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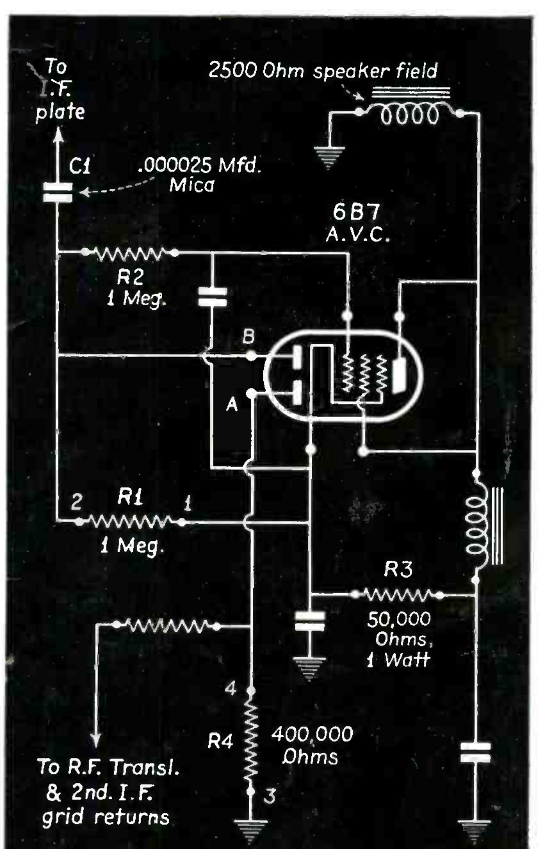

Novel 6B7 AVC Circuit

(*See page* 183)

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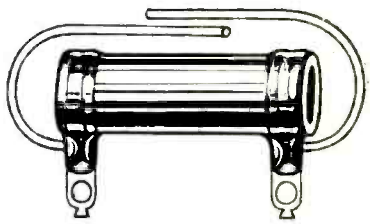

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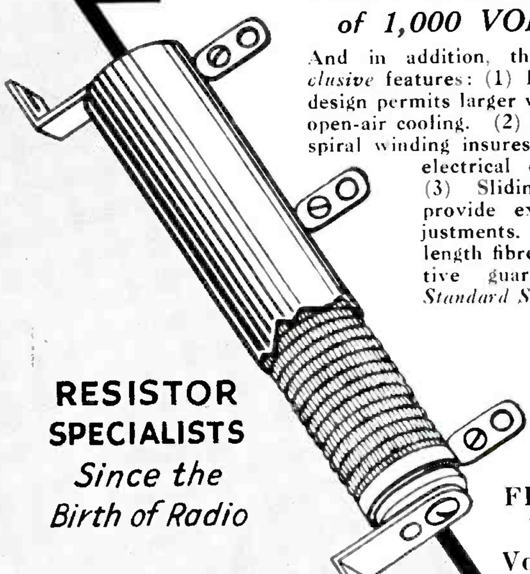

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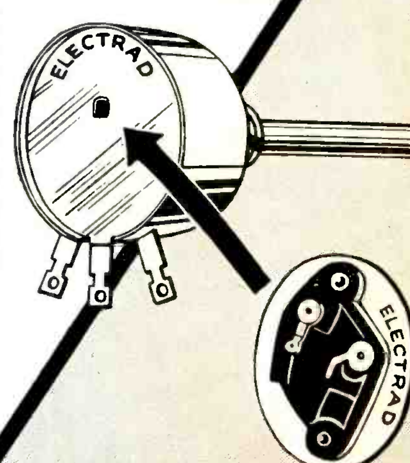

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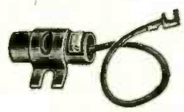

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"300"

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SERVICE

A Monthly Digest of Radio and Allied Maintenance

MAY, 1934
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EDITOR
M. L. Muhleman

ASSOCIATE EDITOR
Ray D. Rettenmeyer

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JAS. A. WALKER
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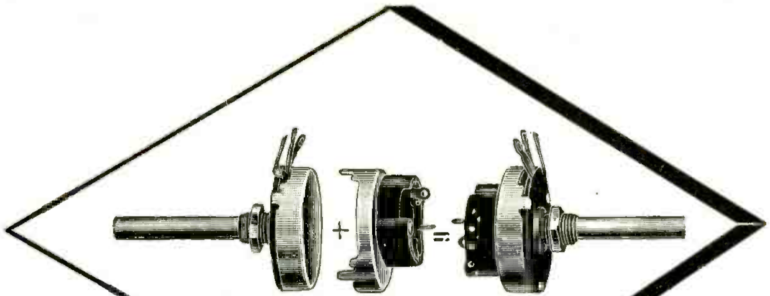
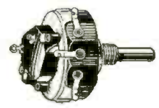
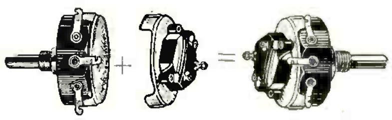
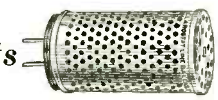
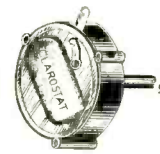
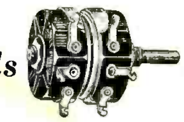
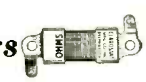


Illustrating Clarostat Ad-A-Switch Series "C"

The CLAROSTAT *line of replacement controls*  *is the most complete and dependable line available.* 477 RECEIVERS CAN BE SERVICED WITH ONLY 4 CLAROSTAT CONTROLS . *Line Ballasts*  *to limit the line voltage fluctuation for all makes of receivers permit Servicemen to make an additional profit* **$ $ $** *on every call. Tone Controls* , *Flexible Resistors* , *"T" and "L" Pads*  *for Public Address applications, Wire Wound Grid Resistors*  *—all these components, manufactured to Clarostat's rigid requirements afford Servicemen with a single, dependable source of supply.*

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"AD-A-SWITCH" was originated by Clarostat

THE ANTENNA...

SALES AND SERVICE

EVERY self-respecting Service Man who considere radio servicing a profession is justified in any attempts he may make to keep his business free and clear of rank commercialism. A Service Man is likened to a doctor, and though this simile is worn to a frazzle, it still holds good. It will continue to hold good so long as Service Men keep their business clean.

Ordinarily we would hesitate in going too deeply into this "Service Man—Doctor" likeness, but the present case seems to call for a complete understanding on the part of all just what a Service Man is, what he should and should not do, and lastly, what his future may be.

There are more obligations attached to the medical profession than there are to the profession of radio servicing. This is obvious, since a broken-down human being represents a more serious case than does a broken-down radio receiver. The doctor should provide his services free if necessary, because of the human element; a Service Man should not, because no human element is involved. The doctor should make sacrifices, the Service Man should not, for the Service Man is not a public servant.

Super-idealists have carried the likeness between doctor and Service Man too far, with the result that there are many men in the radio field who consider that their deportment should be identical with that of the doctor's and that, like the doctor, their professional pride should prevent them from selling anything beyond their normal services.

It is quite true that the average doctor does not sell medicines, crutches, artificial legs, etc. He sends his patients to the proper men who do sell these items. Even so, a doctor may often accept some form of commission on the sale of medicines and equipment, though this is not the general rule and is frowned upon by the profession. The point is, most doctors do not have to commercialize themselves in such a manner in order to produce a living income. There is enough money in doctoring alone without a medico seeking added sources of revenue.

It should—and does—cost more to service a human being than to service a radio receiver. Since a Service Man is not a public servant in the manner that a doctor is, he should look to "commercialism" for some of his profits. It is natural that he should, yet there are so many men who feel that anything dealing with merchandising is not to be considered equal in any respect to the business of servicing. This attitude is in many cases due to overzealous manufacturers and dealers who have seen in the Service Man the "perfect merchandising outlet." This has resulted in some warped viewpoints.

What a few of these men may fail to realize is that a perfect service is not rendered the customer unless an honest endeavor is made to provide everything required. As an example, if a customer makes inquiry regarding tone quality over and above that which his set is capable of producing, or indicates a healthy interest in short-wave reception, it is more or less the duty of the Service Man not only to inform the customer what can or cannot be done but also to sell and install the equipment. This is his duty for the reason that there are still a goodly number of radio stores of one sort or another that will sell anything irrespective of its worth or its adaptability to the case. In some cases, such sales are purely dishonest; in other instances they are made because of the stupidity of salesmen who have no technical understanding of radio.

If you will stop to think things over, you will realize that doctors are up against much the same proposition. It is the duty of the doctor to prevent medical quacks from selling their wares to an unsuspecting public. A Service Man cannot save a life by prescribing to a customer, but he can save a lot of grief and ill-feeling. Every worthless piece of apparatus sold, or every piece of apparatus improperly adapted, does harm to the entire radio industry. Why should not the Service Man function as the guardian at the sales gates?

We have long felt that the Service Man should serve the industry as well as his customers. We know that at the present time both manufacturers and broadcasters are more than usually interested in the Service Man as an individual who can contribute immeasurably to the creation of public good-will by functioning as an advisor, much in the same manner as does a doctor. The more advising the Service Men do, the better conditions will be, for all of us, and the better will be the Service Man's standing in the field.

Now, then, why try to be a doctor all the way? You have a living to make and there is no reason why you shouldn't sell all manner of merchandise when, as, and if it is wanted. If you cannot, or do not wish, to carry a line of merchandise yourself, why not make arrangements with a reliable local dealer so that you may function as his agent on a commission basis? Such an arrangement where you remain, so to speak, a "free-lance," precludes any possibility of the dealer forcing you to enter into high-pressure selling. At the same time it affords a source of extra profit well worth considering.

Reliable manufacturers and dealers are not trying to make supersalesmen out of Service Men. As a matter of fact, the nearer a Service Man comes to being a typical salesman, the less opportunity he has of actually selling the customer. The Service Man's selling opportunity lies in his inherent sincerity and integrity. If you have a good reputation and you tell a customer that such-and-such a product is the best, the customer will believe you, where he will not believe a salesman.

There are thousands of Service Men who make a good thing of sound merchandising. We see no reason why all Service Men shouldn't do the same.

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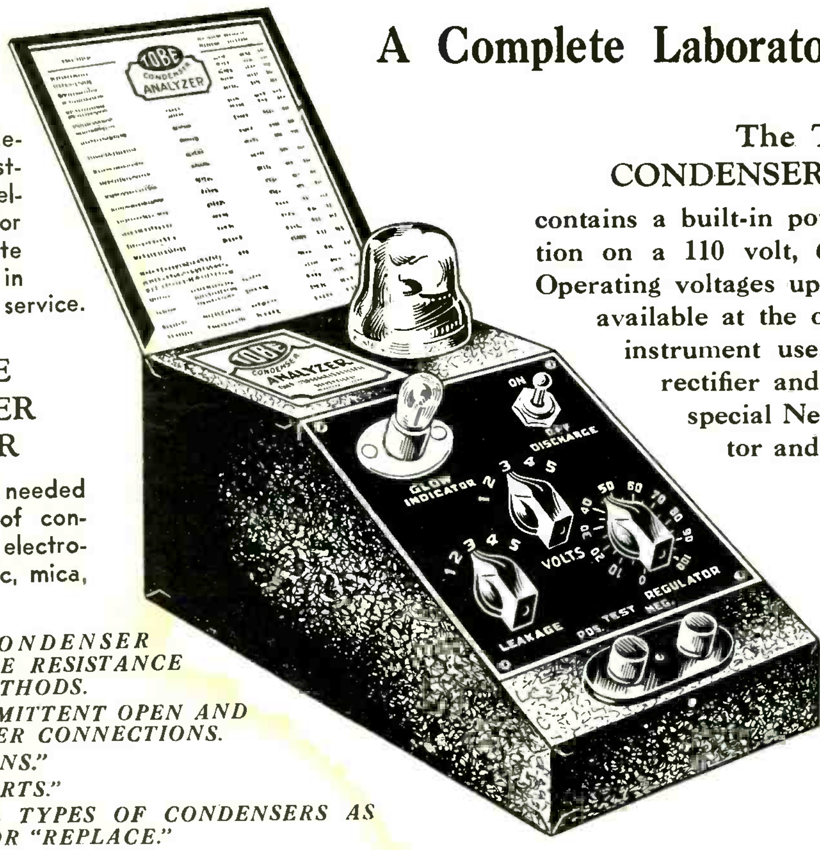

The TOBE CONDENSER ANALYZER

performs these much needed tests on all types of condensers including: electrolytic, paper dielectric, mica, and oil:

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The TOBE CONDENSER ANALYZER

is enclosed in a heavy metal case finished in attractive black Damaskene wrinkle. Size of case only 3¾" x 4½" x 7½".

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This Amplifier is a big improvement over anything ever offered before. It has 4 stages of amplification, providing a tremendous gain. Tone quality is superb even at peak output of 17.5 watts while current drain at maximum output is only 11 amp. It employs the latest tubes while "B" supply is self-contained.

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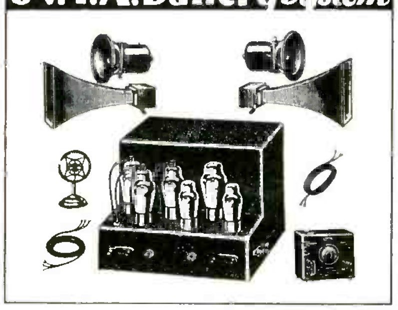
Price of Lafayette 6 V. Amplifier, less tubes $45.00

Kit of matched tubes.......................... $6.94

Complete Lafayette system for battery operation with 2 trumpets, 2 cone units, senior in-put stage, etc. as described above *including* th amplifier $129.95

6 V. P.A. Battery *System*



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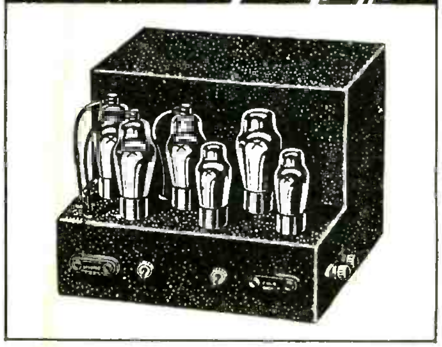

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You'll find portable AC-DC sets, portable phono-radio combinations, portable S.W. sets, Portable P.A., a whole section on Auto Radios and Accessories; Marine Radio and equipment; S.W. kits for those who wish to build during their leisure time this summer. All this in addition to an amazing array of replacement parts, sets, kits, tubes and accessories from the largest stock in the world! This great book is the last word! Our catalogs 55A, B and C have brought you the latest innovations as they have appeared. Now this new 55D brings you right up to the minute. Together they constitute an Encyclopedia of 1934 Radio Bargains . . . *at America's Lowest Wholesale Prices!*

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Send me your newest Catalog 55D.
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SERVICE

A Monthly Digest of Radio and Allied Maintenance

FOR MAY, 1934

COMMUNITY AERIALS

WITH spring here and summer not far behind, it is time for the Service Man to give thought to aerial installations. Not just the common garden variety of aerial, but the new type "community antennas" which permit a number of receivers to operate from a single wire.

Apartment-house owners have gone on a spree of cleaning up and modernizing their buildings, mainly because of increased competition in the realty field. And, if these owners are out for "prettying up" their buildings, one of the first things they ought to do is clean up the roofs which are coming more into use as spots for sun bathing and garden parties. But the average apartment roof is an eye sore in the first place, and unfit for use as a place to "sit out" because of the maze of aerial wires strung in all directions.

This is where the Service Man comes in. Such a jumble of wires can easily be replaced by a few well-strung aerials which will serve as signal feeders for every radio receiver in an apartment building—and provide far superior results in the bargain. These "community aerials" are easily installed, can be extended as a complete and permanent system for every apartment in a building, and will provide noise-free reception for the simple reason that shielded transmission lines are employed.

Available Systems

There is a large variety of "community antenna systems" available, some quite simple and others more complex. The small systems are quite satisfactory for the average size apartment building, and are also perfect for use in private homes where a number of radio receivers are in use. This is another angle of the business the Service Man should not overlook. Many people have two, three, and even four sets located in different parts of the house, such as the living room, kitchen, the "bar" or "game" room in the cellar, workshop, etc. Either separate outdoor aerials are used, which are admittedly eye sores and cause just so much more concern relative to the dangers from lightning, or the small receivers are operated from some form of indoor, makeshift aerial which provides a comparatively low signal voltage at the receiver input and thereby increases noise troubles. With all receivers coupled to a single, shielded antenna provided with the necessary coupling units, each receiver is favored by the increased signal pickup of the single antenna wire and each receiver is protected from lightning by a common lightning arrester.

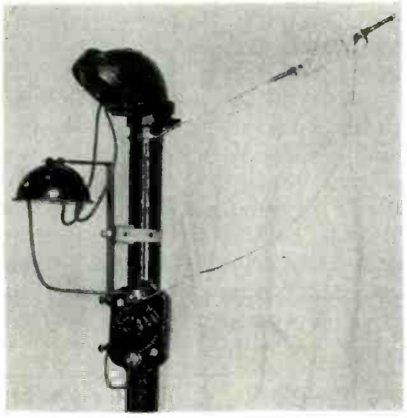


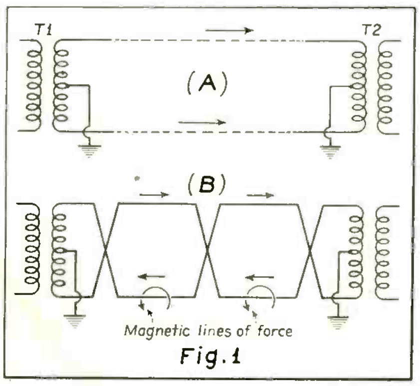
Fig. 5. The aerial lead termination, with antenna transformer, lightning arrester and conduit.

To Service Men wishing to install and service such antenna equipment, it is believed that a better understanding of the principles involved in the functioning of such aerials will be of considerable value in determining which type of system should be used to meet specific conditions. Let us first consider the good, old transmission line which is the backbone of the "noise-reducing" part of a "community aerial" system.

The Transmission Line

All antenna systems are built around the transmission line, whose function is simply to conduct the radio-frequency currents over appreciable distances with a low loss. In general, there are two types of transmission lines, namely, the balanced line[1] and the unbalanced line.[2] The balanced line consists of a twisted pair, and as its name might suggest it is balanced to ground. Referring to Fig. 1-A, it is evident that both wires of the balanced line will be effected similarly by nearby interference fields so that voltages of identical phase and magnitude will be induced in each. The directions of the voltages are indicated by the arrows, and it can be seen that they oppose each other in transformers T_1 and T_2 and hence are drained off to ground. This results in the absence of any interference voltage in the secondary of either transformer, providing, of course, that both line and transformers are perfectly balanced. Now, if some of the lines of magnetic force do pass between the two wires, a condition results in which the induced currents are in such a direction that they flow around the circuit instead of being drained off to ground. However, if the lines are transposed as shown in Fig. 1-B, it is evident that the voltages in the adjacent sections of the line are opposed so that no interference current will flow in the circuit at all. Obviously the greater the number of transpositions the better the chances of current balance becomes. Twisted wire, then, in conjunction with well-balanced trans-

[1]Service, August, 1932, pp. 198.
[2]Service, June, 1932, pp. 125, and Service, August, 1932, pp. 193.



Balanced line lead-in systems, indicating direction of current in wires.

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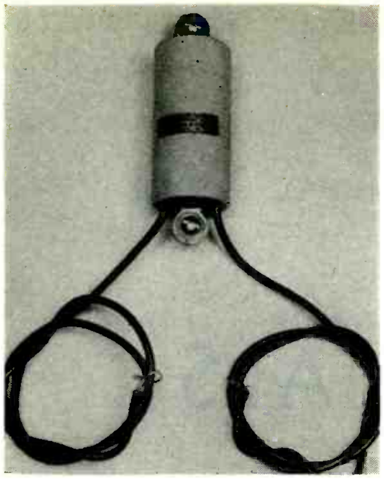


Fig. 6. One of these coupling devices is used for each receiver connected to the common aerial lead.

formers, constitutes a nearly interference-proof transmission line.

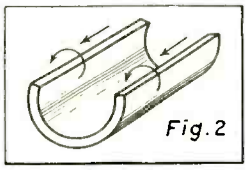
Unbalanced Lines

The unbalanced line generally takes the form of a shielded wire, or as it is sometimes called, a coaxial conductor line. In this case the interference currents are induced in the shield and are simply drained off to ground in the usual manner, and without inducing any interference current in the central conductor. If the impedance of the exposed portion of the shield to ground is zero—i. e., a perfect shield—or if the current is uniformly distributed around the outside of the shield and all points on the outer surface of the shield are equidistant from the central conductor, then it is obvious that the field due to the current in any thin strip of shield is balanced out by an equal field from a similar current diametrically opposite. Fig. 2 shows how the fields from two opposite strips of shield balance out so far as a central space is concerned.

Obviously, concentricity will not be maintained in long lengths of shielded conductor. Consequently a continuous shield is necessary which is either frequently grounded or of low resistance. However, if either a lead shield or a heavy copper braid is used, the interference pickup is nil. Therefore, as far as results are concerned, there is no choice between balanced and unbalanced lines, provided each are built with equal care.

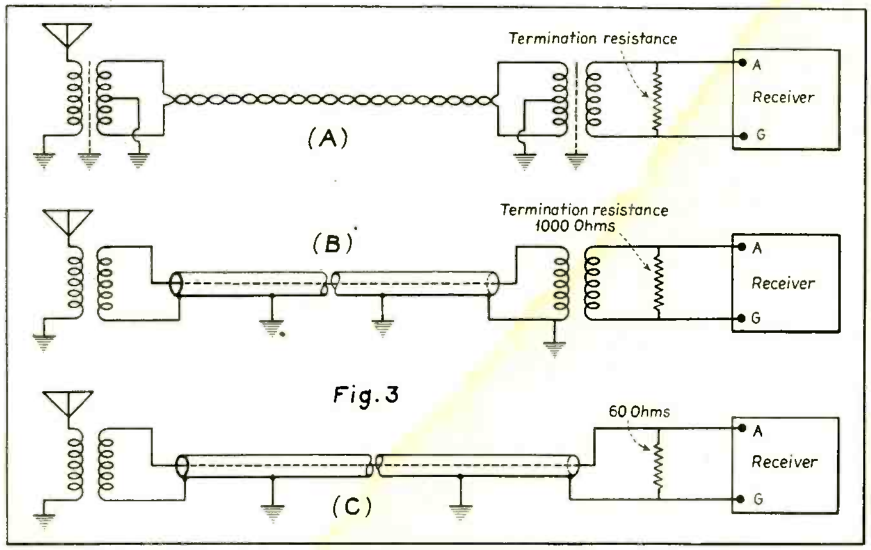
Simple System

Fig. 3 illustrates the simplest types of antenna systems. The balanced transmission line always requires a transformer at each end. Generally both transformers have static shields between primary and secondary, as may be seen from Fig. 3-A, to prevent capacity coupling which might destroy the balance of the system. Further, shields may be employed with the ordinary shielded wire line (Fig. 3-B shows a typical shielded wire line without static shields), although they are of less importance in this application. Now, the impedance ratio of the transformers are usually about 60 to 1000 ohms. Again, some manufacturers recommend connecting as many as 10 receivers to a



How the fields in a conductor shield balance out when an unbalanced line is used.

system of the type shown in Fig. 3-C. In some instances small coupling transformers are used to connect the receivers to the line, in other cases series resistances, and in other instances the receivers are connected directly across the line. All three systems should operate satisfactorily with no interaction between sets. However, if certain types of superheterodyne receivers are connected to such a system some of the oscillator voltage may be fed back into the line to be picked up by other receivers as a beat note on certain stations. Trouble of this sort will occur only when some of the older and cheaper types of supers are used. There is no remedy except the removal of the particular receiver, as any coupling impedance, either condenser or resistance, would cause too high a loss to the set under question, if any measure of relief were to be afforded the others.



Illustrating three different transmission-line arrangements which may be used for noise reducing. These types of lines are used with community aerial systems.

Signal Loss

While the systems of Fig. 3 are very simple and inexpensive, there is always some loss between receivers and antenna. For the average case, about 30 per cent of the induced antenna voltage is lost at the antenna transformers. If good transformers are used their losses are negligible. The antenna voltage is stepped down to the transmission line to about 25 per cent of its value across the transformer primary. Thus if the induced antenna voltage were 1 volt, about .7 volt would appear across the transformer primary, and .175 volt would be applied to the transmission line. About 10 per cent of this remaining voltage is lost for every 100 feet of transmission line. Now if at the end of 100 feet of the line the voltage is stepped up through a good transformer, about .6 volt would be applied to the set. If sets are applied directly across the line, of course, only 17 per cent of the induced antenna voltage will be applied to their terminals and this only when the input impedance of the sets are sufficiently high that their shunting effect is negligible. This does not represent a serious signal loss, since a change of 50 per cent in signal strength is barely noticeable to the average ear. It is evident, however, that series resistances or small capacities should not be used in series with the sets connected directly to the line. If lines of only 100 feet are used the termination resistance can usually be dispensed with, while for longer lines it should always be used. Otherwise standing waves may be set up on the line causing serious losses at certain frequencies.

Complex Systems

Obviously the only disadvantage of the simple systems so far discussed lie in the fact that regenerative sets or poorly designed supers may feed energy back into the line to cause squeals in the other connected receivers. This could be reduced if high-loss coupling elements, such as small condensers or large series resistors, were inserted in series with each set, and this can be done if sufficient amplification is inserted between the antenna and sets.

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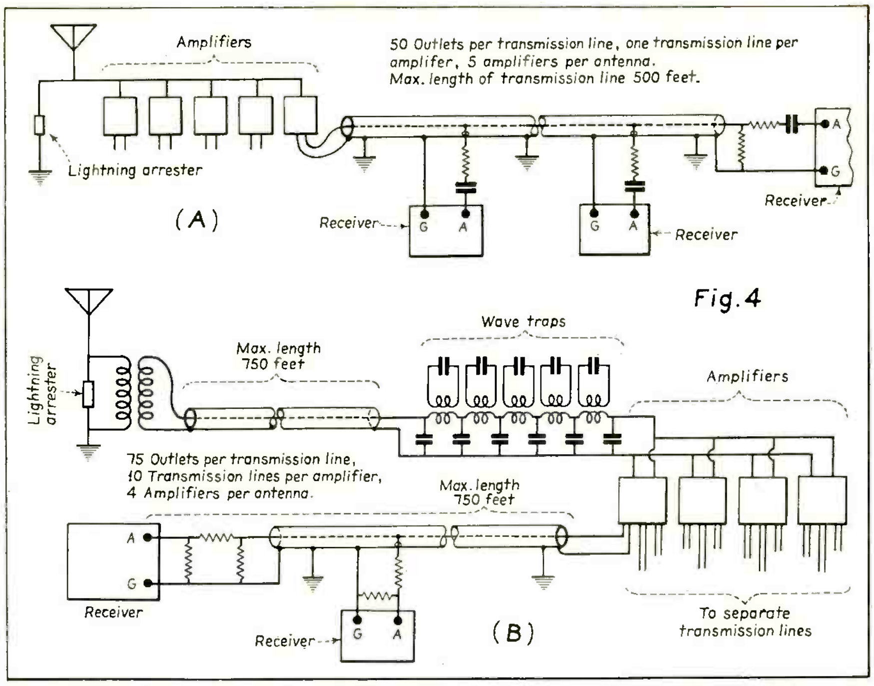
There are at least two manufacturers (RCA and W. E.) producing such systems. These are illustrated schematically in Fig. 4. In general, several hundred radio receivers may be served in this manner with little or no loss in signal from antenna to receiver and with almost complete isolation of each receiver from the others connected to the system. The RCA system of this type (Fig. 4-A) employs from one to five amplifiers located near the antenna to feed 50 receivers each, while the Western Electric system of the same type (Fig. 4-B) employs four amplifiers, each feeding 750 receivers. The amplifiers in this latter system may be connected through a 750-foot transmission line to the antenna. The essential differences of these two systems are evident from the figures, and their principal virtue lies in the fact that several hundred receivers may be served from one system.

Some of the older systems, which are more or less obsolete now, were similar to the systems illustrated in Fig. 4, except that the coupling elements were single-stage amplifiers instead of resistors. While such means of coupling are technically satisfactory, it is inherently more expensive than the systems shown. In addition, care must be taken in systems employing amplifiers to prevent overload from nearby transmitters, for such overloads may cause so-called phantom stations to be produced at the sum or difference frequencies of two strong stations, or the usual cross-modulation. Wavetraps similar to those shown in Fig. 4-B are the most effective remedy for this trouble.



Radio-frequency distribution system for very large installations. In both A and B, amplifiers are used for each set of lines. Note the wave traps in system 4-B.

Small Installations

Amy, Aceves & King and Arthur H. Lynch, Inc., have produced a system that is quite suitable for smaller installations such as small apartments and homes. This system is limited to 12 receiver outlets and may be installed either inside or outside. An antenna transformer, similar to the one shown in Fig. 5, is required with each aerial, the latter being from 40 to 75 feet in length. Also a coupling device is placed directly across the downleads, and the downleads may be run a total length of 400 feet. Such a coupling device is clearly shown in the illustration of Fig. 6. The important feature of this system is that the feeder wires may be run in armored or lead-covered cable.

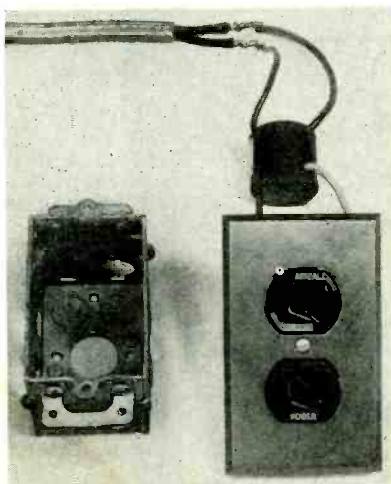


Fig. 7. A typical radio rceptacle for community aerial installations. A small coupling transformer is shown connected in the shielded cable circuit.

Outside System

These companies have, also, an outside system of particular interest that permits a total of 24 receivers. In this system each antenna consists of a single wire 50 to 75 feet in length, supported about 20 feet above the roof, a lightning arrester being installed for each aerial and mounted at the head of the downlead (Fig. 5) in accordance with the requirements of the Board of Fire Underwriters. Where the roof space is limited and it is impossible to construct an aerial 50 feet long in a straight line, satisfactory results may be had by making the aerial up into two or more sections connected at one end and fanned out at the other.

The downlead wire is supported at the top and the bottom by small strain insulators, and it is located outside the windows, allowing the shortest connection to the radio sets. This downlead is held out from the wall by means of standoff insulators, located a few inches below the coupling unit. These coupling units are required for each set.

The lead-in wire of the coupler is brought in through a hole in the window-sill, and is then run to the surface mounting receptacle through wire mold or along or in back of the baseboard. Ground connections are picked up from a water or radiator pipe and run in the same manner to the ground connection of the receptacle. For each downlead a terminal resistance (R) is required and must be connected between the end of the downlead and a good ground. This is shown in the antenna arrangements in Fig. 8. The terminal resistance is 1000 ohms and rated at 30 watts.

Conduit System

A similar description of a conduit or inside type antenna system of the same companies is thought to be of interest. The one which will be described allows a total of 20 receivers to be connected with an average antenna, the antenna being of standard copper wire located as high above the roof as possible and a lightning arrester being installed for each aerial. Two vertical risers (three different riser diagrams are shown in Fig. 8) may be connected

(*Continued on page 183*)

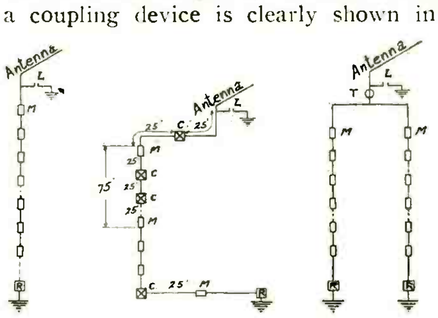


Fig. 8. Three riser connections. Other arrangements can be made, depending upon the size of the complete job.

New All-Wave Aerial

As we all know, there is at the present time a great deal of interest in all-wave receivers, and unless all indications are wrong there is likely to be a great deal more, due to the large amount of valuable information and entertainment on bands other than the broadcast band. Now, along with the advent of these multi-band receivers a great deal of difficulty was experienced with antenna systems.

Antenna Difficulties

The ordinary antenna that worked fine for the old broadcast receivers has been found to be inadequate for short-wave reception due, in part, to the greater noise pickup at the high frequencies and to the antenna length. Now the effectiveness of an antenna depends upon its length, the length determining the point at which it will be resonant. The result is that a good broadcast antenna is too long for good short-wave reception, and the usual short-wave antenna—which is not efficient on all the short-wave bands anyway—is entirely too short for satisfactory reception on the broadcast band. Hence, there is a distinct need for some type of antenna system that will be effective at a number of different points; namely, the 16, 19, 25, 31, and 49 meter bands, *as well as the broadcast band,* and while separate antennas with some sort of switching arrangement might be employed to cover these bands, the installation difficulties, the inconvenience of the switching arrangement and the cost of such a system would be prohibitive.

The "Double-Doublet"

The RCA in their World-Wide Antenna System have combined a number of antennas into one simple system. In general, this system is of the "double-doublet" type using a balanced transmission line of a length to match the doublet antenna, and the receiver matching transformer, the latter being designed to match the receiver impedance to the line, and to eliminate noise pickup on the transmission line.

It can easily be seen from Fig. 1 that the antenna is made up of four sections of different lengths, namely, 29- and 16½-foot sections. A 29-foot section will tend to tune toward the 49-meter band, the 16½-foot section will tend to tune toward the 16-meter band, and the connection of both doublets to the transmission line has a tendency to give a smooth match over the entire short-wave band. A switch is located on the receiver transformer which eliminates the primary and one side of the twisted pair when thrown to the "STD" position. Thus the antenna is converted into the conventional "flat top" or "inverted L" for broadcast reception.

A close inspection of Fig. 1 will reveal a number of interesting features concerning this antenna system. First, the 29-foot sections are horizontal, being connected to their respective supports by strain insulators, while the 16½-foot sections are placed at an angle determined by sighting along the line AD or CB. This is shown in the enlarged view of the crossover insulator, in Fig. 1, which also reveals that the 29-foot section on one side is connected to the 16½-foot section on the opposite side, the connections for the

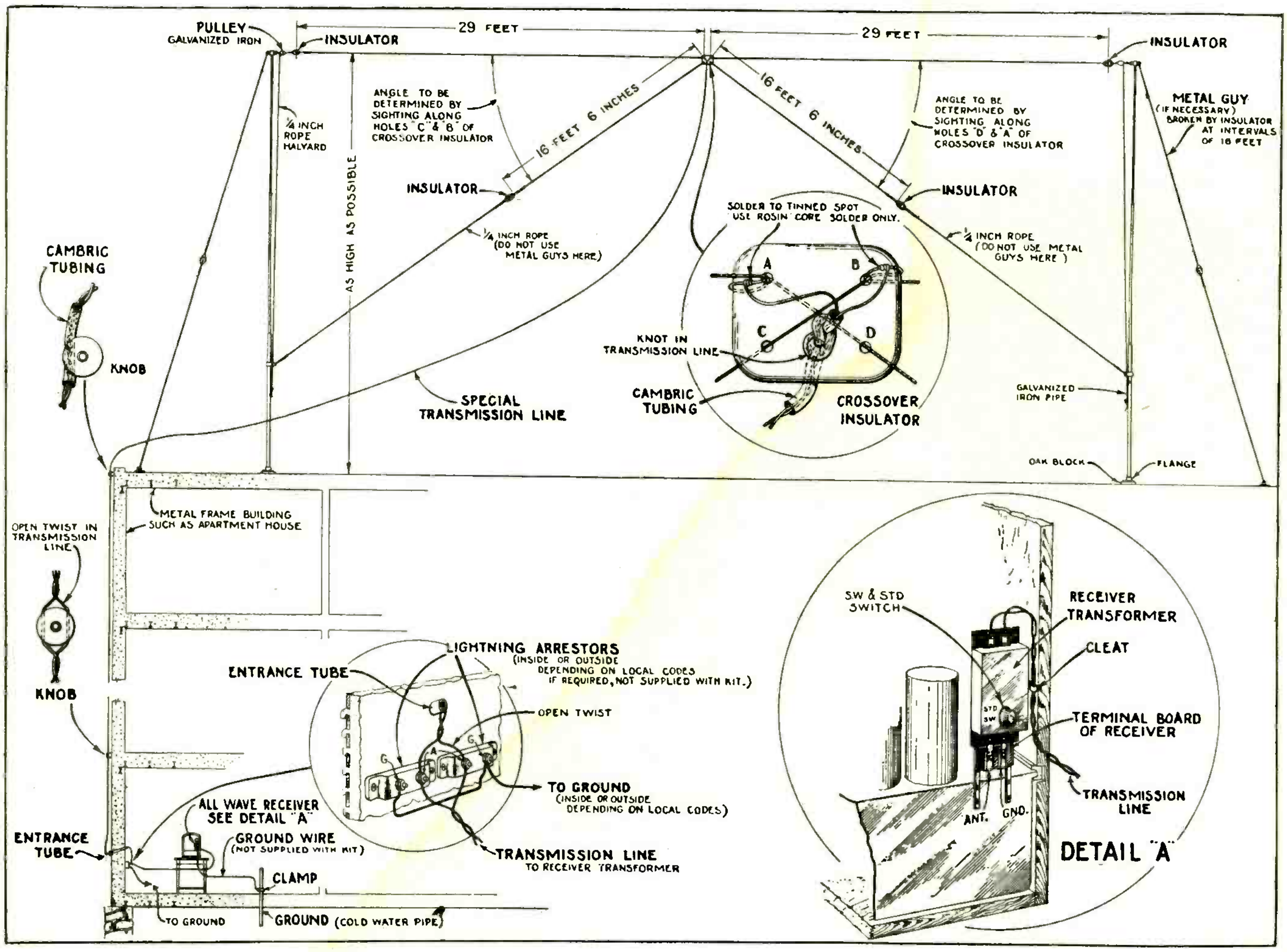


Fig. 1. Details of the RCA Victor "World-Wide Antenna System."

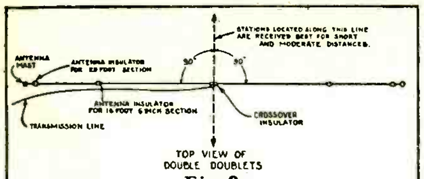


Fig.2

Indicating the correct angle between the two parts of the doublet span.

balanced transmission line being taken from the points A and B.

Direction of Span

Fig. 2 indicates the correct angle between the two parts of the doublet span; i. e., 180°. It should be kept in mind, also, that those stations that are on a line perpendicular to the span will be received best. Again, maximum reduction of interference will be obtained when the span points toward the source of the station interference. However, if it is necessary, the doublet may be placed at an angle of 90° as shown in Fig. 3, though this results in a decrease in signal of about 30 per cent. In still other cases where a 60-foot span cannot be obtained, loading coils (RCA Stock No. 6958) may be used as shown in Fig. 4 and Fig. 5. This permits the reduction of the span to approximately 34 feet, or if the space is still not sufficient, a vertical doublet may be used as illustrated in Fig. 5. A vertical doublet has the advantage of being non-directive, though it will not give as good a signal-to-noise ratio as the horizontal doublet.

Height of Span

Since the signal strength varies with the height above ground, the height of the span is another very important consideration. The height of a doublet of this type is taken as the distance from ground to the center of the span, and this distance should not be less than 30 feet. The location of the ground will depend, of course, upon where the antenna is located. For example, if the antenna is located on top of a building with a grounded metal frame, the height from ground will be the height from the top of the building; while on the other hand, if the location is on a frame dwelling the height may be taken from the actual ground.

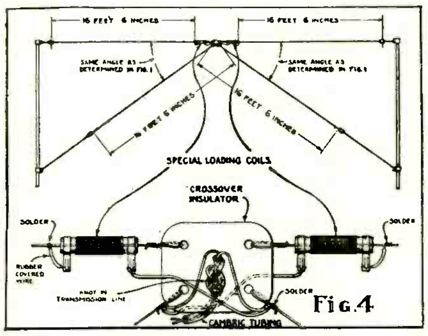


Fig.4

If the full length of the doublet cannot be used, loading coils may be connected in series, as shown.

Clearance

Further, the antenna system should be kept clear of wires, buildings, highways, electrical machinery, and the like, for two very good reasons; namely, the prevention of the possibility of shadows being cast upon the antenna, and the reduction of interference pickup on the antenna. The balanced transmission line, of course, prevents practically all of the interference liable to be picked up on the lead-in. Then, too, another aid to the avoidance of interference lies in the transmission line, as it may be up to 500 feet in length—allowing quite a bit of choice, generally, in the location of the antenna. However, the shortest length of transmission line used is 110 feet, and any remaining length is to be coiled—it must not be cut. For distances greater than this, additional lengths of line must be added in multiples up to two times. After 220 feet, however, additional lengths can be added in any desired length up to 500 feet. This is shown in the accompanying table:

Line Run to Receiver from Doublet in Feet	Line Length Used in Feet	Number of Lengths of 110 Feet	Length to be Coiled in Feet
95	110	1	15
150	220	2	70
210	220	2	10
300	300	3	No coil necessary. Cut off unused portion if desired.
500	500	5	

Matching Transformer

The matching transformer is used to couple the transmission line to the receiver, and it is so designed that it may be used as an electrostatic shield to balance out the transmission line to ground. The transformer is designed to mount directly on the antenna-ground terminal board of RCA Victor All-Wave receivers such as Models 140, 240, 120, 121, 320, and 321, giving as a result the shortest connection to the antenna and ground terminals. The installation of the transformer to a Model 140 is shown in Fig. 1, and it should be noted that the length of the ground connection of the special transformer is critical. To insure maximum noise reduction, this connection should be kept the shortest possible distance (not over one inch) from the chassis ground. On other manufacturers' receivers, having the chassis grounded, the transformer should be mounted on the side of the cabinet (by utilizing holes, spacers and screws provided) in such a manner as to permit having the transformer ground connector, when bent, slip under the ground terminal or a chassis nut. If this is not possible, make the ground connection absolutely as short as possible.

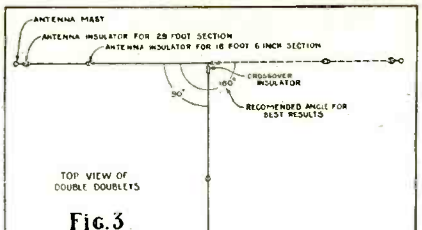


Fig.3

The doublet may be placed at an angle of 90 degrees, but this will decrease the signal about 30 per cent.

Alignment

On the RCA Victor Model 140 (All-Wave) the connection of the receiver matching transformer tends to throw the antenna circuit for band "D" out of alignment. This should be checked in the usual manner by the use of the tuning wand and realigned with the range switch at "D" and the station selector turned to the 25-meter band. If no station or oscillator signal can be used, use background noise as a basis of line-up.

It will be noticed that on most converter types of short-wave receivers, such as the RCA Victor Universal Radiola RO-23, the use of this system reduces serious cross-modulating effects from nearby code, airport, or amateur stations.

In order not to affect the receiving qualities of the antenna system, wood poles and rope guys should be used wherever possible. If guy wires are necessary, lengths of over 16 feet should be broken by insulators, one for every 16 feet.

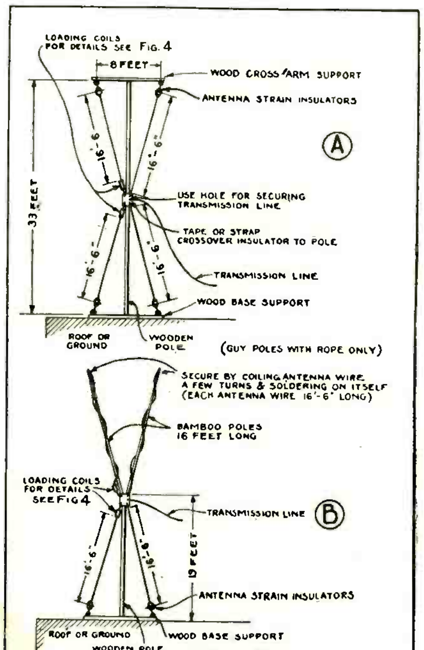


Fig. 5

(A) and (B) show vertical doublets, which are non-directional, but have less efficiency than the horizontal doublet.

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General Data . . .

Wurlitzer Model SA-133

Here is a receiver which should be given your special attention as it includes some new technical features representative of the progress being made in receiver design. For this reason, we are devoting more than the usual amount of space to a description of the functioning of the various circuit sections.

The Complete Circuit

First turn your eyes to the complete circuit of the SA-133, shown on the opposite page. All the necessary dope is given for testing and servicing right on the diagram, and applies to all receivers with serial numbers from 4,300,001 and up. The intermediate frequency employed is 175 kc.

A casual survey of the upper portion of the circuit will reveal that there is a stage of r-f using a type 58, a type 57 first detector, two 58's in i-f stages, a 56 second detector of the biased type, a stage of a-f with a 56 which is transformer coupled to a pair of 2A5's in push-pull, the 2A5's being used as pentodes.

Now start through the upper part of the circuit again, from the left, and note when you reach the first detector tube that there is a phonograph switch in its cathode circuit. When this switch is opened, the cathode circuit is broken with the result that no signal passes through the first detector as the tube is inoperative. The phonograph pickup connects in series with the grid return lead of the second detector tube and may be used when the switch in this circuit—which is in tandem with the other switch—is opened. When the switch is closed, the pickup is shorted.

The output of the second detector tube is resistance coupled to the first a-f tube. The volume control is located in the circuit between these two tubes. The tone control consists of a condenser and variable resistor in series, connected from the grid of the lower 2A5 tube to ground. The 2A5 tubes are coupled to the output transformer across which is shunted a constant impedance load network comprising a resistor and condenser in series. The two dynamic speaker fields, as well as the additional filter choke, are in the negative leg of the power supply, which employs a type 82 rectifier with r-f chokes in series with the plate leads.

The Automatic Gain Control

Now look over that portion of the complete circuit below the ground lead. The first tube is a 56, used as the oscillator. To the right of the oscillator is the type 57 automatic gain control, or "AGC" tube, which functions as a thermionic voltmeter.

The operation of the thermionic voltmeter type automatic gain control is as follows: The voltage divider is so arranged that the plate of the AGC tube and the control grids of the controlled tubes are at the same potential under no-signal conditions. In other words, the power supplies for the AGC tube and the controlled tubes are in series, with the supply for the AGC tube at the negative end.

Referring to the diagram of Fig. 1, the bias on the AGC tube is sufficiently past cut-off to allow no plate current to flow when the signal applied to the grid of this tube is less than, or equal to, the level which it is desired to maintain. Under these conditions the voltage drop across resistor D-H is zero, and the voltage between grid and cathode of the controlled tubes is equal to the initial bias provided by section C-D of the voltage divider.

When the signal applied to the grid of the AGC tube is in excess of the level which the circuit has been adjusted to maintain, this tube draws plate current through the resistor D-H, resulting in a voltage drop across this resistor (the polarity of which is indicated by plus and minus signs). It will be seen that the voltage developed across resistor D-H is in series (aiding) with the voltage developed across section C-D of the voltage divider. This increased bias on the controlled tubes results in decreased gain in the controlled stages, decreasing the signal at the grid of the AGC tube.

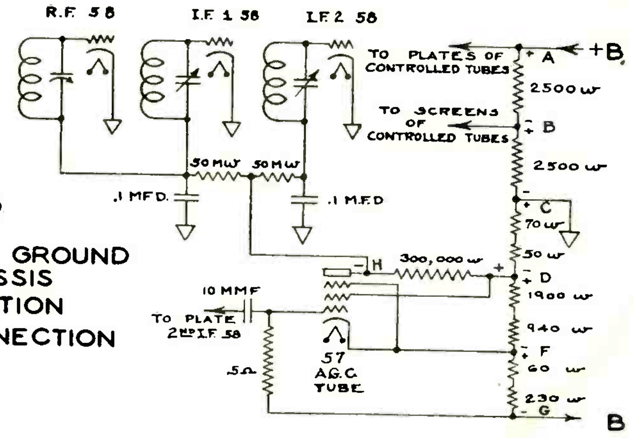
The decreased signal at the grid of the AGC tube results in a decreased drop across resistor D-H, which in turn results in increased gain in the controlled stages, thereby increasing the signal at the grid of the AGC tube.

This completes the cycle of operation which repeats itself indefinitely, oscillating about a value of d-c bias on the controlled tubes that is proportional to the strength of the received signal.

The operation of a thermionic voltmeter type AGC system is a dynamic action, and this type of AGC exercises very good control over signals whose intensities may vary between extremely wide limits.

The circuit of Fig. 1 referred to illustrates only the d-c circuits involved. Fig. 2 shows the complete control circuit, with values.

FIG. 2

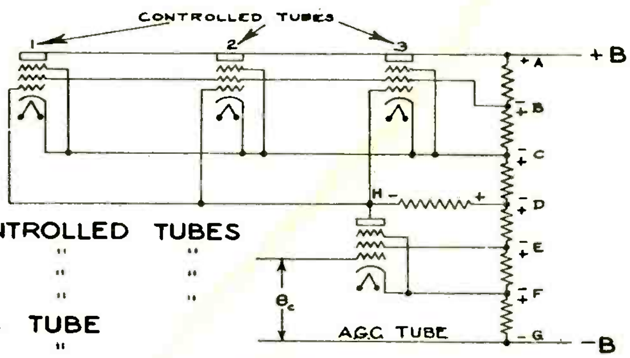


LEGEND

- INDICATES GROUND TO CHASSIS
- CONNECTION
- NO CONNECTION
- Ω MEGOHM
- MΩ KILOHM
- ω OHM

A.V.C. CIRCUITS MODEL SA-133

FIG. 1



C-A E_P CONTROLLED TUBES
C-B E_S " "
C-D E_G " "
D-H AVC E_a " "
F-D E_P AGC TUBE
F-E E_S " "
F-G E_G " "
e_c CONTROL VOLTAGE FOR AGC TUBE

FUNCTIONAL SCHEMATIC THERMIONIC VOLTMETER TYPE AUTOMATIC GAIN CONTROL (H)

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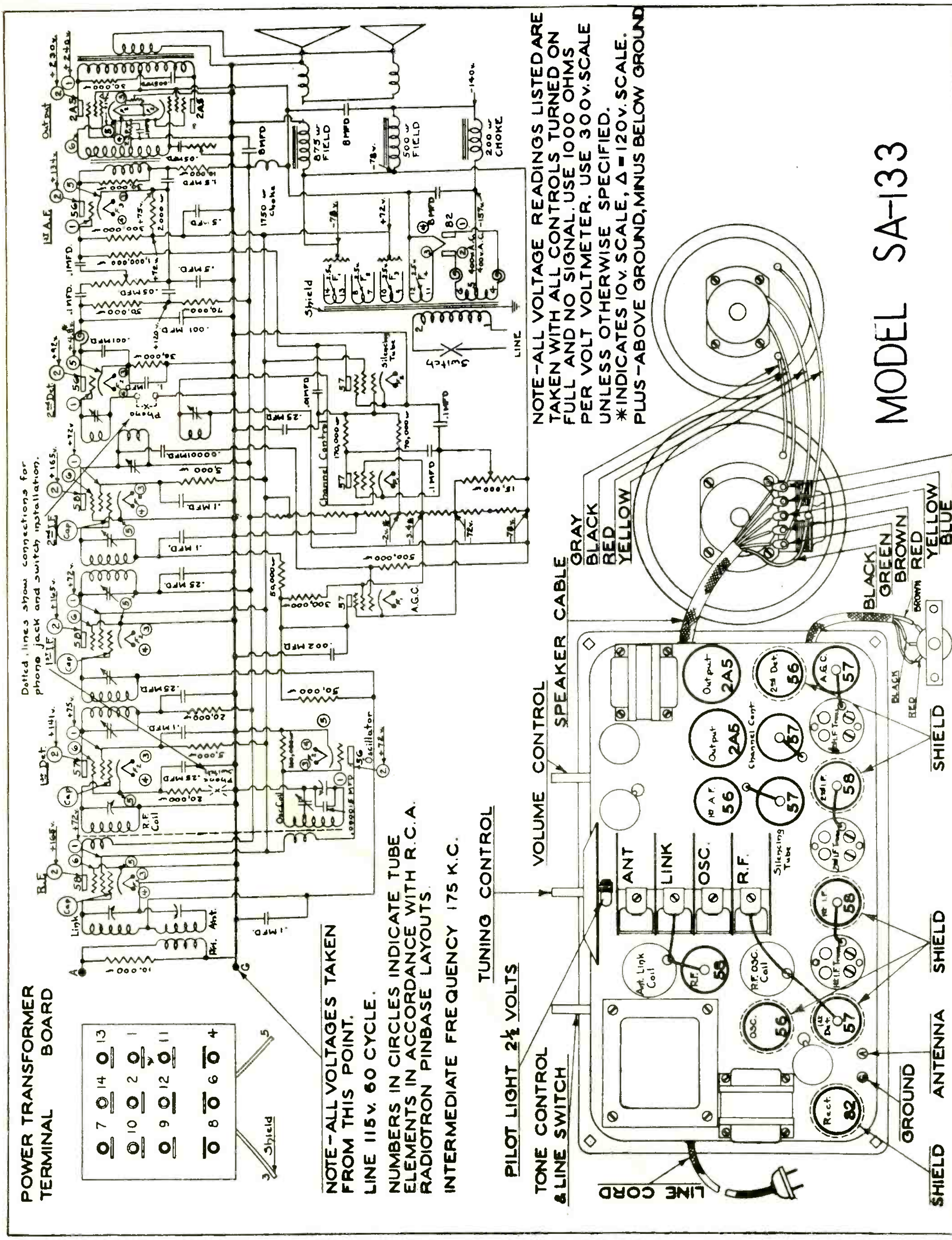


Here is the complete circuit diagram of the Wurlitzer SA-133 receiver, together with resistor, capacity and voltage values, chassis layout and speaker connections. Separate diagrams of the automatic gain control and the channel control are on pages 177, 180 and 181. These should be followed for an explanation of their functioning.

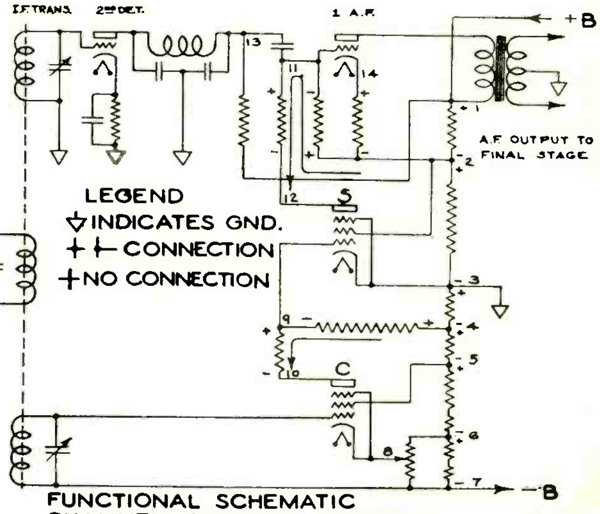
The Channel Control System

To the right of the AGC tube in the main diagram are the two type 57 tubes involved in the channel control system. The first 57 is the actual channel control tube and the second is the silencing tube which controls the type 56 tube in the first a-f stage.

The channel control system insures correct tuning, and eliminates interstation noise. This system functions to silence the audio channel under certain predetermined conditions, and to unlock the audio channel under certain other conditions.

Referring to the diagram of Fig. 4, the tubes involved in the operation of this channel control system are, a channel control tube, C, a silencing or relay tube, S, and the first a-f tube. The operation of the system is as follows:

FIG. 4



FUNCTIONAL SCHEMATIC
CHANNEL CONTROL SYSTEM

When the arm of the 15,000-ohm channel control adjustor, 8, is retarded to the negative side, there is zero bias on the channel control tube and this tube draws plate current irrespective of signal conditions in its grid circuit. This plate current through resistor 4-9 biases tube S to cut-off, resulting in normal bias on the first a-f tube. Under these conditions the channel control is inoperative, and the entire receiver functions as a conventional superheterodyne with AGC.

However, as the arm of the channel control adjustment is advanced toward the positive side, the bias on tube C increases to, and beyond, cut-off. When cut-off bias is applied to tube C and the plate current through resistor 4-9 stops, the bias on tube S returns from cut-off to normal, allowing plate current to flow in the plate circuit of tube S (through resistors 2-4 and 11-12). The current through resistor 2-4 produces a voltage in series with the normal bias developed across resistor 2-14, and these combined voltages bias the first a-f tube to cut-off, thus silencing the audio channel.

If a signal of sufficient strength is applied to the grid of tube C this tube will draw plate current, biasing tube S to cut-off and returning the audio channel to normal operating conditions. The signal strength required to perform this operation is determined by the degree past cut-off to which tube C is biased.

The signal to actuate the channel control circuits is induced in a tuned tertiary winding of the third i-f transformer so coupled to the primary that the selectivity at the grid of tube C is considerably more than the selectivity at the grid of the second detector. As a result of this greater selectivity the signal at the grid of tube C will be insufficient to unlock the audio channel unless the receiver is tuned almost exactly to the carrier. However, this extreme selectivity does not impair the high-frequency response, as the received signal does not pass through this very selective control circuit.

An interesting and important feature of this channel control circuit is, that *as the ratio of noise to signal increases it becomes more difficult for a signal to unlock the audio channel.* An explanation of this peculiar phenomenon follows.

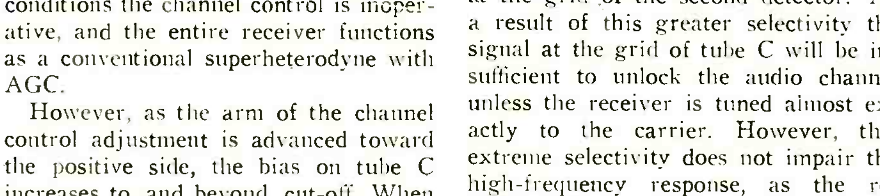
Signal-Noise Selection

Reference to the diagrams of Fig. 1 and Fig. 4 will indicate that the signals that operate both the AGC and channel control circuits are derived from the plate circuit of the second i-f tube. Any signal impressed on the grid of the AGC tube tends to reduce the sensitivity of the receiver. Any signal impressed on the grid of tube C (Fig. 4) tends to unlock the audio channel. The conductance of the AGC coupling circuit is a direct function of frequency. The conductance of the channel control coupling circuit is practically zero except at the frequency to which the i-f transformer is tuned, at which frequency the conductance is high. If a voltage of any frequency other than the i-f (such as noise) appears in the plate circuit of the second i-f stage this voltage will be transferred to the grid of the AGC tube and effect a reduction in sensitivity of the receiver. However, this voltage will *not* be transferred to the grid of the tube C owing to the frequency discrimination of the channel control coupling circuit and, therefore, will have no effect on the channel control circuit.

To sum up—only a voltage whose frequency is equal, or very nearly equal, to the frequency to which the i-f transformer is tuned will have any effect upon the channel control circuits. The AGC circuits function to maintain a constant voltage across the plate load of the 58 second i-f tube with almost no regard for the frequencies present in that voltage.

An illustration might clear up any possible misunderstanding: The AGC circuits function to maintain a constant voltage across the plate load of the second i-f tube. If this voltage is comprised of only the i-f signal, a certain voltage will be transferred to the grid of tube C. If, however, this voltage is comprised of equal parts of signal and noise, and is of the same value as in the first case, only *half as much* voltage will be impressed on the grid of tube C. If this voltage is comprised wholly of noise, the AGC circuits function to

FIG. 3



I.F. AMPLIFIER SECTION MODEL SA—133

maintain this voltage at practically the same value as if it were at i-f, but the channel control coupling circuits transfer none of this voltage to the grid of tube C, and the audio channel remains silent.

The circuit of Fig. 5 shows the channel control circuits and the values of the various elements.

Alignment Procedure

In order to insure correct operation of the receiver and of the channel control in particular, it is essential that the entire alignment procedure be performed with utmost caution in order to maintain a very high order of precision.

In view of the difficulty of correctly aligning the i-f stages, the Service Man is warned against tampering with the adjustments unless a thorough investigation definitely proves them to be in need of attention.

The difficulty in correctly aligning the i-f stages is a result of the design of the i-f transformers. In order to obtain a high degree of selectivity without sacrificing tone quality, these transformers have been designed to provide a very narrow resonance curve with an essentially flat top. This is accomplished by over-coupling these transformers enough to obtain a double peak (or double bumps) the correct distance apart. With these transformers over-coupled it is impossible to correctly align them; therefore, it is necessary to decouple each i-f transformer while it is being aligned. This is accomplished by shunting one winding with a 20,000-ohm resistor and aligning the other winding.

In the event that the i-f stages need alignment, proceed as follows:

(1) Attach output meter from plate to plate of the 2A5 tubes.

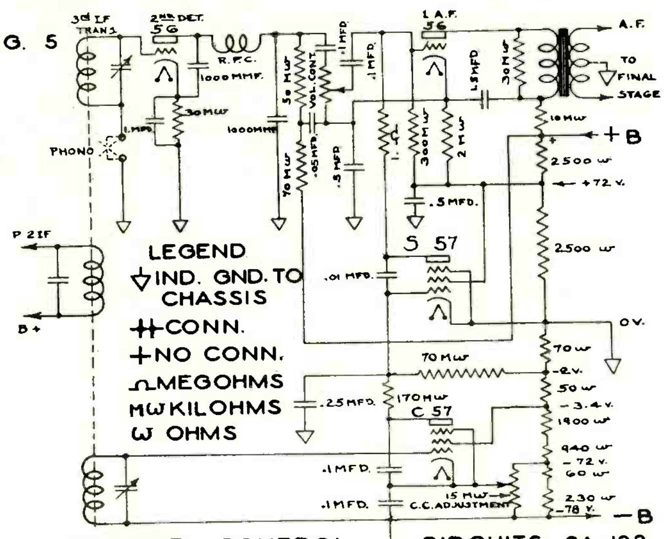
(2) Remove the silencing tube of the channel control circuit.

(3) Attach the local oscillator, tuned to exactly 175 kc, to the control grid of the first detector, using some type of coupling device that provides a d-c path to ground. *In all ganging operations use the weakest signal that will give a satisfactory indication on the output meter.*

(4) Attach a resistor across the secondary of the first i-f transformer (by inserting the leads in holes 3 and 4—See Fig. 3) and adjust screw A for *maximum* indication on the output meter.

(5) Remove the resistor from the secondary of the first i-f transformer and place it across the primary (holes 1 and 2) and adjust screw B for maximum indication on the output meter. *Leave this resistor where it is for the balance of the alignment procedure.*

FIG. 5



CHANNEL CONTROL CIRCUITS SA-133

(6) With a second resistor repeat operation 4 (holes 7 and 8, screw C).

(7) With this second resistor repeat operation 5 (holes 5 and 6, screw D).

(8) With a third resistor repeat operation 4 (holes 11 and 12, screw E).

(9) With this third resistor repeat operation 5 (holes 9 and 10, screw F).

(10) Adjust the channel control pad (screw adjusting trimmer under chassis pan near third i-f transformer (adjustable through hole in chassis pan bottom cover)) for *minimum* (dip) indication on the output meter. This dip is not very pronounced, and unless extreme care is exercised it may be passed over without being noticed. *Note:* Be sure the resistor leads make good contact when inserted in holes in transformers. For all above hole numbers and adjustor screw letters, refer to the diagram of Fig. 3.

Calibration Procedure

(1) Adjust the dial mechanism (if necessary) so that with the plates entirely enmeshed the dial will indicate 525 kc.

(2) Set the dial to the point where a station (or oscillator) of known frequency, about 600 kc, should be received and adjust the oscillator pad (screw adjustment under hole in chassis pan between oscillator section on gang condenser shields) until desired signal is heard.

(3) Set the dial to the point where a station (or oscillator) of known frequency, about 1400 kc, should be received and adjust the oscillator trimmer (screw adjustment, top of gang condenser, third from front) until the desired signal is heard.

(4) Re-check operations 2 and 3.

(5) Check the calibration at, or near, 1200 kc and correct (if necessary) by bending outer oscillator section rotor plates.

(6) Repeat operation 5 at, or near, 950 kc.

(7) Repeat operation 5 at, or near, 650 kc.

(8) A thorough re-check of the foregoing 7 operations to insure perfect calibration is recommended. If the alignment procedure to this point has been performed correctly the calibration will be accurate to within 2 kc at all points on the dial.

R-F Alignment

(1) Attach the output meter from plate to plate of the 2A5 tubes.

(2) Attach the local oscillator to the antenna and tune to set at each test frequency.

(3) At 1400 kc, adjust the antenna, link, and r-f trimmers (screw adjustments, top of gang condenser—see main diagram) for maximum indication on the output meter *using the weakest signal that will give a satisfactory indication.*

(4) At 1200 kc, bend the plates of the antenna, link and r-f rotors to give maximum indication on the output meter.

(5) Repeat operation 4 at 950 kc.

(6) Repeat operation 4 at 650 kc.

(7) Repeat operation 4 at 570 kc.

(8) Re-check operations 3 and 8 inclusive to insure perfect alignment.

(9) *Remove resistors from the i-f transformers.*

(10) Remove output meter and oscillator, attach antenna, set dial to a point where no signal is being received and turn channel control adjustment counter-clockwise just far enough to silence the static and inter-station noises.

The receiver is then ready for operation.

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THE S. W. CONVERTER MARKET

By Ellis Cohen*

AT no time within the past few years has there been such widespread interest in the reception of short-wave foreign broadcasts and the local police and airplane signals. The public has become "short-wave" conscious as evidenced by the increased sales of dual-wave and all-wave receivers.

There are about 18,000,000 radio receivers in the United States. All the owners of these receivers are not going to buy new sets, even with short-wave reception put out as an enticement, for the simple reason that there are thousands of people too well satisfied with their old sets to make any change. Yet, it is quite evident that a large percentage of the people who own these 18,000,000 receivers would like to experience the thrill of pulling in foreign stations and the ever-exciting police signals.

SHORT-WAVE SALES

It is here where the Service Man fits into the picture. He is in a position, when making a service call, to demonstrate just what a modern short-wave converter can accomplish—a converter using the new type tubes and with a satisfactory coupling system which will permit it to be used effectively with most any type of broadcast t-r-f or superheterodyne receiver.

It has already been demonstrated that many people are more inclined to purchase a short-wave converter than an all-wave receiver because the converter adds to a remarkable degree to the capabilities of old broadcast receivers to which the owners have become attached. It gives the owner something to talk about and supports his belief that "the old set is a world beater."

If the Service Man, when he completes a job of repairing a set, would simply attach a good short-wave converter and tune in on one of the short-wave bands, he can show the set owner that he is getting something that he cannot possibly get with the old set. My suggestion is that a converter should be left with the set owner for a day or two for an actual demonstration. The reception of London or Berlin will whet his appetite, and these two stations are comparatively easy to pick up.

Summer is really a very good time to sell short-wave converters, because the high frequencies are not troubled with much static and reception is quite often better than at other times of the year. Summer is also a good time to sell all-wave antenna systems, for installation is more convenient. While it is not advisable to try to sell too many things at one time, there is always the opportunity for a Service Man to call back again after a converter is sold and make a new sale of an all-wave antenna system.

AN ALL-AROUND CONVERTER

Now comes the question as to what sort of a short-wave converter the Service Man should attempt to sell. First of all, there is a better chance of a sale if the price of the converter is not too high. Fortunately, good, low-priced converters are obtainable on which the Service Man can make a good profit. These units are small and quite simple in operation.

Next in importance is the design of the converter. It should preferably be of a type which is self-powered and will operate equally as well on a-c as on d-c. With a converter of this type, all that is necessary in any case is to plug it into the line, change the aerial connection, and attach the output of the converter to the input of the broadcast receiver. Furthermore, the converter should have a switch which will permit the aerial to be changed from the converter input to the broadcast receiver input so that the installation and connection will be permanent.

The circuit of a converter of this type is shown in the accompanying diagram. This unit uses a type 37 tube as a half-wave rectifier in the power-supply, and a type 6A7 tube as first detector and oscillator. Since there is no power transformer or complicated coils and switching system, the cost of the unit is kept low. The absence of a switching system might be considered a drawback on first thought, but it must be remembered that plug-in coils are far superior, and in such a simple unit it is best to keep losses as low as possible. The consequent increase in efficiency makes the converter that much more sensitive to weak signals.

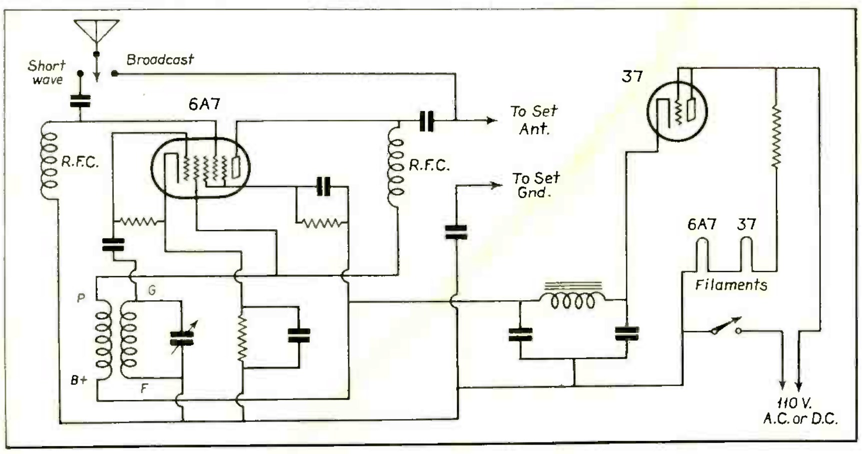
The usual inconvenience of plug-in coils is practically eliminated by the use of a fairly large capacity tuning condenser—used in conjunction with a vernier dial to make tuning easy. Only two coils are therefore necessary, one coil to cover the waveband from 20 to 60 meters and the other to cover the band from 60 to 200 meters. Since the average short-wave listener usually stays in one band for a considerable length of time, the coil changing is no real inconvenience.

EXTERNAL POWERED CONVERTER

If it is believed that there is a good market for an even cheaper converter, there is the type which obtains its heater and "B" supply directly from the power-supply in the broadcast receiver. This type is quite satisfactory providing it uses no more than one or two tubes, for in this case it places no heavy drain on the receiver power-supply unit. Most converters of this type are supplied with an adapter which may be placed over the prongs of the power tube in the broadcast set—the most logical place to pick up the voltage supply. Installation of this type of converter, therefore, is equally as simple as the self-powered type.

The writer believes that the Service Man has a real opportunity to cash in on the publicity being given short-wave radio if he will go ahead with the home demonstration idea. It's certainly worth a fling.

*Sales Manager, Insuline Corp. of America.



Circuit diagram of a simple self-powered short-wave converter which may be used with any type of broadcast receiver. Plug-in coils are used.

NOVEL 6B7 AVC CIRCUIT

(See Front Cover)

The Silvertone (Sears Roebuck) Models 1722X and 1732X twelve-tube receivers employ a novel type of AVC system entirely divorced from the second detector circuit and working directly from the output of the last i-f tube.

Referring to the circuit on the front cover, note that a 6B7 tube is used solely for automatic volume control action. A study of the diagram will show, first, that the cathode circuit of the tube includes the 50,000-ohm resistor, R-3; a choke, which in the complete circuit is in relation to the tuning flasher system; and the 2500-ohm speaker field the low end of which is grounded. For the purpose in hand all three units may be considered as a single cathode bias resistance. Second, note that the diode plate B of the 6B7 tube is connected to the plate of the i-f tube through the condenser C-1. Therefore, a certain percentage of the i-f signal voltage is impressed on diode plate B. Third, the actual AVC voltage is developed in the circuit of diode plate A, and is taken off at point 4 and fed to the controlled tubes through the resistor in series with the lead from point 4.

Operation of Circuit

Now let's get down to the actual operation of the AVC system. Again referring to the diagram on the front cover, it will be seen that if there were no plate current through the 6B7, its cathode would be negative with respect to diode plate A by the amount of the voltage drop across the 2500-ohm speaker field. However, because of the 6B7 plate current and consequent voltage drop across the 50,000-ohm resistor R-3, the cathode potential of the 6B7 is raised so that it is approximately 15 volts positive to diode plate A.

As previously pointed out, a portion of the i-f signal is fed through condenser C-1 to diode plate B. The resulting current, flowing through R-1 creates a voltage drop across it with point 1 positive with respect to point 2. This voltage is impressed through R-2 on to the control grid of the 6B7. This increased negative control grid bias decreases the plate current and the voltage drop across R-3. As a consequence the cathode bias with respect to ground decreases. This is equivalent to saying that diode plate A becomes positive with respect to the cathode. Current therefore flows from diode plate A to the cathode, creating a voltage drop across R-4 with point 3 positive with respect to point 4. Since the grid returns of the r-f, translator and second i-f stages are connected to point 4, the voltage drop across R-4 is impressed on the control grids of these tubes. This negative bias, which varies in step with the strength of the signal, controls the amplification of these tubes. An increase in signal strength is offset by a decrease in tube amplification so that the output of the i-f stage tends to remain at a constant value.

Because the cathode of the 6B7 tube is 15 volts positive with respect to diode plate A (the AVC plate) the AVC action is delayed until the received signal is strong enough to cause diode plate A to go positive with respect to the cathode. In this way the full sensitivity of the receiver is maintained for stations too weak to give full output from the receiver.

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COMMUNITY AERIALS

(Continued from page 175)

to the same antenna provided the total number of outlets does not exceed 25, unless, of course, an exceptionally good antenna is used. In this case an antenna transformer (T) is installed between the antenna and branch risers, as shown in the right diagram of Fig. 8 and also in the illustration of Fig. 5.

The wiring used with this system is enclosed in a rigid conduit and consists of two straight copper wires rubber-insulated and covered with a paraffined braid. One wire is used as the down lead feeder from the antenna, to which the couplers in that riser are connected. The end of this wire is connected through a terminal resistance to ground in the basement. A typical radio receptacle for this type of system is shown at the right in Fig. 7.

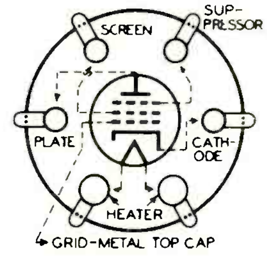
When the length of the conduit between the radio outlets, or the distance between the top of the conduit on the roof of the building and the first radio outlet, is more than 50 feet, loading coils are required. A loading coil should be installed approximately every 25 feet in series with the downlead. Also for each downlead a terminal resistance is used. This resistance is connected between the end of the downlead and a good ground.

After the installation, a continuity test of both the aerial downlead and the ground wire should indicate approximately 1000 ohms for each terminal resistance. Since the resistance of the coupler units are negligible, the resistance of the aerial to ground for a single downlead should measure around 1000 ohms. For two downleads in parallel this value should be 500 ohms.

6C6, 6D6 and 76 Tubes

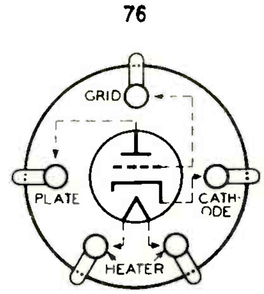
RCA Radiotron, E. T. Cunningham have released the technical data on the 6C6, 6D6 and 76 tubes. The tube symbols and bottom views of the socket connections are given herewith.

6C6 and 6D6



Since the Service Man has no particular use for the specific characteristics of tubes, such as inter-electrode capacity, etc., we believe it will suffice to state in these cases that the 6C6 is the 6.3-volt version of the 57 tube, the 6D6 the 6.3-volt version of the 58, and the 76—a particularly new tube on the horizon—the 6.3-volt version of the 56.

76



All three tubes have the usual heater current of 0.3 ampere, and are operated at the same values of plate and screen voltages as their 2.5-volt sisters.

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Philco Model 58

Model 58 is a four-tube superheterodyne receiver, very similar to Model 57. It uses the same tubes, circuit, and most of the same electrical parts as the Model 57. However, the cabinet is somewhat different, and a pilot light has been added. The illuminated dial and volume indicator are similar to those used in Model 54-C.

The center tap of the filament winding goes to B—instead of to ground. This connection (to B—) is also used on all Model 57's except the earliest production.

Also the connections on the oscillator pick-up coil have been changed from the Model 57. In the Model 58 one end of this coil goes directly to the cathode of the detector-oscillator tube, and the other end to the 8000-ohm resistor and .001-mfd condenser, the other ends of these two units being grounded.

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Knight Model W All-Wave

The diagram of this 8-tube Knight (Allied Radio) superheterodyne, with all values and voltages, is given on this page.

A type 78 tube is used as first detector and a 37 tube as oscillator. Wave changing in these circuits is accomplished by a five-position tandem switch. Separate coils are used for each waveband and one section of the tandem switch selects a colored light for each position or waveband. The lights are supplied by the same winding on the power transformer which feeds the tube heaters.

There are two i-f stages following the first detector, each stage employing a type 78 tube. These i-f tubes obtain their initial bias from the voltage drop in the 300-ohm resistors in series with the cathode circuits. The grid return circuits of the i-f tubes are connected to the automatic volume control line terminating in the output of the diode second detector.

The diode section of the type 85 tube supplies signal voltage to the triode section. The control grid of the 85 triode is biased from the same source as the control grids of the type 42 power pentodes; namely, the drop in voltage across the resistor network shunting the speaker field. Since the speaker field is in the negative leg of the power-supply system, the voltage developed is negative with respect to ground.

The volume control is in the grid circuit of the 85 triode. The tone control is in the grid circuit of the power tubes.

The i-f stages are carefully peaked at 456 kc and should not require adjustment under ordinary circumstances. However, if adjustment is found necessary, feed a 456-kc signal from a test oscillator to the grid cap of the 78 tube located at the rear end of the tuning condenser; then adjust the double trimmers in the top of the coil cans nearest this tube—also the single trimmer in the top of the coil can near the type 85 tube, to loudest volume, being sure to keep the oscillator signal at a low volume level. In trimming the frequency bands, first set the dial to the third group of figures from the right-hand end. Trim the "red" band first by adjusting the trimmers on top of the tuning condensers until a signal of the proper frequency applied to the built-in aerial is heard at its loudest. Next, trim the "orange" band by adjusting the 3-plate trimmers, located on the under side of the chassis, to loudest volume with proper signal frequency applied to the antenna. Finally, trim the "blue" band by adjusting the 2-plate trimmers located adjacent to the 3-plate trimmers, in the same manner. In trimming the various bands, be sure that the band switch is set to the proper band as indicated by the color of the dial lamp. Also, keep the oscillator signal to as low a volume level as possible for accuracy.

Phonograph Connections

If it is desired to employ the audio amplifier of the receiver for the reproduction of phonograph music, mount a single-pole toggle switch and two insulated pin jacks in the rear of the chassis near the type 85 tube socket; connect one side of the switch to one pin jack, the remaining pin jack to one outside terminal of the volume control and the remaining switch terminal to the other outside terminal of the volume control. Plug the phonograph pickup leads into the pin jacks.

Sparton "A" and "AX" Receiver Models

The Sparton receivers Models 75-A, 475-A and 478-A use the same chassis. These are all-wave receivers manufactured for the domestic market and are equipped with an inter-station noise suppressor system.

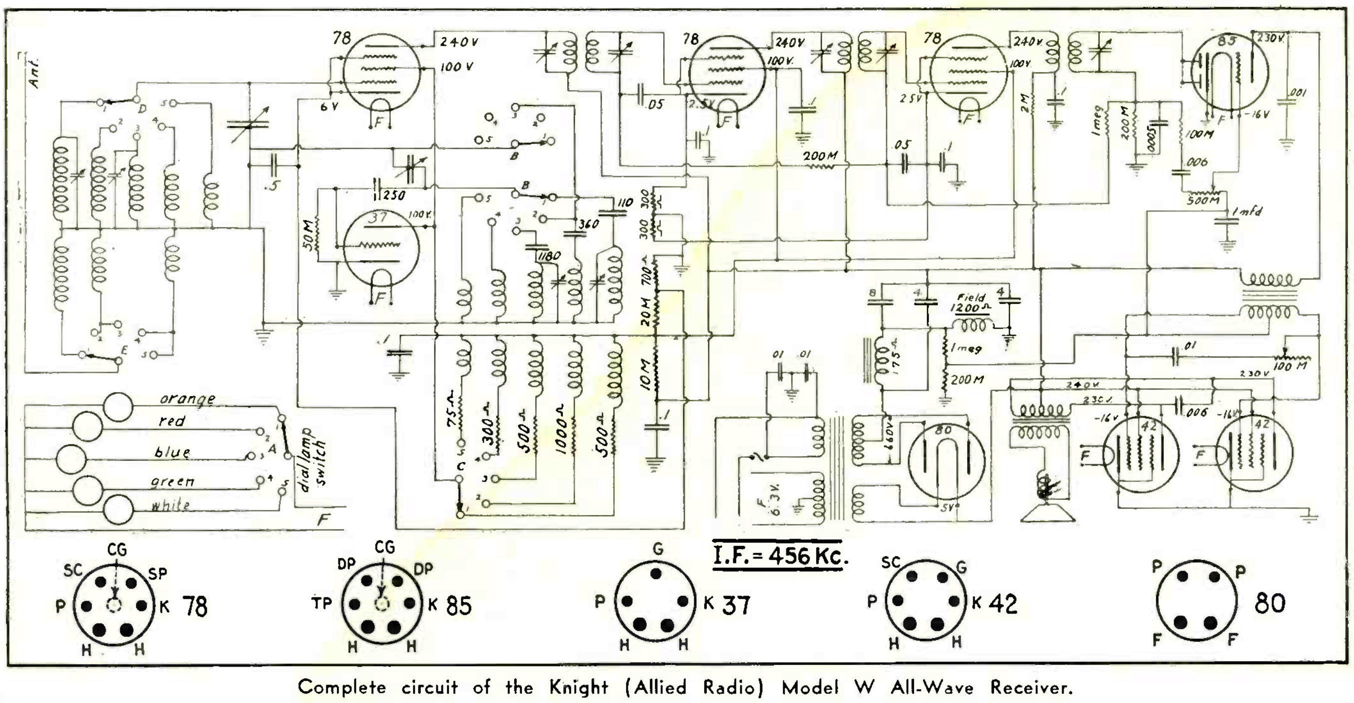
The 75-AX, 475-AX and 478-AX receivers are export models, all using the same chassis. This chassis differs from the chassis used in the "A" models in that there is no inter-station noise suppression and there is added a radio-phonograph switch and pickup jacks.

The i-f peak in all these receivers is 456 kc.

The 1C6 Tube

The 1C6 tube is of the 2-volt filament type. It is a five-grid, electron-coupled, detector-oscillator tube with a high conversion gain and was designed to displace the 1A6 in battery receivers of the all-wave type. It readily oscillates at frequencies in the upper band of 10 to 24 megacycles.

The interchanging of the 1A6 with the 1C6 is recommended only in circuits where the ballast lamp or filament series resistor can be changed to accommodate the .120-ampere filament drain of the 1C6.



Complete circuit of the Knight (Allied Radio) Model W All-Wave Receiver.

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Auto-Radio . . .

Philco Model 800

A new style i-f transformer, complete with padders, is used in the Model 800. The padders are placed in the top of the shield can one above the other.

The primary padder is adjusted by means of the screw slot, accessible through the hole in top of the shield can. The secondary padder is adjusted by means of the small hex nut, also accessible through the hole in top of the can. (See Fig. 2.)

The coil windings terminate in leads instead of terminal lugs. The plate lead is white; B plus, red; grid, black; and grid return, green.

The Circuit

A type 39 or 44 tube is used in the r-f stage. This is inductively and capacitively coupled to the 6A7 mixer-oscillator tube. There is one stage of i-f peaked at 260 kc, using a 39 or 44 tube, which feeds a type 75 diode-triode used as second detector, AVC and a-f. Resistors (32) and (33) are a part of the diode load circuit and the AVC lines leave at this point. Full control is placed on the r-f and mixer tubes, and partial control placed on the i-f tube, through the connection from the midpoint of the two resistors just referred to. The volume-control potentiometer (30) really parallels resistors (32) and (33). A connection dot should be shown where the potentiometer lead crosses the lead from resistor (28) to resistor (32). Make the change now before you forget it.

The 75 triode is resistance coupled to a 37 used as a driver for the type 79 Class B output tube. The tone control is in the plate circuit of the driver tube.

Adjustments

It is essential that adjustments be made very carefully in this receiver. A good test oscillator must be used.

Remove the speaker lid from the receiver and disconnect the antenna. Then remove the grid connection from the 6A7 tube. The location of this tube is given in Fig. 2.

Set up the oscillator and adjust it exactly to 260 kc. Connect the oscillator lead to the grid cap of the 6A7. The output meter must be connected by means of an adapter to the small prong of the speaker plug and to the chassis.

Set receiver volume control approximately full on and the attenuator on the oscillator at a point which gives a half-scale reading on the output meter.

The padders (25) and (27) are adjusted first (See Figs. 1 and 2). Turn the adjusting screw (25) all the way in. A metal screw driver can be used for this. Then, with oscillator attenuator set so there is approximately half-scale reading, adjust the nut (27) with a fibre

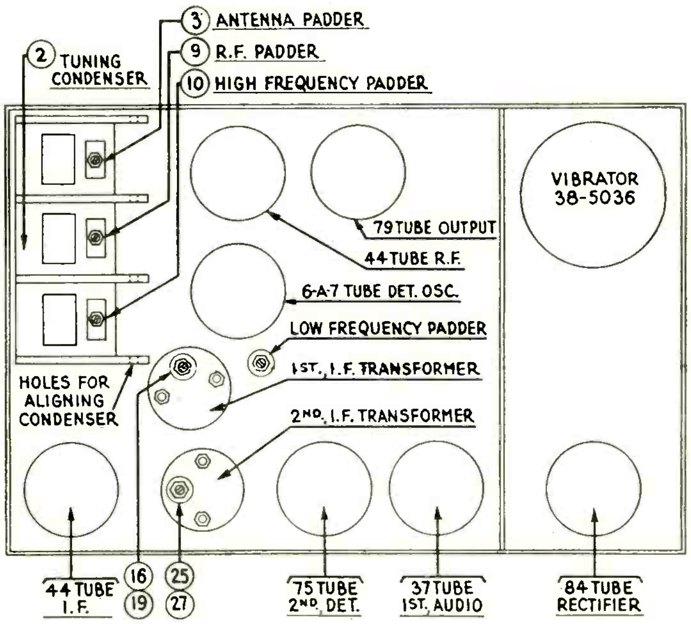
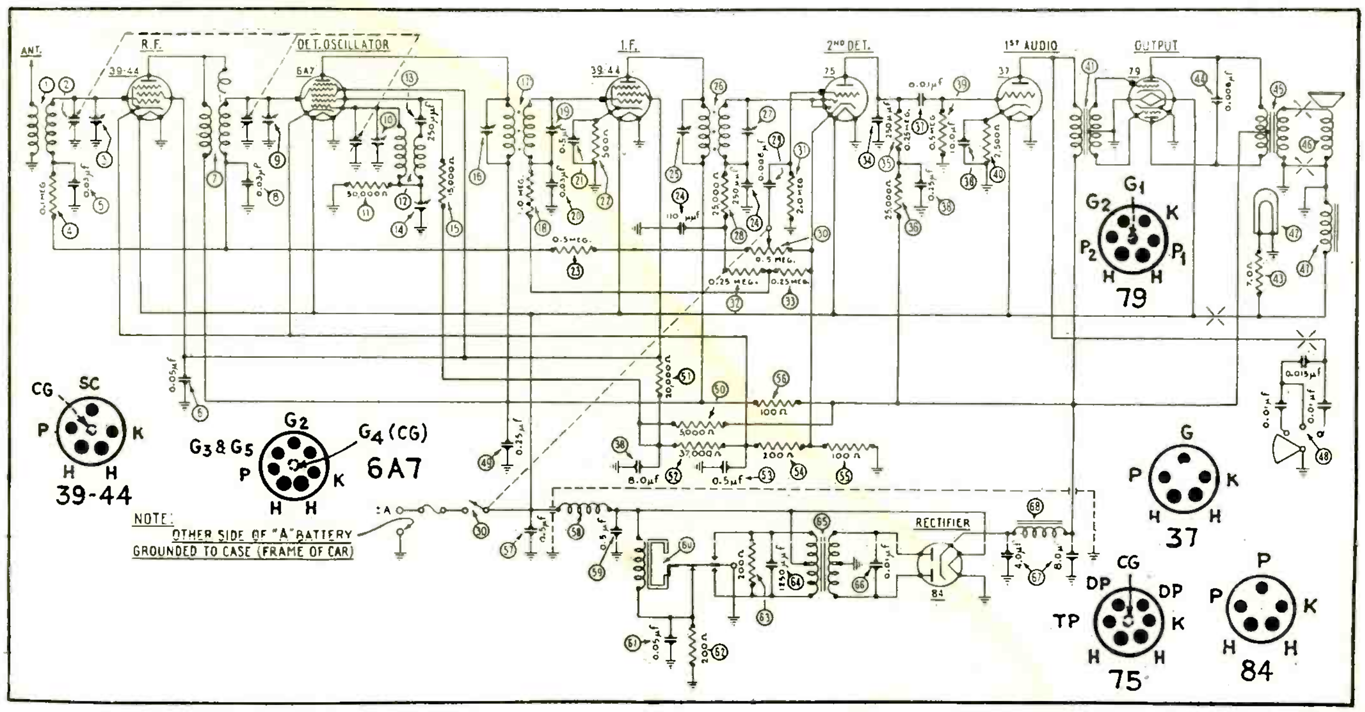


Fig 1. Below: Circuit of Philco 800 Chassis. No voltage data is available.

Fig. 2. Right: Showing location of adjustments for Philco 800.



wrench for maximum reading in output meter.

Then adjust the screw (25) for maximum reading. This adjustment is critical. Note the maximum reading obtainable and then turn the screw in again and readjust, just bringing the adjustment up to the maximum reading. *Do not pass it and then back off.*

Repeat the above procedure with the condensers (16) and (19).

After padding the first i-f stage, remove the oscillator lead from the 6A7 and put back the grid connection on this tube. Also connect the antenna lead to the receiver. Set the oscillator at 1500 kc and then connect the oscillator lead to the antenna lead.

There are four holes in line, one in each of the sections of the tuning condenser housing (See Fig. 2). Place a nail of the size that fits snugly through the holes and then turn the condenser plates out of mesh until they strike against the nail.

With the tuning condenser in this position adjust the high-frequency padder (10) until the maximum reading is obtained. This is the true setting for 1500 kc, 150 on the dial scale.

Next turn the condenser plates in mesh to 140 on the scale (1400 kc), and set the oscillator at 1400 kc. The r-f padder (9) and the antenna padder (3) are next adjusted for the maximum reading.

Turn the condenser plates in mesh to 60 on the scale (600 kc), and readjust the oscillator to this frequency. Adjust the low-frequency padder (14) for maximum reading.

AUTO-RECEIVER I-F PEAKS

Manufacturer	*Model*	*I-F Peak*
Air King Products Corp.	400, 500	175
All American Mohawk Corp.	U-50	485
All American Mohawk Corp.	U-500	456
American Television & Radio Corp.	Duo, 61	175
Arvin-Noblitt Sparks Industries	10-A	175
Arvin-Noblitt Sparks Industries	20-A, 30-A	182.5
Atwater Kent Manufacturing Co.	91, 91-B, 91-C	260
Atwater Kent Manufacturing Co.	424, 666, 816, 926, 936	264
Atwater Kent Manufacturing Co.	534	450
Atwater Kent Manufacturing Co.	636, 756, 756-B	262.5
Audiola Radio Co.	6, 7, A-6, S-6, S-7	177.5
Audiola Radio Co.	345	456
Autocrat Radio Co.	Dictator 5	456
Auto-Vox Radio Co.	75	175
Auto-Vox Radio Co.	80	262
Belmont Radio Corp.	660	175
Cadillac Motor Car Co.	06W, 072, 56V1	262
Car'uso-Laurehk Radio Mfg. Labs.	AE-79	175
Central Radio Corporation	560, 561	256
Central Radio Corporation	261	175
Crosley Radio Corporation	95, 96, 98, 99, 102, 103	181.5
Colonial Radio Corporation	150	480
Colonial Radio Corporation	106B, 164, 164B, 182, 182B	175
Delco Radio Corporation	3026	175
Dewald-Pierce Airo, Inc.	61	456
Dewald-Pierce Airo, Inc.	52	175
Electric Auto Lite Co.	062-A, 072-A, 3722	262
El Rey Radio Mfg. Co.	A, B, C,	465
Emerson Radio & Phonograph Corp.	678	172.5
Erla-Elect. Research Labs.	521	175
Erla-Elect. Research Labs.	601, 602, 5600, 6000	265
Erla-Elect. Research Labs.	4400	370
Fada Radio & Electric Corp.	101 (RK), 102, 104-B	175
Fada Radio & Electric Corp.	104	470
Franklin Radio Corp.	100, 102, 200	175
Freed Radio & Television Corp.	A-7, A-9	456
Gulbransen Company	362, V6Z2, 06-W, Z6Z1	262
Hoodwin Company, Charles	970	175
Jackson Bell Company, Ltd.	24, 205	456
Kayo Manufacturing Co.	Super 4	175
Kayo Manufacturing Co.	Super 5	262.5
Larkin Company	90, 91	175
Lyric, Rudolph Wurlitzer Mfg. Co.	A-60	485
Lyric, Rudolph Wurlitzer Mfg. Co.	460	175
Majestic-Grigsby Grunow Co.	66, 114, 116	175
Melburn Radio Mfg. Co.	40, 45, 50	465
Mission Bell Radio Co.	10-A, 19, 19-A	262
Montgomery Ward Co.	670	175
Motorola-Galvin Mfg. Co.	7-T-47-A, 61, 88	175
Motorola-Galvin Mfg. Co.	44, 55, 66, 77, 77A, 77B	456
Moto-Meter Gauge & Equipment Co.	10-A	175
Packard Radio Corp.	5, 46	470
Philco Radio & Television Corp.	5	460
Philco Radio & Television Corp.	7, 8, 12	175
Philco Radio & Television Corp.	6, 9, 10	260
RCA-Victor Company, Inc.	M30, M32, M34, M105, M116	175
Radio Chassis, Inc.	2, 5	175
Sparks Withington Company	33, 34	172.5
Stewart Radio Corporation	60	262
Stewart-Warner Corporation	R-112	456
Stromberg-Carlson Tele. Mfg. Co.	33	260
Stromberg-Carlson Tele. Mfg. Co.	(Compact Police)	175
Transformer Corporation of America	AR-100	465
United American Bosch Corporation	100, 150, 108 (Police)	175
United Motors (B O P)	2035, 4036, 4037	262
Wells-Gardner & Company	5V, 6V, 6U, 062, 6Z1, V6Z2, Z6Z4, 06-W	262
Wholesale Radio Service Co., Inc.	6-Tube Super	262
Zenith Radio Corporation	460, 461	485

—Courtesy Hygrade-Sylvania "Auto-Radio Installation and Servicing"

Majestic 66 Protection

The Majestic Model 66 auto radio must be carefully protected from moisture, or the set may become inoperative for no apparent reason. Moisture may leak in through the top of the set if the louvres in the cover point forward when the set is in position, or even when they are reversed, if the car in which the set is installed has a leaky cowl.

The moisture gets into the i-f trimmers, changing their capacity or shorting them outright; into the tuning condensers, shorting them,; and around the tube prongs, causing a peculiar, moist substance to form, which shorts out any r-f energy which may get that far. This substance is similar in appearance to the copper sulphate which forms on storage batteries, but the writer has been unable to determine its composition. It must be removed, however, the set dried in a warm place overnight, and morning will find it as good as ever.

Attention should be given this matter in the case of convertibles and older model cars having cowl ventilators.

Irving Seideman,
89-25 Parsons Blvd.,
Jamaica, L. I., N. Y.

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USING OSCILLATOR HARMONICS

THE table printed on this page is made up of the fundamental radio frequencies from 125 kc to 4500 kc and the harmonics of these frequencies through the seventh. This table may be used when it is desired to determine rapidly what fundamental frequency a test oscillator should be set at to provide a harmonic at some specific frequency not within the fundamental range of the oscillator. Or the process may be reversed: For example, suppose we wish to make an adjustment on an all-wave receiver at 9000 kc. A quick glance through the table will show that 9000 kc is the sixth harmonic of 1500 kc. Therefore, if the test oscillator is set at 1500 kc, its sixth harmonic may be used to make the receiver adjustment at 9000 kc. Now, suppose that the frequency desired is 9100 instead of 9000 kc. A glance at the table will show that 9100 kc is the seventh harmonic of 1300 kc. Therefore, if the test oscillator is set at 1300 kc, the seventh harmonic will be heard when the receiver adjustment hits 9100 kc.

CHECKING HARMONICS

If you will run through the table of figures you will find that the harmonics of some frequencies are very close to the harmonics of others. Thus, the second harmonic of 126 kc is only 2 kc away from the second harmonic of 125 kc. Also, as another example, the fourth harmonic of 2500 kc is also the fifth harmonic of 2000 kc, i. e., 10,000 kc. It is seen, therefore, that errors can be made if the oscillator is not well calibrated, or an error may be made through confusion of harmonics. The accompanying table is handy in this respect, too, as it indicates where errors could well be made.

Here is a way to check the harmonic: Suppose we wished to check an all-wave or short-wave receiver at 12,000 kc. First set the test oscillator at 2000 kc and the receiver at 4000 kc. When the receiver reaches 4000 kc the second harmonic of the test oscillator will be picked up. It would be pretty hard to go wrong on this. Now tune the receiver to 12,000 kc, at which point the sixth harmonic of the 2000-kc test oscillator signal will be heard. Now, by leaving the receiver adjustment as it is and re-setting the test oscillator to 3000 kc we can check the latter harmonic, for at the 3000-kc setting we should again hear the oscillator note because 12,000 kc is the third harmonic of 3000 as well as being the sixth harmonic of 2000 kc. A further check can be made at 4000 kc, for 12,000 kc is the third harmonic of this frequency. This procedure insures us that we were using the correct harmonic so that the test oscillator may then be set again at 2000 kc and the receiver adjustment made.

Fundamental	*Harmonics*					
Frequency	*2nd*	*3rd*	*4th*	*5th*	*6th*	*7th*
125	250	375	500	625	750	875
126	252	378	504	630	756	882
127	254	381	508	635	762	889
128	256	384	512	640	768	896
129	258	387	516	645	774	903
130	260	390	520	650	780	910
131	262	393	524	655	786	917
132	264	396	528	660	792	924
133	266	399	532	665	798	931
134	268	402	536	670	804	938
135	270	405	540	675	810	945
170	340	510	680	850	1020	1190
171	342	513	684	855	1026	1197
172	344	516	688	860	1032	1204
173	346	519	692	865	1038	1211
174	348	522	696	870	1044	1218
175	350	525	700	875	1050	1225
176	352	528	704	880	1056	1232
177	354	531	708	885	1062	1239
178	356	534	712	890	1068	1246
179	358	537	716	895	1074	1253
180	360	540	720	900	1080	1260
200	400	600	800	1000	1200	1400
220	440	660	880	1100	1320	1540
240	480	720	960	1200	1440	1680
260	520	780	1040	1300	1560	1820
261	522	783	1044	1305	1566	1827
262	524	786	1048	1310	1572	1834
263	526	789	1052	1315	1578	1841
264	528	792	1056	1320	1584	1848
265	530	795	1060	1325	1590	1855
280	560	840	1120	1400	1680	1960
320	640	960	1280	1600	1920	2240
350	700	1050	1400	1750	2100	2450
400	800	1200	1600	2000	2400	2800
450	900	1350	1800	2250	2700	3150
500	1000	1500	2000	2500	3000	3500
550	1100	1650	2200	2750	3300	3850
600	1200	1800	2400	3000	3600	4200
650	1300	1950	2600	3250	3900	4550
700	1400	2100	2800	3500	4200	4900
750	1500	2250	3000	3750	4500	5250
800	1600	2400	3200	4000	4800	5600
850	1700	2550	3400	4250	5100	5950
900	1800	2700	3600	4500	5400	6300
950	1900	2850	3800	4750	5700	6650
1000	2000	3000	4000	5000	6000	7000
1100	2200	3300	4400	5500	6600	7700
1200	2400	3600	4800	6000	7200	8400
1300	2600	3900	5200	6500	7800	9100
1400	2800	4200	5600	7000	8400	9800
1500	3000	4500	6000	7500	9000	10500
2000	4000	6000	8000	10000	12000	14000
2500	5000	7500	10000	12500	15000	17500
3000	6000	9000	12000	15000	18000	21000
3500	7000	10500	14000	17500	21000	24500
4000	8000	12000	16000	20000	24000	28000
4500	9000	13500	18000	22500	27000	31500

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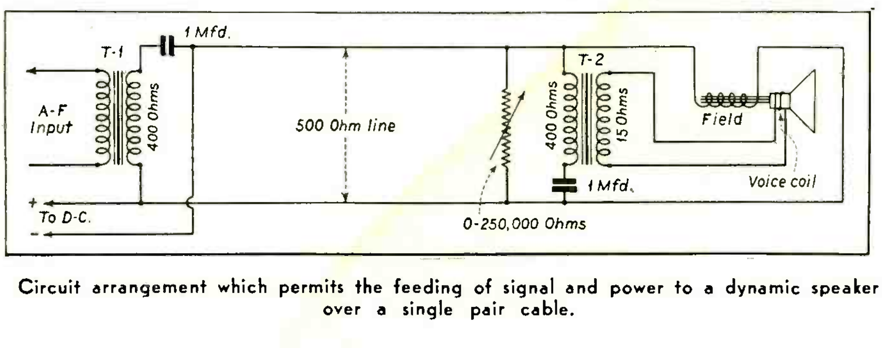
On The Job . . .

UNIVERSAL FEEDER CIRCUIT FOR DYNAMIC SPEAKERS

It is quite often found impractical to run four lines to supply the voice-coils and fields of remotely located loudspeakers. It is possible, by the use of the circuit shown, to use only two lines and send the d-c and a-c over the same line without producing interference. This is accomplished by merely putting in two 1-mfd condensers as shown, the condensers naturally not permitting the d-c to pass. Hence both the d-c field-excitation current and the a-c voice-coil current can be made to pass over the same line. Such a system is well adapted up to distances of 2000 feet, but it is necessary, of course, to take the line drop, resistance, and the like, into consideration at such distances.

In the accompanying diagram, the output-to-line transformer, T-1, has 400 ohms on the output side. The line-to-speaker transformer, T-2, has 400 ohms on the line side and 15 ohms on the speaker side. In series with both transformers are 1-mfd condensers which limit the d-c excitation to the resistor and field circuits. The resistor is variable from 0 to 250,000 ohms and is across a 500-ohm line. This resistor naturally gives any value to the field excitation current that may be desired, with a similar effect upon the amount of a-c flowing through T-2. Other values may be substituted when necessary or desirable.

Bernard Ephraim,
Represa, Calif.



Circuit arrangement which permits the feeding of signal and power to a dynamic speaker over a single pair cable.

Testing Rectifier Tubes

It is an advisable precaution, when testing a customer's tubes, to pay somewhat more than normal attention to the rectifier tube, for failure of the rectifier tube can, and sometimes does, cause damage to the set. After testing the rectifier for plate current, it is well to inspect the stem to determine whether any marked amount of electrolysis has taken place.

Electrolysis

Electrolysis is defined as the chemical decomposition of a substance due to an electric current. Through the glass stem tubing of the rectifier tube pass the plate and filament leads. The spacing between these leads is relatively small; the stem temperature during operation is high and the potential difference existing between the leads is large. All three of the above conditions cause electrolysis to a greater or less degree.

This electrolysis manifests itself as a black growth on the plate lead, or leads, in a rectifier where these leads pass through the glass stem. This black growth is evidence of a decomposition of the glass in the stem and when it has progressed sufficiently far, an arc may occur between the plate and the filament, or it may impair the stem to such an extent that air is admitted to the tube through a microscopic leak. If an arc occurs between the plate and the filament, and the radio set is unprotected by a fuse, there is quite a possibility that the power transformer will be burned out. It is for this reason that one should, when testing tubes, pay particular attention to the rectifier and see that the tube is replaced before electrolysis has progressed to such a point that it may soon damage the receiver.

Degree of Deposit

As stated above, the evidence of electrolysis is found in the black growth surrounding the plate lead. Inspection of a new tube will reveal that, while the surface of the glass stem may be blackened to some extent, still, the point where the lead wires go through the glass stem will usually be clear, or at least, milky in appearance. Inspection of a rectifier tube, which has been used for 1000 hours, or so, in a radio receiver, will readily reveal that surrounding the plate lead wires in the stem is a black deposit. It is impossible to lay down a hard and fast rule as to just how large this deposit may safely be before the tube should be thrown away, but the degree of blackening permissible should probably not be greater than the diameter of the lead wire.

Airline No. 62-20

When an Airline No. 62-20 seven-tube superheterodyne receiver was turned on, with the manual volume control turned to the lowest position, any station came in with full volume for a minute or so, and since the set was used in a hotel it became quite bothersome. Since the manual volume control affects the control grid of the AVC tube, the trouble was remedied by putting in a quicker heating 24-A (AVC) tube.

Realigning Supers

In realigning superheterodynes at the high frequency end of the dial (around 1400 kc), which use one stage or one tube as AVC and 2nd detector, or for that matter whatever the combination may be, always keep the signal from the external oscillator very low in order to keep below the AVC action in the set. A much sharper and more accurate peak can be obtained in this way.

Chevrolet Motor Car Sets

I have had about 18 Chevrolet car sets, Model 364441 (United Motors), in which the vibrator failed. Most of these were in use around 4 months.

To correct, remove chassis and then remove vibrator points. Use a thin carborundum stone to dress up the points, and adjust them very close to the center points.

J. M. Osenton,
Osenton's Radio Service,

Peerless 65 and K-65

Peerless Courier 65 and K-65 (United Reproducers Corp.). Trouble with plate bypass condensers. They should be replaced with 400-volt, 0.1-mfd condensers.

Recently increased the volume of a number of these sets by shorting out the portion of the voltage divider between r-f plate lead (red) and first a-f plate lead (yellow), then changing first a-f bias resistor to 1500 ohms, and detector bias resistor to 25,000 ohms.

S. F. Pusey,
Madera, Pa.

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Public Address . . .

"PUBLIC-ADDRESS" FOR THE SERVICE MAN

• The second of a series of three articles on the sale, rental and use of public-address equipment. The present article deals with outdoor equipment of the mobile type and includes the technical data on a storage-battery-operated job with 15 watts output.

By Frank Lester*

IN the outdoor public-address field more than in the indoor field, aggressiveness is a prime requisite. The wise Service Man with an eye for business will read his local newspaper and the newspapers of surrounding towns very carefully, and will clip out all items referring to carnivals, circuses, American Legion gatherings, fairs, auto races, organization picnics or outings, church festivals, swimming meets, beauty and baby parades, and even outdoor weddings. The two theatrical magazines, "Variety" and "The Billboard," copies of which can be picked up at most railroad stations, should also be consulted. If you expect to sell or rent P-A outfits for outdoor work, you've got to know who and where your prospective customers are.

Many traveling road shows carry their own P-A stuff, so perhaps it is best to stick to your own territory. Write, telephone or visit the commander of the Legion post, or the chairman of the entertainment committee of the fraternal lodge, or the promoter of the auto race or parade, as far in advance of the date of the affair as possible, and tell him what you have to offer. A P-A system invariably makes a big hit at affairs of this kind, as the neighborhood clown gets a chance to perform, the community Lily Pons does a little yodeling, the local politician does a little electioneering, and everybody has a good time.

Rental Business

Of course, the possibility of *selling* P-A units for work of this kind is pretty remote. The "gravy" is renting them for the occasion at a lump sum. Fees of $10 to $25 per day are pretty easy to get, as this money represents only a small part of the total cost of most outdoor shows of various kinds. Figuring a complete outfit to cost about $150 (including amplifier, mike, controls, two speakers and phonograph turntable), a live-wire Service Man should be able to clear the entire investment between May and October, and from then on all income, less comparatively small deductions for maintenance, is pure profit. There is no reason why the sales effort should be relaxed even during the winter, for ice skating contests are highly popular in many sections of the country and draw large crowds.

Portable P-A Outfits

When I speak of "portable P-A outfits," I refer exclusively to 6-volt storage-battery-operated units. Formerly the orphans of the sound business, portable amplifiers have today reached a rather high degree of perfection, thanks to the introduction of versatile, low-drain tubes, the development of high-gain, high-power, Class "B" circuits and the availability of economical high-voltage dynamotors. Rack and panel amplifiers and tons of expensive "B" batteries, once required for the purpose, are no longer needed for outdoor service. A 15-watt amplifier, *with self-contained plate generator,* can now be obtained in the form of a single unit so small it can be hung under the dashboard of a light passenger car! And if you don't think 15 watts of audio signal is a lot of signal, you should be near the speakers with the gain control all the way up!

With compact, efficient amplifiers of this kind, the problem of transportation presents no difficulties at all. A complete P-A outfit can be loaded into most any coach, sedan or touring car, or even a rented horse-drawn wagon, if the Service Man has no car of his own. Of course, it is important to have a husky, fully-charged battery at the start of a day's work; some men even carry a spare. If the regular car battery is of respectable size, there is no reason why it cannot be used, as the total current drain of the typical amplifier mentioned is only about 11 amperes.

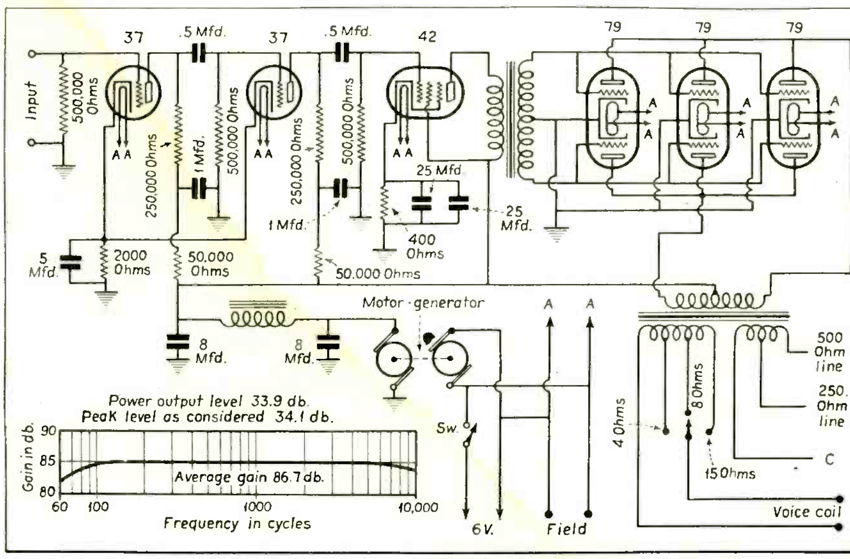
As batteries are pretty cheap, it is a good idea to have a separate 120-hour unit for the amplifier, and the car battery can then be used in a pinch if the amplifier must be operated for more than a whole day. This is not likely, but it pays to be prepared.

Precautions

If you get the P-A job for a picnic or any other outdoor affair, be sure to look the grounds over before you drag out any equipment. In some cases, it is possible to leave all the apparatus in the car, parked near the speaker's stand or headquarter's tent, and to run the mike and speaker wires out from it. Some protection for the amplifier and its accessories must be provided, otherwise it will disappear piece by piece in the hands of souvenir collectors. Keep an especially wary eye on the microphone, as this is a great attraction for people who have never before seen one close up.

For a crowd of several hundred people, one or two speakers is sufficient.

(*Continued on page* 192)



Circuit and frequency curve of a storage-battery-operated Class B amplifier.

*Engineer, Wholesale Radio Service Co., Inc.

HIGHLIGHTS...

Service-Man's Notebook

Who can move these days without realizing that 1934 has reached the spring of its life and is budding profusely on all sides? We noticed it recently, and decided on the spot that since everything else seemed to be filled with new life—including business—that SERVICE should be touched by the fingers of spring, too. So —we finally decided to start a new department, the idea for which has been fermenting in the cask of our brain ever since repeal.

Well, the new department is here, and we've named it the "Service-Man's Notebook."

For the present at least this new department will be confined to a single page, and will include only such items as tables, graphs and calculations which we believe of special value to the Service Man. We have a number of items lined up for forthcoming issues, but are plenty open to suggestions. Maybe you have something in mind which you would wish to have tabulated, graphed or otherwise fingerprinted for quick survey. Something like a wavelength-frequency chart, or a graph for the quick calculation of the value of resistors in parallel. Or what?

If you don't let us know what you want, we'll go our own way and may end up by running dope on how to make your own wine—which wouldn't be so bad, but a bit out of place.

Rider Manual Volume IV

Another addition has been made to the Rider's Manual series. Volume IV made its appearance during the last week in March.

Volume IV picks up where Volume III left off. From reports furnished by the publisher, the new Rider Manual includes schematics and service data covering radio receivers issued as late as February, 1934.

The complete manual, inclusive of a Special Section, totals about 1060 pages. Of special interest is a section of about 24 pages which is devoted to explanations of the path of the signal currents found in some of the highly complicated receivers listed in Volume IV. No doubt Rider realized the need for explanations covering the operation of some of these special circuits. Some of the items mentioned in this Special Section to Volume IV are: Automatic sensitivity control; automatic tone control; delayed AVC; duo-diodes, triodes and pentodes; phase changer tubes; QAVC; reflexed pentodes; various flasher systems, etc.

The index accompanying Volume IV is also unique. It is a separate printed volume of about 40 pages. (In time to come the index will be as voluminous as the manuals themselves!) Of particular interest is the fact that this index covers all of the Rider Manuals ever issued, inclusive of the early Volumes I and II sold by the publisher and also distributed by National Union in connection with tube deals, and also the RCA Radiotron-Cunningham "Combination Rider Manual," which contained Volumes I, II and III.

The revised Volumes I and II and all of the Volumes III and IV sold by the publisher or disposed of by some of the tube companies in connection with tube deals are indexed in this single complete index.

As is to be expected, Rider made every effort to present the most complete picture and there are about 135 manufacturers and trade names listed in Volume IV. The addition of this volume to the previously issued Volumes I, II and III makes a total of about 4,000 pages in Rider's Manual.

Sylvania Auto-Radio Book

Hygrade Sylvania Corporation, Emporium, Pa., have on the presses the new "Auto-Radio Installation and Servicing" manual—and by the time you read this it will probably be ready for distribution.

We have before us as we write the complete page proofs of this manual, and it is undoubtedly the best and most complete compilation of auto-radio data we have so far run across.

The book opens with a number of pages on general engineering information on the calculation of resistor and condenser values. These pages are followed by installation notes on receivers and antennas, with antenna top construction data, and a lengthy treatise on the suppression of ignition interference.

The long chapter on service hints should prove of great value. The hints refer to makes of receivers and the listing is alphabetical. This is followed by further hints listed alphabetically by makes of cars. More hints are given under special headings, such as installation, interference suppressors, power-supply units, tubes and parts, and tube requirements for all makes of receivers. A table is also included, showing which auto-radio tubes are interchangeable.

In the back of the book are tables listing the characteristics of all Sylvania auto-radio tubes, and their base connections.

A copy of this book may be obtained free of charge by writing to Hygrade Sylvania. It's well worth having.

Short Wave Handbook

Standard Publications, Inc., 1123 Broadway, New York, N. Y. (the publishers of the excellent magazine, "Short Wave Radio") have brought out the "Short Wave Radio Handbook," by Clifford E. Denton. There are 122 actual pages of text and tables, and one of the nice things about the book is that there is no introductory section telling how a magnet works and showing you a picture of the thing to convince you of the fact.

The book is primarily intended for the short-wave experimenter who likes to roll his own, but there is so much data on tube applications, coil winding data, simple formulas, etc., that it should also appeal to the Service Man.

The book also contains constructional data on short-wave t-r-f and superheterodyne receivers, converters, super-regenerative receivers, single-signal sets, power-supply units, an i-f oscillator, short-wave oscillators, etc.

$1 for March SERVICE

Copies of SERVICE prior to December, 1934, are scarcer than hen's teeth. Mr. H. A. Shannon, of Shannon Radio Service, Mount Vernon, New York, is a nervous wreck from trying to hunt down a copy of the March, 1932, issue. Now he gives up, and will be glad to pay anyone a dollar for one of these copies.

Who wants to make a dollar? Well, write Mr. Shannon.

"Unit-Matched" P-A.

The Operadio Manufacturing Co., St. Charles, Ill., subscribe to the old belief that when you buy a new suit, by rights the pants ought to match the coat and the vest. We think so too . . . that is, if you're not an Englishman.

With this logical premise in hand, they also figured that if a fellow is going to buy public-address equipment, by rights all the units ought to match up if the thing is to work the way it should.

Thereupon they worked out various types of amplifiers, microphones, pickups, control units and speakers which, when used with the right units will work at maximum efficiency. Thus, no headaches or dissatisfied customers.

Operadio has a bulletin on this new idea, titled "A Sound Argument." Copies may be had free upon request.

New Cornell-Dubilier Catalog

Cornell-Dubilier Corporation, 4377 Bronx Boulevard, New York, have just issued Catalog No. 125 which is available to the trade free of charge. This catalog is especially for the Service Man and is replete with information regarding the most common and popular types of electrolytic, paper and mica condensers used in all types of radio receivers, auto-radios, a-c, d-c midgets, large consoles and all-wave sets.

New Kenyon Catalog

Kenyon Transformer Co., Inc., has just released their new Spring catalog.

It is somewhat changed in form from earlier issues, as it appears in two parts. The Laboratory Standard, the Portable, the Transmitting, and the All-Purpose lines appear in one catalog of twenty pages, and these are presented with full detailed information in tabular form. The Replacement line is covered in a separate eight-page folder and contains many new items, both in the power transformers and audio line.

Copies may be procured through your local dealer, or directly.

Trouble Manual

The Servicemen's Publishing Co., 136 Liberty St., New York, N. Y., have brought out a nice husky pocket manual (which will really fit the pocket) called "Actual Troubles in Commercial Radio Receivers." There are 173 pages of notes on characteristic troubles and cures gained through the experience of Mr. Bertram M. Freed who has worked for large dealer-service companies. The book opens with "Amrad" and closes with "Zenith." It's quite complete, and should be of value to the Service Man who can't waste too much time with Jonah's.

Compact "All-Waver"

The Freed Television and Radio Corp., has the only All-Wave "Midget" receiver we have ever seen. It's the Model 366 SW, and covers the complete band from 15 to 560 meters.

The set is designed for operation on 110/120 volts a-c, and uses a 6D6, two 78's, a 77, a 42 and an 80.

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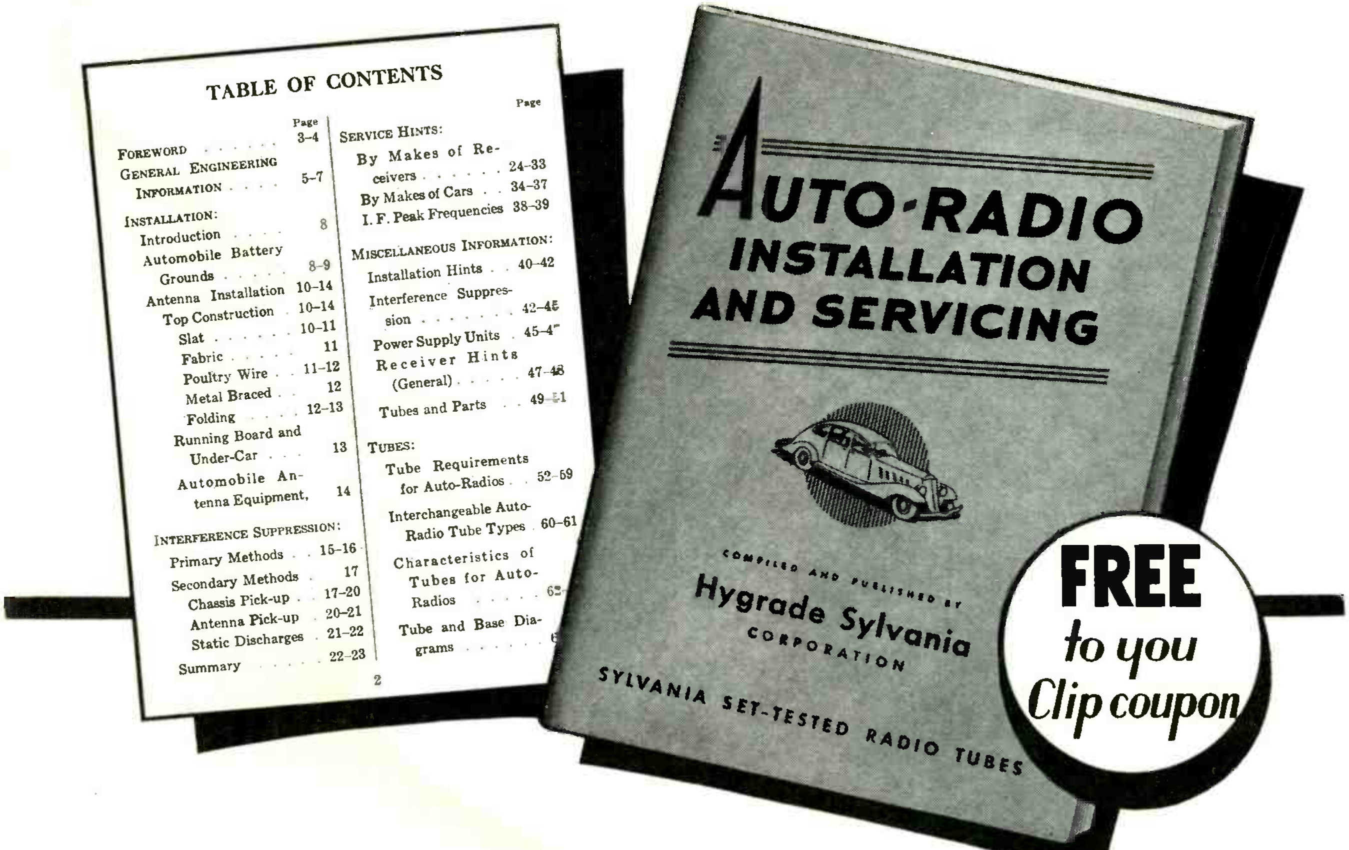
AUTO-RADIO PROBLEMS

simplified

New **SYLVANIA** Service Book reveals short-cuts on 29 different counts!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2

FREE *to you* *Clip coupon*

● Now Sylvania engineers have prepared a reference book devoted solely to auto-radio. This handy pocket manual, written in the service man's terms, contains tested information on suppression of ignition interference, tells which pole of the storage battery is grounded, what car makes and models have antenna installed at the factory . . . and answers other problems you will meet in auto-radio installation and servicing.

Send for your free copy of this new book that will help to put you in on the ground floor of the fast-growing auto-radio industry — a worthwhile business in itself, when you realize that 724,000 sets were sold in 1933, and it is estimated that 1,000,000 sets will be installed in 1934! Sylvania engineers themselves, with their development of the 6.3 volt tube, are responsible to a large extent for the advance of auto-radio. HYGRADE SYLVANIA CORPORATION.

Sylvania

REGISTERED U. S. PAT. OFF.

THE SET-TESTED RADIO TUBE

Makers of
Sylvania Tubes
Hygrade Lamps
Electronic Devices

Factories
Emporium, Pa.
St. Mary's, Pa.
Salem, Mass.
Clifton, N. J. © 1934, H. S. C.

HYGRADE SYLVANIA CORPORATION C-12
Emporium, Pa.
Please send free, without obligation, your new service book, "Auto-Radio Installation and Servicing".

Name..

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

(*Continued from page* 189)
For convenience in connection, try to keep them on top of the car, or on poles or trees close by. For most temporary set-ups it rarely is necessary to extend the speaker leads any distance. A little experimenting with the speakers in relation to the microphone will quickly determine the best set-up for freedom from howling due to acoustic feedback.

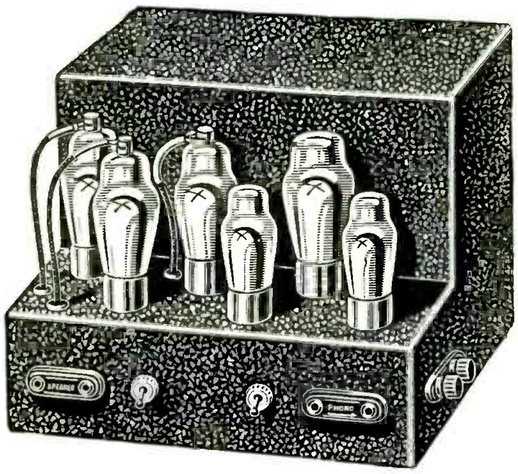
A phonograph turntable and a plentiful supply of records are essential. Incidentally, make sure to include a record of the National Anthem. This is particularly important for semi-military and patriotic organization affairs. Let the chairman or the head of the affair know what your record stock consists of, and try to work out a definite program in advance. Careful arrangement of the musical part of the program will do much to make the event a success. Also determine who is or is not to be allowed the use of the microphone. Everybody will want a chance at it, and unless some person of authority lays down the law, the mike will be assailed by giggling sopranos, boy orators, would-be crooners and so on.

Collecting Fees

One important little detail must not be overlooked, and that is the matter of collecting for your services. First agree with the promoters of an affair as to your fee (don't be afraid to ask for plenty; you can always come down a little, and then your customer will think he has done his organization a good turn), and then determine when and how you are to be paid. Demand at least half of your fee in advance, the balance to be paid before or immediately at the close of the affair. If you think you can demand it, try and get the whole sum in advance. Many social and fraternal affairs start out with a big splash and end up with a deficit, so don't depend on promises. If you don't collect immediately you will invariably be out of luck later. Many a well-meaning club secretary says, "Oh, you'll be paid just as soon as we tally up the receipts," but if the receipts don't cover the beer and the hot dogs, and if you didn't get a deposit in advance, you're likely to go home with a dead battery, a feeling of chagrin, and a lot of apologies.

Typical Six-Volt Amplifier

The Service Man with suitable equipment at his disposal can undertake any ordinary outdoor P-A job with complete confidence. Six-volt amplifiers are now as dependable as any a-c jobs, and really more economical than many of them. An excellent example of present-day trends in this direction is a 6-volt mobile amplifier, which has a 15-watt output rating (17 watts peak) and a self-contained "B" supply in the form of a highly reliable dynamotor, and yet which is actually smaller than the standard 120 ampere-hour storage battery with which it is intended to operate. The steel chassis measures overall only 14⅝ inches wide, 8½ inches deep and 10½ inches high, and contains, in addition to the plate dynamotor, a complete four-stage amplifier using three type 79's, two 37's and one 42. These tubes are of the 6.3-volt automobile class, and are known for their great ruggedness.



The chassis of the storage-battery-operated Class B amplifier, the circuit of which is shown on page 189. This unit employs three type 79 tubes in the output. These are connected in parallel and operated push-push.

Class B Amplifier Circuit

The accompanying schematic diagram shows the circuit arrangement of this amplifier. A 37 feeds another 37, which in turn works into a 42, resistance-capacity coupling being employed. The 42 is transformer coupled into a push-pull output stage comprising three type 79's. The 79 is a double triode in one envelope, so the output stage really consists of six tubes. Their elements are connected in parallel to provide the equivalent of three tubes in half of the stage. The unusual method of connection is responsible not only for the 15-watt output, but also for remarkably clear amplification, the wave-form distortion being only 7 per cent. This figure was not merely calculated, but was measured by means of a cathode-ray oscillograph.

Two input posts, connecting directly to the grid-cathode circuit of the first 37 tube through a half-megohm resistor, are provided. When a regular double-button microphone is to be employed, the use of a small control box containing a suitable coupling transformer and gain control is recommended. A high-impedance phonograph pick-up may, of course, be connected directly to the input posts on the amplifier.

An unusually large and heavy universal output transformer is contained in the amplifier. This has two secondaries; one, with 250- and 500-ohm windings, is for transmission line work; the other, with 4-, 8- and 15-ohm windings, is for direct connection to loudspeaker voice coils. The three sections of the latter secondary are instantly available, being selected by a three-position switch on the front of the amplifier chassis.

The Dynamotor

The plate dynamotor, which is enclosed in an upright compartment behind the tube lineup, is equipped with a two-section filter consisting of a 15-henry choke coil and two 8-mfd condensers. The six-volt side is controlled by a snap switch which also controls the current to the field windings of the speakers used with the amplifier.

In connection with the use of outdoor P-A amplifiers in general, the writer wishes to emphasize the importance of using trumpets. It is highly inadvisable to use ordinary dynamic speakers, as they scatter the sound too much and cause considerable acoustic feed-back trouble. Trumpets concentrate the sound in the area where it is needed most.

(*To be continued*)

Type 42 and 2A5 Tubes

There has been some question as to the interchangeability of the type 42 and 2A5 tubes. Both types have exactly the same characteristics with the exception of the heater voltage. Therefore, any amplifier using one type may equally as well use the other providing the heater voltage is altered.

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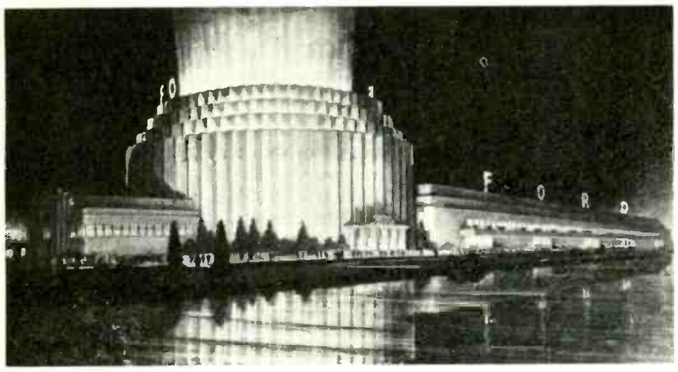
FORD BUILDING . . . A CENTURY OF PROGRESS EXPOSITION



SOUND AMPLIFICATION BY WEBSTER-CHICAGO

To you service men who read this advertisement and think of it in terms of the sound amplification equipment you are going to sell, which you should, it may seem like a long haul from the equipment necessary for a $1,500,000 Exposition Building to the little 3 tube Amplifier.

In a way it is, but the most outstanding thing about it is that it places in your hands the kind of selling talk you may need most in securing whatever job of sound amplification you're after. To be able to point out that the unit you are going to use in providing sound amplification for the smallest hall is the same kind as that selected by the most exacting group of engineers possible to get together, is a whale of a sales argument.

For this little 3 tube WEBSTER-Chicago Amplifier is made with the same exacting, laboratory-controlled production methods; the same sound engineering practice that produces installations for great Exposition Halls.

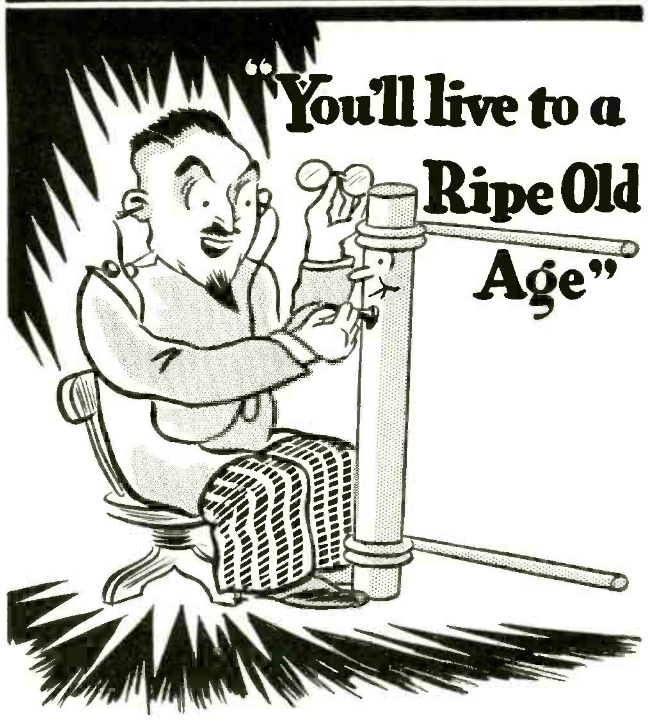
THREE TUBE AMPLIFIER Type SA-2, for general purpose public address systems of small and medium size requirements. Complete with 8" Dynamic Speaker; 4 ft. cord with plug and 6 ft. power cord.

And, this same little 3 tube job should make it more certain than ever before that you can get into this most profitable business of Sound Amplification or Public Address, whichever you prefer to call it, in a big way . . . with little money and the certainty of making such satisfactory installations that your business will grow and prosper.

Let us send you the Webster Catalog and supplementary bulletins of the finest Permanent; Portable; large and small Sound Amplification units possible to buy.

THE WEBSTER COMPANY
CHICAGO U. S. A.

3827 WEST LAKE STREET



Nothin' wrong with this boy. If you ask us he's a tough hombre . . . he ought to be . . . for he was "Baptized with Fire" at 2700 degrees and he's vibration proof, heat proof and moisture proof.

On that next replacement job try a CENTRALAB FIXED RESISTOR and note the difference. Good business too . . . for the customer won't be coming back with a squawk.

At your jobber. . . .

Every Radio Service Man should be a member of the Institute of Radio Service Men

Centralab
RESISTORS

CENTRAL RADIO LABORATORIES
MILWAUKEE, WISCONSIN

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ASSOCIATION NEWS . . .

R. T. A. (San Francisco)

We have just received the first printed issue of the R. T. A. News, put out by the Radio Technicians' Association of San Francisco. It looks like real business, and reads like it, too.

The gang out there made a special trip to the RCA Communications station, at Bolinas, California, on Sunday, February 18th. We think one of the fellows thought the tape in the automatic transmitter gave stock quotations, and tried reading it. We were listening to Bolinas on the eighteenth and the "ditter" had hysterics, to say nothing of the transmissions.

Who was the guy breaking the tape? Or was that KEE sending a program to Koko Head?

•

I. R. S. M. Additions

Listed below are the new I. R. S. M. Sections and Chapters recently formed, and with the names and addresses of the recently elected officers.

BALTIMORE SECTION
Albert O. Rabassa, Chairman, 2920 East Baltimore, St., Baltimore, Md.
F. J. Weipert, Secretary, 408 Calvin Ave., Baltimore, Md.

CEDAR RAPIDS SECTION
Donald Anderson, Paramount Radio Shop, 1232 5th Ave., S. E., Cedar Rapids, Iowa.

CHICAGO SECTION
Chas. K. Failing, 3336 N. Oak Park Ave., Chicago, Ill.
Russell V. O'Byrne, Secretary, 7134 Ridgeland Ave., Chicago, Ill.

LAKE COUNTY CHAPTER
Martin J. Findling, Chairman, 426 Clinton St., Hammond, Ind.
Mike Jancik, Sec'y.-Treas., 4245 Johnson St., Hammond, Ind.

COLORADO SPRINGS CHAPTER
Francis M. Harvey, 15½ E. Pikes Peak Ave., Colorado Springs, Colo.

DENVER SECTION
Wyman C. McKelvy, Sec'y., Federal Radio & Service Shop, 3022 W. 38th Ave., Denver, Colo.

KANSAS CITY SECTION
P. N. Connet, Chairman, 4053 Broadway, Kansas City, Mo.
Fred M. Myers, Secretary, 7439 Lydia, Kansas City, Mo.

LOUISVILLE SECTION
Wallace M. Smith, Chairman, 2304 Wrocklage Ave., Louisville, Ky.
Allan W. Panke, Secretary, 2205 W. Ormsby Ave., Louisville, Ky.

MIDWEST SECTION
Ralph W. Pitt, 543 S. Douglas Ave., Belleville, Ill.

MILWAUKEE SECTION
Cedric E. Heller, Chairman, R. R. No. 2, Nashotah, Wis.
Wm. E. Hough, Secretary, 1854 N. 27th St., Milwaukee, Wis.

NEW YORK SECTION
L. Howard Sack, 40 Lexington St., Newark, N. J.
Forest B. Arnold, Secretary, 303 Vanderbilt, Brooklyn, N. Y.

BROOKLYN CHAPTER
James L. Kearns, Chairman, 9531 4th Ave., Brooklyn, N. Y.
Moe Asch, Secretary, 565 Columbus Ave., New York City, N. Y.

QUAD CITY SECTION
R. E. Rote, Chairman, 2016 16th St., Rock Island, Ill.
D. G. Erickson, Secretary, 4303 15 Ave., Rock Island, Ill.

ROCK RIVER SECTION
Floyd S. Ward, Chairman, 1121 18th St., Rockford, Ill.
Carl H. Gustafson, Secretary, 542 Merrill Ave., Rockford, Ill.

SPRINGFIELD, MO., CHAPTER
Wayne A. Clay, Chairman, 402 E. Elm St., Springfield, Mo.
Virgil F. Anderson, Secretary-Treasurer, 305½ East Walnut St., Springfield, Mo.

TRI-STATE SECTION
Ray D. Johnson, Chairman, 118 Jefferson St., Burlington, Iowa.
Byron B. Jeffrey, Secretary-Treasurer, 214 N. Main St., Burlington, Iowa.

•

New York Section I.R.S.M.

Another angle on the seasonally important subject of auto-radio will be presented by Mr. Murray Yoemans, of the Galvin Manufacturing Co., when he delivers a paper on "Auto-Radio Installation and Service" on Monday, June 11. The Service Forum, conducted by Herb Zvorist, will be devoted to auto-radio problems.

Noise reducing antennas are becoming more and more necessary with the increasing interest in high-fidelity reception, short-wave and television, and hence a talk by Mr. Arthur H. Lynch, President of Arthur H. Lynch, Inc., on the subject of "Correct Installation of Noise Reducing Systems" has been arranged for Monday, June 25. Come and get first-hand information on this important and timely subject.

Both of the above meetings are to be held in the Pennsylvania Hotel, 33rd Street and 7th Avenue, at 8 o'clock, on their respective Monday evenings.

•

Moe Asch to Represent I.R.S.M.

The Institute of Radio Service Men will be represented by Mr. Moe Asch, of Brooklyn, N. Y., on the Joint Standards Committee of the I.R.E. and R.M.A. This committee determines standards affecting receiver design, its several members co-operating to standardize the various parts and the form of circuit and other information so as to be of greatest benefit to Service Man, Dealer, Manufacturer and Engineer alike.

Mr. Asch, in addition to being a member of the I.R.S.M. is the secretary of the Brooklyn chapter of that organization, he also has conducted business in Brooklyn for several years under the name of "Radio Laboratories" and specializes in dealer service work.

•

New York Chapter N.R.I. Alumni Association

The initial meeting of the New York Chapter of the National Radio Institute Alumni Association was held in the North Ball Room of the New Yorker Hotel on Friday evening, April 27.

Mr. Phillip J. Murray, the Executive Secretary of the Alumni Association, opened the meeting and explained the aims and purposes of the Association and its relationship to other organizations. Mr. James L. Kearns, Chairman of the Brooklyn Chapter of the I. R. S. M., and a member of the Alumni, also adressed the meeting.

A charter was presented to the chapter by Mr. Murray and temporary officers were elected as follows: J. L. Kearns, chairman; Forrest B. Arnold, secretary; and a financial committee was elected comprising the secretary, Louis Giannone, and Bert Shapiro. These officers will serve until a regular election can be held.

•

Service Men Attaining Professional Status

That Service Men have attained professional and business status in most communities is the observation made by Walter Jones, Tube Commercial Engineer of the Hygrade Sylvania Corporation, who contacts Service Men's organizations throughout the country.

"The Real Service Man is certainly coming into his own," states Mr. Jones. "He is no longer a radio experimenter, dabbler or backyard mechanic; nor does he work nights and in spare time to pick up a few spare dollars. The true Service Man is in business, working full time, making a fair living.

"That radio set and tube manufacturers fully realize the changed status of the Service Man is evidenced by the growing collection of technical literature and service notes being issued. Service Men are kept posted on circuit and tube techniques by wide-awake manufacturers.

"And following in the footsteps of the automobile industry, certain set manufacturers are now appointing authorized Service Agencies or Service Men in various territories, so that owners of such sets may know where to secure dependable service. This seems particularly true of automobile radio sets, because this class of equipment is far more critical than the home category. Authorized service agencies and the true Service Men are by now provided not only with the necessary knowledge and skill, but also with good test equipment for use both in the shop and out in the field. Reasonable stocks of spare parts are also carried for immediate repairs.

"Too much cannot be said regarding the splendid efforts of the Institute of Radio Service Men, in promoting not only the technical standards but also the business methods of member Service Men. We can look forward to a striking merchandising activity by these fellows who gain access not only to homes but also to the confidence of their trade.

"In certain territories broadcasting stations are collaborating with Service Men in gaining public recognition and support. In Buffalo, Chicago, Detroit, Cleveland and Pittsburgh, only to mention a few, broadcasting stations are featuring regular programs on behalf of local Service Men's organization, thereby impressing the radio listeners with the value of genuine radio service. The NRA code as applied to radio servicing further strengthens the true Service Man in his business and professional standing, his public acceptance and his well-earned profits," concludes Mr. Jones.

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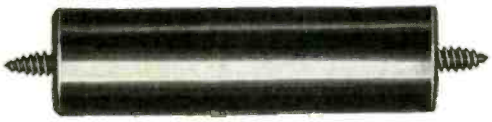
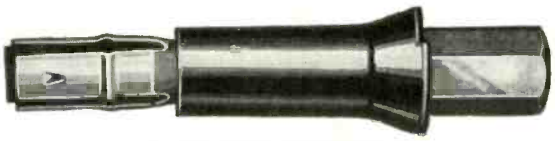
THESE ARE *Genuine* OHIOHM SUPPRESSORS

ACCEPT NO OTHER

Model WP (Plug)



Model Z (Universal)



Model WD (Distributor)

153,000 CAR MILES

Without a failure!

OHIOHM SUPRRESSORS

Have achieved such a record under conditions of 95% relative humidity, a temperature of 140° F., and connected in series to an ignition system operating at the equivalent of 60 M. P. H. for 2,550 consecutive hours.

Also Available in Complete Sets

consisting of necessary suppressors and condenser to fit all makes of cars.

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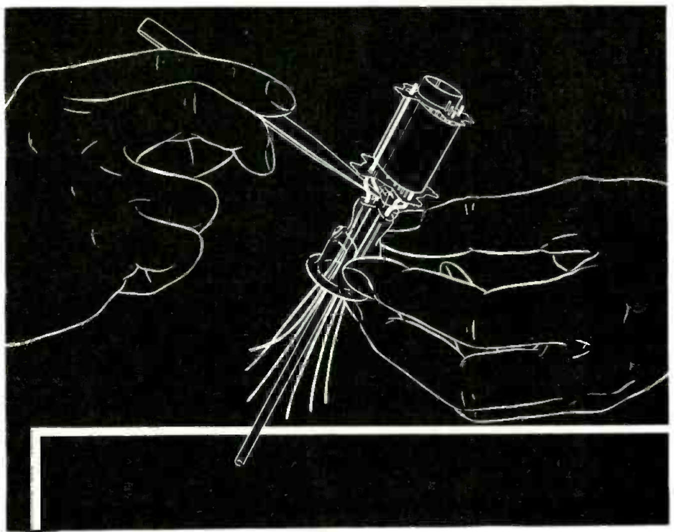
Get them from Your Jobber or directly from

THE OHIO CARBON CO.
12511 BEREA ROAD CLEVELAND, O.



BEHIND THE FINGERS, THE PURPOSE

FINGERS can be skilful and yet fashion nothing of practical importance. They must be guided by a purpose — a vision of perfection, the desire to create something better.

It is such a purpose that guides the many manual operations in the assembling of Raytheon 4-pillar Radio Tubes. For these tubes are made by workers steeped in the watchmaker's tradition of precision. Even the machines, employed in several stages of their manufacture, are fashioned for an express purpose — the construction of the 4-pillar principle of support which holds the vital elements in a Raytheon secure from damage through vibration.

Every operation through which the raw materials for these tubes pass, reflects that guiding purpose. The result is a tube that performs to perfection under the most rigorous circumstances. That is why police departments, air transportation companies, polar expeditions and millions of set owners everywhere, use Raytheon 4-pillar Tubes and nothing else. When you put a Raytheon 4-pillar Tube in a set, you are assured of perfect tube performance and customer satisfaction.

RAYTHEON 4-PILLAR RADIO TUBES

RAYTHEON PRODUCTION CORPORATION

30 E. 42nd Street, *New York City*
445 Lake Shore Drive, *Chicago*
55 Chapel Street, *Newton, Mass.*
555 Howard Street, *San Francisco*

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Volume I Will Be Out of Print Soon!

The supply of Rider's "Perpetual Trouble Shooter's Manual," Volume I, now in the hands of our distributors in the United States is very definitely limited!

After the present edition is exhausted, Volume I will not be reprinted. If you or your friends have not as yet secured your copy—NOW is the time to buy your Volume I.

This valuable Manual covers radio receivers announced and sold up to April, 1931. . . . Many millions of radio receivers now in use and which will find their way into your shop are included in this manual. . . . Years of service are still in this Manual.. . . Your shop needs Volume I!

Due to an unforseen accident—many of the plates used for the printing of Volume I were destroyed. . . . If you have any intentions of buying this volume—NOW is the time to act. . . . If you wait too long—you will not be able to secure your copy.

DON'T DELAY.......BUY TODAY!

Volume I of Rider's Manual—as long as it lasts $7.50

•

Here It Is!

The NEW

Larger—Entirely Rewritten

Servicing Superheterodynes

BY

JOHN F. RIDER

Now on the press. Ready for delivery in June

The original volume published first in 1931 was acclaimed over night as being the finest, most comprehensive and easy to understand practical volume covering the servicing of superheterodyne receivers.

The NEW revised book announced in this advertisement has been rewritten. . . . It is better than the original in every respect. . . . It is brand new. . . . Right-up-to-the-minute. . . . In this NEW book you will find the most comprehensive explanations of the principles underlying the operation of all types of superheterodyne receivers—broadcast—short wave—all wave—converters—electron coupled mixer-oscillators—wave changing systems—AVC and QAVC used in superhets—demodulators—special circuits, etc.

The most complete information covering alignment operations on old and new superheterodynes—inclusive of special condenser arrangements—will be found in the NEW "Servicing Superheterodynes" by Rider. . . . Peculiarities in these receivers accompanied by practical trouble shooting is a feature of this volume. 200 pages.

Absolutely no service station handling superheterodyne receivers can afford to be without the NEW "Servicing Superheterodynes."

Price $1.00 Postpaid

Place your orders with us or with your dealer.

JOHN F. RIDER

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NOW—*the New*

Volume IV
Rider Manual

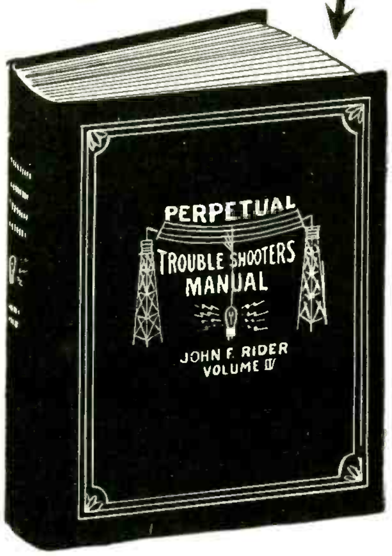
1040 pages
$7.50
Postpaid

"I do not hesitate to say that Volume IV is the most important of all the manuals I have issued. Volumes I, II and III found their place in the servicing world as important aids to the service man. . . .

Volume IV is destined to be more than just an important aid. . . . It will be a vital necessity. . . . I am firm in the belief that because the contents of Volume IV cover the most scientific and complicated radio receivers ever produced in the history of the radio industry—its ownership will mean the difference between success and failure when servicing the 1933 crop of radio receivers.

You will witness a new era in radio servicing during 1934 . . . and it is only the start of complex radio service problems. . . . Research laboratories in contact with receiver manufacturers forecast increased science applied to radio receiver design. . . . We are passing out of the three and four tube receiver stage—back into the 8, 10 and 12 tube stage with highly complicated electrical networks. . . . Hourly use of radio service data will be imperative. . . ."

John F. Rider

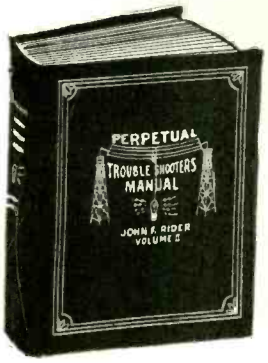


No service man, or service organization, can operate effectively without Volume IV. . . . Advances in radio receiver design have been so numerous within the past twelve months that no ordinary text is able to keep abreast of these new ideas. . . . Volume IV, by including receivers as recent as February, 1934, affords you service data coverage on—dual oscillator systems—bucking bias voltages—automatic noise control—reflexed i-f and 2nd detectors—reflexed r-f, detector and a-f amplifiers—combination rectifier-power pentodes—electron coupled oscillators—single envelope multi-tubes—automatic noise gates and tuning indicators—compensated volume controls—continuously variable frequency compensation circuits—phase shifting tubes—voltage doubler rectifier circuits, etc.

Now is the time to secure those volumes which you lack to make up the complete series. . . . You'll need them—every one of them . . . and they now are available at the lowest prices.

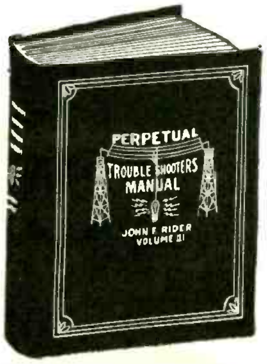
VOLUME II
800 Pages, $6.50

This volume covers the period between early 1931 and the middle of 1932. It also includes some older receivers, which were not available when Volume I was printed. Point-to-point data is to be found in this volume.



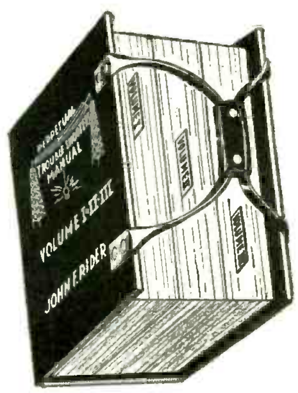
VOLUME III
1185 Pages, $7.50

This volume covers the period between middle 1932 and about June of 1933. It also includes some old receivers which were secured subsequent to the publication of Volumes I and II. Volume III also contains some point-to-point data and the world's only set catalog identifying about 8,000 models.



Combination Manual
3000 Pages, $25.00

Contains Volumes I, II and III under one cover. Available in two types. Without carrying handle $21.50. With carrying handle $25.00.



All of these manuals contain schematic wiring diagrams, socket layouts, chassis diagrams, voltage data, photographic views, resistor data, condenser data, electrical values, alignment notes, i-f peaks, trimmer location, continuity test and point-to-point data, etc., etc. All manuals are loose leaf bound in "instant-removal" type binder and contain cumulative index.

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THE FORUM . . .

Interference and Fading

Editor, SERVICE:

We have experienced the interference and fading (condition occurs only at night during the winter) problems mentioned in your editorial columns. For example, there is continued hash from two or more stations on the same frequencies, stations fade out to be supplanted by others on the same channel hitherto covered up (sometimes 3 or 4 programs will be heard in 5 minutes), and particularly annoying is a 40 or so cycle heterodyne between two carriers. This makes reliable DX impossible. Further, these effects are not caused by the receivers as they appear in all sets used in the same location, so we tell our customers that skip distance and the 11-year sun spot cycle are the causes.

We have no trouble in separating WGN and WOR, with cross talk only on high audio frequencies.

F. R. ASHLEY,
Stamford, Conn.

Broadcast Interference

Editor, SERVICE:

I have read with a great deal of interest the recent letters published in The Forum, regarding broadcast interference, and inasmuch as I have noticed a similar condition in this locality, a report may be in order to aid in clearing up the mystery(?).

In the first place I think that Mr. Ralph P. Worden's letter in the April issue regarding the propagation of skywaves has pretty well covered that phase of the matter insofar as the sun spot cycle affects the intensity of signals. (Although I do not quite agree with one of Mr. Worden's statements, i.e., "Night reception is produced by skywave only.") Another governing factor, no doubt, is that in some localities the broadcast stations may be at fault, as pointed out by Mr. J. Glen Kirstie in the March issue. It is a generally known fact that the frequency of a broadcast station, under certain conditions, is likely to "creep" even though crystal controlled. True, this condition is restricted to a very narrow margin and a "creeping" frequency is not likely to interfere with its frequency neighbor. We must remember however that there are hundreds of small stations throughout the nation that share channels with some of the larger stations. Under favorable conditions some of these smaller stations come through with remarkable volume and are likely to snatch a vacant place on the tuning dial when the desired station has faded to oblivion. This condition is liable to be noticed on any type of set but as sets equipped with straight AVC will hang on to a station until it is practically inaudible, it is only natural that such sets will be much more susceptible to this annoyance, for the simple reason that when the desired station fades to inaudibility, the circuit is thrown "wide open" and any station lurking in the background on approximately the same frequency will be pulled in, to be blanketed out again when the desired station swings back to normal. The same condition would exist on a non-AVC set if the volume were pushed to maximum in following the fading station.

A sharply tuned receiver is a great help in lessening this condition. Therefore it is always advisable and good service practice to *properly* align all circuits using a well-calibrated oscillator and a *sensitive* output meter.

So much for broadcast interference.

I would like to hear from some of your readers regarding their experiences with what is generally termed "fading distortion." This is a condition that I think is far more annoying than the aforementioned interference. Then, too, I have formed theories regarding its cause that I would like to have corroborated. More about this in another letter.

H. B. BENNETT,
623 *Fairfax Ave.,*
Norfolk, Va.

(Have any Service Men experienced similar interference difficulties in connection with receivers having delayed AVC? We should like reports on interference from other parts of the country, too, if any other localities are suffering from similar cases. THE EDITORS.)

Aerial Installations

Editor, SERVICE:

Going over some old files I ran across a copy of an order issued by the Tenement House Department of the City of New York, forwarded to me under date of June 20, 1932, attached to a covering letter by John P. Finnerty, First Deputy and Acting Commissioner.

The order refers to radio aerials on certain types of apartment buildings and reads as follows:

"On April 4, 1932, the Governor signed the Potter-Burchill bill which added subdivision 2 to section 62 of the Multiple Dwelling Law, and which is in relation to radio antenna or other wires placed over the roofs of multiple dwellings. The following departmental regulations shall apply:

A. There shall be headroom of not less than 10 feet between the roof and all portions of such antenna or other wires.

B. Such antenna or other wires shall be so placed as not to obstruct any required means of access to the said roof.

C. All radio antenna or other wires so placed above the roof of a multiple dwelling shall be properly supported, and such supports shall be sufficiently strong and adequate for the purpose required.

D. No radio antenna or other wires, or the supports which carry them shall be secured to any pipe which is a part of the plumbing or drainage system of such buildings, or to any portion of a fire-escape or other required secondary means of egress.

E. All radio antenna or other wires and supports of the same when placed above the roof of class A multiple dwellings, shall be kept clear of bulkhead doors, scuttle openings, gooseneck ladders or other means of egress for said dwelling.

F. All radio antenna and lead-in wires from same, or any wire which is placed above the roof of a class A multiple dwelling, the purpose of which is to carry an electrical charge, shall be properly insulated from contact with all portions of said roof."

Now if we could get this order enforced I think it would at least do something in New York City to solve the unemployment among radio men. How about some of the organizations contacting their influential friends on this one?

CARL D. SHORT,
2715 *E. Tremont Ave.,*
Bronx, N. Y.

(It would be a fine thing if the order referred to was enforced, not only for the sake of Service Men and better reception, but also for the sake of people who use the roofs. The aerial situation is absolutely lousy everywhere and it is about time something was done. Every city and village should have some form of regulation in respect to aerial installations, and we would raise a couple of cheers if service organizations would get busy on this matter in their respective localities.—THE EDITORS.)

Poor Taste

Editor, SERVICE:

I think the tone of Mr. Burkholder's letter in the April issue is uncalled for. I understand the Forum is for readers to discuss problems and suggestions for your magazine.

I don't think it is very good form to be insulting and sarcastic when replying to some letters published in The Forum.

We can't all be super radio engineers.

FRANK PALMER,
Edgewater, Colo.

(The poor taste rests with us. It is quite possible that the interference difficulties experienced by so many Service Men are not apparent in Mr. Burkholder's locality. Presumably this led him to believe that the entire matter is so much tommyrot, which, of course, is not the case.—THE EDITORS.)

Diagram Improvement

Editor, SERVICE:

An article, "Self-Reading Diagrams," in the "Highlights" section of the February issue of SERVICE, requested the reaction of Service Men toward the Wurlitzer diagram, shown in that issue, with reference to tube element indications.

This method is better than your previous diagrams. However, on page 50 of the same issue may be seen a diagram of the Spartan Model 82 receiver in which a still better method of tube element indication is shown. This method suits my taste better than any I have seen heretofore, and could be still further improved if the tube cap would be indicated as shown—each prong indication being numbered.

I would appreciate your kindness in putting this type of diagram before the field for its approval (or disapproval), and if deemed practical, incorporating it in all your future diagrams.

THEODORE R. SAYRE,
1136 *Woodruff Ave.,*
Hillside, N. J.

(What do you think? Remember that in some cases it may be necessary to sacrifice "readability"—but then it is a question whether most Service Men find the reading of a diagram necessary.—THE EDITOR.)

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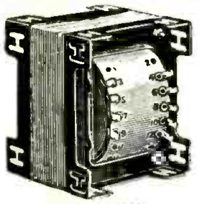
Service Engineers'
1934—B Replacement Transformer Catalog!

General Power Transformers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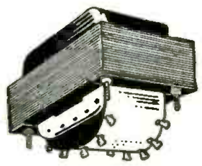
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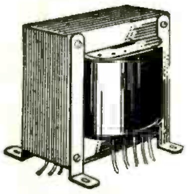
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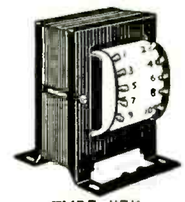
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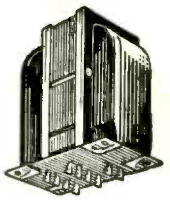
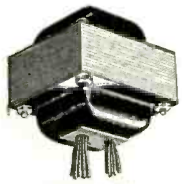

TYPE "F"


TYPE "G"

8 pages 8½" x 11"—fits your price manual or ready reference file.

Lists power transformers shown for any set from 4 tube midgets to 12 tube super-power, 110-120 V, 220-240 V, 50-60 cycle—or 115 V, 25-40 cycle.

GIVES COMPLETE INFORMATION REGARDING

"Multi-Tap" UNIVERSAL TRANSFORMERS

5 units for any of 1997 models of radios—
from smallest to largest high-powered sets.

EXACT DUPLICATES FOR 500 MODELS OF THE MOST POPULAR SETS

Auto Radio Multi-Tap "B" power and single and synchronous vibrators.

Class B amplifier and Amateur broadcasting equipment.

Also — Outputs, Input Audios, Interstage coupling chokes for every need.

Tube testing microphone, Step-down and Step-up transformers.

Free for the Asking!

The most comprehensive manufacturers' catalog of power supply units for replacements or for new set building, will please you. Illustrations—units listed, giving code word, dimensions, technical description, shipping weight, and list price of each.

MAIL THIS COUPON TODAY!

GENERAL TRANSFORMER CORP.
502 South Throop Street, Chicago, Ill.

Please send me, without obligation, your 1934-B Catalog and address of nearest distributor.

NAME ....

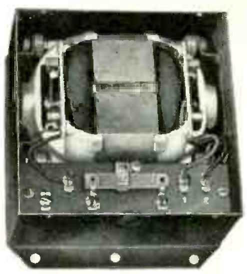
ADDRESS ....

CITY .... STATE ....

GENERAL TRANSFORMER CORPORATION
502 South Throop Street : : Chicago, Illinois

Replace Faulty Auto-Radio "B" Packs

PIONEER Gen-E-Motors for Sound Amplifiers

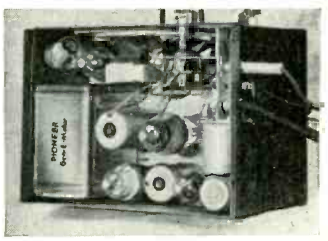


High voltage D. C. for sound amplifiers may be obtained from 6, 12, 32, and 110 volt D. C. power sources with these PIONEER Gen-E-Motors. Used by leading amplifier manufacturers for sound truck and other installations where A. C. power is not available. Let PIONEER engineers help solve your problems. Write, giving full details of your power needs, and you will receive complete power data without obligation.

PIONEER D. C. to A. C. Converters

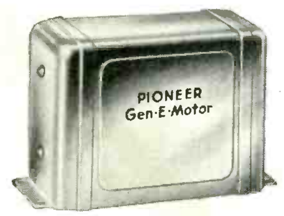
110 volts A. C. for operating radio receivers, sound amplifiers, and electric appliances may be secured from 6, 12, 32, or 110 volt D. C. sources with the new PIONEER Converters.
Heavy duty design with conservative ratings—yet offered at remarkably low prices. Write for price list today!

with this NEW Pioneer Model JW Gen-E-Motor



Here at last is a complete solution of all auto-radio "B" power troubles. The new PIONEER Model JW Gen-E-Motor replaces vibrator type power units on all popular auto-radio receivers.

It is so compact, measuring only 4⅛" high x 5½" wide x 2⅞" deep, that installations may be made within the auto-radio housing in the space vacated by removal of the vibrator unit. Installation is extremely simple. Only three connections and the Gen-E-Motor is ready to bring noise-free, dependable power.



No adjustments, no lubrication, no servicing to cut your profits. Guaranteed ONE YEAR!

The Model JW-25 Gen-E-Motor delivers 225 volts at 50 m.a. with only 3.8 amps. battery drain. The Model JW-50 delivers 250 volts at 50 m.a. with a battery drain of 4.2 amps.

List price only $13.00

ALSO—new compact models, complete with filter, measure only 5-7/16 x 5-7/16 x 2⅞ in. Write for price list.

The leading 1934 auto-radios are PIONEER Gen-E-Motor Equipped!

Write for full information — today!

Pioneer Gen-E-Motor Corp.,
460-C W. Superior St., Chicago, Il.

Send full information about the new PIONEER Replacement Gen-E-Motor and net prices to servicemen.

Name ....

Address ....

My Jobber is ....

www.americanradiohistory.com

THE MANUFACTURERS . . .

TOBE CONDENSER ANALYZER

With the advent of electrolytic condensers, radio sets have been increasingly difficult to service; particularly so during the past two years because of circuit designs incorporating the use of multiple and concentrically wound condensers.

Many aids have been available to the Service Man in an assortment of testing devices which check continuity, resistance, voltage, current, and other such electrical characteristics. However, no practical device has been produced to accurately determine the "quality" and efficiency of electrolytic and paper condensers. The Service Man has encountered much difficulty and delay in his work due to the unsatisfactory and sometimes unreliable methods of testing condensers.

The Tobe Deutschmann Corporation continuing its policy of close co-operation with the service field, has spent considerable time in developing a condenser analyzer which satisfies the most exacting requirements. With this instrument practically any commercial paper and electrolytic condenser can be quickly and accurately tested and its quality directly determined, it is stated.

The condenser analyzer detects defective condensers according to the leakage-resistance-voltage method used by the majority of manufacturers in determining the quality of their products. It is an accepted fact that a condenser not having sufficient dielectric leakage-resistance and not capable of withstanding a definite voltage will not operate satisfactorily.

The fundamental principle of the analyzer is to test condensers under normal operating conditions. This is accomplished by means of a specially designed adjustable power supply which is an essential part of the device. The quality of the various condensers is determined by a simple setting of three controls which adjust the circuit for the allowable electrical characteristics.

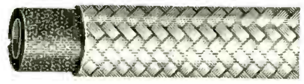
The condition of the condensers is directly indicated as good or defective by a sensitive Neon Glow Tube. This instrument quickly and efficiently locates practically any type of defective condenser without removing the condensers from the radio set.

A complete analysis of the entire condenser installation can be accomplished in a few minutes, thereby improving the ultimate value of the repair job.

The condenser analyzer is furnished complete with instructions and valuable data on condensers and condenser testing.

SHIELDED WEATHERPROOF TUBING

The Shielded Low Capacity Weatherproof Tubing shown in the accompanying illustration is manufactured by the Lenz Electric Manufacturing Company, 1751-57 N. Western Avenue, Chicago, Ill. This



tubing, they state, is excellent for shielding the output of signal generators and, in addition, the small outside diameter permits easy assembly in corner posts of autos as a shield for the antenna lead-in. The inside diameter of this low capacity tubing is 3/16 inch, with an outside diameter of approximately ¼ inch, and it may be obtained in either 50- or 100-foot coils, the respective weights of these coils being 2.0 and 4.0 lbs.

ALL-WAVE OSCILLATOR

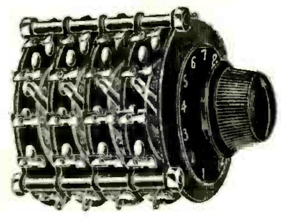
The Radio Products Company, Dayton, Ohio, recently announced an all-wave signal generator—the Series 32—that enables the Service Man to align any radio set on intermediate, broadcast, and short-wave frequencies. Continuous frequency alignment without use of harmonics, a vernier dial that may be used in "flat topping" intermediates, extremely wide range of output voltages made available through the use of a three-section attenuator, unusual stability through the use of a "high C" circuit, an individually calibrated chart that is easily read by hairline sliders, and a switch for unmodulated and modulated signals, calibration

being the same for each position, are the features given for this signal generator. In addition, the unit, which is shown here, is completely shielded and filtered, shielded connector leads being included, while stability is obtained through the use of batteries. The frequency range is from 100 to 13,000 kc, this being gained through the use of six separate coils covering the following bands: 100 kc-220 kc, 220 kc-485 kc, 485 kc-1100 kc, 1100 kc-5750 kc, and 5750 kc-13,000 kc.

NEW "DEPENDABLE" SWITCHES

A new line of switches is being produced by the Radio City Products Co., 48 West Broadway, New York, N. Y. These switches, it is stated, fulfill all requirements for a quality product where demands are exacting, and they are unusually rugged in design and construction which safeguards against decrease in efficiency after continued use.

The discs are made of high grade bakelite with a low moisture content, the electrical conductors are made of a special alloy giving high conductivity and a small amount of wear, and the moving arm makes a positive and wiping contact which is self cleaning.



The shaft is entirely insulated from the contact arm, (bakelite shafts being supplied upon order for ultra short-wave use), and the capacity between contacts is low.

These units require only a single hole for mounting (⅜-inch bushing), numbered dial plate and knob being included with each switch which is individually boxed. While the switch illustrated here is of the 12-point type, they may be had in ranges from 3- to 12-point in single or multi-gang up to seven gangs.

"UNIVERSAL" DETECTIVE LISTENING EQUIPMENT

Detective Listening-in Equipment has just been placed on the market by the Universal Microphone Co., Inglewood, Cal., in a specially constructed carrying case. It may be used as a portable outfit, or kept in one location as permanent equipment.

Technically the outfit has two stages of amplification, a volume control, a high and low switch, two pairs of earphones and comes supplied with six microphones of an ultra-sensitive type.

The instrument is said to be practically foolproof. There are no complicated adjustments. Plug in the phones and it is ready to operate. There are 800 feet of lead-in wire which is so small it cannot easily be seen or discovered. The outfit has volume, power and exceptional tonal quality, it is stated.

LE BOURG AERIAL TOWERS

A. LeBourg, 602 South 11th Street, Gadsden, Alabama, has made available a new type aerial support. These metal Aerial Towers, which are light in weight, may be fastened to any type of roof, without any resulting damage, by means of the loops in the feet of the support. On wood or composition roofs staples may be

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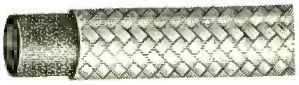
LENZ RADIO WIRE

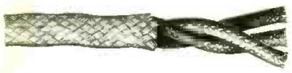
Products For Auto Set Installation
Three Most Generally Used Items

A NEW LEAD-IN SHIELD



Shielded tubing for auto aerial lead-in. 3/16" inside diameter. Approximately ¼" outside diameter. Low capacity weatherproofed tubing with tinned copper shield applied. Small O.D. permits convenient installation. Used by many prominent manufacturers of auto radios.

AUTO RADIO SHIELDED CONTROL, SPEAKER AND BATTERY CABLE



Two to six conductors. Cotton braids on individual conductors thoroughly moisture-proofed and color coded. Closely braided tinned copper shield applied overall. Also supplied with cotton braid over shield.

TINNED COPPER SHIELDING AND BONDING BRAID

Following widths available:
3/16", 13/64", ⅜", 9/16", 11/16"

Used for general shielding and bonding purposes.

The above products are available on spools and coils in convenient lengths. Send for Lenz Radio Products (illustrated) catalogue No. 20 today showing complete line for Auto Radio installations and replacements.

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LENZ ELECTRIC MFG. CO.
1751 No. Western Ave.
Chicago, Ill.

RADIO MANUFACTURERS ASSOCIATION RMA MEMBER

The Most COMPLETE Tube Tester

in the moderately priced class

JACKSON

MODEL 427

Direct Reading

Every important feature you have wanted in your new tester—and more. This tester has been scientifically planned to meet modern, exacting requirements.

Checks every tube has line voltage control to assure accuracy—complete neon test for shorted elements and leakage between elements. Also the exclusive Jackson test system for locating "open elements."

Precision D'Arsonval type meter with colored scale. Operating the tester is simple and rapid. Housed in attractive leatherette case with complete instructions.

You cannot afford to be without this Instrument!

Price **$28.40** (Net to Dealer)

See Your Jobber—or Write Today

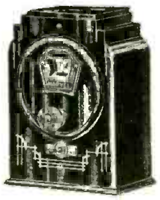
THE JACKSON ELECTRICAL INSTRUMENT CO.
INCORPORATED
432 KISER STREET DAYTON, OHIO

INSULINE CORP. OF AMERICA ICA TRADE MARK

SHORT WAVE CONVERTERS

EASY TO CONNECT AND OPERATE
WORK WITH ANY ELECTRIC SET

The "MARVEL" for A.C. Sets



A Brand new low priced converter which brings any A.C. electric set up-to-date! Connects in a moment without wiring change. The **Marvel** utilizes the entire circuit of your present set plus power pack making it a super-het all wave receiver. Comes in beautiful bakelite case. Wave length, 20-200 meters. A source of genuine pleasure—it lives up to its name! Our Low List Price less tube, $9.50.
Your net cost at 40% off............... **$5.70**

The "SCOUT" for Either A.C. or D.C. Sets

For DeLuxe performance the **Scout** has no peer. Efficient with any make radio. Utilizes a No. 37 tube as rectifier; and 6A7 Pentagrid converter tube. Gets Europe easily. Comes in beautiful walnut cabinet complete with both tubes and 2 plug in coils covering band from 20-200 meters. List price complete, $17.50.
Your net cost at 40% off.................. **$10.50**

Both switch from s.w. to broadcast band without disconnecting.

ORDER TODAY
from your jobber or favorite Mail Order House at 40% discount. If he cannot supply you write us direct. Be sure you get our big FREE Catalog listing hundreds of IC quality S.W. parts and accessories . . . today!

WARNING
Be sure you ask for and get ICA quality products. Accept no substitute for the value ICA offers you. All ICA products come packed in ICA containers. They never are sold loose or in bulk. Insist upon the container bearing the ICA trade mark and you will be assured of satisfaction.

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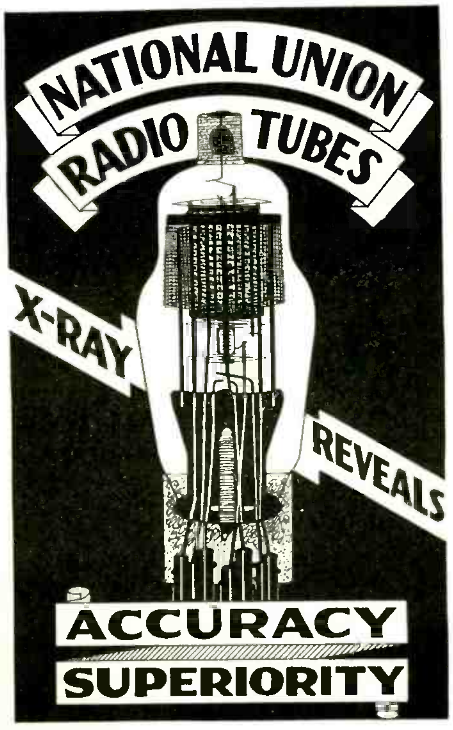
23-25 PARK PLACE NEW YORK, N.Y.

Department V-54
Send me details of ☐ the Marvel ☐ The Scout Converter
☐ Send me name of nearest jobber.
☐ Send me your FREE S.W. Catalog.
Name ....
Address ....
City .... State ....



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EXTRA!
Month of June only! Clough-Brengle Electron Coupled Test Oscillator FREE on special tube purchase offer. Quantity limited. Get details.

Superior Tubes
More Profit
Higher List Price
Free Equipment
Service Aids
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City .... State ....

used to fasten the tower, while for tile or slate roofs, wires running along the ridge from tower to tower and passing through the loops may be used. In case the middle of the tower should sag it is easy to use a third support.

A. T. R. FULL-WAVE VIBRATORS

The American Television and Radio Co., St. Paul, Minn., have full-wave vibrators of the inverter and self-rectifying inverter types for use in 6- and 32-volt "B" power units.

The full-wave inverter is designed for use with a transformer to deliver a-c current for rectification by means of a tube, such as the 84 type, at a minimum efficiency of 61 percent, and for use with any circuit regardless of whether or not the B- is grounded. It may also be used with just the transformer for supplying current to a-c operated devices.

The self-rectifying inverter is of the full-wave synchronous type, and is designed to deliver high voltage direct current when used with a transformer at a minimum efficiency of 70 percent. It is usually used with circuits having the B- grounded when operated from a common battery supply.

CONDENSER MICROPHONES

Several refinements, involving mechanical construction and frequency response characteristics, are present in the current production of Model 40C Condenser Microphones by Shure Brothers Company, 215 West Huron Street, Chicago.

All condensers and resistors are mounted in a catacomb; and are double shielded, protected, and mechanically rigid. The cable to the tube sockets and the output transformer are the only visible elements.

An interesting feature of the new instrument is "valve-control" of barometric compensation to equalize performance under varying air pressures. The range of compensation has been greatly extended, insuring constant performance under widely varying conditions of weather and altitude and improving the frequency characteristic, they state.

Accessibility of amplifier tubes and the four terminals for the adjustment of the output impedance have been retained. They are readily available under the back cover which unlocks with a twist of a tiny chrome lever.

JEFFERSON REPLACEMENT TRANSFORMERS

In their new catalog No. 341-R, the Jefferson Electric Company announces the addition of a great many replacement and manufacturers' style transformers, including audio, input, output, filament, microphone, line and power, as well as a complete line of chokes, radio fuses, and fuse blocks. Copy of the catalog, together with quotations, may be obtained by applying to the Jefferson Electric Company, Bellwood, Illinois.

LYNCH AUTO ANTENNA SYSTEMS

The Lynch Radio Laboratories, Inc., 51 Vesey Street, New York, N. Y., has recently introduced an antenna system for auto-radios. This system is procurable in three kits; namely, Kit A-1, Kit A-2, and Kit A-3.

Kit A-1, which is made up of the antenna parts only, is for installation under the car. It is triangular in shape, may be folded back on itself, and is fastened to the flywheel housing and the two rear springs. The lead-in is taken from the flywheel end of the triangle.

Kit A-2 is a coupling system that may be used on existing installations and consists of a receiver transformer, an antenna transformer, and ten feet of shielded cable, the latter acting as a low-loss transmission line.

Kit A-3 is the combination of A-1 and A-2, giving the complete antenna system, including insulators, antenna, coupling cable, and transformers.

WECO GENERATORS

The Weco Manufacturing Company, Inc., 520 Second Avenue, Seattle, Wash., announce a new alternating-current generator, in which voltage regulation is accomplished automatically within the generator itself without the use of moving parts or resistances. The principle upon which the unit is based may be incorporated in generators of any size or voltage, either single or polyphase, they state.

The generator is a 60-cycle, 110-120-volt, 500-watt (350-watt equipment) unit that is radio shielded and self excited. It requires no batteries and weighs about 60 pounds. It can, they state, be used in the open and under all climatic conditions. A special cooling system is provided.

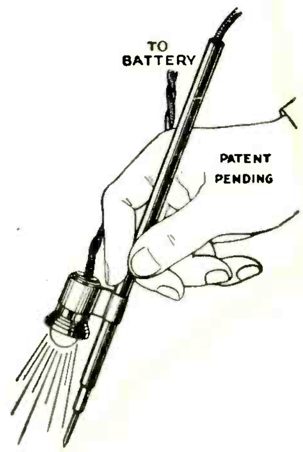
KESTER ALUMINUM SOLDER

The Kester Solder Company recently announced a flux-filled aluminum solder which, they say, successfully meets the requirements for proper aluminum soldering.

This solder, which is of special alloy, has an efficient flux sealed in the core or center opening of the solder. It is sold in small tins for repair work, and in one pound spools for commercial use.

"PROD-LITE"

The "Prod-Lite," a new device of the Radio City Products Co., 48 West Broadway, New York, N. Y., is a complete system to illuminate test prods without interfering with the normal test procedure, it is stated.



As shown in the accompanying illustration, the lamp socket is clamped to the test prod, adjustment to any position on the prod being quickly obtainable; and it is furnished complete with bulb, flexible cord and standard flashlight battery which is contained in a case that may easily be carried in the pocket. An additional feature of the unit lies in the fact that there are no protruding contacts on the case, a slight movement of the cover switching the light on or off as desired.

NEW SHURE MICROPHONES

Shure Brothers Company, 215 West Huron Street, Chicago, Ill., have announced three new microphones.

The Model 5B is a two-button full-size microphone weighing 15½ ounces. This chromium plated unit has a maximum current rating of 21 ma. per button and an equivalent internal impedance of 200 ohms. The frame diameter is 3 inches and the frame thickness 1 1/16 inches.

The Model 3A is a two-button microphone suitable for paging systems, portable public-address, and the like. The maximum current rating for this unit is 10 ma., the equivalent internal impedance is 200 ohms, the frame diameter is 2½ inches, the frame thickness ½ inch, and the net weight 5½ ounces.

A maximum current rating of 10 ma., an equivalent internal impedance of 100 ohms, a frame diameter of 2½ inches, a frame thickness of ½ inch, an overall diameter of 3⅝ inches, and a net weight of 5 ounces are the specifications for the single-button Model 2A microphone which was designed to be used on amplifiers that will only accompany a single button unit.

CURTIS CONDENSER CATALOGUE

The Curtis Condenser Corporation, 3601 W. 140th St., Cleveland, Ohio, have released a new catalogue covering their complete line of electrochemical condensers. A copy may be had free on request.

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The Ideal, Compact Tester for AUTO-RADIO and General Use

Model 403

MULTITESTER

2,000 ohms per volt.

ACCURACY within 2 per cent, and adaptability for all future needs—that's what the new Model 403 MULTITESTER assures you at low cost.

D'ARSONVAL type moving coil. 3-range 0-2,000,000 ohmmeter. 4-range 0-5-50-250-750 voltmeter. Microammeter, 0-500, for small photo-cell and grid measurements. Crystalline finish case, only 5¾" x 8¾" x 2¾". Etched panel. Complete, with self-contained batteries. NET $14.95 to Dealers and Service Men. List $37.50. KIT FORM $10.95 NET. List $27.50.

Write Dept. S-5 for FREE Data Sheets on Radio City Products.

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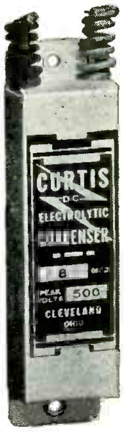
Curtis Electrolytic CONDENSERS



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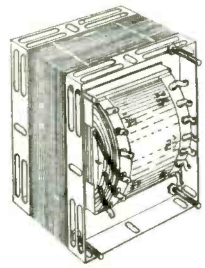
KENYON PRODUCTS

Making Money?

Are you? Not just a bare living but a really comfortable living? If not—particularly now that so many old sets must be kept going—then we have a message for you.

Don't fail to repair those old sets with KENYON replacement transformers. Five types of replacement power transformers service over 95% of all sets. One type audio transformer and one type choke service all sets. Carry a small stock of these universal replacement units. Do the job just once . . . thoroughly . . . satisfactorily . . . profitably — the KENYON WAY.



SERVICE DATA FREE

Get our chart specifying replacement power transformer requirements for any popular make of receiver, by writing to us on your business letterhead. Also circuit data on amplifiers and power packs utilizing latest tubes.

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KENYON TRANSFORMER CO., Inc.
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ACTUAL TROUBLES *in* *COMMERCIAL RADIO RECEIVERS*

by BERTRAM M. FREED

$1.00 POST PAID

Servicemen! This 190 page book will prove to be as valuable as your set analyzer. The author points out the most common faults to be found in over 500 models of commercial receivers. He simplifies your trouble shooting approach. You'll save time and money.

"Actual Troubles" is a written record of Mr. Freed's 9 years of actual experience in an executive capacity in the service department of one of the largest radio chains in the country. Compiled from thousands of actual records taken by the author, and collaborated upon by several of the leading servicing organizations in the country.

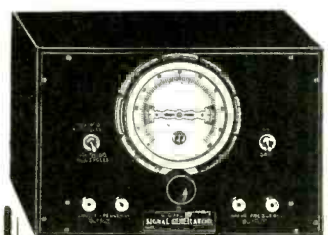
FREE TRIAL— SEND NO MONEY

Examine this book for 10 days. If you decide to keep it, send us $1.00—If not, please return it.

SERVICEMEN'S PUB. CO. 136 SM Liberty St., N. Y. C.

Introducing . . .

MODEL 77
SIGNAL GENERATOR
Universal A.C.-D.C.



BEAUTIFUL 1/10 division New Egert accurate reading dial — no backlash. Frequency calibrated range 105 - 3,000 kilocycles. Audio Modulation 1,000 cycles. Totally shielded. Etched metal panel. Sure Tip Jack connection with shield leads.

Frequency can be read to 1/10 of 1%. Extremely stable electron coupled circuit. Supplies both Radio and Audio Frequency outputs INDEPENDENTLY. Powerful signals available down to 10 meters. The tubes employed are 6A7 and a '37.

Write for Complete Information

Price Complete with Tubes .... list $25.00

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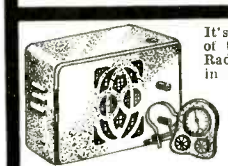
SOUND MEANS PROFITS

Make big cash profits . . . sell and rent Public Address Equipment this summer to supplement your service work. Your community is packed with live prospects. Sell them with selections from ALLIED'S great listing of permanent and Mobile Sound Equipment. Our prices are consistently lower. Here's a sample: It's our 4-watt "Little Giant" amplifier (Illustrated)—2B6 output, phono and mike input, only $12.95, less tubes. Write today for our FREE book with the new 4 to 50 watt output P. A. Listings.

SELL AUTO RADIO NOW



It's a banner year for Auto Radio sales. Get your share of the profits. Sell our new All-electric, Single-unit Auto Radios with the latest airplane type dials. Easy to install in any car . . . free from motor noise . . . unusually economical. There's big money begging to be made every day this summer with the new ALLIED Auto Radios.

Don't wait. Send for our FREE catalog, and order your Auto Radio Demonstrator at once.

THIS FREE BOOK WILL BRING YOU PROFITS!

Write for the valuable new ALLIED Catalog. It's FREE. In addition to SOUND and AUTO RADIO Listings, you will find radio's most complete stock of standard replacement parts, Test Equipment, Build Your Own Kits, and a new profitable line of World-wide All-wave Receivers. Write Dept. N today for your FREE copy.

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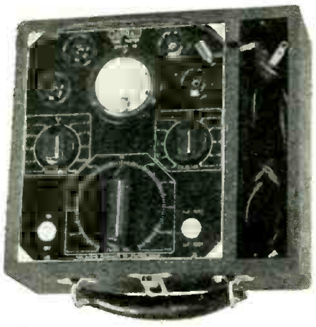

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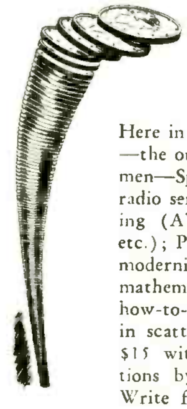

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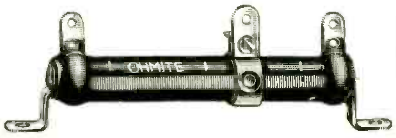

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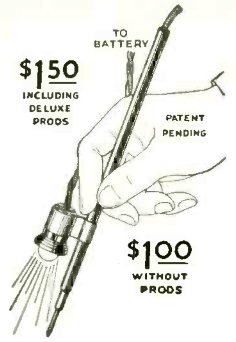

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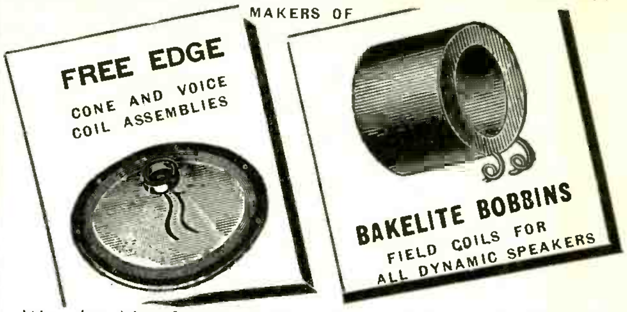

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