

RAY-O-VAC

RADIO

TROUBLE FINDER
AND
BROADCASTING STATION
DIRECTORY



STERLING RADIO CO.
115 N. 14TH AND WALNUT
KANSAS CITY, MO.
FRENCH BATTERY & CARBON CO.
MADISON, WISCONSIN

RAY-O-VAC RADIO TROUBLE FINDER and BROADCASTING STATION DIRECTORY



A complete list of
Broadcasting Sta-
tions in North
America and a
Guide for the lo-
cation and elimi-
nation of trouble
in Radio Receiv-
ing Sets.



Copyright 1923
By
BERTRAM W. DOWNS
All Rights Reserved

Introductory Note

RADIO, as a means for entertainment, education and the dissemination of general information, has reached a high degree of development.

Standard radio instruments themselves have reached a degree of excellence comparable to the precision work in fine motor cars.

The "Trouble Finder" portion of the title of this booklet should not be taken as an insinuation that radio sets are continually out of operation; for such is not the case.

The normal condition of a radio set is a healthy one. This booklet is offered as an instructor in the proper operation of a radio set, comparable to the instruction book which every wise owner of a motor car will buy.

The Best Radio Dealers Stock Ray-O-Vac Radio Batteries

Contents

	Page
Facts That Everyone Interested in Radio Should Know	4
On Aerials	6
On Loud Speakers and Amplifiers.....	9
On Tuning	10
Vacuum Tubes	12
Radio Batteries	13
Most Common Radio Questions and Answers.....	15
In Case of Trouble.....	17
Popular Misconceptions Corrected.....	19
The Correct Way to Test a Set.....	20
In Closing	21
Radiophone Broadcasting Stations in North America, Classified Alphabetically by Calls.....	22
Radiophone Broadcasting Stations in North America, Classified Alphabetically by States and Cities.....	35
Illustrations and Descriptions of Ray-O-Vac "B" Bat- teries for Radio	40
Illustrations and Descriptions of Ray-O-Vac "A" Bat- teries for Radio	44
The Continental Code.....	48

Facts That Everyone Interested in Radio Should Know.

1. Long distance stations ordinarily can not be heard with a crystal detector set.
2. A vacuum tube regenerative set, using only one tube, will bring in signals from nearly the same distance as a set having an audio-frequency amplifier. The amplifier only serves to increase the strength of signals brought in by the detector tube, for the purpose of operating a loud-speaker or making the signals louder in the phones.
3. The night range of sending and receiving stations is much greater than the daylight range. Do not expect to hear stations a great distance away in the daytime.
4. There are nights, rare in winter, and common in the summer, when it is impossible to bring in distant stations. This is due to atmospheric conditions beyond our control. This condition should be met philosophically as something that can not be avoided, and not used as the basis of a complaint to the radio dealer who sold you your set.
5. A radio set will not work satisfactorily when the "A" battery or "B" batteries are nearly run down. The "B" batteries should last from four to six months or longer.
6. Never get impatient with your set. Nine chances out of ten a man familiar with radio can find your trouble in a half minute. If you will take the trouble to familiarize yourself with the principles of radio you can do the same. There is a reason for every radio trouble.
7. Don't talk about the wonders and mysteries of radio, and the scientific and delicate sets that have made it possible, and then condemn the dealer or manufacturer when your set won't work with the aerial disconnected, the vacuum tubes burned out, or the batteries connected with the polarity wrong. A scientific instrument must be treated in an intelligent manner.
8. If you have not learned to tune properly, but manage to tune in one long distance station, don't condemn your set because you do not hear them all. The fact that you heard one distant station shows that the set is all right; all you need is patience and practice, and you will be able to get the same ones as your neighbors.

Use Ray-O-Vac "A" Batteries on All Dry Cell Tubes

9. Don't expect to get louder or clearer music when your vacuum tubes are turned up brighter than normal. If anything, the material you receive will be less loud and there will be unpleasant noises introduced. A slight overload on the tubes will make them burn out in a fraction of their normal life.
10. Radio does not change overnight. The set that you buy today will be good a year from today, and probably for many more years. The long-distance receiving sets in thousands of homes at present are practically identical, with a few minor refinements, to the sets that were used by radio-telegraph enthusiasts five years ago. If you have postponed getting a good radio set because you are waiting for a big change in radio, you are missing more enjoyment than the individual who puts off buying an automobile for the same reason. Radio is not new—it is not a fad; popular interest has merely become more widespread in the past year. Radio telephone broadcasting has been conducted on a small scale for years; and radio telegraph broadcasting for a decade or more.
11. Don't expect your radio set to act like a phonograph. You can't push the button for grand opera or jazz and get it. You will hear many stations better than over a phonograph, but some of them can not be heard over a loud-speaker, for the reason that they are out of your range. When you analyze it, you will realize that this fact lies at the root of the lure of radio. The fascination is in the uncertainty of the thing; always something new, greater distances to cover, and the ever-increasing mystery of the science. If you just had to push the button to bring in anything you wanted to hear, you would discard the set in a month. As it is, the experience of those who have followed radio since its inception decidedly indicates that "once a radio fan, always a radio fan."



WD-11.

THE WD-11 AND WD-12

1 1/2 volt—1/4 ampere.

The WD-12 needs no adaptor and fits any standard socket.



WD-12.

On Aerials.

THE aerial is the part of the radio system which "catches" the radio waves and leads them to the receiving instrument, where the waves are transformed into sounds corresponding to those sent out at the broadcasting station.

Aside from underground aerials, condenser aerials, "Beverage wires," and other unusual constructions, there are two popular types which are most in favor at the present time:

1. **The Flat-Top Aerial.** This type is in use in fully 95% of the receiving stations. It consists of one or more wires, from 25 to 50 feet high, suspended by insulators from two supports. For the reception of broadcasting programs, the ideal length is from 100 to 150 feet, with the mean length, 125 feet, probably the best for signal strength.

There is, however, a tendency toward the use of shorter aerials in connection with the highly efficient present-day sets. Two causes contribute to this tendency:

- a. The use of an aerial from 60 to 80 feet in length makes it possible to "tune out" or eliminate undesired stations much better than is possible with an aerial of two times that length. In the face of the rapidly increasing numbers of broadcasting stations, this becomes an advantage of decided importance.
- b. Radio sets have reached a point of efficiency where the energy picked up by short aerials, such as the above, is sufficient to give excellent results over long distances, and the increased selectivity of the short aerial often outweighs the advantage derived from the use of an aerial of greater length.

The length of an aerial for broadcast reception should never exceed 150 feet.

There is absolutely no advantage to be gained by using more than one wire for receiving. The direction in which an aerial of this length points is of practically no importance.

A flat-top aerial should not be parallel to high power electric lines, unless they are 25 feet or more away. An aerial in the open country is ordinarily more effective than one in a congested residence or business district.

The lead-in wire from a flat-top aerial should be free from obstructions, and well insulated. It should touch as few insulators as possible, so as to eliminate possibility of electrical leakage. The lead-in should make good contact with the flat-top portion, and should, if possible, be soldered. Connection with the overhead

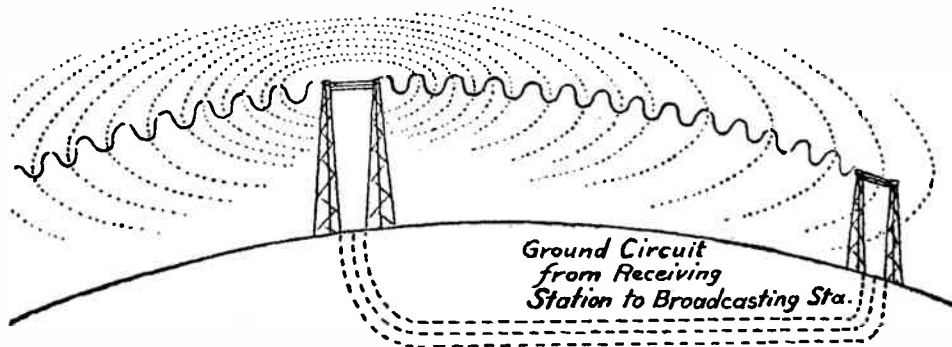
Ray-O-Vac "B" Battery Spring Clips Assure Positive Connections

wire should be as near to the end of the horizontal span as possible. If such an arrangement is not practical, the lead-in may be attached near the center of the flat-top portion, and only a slight loss in efficiency will be suffered; probably so slight as to be unnoticed. Refer to diagram for sketch of an aerial.

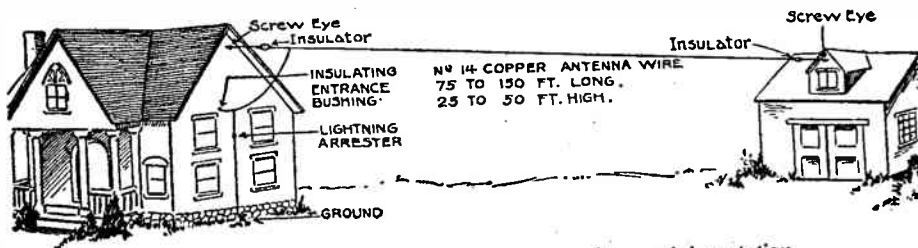
2. **Loop or Coil Aerials.** Loop aerials are coming more or less into favor where it is not possible to erect an outdoor aerial. They are satisfactory for short distance reception with a vacuum tube detector, but only satisfactory for long distance work when used with a radio frequency amplifier of at least two or three stages in addition to the vacuum tube detector and, if desired, audio frequency amplifiers. Loop aerials are supposed to have the advantage of receiving only from the direction in which they are pointed, but this characteristic has been greatly exaggerated in many of the reports in circulation. No ground connection is used with a loop, which is in fact nothing but a tuning coil enlarged to such proportions that it serves to pick up the waves from the sending station, and pivoted so that it may be pointed in any direction.

Lighting Protection. With a loop or an indoor aerial there is of course no need for lightning protectors. In the case of the outdoor aerial, the condition is somewhat different. During a lightning storm the aerial picks up a considerable amount of static electricity, which should have a fairly easy path to the ground, in order to protect the receiving instruments. The danger is not that the lightning will strike the aerial and then set fire to the house; if lightning strikes an aerial it burns up the wire before it gets to the ground—but the static charges coming from flashes of lightning some distance away are liable to do some harm if not provided for by a grounding switch or protector of some kind. In this connection the vacuum type of protector is most highly recommended. As a means of protection it is highly effective, and it may be employed with the very minimum of loss in efficiency of the receiving system. As far as actual danger to the house is concerned, the metal eave-troughs or gutters present a greater fire hazard than an aerial.

The Ground. Except in cases where a loop aerial is employed, a good ground connection is a necessity. The best ground is usually a water pipe (faucet, radiator, or the like) connecting with a city water-works. A gas pipe makes a good substitute. In the country, a metal plate buried deep in moist earth will serve, or a "counterpoise" may be used. This consists of another aerial only a few feet above the ground, and constructed like the overhead aerial. This gives excellent results, but involves more difficulty in construction than does the direct connection to a water pipe. In every case the connections between the instruments and the ground should be as short as possible.



Radio waves traveling out in all directions from transmitting to receiving stations.



A typical antenna system for a radio receiving station.

Ray-O-Vac Batteries Are Water Proof

Ray-O-Vac Radio Batteries Have Longer Life

On Loud-Speakers and Amplifiers.

A LOUD SPEAKER is not an amplifier. A loud speaker can not be connected directly to a crystal set, or to a vacuum tube set having only one tube. A loud speaker can only transform the electrical energy into an amount of sound-energy of about the same value. That is, the amount of electrical energy received in the aerial is not enough to fill a room with sound, when transformed into sound-energy by the loud speaker. This electrical energy must first be amplified, by an instrument called a "Vacuum Tube Amplifier."

Many receiving sets include a two-stage amplifier; if this is the case with your set, it will operate a loud speaker without any additional equipment. If your set has only one vacuum tube, you must first add a two-stage amplifier before you can have satisfactory results with a loud speaker. Recognition of these facts will prevent disappointment when buying a loud-speaking horn.

In general there are two types of vacuum tube amplifiers, each serving its particular purpose:

1. The Audio-frequency Amplifier (Tone-frequency amplifier) is used to increase the strength of the signals received by the detector tube, after they have passed through the detector. Where the incoming signals are too weak to operate the detector tube, it is useless to try to increase them with audio frequency amplifiers. A one-stage amplifier strengthens the sound about 7 times; a 2-stage amplifier makes the sound about 50 times as loud. More than 2 stages of audio frequency amplification can not ordinarily be used without producing "howling."
2. The Radio-frequency Amplifier is used to increase the incoming current before it is fed into the detector. Thus signals that would not be strong enough to operate the detector are amplified so that a good response will be made by the detector tube, after which the intensity of the sound may be increased by the use of an audio-frequency amplifier. The tuners used with radio frequency amplifiers are simpler than the ones ordinarily used with sets without the radio-frequency feature. However, the radio-frequency amplifier is somewhat more complex than the audio-frequency type.

If you do not know just what type of set you want, ask your radio dealer; he can tell you just what you can expect from any radio set.

Ray-O-Vac Rubbery Cell Insulation Eliminates Internal "B" Battery "Shorts"

On Tuning.

NINETY-FIVE per cent of radio "troubles" are caused by ignorance or disregard of the rules of tuning. It is surprising to find what a change in one's viewpoint is made when a radio set is purchased. Before we own the set radio is a most mysterious science; wonderful in the extreme. After we get the set, most of us expect to sit down and hear stations thousands of miles away, without paying any attention to the operation of the set according to instructions.

Turning the dials at random is not tuning. You may run into some stations by accident, but the chances are that you will hear nothing but the near-by stations that you can't help but tune in.

Just as the violinist tunes his instrument to the piano that is to accompany him, so you must tune your instrument to resonance with the sending stations. Not only that, but you have several separate circuits that must be in tune with one another as well as with the broadcasting station. The first thing for the beginner to do in starting to tune in a station is to turn on the filament of the vacuum tube. If you have amplifiers, turn on the amplifier tubes first, as they do not need a very careful adjustment. They should be slightly less bright than an ordinary electric light, except in the case of the new dry-cell tubes or those with an oxide-coated filament, which should be dull red. Tubes burned too bright give fainter signals and more harsh noises, and last about one-tenth as long as tubes burned at the proper temperature. The detector tube adjustment is very important, and it should be burned at a temperature lower than the point where a hissing sound can be heard.

After regulating the detector, advance the tickler, or plate inductance (this is marked on most sets, and is usually the farthest dial to the right on the tuner), to about one half its capacity or a little more. Now turn the primary condenser and switch (this is usually at the left, and marked "tuner") until a sound is heard like a whistle, or if the dial is moved past very rapidly, a chirp of a bird. Now turn back the dial until this whistle is heard loudest, and then reduce the value of the tickler, meanwhile holding the whistle at its loudest point, until the whistle becomes blurred, finally melting into the voice or music at the sending station. It is possible to tune in stations with the tickler advanced too far; but this will be unstable, and the set is liable to start to howl when the hands are moved. On the other hand, the tickler should be exactly at the place where the whistle disappears, for below this point it will be impossible to hear distant stations. The sum this all up:

Ray-O-Lite Flashlight Dealers Carry Ray-O-Vac Radio Batteries

1. Advance tickler to half or three quarters position.
2. Turn primary, or tuner adjustments until a whistling sound is heard.
3. Stop at this point, and reduce the tickler until the whistling sound disappears, meanwhile varying the tuner so that the whistle is held at its greatest intensity until it completely disappears. At this point the voice will be heard.

A little practice will make this operation seem very simple, yet if this procedure is not followed, it is probable that no distant stations will be heard at all. These instructions apply only to regenerative sets, but unless your set is regenerative or has a radio frequency amplifier, very few long distance stations will be heard under any conditions.

Note.

When these instructions are followed, that is picking up the carrier wave of the sending station by advancing the tickler, your own receiving set becomes a source of interference for your immediate neighbors, due to the radiation of energy by your detector tube. Should you have some neighbors with receiving sets, you should learn to tune with the tickler adjusted to the point just below where the detector begins to oscillate, that is, to make the carrier wave audible. It requires much more skill and familiarity with the instrument to do this, but with the increasing numbers of receiving stations, it becomes a duty to your neighbors to learn to keep your set from oscillating. The owner of a radio set should consider the rest of the radio public, and the best way to do this is to learn the fundamentals of radio from a good text book or radio class, and study the principle and operation of his own set conscientiously. A little practice will show you how the set sounds just before it reaches the oscillating point, and you should strive to keep your tickler at this critical adjustment at all times. This will give you the best results, and cause practically no interference to other stations.

Ray-O-Vac Radio Batteries Will Improve Any Receiving Set

Vacuum Tubes.

The vacuum tube is the one piece of equipment that has done most for the rapid development of radio telephony.

The vacuum tube is the common name generally employed in radio. Other names employed for the same piece of apparatus are audion, vacuum valve, electron relay, pliatron, triode, audiotron, radiotron, WD-11, WD-12, UV-199, UV-201A; and others. Some are of scientific origin and others are manufacturers' trade names and numbers.

The vacuum tube is used in radio for three purposes:

1. As a generator of alternating currents.
(for radio telephony and telegraphy)
2. As a detector of received radio currents.
(instead of a crystal detector)
3. As an amplifier of received currents.
(for greatly increasing the loudness of signals received)

The tubes used as generators of alternating currents need not be discussed here, as they are used only in sending stations; neither will scientific discussion of the vacuum tubes used as detectors and amplifiers be entered into.

The vacuum tube consists of six essential parts, these being the "A" filament, the plate in the "B" circuit, the grid, the glass bulb from which the air has been exhausted, the brass base and the terminals.

The "A" battery is connected through the proper terminals to the "A" filament and heats that filament to incandescence. The "B" battery, through the proper terminals, is connected to the plate circuit to create a difference of potential between the filament and the plate.

The original tubes were all designed for a six-volt source of current for the "A" filament and consumed such a high current that only a storage battery could be used as a satisfactory source of current.

Recently marked improvements in these tubes have been made by the tube manufacturers, the trend being toward designs of "A" filaments of low voltage and low current consumption suitable for operation from dry batteries. The tubes of this character in most general use at present are those known as the WD-11 or WD-12 tubes, which are designed to operate on 1½ volt and in which the "A" filament draws approximately one-fourth of an ampere, and the UV-199 tube commonly rated at 4 volts, .06 ampere. The WD-11 tube is provided with a special base requiring an adapter to fit it to the standard six-volt radio socket, whereas the WD-12 tube is provided with the standard base to fit the standard socket.

This tube has unusually long life if not abused by rough handling or overheating of the filament. Under no conditions should more than 1½ volts be connected across the "A" filament. This maximum voltage is automatically obtained from Ray-O-Vac "A" Batteries No. 1211 or No. 1212. If a storage battery is used, the rheostat should always be turned with full resistance in the circuit when the storage battery is connected across the terminals and the filament then gradually brought up to the proper incandescence, which is a dull red glow. This is dangerous practice in the hands of the amateur. If properly used this tube will give approximately 1000 lighted hours of service and the number 1212 Ray-O-Vac "A" dry battery will give approximately 200 hours of service per tube at an average of two hours per night. One additional advantage of this tube is that it can be used both as a detector and as an amplifier.

Ray-O-Vac "B" Batteries Are Not Made From Ordinary Flash Light Cells

This tube is to be preferred to the six-volt tube on account of the elimination of the troublesome and undesirable storage battery with its acid and the inconvenient maintenance feature of re-charging. The Ray-O-Vac "A" dry battery is easily portable and is available everywhere. Radio sets, therefore, using dry battery tubes enjoy the distinct advantage of using a fool-proof portable source of power that can be purchased at minimum initial expense and used at minimum operating expense in the most remote corner of the country.

Other tubes of various voltages are being developed, the trend being almost entirely toward low current consumption on the "A" filament and operation from dry batteries.

Radio Batteries.

Radio batteries are divided into two general classifications, the storage battery and the dry battery. In turn, each of these classifications is divided into two types—the "A" battery and the "B" battery.

The storage battery, both "A" and "B", is normally of the ordinary lead plate-sulphuric acid type. It has the distinct advantage of permitting of the high current output required for the "A" filaments of the original types of vacuum tubes, and has the distinct disadvantages of requiring recharging and requiring especial care to prevent damage from its sulphuric acid electrolyte. The dry batteries have the distinct advantage of light weight, portability, low initial cost, and low maintenance cost on the new types of vacuum tubes, with no danger from acids and requiring no especial care.

THE "A" BATTERY—

The purpose of this battery is to light the filament of the vacuum tube to incandescence. In the case of the older type six-volt tubes with high current consumption, this battery is almost universally a storage battery. With the newest tubes, requiring $1\frac{1}{2}$ volts on the "A" filament, this battery is almost universally a dry battery. Tubes known as WD-11 and WD-12 use Ray-O-Vac "A" dry battery No. 1212 on a single tube, No. 1214B on two tubes, and No. 1216B on three tubes, with two No. 1214B batteries connected in parallel on four-tube sets. The maximum voltage of such tubes is approximately $1\frac{1}{2}$ volts and under no condition should higher voltage be applied on the "A" filament. Failure to heed this precaution will result in burnt-out filaments, resulting in useless tubes.

In using Ray-O-Vac "A" dry batteries with WD-11 and WD-12 tubes, the following precautions should be observed:

1. Be sure the "A" battery is properly connected to the receiving set. That is, the (+) terminal of the "A" battery to the (+) terminal of the receiving set, and the (—) terminal of the "A" battery to the (—) terminal of the receiving set. On homemade sets, be sure that the filament side of the tuning coil is connected to the positive side of the detector tube and that the filament side of the secondary of the amplifying transformer is connected to the negative side of the "A" battery, connecting the filament rheostat in the negative lead.
2. Make all connections as clean and tight as possible. Connecting wires should be polished clean with a knife or sand paper and a pair of pliers used to tighten all nuts. Loose connections in a set are sure to cause noises.
3. Dry batteries should not be located too near a hot radiator. Undue exposure to heat is injurious, causing the battery to discharge slightly even when not in use.
4. Under no conditions light the "A" filament of the tube brighter than a dull red. The filaments in dry cell tubes UV-199 and UV-201-A should be lighted to a higher incandescence.

Ray-O-Vac the Battery that Completes Radio

THE "B" BATTERY

The "B" battery almost universally is of the dry battery type because, while the voltage is comparatively high (about $22\frac{1}{2}$ volts per tube) the current drawn from it is exceedingly small (from three to six thousandths of an ampere per tube). Because of the small current drain on the battery, dry "B" batteries will last for months and sometimes as long as a year, depending upon the size of the battery. When worn out or when the voltage has been reduced to the point where reception is diminished, the "B" battery should be replaced with a fresh one.

In leaving the receiving set there is no need to turn off anything but the rheostats, as this automatically disconnects both "A" and "B" batteries. In the case of sets containing an "A" battery potentiometer (this is rarely found except in the case of a radio frequency amplifier) it is advisable to disconnect one of the wires leading from the "A" battery as the potentiometer causes a slight drain on the "A" battery.

Never connect the "B" battery in place of the "A" battery. This mistake has been the cause of more burnt-out vacuum tubes than any other mistake made. While the "B" battery is composed of small individual cells, its high voltage is far more than the vacuum tube "A" filament will stand and a connection of a fraction of a second will burn out the "A" filament. Vacuum tubes will not operate without a "B" battery.

"B" batteries have in the past been blamed for noise in receiving sets. However, there are so many other things in a set that can cause noise, such as too much filament current in the "A" circuit; too much regeneration from the plate feed back circuit; loose connections, and atmospheric conditions such as static, that in reality the "B" battery should be the last part of the set tested in looking for undue noise. Ray-O-Vac "B" batteries, due to the unique methods of construction of the individual cells and unique methods of assembly will not produce noise when properly connected.

Ray-O-Vac "B" batteries are composed of a number of small dry cells mounted in one block, each cell thoroughly insulated from all other cells by an exclusive process of manufacture and with a special rubbery sealing compound. The usual size of the batteries are of $22\frac{1}{2}$ volts maximum across the battery terminals, although other sizes of 45 volts and of 112 volts are standard.

There are several sizes of $22\frac{1}{2}$ volt batteries, depending upon the size of the individual cells used to make up the completed battery. In general, the larger the size of the individual cell, and, therefore, the larger the size of the assembled battery for a given voltage, the longer the service that will be obtained from the battery. The smallest size of $22\frac{1}{2}$ volt batteries should not be used on the ordinary home receiving sets for, while the initial cost of such small batteries is less than the initial cost of larger batteries, the service received will be so much less as to make maintenance and operating costs excessive.

The standard type of "B" battery that should be used is one No. 2151 Ray-O-Vac "B" battery per tube, although there are some cabinet sets that require a size such as Ray-O-Vac "B" battery No. 5151 or No. 5151BP (Wire lead and binding post), and this size of battery will give satisfactory service. Instead of one No. 2151 battery per tube, one No. 2301 battery (45 volts) can be satisfactorily used on a three tube set, $22\frac{1}{2}$ volts of this battery being used on the detector tube and the full 45 volts on the two amplifying tubes.

Agency taps on the larger sizes of batteries are provided at varying voltages, and by experimenting with the tubes in the various receiving sets the operator can determine just what "B" battery voltage is best for his specific tubes.

With the newer types of dry battery low voltage vacuum tubes, even higher voltage can be used on "B" circuits of the amplifier tube than $22\frac{1}{2}$ volts per tube, some tubes working more satisfactorily on voltages as high as 100 per tube. Such high voltage can be readily obtained by connecting several standard $22\frac{1}{2}$ volt batteries together in series (+ to -). Although the voltage applied to the detector tube must be carefully selected, and ordinarily will be about 18 volts, this is not the case with amplifiers which are, in radio parlance, "not critical."

Ray-O-Vac "B" Battery Seals Do Not "Bulge"

Most Common Radio Questions and Answers.

- Q. Instead of making my aerial a straight wire, can I get the same result by doubling it back and forth, or around corners?
- A. No. The portion which doubles back, unless separated from the rest of the aerial by considerable distance, tends to counteract the effect of the other portion. The simpler your aerial is, the better. If you must have an aerial as short as 20 or 30 feet, some advantage may be obtained by forming it from four or five parallel wires, insulated at each end, and connected together at the lead-in end, and not connected together at the free end. This construction is recommended for aerials built in the attic. If firmly constructed it may serve as a clothes line in the daytime. Rather good results may be had from such an aerial, in connection with a good regenerative set, or with a stage or two of radio frequency amplification. However, an outdoor aerial is always advisable.
- Q. Can more than one pair of phones be used?
- A. Yes. There is very little loss of efficiency when more than one pair of phones are connected. In all cases the phones should be connected in series, that is, tip to tip, with the two free tips inserted in the "Phones" binding posts or plug.
- Q. Can two radio sets use the same aerial?
- A. As a rule this is decidedly not satisfactory. Re-radiation from each receiving set tends to produce squeals and howls in the other.
- Q. Can the vacuum tubes be operated directly from the house current, or through a small transformer?
- A. A few advanced experimenters have been able to do this, by the use of an elaborate filtering apparatus to remove the hum of the generators. If you wish to avoid the storage battery, use the new dry cell vacuum tubes, which are adaptable to most sets.
- Q. What can I do to tune out nearby stations, and hear the long distance ones?
- A. Some local stations are so strong that they can not be tuned out. A number of things can be done to reduce such interference:
1. Use an aerial of about 60 feet in length, one wire.
 2. If your set has a primary variable condenser, keep the setting near minimum, using a greater amount of inductance in the primary tuning coil. If your set has a fixed primary condenser, such as in the Westinghouse Radiola Senior or a condenser mounted on the same shaft as the tuning coil, such as the RC set of the same manufacturer you will find that it is easier to tune out interfering stations with a small variable condenser (3 or 5 plates) connected between the lead-in and the set.
 3. Eliminate the ground connection, and in its place connect another aerial (counterpoise). For very best results this should lie under the main aerial, but any other aerial will serve. Results that are obtained from such a combination are fully equal to the results that are obtained from the use of a ground, and the counterpoise is often better. Practically all transmitting stations use a counterpoise in preference to a direct ground connection.
 4. By using a loop aerial and a three-stage radio-frequency amplifier you will obtain somewhat better selectivity. The loop receives best when

Ray-O-Vac "A" Batteries on 1½ Volt Tubes Will Give 200 Hour Service at 2 Hours per Night

it is pointed in the general direction of the sending station, and will cut out local or other stations when it points at right angles to the direction of the interfering station. The writer believes that the advantages of loop reception have been somewhat over emphasized, although there are unquestionable advantages to be obtained.

Q. I try to follow the instructions on tuning, etc., but I can not hear the long distance stations unless the vacuum tube is burning very bright. What is wrong?

A. One of a number of things may account for this:

1. The tube may actually be defective. Try it out in a friend's set.
2. Your aerial may be of poor design. An aerial longer than 150 feet will make the set act this way, and so will an aerial that is parallel to other wires which are grounded. If the aerial is very low, say 20 feet above the ground, and over 100 feet long, the same effect may be noticed.
3. The voltage of the B battery may be too low, due to use, old age, dropping, or other mistreatment. Try a new Ray-O-Vac "B" battery.

NOTE: Don't underestimate the services of a good "radio doctor." Nearly every city has one or more, and there will undoubtedly be many more of these specialists in the near future. A few dollars spent on expert service is much better than burning out tubes and buying a lot of extra "radio patent medicines" that your friends will advise.

Q. What is the best type of set to build or buy?

A. All standard sets represent good value for the money. Practically all regenerative sets will give the same results. It is possible to build at least 50 different styles of regenerative sets, all of which will give the same results. If you are not experienced in radio you will be safest in asking your dealer for his advice when buying a new set. In building a set for your own use, it is a pretty safe rule to avoid the "freak" hook-ups that appear in some of the more sensational radio magazines, and follow the standard designs. The main thing to seek is simplicity of control, so long as efficiency is not sacrificed.

Q. What about the electric wires for an aerial, with an aerial plug?

A. The only way to tell if this will be satisfactory is to try it in your own house. Aerial plugs will operate in about 75% of the cases, and it is difficult to predict where they will or will not operate. Ordinarily aerial plugs are not satisfactory in new apartment houses, where the electric wiring is carried in metallic pipes or cables. Where they will work, aerial plugs seem to be as satisfactory as a good aerial, with the additional advantage of simplicity and freedom from protective devices.

Q. Would you advise the construction of a "super-regenerative" set?

A. It is entirely possible that in the future the principle of super-regeneration will be adapted to sets that will be fairly dependable and simple to operate. At present these sets are in the laboratory stage, and only experienced radio men can obtain any degree of success with them.

Q. Can a storage battery from an automobile be used with a radio set?

A. Yes, providing due care is taken not to use a voltage too high for your vacuum tubes. A six volt battery is right for the standard tubes, and if your car has a 12 volt battery, it will be necessary for you to use only half of the battery at one time.

Q. Can I use a tree as an aerial support?

A. Yes, but this is not advised. Place a spring or strip of strong rubber between the tree and the insulator, to prevent the wire from breaking in a wind storm. The greatest disadvantage is the change in wave length of the aerial so supported, due to swaying in the wind.

Ray-O-Vac "B" Batteries Are Especially Designed for Radio Work—"There's a Difference"

In Case of Trouble Inside Your Set, Have a French Ray-O-Lite Handy.

DON'T pack up the set and take it back to the dealer. You wouldn't do this with an automobile when it ran out of gasoline. Your batteries may be run down, your vacuum tube burned out, the phone cord broken, or there may be some other minor defect. A careful examination will reveal the trouble.

If the vacuum tube will not light:

1. It may be burned out.
2. The "A" battery may be dead.
3. There may be a broken connection within the set or in the cord from the battery to the set. If it is factory built the chances are that the trouble is not in the set.
4. If the tubes light only dimly the battery is quite certain to be partly discharged.
5. One of the prongs on the tube socket may be bent preventing contact.

If rattling noises are heard with the signals:

1. There may be atmospheric electricity in the air (static). This is not the fault of your set, and there is no way to tune it out.
2. There may be a broken-down transformer or arc light in your locality. Disconnect the aerial and ground wires from your set; if the noise ceases, it is due to one of the above causes.
3. A dead, or nearly discharged, A or B battery will cause such a noise. Ordinarily, when this is the trouble, the noise will not begin at the first moment the rheostat is turned on, but will begin after a short period, and get so bad that nothing else can be heard.
4. If rattling noises are heard only when the dials are turned, it is practically certain that there is a loose connection in the set, the exact location of which can be found by finding which dial produces the noise, and then examining the instrument connected with the dial. Sometimes a wire will break inside the insulation, and when the set is jarred it will make and break the circuit, causing a periodic rattling noise.

If you have a regenerative set, a good aerial, and you can hear the local stations loud and clear, but can't hear any long distance:

1. You have not learned to tune your set. There is no other explanation. Read the part on "tuning." (Exception: bad atmospheric conditions).

If the set is "paralyzed," and nothing seems to come in:

1. You may have the detector tube in the amplifier socket.
2. You may have too much B battery voltage on the detector.
3. The tickler may be advanced too far.
4. The phone cord may be broken or the phone plug short-circuited.

Ray-O-Vac Radio Batteries Are Carefully Aged and Inspected Before Shipping

If the set howls when the hands are moved:

1. Tickler is advanced too far.
2. If a home-made set, you may have neglected to shield the panel with metal.

If the signals are louder with one tube than when using the amplifier:

1. The A battery connections are reversed, or
2. If a home-made set, you may have reversed one of the amplifying transformers or
3. You may have neglected to make one of the connections to the amplifying transformers.
4. It is possible that one of the amplifier tubes is defective. This may be tested in the detector socket, as an amplifier tube makes a fairly good detector. If signals come thru the amplifier tube fairly strong, it is probably all right.

If there is a continual singing noise when the amplifiers are used:

1. This will not occur in a well designed set. It is caused by the tubes or amplifying transformers being too close together. If available space is limited, place the transformers at right angles. It is not advisable to use more than two stages of audio-frequency amplification.

If your vacuum tube burns out in a short time:

1. You may have burned it at too high a temperature. Don't expect a replacement if this is the case.
2. If it is a standard storage-battery tube with an incandescent filament, it may have been burned at too low a temperature. Tungsten filaments will wear out as quickly when burned too low as when they are burned too high. If burned too low the filament crystallizes; if too high, it evaporates rapidly.
3. If you think the burn-out was due to an actual defect, send the tube to your dealer, advising him of the circumstances. He will send the tube to the manufacturer, who will examine the filament under a microscope, and if the tube was defective you will get a replacement without charge. Don't expect the dealer to replace the tube at once. He is put to enough expense in sending in the tube for you, paying the express, and keeping book records of it.

Ray-O-Vac Radio Batteries Are Made by Radio Engineers Who Know How

Popular Misconceptions Corrected.

POPULAR credulity has been taken advantage of in many instances by the spreading of propaganda designed to create a demand for certain instruments used in radio. In some cases this has been originated through ignorance by writers uninformed; in other cases there has been a deliberate attempt to mislead, and create a demand for the supposed "cure-all." Some of the resulting misconceptions are taken up below:

1. Ohmic resistance is not a basis for the sensitivity of radio receivers (phones). Impedence is the important thing, but this varies with the signals received, so it is impossible to rate the phones by any fixed standard of impedence. The best pair of receivers ever used by the writer had a resistance of 2,200 ohms. Many receivers with a resistance of 3,000 to 6,000 ohms are markedly inferior to low priced receivers of 2,000 ohms. In fact, the writer is favorably impressed toward any manufacturer who omits a statement of the resistance of his phones when advertising them. High resistance looks impressive, but "it doesn't mean anything."
2. There is no radio set that will eliminate static.
3. It is difficult in the extreme to eliminate interference from local broadcasting stations. Don't expect too much from loop aerials, selective tuners and the like. Local stations usually can not be tuned out, because they "force" themselves in, regardless of whether they are tuned in or out.
4. Do not expect amplifying transformers with a high step-up ratio to always give best results. Many 9-to-1 transformers are inferior to 3 $\frac{1}{2}$ -to-1 types. There are good ones of each style. Remember that the transformer can not add energy; the B batteries do that.
5. Very long aerials will not bring in loud signals from broadcasting stations. Aerials over 150 feet in length make tuning more difficult, give weaker signals, and bring in more static. More than one wire will not increase the effectiveness of your aerial, except in the case of exceedingly short ones—say 20 feet in length.
6. A radio aerial is not so much of a fire hazard as it is sometimes reported to be. This is not meant to indicate that lightning arresters are not worth while, for protection of the radio apparatus, however. If you have a good protector the house and instruments are as safe as if you did not have a radio at all. Without a protector the house is safe, but slight damage might result to the instruments if lightning struck in the back yard.

Equip Your Receiving Set With Ray-O-Vac

The Correct Way to Test a Radio Set.

ONE subject that should be understood by every owner of a radio is that of tracing out the trouble in his set. The procedure is as follows:

First, obtain a circuit drawing of your set. Your dealer will supply you with such a drawing of a factory built set, but if you have an instrument made by a reputable manufacturer, the chances are against trouble in the set. To locate trouble in a home-made set, you will of course refer to the diagram by which you made it.

You will need a small dry cell and a pair of phones for testing. First test the phones by touching the tips on the battery terminals. If you do not hear a loud click, the trouble lies in the phone. Connect wires to the battery and touch them to the terminals of each phone. If a response is not given by the phone being tested, there is either an "open circuit" or a "short circuit" within that phone. If both phones test O. K., the trouble lies in the phone cord, and a new one should be purchased.

If the phones are found all right, they will then serve as part of the testing outfit. Connect one of the phone tips to one terminal of the battery. Connect a wire to the other side of the battery, and then connect another wire to the free phone tip. Now, when the tips of these two wires are touched together a click will be heard in the phones.

Now refer to your diagram, and test each instrument for open or short circuit. For testing coils (variometers, tapped coils, vario-couplers, etc.), touch one of your wires to one end of the coil in question, the other being connected to the opposite end of the coil. A click should be the result.

In testing condensers, it is best to disconnect one wire from the condenser, and this must be done if the condenser is shunted by a conductor of any sort. A condenser that is correct, will not produce a loud click in the phones. When first touched there will be a very faint click, caused by the instrument discharging through the phones, but the second or third time the test is applied, there should be no click in the phones. If the click is heard, the condenser is defective. After testing the condensers and tuning coils, test out the wiring between these instruments, with the tubes out of their sockets. As an example, this is the way one should proceed in testing out a single circuit tuner, after having tested the condensers and tuning coils:

1. Test from "aerial" binding post to series condenser. This should show a closed circuit, evinced by the click in phones.
2. Test from other side of condenser to primary tuning coil. Should be closed circuit.
3. Test from other side of same coil to ground binding post. Should be closed circuit. This completes the aerial-to-ground circuit.
4. Now test from series condenser to grid condenser. This will show closed circuit, if wiring is correct.
5. Test from other side of grid condenser to the prong on the detector socket marked "G". Should be closed circuit.

Follow this scheme of testing until the trouble is located in the instruments or wiring. Due to the differences in sets, it is impossible to give a strict rule for testing all makes.

Radio Batteries and Note the Improvement

It is a good idea for a beginner to test out his set this way when he first gets it, and thus familiarize himself with the procedure in testing. Let us repeat that the greatest pleasure from radio comes to him who learns the "Why" and "How" of his set, and finds a thrill of achievement when he has located his trouble unaided. The greatest development of radio will only come when every radio owner is educated in the principle and operation of his set. As was pointed out before, an improperly operated receiving set can become a source of annoyance to other listeners, and in order to do the fair thing for the rest of the radio public we must first understand how to operate our instruments. This understanding can come only from study, coupled with practice.

6. If possible test your radio batteries with a voltmeter to be sure voltage is same as stamped at taps on seal.

In Closing.

RADIO is here to stay. It will not be many years before the home radio set will be a necessity of the first order. As a source of entertainment it is in a class by itself. As a means of education and a force for better government, its possibilities can not be over-emphasized. It does not require a visionary to foresee the day when country schools will be absolutely dependent on radio stations miles away, for the larger portion of the curriculum. The highest development of democracy will come about through the discussion of national problems and questions before an audience of the nation—possibly the whole civilized world.

Let us, then, all "do our bit" to bring about the greatest radio development. Let us encourage the study of radio in schools; let us study it ourselves; learn to operate our sets so as to cause a minimum of annoyance to our neighbors; and feel that we have done our share to bring about a revolution in the methods of education and communication—the bases of civilization.

It's Economy to Equip Your Set With 1½

Radiophone Broadcasting Stations in North America, Classified Alpha- betically by Calls

AGI, Presidio of San Francisco, Cal. Signal Corps, U. S. A.
AQG, Canton, O., Hdqtrs, 135 F. Artillery O. N. G.
ASG, San Antonio, Tex. U. S. Army, Camp Travis.
AV7, St. Paul, Minn. Minnesota National Guard.
CFAC, Calgary, Alta., Can. Western Radio Co. Ltd.
CFCA, Toronto, Ont., Can. Toronto Star.
CFCB, Vancouver, B. C., Can. Marconi Co.
CFCE, Halifax, N. S. Can. Marconi Co.
CFCF, Montreal, P. Q., Can. Marconi Co.
CFCH, Iroquois Falls, Ont., Can. Abitibi Power & Paper Co., Ltd.
CFCI, Walkerville, Ont. Can. Motor Products Corp.
CFCN, Calgary, Alta., Can. W. W. Grant Radio Ltd.
CFCX, London, Ont., Can. The London Advertiser.
CFPC, Fort Frances, Ont., Can. International Radio Develop, Co.
CFTC, Toronto, Ont. Can. The Bell Telephone Co.
CFYC, Vancouver, B. C., Can. Victor Wentworth Odum.
CFZC, Montreal, Que., Can. Can. Westinghouse Co., Ltd.
CHBC, Calgary, Canada. W. W. Grant Radio Ltd. (Morning Albertan.)
CHCA, Vancouver, B. C., Can. Radio Corp. of Vancouver, Ltd.
CHCB, Toronto, Can. Marconi Co.
CHCC, Edmonton, Alta., Can. Can. Westinghouse Co., Ltd.
CHCF, Winnipeg, Man., Can. Radio Corp. of Winnipeg, Ltd.
CHCQ, Calgary, Alta., Can. Western Radio Co., Ltd.
CHCS, London, Ont. Can. London Radio Shoppe.
CHCX, Montreal, Que., Can. B. L. Silver.
CHCZ, Toronto, Ont., Can. Globe Printing Co.
CHOC, Vancouver B. C., Can. Can. Westinghouse Co. Ltd.
CHVC, Toronto, Canada. Metropolitan Motors Co.
CHXC, Ottawa, Ont., Can. J. R. Booth Jr.
CHYC, Montreal Que., Can. Northern Elec. Co.
CJBC, Montreal, Que., Can. Dupuis-Freres.
CJCA, Edmonton, Alta., Can. Edmonton Journal, Ltd.
CJCB, Nelson, B. C., Can. James Gordon Bennett.
CJCD, Toronto Canada. T. Eaton Co.
CJCE, Vancouver, B. C., Can. Vancouver Sun.
CJCF, Kitchener Kitchener, Ont. Can. News Record Limited.
CJCG, Winnipeg, Canada. Manitoba Free Press.
CJCH, Toronto, Ont., Can. United Farmers of Ontario.
CJCI, St. John, N. B., Can. McLean, Holt & Co., Ltd.
CJCN, Toronto, Ont., Can. Simons, Agnew & Co.
CJCS, Halifax, N. S., Can. Eastern Telephone & Telegraph Co.
CJCY, Calgary, Alta., Can. Edmund Taylor.
CJGC, London, Ont., Can. London Free Press.

Volt Tubes and Ray-O-Vac "A" Batteries

- CJNC**, Winnipeg, Man., Can. Tribune Newspaper Co.
CJSC, Toronto, Ont., Can. Evening Telegram.
CKAC, Montreal, Can. La Presse.
CKCB, Winnipeg, Man., Can. T. Eaton Co., Ltd.
CKCD, Vancouver B. C., Can. Vancouver Daily Province.
CKCE, Toronto, Ont., Can. Can. Ind. Telephone Co.
CKCK, Regina, Sask., Can. Leader Pub. Co.
CKCR, St. John, N. B., Can. Jones Elec. Radio Co., Ltd.
CKCS, Montreal, Que., Can. The Bell Telephone Co.
CKCZ, Toronto, Ont., Can. Westinghouse Co., Ltd.
CKKC, Toronto, Ont., Can. Radio Equipment & Supply Co. Ltd.
CKOC, Hamilton, Ont., Can. Wentworth Radio Supply Co. Ltd.
CKQC, London, Ont., Can. Radio Supply Co.
CKZC, Winnipeg, Man., Can. Salton Radio Eng. Co.
DD5, Denver, Colo. Fitzsimmons General Hospital.
DM4, San Antonio, Tex. U. S. Army, Kelly Field.
DM7, San Antonio, Tex. U. S. Army Brooks Field.
DN4, Denver, Colo. Colorado National Guard.
KDBZ, Bakersfield, Calif. Frank Seifert.
KDKA, E. Pittsburgh, Pa. Westinghouse Elec. & Mfg. Co.
KDN, San Francisco, Calif. Leo J. Meyberg Co.
KDOW, New York, N. Y. S. S. America.
KDPM, Cleveland, O. Westinghouse Elec. & Mfg. Co.
KDPT, San Diego, Calif. Southern Elec. Co.
KDYL, Salt Lake City, Utah. Salt Lake Telegram.
KBYM, San Diego, Calif. Savoy Theater.
KBYO, San Diego, Calif. Carlson & Simpson.
KDYQ, Portland, Ore. Oregon Inst. of Technology.
KDYR, Pasadena, Calif. Pasadena Star-News Pub. Co.
KDYS, Great Falls, Mont. Great Falls Tribune.
KDYV, Salt Lake City, Utah. Cope & Cornwell Co.
KDYW, Phoenix, Ariz. Smith Hughes & Co.
KDYX, Honolulu, T. H., Hawaii. Honolulu Star-Bulletin Co. Ltd.
KDZA, Tucson, Ariz. Arizona Daily Star.
KDZB, Bakersfield, Calif. Frank E. Siefert.
KDZE, Seattle, Wash. The Rhodes Co.
KDZF, Los Angeles, Calif. Automobile Club of Southern California.
KDZG, San Francisco, Calif. Cyrus Pierce & Co.
KDZH, Fresno, Calif. The Herald-Butford Co.
KDZI, Seattle, Wash. Seattle Radio Assn.
KDZK, Reno, Nev. Nev. Mch. & Elec. Co.
KDZL, Ogden, Utah. Rocky Mountain Radio Corp.
KDZM, Centralia, Wash. Hollingworth Hdwe. & Radio Supply Store.
KDZP, Los Angeles, Calif. Newberry Elec. Corp.
KDZQ, Denver, Colo. Wm. D. Pyle.
KDZR, Bellingham, Wash. Bellingham Pub. Co.
KDZT, Seattle, Wash. Seattle Radio Assn.
KDZW, San Francisco, Calif. Claude W. Gerdes.
KDZZ, Everett, Wash. Kinney Bros. & Seppell.
KFAC, Glendale, Calif. Daily Press.
KFAD, Phoenix, Ariz.

**Ray-O-Vac "B" Batteries Are Made in Several Sizes.
Cost per Hour of**

KFAE, Pullman, Wash. State College of Washington.
KFAF, Denver, Colo. Western Radio Corp.
KFAJ, Boulder, Colo. Univ. of Colo.
KFAN, Moscow, Idaho. The Elec. Shop.
KFAP, Butte, Mont. Standard Pub. Co.
KFAQ, San Jose, Calif. City of San Jose.
KFAR, Hollywood, Calif. Studio Lighting Service Co.
KFAS, Reno, Nev. Reno Motor Supply Co.
KFAT, Eugene, Ore. Pac. Radio Co.
KFAU, Boise, Ida. Boise H. S.
KFAW, Santa Ana, Calif. Radio Den.
KFAY, Medford, Ore. Virgin Radio Service.
KFBA, Lewiston, Ida. Ramey & Bryant Radio Co.
KFBB, Havre, Mont. F. A. Buttery & Co.
KFBC, San Diego, Calif. W. K. Azbill.
KFBD, Hanford, Calif. Calif. Radio Lab.
KFBE, San Luis Obispo Calif. R. H. Horn.
KFBG, Tacoma, Wash. First Presbyterian Church.
KFBH, Marshfield, Ore. Thomas Musical Co.
KFBJ, Boise, Ida. Boise Radio Supply Co.
KFBK, Sacramento, Calif. Kimball-Upson Co.
KFBL, Everett, Wamsh. Leese Bros.
KFBM, Astoria, Ore. Cook & Foster.
KFBN, Oakland, Calif. Borch Radio Corp.
KFRQ, Prescott, Ariz. Savage Elec. Co.
KFBS, Trinidad, Colo. Chronicle News & Gas & Elec. sup-
 ply Co.
KFBU, Laramie, Wyo. Bishop N. S. Thomas.
KFBV, Colorado Springs, Colo. Clarence O. Ford.
KFC, Seattle Wash. Northern Radio & Electric Co.
KFCB, Phoenix, Ariz. Nielsen Radio Supply Co.
KECC, Wallace, Ida. Auto Supply Co.
KFCD, Salem, Ore. F. S. Barton.
KFCF, Walla Walla, Wash. Frank A. Moore.
KFCH, Billings, Mont. Electric Service Station Inc.
KFCJ, Colorado Springs, Colo. Colorado Springs Radio Co.
KFCL, Los Angeles, Calif. Los Angeles Union Stock Yards.
KFCQ, Casper, Wyo. Motor Service Sta.
KFDA, Baker, Ore. Adler's Music Store.
KFDB, San Francisco Calif. Mercantile Trust Co.
KFDC, Spokane, Wash. Radio Supply Co.
KFDD, Boise, Idaho St. Michael's Cathedral.
KFDF, Casper, Wyo. Wyo. Radio Corp.
KFDH, Tuscon, Ariz. University of Arizona.
KFDS, San Francisco, Calif. John D. McKee.
KFER, Taft, Calif. City of Taft.
KFEC, Portland, Ore. Meier & Frank Co.
KFED, Polytechnic, Mont. Billings Polytechnic Institute.
KFEG, Tacoma, Wash. Guy Greason.
KFEP, Denver, Colo. Radio Equipment Co.
KFEA, San Diego, Calif. Dr. R. C. Shelton.
KFEE, Pendleton, Ore. Eastern Oregon Radio Co.
KFGG, Astoria, Ore. Astoria Budget.
KFGH, Stanford Univ. Calif. Leland Stanford Jr. Univ.
KFL, Los Angeles, Calif. Earle C. Anthony, Inc.

We Recommend Our No. 2151 Because the Operating Service Is Less

- KFV, Yakima, Wash. Foster-Bradbury Radio Store.
KFZ, Spokane, Wash. Doerr Mitchell Elec. Co.
KGB, Tacoma, Wash. Tacoma Daily Ledger-William A. Mullins Elec. Co.
KGG, Portland, Ore. Haddock & Watson Radio Service.
KGN, Portland, Ore. Northwestern Radio Mfg. Co.
KGO, Altadena, Calif. Altadena Radio Lab.
KGU, Honolulu, Hawaii. The Honolulu Advertiser.
KGW, Portland, Ore. Ship Owners Radio Service Inc. (Daily Oregonian.)
KGY, Lacey, Wash. St. Martins College.
KHD, Colorado Springs, Colo.
KHJ, Los Angeles, Calif. Los Angeles Times.
KHQ, Seattle, Wash. Louis Wasmser.
KJJ, Sunnyvale, Calif. Radio Shop.
KJQ, Stockton, Calif. C. O. Gould.
KJR, Seattle, Wash. Northwest Radio Service Co.
KJS, Los Angeles, Calif. Bible Inst. of Los Angeles.
KLB, Pasadena, Calif. J. J. Dunn Co.
KLN, Del Monte, Calif. Monterey Elec. Shop.
KLP, San Francisco, Calif. Colin B. Kennedy Corp.
KLS, San Francisco, Calif. Warner Bros. Radio Supply Co.
KLX, Oakland, Calif. Oakland Tribune.
KLZ, Denver, Colo. Reynolds Radio Co.
KMC, Reedley, Calif. Lindsay-Weatherill & Co.
KMJ, Fresno, Calif. San Joaquin Lt. & Pr. Co.
KMO, Tacoma, Wash. Tacoma Times. (Love Electric Co.)
KNI, Eureka, Calif. T. W. Smith
KNJ, Roswell, New Mex. Roswell Public Service Co.
KNN, Los Angeles, Calif. Bullock's.
KNT, Aberdeen, Wash. Grays Harbor Radio Co.
KNV, Los Angeles, Calif. Radio Supply Co.
KOB, State College, N. M. College Agri. & Mech. Arts.
KOG, Los Angeles, Calif. Western Radio Elec. Co.
KON, San Diego, Calif. Holzwasser Inc.
KOP, Detroit, Mich. Detroit Police Dept.
KPO, San Francisco, Calif. Hale Bros., Inc.
KQI, Berkeley, Calif. Univ. of Calif.
KQP, Hood River, Ore. Hood River News.
KQV, Pittsburgh, Pa. Doubleday-Hill Elec. Co.
KQW, San Jose, Calif. Chas. D. Herrwold.
KQY, Portland, Ore. Stubbs Elec. Co.
KRE, Berkeley, Calif. Maxwell Elec. Co.
KSD, St. Louis, Mo. St. Louis Post-Dispatch.
KSL, San Francisco, Calif. The Emporium.
KSS, Long Beach, Calif. Prest & Dean Radio Co.
KTW, Seattle, Wash. First Presbyterian Church.
KVO, San Francisco, Calif. San Fran. Examiner.
KUS, Los Angeles, Calif. City Dye Works & Laundry Co.
KUY, El Monte, Calif. Coast Radio Co.
KVQ, Sacramento, Calif. Sacramento Bee.
KWG, Stockton, Calif. Portable Wireless Telephone Co.
KWH, Los Angeles, Calif. Examiner, Dalley ex Sun.
KXD, Modeste, Calif. Herald Pub. Co.
KXS, Los Angeles, Calif. Braun Corp.

Ray-O-Vac 1211 "A" Battery Is Designed Especially

KYF, San Diego, Calif. Thearle Music Co.
KYG, Portland, Ore. Radio Service Bureau.
KYL, Bakersfield, Calif. Bakersfield Californian.
KYJ, Los Angeles, Calif. Leo J. Meyberg Co. (Hamburgers.)
KYQ, Honolulu, Hawaii. Electric Shop.
KYW, Chicago, Ill. Westinghouse Elec. & Mfg. Co.
KYY, San Francisco, Calif. The Radio Telephone Shop.
KZC, Seattle, Wash. Public Market & Department Store Co.
KZM, Oakland, Calif. Western Radio Institute (Hotel Oakland).
KZN, Salt Lake City, Utah. Desert News.
KZV, Wenatchee, Wash. Wenatchee Battery & Motor Co.
KZY, San Francisco, Calif. Atlantic-Pacific Radio Supplies Co.
NAA, Arlington, Va. U. S. Navy Dept.—710 meters only.
PWX, Havana, Cuba. Cuban Telephone Co.
WAI, Dayton, O. McCook Field, U. S. Army.
WAAB, New Orleans, La. Valdemar Jensen.
WAAC, New Orleans, La. Tulane Univ.
WAAD, Cincinnati, O. Ohio Mechanics Inst.
WAAF, Chicago, Ill. Chicago Daily Drivers Journal.
WAAH, St. Paul, Minn. Commonwealth Elec. Co.
WAAJ, Boston, Mass. Eastern Radio Inst.
WAAK, Milwaukee, Wis. Gimbel Bros.
WAAM, Newark, N. J. I. R. Nelson Co.
WAAN, Columbia, Mo. Univ. of Mo.
WAAO, Charleston, W. Va. Radio Service Co.
WAAP, Wichita, Kan. United Elec. Co.
WAAQ, Greenwich, Conn. New England Motor Sales Co.
WAAR, Huntington, W. Va. Groves-Thornton Hdw. Co.
WAAS, Decatur, Ga. Georgia Radio Co.
WAAT, Jersey City, N. J. Jersey Review.
WAAV, Athens, O. Athens Radio Co.
WAAW, Omaha, Neb. 500 Omaha Grain Exchange.
WAAZ, Crafton, Pa. Radio Service Corp.
WAAY, Youngstown, O. Yohrling Ravner Music Co.
WAAZ, Emporia, Kans. Hollister-Miller Motor Co.
WAH, Eldorado, Kans. The Midland Refining Co.
WAJF, Marshall, Mo. Kelly-Vawter Jewelry Co.
WAJU, Yankton, S. D. Yankton College.
WBAA, W. Lafayette, Ind. Purdue University.
WBAB, Syracuse, N. Y. Syracuse Radio Tel. Co.
WBAD, Minneapolis, Minn. Sterling Electric Co.
WBAP, Moorestown, N. J. Fred M. Middleton.
WBAG, Bridgeport, Pa. Diamond St. Fibre Co.
WBAM, Minneapolis, Minn. The Dayton Co.
WBAJ, Toledo, O. Marshall-Gerken Co.
WBAN, Paterson, N. J. Wireless Phone Corporation.
WBAO, Decatur, Ill. James Millkin Univ.
WBAQ, Mishawaka, Ind. Lyradion Mfg. Co.
WBAP, Fort Worth, Texas. Fort Worth Star Telegram.
WBAU, Hamilton, O. Republican Pub. Co.
WBAV, Columbus, O. The Ernor Hopkins Co.
WBAW, Marietta, O. Marietta College.
WBAX, Wilkes-Barre, Pa. John H. Stenger, Jr.

for 4½ Volt 60 Milliampere Tubes, Using 3 in Series

- WBAV**, New York, N. Y., A. T. & T. Co.
WBL, Anthony, Kans., T. & H. Radio Co.
WBS, Newark, N. J., D. W. May, Inc.
WBT, Charlotte, N. C., Southern Radio Corp.
WBU, Chicago, Ill., City of Chicago.
WBZ, Springfield, Mass., Westinghouse Elec. & Mfg. Co.
WCAB, Newburgh, N. Y., Newburgh Daily News.
WCAC, Fort Smith, Ark., John Fink Jewelry Co.
WCAD, Canton, N. Y., St. Lawrence Univ.
WCAG, Pittsburgh, Pa., Kaufman & Baer Co.
WCAG, New Orleans, La., Clyde R. Randall.
WCAH, Columbus, O., Entekm Elec. Co.
WCAI, San Antonio, Tex., Southern Equipment Co.
WCAJ, Univ. place, Nola, Wesleyan Univ.
WCAK, Houston, Tex., Alfred P. Douch.
WCAI, Northfield, Minn., St. Olaf College.
WCAK, Villanova, Pa., Villanova College.
WCAM, Baltimore, Md., Sudders & Singman Co.
WCAP, Kalamazoo, Mich., Kalamazoo College.
WCAP, Coonrad, Ill., Central Radio Co., Inc.
WCAQ, Coopers, O., The State Radio Mfg. Co.
WCAR, San Antonio, Tex., Lehman Radio Elec. Co.
WCAS, Minneapolis, Minn., Wm. H. Franzen, Jr., Sr.
Inst.
WCAT, Raold City, S. D., S. D. State School of Mines.
WCAU, Philadelphia, Pa., Philadelphia Graphophone Co.
WCAY, Little Rock, Ark., J. C. Foss, Elec. Co.
WCAX, Chicago, Ill., Chicago Electric Supply Co., Inc.,
Headq.
WCAX, Philadelphia, Pa., City of Phila.
WCAY, Milwaukee, Wis., Knott Radio & Electric Co.,
Inc.,
WCAY, Chicago, Ill., Chicago Electric Supply Co.,
Headq.
WCB, Milwaukee, Wis., Phoenix Elec. Co.
WCJ, New Haven, Conn., A. C. Gilbert Co.
WCK, St. Louis, Mo., The St. Louis School of
Broadcasting.
WCM, Austin, Tex., W. J. Fox.
WCX, Waco, Tex., The Waco Electric Co.
WCX, Detroit, Mich., The Detroit Radio Plant.
WDA, New York, N. Y., Newsday, Inc.,
Editor.
WDAC, Spartan Bl. Md., Herald-Examiner.
WDAB, Memphis, Tenn., Memphis Daily Press.
WDAB, Kansas City, Mo., Kansas City Star.
WDAG, Amarillo, Tex., The Daily Amarillo
News.
WDAH, El Paso, Tex., El Paso Electric Co.
WDAI, Syracuse, N. Y., Frank's Radio Corp.
WDAJ, Collins Park, Ga., A. & W. P. R. Co.
WDAK, Hartford, Conn., Hartford Courant.
WDAI, Jacksonville, Fla., Florida Times Union.
WDAN, Sayreport, La., Contemporary College and
Georgetown
Radio Corp.
WDAO, Dallas, Tex., Automobile Elec. Co.
WDAP, Chicago, Ill., Thomas Donnelly and J. Elliott Jen-
kins, Drake Hotel.
WDAQ, Brownsville, Pa., Hartman-Riker Elec. & Mach. Co.
WDAR, Philadelphia, Pa., Ed Bros.
Boston, Mass., Samuel A. White.

Ray-O-Vac Radio Batteries Reach

WDAU, New Bedford, Mass. A. H. Smith.
WDAV, Muskogee, Okla. Daily Phoenix.
WDAX, Centerville, Iowa. First Nat'l Bank.
WDAY, Fargo, N. D.
WDM, Washington, D. C. Church of the Covenant.
WDT, New York, N. Y. Ship Owners Radio Service.
WDY, Omaha, Neb. John O. Yeiser, Jr.
WDZ, Roselle Park, N. J. Radio Corp. of America.
WEAA, Tuscola, Ill. James L. Bush.
WEAB, Flint, Mich. Fallain & Lathrop.
WEAB, Fort Dodge, Iowa. Standard Radio Equip. Co.
WEAC, Terre Haute, Ind. Baines Elec. Service Co.
WEAD, Atwood, Kans. N. W. Kansas Radio Supply Co.
WEAE, Blacksburg, Va. Polytechnic Inst.
WEAF, New York City, N. Y. Am. Tel. & Telg. Co.
WEAG, Edgewood, R. I. Nichols-Hineline-Bassett Lab.
WEAH, Wichita, Kans. Lander Radio Co.
WEAI, Ithaca, N. Y. Cornell Univ.
WEAJ, Vermillion, S. D. Univ. of S. D.
WEAJ, Grove City, Pa. Grove City College.
WEAK, St. Joseph, Mo. Julius B. Abercombie.
WEAM, North Plainfield, N. J. Borough of N. Plainfield.
WEAN, Providence, R. I. The Shepard Co.
WEAO, Columbus, O. Ohio State Univ.
WEAP, Mobile, Ala. Mobile Radio Co.
WEAR, Baltimore, Md. News & American Pub. Co.
WEAS, Washington, D. C. The Hecht Co.
WEAT, Tampa, Fla. John J. Fogarty.
WEAV, Sioux City, Iowa. Davidson Bros. Co.
WEAV, Rushville, Neb. Sheridan Elec. Service Co.
WEAW, Anderson, Ind. Arrow Radio Lab.
WEAX, Little Rock, Ark. T. J. M. Daly.
WEAY, Houston, Tex. Will Horwitz, Jr.
WEB, St. Louis, Mo. The Benwood Co., Inc.
WEH, Tulsa, Okla. (300 S. Main St., Eldorado, Kans.) Mid-land Refining Co.
WEV, Houston, Tex. Hurlburt-Still Elec. Co.
WEW, St. Louis, Mo. St. Louis, Univ.
WEY, Wichita, Kans. Cosradio Co. (Wichita Beacon).
WFAA, Dallas, Texas. Dallas News and Dallas Journal.
WFAB, Syracuse, N. Y. C. F. Woese.
WFAC, Superior, Wis. Superior Radio Co.
WFAD, Salina, Kans. Watson Weldon Motor Supply Co.
WFAF, Poughkeepsie, N. Y. H. C. Spratley Radio Co.
WFAG, Waterford, N. Y. Radio Engineering Lab.
WFAH, Port Arthur, Tex. Elec. Supply Co.
WFAJ, Asheville, N. C. Hi-Grade Wireless Instrument Co.
WFAM, St. Cloud, Minn. Granite City Elec. Co.
WFAN, Hutchinson, Minn. Hutchinson Elec. Service Co.
WFAQ, Cameron, Mo. Cameron Radio Co. and Mo. Wesleyan College.
WFAK, Sanford, Me. Hall & Stubbs.
WFAS, Fort Wayne, Ind. United Radio Corp.
WFAT, Sioux Falls, S. D. Argus Leader.
WFAU, Boston, Mass. Edwin C. Lewis.
WFAV, Lincoln, Neb. Univ. of Neb?

the User While Still Fresh

- WFAW, Miami, Fla. Daily Metropolis.
WFAY, Independence, Kan. Daniels Radio Supply Co.
WFAZ, Charleston, S. C. S. C. Radio Shop.
WFI, Philadelphia, Pa. Strawbridge & Clothier.
WFO, Dayton, O. Rike-Kumler Co.
WGAB, Houston, Tex. QRV Radio Co.
WGAD, Ensenada, Porto Rico. Escuela Hispano Americana de Radio Telegrafia, Inc.
WGAH, New Haven, Conn. New Haven Elec. Co.
WGAI, Shenandoah, Ia. W. H. Gass.
WGAJ, Macon, Ga. Macon Elec. Co.
WGAL, Lancaster, Pa. Lancaster Elec. Supply and Construction Co.
WGL, Philadelphia, Pa. Thos. F. J. Howlett.
WGAM, Orangeburg, S. C. Orangeburg Radio Equipment Co.
WGAN, Pensacola, Fla. Cecil E. Lloyd.
WGAQ, Shreveport, La. Glenwood Radio Corp.
WGAR, Fort Smith, Ark. Southwest American.
WGAS, Chicago, Ill. Ray-di-co Organization, Inc.
WGAT, Lincoln, Neb. Am. Legion, Dept. of Neb.
WGAU, Wooster, O. Marcus G. Limb.
WGAW, Altoona, Pa. Ernest C. Albright.
WGAX, Washington C. H., O. Radio Elec. Co.
WGAY, Madison, Wis. North Western Radio Co.
WGAZ, South Bend, Ind. South Bend Tribune.
WGF, Des Moines, Iowa. Register and Tribune.
WGI, Medford Hillside, Mass. Am. Radio and Research Corp.
WGM, Atlanta, Ga. Atlanta Constitution.
WGR, Buffalo, N. Y. Federal Tel. & Telg. Co.
WGY, New Orleans, La. Interstate Elec. Co.
WGY, Schenectady, N. Y. General Elec. Co.
WHA, Madison, Wis. Univ. of Wis.
WHAA, Iowa City, Ia. State Univ. of Ia.
WHAB, Galveston, Tex. Clark W. Thompson Co.
WHAC, Waterloo, Ia. Col. Bros. Elec. Co.
WHAD, Milwaukee, Wis. Marquette Univ.
WHAE, Sioux City, Ia. Automotive Elec. Service Co.
WHAF, Pittsburg, Pa. Radio Elec. Co.
WHAG, Cincinnati, O. Univ. of Cincinnati.
WHAH, Joplin, Mo. John T. Griffin.
WHAI, Davenport, Ia. Radio Equip. & Mfg. Co.
WHAK, Clarksburg, W. Va. Roberts Hdw. Co.
WHAL, Lansing, Mich. The Capital News.
WHAM, Rochester, N. Y. Univ. of Rochester.
WHAO, Savannah, Ga. Frederick A. Hill.
WHAP, Decatur, Ill. Dewey L. Otta.
WHAQ, Washington, D. C. Semmes Motor Co.
WHAR, Atlantic City, N. J. Paramount Radio & Elec. Co.
WHAS, Louisville, Ky. Courier Journal and Louisville Times Co.
WHAV, Wilmington, Del. Wilmington Elec. Spec. Co.
WHAW, Tampa, Fla. Pierce Elec. Co.
WHAY, Huntington, Ind. Huntington Pub. Co.
WHAZ, Troy, N. Y. Rensselaer, Polytechnic Inst.

Ray-O-Vac Radio Batteries Give Dependable

WHB, Kansas City, Mo. Sweeney Auto & Tractor School.
WHD, Morgantown, W. Va. W. Va. University.
WHK, Cleveland, O. Warren R. Cox.
WHN, Ridgewood, N. Y. Times Printing & Pub. Co.
WHX, Des Moines, Iowa. Iowa Radio Corp.
WIAA, Waupaca, Wis. Waupaca Civic & Commerce Assn.
WIAB, Rockford, Ill. Joslyn Automobile Co.
WIAC, Galveston, Tex. Galveston Tribune.
WIAD, Ocean City, N. J. Ocean City Yacht Club.
WIAE, Vinton, Ia. Zimmerman Radio Co.
WIAF, New Orleans, La. Nola Radio Co.
WIAH, Newton, Ia. Continental Radio & Mfg. Co.
WIAI, Springfield, Mo. Heer Stores Co.
WIAJ, Neenah, Wis. Fox River Valley Radio Supply Co.
WIAK, Omaha, Neb. Daily Journal-Stockman.
WIAO, Milwaukee, Wis. School of Engineering.
WIAQ, Marion, Ind. Chronicle Pub. Co.
WIAR, Paducah, Ky. J. A. Rudy & Sons.
WIAS, Burlington, Ia. Hawk-Eye Home Elec. Co.
WIAT, Tarkio, Mo. Leon T. Noel.
WIAU, Le Mars, Ia. Am. Trust & Savings Bank.
WIAV, Binghamton, N. Y. N. Y. Radio Lab.
WIAW, Saginaw, Mich. Saginaw Radio & Elec. Co.
WIAZ, Lincoln Neb. Capital Radio Co.
WIAY, Washington, D. C. Woodward & Lothrop.
WIAZ, Miami, Fla. Flager St., Electric Supply Sales Co.
WIK, McKeesport, Pa. K. & L. Elec. Co.
WIL, Washington, D. C. Continental Elec. Supply Co.
WIP, Philadelphia, Pa. Gimbel Bros.
WIZ, Cincinnati, O. Cino Radio Mfg. Co.
WJAB, Lincoln, Neb. American Radio Co.
WJAC, Joplin, Mo. Redell Co.
WJAD, Waco, Tex. Jackson's Radio Engrng. Lab.
WJAE, San Antonio, Tex. Texas Radio Syndicate (Evening News).
WJAF, Muncie, Ind. Muncie Press and Smith Elec. Co.
WJAG, Norfolk, Neb. Norfolk Daily News.
WJAH, Rockford, Ill. Central Park Amusement Co.
WJAJ, Dayton, O. Y. M. C. A.
WJAK, Stockdale, O. White Radio Lab.
WJAL, Portland, Me. Victor Radio Corp.
WJAM, Cedar Rapid, Ia. D. M. Perham.
WJAN, Peoria, Ill. Peoria Star and Peoria Radio Sales Co.
WJAP, Duluth, Minn. Kelley Duluth Co.
WJAQ, Topeka, Kans. Copper Publications.
WJAR, Providence, R. I. The Outlet Co.
WJAS, Pittsburgh, Pa. Pittsburgh Radio Supply House (Pittsburgh Leader).
WJAT, Marshall Mo. Kelley-Vawter Jewelry Co.
WJAX, Cleveland, O. Union Trust Co.
WJAZ, Chicago, Ill. Chicago Radio Lab.
WJD, Granville, O. Dennison University.
WJH, Washington, D. C. White & Boyer Co.
WJK, Toledo, O. Service Radio Equipment Co.
WJX, New York, N. Y. De Forest Radio Telephone & Telegraph Co.

Service Throughout Their Long Life

- WJZ**, Newark, N. J. Westinghouse Elec. & Mfg. Co.
WKAA, Cedar Rapids, Ia. H. F. Paar.
WKAC, Lincoln, Neb. Star Pub. Co.
WKAD, East Providence, R. I. Charles Looff.
WKAF, Wichita Falls, Tex. W. S. Radio Supply Co.
WKAG, Louisville, Ky. Edwin T. Bruce.
WKAH, West Palm Beach, Fla. Planet Radio Co.
WKAK, Okemah, Okla. Okfuskee County News.
WKAL, Orange, Tex. Gray & Gray.
WKAM, Hastings, Neb. Daily News.
WKAN, Montgomery, Ala. Alabama Radio Mfg. Co.
WKAP, Granston, R. I. Wilcox Flint.
WKAQ, San Juan, Porto Rico. Radio Corp. of Porto Rico.
WKAR, East Lansing, Mich. Mich. Agri. College.
WKAS, Springfield, Mo. L. E. Lines Music Co.
WKAU, Laconia, N. H. Laconia Radio Club.
WKAW, Beloit, Wis. L. M. Turner.
WKAX, Bridgeport, Conn. Wm. A. Macfarlane.
WKAU, Gainesville, Ga. Brenau College.
WKAZ, Wilkes-barre, Pa. Landau's Music Co.
WKC, Baltimore, Md. Jos. M. Zamolski Co.
WKN, Memphis, Tenn. Riechman-Crosby Co.
WKY, Oklahoma City, Okla. Oklahoma Radio Shop. (Daily Oklahoman.)
WL2, Fairfield, O. U. S. Army.
WLAB, Carrollton, Mo. George F. Crossman.
WLAC, Raleigh, N. C. N. C. State College.
WLAD, Hastings, Neb. Arvanette Radio Supply Co.
WLAF, Lincoln, Neb. Johnson Radio Co.
WLAG, Minneapolis, Minn. Operated by Cutting & Washington Radio Corp. for: L. S. Donaldson Co., Findley Electric Co., N. W. National Bank, N. W. Farmstead, Powers Merc. Co., Sterling Elec. Co., E. E. Atkinson Co.
WLAH, Syracuse, N. Y. Samuel Woodworth.
WLAJ, Waco, Tex. Waco Electric Supply Co.
WLAU, Bellows Falls, Vt. Vermont Farm Machine Co.
WLAL, Tulsa Radio Co., Tulsa, Okla.
WLAM, Springfield, O. Morrow Radio Co.
WLAN, Houlton, Me. Putnam Hdw. Co.
WLAO, Scranton, Pa. R. C. Ehrhardt and J. H. Jones.
WLAP, Louisville, Ky. W. V. Jordan.
WLAQ, Kalamazoo, Mich. A. E. Schilling.
WLAR, Marshalltown, Ia. Meikel Music Co.
WLAS, Hutchinson, Kans. Hutchinson Grain Radio Co.
WLAV, Pensacola, Fla. Electric Shop, Inc.
WLAW, New York, N. Y. New York Police Dept.
WLAX, Greencastle, Ind. Greencastle Community Broadcasting Station. (Putnam Elec. Co.)
WLAY, Fairbanks, Alaska. Northern Commercial Co.
WLAZ, Warren, O. Hutton & Jones Elec. Co.
WLB, Minneapolis, Minn. Univ. of Minn.
WLK, Indianapolis, Ind. Hamilton Mfg. Co.
WLW, Cincinnati, O. Crosley Mfg. Co.
WMA, Anderson, Ind. Arrow Radio Lab.
WMAB, Oklahoma City, Okla. Radio Supply Co.
WMAC, Cazenovia, N. Y. C. B. Meredith.

**Ray-O-Vac "A" Batteries Are Not Ordinary Dry Cells
to Good**

- WMAD**, Rock Port, Mo. Atchinson County Mail.
WMAF, Dartmouth, Mass. Round Hills Radio Corp.
WMAG, Liberal, Kans. Tucker Elec. Co.
WMAH, Lincoln Neb. General Supply Co.
WMAJ, Kansas City, Mo. Daily Drivers Telegram.
WMAK, Lockport, N. Y. Norton, Labs.
WMAL, Trenton, N. J. Trenton, Hdw. Co.
WMAM, Beaumont, Tex. Beaumont Radio Equipment Co.
WMAN, Columbus, O. First Baptist Church.
WMAF, Easton, Pa. Utility Battery Service.
WMAQ, Chicago, Ill. Chicago Daily News.
WMAR, Waterloo, Iowa. Waterloo Electrical Supply Co.
WMAT, Duluth, Minn. Paramount Radio Corp.
WMAV, Auburn, Ala. Ala. Polytechnic Inst.
WMAW, Wahpeton, N. D. Wahpeton Elec. Co.
WMAX, Ann Arbor, Mich. K. & K. Radio Supply Co.
WMAY, St. Louis, Mo. Kingshighway Presbyterian Church.
WMAZ, Macon, Ga. Mercier University.
WMB, Auburn, Me. Auburn Elec. Co.
WMC, Memphis, Tenn. The Commercial Appeal.
WMI, Cincinnati, O. Precision Equipment Co.
WMU, Washington, D. C. Doubleday-Hill Elec. Co.
WNAB, Bowling Green, Ky. W. H. Riley.
WNAC, Boston, Mass. Shepard Stores.
WNAD, Norman, Okla. Okla. Radio Engineering Co.
WNAF, Enid, Okla. Enid Radio Dist. Co.
WNAG, Cresco, Ia. Rothert Radio and Electric Shop.
WNAH, Wilkes-Barre, Pa. Wilkes-Barre Radio Repair Shop.
WNAJ, Chicago, Ill. Benson, Co.
WNAK, Manhattan, Kans. Manhattan Radio Supply Co.
WNAL, Omaha, Neb. R. J. Rockwell.
WNAH, Evansville, Ind. Ideal Apparatus Co.
WNaN, Syracuse, N. Y. Syracuse Radio Telephone Co.
WNAQ, Charleston, S. C. Charleston Radio Elec. Co.
WNAP, Springfield, O. Wittenberg College.
WNAR, Butler, Mo. C. C. Rhodes.
WNAS, Austin, Tex. Tex. Radio Corp. (Austin Statesman.)
WNAT, Philadelphia, Pa. Lennig Bros. Co.
WNAV, Knoxville, Tenn. People's Tel. & Telg. Co.
WNAW, Fortress Monroe, Va. Henry Kunzmann.
WNAX, Yankton, S. D. Dakota Radio Apparatus Co.
WNAF, Baltimore, Md. Shipowners Radio Service.
WNJ, Albany, N. Y. Shotton Radio Mfg. Co., Inc.
WNO, Jersey City, N. J. Wireless Telephone Co. of Hudson Co., N. J.
WOAA, Ardmore, Okla. Dr. Walter Hardy.
WOAB, Grand Forks, No. Dak. Valley Radio.
WOAC, Lima, O. Maus Radio Co.
WOAD, Sigourney, Ia. Friday Battery & Elec. Co.
WOAE, Fremont, Neb. Medland College.
WOAF, Tyler, Tex. Tyler Commercial College.
WOAG, Belvidere, Ill. Apollo Theatre.
WOAH, Charleston, S. C. Palmetto Radio Corp.
WOAI, San Antonio, Tex. Southern Equip. Co.

They Maintain the High and Uniform Voltage Essential Reception

- WOAJ, Pansons, Kans. Ervin's Elec. Co.
WOAK, Frankfort, Ky. Collins Hardware Co.
WOAL, Webster Grove, Mo. William E. Woods.
WOAN, Lawrenceburg, Tenn. J. D. Vaughan.
WOAQ, Portsmouth, Va. Portsmouth Radio Assn.
WOAR, Kenosha, Wis. H. P. Lundskow.
WOAS, Middletown, Conn. Bailey's Radio Shop.
WOAT, Wilmington, Del. Boyd Martell Hamp.
WOAU, Evansville, Ind. Sowder Bowling Piano Co.
WOAV, Erie, Pa. Pa. National Guard.
WOAX, Trenton, N. J. Franklin J. Wolff.
WOAY, Birmingham, Ala. John W. Wilder.
WOAZ, Stanford, Tex. Penick Hughes Co.
WOC, Davenport, Ia. Palmer School of Chiropractic.
WOE, Akron, O. Buckeye Radio Service Co.
WOH, Indianapolis, Ind. Hatfield, Elec. Co. (Indianapolis Star.)
WOI, Ames, Ia. Iowa State College.
WOK, Pine Bluff, Ark. Ark. Light & Power Co.
WOO, Philadelphia, Pa. John Wanamaker.
WOQ, Kansas City, Mo. Western Radio Co.
WOR, Newark, N. J. L. Bamberger & Co.
WOS, Jefferson City Mo.
WOV, Omaha Neb. R. B. Howell.
WOU, Omaha, Neb. Metropolitan Utilities Dist.
WOZ, Richmond, Ind. Palladium Printing Co.
WPA, Fort Worth, Tex. Forth Worth Record.
WPAA, Waco, Neb. Anderson & Webster Elec. Co.
WPAB, State College, Pa. Pa. State College.
WPAC, Okmulgee, Okla. Donaldson Radio Co.
WPAD, Chicago, Ill. W. A. Wieboldt & Co.
WPAF, Council Bluffs, Ia. Peterson's Radio Co.
WPAG, Independence, Mo. Central Radio Co. Inc.
WPAH, Waupaca, Wis. Wis. Dept. of Markets.
WPAJ, New Haven, Conn. Doolittle Radio Corp.
WPAK, Fargo, N. D. N. D. Agricultural College.
WPAL, Columbus O. Superior Radio & Tel. Equip. Co.
WPAN, Topeka, Kans. Averbach & Guettel.
WPAN, Houston, Tex. Levy Bros. Dry Goods Co.
WPAR, Beloit, Kans. R. A. Ward.
WPAT, El Paso, Texas. St. Patrick's Cathedral.
WPE, Kansas City, Mo. Central Radio Co.
WPG, New Lebanon, Ohio. Nushawg Poultry Farm.
WPL, Clearfield, Pa. Elec. Supply Co.
WPN, Philadelphia, Pa. St. Joseph's College.
WPM, Washington, D. C. Thos. J. Williams, Inc. (Washington Daily News).
WPO, Memphis, Tenn. United Equip. Co.
WQAA, Parkesburg, Pa. Horace A. Beale, Jr.
WQAL, Mattoon, Ill. Cole Tel. & Telg. Co.
WQAB, Springfield, Mo. Southwest Missouri State Teachers College.
WQAF, Sandusky, O. Sandusky Register.
WQAJ, Ann Arbor, Mich. Ann Arbor Times-News.
WQAK, Dubuque, Ia. Appel-Higley Elec. Co.

Ray-O-Vac Radio Batteries Have 20 Years of

WQAP, Lincoln, Neb. Am. Radio Co.
WQAO, Abilene, Ark. West Tex. Radio Co.
WQX, Chicago, Ill. Riverview Park, Walter A. Kuehl.
WRAA, Houston, Tex. Rice Institute.
WRAN, Waterloo, Ia. Black Hawk Elec. Co.
WRAR, David City, Neb. Jacob Carl Thomas.
WRAU, Amarillo, Tex. Daily News.
WRAY, Scranton, Pa. Radio Sales Corp.
WRK, Hamilton, O. Doron Bros. Elec. Co.
WRL, Schenectady, N. Y. Union College Radio Club.
WRM, Urbana, Ill. Univ. of Ill.
WRP, Camden, N. J. Federal Inst. of Radio Telg.
WRR, Dallas, Tex. City of Dallas.
WRW, Tarrytown, N. Y. Koenig Bros.
WSAJ, Grove City, Pa. Grove City College.
WSAS, Lincoln, Neb. Neb. Dept. of Agriculture.
WSAV, Houston, Tex. C. W. Vick Radio Const'n Co.
WSB, Atlanta, Ga. Atlanta Journal.
WSL, Utica, N. Y. J. & M. Elec. Co.
WSN, Norfolk, Va. Shipowners Radio Service, Inc.
WSX, Erie, Pa. Erie Radio Co.
WSY, Birmingham, Ala. Alabama Power Co.
WTAC, Johnston, Pa. Penn Traffic Co.
WTAU, Tecumseh, Neb. Ruegy Battery & Elec. Co.
WTAW, College Station, Tex. Agricultural and Mechanical College of Tex.
WTC, Manhattan, Kans. Kansas State Agricultural College.
WTP, Bay City, Mich. Ra-Do Corp.
WWAC, Waco, Tex. Sanger Bros.
WWAX, Laredo, Tex. Wormer Bros.
WWB, Canton, O. Daily News Printing Co.
WWI, Dearborn, Mich. Ford Motor Co.
WWJ, Detroit, Mich. Evening News.
WWL, New Orleans, La. Loyola Univ.
WWT, Buffalo, N. Y. McCarthy Bros. & Ford.
WWX, Washington, D. C. Post Office Dept.
WWZ, New York City. John Wanamaker.
WXAD, Pawtucket, R. I. Standard Radio & Elec. Co.
WXAI, Newark, N. J. Westinghouse Elec. & Mfg. Co.
XXI, Schenectady, N. Y. General Elec. Co. Test Call.
XXJ, Deal Beach, N. J. Am. Tel. & Telg. Co.
XXW, Parkesburg, Pa. Horace A. Beale, Jr.
XXN, Washington, D. C. Nat'l Radio Inst.
XXRU, Louisville, Ky. Darrell A. Downard.

Battery Manufacturing Experience Behind Them

Radiophone Broadcasting Stations in North America, Classified Alpha- betically by States and Cities

State, City, Call	State, City, Call
Alabama: Auburn, WMAV Birmingham, WOAY, WSY Mobile, WEAP Montgomery, WKAN	Stanford Univ., KFGH Stockton, KJQ, KWG Sunnyvale, KJJ Taft, KFEB
Arizona: Phoenix, KDYW, KFAI, KFQB Tucson, KDZA, KFDH	Colorado: Boulder, KFAJ Colorado Springs, KFBV, KFCK, KHD Denver, DDJ, DNJ, KDZQ, KFAP, KFBL, KLZ, KFEP Trinidad, KFBS
Arkansas: Fort Smith, WCAC, WGAR Little Rock, WCAV, WEAX Pine Bluff, WOK	Connecticut: Bridgeport, WKAX Greenwich, WAAQ Hartford, WDAK Middleton, WOAS New Haven, WCJ, WGAH, WPAJ
California: Altadena, KGO Bakersfield, KDZB, KYI Berkeley, KQI, KRE Del Monte, KLN El Monte, KUY Eureka, KNI Fresno, KDZH, KMJ Glendale, KFAC Hanford, KFBD Hollywood, KFAR Lone Beach, KSS Los Angeles, KDZF, KDZP, KFCL, KFI, KHJ, KJS, KNN, KNV, KOG, KUS, KWH, KXS, KYJ Modesto, KXID Oakland, KFBN, KLX, KZM Pasadena, KBYR, KLB Reedley, KMC Sacramento, KFBN, KVQ San Diego, KDPT, KDYM, KDYO, KFBC, KFFA, KON, KYF San Francisco, AGI, KDN, KDZG, KDZW, KDZX, KFDB, KLP, KLS, KPO, KSL, KUO, KZY San Jose, KFAQ, KQW San Luis Obispo, KFBE Santa Ana, KFAW	Delaware: Wilmington, WHAV, WOAT
	District of Columbia: Anacostia, NOF Washington, WDM, WEAS, WHAQ, WII, WIAY, WJH, WMU, WPM, WWX, 3YN
	Florida: Jacksonville, WDAJ Miami, WFAW, WIAZ Pensacola, WGAN, WIAV Tampa, WDAE, WEAT, WHAW West Palm Beach, WKAH
	Georgia: Atlanta, WGM, WSB College Park, WDAJ Decatur, WAAS Gainesville, WKAY Macon, WGAK, WMAZ Savannah, WHAO

Ray-O-Vac Batteries Are Manufactured From

State, City, Call	State, City, Call
Idaho:	Kansas:
Boise, KFAU, KFBJ, KFDD	Anthony, WBL
Lewiston, KFBA	Atwood, WEAD
Moscow, KFAN	Beloit, WPAR
Wallace, KFCC	Eldorado, WAH
	Emporia, WAAZ
Illinois:	Hutchinson, WLAS
Belvidere, WOAG	Independence, WFAV
Chicago, KYW, WAAF, WBU,	Liberal, WMAG
WDAP, WGAS, WJAZ,	Manhattan, WNAK, WTG
WMAQ, WNAJ, WPAD,	Parsons, WOAJ
WQX	Salina, WFAD
Decatur, WBAO, WCAP	Topeka, WJAQ, WPAM
WHAP	Wichita, WAAP, WEAH, WEY
Maton, WQAL	
Peoria, WJAN	Kentucky:
Quincy, WCAW, WCAZ	Bowling Green, WNAB
Rockford, WIAB, WJAH	Frankfort, WOAK
Springfield, WDAC	Louisville, WHAS, WKAG,
Tuscola, WDZ	WLAP, 9ARU
Urbana, WRM	Paducah, WIAR
	Waco, WPAA
Indiana:	Louisiana:
Anderson, WEAW	New Orleans, WAAB, WAAC,
Evansville, WNAM, WOAU	WCAG, WGV, WIAF, WWL
Fort Wayne, WFAS	Shreveport, WDAN, WGAQ
Greencastle, WLAX	
Huntington, WHAY	Maine:
Indianapolis, WLK, WOH	Auburn, WMB
Marion, WIAQ	Houlton, WLAN
Mishawaka, WBAQ	Portland, WJAL
Muncie, WJAF	Sanford, WFAH
Richmond, WOZ	
South Bend, WGAZ	Maryland:
Terre Haute, WEAC	Baltimore, WCAO, WEAR,
West Lafayette, WBAA	WKC, WNAV
Iowa:	Massachusetts:
Ames, WOI	Boston, WAAJ, WFAU, WNAC
Burlington, WIAS	Dartmouth, WMAF
Cedar Rapids, WJAM, WKAA	Medford Hillside, WGI
Centerville, WDAX	New Bedford, WDAU
Council Bluffs, WPAF	Springfield, WBZ
Cresco, WNAG	Worcester, WCN, WDAS
Davenport, WHAI, WOC	
Des Moines, WGF, WHX	Michigan:
Dubuque, WQAK	Ann Arbor, WMAX, WQAJ
Fort Dodge, WEAB	Bay City, WTP
Iowa City, WHAA	Dearborn, WWI
Le Mars, WIAU	Detroit, KOP, WCX, WWJ
Marshalltown, WLAR	East Lansing, WKAR
Newton, WIAH	Flint, WEEA
Shenandoah, WGJ	Kalamazoo, WCAP, WLAQ
Sigourney, WOAD	Lansing, WHAL
Sioux City, WEAU, WHAE	Saginaw, WIAW
Vinton, WIAE	
Waterloo, WHAC, WMAR,	
WRAN	

Carefully Selected and Rigidly Inspected Materials

State, City, Call

Minnesota:

Duluth, WJAP, WMAT
Hutchinson, WFAN
Minneapolis, WBAH, WBAD
WCAS, WLAG, WLB
Northfield, WCAL
St. Cloud, WFAM
St. Paul, WAAH, AV7

Missouri:

Butler, WNAR
Cameron, WFAQ
Columbia, WAAN
Independence, WPAG
Jefferson City, WOS
Joplin, WHAH, WJAC
Kansas City, WDAF, WHB,
WMAJ, WOQ, WPE
Marshall, WJAT
Rockport, WMAD
St. Joseph, WEAK
St. Louis, KSD, WCK, WEB,
WEW, WMAY
Springfield, WIAI, WKAS,
WQAV
Tarkio, WIAT
Webster Grove, WOAL

Montana:

Billings, KFCH
Butte, KFAP
Great Falls, KDYS
Havre, KFBB
Polytechnic, KFED

Nebraska:

David City, WRAR
Fremont, WOAE
Hastings, WKAM, WLAD
Lincoln, WFAV, WGAT, WIAX,
WJAB, WKAC, WLAF,
WMAH, WQAP, WSAS
Norfolk, WJAG
Omaha, WAAW, WCAW,
WDV, WIAK, WNAL, WOU,
WOV
Rushville, WEAV
Tecumseh, WTAU
University Place, WCAJ
Waco, WPAA

Nevada:

Reno, KDZK, KFAS

New Hampshire:

Laconia, WKAU

State, City, Call

New Jersey:

Atlantic City, WHAR
Camden, WRP
Deal Beach, 2XJ
Jersey City, WAAT, WNO
Moorestown, WBAF
Newark, WAAM, WBS, IWJZ,
WOR, 2XAI
N. Plainfield, WEAM
Ocean City, WIAD
Paterson, WBAN
Roselle Park, WDY
Trenton, WMAL, WOAX

New Mexico:

Roswell, KNJ
State College, KOB

New York:

Albany, WNJ
Binghamton, WIAV
Buffalo, WGR, WWT
Canton, WCAD
Cazenovia, WMAC
Ithaca, WEAI
Lockport, WMAK
Newburgh, WCAB
New York, KDOW, WBAY,
WDT, WEF, WJX, WLAW,
WWZ
Poughkeepsie, WFAF
Rochester, WHAM
Ridgewood, WHN
Schoenectady, WGY, WRL, 2XI
Syracuse, WBAB, WDAI
WFAB, WLAH, WNAN
Tarrytown, WRW
Troy, WHAZ
Utica, WSL
Waterford, WFAQ

North Carolina:

Asheville, WFAJ
Charlotte, WBT
Raleigh, WLAC

North Dakota:

Fargo, WDAY, WPAK
Grand Forks, WOAB
Wahpeton, WMAW

Ohio:

Akron, WOE
Athens, WAAV
Canton, WWB
Cincinnati, WAAD, WHAG
WIZ, WLW, WMH
Sandusky, WQAF

Ray-O-Vac Radio Batteries Are

State, City, Call

Cleveland, KDFM, WHK,
 WJAX
 Columbus, WBAV, WCAH,
 WEO, WMAN, WPAL
 Dayton, WA1, WFO, WJAJ
 Defiance, WCAQ
 Fairfield, WL-2
 Granville, WJD
 Hamilton, WBAU, WRK
 Lebanon, WPG
 Lima, WOAC
 Marietta, WBAW
 Springfield, WLAM, WNAP
 Stockdale, WJAK
 Toledo, WBAJ, WJK
 Warren, WLAZ
 Washington, C. O., WGAX
 Wooster, WGAU
 Youngstown, WAAY, WMC

Oklahoma:

Ardmore, WAAA
 Enid, WNAF
 Muskogee, WDAV
 Norman, WNAD
 Okemah, WKAK
 Oklahoma City, WKY, WMAB
 Okmulgee, WPAC
 Tulsa, WEH, WLAL

Oregon:

Astoria, KFEM, KFGG
 Corvallis, KFDJ
 Eugene, KFAT
 Hood River, KQP
 Marshfield, KFBH
 Medford, KFAY
 Pendleton, KFFE
 Portland, KDYQ, KFEC, KGG,
 KGN, KGW, KQY
 Salem, KFCD

Pennsylvania

Altoona, WGAW
 Bridgeport, WBAG
 Brownsville, WDAQ
 Clearfield, WPI
 Crafton, WAAX
 Easton, WMAP
 Erie, WQAV, WSX
 Grove City, WSAJ
 Johnstown, WTAL
 Lancaster, WGAL
 McKeesport, WIK
 Parkersburg, WQAA
 Philadelphia, WCAU, WDAR,
 WFL, WGL, WIP, WNAT,
 WOO, WPI

State, City, Call

Pittsburgh, KDKA, KQV,
 WCAE, WHAF, WJAS
 Scranton, WLAO, WRAY
 State College, WPAB
 Villanova, WCAM
 Wilkes-Barre, WBAX, WKAZ,
 WNAH

Rhode Island:

Cranston, WKAP
 Edgewood, WEAG
 East Providence, WKAD
 Providence, WEAN, WJAR

South Carolina:

Charleston, WFAZ, WNAQ,
 WOH
 Orangeburg, WGAM

South Dakota:

Rapid City, WCAT
 Sioux Falls, WFAT
 Vermillion, WEAJ
 Yankton, WAJU, WNAX

Tennessee:

Knoxville, WNAV
 Lawrenceburg, WQAN
 Memphis, WKN, WPO, WMC

Texas:

Ahilene, WQAQ
 Amarillo, WDAQ, WRAU
 Austin, WCM, WNAS
 Beaumont, WMAM
 College Station, WTAW
 Dallas, WDAO, WFAA, WRR
 El Paso, WDAH, WPAT
 Fort Worth, WBAP, WPA
 Galveston, WHAB, WIAC
 Houston, WCAK, WEAY, WEV,
 WGAB, WPAN, WRAA,
 WSAV
 Laredo, WWAX
 Orange, WKAL
 Port Arthur, WFAH
 San Antonio, AS6, DM7, WCAR,
 WJAE, WQAI
 Stanford, WOAZ
 Tyler, WOAF
 Waco, WJAD, WLAJ, WWAC
 Wichita Falls, WKAF

Utah:

Ogden, KDZL
 Salt Lake City, KDYL, KDYV,
 KZN

of High and Uniform Quality

State, City, Call

Vermont:

Bellows Falls, WIAK
Burlington, WCAX

Virginia:

Arlington, NAA
Blacksburg, WEAE
Fortress Monroe, WNAW
Portsmouth, WOAQ

Washington:

Aberdeen, KNT
Bellingham, KDZR
Centralia, KDZM
Everett, KDZZ, KFBL
Lacey, KGY
Pullman, KFAE
Seattle, KDZE, KDZT, KFC,
KHQ, KJR, KTW, KZC
Spokane, KFDC, KFZ
Tacoma, KFBG, KFEJ, KGB,
KMO
Walla Walla, KFCE
Wenatchee, KDZI, KZV
Yakima, KFV

West Virginia:

Charleston, WAAO
Clarksburg, WHAK
Huntington, WAAR
Morgantown, WHD

Wisconsin:

Beloit, WKAW
Kenosha, WOAR
Madison, WGAY, WHA
Milwaukee, WAAK, WCAY,
WHAD, WIAO
Neeah, WIAJ
Superior, WFAC
Waupaca, WIAA, WPAH

State, City, Call

Wyoming:

Casper, KFCC, KFDF
Laramie, KFBU

Alaska:

Fairbanks, WLAY

Hawaii:

Honolulu, KDYX, KGU, KYQ

Porto Rico:

Ensenada, WGAD
San Juan, WKAQ

Canada:

Calgary, CHBC, CHCQ, CFCA,
CFCN, CJCY
Edmonton, CHCC, CJCA
Fort Frances, CFPC
Halifax, CFCE, CJCS
Hamilton, CKOC
Iroquois Falls, CFCH
Kitchener, CJCF
London, CFCX, CHCS, CJGC,
CKQC
Montreal, CFCE, CFZC, CHCX,
CHYC, CJBC, CKAC, CKCS
Nelson, CJCB
Ottawa, CHXC
Regina, CKCK
St. John, CJCI, CKCR
Toronto, CFCA, CFTC, CHCB,
CHCZ, CHVC, CJCD, CJCH,
CJCN, CJSC, CKCE, CKCZ,
CKKC
Vancouver, CFCB, CFYC,
CHCA, CHOC, CJCE, CKCD
Walkerville, CFCI
Winnipeg, CHCF, CJCG, CKCB
CKZC, CJNC

Cuba:

Havana, PWX

FRENCH RAY-O-VAC

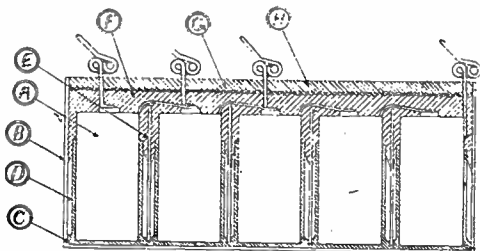
“B”

BATTERIES FOR RADIO

French Ray-O-Vac “B” Batteries are especially designed for use on plate circuits in detectors or amplifying tubes. They have exclusive design and construction features that make them highly desirable and most satisfactory for Radio use.

Each battery consists of a number of cells assembled and connected in series by soldered connecting leads. The individual cells are made from rolled sheet zinc of uniform thickness, with securely soldered seams. The use of rolled sheet zinc eliminates thin spots in the walls of the cells that make for noise in the operation of the battery. The individual cells are carefully manufactured from special formulae developed for radio requirements by the same experts who have made French Ray-O-Lite batteries famous for quality.

CROSS SECTION OF RAY-O-VAC “B” BATTERY

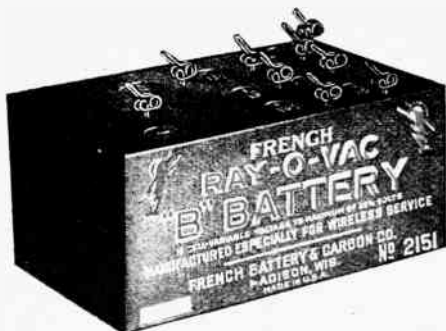


A—Cell B—Outer Case C—Rubbery Insulation and Seal D—Rubbery Insulation E—Water and Acid Proofed Cardboard Partition F—First Seal of Rubbery Sealing Compound G—Cloth Binder H—Second Seal of Rubbery Sealing Wax. (red)

The exclusive construction of French Ray-O-Vac “B” Batteries combines all of these characteristics. Each cell is covered and insulated with a special rubbery compound and each cell and each cardboard partition between the cells is embedded in this same material. The heavy tough seal covering the top and extending down and between the cells binds them together at the top, forming a compact solid unit battery. Water or moisture has no effect on it, dropping or jarring cannot even vibrate the cells or connections.

This construction, designed by experts, forms an air-tight, water and moisture proof, noiseless battery that is serviceable under any atmospheric or barometrical conditions.

RAY-O-VAC BATTERY NO. 2151



15 cells—7 positive terminal taps.

Voltage adjustment:—1.5, 3, 4.5, 18, 19.5, 21, 22.5 volts. Arrangement of terminals permits adjustment of voltage to as low as 1.5 volts.

Long service battery.

Less than 20% depreciation in 12 months.

Recommended for stationary sets or any place where space and weight limits permit.

Size:—6 $\frac{5}{8}$ in. x 4 in. x 5 in. Weight:—4.5 lbs. each.

Standard package 20 batteries

RAY-O-VAC BATTERY NO. 5151



15 cells—2 positive terminal taps.

Voltage adjustment:—18 and 22.5 volts.

Medium service battery.

Less than 20% depreciation in six months.

Recommended for portable sets.

Size:—2 $\frac{3}{4}$ in. x 2 $\frac{1}{8}$ in. x 4 $\frac{1}{4}$ in. Weight:—1.5 lbs. each.

Packed in individual corrugated boxes.

Standard package 25 batteries

RAY-O-VAC BATTERY NO. 4151



15 cells—22.5 volts

Less than 30% depreciation in six months.

Small, light weight. Adaptable to aeroplane and portable sets.

Size:—3 3/4 in. x 2 in. x 2 1/2 in. Weight:—1 lb. each.

Packed in individual corrugated boxes.

Standard package25 batteries

RAY-O-VAC BATTERY NO. 2301



30 cells—7 positive taps

Voltage adjustment:—16 1/2, 18, 19 1/2, 21, 22 1/2, 24, 27 and 45 volts.

Long service battery.

Size:—8 1/2 in. x 6 7/8 in. x 3 1/4 in. Weight:—11 lbs. each.

Packed in individual corrugated boxes.

Standard package10 batteries

RAY-O-VAC BATTERY NO. 2721



For Amplifiers

72 Cells—8 positive terminal taps

A 100 volt "B" Battery with voltage taps at 16, 19, 22, 25, 45, 68, 80, 110
Less than 20% depreciation in 12 months.

Wooden box—wire terminals.

Size:—16 $\frac{3}{4}$ in. x 9 in. x 4 in. deep. Weight:—26 pounds each.

RAY-O-VAC BATTERY NO. 5151BP



For Cabinet Sets

15 Cells—22 $\frac{1}{2}$ volts

Positive terminal (+) wire lead, negative terminal—screw binding pos.
Less than 20% depreciation in six months.

Size:—2 $\frac{3}{4}$ in. x 2 $\frac{1}{8}$ in. x 4 $\frac{1}{4}$ in. Weight:—1 $\frac{1}{2}$ pounds each.

Packed in individual corrugated boxes.

Standard package.....25 batteries

FRENCH RAY-O-VAC "A" BATTERIES FOR RADIO

THE 200 HOUR BATTERY

A battery of cells specially designed and constructed to operate the "A" circuits of all dry battery vacuum tubes, such as the WD-11, WD-12 and No. UV-199 tubes, etc.

Special design and construction features produce—

Uniformly high sustained voltage.

Uniform flow of current.

Quick recuperation.

No internal action when the set is not being operated.

A "Protective Coating" within each individual cell of a Ray-O-Vac "A" Battery prevents the "running down" of the battery when not in use.

RAY-O-VAC "A" BATTERIES

produce the steady uniform heating of the vacuum tube filament that is necessary for good reception. Between periods of use the battery "recuperates" and builds up its voltage ready for another period of heating the tube filament to the dull red glow required.

Screw terminals and rubberized thumb nuts provide outside connections—plainly marked positive (+) and negative (—). Light in weight, portable, and require no recharging.

Built by the same battery experts and in the same factory as the famous

FRENCH RAY-O-LITE FLASHLIGHTS
FRENCH IGNITION DRY BATTERIES
FRENCH TELEPHONE DRY BATTERIES
FRENCH RAY-O-VAC "B" BATTERIES

RAY-O-VAC BATTERY NO. 1211



1 Cell—1½ volt.

Maximum service obtained by using two batteries connected (+) to (+) on WD-11 and WD-12 tube, or three batteries connected (+) to (-) on three UV199 tubes.

Size:—2 in. x 6½ in. Weight:—2.16 pounds each.

Standard package 50 batteries. Weight of standard package 125 pounds.

RAY-O-VAC BATTERY NO. 1212



2 Cells—1½ volt.

Maximum service obtained by using one No. 1212 Ray-O-Vac per WD-1 or WD-12 dry cell tube.

Size:—5¼ in. x 2⅝ in. x 7½ in. Weight 5.5 pounds each.

Standard package 24 batteries. Weight of standard package 124 pounds

RAY-O-VAC BATTERY NO. 1214B



1 Cell—1½ volt.

Maximum service obtained by using one No. 1214B Ray-O-Vac on two WD-11 or two WD-12 dry cell tubes.

Size: 5¼ in. x 5¼ in. x 7½ in. Weight 10.9 pounds.

Standard package 12 batteries. Weight of standard package 150 pounds.

RAY-O-VAC BATTERY NO. 1216B



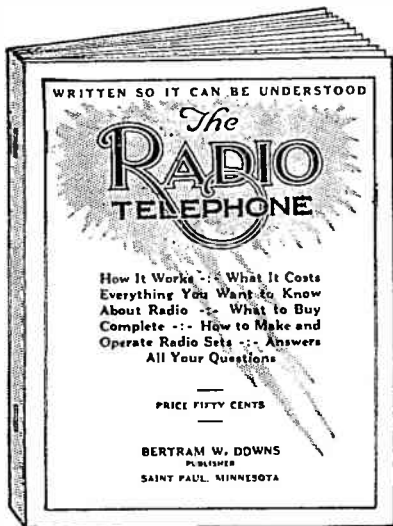
6 Cell—1½ volt.

Maximum service obtained when used on three WD-11 or on three WD-12 dry cell tubes.

Size: 8 in. x 5¼ in. x 7½ in. Weight 17.1 pounds each.

Standard package 8 batteries. Weight of standard package 150 pounds.

EVERY RADIO ENTHUSIAST SHOULD READ THIS BOOK



By The
Same Writer

*Explains the
theory and
operation of
Radio in
plain Eng-
lish.*

Now In Its
8th Edition

96 Pages
Fully
Illustrated

M. K. THOMEN,
PETROLEUM IMPORT & EXPORT CO., New Orleans, La.
".....believe it is the finest specimen of plain English and
technical information that I have even seen. I wish that more men
could give us their thoughts as clearly and concisely as you have."

MR. W. R. HERSTEIN, Gen. Mgr.
ELECTRIC SUPPLY CO., Memphis, Tenn.
"I have taken occasion to read a great many books on the
subject, and I believe I can say without hesitation that your book is
undoubtedly the best I have yet seen."

MR. M. P. RYPINSKI (In charge of Radio Sales).
WESTINGHOUSE ELEC. & MFG. CO.
"The book should meet a real need."

AT YOUR DEALER'S OR MAILED
Postpaid on Receipt of 50c, Stamps, Check or Coin
BERTRAM W. DOWNS, Publisher
2126 Iglehart Ave. - - - St. PAUL, MINN.

Ray-O-Vac Radio Battery Quality Is Maintained by Rigid Inspection

A	. —	N	— .
B	—	O	— — — —
C	— . — . .	P	. — — . .
D	— . . .	Q	— — — . —
E	. . . . .	R	. — . . .
F	. . . — .	S	. . . . .
G	— — — .	T	—
H	. . . . .	U	. . — . .
I	. . . . .	V —
J	. — — — —	W	. — — . .
K	—	X	—
L	. — . . .	Y	— . — — —
M	— — . . .	Z	— — — . .

Period
 Interrogation . . — — . . .
 Error
 Comma . — . — . — .

1	. — — — —	6	—
2	. . — — —	7	— — . . .
3	. . . — —	8	— — — . .
4	. . . . —	9	— — — — .
5	. . . . .	0	— — — — —

Continental (International Morse) Code

USE

French RAY-O-VAC

Radio
Batteries

STERLING RADIO CO.
N. W. COR. 16TH AND WALNUT STS.
KANSAS CITY, MO.

FRENCH BATTERY & CARBON CO.

2335 Winnieboe St., Madison, Wis.

111-113 Hudson St., New York City, N. Y.

BRANCHES

CHICAGO, ILL.

ATLANTA, GA.

DALLAS, TEXAS

11 S. Des Plaines St.

Anstett Bldg.

2012 Cabell St.

MINNEAPOLIS, MINN.

KANSAS CITY, MO.

31 Western Ave.

911 Broadway