Ohiohm Suppressor is the life of the car.


**Every Radio Customer a Prospect for CLEANAIRE Refrigerator Deodorizer**

- Absorbs and destroys food odors.
- Prevents blending of flavors and tainted foods.

Add this to your line . . . exceptional profit . . .

WRITE FOR FACTS



**THE OHIO CARBON COMPANY**

**12502 BEREA ROAD • • • CLEVELAND, OHIO**

• Ohiohms are made in Canada by C. C. Meredith, Ltd., 639 Bay St., Toronto •

# An Oscillator for Service Work

AN oscillator to be used for service work must meet a number of special requirements. Of these requirements, portability, convenience and stability are probably the major points. Of secondary importance, but still quite necessary, are wide frequency coverage, satisfactory modulation, proper attenuation, and the elimination of interference with the test signal generated by the oscillator.

In designing the oscillator to be described, the above points were taken into consideration and were met as follows:

Portability was gained by the use of a type 30 tube which requires little in the way of "A" current and will oscillate satisfactorily with but 22½ volts on the plate. This permits including both the "A" and "B" batteries within the case without sacrificing compactness. At the same time, the point of possible interference is eliminated, as the oscillator is in no way coupled to the a.c- line supplying the radio receiver under test and consequently there can be no r-f. getting into the receiver through the power line and upsetting the alignment or adjusting procedure.

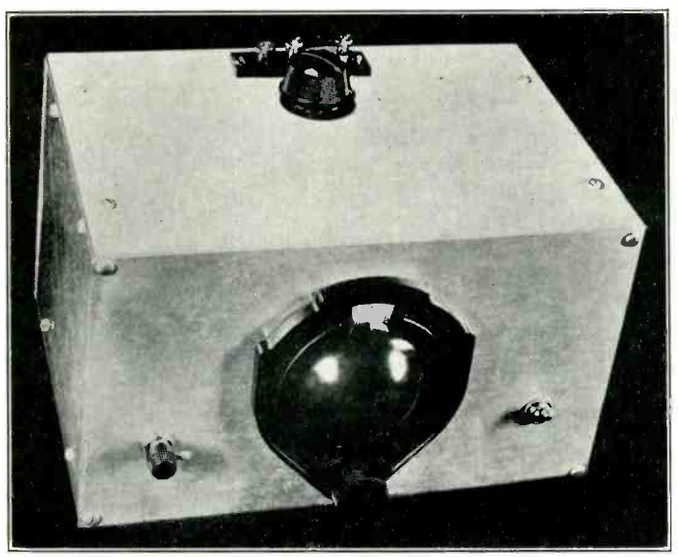


**Fig. 1. A view of the completed plate-tuned oscillator**

The oscillator is made convenient by its small weight and because a change of frequency band is made by merely flipping a single switch mounted on the front panel. Its convenience is further added to by the fact that the oscillator will cover all the most important intermediate frequencies (150 kc. to 300 kc.), the complete broadcast band of 550 kc. to 1500 kc. (actually, about 540 to 1700 kc.) and by the use of harmonics, "short-wave" frequencies as high as 20,000 kc. (15 meters). More of this later.

The matter of stability was not so easily licked. First of all, we tried a resistance-stabilized circuit. This proved fine for any single frequency but was unreliable where a wide sweep of frequencies had to be made. Electron-coupled oscillators were also tried, and these are quite satisfactory when a tube with a cathode is employed, but not so satisfactory with a filament-type tube.

We finally resorted to the good, old plate-tuned oscillator with a low L-C ratio; that is, a high-C circuit, wherein the capacity is large in comparison to the inductance. This proved entirely satisfactory and is used in this oscillator. It provides a better degree of stability than is ordinarily obtained and is therefore of value.

There is nothing new about the self-modulation scheme. The tube is made to block at an audio-frequency rate by the proper selection of capacity and resistance values for the grid condenser and leak, which in this case are connected in the low-potential end of the grid circuit.

One other important thing is the attenuator. This is a 100-ohm variable resistance mounted in a metal case so that no other shielding was necessary. It is self-shielded as it stands. This attenuator provides very good control and does not reduce the gain too rapidly. Yet a very low output can be had, which is necessary for the sake of accuracy in alignment, etc. A strong signal "spreads" too much and is therefore unsatisfactory.

## Constructional Details

A photo of the complete oscillator is shown in Fig. 1. The case is of aluminum and is 10 inches long, 6 inches high and 7⅛ inches deep. These measurements do not have to be followed exactly, but a metal cabinet somewhere near this size should be used.

The frequency selector dial is in the center of the front panel and might well be a vernier dial of the type which has blank white spaces near the bottom or sides so that calibrations can be marked thereon. However, a dial of the type shown is perfectly satisfactory if charts are made up for the frequency bands. It all depends on which you like the best.

The frequency selector switch is on the left side of the front panel and this is marked S1 and S2 in the diagram. When switched to the right, the oscillator covers the broadcast band and the short-wave band by harmonics, and when switched to the left covers the intermediate-frequency band.

The toggle switch to the right of the dial makes and breaks the filament circuit of the type 30 tube.

On the top panel of the case is mounted the attenuator control knob and directly behind this knob the three terminal posts for the oscillator output. The lead used on the "high side" of the output should be shielded. The shielding itself can be used as the grounded lead if desired, in which case only one cable will lead from the oscillator to the receiver.

An inside view of the oscillator is shown in Fig. 2. The two "A" batteries and the "B" battery can be seen at the rear of the case. These should be fastened securely to the wooden baseboard so that at no time will they shift around.

In front of the batteries is the voltage regulator tube, marked R in the diagram. This is used to keep the filament voltage constant and in this manner adds to the stability of the oscillator.

Now note the two inductances. The "broadcast" inductance is by the side of the "B" battery and is at right angles to the i-f. inductance.

Now let's look at the circuit diagram, shown in Fig. 3. The switch S1-S2 is all in one hunk, so to speak, and is really a triple pole, double pole affair. The S1 section permits a change-over from the plate broadcast coil L-1 to the plate i-f. coil L-2, while the S2 section does the same for L-3 and L-4.

CIRCUIT CONSTANTS

| | | | |
|---|---|---|---|
| R-1 (fixed) | 500,000 ohms | C-3 (adjustable) | .00003 mfd. |
| R-2 (fixed) | 1,000 ohms | C-4 (adjustable) | .00003 mfd. |
| R-3 (variable) | 100 ohms | C-5 (paper) | 0.5 mfd. |
| C-1 (variable) | .0005 mfd. | C-6 (paper) | 0.5 mfd. |
| C-2 (mica) | .0001 mfd. | C-7 (mica) | .005 mfd. |

When the switch is thrown, it "throws" the variable condenser C-1 with it, so that in one case C-1 tunes L-1 and in the other case it tunes L-2. But since L-2 has a large value of inductance in comparison to the capacity of C-1, which is .0005 mfd., we no longer have a high-C circuit. Therefore, the condenser C-2 is permanently shunted across L-2 to provide the large capacity we wish. This is a .0001-mfd. moulded bakelite mica condenser. Its value may wander a bit over a period of time but not sufficiently to cause trouble.

The blocking condensers C-5 and C-6 are necessary to keep the plate voltage from getting back to ground. The condensers C-3 and C-4 are also blocking condensers and are used to keep the plate voltage out of the feeder. These are small adjustable trimmer condensers each with a maximum capacity of about .00003 mfd. or so. Turn the screw on C-3 all the way in and the screw on C-4 all the way out. Then, when using the oscillator, strap together terminals 1 and 2 for frequencies less than 500 kc., so that C-3 and C-4 are in parallel, and for frequencies higher than 500 kc., just use posts 2 and 3, the latter being the ground.

Now for the grid leak and condenser: R-1 and C-7 respectively. These units provide the self-modulation feature and it is desirable to have a rather high-pitched note as it has less tendency to spread. However, the note may be most any pitch you wish within reason and you can change it by altering the values of R-1 and C-7. In this oscillator C-7 has a value of .005 mfd. and R-1 a value of approximately 500,000 ohms.

No matter what type of circuit is used, a self-modulated oscillator will change its pitch as the variable condenser is swung through its range. This change in audio pitch makes

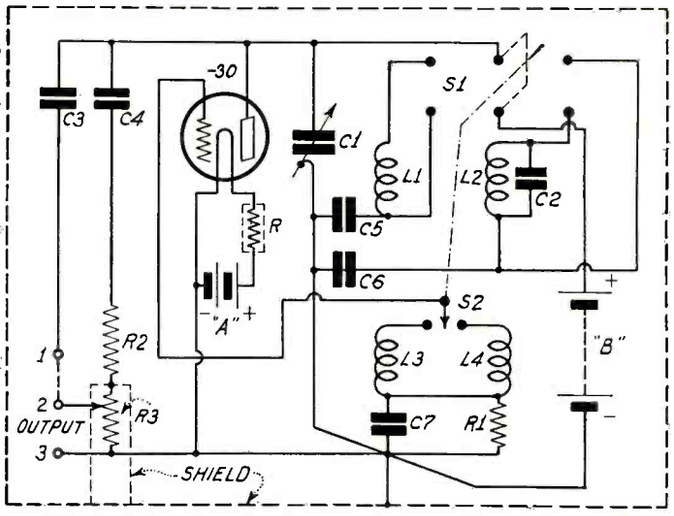
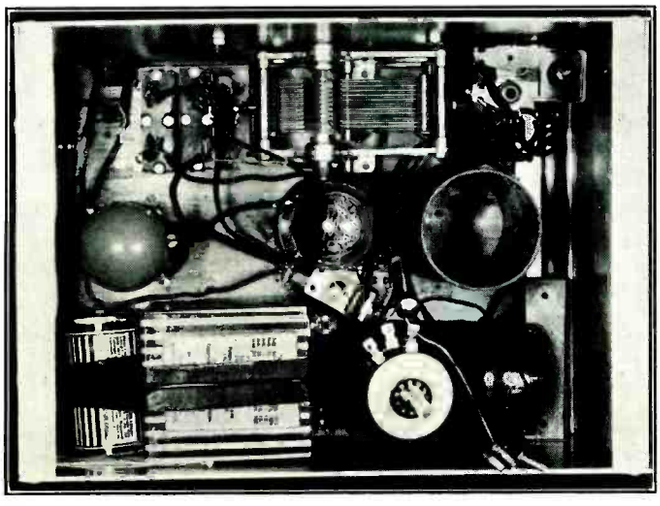



**Fig. 3. The schematic diagram of the oscillator. Parts values are given in the table to the left**

**Fig. 2. Interior view of oscillator, showing location of parts**



no difference in the operation of the oscillator unless the pitch happens to go so low as to "spread." In such an event the resistance value of the grid leak should be decreased and the lower the value of resistance here the less variation there will be in the audio pitch. At the same time the capacity of the grid condenser may be increased to provide the pitch most desired.

### Coil Data

The broadcast coils L-1 and L-3 are both wound on the same form. This form should be 2 inches in diameter and about 2½ inches long. Bakelite tubing will do very nicely. Coil L-1 consists of 55 turns of No. 26 S.S.C. wire close wound and will come close to filling the length of the form. Coil L-3, which is the grid coil, consists of 20 turns of the same size wire either layer wound or scramble wound on a section of celluloid sheet fitting directly over coil L-1 so that

(*Continued on page* 68)

# The Man on the Cover

## M. T. Nordengren

### Service Manager, Grigsby-Grunow

AFTER Mr. Nordengren had completed his high school education, he delved into the problems of Physics and Economics with great interest—but after a tough battle, Physics got the upper hand and led him into an Electrical Engineering University course.

And out of all this grew Mr. Nordengren's interest in radio. Off he went to the Western Electric Company and stayed there for the next four and a half years as Section Head of the Inspection Division on transformers, filters, repeating coils, etc. Then a year on Movietone equipment and sound projection.

With this experience and education behind him, he took a position with the Grigsby-Grunow Company, in 1928. He landed right in the Engineering Division as Product Analysis Engineer in the factory.

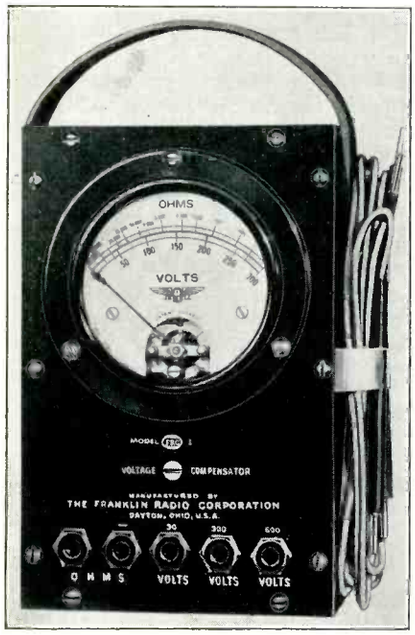
In November, 1931, he took the position of Service Engineer of the Company, and a month later walked into the position of General Service Manager of the Radio Division, where he still reigns.

# General Data . . .

## REVIEW OF OHMMETERS

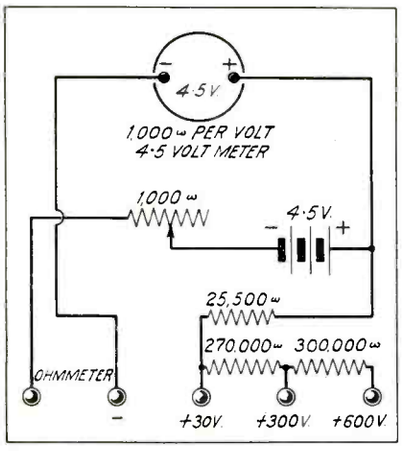
### Franklin Model 1 Volt-Ohmmeter

The Model 1 Voltmeter-Ohmmeter uses a single meter to cover the various voltage and resistance ranges, as shown in the accompanying photo.




**Panel view of the Franklin Model 1 Volt-Ohmmeter**

The meter has a double scale; the upper scale reading 0-100,000 ohms; the lower scale reading 0-300 volts. The resistance can be reduced to one-tenth its value and the voltage range can be reduced to 3 or 30 volts and increased to 600 volts. A high-range and low-range switch is mounted on the bakelite panel.




**Complete schematic diagram of the Franklin Model 1 Volt-Ohmmeter**

When used as a voltmeter, the Model 1 has a resistance of 1,000 ohms per volt in each of its ranges, thereby measuring plate voltage without distortion of reading.

The 4½-volt dry cell to supply the voltage for the ohmmeter action is inclosed in the case. On the panel is a compensator adjustor to provide for zero reading.

The pin jacks for resistance and voltage readings are arranged along the front edge of the panel.

The complete circuit diagram of this instrument is shown herewith.

•

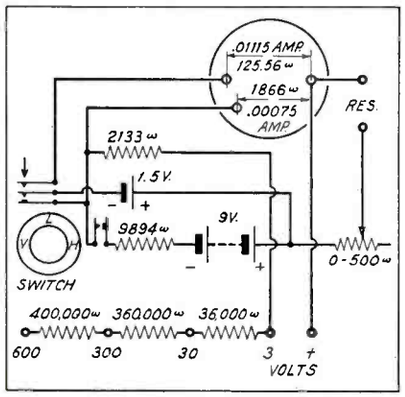
### Hickok Ohm Capacity Voltmeter

For a description and circuit of the Hickok Ohm Capacity Voltmeter, see the article on page 308 in the November issue of SERVICE.

•

### Hickok 4855 AO Volt-Ohmmeter

This unit, illustrated herewith, employs a meter with a sensitivity of 1,333 ohms per volt. There are four voltage ranges of 0-3-30-300 and 600 volts and two resistance ranges of 0-10,000 ohms and 0-1,000,000 ohms, the resistance range being readable from 1 ohm up to 1,000,000 ohms. Provisions are made so that with the addition of another calibrated resistor, the readings can be carried up to 10,000,000 ohms.




**The schematic diagram of the Hickok 4855 AO Volt-Ohmmeter. All values are given**

The values of the resistors, etc., are given in the accompanying circuit diagram of the unit. The switch marked V, L, and H (Volts, Low Resistance Scale, High Resistance Scale) is the switch on the panel just to the left of the "Resistance" binding posts.

The voltage compensator or zero adjustor is mounted to the left of this switch and in the diagram is the 500-ohm variable resistance connected in series with the batteries. The batteries are contained in the case of the instrument.

Along the front edge of the panel are the binding posts for voltage readings. These are marked with their respective values.

The meter used has a 2⅞-inch scale length, the entire meter diameter being 4¼ inches.


**The Hickok 4855 AO Volt-Ohmmeter. The knob at the left is for battery voltage adjustment**

•

### Dayrad Type 870 Test Meter

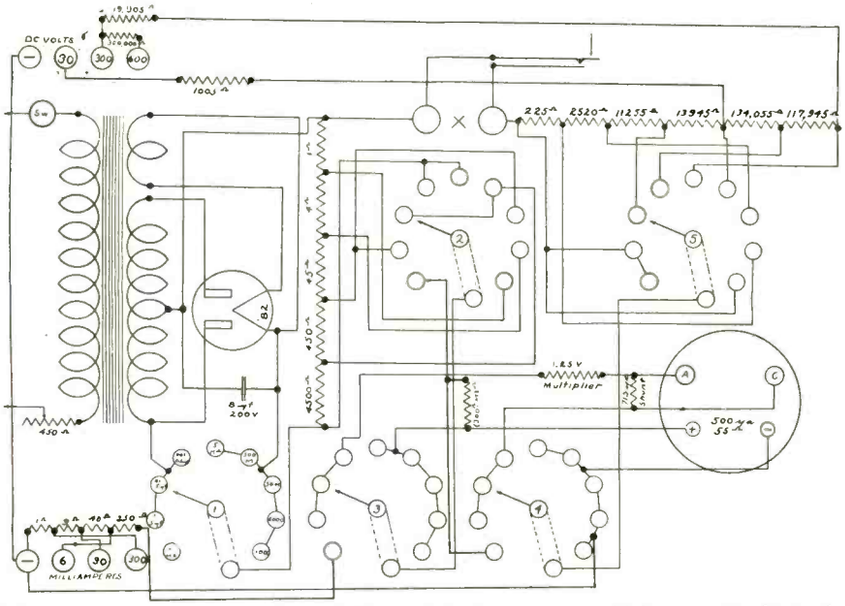
The Dayrad 870, illustrated herewith, is designed to provide a number of tests and operates from any 100-130-volt, 60 cycle line. The instrument uses a type 82 tube as the rectifier, as indicated in the accompanying diagram.

The following measurements and ranges are covered by the instrument:

Ohms; 0-1,000-5,000-50,000-500,000 and 0 to 5 megohms. D-C. Volts; 0-30, 0-300 and 0-600 volts at 1,000 ohms per volt. D-C. Milliamperes; 0-30 and 0-300. Microfarads; .05-.001, 5-.01 and 5.0-0.1 mfd.

Provisions are made so that the unit may also be used as an output meter for aligning receivers, etc.


**Panel view of the Dayrad Type 870 Test Meter. The dome cap at the rear of the panel covers the rectifier tube**




**Schematic diagram of the Dayrad Type 870 Test Meter, which operates from the 110-volt, 60-cycle line. All values are given**

The panel carries a selector switch for the various measuring ranges, a special a-c. line adjustor and a push button to be used when the line voltage is being adjusted to the meter.

The instrument is mounted in a cast aluminum case.

•

## Dayrad Type 875 Test Meter

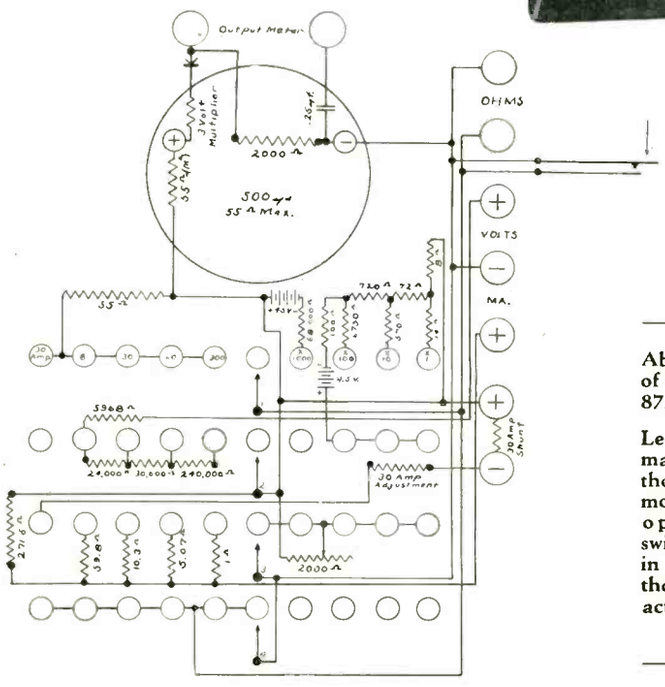
This instrument, illustrated herewith, is somewhat similar to the Type 870 but is battery operated, two standard 22½-volt batteries and one 4½-volt battery being used. Compartment space for these batteries is provided inside the cast aluminum case.

Ranges are selected by means of a rotary switch. The measurements possible, and the ranges, are as follows: Ohms; 0-3,000, 0-30,000, 0-300,000 and 0-3 megohms. D-C. Volts; 0-6, 0-30, 0-60 and 0-300 volts at 1,000 ohms per volt. D-C. Milliamperes; 0-6, 0-30, 0-60 and 0-300. D-C. Amperes; 0-30.

The instrument has a self-contained d-c. blocking condenser so that the unit may be employed as an output meter with adjustable sensitivity. The blocking condenser makes it possible to connect the meter directly to the plate terminal of the output tube in a radio receiver.

The meter has a zero adjustor knob on the panel.

**Above: Panel view of the Dayrad Type 875 Test Meter.**




**Left: The schematic diagram of the same unit. This model is battery operated. The switches are shown in a straight line, though they are actually of the rotary type**

•

## Weston Model 663 Volt-Ohmmeter

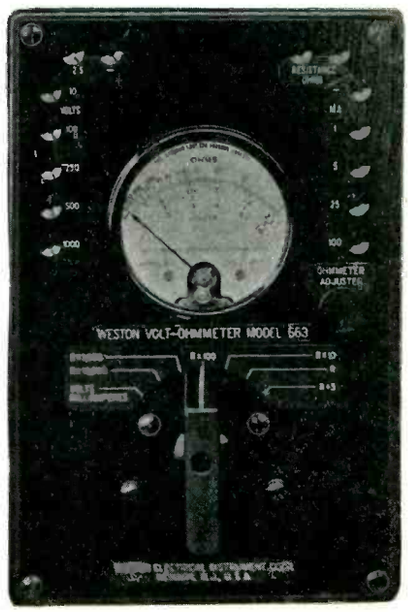
The Weston Model 663 Volt-Ohmmeter shown in the accompanying illustration, uses a single meter with an indicating scale marked 0-1,000-ohms, 0-2.5-5-10 volts and milliamperes. The following ranges are available: 0-5-25-250-2,500-25,000-250,000 ohms center scale; 0-200-1,000-10,000-100,000-1,000,000 and 10,000,000 ohms full scale; 0-2.5-10-100-250-500 and 1,000 volts full scale at 1,000 ohms per volt. Also 0-1-5-25 and 100 milliamperes full scale at 500 millivolts.

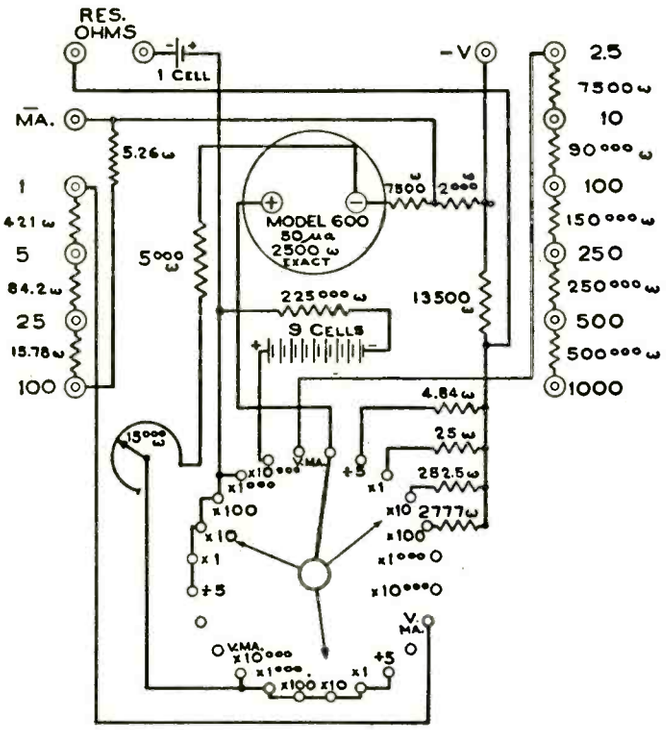
When used as an ohmmeter it will give a reading as low as 0.1 ohm, the first calibrated meter division being 0.2 ohm.

Jacks are provided on the left side of the moulded bakelite panel for voltage readings and on the right side of the panel for resistance readings.

In the center of the panel, below the meter, is the selector switch. When in the first or extreme left position, voltage and current readings can be taken. The remainder of the positions are for selecting the resistance ranges.

**Front panel view of the Weston Model 663 Volt-Ohmmeter. The meter has scales for reading ohms, volts and milliamperes in various ranges**






**The schematic diagram of the Weston Model 663 Volt-Ohmmeter. The value of each resistor is given as well as the various terminal markings which will be found on the panel of the instrument**

Only one resistance range is actually shown on the instrument scale. The other five ranges are obtained by using the factor indicated, i.e., multiplying by 10,000 for the high range in one instance or dividing by 5 for the low range in another instance. These factors are indicated on the scale of the selector switch. These same factors are also included in the accompanying schematic diagram of the instrument, as well as the resistance values at each point. This is a worm's eye view diagram, that is, as it would appear from beneath the panel, the jacks and so on therefore being reversed in their positions.

The panel of the instrument also includes an ohmmeter adjustor so that zero adjustment can be made on the different resistance ranges.

The necessary dry cells for supplying voltage fit into clips mounted on the back of the panel. The current drawn from the batteries and passing through the resistance being measured, is a maximum of 60 microamperes on ranges X x 10,000 and R x 1,000 and 600 microamperes on range R x 100. On range R x 10 the current drain is 6 milliamperes and on the direct range, 60 milliamperes. On the range R ÷ 5 the drain is 300 milliamperes. These maximum values occur at the zero ohms position on each range. The value of current at center scale would be one-half of the maximum value given in each case.

•

## Weston Model 564 Volt-Ohmmeter

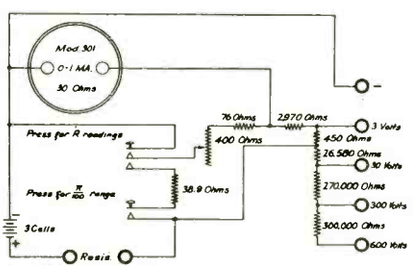
This unit consists of a Model 301 meter with four 1,000 ohms per volt voltage ranges of 0-3-30-300 and 600, two resistance ranges of 0-100,000 and 0-10,000 ohms.

A self-contained 4½-volt "C" battery is provided for potential. The battery adjustor, to provide zero scale adjustment, is directly below the meter on the panel, as shown in the accompanying illustration. Any change in potential of the self-contained battery can be readily compensated for by short-circuiting the pin jacks marked X-X at the bottom of the panel, and then varying the voltage adjustor.

**Panel view of the Weston Model 564 Volt-Ohmmeter. The right hand toggle switch alters the sensitivity of the meter when used as an ohmmeter**

All voltage ranges are brought out to pin jacks at the top of the panel. A toggle switch connects the meter in circuit as a voltmeter or ohmmeter. The instrument sensitivity, when used as an ohmmeter, may be changed by the toggle switch on the right side of the panel from 1 to 10 milliamperes when using the 100,000 or 10,000 ohm scale. This simplifies checking up trouble in high or low resistance circuits.

The values of the various resistors, and so on, are indicated in the circuit diagram reproduced herewith.

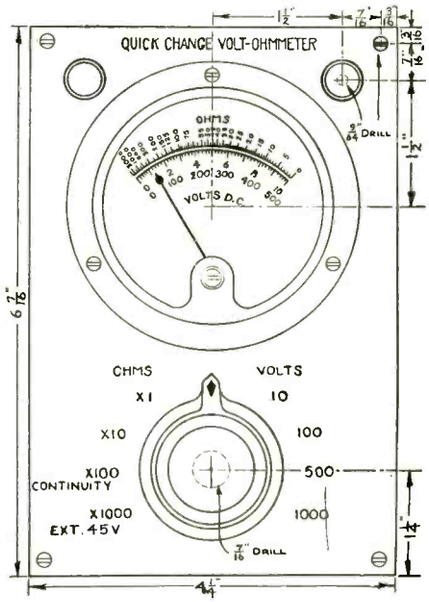



**Schematic diagram of the Weston Model 564 Volt-Ohmmeter. Note the connections of the toggle switches in the center**

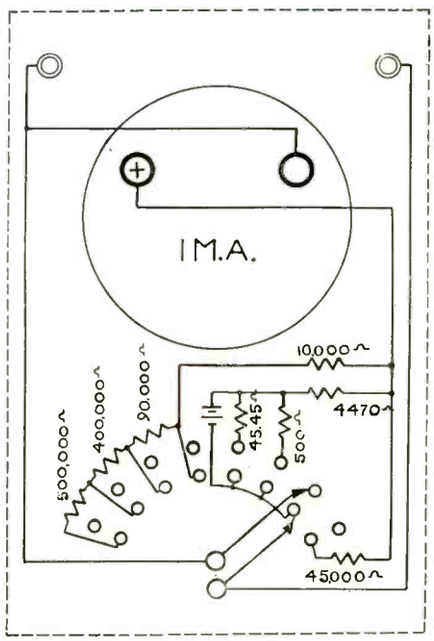
•

## Shallcross Quick-Change Volt-Ohmmeter

This instrument, illustrated herewith, is designed to provide the essential voltage and resistance measurements encountered in servicing work with minimum adjustments. A




**Above: Dimensional drawing of the Shallcross Volt-Ohmmeter panel. Below: Circuit diagram of the Shallcross job, including all resistance values**



single set of binding posts and a "quick-change" tap switch make it possible to select any of the following voltage or resistance ranges without the necessity of changing test leads to different binding posts or pin jacks: Voltage Ranges; 0-10-100-500 and 1,000 volts. Resistance Ranges; 2.5 to 3,000 ohms, 25 to 30,000 ohms, 250 to 300,000 ohms and 2,500 to 3,000,000 ohms. The last named


**Panel view of the Shallcross Quick-Change Volt-Ohmmeter, all functions of which are controlled by a single rotary switch**

range is obtainable by connecting in series with the test leads an extra battery of 45 volts and by setting the selector switch to "X 1,000."

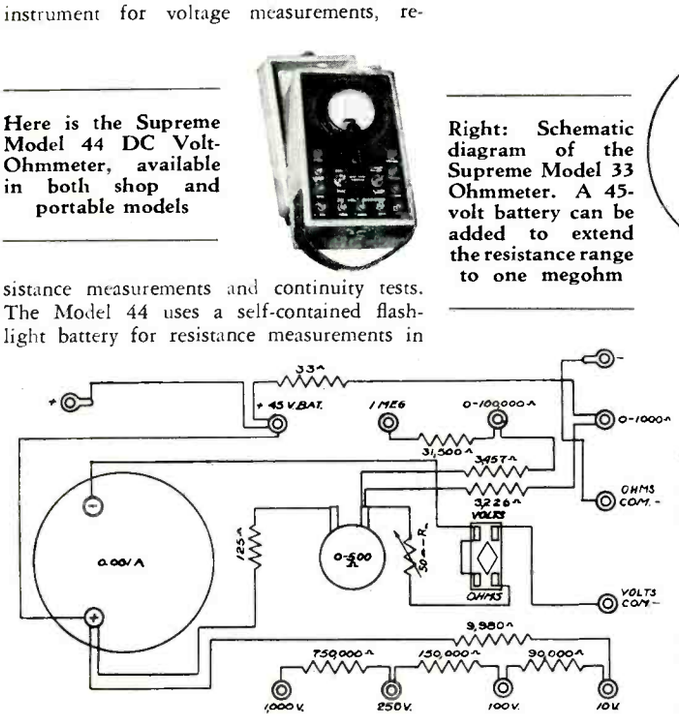
A Weston Model 301, 0-1 d-c. milliammeter is used in this instrument. Its connections and the values of the resistors used are shown in the accompanying schematic diagram.

•

## Supreme Model 44 DC-Volt-Ohmmeter

The new Model 44 D-C. Volt-Ohmmeter, illustrated herewith, is an unusually compact instrument for voltage measurements, resistance measurements and continuity tests. The Model 44 uses a self-contained flashlight battery for resistance measurements in two ranges, 0/1,000 and 0/100,000 ohms, and is provided with external connections, as shown in the diagram, for a 45-volt battery to increase its range to 1,000,000 ohms. Also, four d-c. voltage ranges of 0/10, 0/100, 0/250, 0/1,000 volts are available. The 44 is contained in a hardwood case and is available in shop or portable models.

**Here is the Supreme Model 44 DC Volt-Ohmmeter, available in both shop and portable models**




**Left: Circuit diagram of the Supreme Model 44 DC Volt - Ohmmeter. A double pole, double throw switch changes the readings from volts to ohms, or vice versa**

•

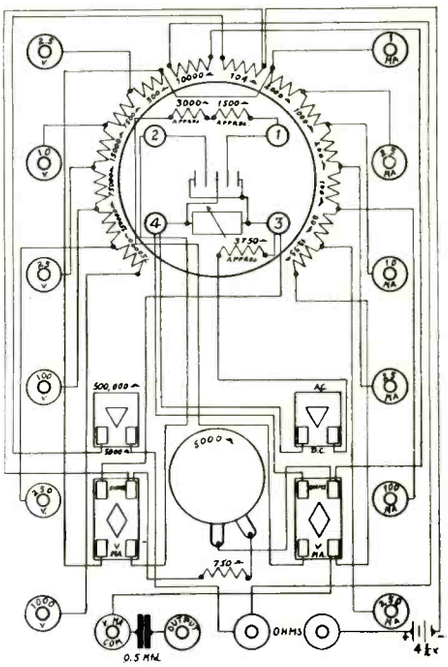
## Supreme Model 75 AC-DC-Volt-Ohm-Milliammeter

The Model 75 provides six output meter ranges, six a-c. voltage ranges, 0/2.5/10/100/250/1,000 volts, six d-c. voltage ranges, 0/1, 0/2.5/10/100/250 volts, six d-c. milliampere ranges 0/1, 0/2.5/10/100/250 ma., two resistance ranges 0/5,000/500,000 ohms.

**Left: The Supreme Model 75 AC - DC Volt - Ohm - Milliammeter, which also may be used for a bridging test for condensers**

All a-c. and d-c. current and voltage ranges are at a senstitivity of 1,000-ohms-per-volt. High sensitivity of a-c. voltage and current ranges, 1,000-ohms-per-volt, facilitates capacity measurements. All a-c. and d-c. voltage and current measurements are at same scale distribution, which simplifies readings.

The a-c. and d-c. milliampere ranges are protected with fuses for added protection in event of inadvertent overload. All measurements are within the standard accuracy tolerances.



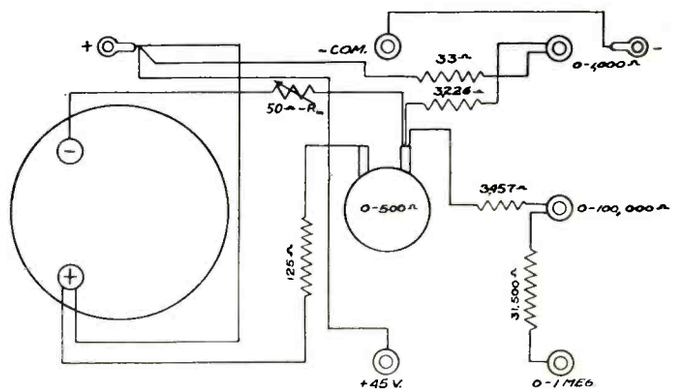

**Circuit diagram of the Supreme Model 75 AC-DC Volt-Ohm-Milliammeter**

Self-contained capacitor is very useful for bridging test of capicitors when suspected of being open circuited or of low capacity; many times found to be the condition of electrolytic capacitors.

•

## Supreme Model 33 Ohmmeter

The Model 33 Ohmmeter is a completely self-contained instrument for resistance measurements and continuity tests. A large 3½" bakelite case meter is employed, accurately calibrated in resistance ranges of 0/1,000 and 0/100,000 ohms, actuated by a self-contained flashlight battery. The Model




**Right: Schematic diagram of the Supreme Model 33 Ohmmeter. A 45-volt battery can be added to extend the resistance range to one megohm**

**Left: A panel view of the Supreme Model 33 Ohmmeter which has two resistance ranges, and by the use of a separate battery will read up to one megohm**

33 is provided with external connections for a 45-volt battery to extend its range to 1,000,000 ohms. A set of Supreme test leads are included in the equipment.

An illustration of the Model 33 Ohmmeter and schematic diagram are shown herewith.

•

## Readrite No. 1,000 Resistance Tester

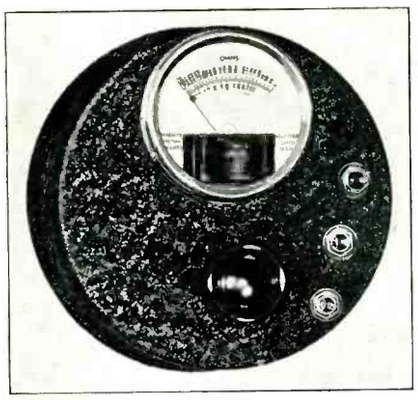
For a description and circuit diagram of the Readrite No. 1,000 Resistance Continuity and Capacity Tester, see the article on page 310 in the November issue of SERVICE.

•

## Readrite No. 502 Ohmmeter

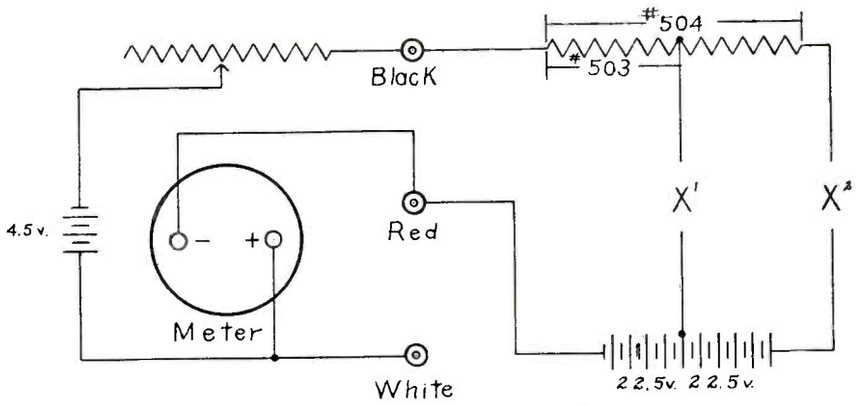
The Readrite No. 502 Ohmmeter, shown in the accompanying illustration, is a two-scale resistance meter. The upper scale range is 0 to 10,000 ohms and the lower scale is 40 to 0 ohms.

Directly below the meter is the knob for zero adjustment. To the right of the knob are the three insulated jacks, one common, for the two ranges on the meter. Special cords



**A view of the compact Readrite No. 502 Ohmmeter which has low-scale and high-scale readings**

are used to patch from one jack to another. The external connections are shown on this page, along with the circuit diagram.




**Circuit diagram of the Readrite No. 502 Ohmmeter. The external connections are also shown**

•

## New Rectifier and Amplifier Tubes

RCA and Cunningham have announced four new tubes which will immediately take their place in the design of new receivers. Two of these tubes are rectifiers and two are amplifiers.

First a word about the type numbers. The new rectifier tubes carry the numbers 25Z5 and 5Z3. These numbers have a particular significance which should not be overlooked, as more than likely this type of coding will be used from now on.

Now, in the case of the type number 25Z5, the letter Z indicates that the tube is a rectifier. The number 25 means that the tube has a 25-volt filament. The 5 following the Z means that the tube has five useful elements, counting the filament as one. Thus, when we come to the type number 5Z3, we know that the tube has a five-volt filament, that it is a rectifier and that there are three useful elements.

The two new amplifier tubes carry the type numbers 2A3 and 2A5. In both these cases 2.5-volt heaters are used, but the 0.5 volt is dropped from the coding in order to avoid confusion. The A brands each tube as an amplifier, and by looking at the numbers we know that one is a triode and the other a pentode, or something very similar.

Now, let's get down to the tubes themselves.

### THE TYPE 5Z3 HEAVY DUTY, FULL-WAVE RECTIFIER

This tube is somewhat similar to the type '80 but will furnish approximately twice the d-c. load current at higher d-c. output voltages

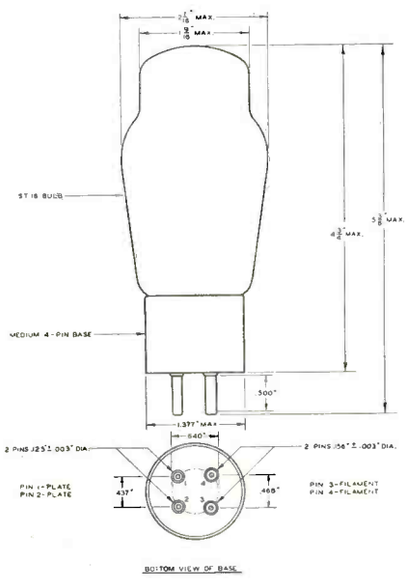



**Fig. 1. Details of the 5Z3 full-wave rectifier**

and is therefore intended for supplying rectified power to radio receivers and amplifiers having very large direct-current requirements.

A sketch of the tube, giving the dimensions and base connections, is shown in Fig. 1. The tube fits the standard four-contact socket, but this does not mean that it should be plugged in in place of an '80. Don't do it.

The tentative rating and characteristics of this new rectifier are as follows:

| | |
|---|---|
| Filament Voltage (A-C) | 5.0 |
| Filament Current | 3.0 Amps. |
| A-C. Voltage per Plate (RMS) | 500 max. |
| D-C. Output Current | 250 max. MA. |

This rectifier can be used with filter circuits of the condenser-input or choke-input type, but the filter circuits must be so designed as to meet the current and voltage demands placed by the tube.

### THE TYPE 25Z5 RECTIFIER-DOUBLER TUBE

This is an interesting tube because it is adaptable to the new crop of "transformerless" receivers of either the "universal" type or the "a-c. operated" type. In "Universal" receivers the 25Z5 may be used as a half-wave rectifier, while in the "a-c. operated" type, it may be used as a voltage doubler to provide about twice the d-c. output voltage obtainable from the half-wave arrangement. Thus, operating directly from a 110-volt a-c. line, with no power transformer, output voltages from about 120 to approximately 260 may be had at the output, depending on the load or current drain of the receiver.

A sketch of this tube, with dimensions and base connections, is shown in Fig. 2. The tube fits the standard six-contact socket. A glance at Figs. 3 and 4 show that the tube has the usual two plates and a filament which is divided between *two* cathodes. The cathodes

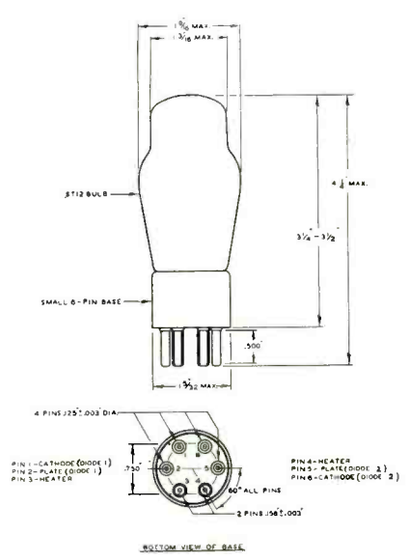



**Fig. 2. Details of the 25Z5 rectifier-doubler tube**

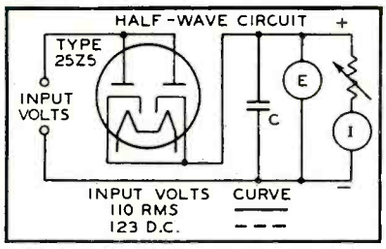



**Fig. 3. The 25Z5 connected to function as a half-wave rectifier**

are independent of each other and connect to separate base prongs. When the tube is used as a half-wave rectifier the two plates are joined and the two cathodes are joined, as shown in Fig. 3. When the tube is used in a voltage doubler circuit, as shown in Fig. 4, these same elements are used separately.

The heater of this tube has been designed to facilitate its economical operation in series with the heaters of other tubes in the radio set. The employment of a 25-volt heater permits the construction of a receiver having reduced heat dissipation in the fixed series resistor. Furthermore, the heater-cathode design permits of close electrode spacing and provides high rectifying efficiency.

When the rectifier is used in the voltage-doubling circuit, each section functions as a half-wave rectifier and each section charges one of the condensers C (See Fig. 4). The two condensers in turn discharge through the load with the result that the voltage across the load is the sum of the d-c. output voltage of the tube and the discharge voltage of the condenser.

Like the full-wave circuit, the voltage-doubling circuit gives an output having a ripple frequency twice that of the supply line, or 120 cycles if the supply voltage is 60 cycles.

In using this circuit large condensers are

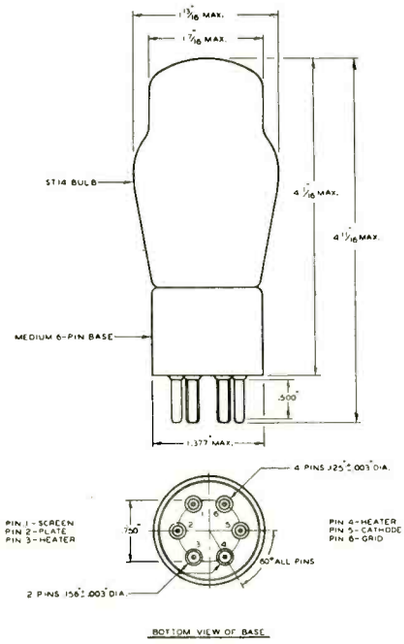



**Fig. 5. Details of the 2A5 power amplifier pentode**

necessary to give good regulation of the d-c. output voltage at higher values of load current . . . in most cases from 8 mfd. to 16 mfd. However, these condensers need not have a high voltage rating as they have only to withstand the peak value of the a-c. supply.

The tentative rating and characteristics of the 25Z5 are as follows:

| | |
|---|---|
| Heater Voltage | 25 |
| Heater Current | 0.3 Amp. |
| A-C. Voltage per Plate (RMS) | 125 max. |
| D-C. Load Current | 100 max. MA. |

No doubt this tube will find wide application in the near future.

### Type 2A5 Power Amplifier Pentode

This is a power amplifier pentode of the heater-cathode type for use in an audio output stage and is capable of giving a large output with a relatively small input signal voltage.

A single 2A5 in the output stage is capable of supplying about 3.0 watts, while two 2A5's in push-pull can deliver in excess of 6.0 watts.

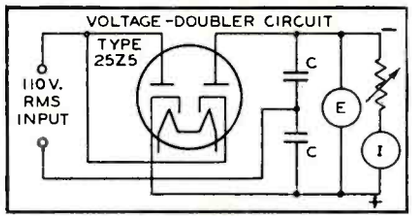



**Fig. 4. The 25Z5 connected to function as a voltage doubler**

The power handling ability of the 2A5 is essentially the same as that of the 59 with pentode connection. The two types, however, are not directly interchangeable because of the difference in base connections. This will be apparent from the sketch of Fig. 5.

The tentative rating and characteristics of the 2A5 are as follows:

| | |
|---|---|
| Heater Voltage (A-C. or D-C.) | 2.5 |
| Heater Current | 1.75 Amps. |
| Plate Voltage | 250 max. |
| Screen Voltage | 250 max. |
| Grid Voltage | -16.5 |
| Plate Current | 34.0 MA. |
| Screen Current | 6.5 MA. |
| Plate Resistance | 100,000 approx. Ohms |
| Amplification Factor | 220 approx. |
| Mutual Conductance | 2,200 Micromhos |
| Load Resistance | 7,000 Ohms |
| Power Output (7% total harmonic distortion) | 3.0 Watts |

A load resistance of 9,000 ohms will give approximately the same power output and the same total harmonic distortion as 7,000 ohms.

When the tube is self-biased, the biasing resistor should have a value of 408 ohms for a single tube and 204 ohms when two tubes are operated in push-pull.

### Type 2A3 Power Amplifier Triode

This tube has what is referred to as a "Multifilamentary Cathode" which is a way of saying that the cathode is composed of a

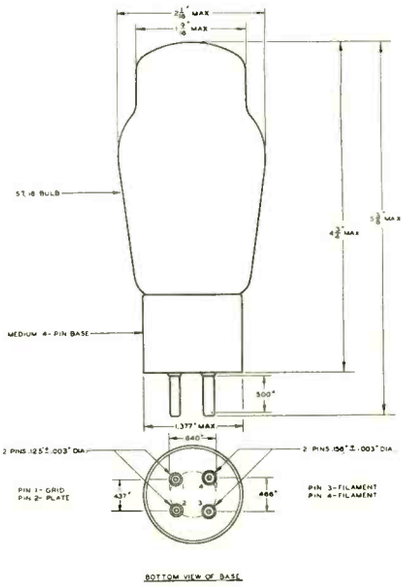



**Fig. 6. Details of the 2A3 power amplifier triode**

large number of coated filaments arranged in series-parallel combination. This is done to provide a very large effective cathode area, and as a result, this tube has a very high mutual conductance. A pair of them in Class A push-pull and operating at 300 volts on the plates can supply 15 watts of undistorted power.

A sketch of this tube, with base connections, is shown in Fig. 6. The tube fits a standard four-contact socket. The rating and characteristics are as follows:

SINGLE STAGE CLASS A

| | |
|---|---|
| Filament Voltage (A-C. or D-C.) | 2.5 |
| Filament Current | 2.5 Amps. |
| Plate Voltage | 250 Max. |
| Grid Voltage | -42 |
| Plate Current | 60 MA. |
| Plate Resistance | 765 Ohms |
| Amplification Factor | 4.2 |
| Mutual Conductance | 5,500 Micromhos |
| Load Resistance | 2,500 Ohms |
| Power Output (5% second harmonic) | 3.5 Watts |

PUSH-PULL CLASS A

| | *Fixed Bias* | *Self Bias* |
|---|---|---|
| Plate Voltage | 300 max. | 300 max. |
| Grid Voltage | −62 | −62 |
| Plate Current (per tube) | 40 | 40 MA. |
| Load Resistance (plate to plate) | 3,000 | 5,000 Ohms |
| Total Harmonic Distortion | 2.5 | 5.0 % |
| Power Output | 15 | 15 Watts |

Grid volts are measured from mid-point of a-c. operated filament. When the tube is self biased the bias resistor should have a value of approximately 700 ohms. This same value is also recommended for the bias resistor when two of the tubes are operated in push-pull.

## Western Electric Aircraft Super

The Western Electric Company has developed a new superheterodyne receiver for use in aircraft which contains a number of very interesting design features.

Nowadays, these aircraft stations work on closely-adjusted pre-arranged frequencies and go in for fast break-in work, snapping back

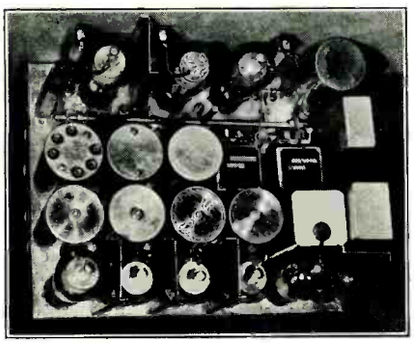


**Fig. 1. A view of the new Western Electric aircraft superheterodyne receiver, which is "pre-tuned." Believe it or not, the square posts carrying the grid leads and the antenna binding post are miniature transmission lines of the coaxial conductor type! The crystals are in the square cases with the black tops and are temperature controlled**

and forth to each other like a couple of stock brokers on the trading floor. Since the operating frequencies are pre-arranged, and are not changed over long periods of time, there is no necessity for having receivers which can be tuned by the pilot over wide bands of frequencies.

For this reason, the new Western Electric receiver has no tuning condensers, as the illustration of Fig. 1 will reveal. Instead, there is a knob which permits the pilot to select either one of two frequencies. This knob controls a long shaft which has projecting levers. The levers attach to single-pole-double-throw toggle switches and these switches throw the receiver from one frequency to another, as indicated in the schematic diagram of Fig. 2. The switches are marked D1, D2, D3, D4 and D5. Switches D1 and D2 permit the frequency change in the antenna inductance. Switch D3 selects one or the other of the two coils in the plate circuit of the r-f. tube. The other switches control the oscillator circuit of the tube V3.

The tuned circuits are precisely adjusted to the proper frequencies upon which the receiver is to operate by small trimmer condensers. The adjusting screws for a few of these condensers can be seen in the center of the chassis base, in Fig. 1.

### Crystal-Controlled Oscillator

Now, it is obvious that if the receiver is to be permanently tuned to two predetermined frequencies, and of necessity sharply tuned, means must be provided to keep the receiver exactly on these frequencies. This is accomplished by using a crystal-controlled oscillator. Two temperature-controlled crystals are used, one for each frequency, and these have a high degree of precision. For example, the crystal in the left case in Fig. 2 is ground to a frequency of 6027.500 kc.

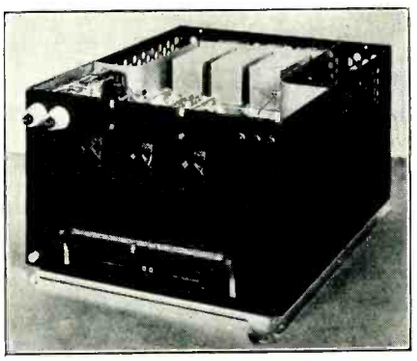


**Fig. 3. The crystal-controlled transmitter with a "servicing and adjusting hatch" near the bottom**

Tube V2 in the diagram of Fig. 2 is the first detector. The next three tubes are intermediate-frequency amplifiers and are variable-mu screen-grid tubes. Tube V7 is the second detector and is so connected as to give wide-range automatic gain control. Tube V8 is the audio amplifier.

This receiver is designed so that it may be checked without difficulty. Checks and adjustments can also be made on the plane transmitter without "messing around." We show Fig. 3 as a matter of interest in this respect. The little raised panel at the bottom of the case normally covers a group of jacks through which tests and adjustments can be made in the plate and grid circuits of the various tubes used. It would be nice if we could service broadcast receivers in a like manner.

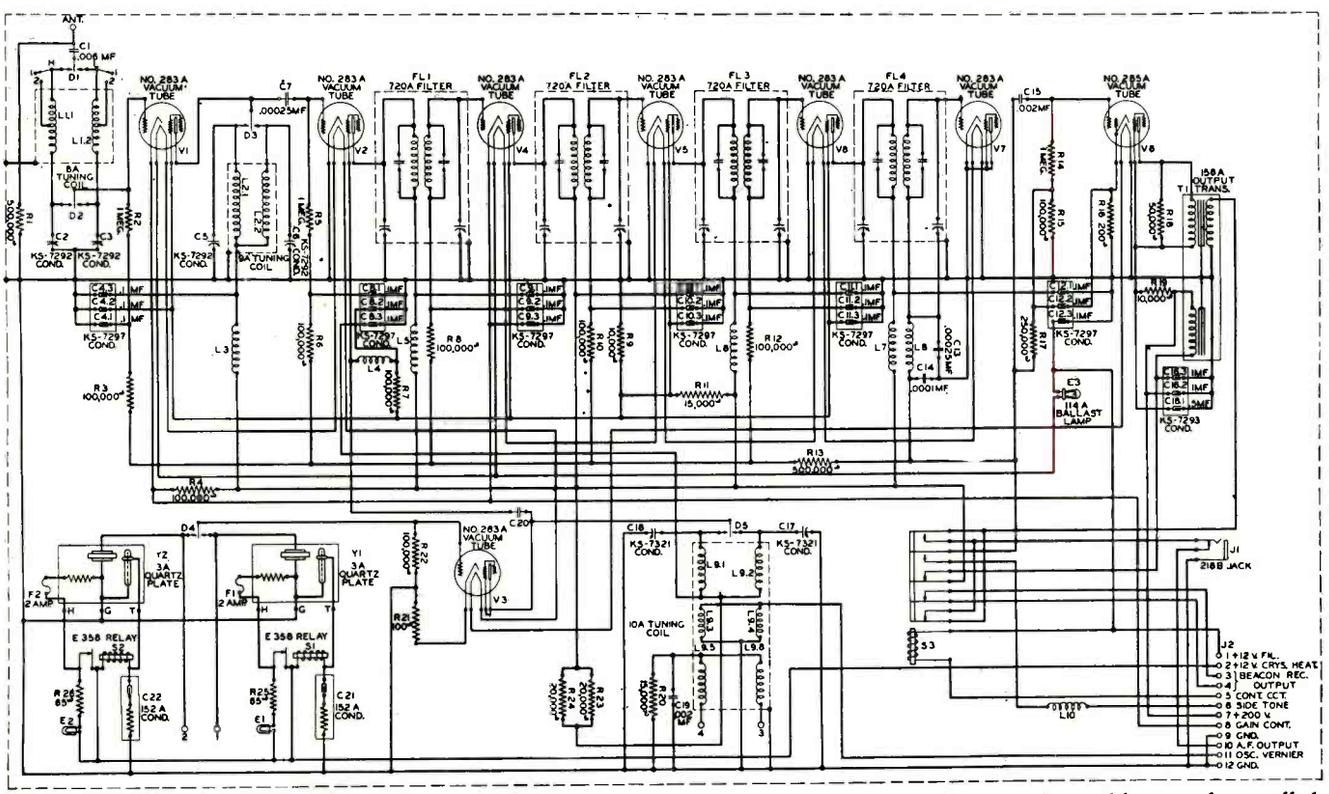



**Fig. 2. The complete schematic diagram of the new Western Electric aircraft superheterodyne receiver with crystal-controlled oscillator and toggle switches for wave changing. Post 6, marked "side tone," permits the pilot to hear himself talk so that he will not yell into the mike. Automatic gain control is provided by the second detector tube**

## Majestic Model 360 Super

The Model 360 is an eleven-tube chassis designed for single speaker operation in the Model 363 receiver. This chassis is very similar to the Model 300 chassis in that it provides Synchro-Silent Tuning, resistance-coupled push-pull output, reactance dimmer action and automatic volume control. The tubes employed and their respective stages are as follows: G-58-S, r-f. amplifier; G-56, oscillator; G-58-S, first detector; G-58-S, i-f. amplifier; G-56, second detector; G-57-S, first a-f., G-57-S, suppressor; G-56, phase rotator; two G-59-B, push-pull output; G-82, rectifier.

### Synchro-Silent Tuning Control Operation

For adjustment of this turn Automatic Synchro-Silent Tuning Control knob (located on side of cabinet) clockwise as far as possible—to position marked "distance." Then turn the tuning dial to a position between 650 and 800 kc. at a point on the dial where no station is heard and then turn the volume control to maximum volume position.

Now, for local stations, adjust the Synchro-Silent Control by turning the knob toward "local" position (counter clockwise) until noise and static is no longer heard. This noise and static will diminish suddenly and care must be taken to see that the control knob is turned toward "local" position only far enough to eliminate the noise and static, and *no further*.

The set is now ready for operation and should be quiet when tuning between stations.

When distance reception is wanted without regard to noise between stations, simply turn the Synchro-Silent control knob as far clockwise as possible.

### Reactance Dimmer Operation

This is the Reactance Resonance Indicator and is a new feature. By referring to the accompanying wiring diagram, it will be seen that the reactor used (to the right of the tuning light) consists of three windings on three legs respectively, of the iron core. The windings on the two end legs are connected in series with the tuning light, while the winding on the center leg is connected in series with the plates of the r-f., first detector and i-f. tubes. An electrolytic condenser (C-20) is connected so as to shunt the center winding.

When the set is turned on, but with no station tuned in, a relatively large plate current will flow through the center winding. This saturates the iron core so that the reactance of the two outer windings is quite low, and considerable current therefore flows through the tuning light. When a station is tuned in, it operates the G-56 second detector so that an automatic bias voltage is built up across resistor R-13. This bias voltage is, in turn, impressed upon the control grids of the r-f., second detector and i-f. tubes. When this bias is impressed on these tubes, the normal AVC action takes place; namely, their amplification is decreased. It also happens, however, that their plate current is decreased, due to the higher negative bias on their grids. This reduced plate current flowing through the center winding of the reactor relieves the saturation in the iron core so that the reactance of the outer windings increases and the current flowing through the tuning light is therefore reduced, and causing this light to dim when a station is tuned in.

The two outer windings of the reactor are connected so that they buck each other so far as the center leg of the core is concerned. Hence, there will be induced no a-c. in the center winding, which is in the plate circuit of the amplifier tubes. Because of small unbalances which may occur, it has been found necessary to place a condenser across the center winding so that there is no possible chance of any a-c. getting into the plate circuit of the amplifier tubes. This is the electrolytic condenser C-20 previously referred to.

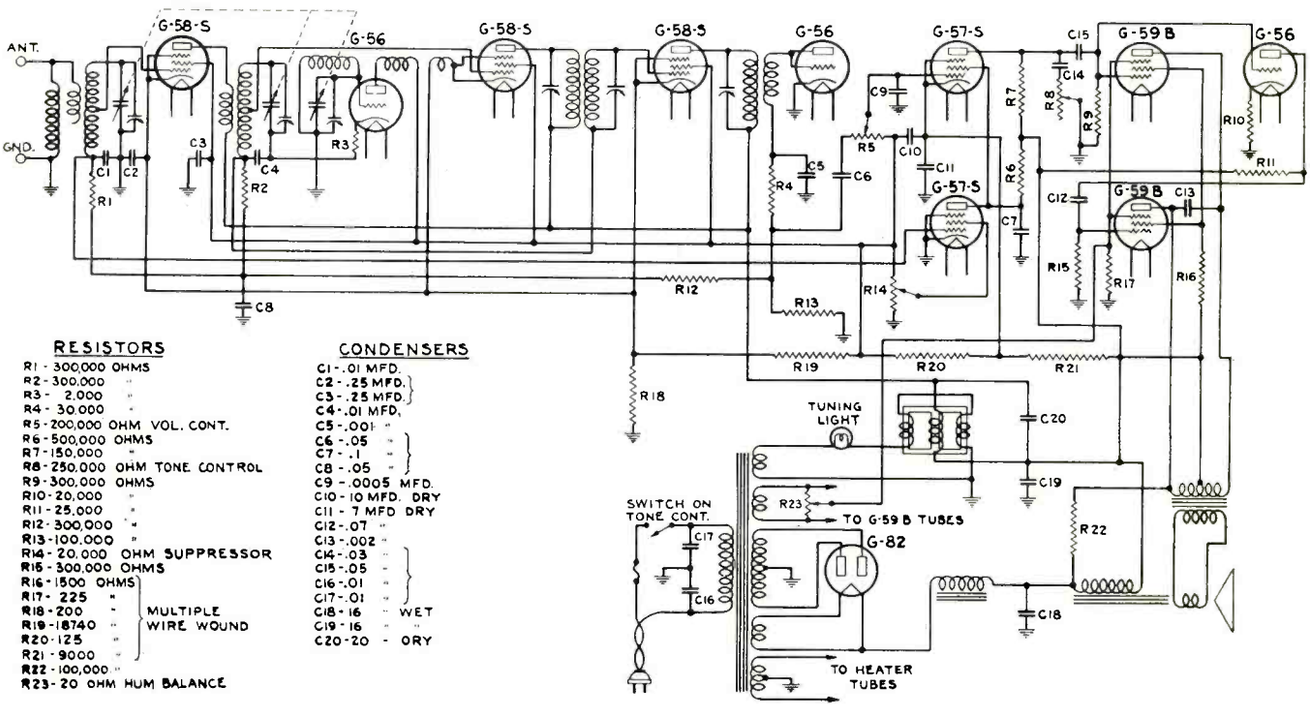
The manual volume control is a 200,000-ohm potentiometer connected in the grid circuit of the first audio amplifier and it is entirely independent of the automatic volume control in its action.

### The Phase Rotator

And here is something else brand new . . . a phase rotator operating in conjunction with the resistance-coupled push-pull amplifier.

In push-pull amplification, it is necessary that the grids of the push-pull tubes be fed with voltages that are equal in magnitude, but exactly opposite in phase or polarity. When a transformer is used, this is accomplished simply by using the two extremes of the secondary winding to feed the push-pull grids, and if a true center tap is provided, these voltages are bound to be equal, and opposite in polarity.

In the Model 360, phase rotation is accomplished by making use of the fact that a signal in passing through a vacuum tube is rotated in phase exactly 180 degrees (complete reversal). Following the audio channel, the signal voltage in the output of the first audio




**Schematic diagram and unit values for the Majestic Model 360 Superheterodyne receiver. The G-56 tube to the extreme right is the phase rotator. The unit to the right of the tuning light is the reactance dimmer tuning control**

stage takes two paths. A portion of the signal is impressed on the control grid of the upper G-59 B tube, through condenser C-15, and another portion of the signal is impressed on the control grid of the G-56 phase rotator tube. Now, the signal is reversed in phase in the output of the phase rotator, and this signal voltage is then impressed on the grid of the lower G-59 B tube. In this way we have two voltages fed to the two G-59 B output tubes exactly opposite in phase, and true push-pull resistance-coupled operation results. By suitable design the G-56 phase rotating tube and associated circuit is arranged so that no change in the magnitude of the signal takes place, so that the signal magnitude on each control grid of the output tubes is the same.

### Speaker

The type G-22-D dynamic speaker is used in conjunction with the Model 360 chassis. The field coil resistance is 450 ohms. The speaker is connected to the chassis by the plug system and is so wired that when the plug is removed from the chassis, no d-c. voltage can be applied to the electrolytic condensers even if the receiver is turned on.

### Power Transformer Connections

Following are the connections and color coding for the power transformer:

| | | |
|---|---|---|
| Primary | Yellow lead | |
| Primary | Yellow lead | |
| High voltage | Red lead | |
| High voltage C.T. | Black lead | (Stranded) |
| High voltage | Red lead | |
| Pentode heater | Lug No. 7 | |
| Pentode heater | Lug No. 8 | |
| R-F. heater | Lug No. 4 | |
| R-F. heater C.T. | Lug No. 1 | |
| R-F. heater | Lug No. 5 | |
| Tuning light | Lug No. 10 | |
| Tuning light | Lug No. 11 | |
| Rectifier filament | Black lead | (Solid) |
| Rectifier filament | Black lead | (Solid) |

The receiver must be aligned with the volume control in maximum position. Supply a 175-kc. signal to the first detector grid and align the three i-f. tuning condensers to give maximum sensitivity.

Turn the gang condenser completely in mesh; set the dial at the line below 550 kc. and lock in place. Then set the dial at 1,500 kc. and after supplying a 1,500 kc. signal to the input of the receiver, align the three radio-frequency circuits for maximum output.

### Resistance and Continuity Testing

Resistance and continuity test data is given in the accompanying table. All readings are taken from designated point to ground unless otherwise specified. Readings are taken with volume control turned to maximum clockwise position and all tubes removed from their sockets—the speaker to remain in circuit.

The values of resistance given in the table may be expected to differ plus or minus 25 per cent.

Before making these tests, check for gang condenser or i-f. trimmer short circuits. Note that some readings, marked (*), vary according to the polarity of the test leads due to the presence of electrolytic condensers. Use the polarity giving approximately the results shown in the table.

•

## A-K. 480 Correction

In the data supplied on the Atwater Kent Model 480 S.W. and B.C. Super, appearing on page 18 of the January issue of Service, the intermediate frequency was incorrectly stated. The i-f. is 472.5 kc. rather than 477.5 kc. as given.

It was also stated that the gain of the two i-f. tubes is increased for the broadcast band and decreased for the short-wave band. Actually the gain is decreased from its normal value only when the switch is in the local broadcast position.

•

## Philco 80 Notes

In the Philco Model 80, resistor (20) (See page 267, October Service) should be as far away from the i-f. coils as possible. This resistor functions as a choke to prevent the feeding of i-f. into the audio circuit.

Also, the black and white lead from i-f. coil (14) should be placed as near the chassis as possible over the oscillator coil.

### MAJESTIC 360 CONTINUITY TEST DATA

| *Terminal Number* | *Resistance in Ohms* | *If not correct, check the following* |
|---|---|---|
| 1-Ant. lead | Low resistance | Ant. coil primary and ant. lead |
| 2-Gnd. lead | Short circuit | Solder connection gnd. lead to chassis |
| 3-R-F. cathode | 200 | C2, R18 |
| 4-R-F. suppressor | Same as No. 3 | |
| 5-R-F. grid | 700,000 | C1, R1, R12, R13, C8 and tests No. 17 and 30 |
| 6-R-F. screen* | 9,730 | C3, R14, R19, R18, C11, C19 |
| 7-R-F. plate* | 20,655 | R-F. coil pri. reactance unit, C19, C3, R21, C11, R20, R14, R19, R18 |
| 8-R-F. filament | Same as No. 13 | |
| 9-R-F. filament | Same as No. 13 | |
| 10-Osc. cathode | 2,000 | R3 |
| 11-Osc. grid | Low resistance | Osc. coil secondary |
| 12-Osc. plate* | 9,730 | Osc. coil primary and test No. 6 |
| 13-Osc. filament | Very low res. | Heater fil. winding or center tap to ground |
| 14-Osc. filament | Same as No. 13 | |
| 15-1st Det. cathode | 200 | Osc. coil cathode winding and test No. 3 |
| 16-1st Det. grid | Same as No. 15 | |
| 17-1st Det. grid | 700,000 | C4, R2, C8 and tests No. 5 and 30 |
| 18-1st Det. screen* | Same as No. 6 | |
| 19-1st Det. plate* | 20,755 | 1st i-f. primary and test No. 7 |
| 20-1st Det. filament | Same as No. 13 | |
| 21-1st Det. filament | Same as No. 13 | |
| 22-I-F. cathode | Same as No. 3 | |
| 23-I-F. suppressor | Same as No. 3 | |
| 24-I-F. grid | 700,100 | 1st i-f. secondary and test No. 17 |
| 25-I-F. screen* | Same as No. 6 | |
| 26-I-F. screen* | 20,755 | 2nd i-f. primary and test No. 7 |
| 27-I-F. filament | Same as No. 13 | |
| 28-I-F. filament | Same as No. 13 | |
| 29-2nd Det. cathode | Short circuit | Solder connection No. 29 to ground |
| 30-2nd Det. grid | 130,100 | 2nd i-f. secondary, C5, R4, R13, C8 and tests No. 5 and 17 |
| 31-2nd Det. plate | Same as No. 30 | |
| 32-2nd Det. fil. | Same as No. 13 | |
| 33-2nd Det. fil. | Same as No. 13 | |
| 34-A-F. cathode* | 9,855 | C11, R20, R14, R19, R18, C19, C3 |
| 35-A-F. suppressor* | Same as No. 34 | |
| 36-A-F. grid* | 209,730 | C9, R5, R14, R19, R18, C3, C6, C19, C11 |
| 37-A-F. screen* | 518,855 | C7, R6, C12, C19, R20, R19, R14, R18, C14, R21 and test No. 6 |
| 38-A-F. plate* | 168,855 | R7, R21, R20, C19, C14, C15, C7 and test No. 6 |
| 39-A-F. filament | Same as No. 13 | |
| 40-A-F. filament | Same as No. 13 | |
| 41-Synchro cathode | Short circuit | Solder connection 41 to ground |
| 42-Synchro suppressor | Same as No. 41 | |
| 43-Synchro grid | 700,000 | Test No. 5 |
| 44-Synchro screen* | 0 to 9,730 | R14, R19, R18 and test No. 7 |
| 45-Synchro plate* | Same as No. 37 | |
| 46-Synchro fil. | Same as No. 13 | |
| 47-Synchro fil. | Same as No. 13 | |
| 48-Phazer cathode | 20,000 | R10 |
| 49-Phazer grid | 300,000 | R9, C15 and test No. 38 |
| 50-Phazer plate* | 43,855 | R11 and test No. 38 |
| 51-Phazer fil. | Same as No. 13 | |
| 52-Phazer fil. | Same as No. 13 | |
| 53-Power grid | 300,000 | C12, R15 |
| 54-Power screen* | 20,355 | R16 and test No. 7 |
| 55-Power suppressor | 225 | R17, or 59-B fil. winding |
| 56-Power plate* | Approx. 453 | Output transformer pri. and test No. 7 |
| 57-Power fil. | Same as No. 55 | |
| 58-Power fil. | Same as No. 55 | |
| 59-Power grid | Same as No. 49 | |
| 60-Power screen* | Same as No. 54 | |
| 61-Power suppressor | Same as No. 55 | |
| 62-Power plate* | Same as No. 56 | |
| 63-Power fil. | Same as No. 55 | |
| 64-Power fil. | Same as No. 55 | |
| 65-Rect. plate | Approx. 163 | |
| 66-Rect. plate | Same as No. 65 | |
| 67-Rect. fil.* | 19,595 | Filter choke, speaker field and test No. 7 or G-82 filament winding |
| 68-Rect. fil.* | Same as No. 67 | |
| Line cord leads to ground | Open | Power transformer primary C16, C17 |
| 17 to 36 | 909,730 | C6 |

*Note that the readings vary according to the polarity of the test leads due to the presence of electrolytic condensers. Use the polarity giving approximately the results shown above.

## U. S. Radio Model 7D All-Wave Super

The U. S. Radio & Television Model 7D All-Wave Superheterodyne employs the No. 700 chassis, the circuit diagram for which is shown in Fig. 1. It will be seen that a type 57 tube is used as first detector, a 56 as oscillator, two 58 tubes as intermediate frequency amplifiers, a 56 as second detector and a type 47 pentode in the output.

The i-f. transformers in this job are peaked at 455 kc. and both primary and secondary windings are tuned, as indicated. The frequency of the oscillator signal is always 455 kc. above the frequency to which the first detector is tuned when all circuits are in perfect alignment.

The frequency range is divided into four bands as follows: 550 to 1,350 kc., 1,300 kc. to 3,200 kc., 3,000 kc. to 8,000 kc. and 7,500 kc. to 20,000 kc. These changes in frequency bands are accomplished by the selection of taps on the inductances. The switch automatically shorts the portions of the inductances not in use in order to avoid dead-end losses.

There are a number of interesting points relative to the design of this receiver which are well worth explanation. For instance, the inductance shunted by the 250-mmfd condenser in the aerial circuit is tuned to 455 kc. which is the intermediate frequency used in the receiver. This trap circuit therefore prevents signals of 455 kc. from reaching the grid of the first detector tube.

There is also an image suppression coil (shown in a horizontal position in the diagram just below the waveband switch) resonated at 910 kc. or double the intermediate frequency. This coil system is designed with constants of such value that the voltage induced in the first detector transformer at the image frequency is compensated for and counteracted by an equal voltage of opposite phase set up in the small coil shown in inductive relation to the image suppression coil. The 350-ohm resistor serves to make the image suppression coil rather broadly resonant and more effective over the frequency range in which it operates.

A special biasing system is used with the second detector to allow it to handle strong signals without overloading. This was described in detail on page 17 of the January issue of SERVICE.

### SERVICE NOTES

The antenna and ground should be disconnected during voltage readings and the tube shield removed only from the socket in which the analyzer plug is inserted. In reading the i-f. voltages at the sockets, oscillation may be caused by the capacity of the analyzer cable. This will cause incorrect readings but may be overcome by touching the control grid connection on the analyzer plug or by ground-

Fig. 2

| Tube | A Volts | B Volts | Grid Volts | Screen Volts | Screen Current | Cathode Volts | Plate Current | Grid Test MA. |
|---|---|---|---|---|---|---|---|---|
| Osc. | 2.4 | 70 | 18[1] | .. | .. | 0 | 6.2 | 6.2 |
| 1st Det. | 2.4 | 170 | 8.0 | 170 | 0.3 | 8.0 | 1.2 | 1.6 |
| 1st I-F. | 2.4 | 260 | 7.0 | 90[2] | 0.6 | 7.0 | 2.5 | 4.0 |
| 2nd I-F. | 2.4 | 260 | 7.0 | 90[2] | 0.6 | 7.0 | 2.5 | 4.0 |
| 2nd Det. | 2.4 | 200[3] | 17.0[2] | .. | .. | 17.0 | 0.2 | 0.3 |
| A-F. | 2.4 | 240 | 1.6[4] | 265 | 6.8 | .. | 33.0 | 38.0 |
| Rect. | 5.0 | | | | | | 39.0 | (per plate) |

(1) Varies with frequency. Actual voltage measured across 25,000 ohm bias resistor = 39 volts.
(2) Voltage measured with 120,000-ohm meter.
(3) Voltage measured with 600,000-ohm meter.
(4) Actual voltage measured across 225-ohm section of voltage divider = 17 volts

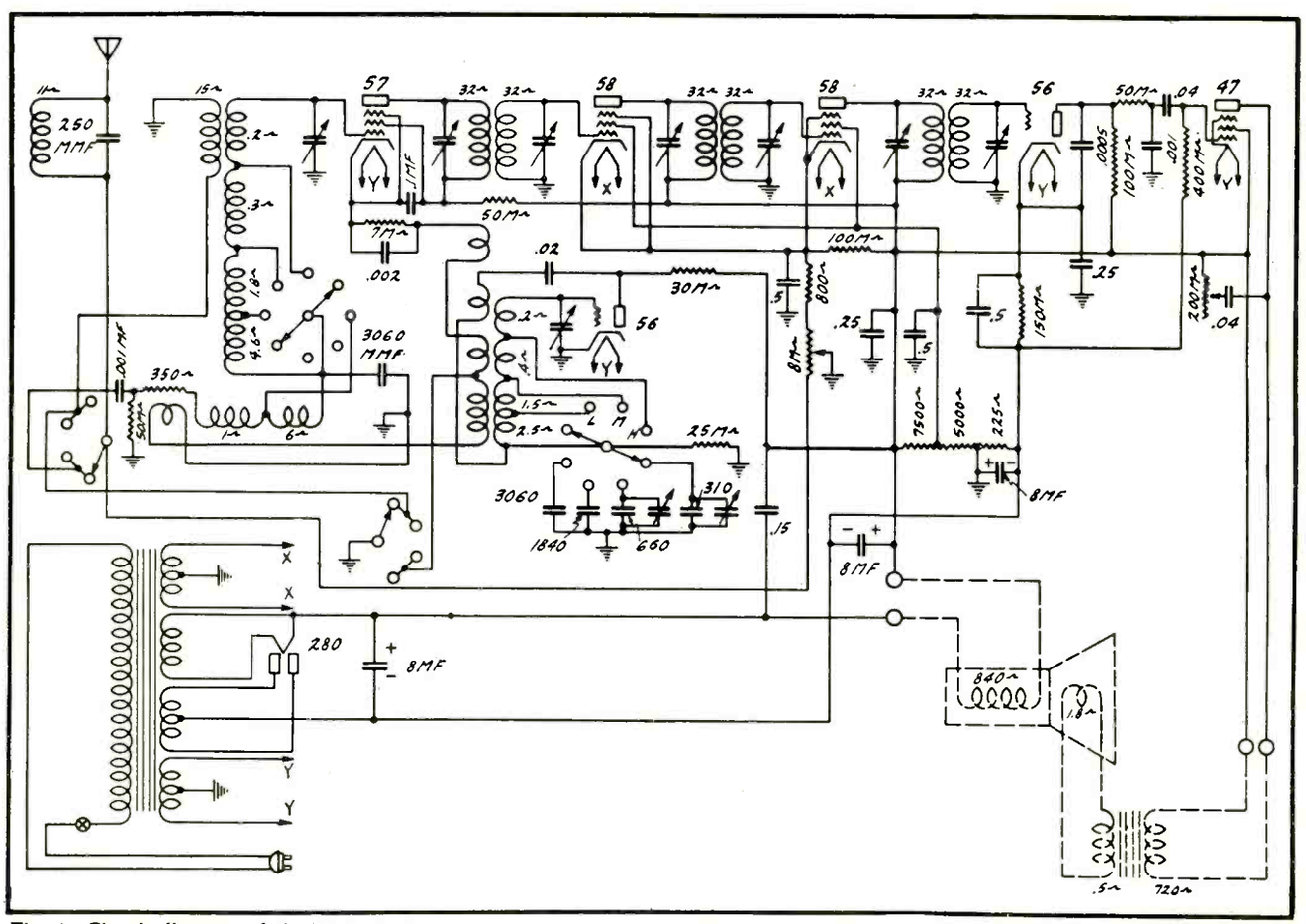



**Fig. 1. Circuit diagram of the U. S. Radio and Television Model 7D All-Wave Superheterodyne, using No. 700 chassis. The resistance values of all units are given for the purpose of point-to-point resistance analysis**

ing this through a 0.1-mfd. condenser.

Voltage data is given in the table of Fig. 2. The readings are taken with all tubes in, speaker connected and with volume control set at maximum. Voltage readings are based on a line voltage of 115.

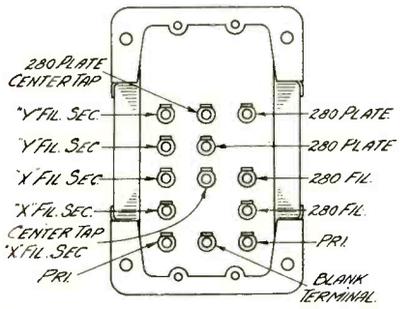



**Fig. 3. Power transformer terminal connections for U. S. Radio Model 7D receiver**

Certain defects will not affect voltage readings but may be located by means of resistance tests on the receiver circuits. The schematic diagrams of Fig. 1 shows the resistance value of practically every section of the circuit with the exception of coils of very low resistance.

The power transformer terminals and their markings are given in Fig. 3. These same markings also hold for the power transformer used in the No. 700X chassis which is for use on 25-cycle lines.

•

## Philco 37 Battery Super

The Model 37 is a 5-tube battery-operated superheterodyne.

There are a number of special points relative to this receiver which should be noted from the schematic diagram of Fig. 1. First, note that the new Philco type 15 r-f. pentode tube is used as a combination first detector and oscillator. Second, note that the new type 19 tube is used in the output. This is virtually two tubes in one, and in this particular circuit is used in a Class B push-push circuit. With this Class B circuit, the "B" battery current drain is relatively small, increasing only with an increase in the vol-

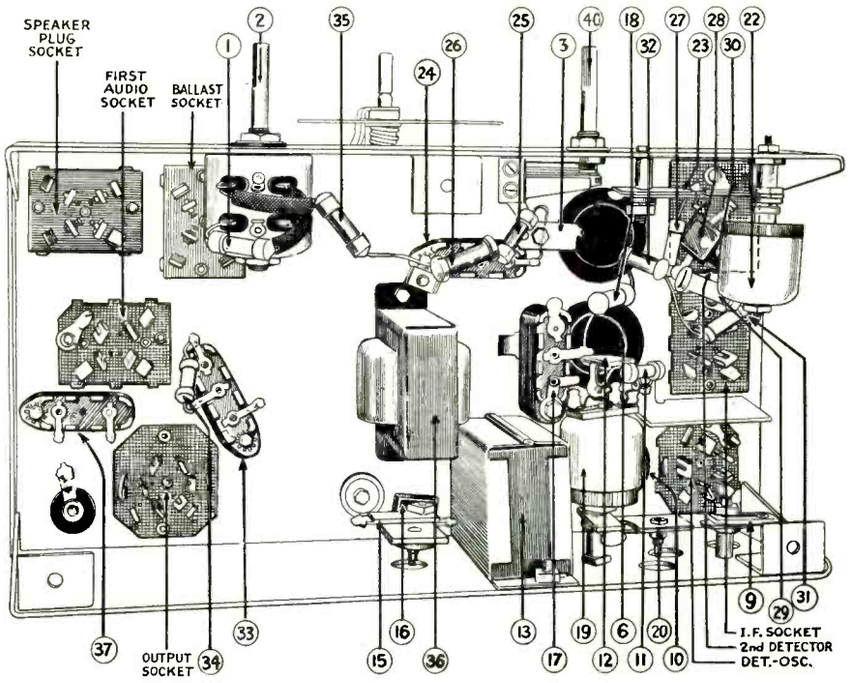



**Fig. 2. Under view of the Philco Model 37 chassis, with all units numbered, the numbers corresponding to those given in the circuit diagram and in the tables**

PHILCO 37 VOLTAGE DATA

| *Tube* | *Fil. F to F* | *Plate P to F* | *Screen SG to F* | *Grid CG to F* | *Cathode K to F* |
|---|---|---|---|---|---|
| Det.-Osc. | 1.9 | 120 (P to K) | 60 (SG to K) | 2.5 (CG to K) | 5.5 |
| I-F. | 1.9 | 120 | 60 | 2.5 | .. |
| 2nd Det. | 1.9 | 2.0 | 45 | 2.5 | .. |
| 1st A-F. | 1.9 | 110 | .. | 0.4 | .. |
| Output | 2.0 | 120/Plate | .. | 0.4/Grid | .. |

PHILCO 37 RESISTOR DATA

| *No. in Figs. 1 and 2* | *Resistance (Ohms)* | Color *Body* | *Tip* | *Dot* |
|---|---|---|---|---|
| (18) (35) | 1,000 | Brown | Black | Red |
| (1) | 2,900 | Red | White | Red |
| (11) | 6,000 | Blue | Black | Red |
| (26) | 25,000 | Red | Green | Orange |
| (25) | 51,000 | Green | Brown | Orange |
| (27) (29) (32) | 99,000 | White | White | Orange |
| (31) (34) | 490,000 | Yellow | White | Yellow |

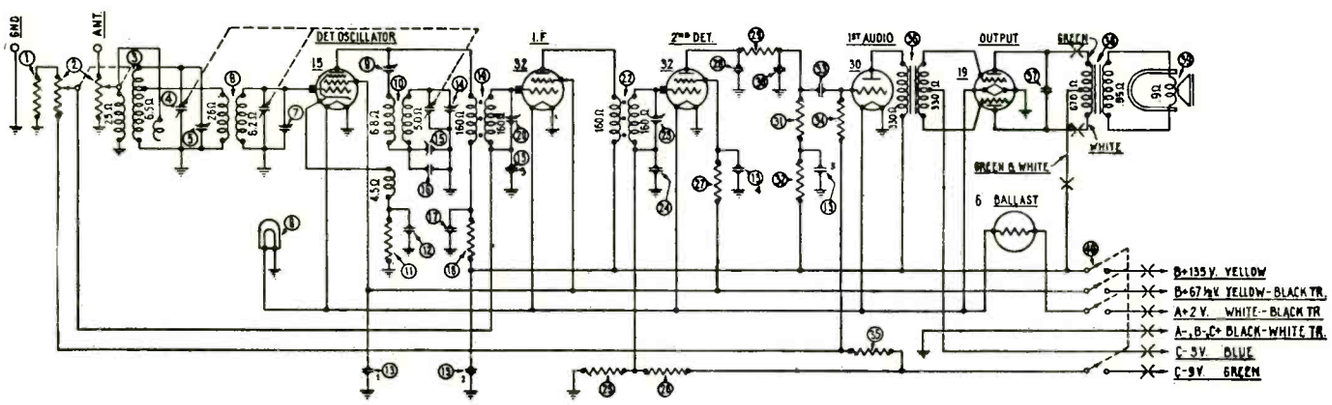



**Fig. 1. Circuit diagram of the Philco 37 Battery Superheterodyne with all values of resistance given for point-to-point resistance analysis. Note the twin output tube**

ume of the signal. The type 19 tube draws practically no current when "idling."

The chassis is equipped with an automatic voltage regulator tube (6) which keeps the "A" voltage constant. The total "A" battery drain is 720 milliamperes. At 135 volts, the "B" battery drain varies between 8 and 12 milliamperes, depending upon the output volume level.

PHILCO 37 CONDENSER DATA

| *No.* | *Mfd.* | *No.* | *Mfd.* |
|---|---|---|---|
| (12) | .00071 | (17) | .05 |
| (13) 1 | .5 | (24) | .05 |
| 2 | .15 | | |
| 3 | .1 | (28) | .00025 |
| 4 | .2 | | |
| 5 | .5 | (30) | .00025 |
| (18) | .00071 | (33) | .01 |
| | | (37) | .002 |

The intermediate frequency employed is 175 kc. Alignment is carried out in the usual manner, as has been described numerous times before.

An under view of the chassis is shown in Fig. 2. The numbers correspond to those given in the schematic diagram.

Resistance data, condenser data and voltage data are given in the accompanying tables.

•

## Crosley Model 148 Super

This is a five-tube a-c. superheterodyne using an intermediate frequency of 456 kc. The chassis is used in the "Fiver" and the "Fiver Lowboy."

A type 58 tube is used as combination first detector and oscillator, a second 58 as i-f., a type 57 as second detector—with phonograph connection in the cathode circuit—resistance coupled to a type 42 output pentode.

The voltage data is given in the accompanying table. The voltage limits are + or —10% of values given.

Plate voltage is measured from plate to cathode; screen voltage from screen to cathode; suppressor grid voltage from suppressor grid to cathode; bias voltage measured from cathode to chassis, except as otherwise noted.

•

## Philco Shadow Tuning Width

If there is little or no change in the width of the shadow on Philco models with shadow tuning, the aerial is too small or inefficient. It is necessary that a signal of fair strength be received on the aerial to operate shadow tuning satisfactorily. If practically all of the volume is made up by gain through the i-f. amplifiers instead of by a larger input signal, the amount of change in width of the shadow will be a minimum.

•

## Brunswick Panatrope Chassis

Here is some information about the i-f. transformers employed in the Brunswick Panatrope which used Radiola Model 3 NC8 and the Brunswick radio Model 5 NC8. The primaries of the i-f. transformers are of 20 ohms each. The secondary windings are not available for measurement as complete windings. The halves which are available by checking between the control grids and ground are of 50 ohms each.

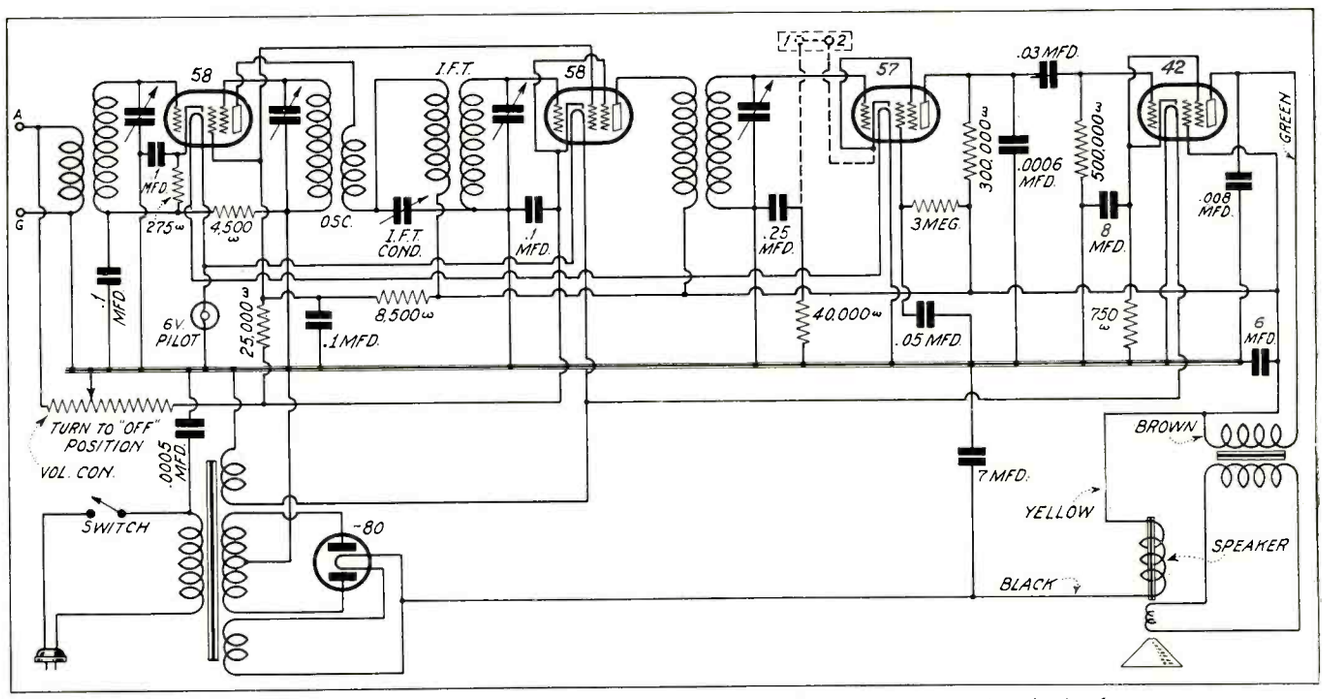
The following is some information pertaining to the color coding of the power transformers in some of these receivers. In the Model R1, the yellow leads are for the '80 filament; the green leads for the '71 tubes; the two brown and the black with brown tracer are the three leads for the rectifier anode circuit. The two brown leads are the anode voltage supply leads and the black with brown tracer is the center tap. The black with yellow tracer leads are the '26 tube leads and the two blue leads are for the '27 tube heaters.

In the 14 and 21 models, the following are the connections to the power transformers: The brown lead connects internally to the electrostatic shield. The two red leads supply the heater voltage for the '27s. The green leads supply the filament voltage for the '45s. The yellow leads supply the filament voltage to the '80 filament. The two white leads supply the voltage to the anodes of the rectifier and the black lead to the terminal between the two white lead junctions is the center tap upon the anode winding of the power transformer. The blue lead connects to one terminal of the voltage regulator. The remaining black lead, connected to the terminal near the edge of the transformer, connects to the a-c. switch terminal.

CROSLEY MODEL 148 VOLTAGE DATA

| *Tube* | *Plate* | *Screen* | *Suppressor* | *Grid Bias* | *Filament* |
|---|---|---|---|---|---|
| Osc. Det. | 230 | 110 | 33 | 2.7* | 2.5 |
| I-F. | 255 | 140 | 0 | 3.0 | 2.5 |
| Det. | 180 | 40 | 0 | 5.8 | 2.5 |
| Output | 240 | 255 | 0 | 17.0 | 7.0 |
| Rect. | 330 | .. | .. | .. | 4.8 |

*Across 275-ohm resistor in cathode circuit.




Schematic diagram of the Crosley Model 148 Superheterodyne with a type 42 pentode tube in the output

# Public Address . . .

## Noise and Shielding

Reasonable precautions must be taken to prevent noise pickup in the microphone supply leads. Care must be taken to obtain a good ground for either double-button carbon, or condenser microphones. The ground lead should always be continuous between the mixer and the microphone regardless of whether the actual ground is obtained near the microphone outlet or at the amplifier and mixer equipment.

Of course, the conduit and cable sheath must also be carefully grounded. Poor ground connections are probably responsible for more noise in such circuits than is produced by any other single source.

•

## Head Amplifier for Talkies

Many radio Service Men servicing motion picture sound equipment will probably be acquainted with much of the older "sound-on-film" equipment which has been in use at many of the smaller theatres for several years, and which, due to the depression, will probably have to be used sometime longer before more modern units will be installed as replacements.

Some of these outfits in use are in bad need of repairs and require modernizing to some limited extent, being of the original system in which two separate photo cell head amplifiers were used, which in turn were connected separately to the main amplifier alternately by the use of a "fader."

It is in many cases preferable to replace these head amplifiers with a more modern unit of better tonal range possibilities, than to attempt rebuilding the old units. Such procedure will simplify "change-over" operations for the operator, as well as eliminate much of the former unit's noise and tube howls, provided, of course, that the main amplifier is in good condition and its design is suitable for good voice and music reproduction.

The writer has had occasion to rebuild the head amplifier arrangement on some of these older installations and in order to improve the "change-over" speeds for the operator, and simplify construction, the following photo cell head amplifier circuit was finally arranged, feeding a 3-stage resistance coupled amplifier, using for battery operation three type 37 heater type tubes or three type 56 heater tubes for a-c. operation.

As each of the two photo cells feed directly into the new single head amplifier, their anode voltage is individually controlled by separate leads to the "B" battery power supply enabling one to use several type of P. E. cells of different individual characteristics, without disturbing the operation of the other cell.

### Change-Over Arrangement

The "change-over" of sound from one projector to the other in the course of operation is accomplished by a single "change-over switch" which is a single pole, double throw toggle, which extinguishes one exciter lamp and turns on the lamp on the other projector. Each exciter lamp has its own individual rheostat for voltage regulation as well as its own individual voltmeter.

This system was devised and installed by the writer in a theatre in this vicinity and worked with very satisfactory results both in gaining simplicity of operation and improved tone quality over the pair of head amplifiers formerly in use. The sound is practically continuous when changing over from one projector to another, and does not have that momentary dead spot in the sound as with the old "fader" system, when the fader arm passed over dead center.

### Volume Control

The volume of each projector can be regulated either by the variation of the filament voltage on each exciter lamp, or adjustment for correct anode voltage on each P. E. cell, to balance the output of both projectors. Variations in volume in the various prints can be controlled by a volume control located between the output of the new head amplifier and the input terminals of the main amplifier. In some cases one-half of the old fader was used for this volume control with satisfactory results.

It is, of course, suggested that the head amplifier be constructed in some form of shielded cabinet, and that photo-cell leads be entirely shielded, as well as output and power supply leads, for small arcs from switches, etc., anywhere in the projection room or vicinity will be picked up and amplified by the sound equipment unless the subject of shielding is carefully dealt with.

The sizes of resistors, coupling condensers, tube voltages, and power supply will be entirely governed by the equipment available and the types of tubes used, but with a little experimenting the desired results can be obtained.

The output system can be varied to meet conditions in the field, and also the method used in coupling the output of the head amplifier to the grid of first tube in the main amplifier. The condenser system worked very well with an amplifier which had the input feed directly to the grid of the first tube in the main amplifier without the use of a coupling transformer. If the main amplifier is quite widely separated from the head amplifier, some form of coupling transformers, with a low impedance line, would probably be best suited.

*Ralph L. Hanson.*

•

## Grid Bias and Degeneration

The common method of supplying grid bias for an audio tube is shown in Fig. 1. You all recognize this as the "self-biasing circuit."

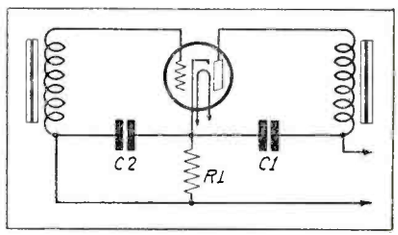
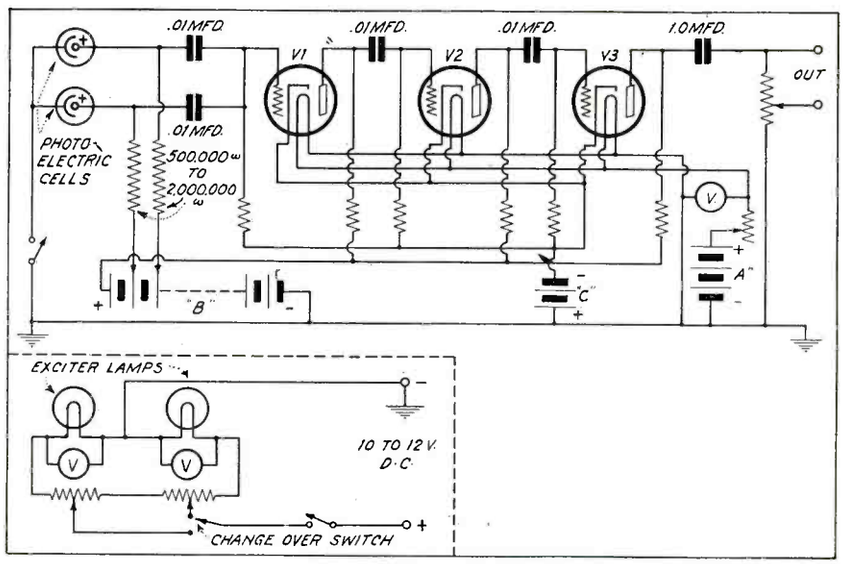



**Fig. 1. The usual form of self-biasing circuit which suffers from degenerative effects**

This arrangement has one drawback; since the bias resistor R-1 is common to both plate and grid circuits, a degenerative action takes place, causing the amplification to be decreased, particularly at the low frequencies. In an attempt to prevent this action condenser C-2 is made large—2 mfd. or more, and of 8 mfd. for audio amplifiers going down to 20 cycles.




**The circuit diagram of an excellent "replacement" head amplifier for a talkie installation, which is resistance-capacity coupled. The change-over from one projector to another is instantaneous, with practically no "dead spot"**

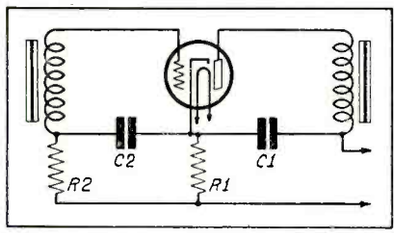



**Fig. 2. With this circuit, the degenerative effect or feedback, is negligible, and low-frequency amplification is improved**

Now look at Fig. 2. If resistance R-2, with a value of about 250,000 ohms, is inserted between the grid side of C-2 and the negative end of R-1, then the value of C-2 may be reduced to a value of about 0.25 mfd. The reason for this is that if at the lowest useful frequency the impedance of C-2 is low compared to the resistance of R-2, the feedback, due to voltage across R-1, will be negligible.

This arrangement is well worth using and may be applied to most any audio circuit.

•

## Speakers in Auditoriums

When a public-address system is installed in an auditorium mainly for the purpose of lectures, etc., one or more horn-type speakers should be used and the horns should preferably be of the exponential type.

Let us assume that it is a small auditorium and that one loudspeaker will serve for the whole area. Now, with voice frequencies, the radiation from the speaker with an exponential horn may be considered to be a solid angle 45 degrees on all sides of the center line of the horn mouth.

If this horn is located improperly, or if sound-absorbing materials are not used, echoes may be caused and the speaker may also cause feedback to the microphone.

Generally speaking, the loudspeaker should be located above the point where the microphone stand is permanently placed and some distance out from the mike, so that the speaker is above and beyond the lecturer. With the loudspeaker further front than the microphone, there is much less chance of feedback.

The horn of this speaker may be directed to radiate the sound of the lecturer's voice to the audience near the back, while those people occupying the front seats will hear the lecturer's voice direct.

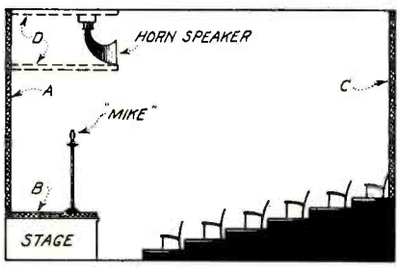



**Fig. 3. Illustrating the manner in which an auditorium should be treated with sound-absorbing material, and the placement of the speaker with respect to the microphone**

The arrangement as described above is illustrated in Fig. 3. This illustration also indicates the use of sound-absorbing materials. The materials A and B on the stage further prevents feedback from the loudspeaker to the microphone.

Sound-absorbing material (C) should also be placed at the far end of the auditorium and on the walls, to prevent reverberation and echoes. The far wall would probably need a 50 per cent coverage and the side walls a 25 per cent coverage.

If feedback and echoes are still present, the addition of sound-absorbing material D, enclosing the speaker, will more than likely cure the trouble.

If a single speaker is not sufficient to cover the entire area, extra speakers may be used to "sweep" certain areas that may be "dead."

•

## Amplifier Stability

In building an amplifier for public-address work, keep in mind that trouble often results from stray magnetic and electric fields. It is therefore important to take care in the design and construction of such a job, and all precautionary measures should be figured in before you start building, so that you won't have to make changes later.

Magnetic pickup may be avoided by mounting transformers, chokes, etc., at angles. It is quite often necessary to leave these units loose and twist them around until the position of minimum pickup is found. Leads that may constitute a single loop should be twisted.

In order to get away from electric pickup, it is a good idea to shield all high-potential leads.

# GENERAL DATA
## continued

## Apex 8 and 8A

The color of the wires in the Apex 8 series Hi-Lo Power Level switch are: Red—common, White—Hi Power, Green—Lo Power.

By breaking the red lead or white lead and inserting a milliammeter, one can notice the action of the AVC system as stations are tuned in without pulling chassis or using adapters and with complete freedom from oscillation.

Have had three cases recently in connection with the Apex 8A (8 series) where the 50,000-ohm oscillator plate resistors went low and were burned to a crisp.

This is a one-watt resistor, and according to the servicing data the oscillator plate current is 4.7 milliamperes. By the $I^2R$ rule, this resistor should have a rating of 1.1 watts in open air. I have been using two-watt resistors successfully. *S. F. Pusey.*

•

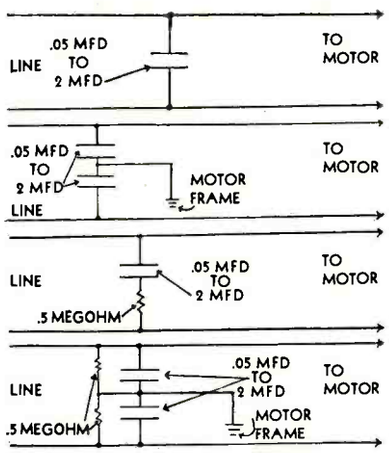
## Interference Elimination

The elimination of radio interference caused by small motors and electrical appliances has become a major radio problem and one in which the Service Man can share some profits.

Philco provides the following data relative to the snuffing out of such noises:

Radio interference from small household motors is brought into the radio set in two ways. By far the greater part of this noise is radiated from the power line of the interfering device in the form of a radio-frequency disturbance, and is picked up in the aerial and leadin wires. A smaller portion of the noise is carried through the power line and eventually into the radio through its own power-supply cord.

By placing the interference-eliminating device at the source of the noise—that is, within the frame of the motor or as near the frame as possible, there is little or no possibility of radiation or transmission. If the device is placed at the baseboard outlet, four or five feet away from the motor, the noise which might be carried along the power line will be suppressed, but there still remains the four or five feet of wire to radiate this interference. The amount of noise thus eliminated is only a small portion of the total which exists. In many cases, only a few inches of wire between the motor and the suppressor will radiate enough interference to make reception practically impossible. Just as soon




**Four circuit arrangements for the elimination of interference from small electrical appliances**

as the suppressor is placed within the motor frame, however, all noise stops. The moral, then, is to connect the suppressor right at the point of disturbance and not a few inches or feet away from the source.

The diagrams shown herewith provide four different connection arrangements for suppressors. In most cases of small motors, a .05-mfd. condenser connected across the power line inside or adjacent to the motor frame will be sufficient. In other cases a 0.5-megohm resistor in series with the condenser will be found necessary.

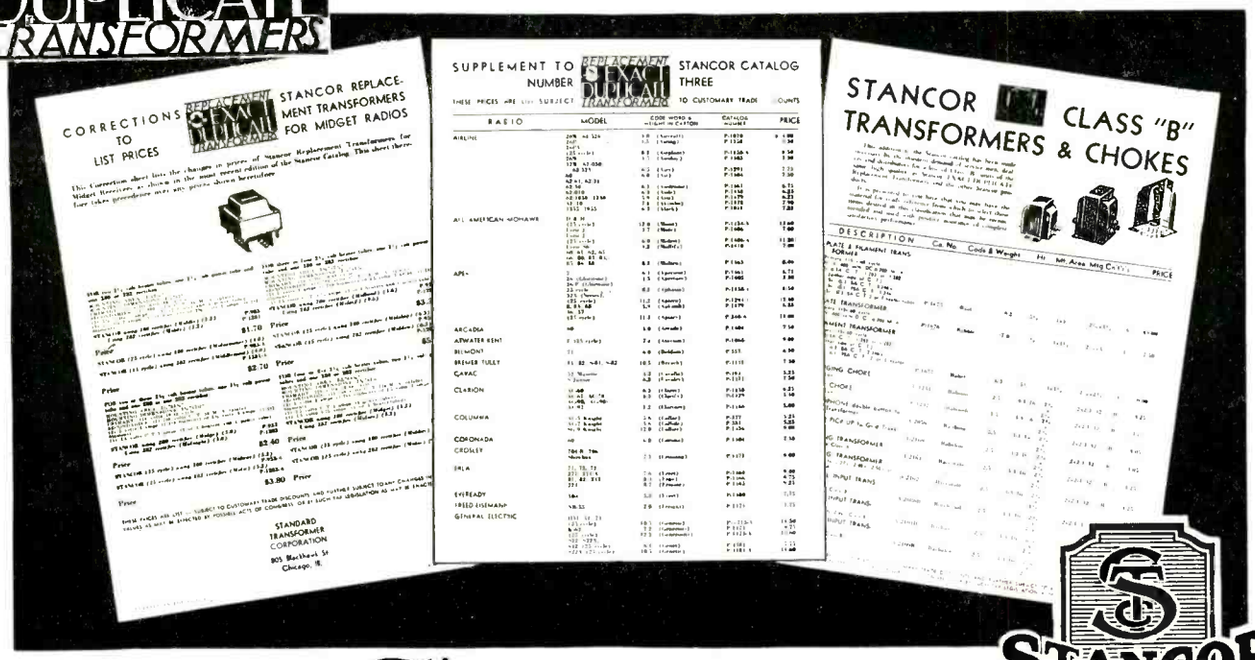
In the case of larger motors, or those which produce an excessive amount of noise, a large condenser or two condensers and two resistors may be needed.

•

## Kolster K-21 Noise

A frying noise in a Kolster K-21 is often due to a faulty hum control center tap on the '26 tube filaments. *Hugh Mausser.*

REPLACEMENT EXACT-DUPLICATE TRANSFORMERS




STANCOR

# *Three new* GUIDES TO RADIO SERVICE

**1** A four page Supplement to Stancor Catalog No. 103. Containing the new Stancor EXACT-DUPLICATE Replacement Transformers for those makes and models of receiving sets which until now had not been long enough in operation to require renewal of original performance.

**2** A new schedule of prices on Replacement Transformers for the Midget Sets.

**3** The listings and specifications of the new, complete line of Stancor Class B and filament transformers.

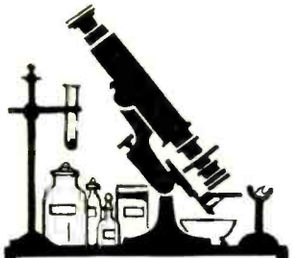
. . . really three new guides to radio servicing. With them and Stancor Catalog No. 103 in your hands you will have the most complete list of transformers available . . . to assist you in maintaining the high level of service your customers expect.

Every year the number of radio sets requiring servicing, running into the millions, increases. Service requirements mount proportionately. Only an organization such as Stancor, pioneers in the field of EXACT-DUPLICATE Transformer replacement, can keep the service man in step with the demands made upon him.

To the entire service field, the Stancor trade mark has long been an ear mark of assurance. It is not surprising that there should have been an insistent demand for a line of Class B units similarly protected . . . one of these three new guides to radio service adds its part to Stancor service to service men.

Stancor EXACT-DUPLICATE Replacement Transformers, Class B and filament Transformers are distributed by authorized distributors throughout the United States, Canada and our Island possessions, as are the catalogs and supplements.

Get in touch with your distributor. Ask him for these additions to the Stancor Catalog. If he is not equipped to supply you, let us tell you who the authorized distributor is in your locality.



**LABORATORY PROTECTED**

All Stancor Replacement and Class B Transformers have their beginnings in the laboratory.

And, not the least of the duties of this department are the testing of all materials entering the finished product.

## STANDARD TRANSFORMER CORP.

862 BLACKHAWK STREET CHICAGO, ILL.

# Auto-Radio . . .

## Franklin No. 100 Six-Tube Super

This set employs a type 36 tube as combination first detector and oscillator, another 36 as i-f. amplifier and a third 36 as second detector. This last tube feeds into a type 37 a-f. tube, through resistance coupling, and the type 37 feeds two type 38 tubes in push-pull.

This is the only auto-radio receiver we have seen which has provisions for connecting in an electric phonograph pickup. The connections are in the cathode circuit of the detector tube and are normally shorted by a jumper.

### Mounting

When locating a position for the receiver, always bear in mind that you must allow sufficient room for mounting the speaker.

The Model 100 has been designed to be mounted on the steering column or dash board. You can mount the set either in the driver's compartment of the car, or in the motor compartment—but, wherever possible, it is recommended that you mount the set on the right hand side of the driver's compartment side of the dash board, when not using the steering column mounting.

When running the wires and tuning control cable from the set to the control, be sure that you do not kink them excessively, as this will make the tuning control work hard. Always be sure to securely tape the tuning control at about every six inches along its length to some solid part of the car. If you do not do this and the control is left free to swing, it will detune the set.

When looking at the back of the speaker, the connections at the bottom, from left to right, are as follows: Ground sheath, yellow lead, black lead, red lead, blue lead.

The "A" battery connections have no polarity. By this is meant, neither negative nor positive, but the heavy green wire with tracer must always be attached to the hot side of the storage battery—that side of the battery ungrounded. The sheath may be attached to any convenient ground connection such as any bolt passing into the frame of the car or direct to the grounded terminal of the storage battery.

It is recommended that the heavy green wire with tracer be attached either directly to the hot side of the storage battery or to the heavy cable running to the starter switch. Never, under any circumstances, attach this green wire with yellow tracer to any of the ignition wires or light wires. Special warning is given against connecting this wire to the generator wire anywhere along its length.

### Adjustment

After the receiver has been put into operation, the antenna circuit must be phased. Underneath the large hole to the left on the chassis there is a screw adjustment for a variable condenser. This should be adjusted for maximum volume with a screw driver. Do not adjust the two screws underneath the two holes to the right, as they have already been adjusted at the factory.

## Extra Precautions

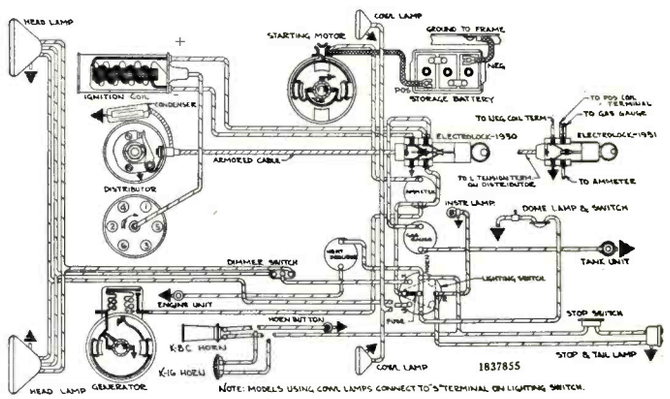
A shield around the ignition coil extending to an area of about 2 or 3 inches beyond the high-tension terminal so that the high-tension cable connection to the high-tension terminal is within the shield. Naturally, ground the shield.

A low d-c. resistance r-f. choke in the dome light and side light circuits. Yes, even in the tail and stop light circuit. A by-pass condenser across the lighting circuit to the chassis, connected at the light side of the choke. The chokes and associated by-pass condenser must be located at the point closest to the location of the radio receiver.

The suggestion is made to try two suppressors in the high-tension lead, one at the distributor and one at the ignition coil.

### CHEVROLET

**Here is the diagram of the electrical system used in the Chevrolet 6-cylinder cars for the years 1930 and 1931. The negative side of the storage battery is grounded**

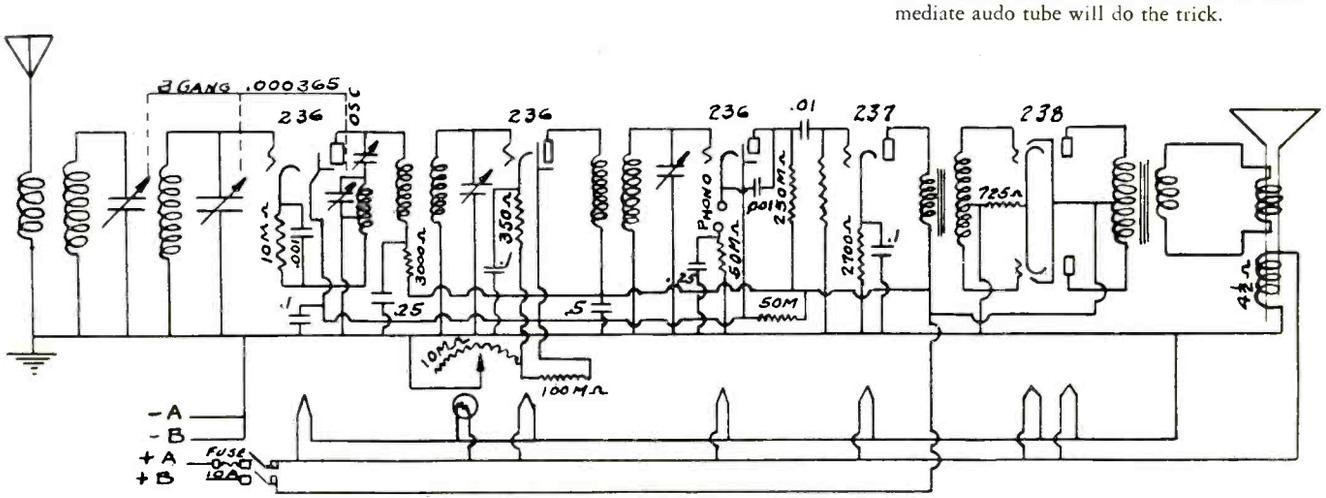



## Auto-Phonographs

If you will refer to the schematic diagram of the Franklin auto-radio receiver shown on this page, you will note that provision has been made to use the audio amplifier for phonograph music from an electric pickup.

There are literally thousands of autoists who go camping or picnicking and who would welcome the opportunity of amplified phonograph music for dancing, etc., when such music could not be picked up from a broadcast station.

Here is a chance for you to make the necessary changes in existing auto-radio receivers so that they may be used for this purpose also. In most cases, merely breaking into the cathode circuit of the dectector or intermediate audo tube will do the trick.




**The circuit diagram of the Franklin No. 100 six-tube superheterodyne receiver using the auto series tubes. The field of the dynamic speaker receives its current from the car storage battery. A variable resistance of 10,000 ohms, which alters the bias on the i-f. tube, is used as the volume control**

# WARNING

THE SUBSCRIPTION PRICE OF SERVICE WILL BE INCREASED TO $2.00 PER YEAR

Your present subscription will be fulfilled at no additional charge, but after March 15th, 1933, the subscription price will be $2.00 per year, 20c per copy.

## EXTENDED SUBSCRIPTIONS

All subscriptions in force at the present time can be extended for another year at $1.00 if we are notified before midnight March 15th, 1933.

Regardless of when you subscribed, your extended subscription will start with the issue following the expiration of your present subscription and will entitle you to twelve issues from that date.

## RENEWALS

If a subscription expires with the January, February or March issues, the receipt of $1.00 in this office before midnight March 15th, 1933, will automatically renew that subscription for twelve issues after the date of expiration.

## NEW SUBSCRIPTIONS

New subscriptions will be accepted at $1.00 per year until midnight March 15th, 1933, after which date the price will be $2.00 per year.

FILL OUT THE COUPON NOW AND SAVE $1.00.

*(Canadian and foreign subscriptions $1.00 additional)*

## SERVICE

1440 Broadway New York, N. Y.

---

I am a new subscriber ☐
I now have a subscription ☐ Check which

NAME .....

ADDRESS .....

CITY .....

STATE .....

# AN OSCILLATOR FOR SERVICE WORK

(*Continued from page* 50)

the celluloid tube so formed can be slid back and forth over L-1. The windings, and the seam of the celluloid should be painted with cellulose acetate or something similar.

Coil L-2 is also close wound on a form 2 inches in diameter, but this form should be 4 inches long. L-2 consists of 240 turns of No. 32 S.S.C. wire. Coil L-4, which is the grid coil, has 90 turns of No. 32 S.S.C. wire and is wound and mounted exactly the same as the other grid coil.

You will note from the photo of Fig. 2 that the grid coils are at the end of the plate coils. This is satisfactory if the type 30 tube is a good oscillator, but the system described above is better as it is then possible to adjust the coupling between the coils to the best value for the tube used.

The idea is to set the celluloid tube so that the grid coil is over the center of the plate coil. This is the position of maximum coupling. Then, with the variable tuning condenser fully meshed (low frequency) move the grid coil out by sliding the tube until oscillation just ceases. Then move the coil back a ways until the tube again oscillates. This, then, is the best position, and a bit of acetate should then be put on the end of the celluloid tube to hold it fast in this position. The same procedure should be gone through for the other two coils.

As a precaution, do not attempt to make any adjustments while the coils are wet as then the tube will not oscillate. Wait until the forms are completely dry. If the tube won't oscillate first off, try reversing the leads to the grid coil.

All wiring in this job should be bussed to prevent movements of wiring changing the final calibration. And, of course, all units should be firmly mounted.

### Calibrating the Oscillator

It is impossible to provide calibrations for an oscillator in an article. The spacing between coils and shielding, the lump circuit capacity and the manner in which the coils are wound and treated all have an effect on the frequency for any given dial setting. Therefore, you will have to calibrate the oscillator yourself, but this is not difficult.

Since all of the better class broadcast stations are now crystal controlled and do not depart from their assigned frequency by more than 50 cycles, a good broadcast signal can be used for the purpose of calibrating the oscillator. For the i-f. end of the oscillator you may beat a harmonic against some broadcast signal. To do this, tune a broadcast receiver to, say, a station of 600 kc., then feed the oscillator to the input of the receiver and adjust to a point near maximum capacity to a zero beat or a very slow beat. The frequency of the oscillator at this point will then be 150 kc. for the reason that 600 kc. is a harmonic of 150 kc. The next harmonic will appear at 750 kc., etc. In a like manner an oscillator frequency of 175 kc. will beat with 700 kc. on the receiver and an oscillator frequency of 260 kc. with 1040 kc. on the receiver, etc.

The oscillator broadcast inductance will tune over the entire broadcast band and therefore the oscillator may be calibrated by beating the fundamental directly with broadcast stations in any receiver. Once this inductance is calibrated, the harmonics may be used up to about 20,000 kc. for short-wave work.

# VOLTAGE and RESISTANCE MEASUREMENTS

95% of radio-set troubles can be located quickly and accurately with the

## SHALLCROSS

**No. 681**

## QUICK-CHANGE VOLT-OHMMETER

**10-100-500-1000 Volts**

**1 ohm to 3 megohms**

This instrument is very easy to build. The important parts required are a 1-milliampere D.C. meter and the SHALLCROSS Resistor Kit No. 681.

*Send 6c in stamps for Bulletin 681-E, describing the service man's most useful test instrument.*

ALWAYS Super AKRA-OHM ACCURATE

**Shallcross Mfg. Company**

ELECTRICAL SPECIALTIES

700 PARKER AVENUE

Collingdale, Pa.

(NEAR PHILADELPHIA)

Accurate NON-INDUCTIVE WIRE WOUND RESISTORS

# LET'S TALK ABOUT REPLACEMENT RESISTORS


Replacement resistors are an important item in the radio service business; they can be a very profitable item if the right type is used.

An ideal replacement resistor is one which may be quickly obtained in a large range of resistance values; one which is small in size; one which has a high overload capacity and good operating characteristics. Such a unit offers the service man the greatest opportunity for profit; and there is only ONE such resistor.

The Ohmite RED DEVIL is the ideal replacement resistor. It can be used for over 80% of your resistor replacements and because of its five-to-one factor of safety it insures against further trouble (RED DEVILS will withstand an overload of five hundred per cent even though they become red hot).

Ask your jobber to show you the Ohmite Heat Test, and in the meantime send for Radio Resistor Replacement Bulletin No. 10. Use the coupon!

**OHMITE**

MANUFACTURING COMPANY

640 N. Albany Avenue Chicago, Ill.

Please send me Replacement Resistor Bulletin No. 10.

Name .....

Address .....

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

Jobber's Name .....


# *Let this book help you make money!*

Centralab's new VOLUME CONTROL GUIDE is showing hundreds of service men how to make added profits. This is a banner season for replacement business. Cash in . . . use this up-to-date VOLUME CONTROL GUIDE . . . and Centralab Replacement Controls and Resistors.

This 50c Book is yours for the asking; enclose two three-cent stamps to cover postage and wrapping and it will be mailed to you . . . pronto. Mention Dept. A.

# Centralab

Dept. A

Keefe Avenue and Humboldt

MILWAUKEE, WIS.

# FREE LECTURE

## "What You Should Know About Rectifiers"

● Send for a FREE treatise dealing with half-wave and full-wave rectifiers of both the vacuum and mercury-vapor types. It is yours for the asking.

The scarcity of trained men in the Public-Address field has retarded progress and manufacturers of this equipment *need* Service Men as their local representatives to make estimates and to guarantee maintenance of P. A. Equipment.

The Eastern Institute of Electronics offers a course which is so simple and easy to understand that you as a Service Man can increase your earnings by breaking into the P. A. field as you are learning. It is the first time this information has been made available. Send for the FREE treatise today. It contains valuable data.

**MAIL THIS COUPON TODAY!**

E I E

**EASTERN INSTITUTE of ELECTRONICS, Inc.** Camden • New Jersey

Gentlemen:

Please send me without obligation on my part your *free* Brochure and Sample Lesson.

NAME..... (Please Print)

ADDRESS..... (Please Print)

CITY..... STATE.....

# ON THE JOB . . .

## FIRST PRIZE
### PSYCHOLOGY HELPS SALES
By J. H. Van Nice

"I can't afford it now." And that is that! The customer, in these perilous times, will not replace a weak tube as long as the old radio plays.

But, wait a minute. Suppose we use the gentle art of suggestion on Mr. Customer.

"This tube is a weak sister, Mr. Customer," explains Mr. Service Man. "I'll put a label on it so that we will remember it, and can find the right tube in a jiffy when trouble comes.

"What? . . . Oh, yes, there is always danger of a 280 shorting and burning out the set. Why, yes, a heater type tube with defective cathode or heater insulator is sure to be noisy, or to cause fading . . . and, of course, it is best to change the tube before more serious trouble develops."

It won't always result in a sale on the spot, but, if you will have printed up a label similar to the one below, and paste them on the poor tubes, it will get under the skin of the customer until he orders new tubes.

**TESTED and FOUND** **WEAK**

(*Your name and address*)

And the "DEAD" label shown below . . . they simply cannot resist that impulse to buy! But, mister, when you use labels like this, you had better know how to test tubes, and then do it with a conscience, for, sure as fate, some bright fellow is going to accept your challenge some time and check you up.

**TESTED and FOUND** **DEAD**

(*Your name and address*)

Anyway, the idea has more than doubled my tube business in spite of hard times, so go to it.

•

## SECOND PRIZE
### TAKING OUT THE NOISE
By Harry E. Strok

I have become a firm believer in signs, and whenever I see a sign announcing an installation of electrical refrigeration in an apartment house I make it a point to contact the Superintendent of that house and explain that most electrically-operated appliances create interference which spoils the enjoyment of radio programs.

Then I demonstrate to his satisfaction upon the installation in his own apartment and by the simple insertion of a pair of filter condensers, and sandpapering the commutator in more stubborn cases, I have made a friend.

After a short conversation and presenting my card I tell him there is no charge on his job and have done it merely to prove to tenants in the apartment that I can, at a very moderate cost, make their radio reception more enjoyable. Believe it or not, it works, and I can truthfully say that a few inexpensive condensers in each case made a most welcome income, and what is more, a host of satisfied customers.

•

## NO MORE CRAMPS, BUT . . .

*Well, you could knock us over with a Christmas Tree! You fellows certainly haven't got writer's cramp.*

*Since the publication of the little announcement in the "On The Job" department a while back, we have been literally snowed in with contest entries. Each mail brought dozens of them, and we are more pleased than we can say.*

*There is just one hitch. The rules of the contest state that contributions should be of such a nature that they will materially assist in building up a servicing business.*

*Many of the contributions received were of the nature of "kinks" rather than business-building ideas which have been put to practice. Most of these kinks are excellent, and we will publish them elsewhere in the magazine, paying for them at our usual rates.*

*It is not so easy to draw a definite line between what may be a kink and what may be a business-building idea . . . but here is an example: A method of testing receivers, or a cure and the repair of a specific trouble may be termed a kink. On the other hand, a method of installing extra speakers, or improving the tonal quality of a receiver may be termed a business-building idea, as both open up new channels of profit.*

*By all means, continue to send us your kinks. We will pay for all such material published at the rate of one dollar each. But, come across with your business-building ideas for the contest.*

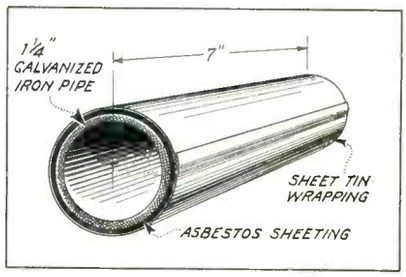
## THIRD PRIZE
### HOT SOLDERING IRONS
By Walter H. Jessen

Just what to do with a hot soldering iron when leaving the job has bothered every Service Man.

I have licked this little problem nicely by using an insulated tube made as follows:

A 1¼-inch galvanized iron tube or pipe, 7 inches long, is wrapped with asbestos sheeting $\frac{1}{16}$-inch thick. Around this asbestos is wrapped soft tin and this soldered at the joint, as shown in the accompanying sketch. The tin sheet holds in place and protects the asbestos.

The hot soldering iron will fit into this tube very nicely and though it takes a little more room in the kit, you need not worry about a hot iron burning the cord or other parts in the kit. Or, looking at it the other way, it saves times for you, as there is no waiting on the job while the iron cools.



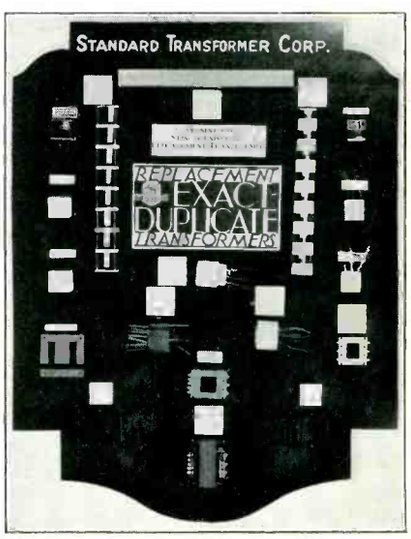

**Details of the cover for hot soldering irons**

•

## HONORABLE MENTION
### CREATING NEW LISTENERS
By S. W. Wilkinson

We have a number of old battery sets, which are in fairly good shape as they go. We let these out to any persons who have not had a radio, if they will buy the batteries and tubes for them.

We find that these old sets pave the way for new sets. Even if we never sell a new set, we figure that they are a good investment as they take considerably more current than the new sets, and the people always come back to us for their new batteries. Otherwise, we would wreck 'em.




**One of the Standard Transformer Corporation's displays at the recent I.R.S.M. Convention in Chicago**

# HIGHLIGHTS . . .

## Police Signals

S. V. M. reports that a Headquarters Station ordered a police cruiser to a certain location "to see a man about a dog."

This is hardly news. But, wait until they send a cruiser to see a dog about a man!

•

## Compact Plus

Crosley has a set with no power tube . . . the function of detector and power tube being rolled into one. It's a type 47 pentode and is used as a power detector, the output being sufficient without any other additions.

•

## Wunderlich Tube Data Book

A 20-page book, covering the technical data and applications of the various types of Wunderlich tubes, has been prepared by the Wunderlich Corporation, 1337 Fargo Ave., Chicago.

The first part of the book covers the history of the tubes and this is followed by full data on their application to t-r-f. and superheterodyne circuits, including some of the commercial jobs, such as the Scott All-Wave Superheterodyne, Motorola Auto Radio, Wells-Gardner, etc. The diagrams are given in each case.

Design data for receivers using these tubes is also included, as well as information on the use of the tubes as inter-carrier noise suppressors, fixed level automatic volume controls, delayed automatic volume controls, amplified automatic volume controls, combined detector-oscillators, etc.

Copies of the book may be obtained for fifty cents each, from the company.

•

## Parlance

Last month we spoke of "flat tubes." These are tubes which refuse to oscillate.

We figured that it is about time the radio service field worked up a special parlance if for no other reason than to get back at the doctors with their "furora transitoriums" and whatnot.

The best we have been able to squeeze out of you fellows so far is "slow short." This, we are told, is most anything outside of a complete and direct short circuit. Thus, a leaky bypass condenser, a short through a comparatively high resistance, etc.

Come on, fellows . . . what are your pet terms? Send them in.

•

## Fifty-fifty

The client is entitled to an estimate of the cost for repairs, if he asks for it, but the Service Man is entitled to a fee for the estimate.—*M. K. Barber.*

•

## Another Convention

General Headquarters of the Institute of Radio Service Men announces that tentative plans are being laid for a Service Men's Convention to be held at the Pennsylvania Hotel, New York City, next October.

•

## Barter

Here is an interesting bit we received from Mr. J. H. Van Nice, of Waukon, Iowa. It falls right in line with a movement which is taking hold in practically all sections of the country. It may give some of you fellows an idea or two.

Says Mr. Van Nice:

"While my service work has been advertised 'CASH' I quickly found out that there were dozens of sets not working because the owners had no ready money. By doing a little investigating, in each case, I found that nearly all these sets could be enticed into the shop for repair.

"We live in a small town, and there are six of us. We eat like starving Armenians, but the local markets and stores charge too much for their produce over and above what they pay the farmer, and that makes things tough.

"By putting it up squarely to the farmer and others, I get dressed hogs or other meat, fuel, apples and vegetables, feed for our chickens, labor around the place, and countless other commodities or services in exchange for radio service. It means that I am busy all the time, and I get my living at less expense. Both items swell the net proceeds!

"Of course, there has to be a limit. You can't do all your work this way and pay bills. But most Service Men could extend their range this way and save money at the same time."

So, there you have it. There are many people throughout the country who are exchanging services or products in cases where they no longer have sufficient money to obtain these things. Lacking money as a medium of exchange, they are employing their own particular abilities.

This plan not only works in the country, but in the city as well. We just heard of a case where a Service Man repaired a set for a sign maker, who in turn made a display sign for the Service Man. It works to advantage both ways.

From other parts of the country we hear that Service Men could get all the work they wanted if they could "write it on the cuff," that is, carry the customer for awhile at least. Well, maybe some of these men could do a bit of bartering for services or products, with benefit to all concerned.

•

## RSM

The Radio Service Man . . . partly merchant, partly scientist, partly craftsman, but above all, a student.—*M. K. Barber.*

•

## Rumors

We hear that one large tube company is about to absorb another of about equal expansiveness. Who? You do the guessing.

At the present rate of design, there will be announced an average of seven new tubes each month for some time to come. This is all simply amazing. We should like a month's interval to permit us to catch up with the present batch. We are so confused that the other night we dreamt that a '99 grew about twenty prongs and started chasing a 59 with a couple of glass horns. They got into a scrimmage and when the smoke cleared away, there stood a duo-diode pentode with free wheeling on its cathode and all set for wizard tone control.

Sets are becoming so complicated that a certain well-known radio training school has prepared a special course for men who want to be on the top in the future. The course requires a year of study at the rate of eight hours per day!

•

## Halitosis Cure

Says a reader, "Have you ever noticed that new sets have halitosis? They smell like an old barn. Can't something be done about it?"

We suggest a daily spray of Ashes of Roses Perfume, Midnight Passion or The Dove's Holiday . . . but Flit might do.


**Here is a photo of the exhibition booth of the Grigsby-Grunow Co. as it appeared in the Hotel Sherman during the recent I.R.S.M. Convention in Chicago**

# THE FORUM . . .

## Many Thanks

*Editor,* SERVICE:

I spent two or three hours during the past week in looking over the past year's copies of SERVICE and was very much surprised to find the ready response which you are getting from the manufacturers in regard to the point-to-point method of testing.

In this connection, I am wondering if you have attempted to give advice in your magazine in regard to efficient types of instruments to be used in servicing—that is, should a set analyzer be used, an oscillator, voltmeter and ohmmeter, or what in order to render the most efficient type of servicing both in the home and in the shop.

I do want to congratulate you on your accomplishments and the contributions which you have made in the radio servicing field in the past year. It is my earnest wish that you will enjoy good health and have the energy and ambition to continue the wonderful work that you are doing.

J. E. SMITH, PRESIDENT,
NATIONAL RADIO INSTITUTE,
*Washington, D. C.*

●

## Cheap Sets, and Service

*Editor,* SERVICE:

The first of the year I received a sample copy of SERVICE and it so impressed me that I immediately subscribed and have not been disappointed, as this magazine seems to fill a want much needed by the Service Man. I have been servicing radios for over ten years and have found much bad and much good in it in that time.

I read with interest the letter by Herb. Corbett in the December issue. He has the right idea on the cheap sets. We have decided that a dealer cannot handle them as the public expects a radio set to be handled by a dealer and do anything except lose money on the sale. What I mean by that is that John Public expects demonstrations, service and the same attention he would on a higher-priced set.

For this reason we are not handling any of the sets under $40.00. Possibly we are wrong . . . time will tell. For a department store or large city store where the sets can be sold over the counter, it may be a good thing.

We make the same service charge on the cheap midgets that we do on the higher-priced sets for, in our opinion, it takes as long to repair the midgets as it does their big brothers, and sometimes longer because of the compact way they are put together. We also try to discourage prospective customers for these small sets.

The writer agrees with Mr. Corbett that at present there does not appear to be any set rate of service charges which prove satisfactory even in the larger percentage of cases.

J. GLEN KIRSTE,
ELECTRIC SERVICE COMPANY,
*Leesburg, Florida.*

●

## Government Control?

*Editor,* SERVICE:

During ten years of association with radio, it has been my experience that the service end of the radio industry is in such condition that the men who have invested time and money in learning and in equipment are unable to realize a living from their efforts.

Many experiments have been tried in an effort to alleviate this situation, but so far without noticeable success.

Granting that there are differences of opinion between the various branches of the industry as to the relative merits of the service end, it would seem to me that if servicing is of any advantage to the rest of the industry, it would be to the best interest of all to have some settled method of knowing who is really qualified for servicing.

Drawing on experience for a solution, it would seem that according to all set standards established in professional lines, it would be unethical to band together, except to set a higher standard for radio service. But only those men who are actually interested in real servicing will take the time, money and effort to unite for better conditions. The tinkerers, gyps and others, who are only interested in what they can get out of their so-called servicing, are not regarding the interests of the other branches of the radio industry and the B. C. L.

Consequently, it would seem to me that every worthwhile Service Man would welcome an opportunity to qualify under State laws in order to practice his profession. All professional men are required to pass State examinations in order to practice in their State . . . why not Service Men?

Or would it be more practical to have Service Men examined and qualified by a Government Radio Inspector, such as now handle the licensing of transmitters? The government already has a set-up which would be sufficient for handling examinations for Service Men without materially increasing their personnel.

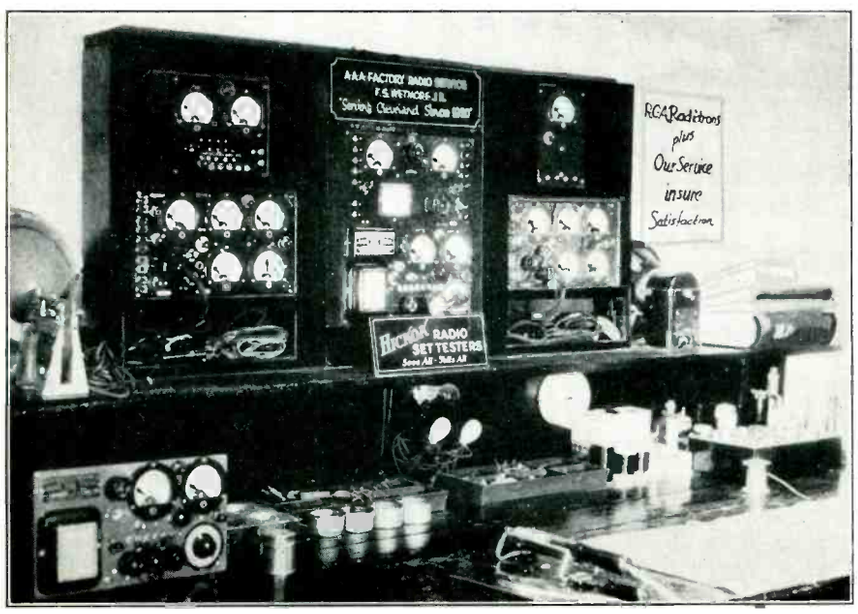
I should think the radio manufacturers would be interested in assuring the consumers of their product that the Service Man who is called in is fitted to make the necessary repairs. The Service Man is surely the one who keeps the sets sold, and is in a position to cause the manufacturers trouble by poor workmanship or by what he has to say about the set.

Do you think it would be possible for the R. M. A. to interest itself to the extent of agitating for a system of qualifying and licensing Service Men? Both sides would benefit, but I believe the R. M. A. is in a much stronger position to secure recognition from the necessary parties in order to start the movement for this remedy.

By eliminating from the field only those men who cannot qualify for modern servicing, it would make it possible for the licensed men to secure a greater share of the work and thus increase their incomes.

RICHARD P. ROBERTS,
*Philadelphia, Pa.*

*(We have had many discussions regarding the advisability of government control of the radio servicing profession and have been unable to come to any definite conclusion. Somehow, we are inclined to believe that in the long run the Service Man will fare better if he is free of all such restrictions; in other words, we believe that eventually the Service Man will be able to work out his own salvation without the aid of any form of legislation. However, the point is too important to be dropped and we would greatly appreciate the opinions of other Service Men regarding Mr. Robert's suggestions.*—THE EDITORS.)




**The AAA Factory Radio Service laboratory, owned by F. S. Wetmore, Jr., all set for making any kind of test you can name—except the blindfold test. A nice layout**

# THE BOOK of the YEAR

PUBLIC ADDRESS SYSTEM DESIGN, INSTALLATION AND SERVICE is the book the modern, wide-awake Service Man requires to enter the Public Address field. It has been especially prepared with the service field in mind and is written for the Service Man who wants to expand his activities by making small and medium-sized Public Address Installations.

In this book you will find the practical information which has been lacking for so many years—written in a manner which you can easily understand and apply to profitable practice.

## PART I

Part I covers the Kind of Systems required—Acoustic Power Determination—Distribution of Power into Loud Speakers and Headsets, and Calculation of the Amount of Power Needed—Pre-amplifiers and their Arrangement—Design and Selection of Power Amplifiers—Calculation of Gain Required—Design of Power Packs—Tubes for Power Amplifiers—Class A and Class B Amplifier Systems — Electric Pick-ups — Attenuator Pads, how to Make and Use them—Volume Level Indicators, Application and Design—Mixing Transformers and Arrangements—Coupling Transformers—Power Amplifiers in Parallel Combinations—Arranging Patching Panels, etc.

## PART II

Part II covers the normal servicing problems that arise in Public Address Work. This section is written in the usual Rider manner, explaining troubles and their remedies in complete detail. Practical installations are also considered with wiring diagrams of various P.A. systems such as Samson, Radio Receptor, etc.

## PART III

Part III covers Acoustics and Acoustical Treatment, and was written specifically for this book by Vesper A. Schlenker, one of the foremost acoustical engineers in this country. Mr. Schlenker covers in easily understandable language, the Fundamental Relations of Radiated Sound—Acoustical Properties of Rooms—Frequency Analysis of Noise—Determination of Acoustical Conditions and Noise Level, and the Amount of Power Necessary to Over-ride the Noise—Kinds of Noises present in various Installations and their Minimization—Breakdown of Noises into Frequency Bands—Acoustic Materials and their Properties—Specific Treatment of Rooms—Areas to be Treated—Installation of Acoustic Materials—Applications to Various Kinds of Surfaces in Old and New Buildings. Also chapters on Microphones and Pick-ups—General Types of Loud Speakers and Driving Units—Characteristics of Speakers, their Radiation Properties, and where they should be located.

The Appendix to the volume contains a complete decibel table covering the full range of power values to be experienced in practice. This table eliminates the need for extensive calculation.

You need this book. It is absolutely indispensable to any man who expects to do Public Address work. Order your copy today. Price, Post Paid, $3.50.

**USE THIS COUPON**

JOHN F. RIDER
125 West 40th Street
New York City, N. Y.

Here is $3.50 for my copy of "Public Address System Design, Installation and Service."

NAME .....

ADDRESS .....

CITY..... STATE.....

# Is Your Future Worth 3¢?

*Mr. E. H. Rietzke, Pres. Capitol Radio Eng. Inst.*

*Let me mail you my FREE BOOK—*

"PRACTICAL RADIO ENGINEERING"

Write for this interesting booklet. If you have the necessary ambition and experience, this Advance home-study course will help give you the knowledge necessary for specialization in the more advanced fields of radio and its many branches.

*. . . SOON!*
THE MOST IMPORTANT ANNOUNCEMENT WE HAVE EVER MADE
*. . . watch for it!*

**Here It Is . . . . .**

*Write for this Book Now! It Proves Training Is Necessary for Advancement.*

PRACTICAL RADIO ENGINEERING

**MAIL THIS TODAY!**

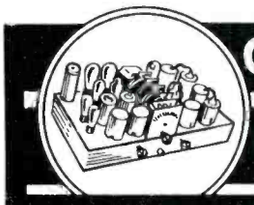
Capitol Radio Engineering Institute Dept. S-2
14th and Park Road, N. W., Washington, D. C.

Please send me your Free, 28-page booklet, "Practical Radio Engineering," at no obligation to me.

Name .....

Address..... City.....

N. Y. City Representative—M. Schatt, 200 Broadway—Phone Rector 2-4152



# OVER 2 MILLION RADIO SETS -

**— FREE —**
THE LATEST ALLIED BOOK PREPARED EXCLUSIVELY FOR THE RADIO SERVICEMAN

**Write for our new 1933 World's Fair** Issue of the ALLIED radio catalog — an astounding guide to radio's finest merchandise, lowest prices, and quickest service. It is prepared exclusively for you as a Radio Serviceman— that you may profit. Send for this new ALLIED catalog today. It is absolutely FREE and worth having.

FREE


**Statistics show that during the next few** months, over 2 million radio sets sold in 1929, 1930, and 1931 will require servicing and replacement parts. You will get a good share of that business and your reputation will be built up largely on the parts you use.

Let ALLIED supply you with exact duplicate replacements for power transformers, volume controls, condensers, resistors, tubes, speakers, modernizing equipment, etc. You can depend on ALLIED for—

MERCHANDISE that is new and clean—
COMPLETENESS—Radio's largest stock—
VALUES that bring you profits and savings—
SPEED—24 hour rush service—
PERSONALIZED SERVICE—
RELIABILITY — the ALLIED name means permanence and stability.

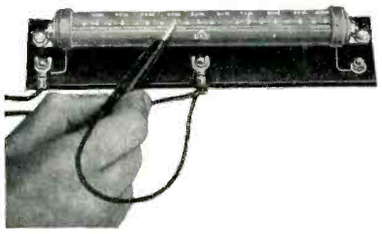
**Allied Radio**
CORPORATION
833 W. JACKSON BLVD.
CHICAGO, ILL.

# THE MANUFACTURERS . . .

## I. R. C. Resistor Indicator

The Resistor Indicator recently announced by the International Resistance Co. is a wire-wound job and therefore can be applied to most any circuit structure, including those of amplifiers, as the unit can handle heavy current.

The Resistor Indicator is a clever arrangement. There are two leads with clips and these are connected across the open resistor in receiver or amplifier. The "feeler" or



prod, as shown in the accompanying illustration, is then run along the exposed portion of the wire, directly under the calibrated resistance markings, and brought to a stop when the operation of the receiver or amplifier is again normal—or when the correct voltage reading for that particular portion of the circuit is reached. This point at which the prod makes contact on the wire then represents the resistance value of the open resistor—the value being read from the scale, such as 40M, or 40,000 ohms, as in the illustration.

The I. R. C. Resistor Indicator is also very handy as a temporary voltage divider for tapping off fixed voltages from a supply. Resistance values slightly in excess of 100,000 ohms can be covered. By adding resistors of known value in series, the range can be extended to most any figure desired.

•

## New "Universal" Units

Universal Microphone Co. has announced a group of new units particularly adaptable to public-address work. There is, for instance, a new remote control panel of Universal make, which is a one-stage microphone amplifier, which may be used in connection with mikes or electric pickups, and as a telephone amplifier, a pre-amplifier for home recording, a phono-mike mixing panel, etc.

The panel consists of a single stage amplifier to bring the output level of the microphone up to approximately that of the phonograph pickup. Equipment is portable, housed in black enamel casing, and includes "A" and "B" with total weight of 20 pounds. There are two output combinations—a low and high impedance—one designed to feed into an amplifier, and the other to feed into a line of the order of 400 to 600 ohms.

The unit is equipped with volume controls and tone control, and uses a type 230 tube.

Universal also has some other input stages, one designed for two-button microphones and the other designed for single-button microphones.

## Philco Interference Eliminators

Philco has announced a new line of condenser units especially suitable for interference elimination work.

Two of these condensers are of the tubular type of construction with self-supporting leads. They are small in size so that they can be used in a limited space, such as within the casing of a small motor, etc., and come in capacities of .05 mfd. and .1 mfd.

In addition to the small condenser units listed above, Philco has available four additional larger capacity condensers for heavier interference elimination. These are uncased condensers, available in 0.25 mfd., 0.5 mfd., 1.0 mfd., and 2.0 mfd.

•

## Balanced Antenna System

The Clough-Brengle Company, of 1134 W. Austin Avenue, Chicago, have announced their new Staticlear Balanced Antenna System, specifically designed to eliminate man-made interference.

The Staticlear system departs from the usual type of system in that it employs a two-wire transmission line, without a shield cov-


ering, the two wires of the line being continuously transposed from the point of the antenna to the point of the receiver. The use of this arrangement eliminates capacity to ground which is sometimes excessive when a singe or double shielded cable is used, with the shield grounded.

The complete outfit consists of 75 feet of two-wire transposed line, an antenna transformer and a receiver transformer. The antenna transformer is used to match the impedance of the antenna to that of the line, and the receiver transformer to match the input impedance of the receiver to that of the line. The line itself is balanced to ground.

It is stated that the system is so designed that it may also be used in connection with an antenna for short-wave reception with no appreciable losses and a decided gain in signal over noise.

## Na-Ald Universal Tube-Checking Adapter

The new Na-Ald Universal Tube-Checking Adapter, Type 950XYL, illustrated herewith, permits the checking in most any make of tube checker of forty-seven different tubes. All these forty-seven tubes are checked in this adapter when used in the UY screen-grid

socket of a tube checker having a filament voltage switch; with tube checkers having 14, 25 and 30-volt filament potentials the 14, 17, 43 and 48 tubes can also be checked with this adapter in addition to the forty-seven tubes.

The adapter has the proper resistance network to protect diodes from excessive current as well as to safeguard the tube checker meters from the high current of the mercury-vapor rectifiers.

The Universal Tube-Checking Adapter is sold complete and ready for operation, or in kit form with diagram and instructions for assembling and wiring.

•

## Wirt Rotary Snap Switch

The Wirt Company have brought out a new rotary snap switch with a rating of 3 amperes at 125 volts. It is of the single

pole, single throw type and has low contact resistance. It is designed primarily for use as a power switch for radio receivers and is of the single-hole mounting type.

•

## Littelfuse Protection Plan

Littelfuse Laboratories have made the announcement that hereafter all instruments protected by Instrument Littelfuses will be covered by a $100 Indemnity Protection Guarantee.

According to the manufacturer, this policy has been made possible by several improvements in their line during the past year, including the use of platinum wire in the finest capacities which, it is said, is much more reliable than the metallized quartz fibre formally used. A special type of mounting (see illustration) is used for this wire, the support wires being united by a glass bead.

# Index of Monthly Literature

## BROADCAST

### Amplifiers, A-F.

Acoustically Compensated Volume Control
*Wolff and Cornell, Electronics, pp 50, February, 1933*

Volume Controls in Audio Channels
*P. V. O'Rourke, Radio World, pp 4, February 18, 1933*

### Amplifiers, R-F.

Band-Pass Filter (Construction)
*Radio Review & Television News, pp 268, February, 1933*

Gaseous "Noise Gate" Tube
*J. F. Dreyer, Electronics, pp 40, February, 1933*

### General

Circuits of "Universal" Midget Sets
*Radio Retailing, pp 35, February, 1933*

Matching Impedance Loads
*Radio Review & Television News, pp 264, February, 1933*

### Receivers

Hammarlund Comet "Pro" (New Model)
*L. W. Martin, Short Wave Craft, pp 604, February, 1933*

Midwest All-Wave Super, Part I
*Taylor and Dorf, Radio News, pp 544, March, 1933*

Scott All-Wave Super (New Model)
*Taylor and Borst, Radio News, pp 542, March, 1933*

## PUBLIC-ADDRESS

Acoustically Compensated Volume Control
*Wolff and Cornell, Electronics, pp 50, February, 1933*

Class AAA P-A. Amplifier (Construction)
*L. J. Littmann, Radio-Craft, pp 536, March, 1933*

Handling P-A. Rentals
*Radio Retailing, pp 24, February, 1933*

Rack and Panel P-A. System, Part II (Construction)
*W. C. Dorf, Radio News, pp 536, March, 1933*

Sound Absorption and Materials
*G. W. Baker, Projection Engineering, pp 11, January, 1933*

Technical Terms for the Projectionist
*Projection Engineering, pp 21, January, 1933*

Velocity Microphones (Construction)
*C. W. Melotte, G. A. Elliot, QST, pp 23-24, February, 1933*

## SHORT WAVE

A-C. Super-Wasp Brought Up to Date
*A. A. Dolid, Short Wave Craft, pp 590, February, 1933*

Hammarlund Comet "Pro" (New Model)
*L. W. Martin Short Wave Craft, pp 604, February, 1933*

Midwest All-Wave Super, Part I
*Taylor and Dorf, Radio News, pp 544, March, 1933*

National AGS Short Wave Super
*James Millen, Radio News, pp 546 March, 1933*
*(Also Modern Radio, pp 7, February, 1933)*

Scott All-Wave Super (New Model)
*Taylor and Borst, Radio News, pp 542, March, 1933*

Short Wave Antenna Design and Construction
*Don C. Wallace, Radio, pp 14, January, 1933*

## TESTING SYSTEMS

A Perpetual Analyzer
*L. W. Hatry, Modern Radio, pp 10, February, 1933*

Improving the D-C. Set Tester
*B. J. Montyn, Radio News, pp 538, March, 1933*

Low and High Resistance Ohmmeters (Design)
*A. H. Lynch, Radio-Craft, pp 535, March, 1933*

Oscillator Circuits
*J. E. Anderson, Radio World, pp 3, January 28, 1933*

Practical Tests for Microvoltmeters
*M. Ferris, Modern Radio, pp 13, February, 1933*

Resistors for Test Meters
*Radio News, pp 554, March, 1933*

Shallcross 651 Set Tester (Construction)
*P. Shallcross, Radio-Craft, pp 534. March, 1933*

Simple Capacity Bridge
*M. O. Sharpe, Radio News, pp 552, March, 1933*

V. T. Voltmeters for Servicing
*C. H. W. Nason, Radio-Craft, pp 544, March, 1933*

## TUBES

Filamentless Tube (Cold Cathode)
*Radio-Craft, pp 528, March, 1933*

Gaseous Discharge Tubes for Radio Receiver Use
*J. F. Dreyer, Electronics, pp 40, February, 1933*

New Detectors, Rectifiers and Amplifiers
*Electronics, pp 35, February, 1933*

New-Tube Base Connection Table
*Radio Retailing, pp 43, February, 1933*

Tube Reference Index
*Radio-Craft, pp 532, March, 1933*

## MISCELLANEOUS

Electronic Musical Instrument (Construction)
*C. E. Denton, Radio-Craft, pp 522, March, 1933*

Improving Home Recording on R.C.A., G.E. and Westinghouse Sets
*H. F. Pitzer, Radio-Craft, pp 539, March, 1933*

Wavelength-Kilocycle Conversion Table
*Radio World, pp 10, February 18, 1933*

All articles listed on this page are cross-indexed for your convenience. Titles given are not necessarily the titles of the original articles, but in each case serve to determine the substance of the article. Listings marked with an asterisk (*) are abstracted in this issue. The material in each issue of SERVICE is alphabetically indexed on the Contents Page.

# IRC

# We Repeat Our Most Popular Offer


I'VE been in the service game long enough to know a good thing when I see it, and this method of testing a radio set or amplifier by means of point-to-point resistance measurement is sure the berries.

I should say that two years ago this method would not have stacked up so well with good, old voltage analysis—but with these new-fangled circuits with automatic volume control, duo-diodes and "hush 'em up" tuning, there are more resistors than you can shake a soldering iron at.

Some of these trick circuits are so constituted that it is next to impossible to make any sort of a voltage analysis that will indicate the conditions in all portions of the circuit. Therefore, it is essential to resort to the ohmmeter to get results.

More and more of the fellows are turning to the ohmmeter for carrying out all tests, and I know that some of the gang around here have gotten so proficient that they can shoot a resistance test on a receiver as rapidly as they formerly carried out a voltage test.

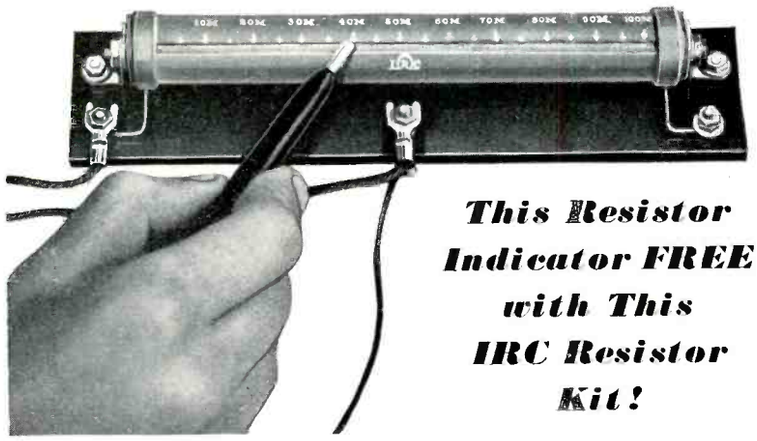
Now, if you want your resistance tests to be worth a hang, you've got to have a good ohmmeter—which means that it must be accurate not only for high values of resistance, but also the low values.

Accuracy in an ohmmeter is dependent on two factors: i.e., the accuracy of the meter used—and most good meters are accurate nowadays—and the accuracy of the resistors used in the ohmmeter to obtain varions readings. If the resistors are not accurate to begin with, or fail to maintain their accuracy over a long period of time . . . well, you might just as well test with a battery and flashlight bulb!

So many of the fellows are building their own ohmmeters that I wanted to stress this accuracy point. Accuracy is not only a matter of hitting the right value right on the nose, but also is a matter of the construction of the resistor that it may *hold* this accuracy.

To obtain and maintain accuracy, my friends at IRC go in for wire-wound resistors which are directly calibrated against standards. These resistors are made especially for ohmmeters and other measuring instruments which *must* be accurate.

Service Sam.



***This Resistor Indicator FREE with This IRC Resistor Kit!***

*(Indicator may be bought separately for $2.40)*

Once more—the biggest, most popular offer IRC has ever made! For less than the regular cost of the Resistors alone, you get: (1) The famous IRC Resistor Indicator, value $2.40; (2) Sturdy *steel* cabinet, value $2.50; (3) Resistor Replacement Guide, value $1, and (4) Color Code Chart, value 25c—$23.55 worth of service helps for only $16.50. Cabinet contains 69 IRC Resistors of most needed types which ordinarily sell for $17.40 alone.

The IRC Resistor Indicator is an indispensable service tool. No circuit information or ohmmeter necessary. Indicator instantly gives replacement value of damaged unit and is valuable for checking other Resistors as well.

Offer good for limited time only. Don't miss it! Send check or M.O. at once.

(Price higher in Canada).


*(Tools not included)*

## IRC MOTOR RADIO SUPPRESSORS


SPARK PLUG TYPE


DISTRIBUTOR TYPE


CABLE TYPE

*Helpful Booklet, "The Suppression of Motor Noises," free with each Suppressor Kit.*

1933 will be a big year for auto radio more new sets sold—more replacements. Cash in on opportunity by using IRC Suppressors on every job.

SUPPRESSOR KITS

M-4 Kit (four-cylinder cars), Four Spark Plug Resistors, one Distributor Type Resistor ..... $1.50

M-6 Kit (six-cylinder cars), Six Spark Plug Resistors, one Distributor Type Resistor ..... $2.10

M-8 Kit (eight-cylinder cars), Eight Spark Plug Resistors, one Distributor Type Resistor ..... $2.70

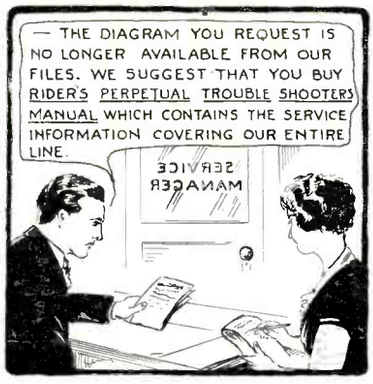
Individual Suppressors, all types 30c each.

## INTERNATIONAL RESISTANCE CO.

76 Wellington St., W.
Toronto, Ont., Canada

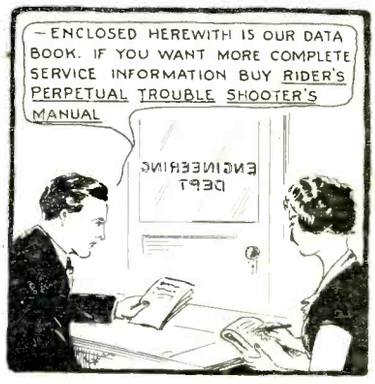
2006 Chestnut Street
Philadelphia, Pa.

# *RIDER'S* PERPETUAL TROUBLE SHOOTER'S MANUALS ARE THE STANDARD OF THE RADIO INDUSTRY




RECEIVER MANUFACTURERS


SCHOOLS




INSTRUMENT MANUFACTURERS

ALL RECOMMEND *RIDER'S* TROUBLE SHOOTER'S MANUALS

*Rider's* Volume II contains wiring diagrams and service data on old as well as new receivers. Some of the information on old sets was not available when Volume I was published. Therefore, unless you have *Rider's* Volume II, you are missing necessary information on sets which need service today—sets produced in 1927

1928

1929

1930

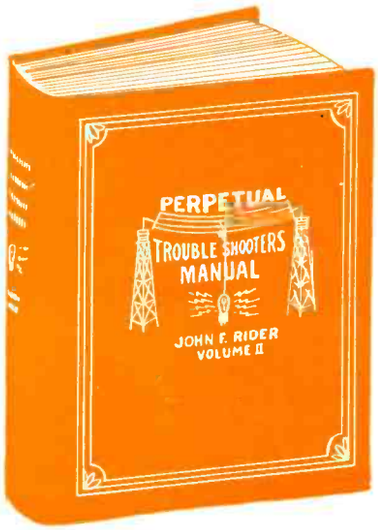
1931

SERVICE DATA ON THESE AND MANY OTHER SETS WILL BE FOUND IN VOLUME II.

Advance Electric
Atwater Kent
American Bosch
Bremer Tully
Brunswick
Bulova
Cable-Nelson
Capehart
Colonial
Columbia
Crosley
Echophone
Erla
Fada
General Electric
General Motors
Grigsby Grunow
Howard Radio
Kennedy
Montgomery Ward
Ozarka
Philco
Sears Roebuck
Silver-Marshall
Sparks Withington
Steinite
Stewart Warner
Stromberg Carlson
Sentinel
U. S. Radio & Television
Ware Mfg. Co.
Wextark Radio
Zenith

Volumes I and II are entirely different—there are no duplicating pages. More and more of the receivers shown in Volume II are coming into your shop for service. You can use this information immediately—the money you spend for Volume II will be returned many times through the service jobs which you can handle with this data.

Volume II contains many pages of wiring diagrams and service data on old as well as new sets, power packs, eliminators, auto-radio sets, chassis layouts, voltage data, electrical values, color coding, alignment data, trimmer locations, socket layouts, peak frequencies, etc. SPECIAL . . . More than 50 pages of point-to-point resistance data. List price $5.00 post paid.




*If there is no dealer near you, clip the coupon now and buy direct from us.*

**RADIO TREATISE COMPANY, INC.**
**1440 BROADWAY** **NEW YORK, N. Y.**

RADIO TREATISE COMPANY, INC.,
1440 Broadway,
New York, N. Y.

I want a copy of *RIDER'S* TROUBLE SHOOTER'S MANUAL, VOLUME II. Here is my $5.00 which will bring it to me post paid.

NAME .....

ADDRESS .....

CITY..... STATE.....

PRINTED BY
BLANCHARD PRESS
NEW YORK