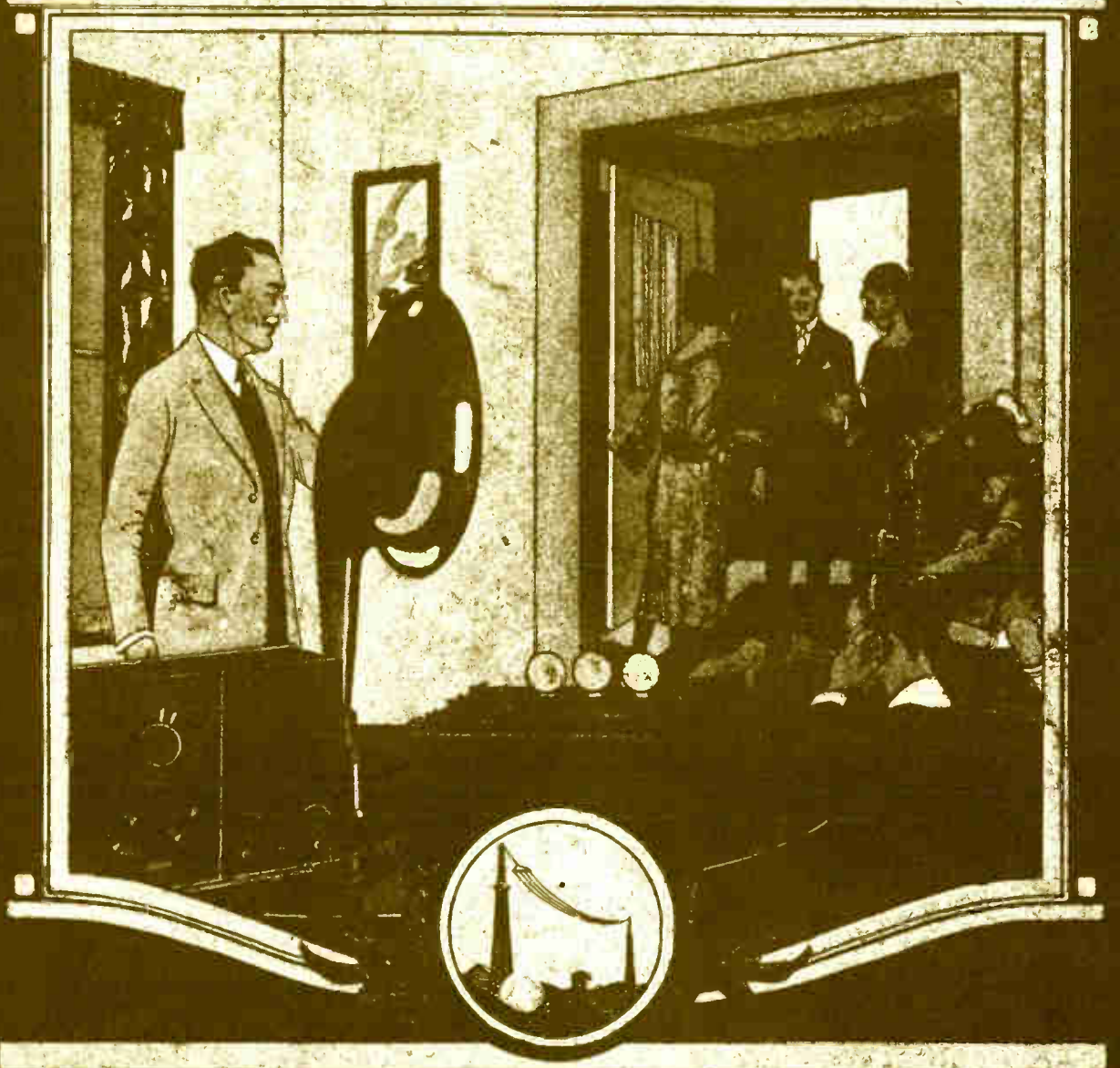
RADIO
EQUIPMENT & SUPPLIES



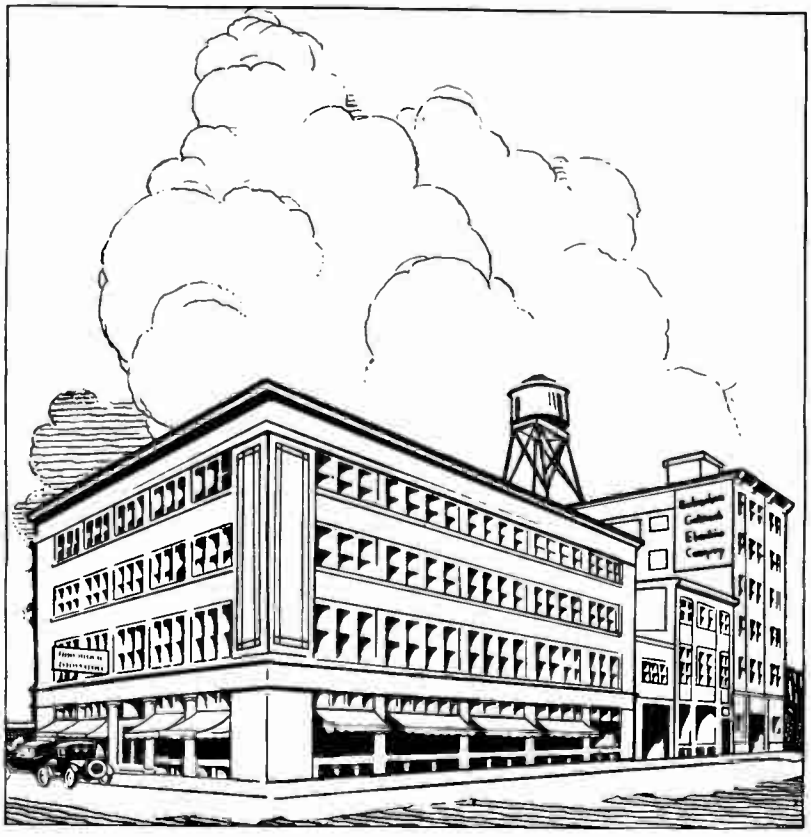
ROBERTSON—CATARACT ELECTRIC COMPANY

NIAGARA · ELMWOOD & MOHAWK
BUFFALO, NEW YORK

RADIO

SUPPLIES AND EQUIPMENT

Catalogue No. 22—1922-1923



Robertson-Cataract Electric Company

Niagara, Elmwood & Mohawk

Buffalo, New York

TERMS

PRICES:

The prices shown are the latest correct list prices at time of going to press, but are inserted for information only and are subject to change without notice. Customers will find our prices in step with the market at all times based on quality and service. All orders received will be billed at prevailing market regardless of published prices.

TERMS:

Our terms are 30 days net, 2% cash 10 days from date of invoice, f. o. b. our store, to concerns or persons of approved credit rating.

C. O. D. orders must be accompanied by a deposit sufficient to pay handling charges and express or freight both ways, so as to insure us against loss in case shipment is refused.

SHIPMENTS:

Where customer does not state definitely how goods should be shipped or routed, we will use our own judgment in selecting route.

LOSS OR DAMAGE IN TRANSIT:

We do not hold ourselves responsible for goods lost or damaged in transit. Any such claims should be referred to tne transportation company handling the shipment. However, we will be glad to co-operate and lend our assistance to secure an adjustment.

SHORTAGE:

Any shortage should be promptly reported.

RETURNED GOODS:

Goods should **not** be returned to us without our permission. When permission is given, it is understood that they will be sent back, charges prepaid, in good salable condition. All returned goods are credited less an adequate service or handling charge, which will be deducted from credit. This does not apply to any mistake or error in shipment on our part. We will cheerfully rectify our mistakes and bear the expense.

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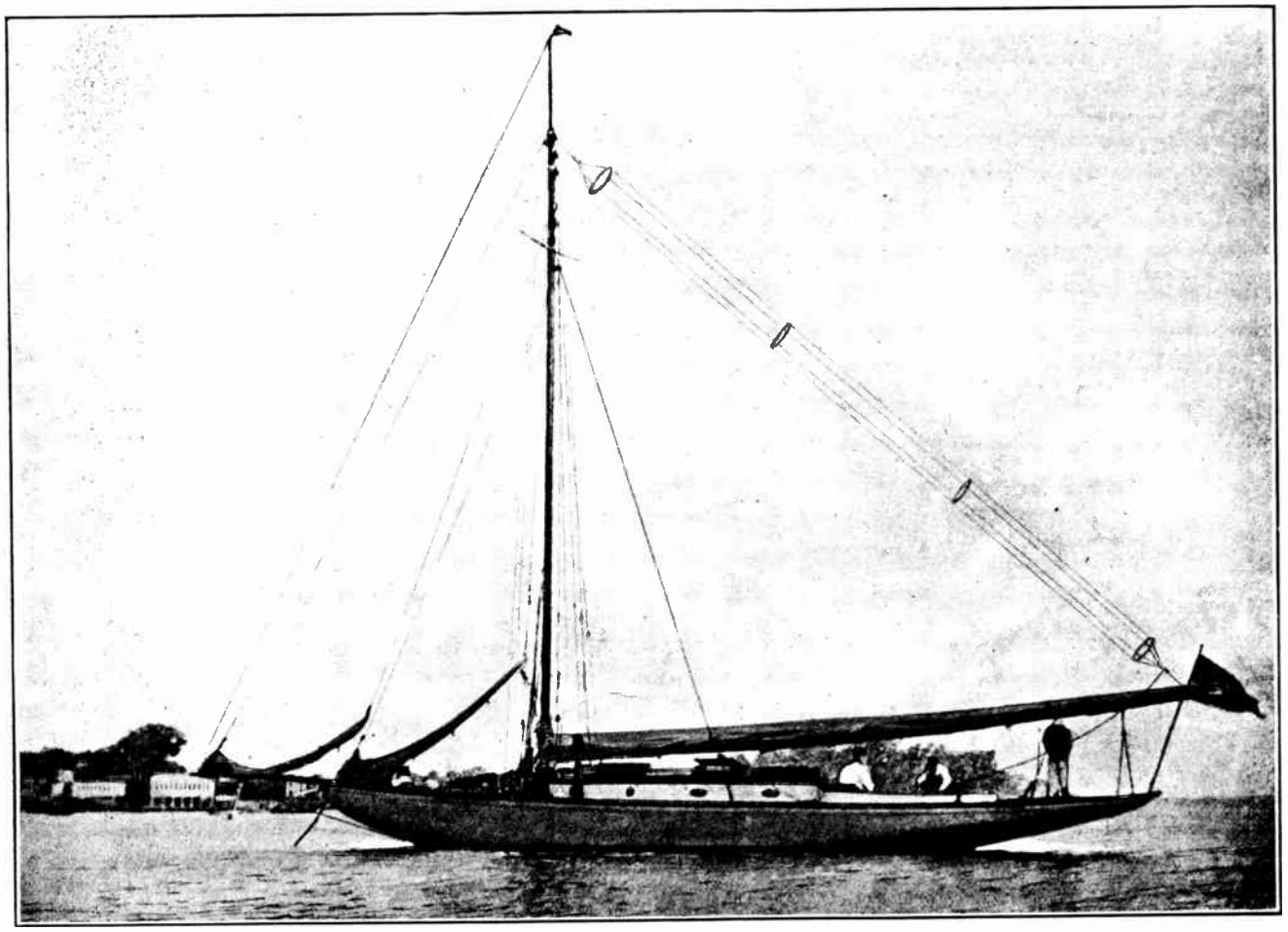
ELECTRICAL COMMUNICATION

By EDWARD L. BOWLES

Electrical Engineering Department, Massachusetts Institute of Technology

Electrical communication has reached such a stage that we would be very helpless today were it suddenly taken from us. The quality of communication is really a measure of the degree of civilization, and, as we advance, we need better methods of bringing our ideas together and of intimately connecting the various countries of the world, our interdependence becomes more and more pronounced. It is only by means of communication that we are able not only to transact all the world's business, but also to enjoy all the advantages of learning. Had it not been for communication, the ideas of various great men would not have come together; there could have been no concerted effort, but each man would have made his contribution, probably duplicating the life's work of someone else.

At first, communities were kept informed by word of mouth, and this method was later extended to connect the continents. In the early days such methods were sufficient, but when man began to study, and to think, and to do, in such a way that his activity affected not only himself, but those about him, a far more efficient means of spreading knowledge became necessary.



YACHT EQUIPPED WITH PORTABLE CAGE ANTENNA

Printing came to us not only to serve as an improved form of communication, but also to serve as a permanent record of the past. But even printing became too tedious and slow. The need of a more

expeditious method of communication caused many men to look to the electrical field for future developments.

In the invention of the telegraph there came the first real accomplishment in the field of communication by the use of electricity. The telegraph, however, was only a crude means of transmitting messages compared to its successor, the telephone. The telephone brought with it the marvelous power of not only transmitting mere sounds, but the actual voice, so that communities theretofore completely isolated could be intimately connected with others.

The great benefits to be gained in trade, education and pleasure demanded even greater flexibility in communication. The telegraph was slow and it required a practiced operator. Submarine cables were expensive. Difficulties were encountered in their breakage, and unlooked-for theoretical difficulties arose to make the submarine cable far slower than land telegraph lines. The telephone had decided advantages, although it was restricted in its use to comparatively short distances, and it could not be used as a means of trans-oceanic communication.

The minds of scientists were bent toward the development of a means of communication without wires. This great dream was realized in the early part of the twentieth century, when, in 1903, the King of England was greeted by the President of the United States in a message sent by wireless from Wellfleet, Cape Cod, Massachusetts, to Poldu, England. Since this first great stride remarkable developments have been made along the lines of wireless communication; but before considering the present it seems only fitting that we should make a brief survey of the work of the pioneers. To them we owe the advantages that we enjoy today when, with little effort, we listen to our greatest musicians, our foremost dramatists, our leading educators and our best comedians by the mere turning of the switch on a broadcast receiving set in our home. The popular world was much impressed with the headlines announcing the invention of the telegraph and later of the telephone, but today, in the field of radio, it has become hardened and tired, so rapid has been the advances.

It seems unfortunate that in all these cases the real story is seldom told. Great men in the past have done their little bit, and it has been the gradual accumulation of these little bits which has brought us the inventions that are unfortunately associated with the names of only a few men.

The foundation of radio was laid so far back that it would be impossible to give the year. At first there was the lodestone with its mysterious north-pointing characteristics that aroused in men a deep curiosity. There was the lightning in the heavens with its great sounds, and the swaying of a pith ball near a glass rod rubbed with silk. These, too, caused men to wonder. But with all the thought which was given to these phenomena by the scientist and the philosopher, there was no crystalization of ideas until the early part of the nineteenth century, when, in 1820, Oersted, a Danish physicist, discovered that a wire carrying current exerted a magnetic effect upon a compass needle. He found that when a current passed through the mire, held just above the compass needle, the north end of the needle would deflect in either an easterly or westerly direction, depending upon how the wire was connected to the electric battery.

Oersted's discovery immediately suggested a connection between electricity and magnetism, and it was just this suggestion that Ampere, a French physicist, needed to ingeniously describe and analyze the relation between these two heretofore unassociated entities.

In 1831 Faraday discovered the effect called electric induction. In his investigations he showed the effect of a change in electric current in one circuit upon another nearby, but not metallically connected to the first one. Faraday's work inspired Maxwell to develop his great theory of electricity and magnetism which suggested a possibility of the propagation of signals through space without the means of wires. This prediction was made by Maxwell himself, and it was based upon his theoretical consideration of some of Faraday's experiments. For a time Maxwell's theory was in dispute until the investigations of Professor Henry Hertz of Karlsruhe were made known. Hertz demonstrated without a doubt the validity of Maxwell's theory. He showed that the predicted electro-magnetic waves were very much like light waves. They could be reflected and refracted. These Hertzien waves were very short in

length, and further, by means of his apparatus, Hertz could only detect them within a few meters of his transmitter. Other men zealously worked along the lines of Hertz, but it remained for Guglielmo Marconi, an Italian, to place the keystone in the wireless arch so brilliantly constructed by pioneers. Dolbear, of Tufts College, by only a slight misfortune of connection in his apparatus, missed the realization of Signor Marconi. Marconi's radiating apparatus utilized the ground and aerial radiator. His receiving set was of the same construction. Before this, the ground had not been used in the same manner except by Dolbear, and the radiator had in most cases been in a horizontal plane instead of a vertical one. The work of Marconi was done mostly in England through the encouragement of Sir William Preece.

After his first accomplishment of a satisfactory method of transmission, Marconi zealously devoted himself to the improvement of his apparatus. Among other things, he made use of and improved the coherer, a piece of apparatus in use in electric circuits as far back as 1866. The coherer, or detector, was simply a piece of apparatus capable of translating, by means of a local circuit, the high frequency inaudible radio waves into a series of dots and dashes.

Soon the wireless telegraph was a recorded success and it rapidly became a definite channel for commercial communication. But even the wireless telegraph was not sufficient, for men then began the work of transmitting, not dots and dashes, but the actual voice without the aid of wires. In 1915, the U. S. Navy Department succeeded in transmitting speech from Arlington, Virginia, to Paris, and even to Honolulu, 5,000 miles away.

During the Great War all countries were working intensely to further electrical communication, and it was during this period that the vacuum tube was brought to a state of perfection, so that today it is the heart of almost all transmission and of all reception in radio. The vacuum tube had its beginning in 1882, when Elster and Geitel discovered the effect on a cold metal plate of a heated filament (when the filament was heated to incandescence). Edison later noticed this effect.

In 1904, Fleming of England, through an extensive investigation in the field of such space conduction of electricity, patented the valve which bears his name. The Fleming valve was the most sensitive receiver of radio waves then devised.

In 1907, DeForest added another element to the valve which he then called the "audion." Today we see the vacuum tube, as this device is popularly known, in every window where radio apparatus is shown. This tube has made radio telephony practical. Not only that, but recently it was announced that these tubes could be made with outputs measured in tens of horse-power. Thus there is the possibility that the vacuum tube, fundamentally Fleming's invention, will supplant even the big Alexanderson alternators which now hurl the signals from Radio Central to all parts of the world. The vacuum tube has made possible, in a way, the transmission of speech from Cuba to Catalena Island via New York, a total distance of almost 5,000 miles. Not only this, but it has made possible the transmission of several telephone and telegraph messages simultaneously over a single pair of wires.

Radiophone broadcasting has come to us practically within only the last two years, and it has already made a place for itself. There could be no more powerful an agent in the centers of a country for the dissemination of information which heretofore could only be gleaned by papers received in rural communities, sometimes days and sometimes weeks later. Communities which a few years ago had no connection with the centers of progress are now closely connected and intimately associated with them. Educational methods of the future will be far more powerful and people will have within their homes the best the world can offer in the way of cultural assets.

The future of radio is secured, for through the timely co-operation of the larger manufacturers broadcasting promises to remain, and the policies of the great centers of production have been made flexible enough to handle future needs. Great research laboratories have sprung up in which great minds are being daily devoted to investigations which will, from time to time, unearth improvements, some even revolutionizing our present radio art. It is due to the vision of the men at the head of these large organizations that the country is able to benefit by our latest development in communication, and it will be through the concerted efforts of these big men that we will enjoy more and and more, in the future, the invaluable benefits of radio.

Radio Equipment and Supplies

WE have attempted, in compiling this catalogue to put before the radio public, apparatus, equipment and supplies of merit that we are prepared to furnish promptly. The several sections include data and general information that is both interesting and useful to the radio dealer and user.

We will add to the lines shown constantly as more improved radio equipment is developed by concerns of national reputation so as to be in a position to give our customers the best in the radio market.

CONTENTS

SECTION ONE

Complete Radio Telephone Receiving Sets

Aeriola Jr. Receiver, Model RE

Aeriola Jr. is a complete Radio receiving outfit designed and manufactured by the Westinghouse Electric and Manufacturing Company. Its range varies from ten to twenty miles. Any one who can

Aeriola Jr., Model RE

operate a talking machine or a camera can operate an Aeriola Jr.

Simple Adjustments

The complete receiver is built in a very substantial and attractive wood cabinet which has a compartment for storing the telephone receivers when the set is not in use.

The tuning elements and the crystal detector are mounted on a black panel which forms the top of the receiving set when the cover is lifted. All the metal parts are finished in nickel. Under the tuning control arm, there is a calibrated dial. Where the receiving station is within range of several broadcasting stations operating on different wave lengths, it is possible to determine just what setting is necessary in order to hear any of the stations at a given time by noting the position of the tuner control arm with relation to the calibrated dial. With Aeriola Jr. there is no maintenance cost. Once the antenna has been erected and the ground connection made according to the instructions given, it is only necessary to adjust the detector and rotate the tuner control arm until radio signals are heard in the head telephone receivers. The wave-length range of Aeriola Jr. is particularly adapted to broadcasting reception on the 190-500 meter wave-length band.

Reliable and Inexpensive

Aeriola Jr. includes everything necessary for this type of receiver—a tuner, a fixed condenser, a supersensitive crystal detector, and a high grade set of head telephones. In order to secure the best results from this outfit, it is but necessary to follow the directions given in another section of this book and devoted to the erection of the antenna and securing the ground connections.

The entire design assures a degree of selectivity and reliable operation not usually found in this type of receiver.

Aeriola Jr. may ordinarily be employed for receiving from the broadcasting stations up to a maximum distance of 20 miles. Under some circumstances this range may be increased; often the Aeriola Jr. will pick up broadcasting distances up to 35 miles.

Operating Instructions for Aeriola Jr.

Text numbers correspond to diagram.

No. 1. First, refer to accompanying sketch, then erect antenna and place protective device in position as described under antenna outfits.

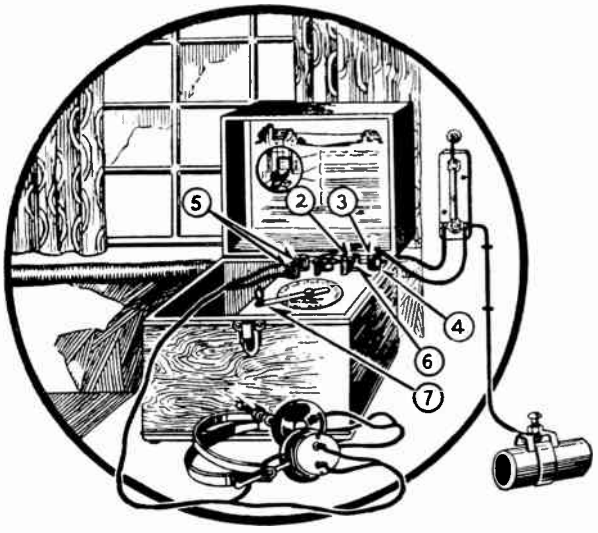
No. 2. Connect a wire leading from terminal marked R on protective device to binding post indicated by arrow for stations below 350 meters.

No. 3. For stations between 350 and 500 meters, connect the above wire to this post.

No. 4. Connect this post with terminal G of protective device.

No. 5. Connect telephone receivers to these two posts. Adjust detector by pulling movable crystal away from stationary crystal and then allowing it to come in contact again at various points. While making this adjustment, rotate tuning handle slowly over the scale, listen until sound is heard in the telephone receivers. Temporarily stop adjustment of detector and manipulate tuning handle until maximum strength is obtained. Leave tuning handle in this position and readjust detector. After a short time the operator will become skillful in finding delicate adjustments on this crystal detector. Various stations may be heard by simply rotating the handle over scale.

Note: As crystals are rubbed together, a black deposit appears on the movable crystal, decreasing the sensitivity of the set. This deposit may be scraped off lightly with a knife.



Complete Aeriola Jr. Broadcasting Receiver, Model RE, 190-500 Meters, with Head Telephone Receivers, Spare Crystals, Antenna Equipment and Full Instructions.....**$32.50**

Aeriola Jr. Broadcasting Receiver, Model RE, as above, less Antenna Equipment.....**$25.00**

Dimensions: 7 in. x 8½ in. x 7¼ in.

Weights: Net, 5 lb.; Shipping, 10 lbs.; with Antenna Equipment, 17 lbs.

Radiola 1

This practical receiver, manufactured by the General Electric Co., covers a band of wavelengths from 180 to 525 meters in two steps. These ranges are from 180 to 300 and 300 to 525 meters respectively.

By merely releasing the bottom catch, the wooden cabinet may be opened to receive the telephone headset, an arrangement which makes the set completely portable. When it is not in use, it may be closed up so that there are no exposed loose wires. By means of a single control you change from one station to another and bring in signals from any station at their greatest strength. This also minimizes interference from other stations.

Complete with Head Telephones, Antenna Equipment and Full Instructions..... **$32.50**

As above, less Antenna Equipment **$25.00**

Radio Concert Receiver, Model AR-1375

This receiver was designed by the Wireless Specialty Apparatus Co. to fill the need for a high-class crystal receiver covering a wave-length range of 170 to 2650 meters, thus permitting the reception of broadcasted concerts as well as daily time signals sent by Arlington (Radio, Va.) on a wavelength of 2500 meters. The entire unit is built in an artistically finished metal case, having a bakelite dilecto front panel. The set is sold complete with a pair of highly sensitive telephone receivers.

Model AR-1375

Radiola AR-1375 is portable, rugged and remarkably sensitive. The ideal Receiver for all around work.

Wave Changing Switch

A wave change switch having three positions is mounted on the left hand side of the panel, providing three distinct wavelength ranges; 170-410, 350-965, 925-2650 meters. Variations between the lower and upper portions of these three ranges can easily be obtained by manipulating the tuning knob found in the center of the front panel.

The tuning knob is provided with an indicator which moves over a graduated dial engraved directly upon the front panel itself. This knob is used to bring in desired, and to cut out undesired stations.

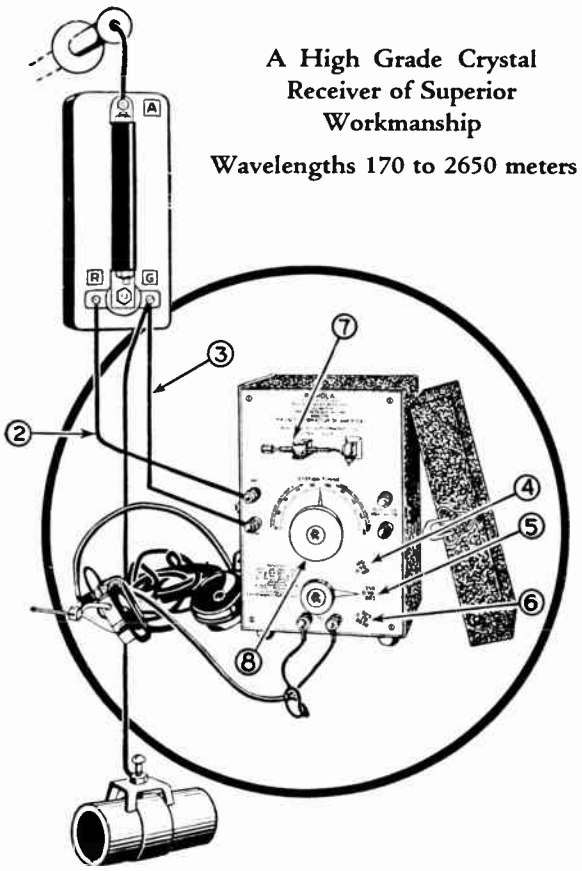
The crystal detector employed with this outfit is mounted directly on the front panel and is of the "catwhisker" type, provided with a very sensitive crystal.

Binding Post Feature

The binding posts on this outfit are of unique design. To connect external wires, it is merely necessary to push down on the top, insert the end of a wire and then release the top. The wire is then automatically held in place by a strong tension spring. This type of post is the simplest and most effective brought out to date.

The receiver is provided with a metal cover which is held in place by two snap catches. One end of the receiver case is removable and forms a suitable receptacle for the telephone receivers when the set is not in use, or when it is being carried about.

An added feature of Receiver AR-1375 is that provisions are made to connect a vacuum tube amplifier unit for loud speaker operation.



A High Grade Crystal Receiver of Superior Workmanship

Wavelengths 170 to 2650 meters

Operating Instructions for Model AR-1375

Text numbers correspond to diagram.

No. 1. First, refer to accompanying sketch, then erect antenna and place protective device in position as described under antenna outfits.

No. 2. Connect a wire leading from terminal marked R on protective device to binding post marked ANT.

No. 3. Connect a wire leading from terminal G on protective device to terminal marked GND on receiver. Connect telephone cord tips to terminals marked TEL.

No. 4. For wavelengths between 170-410 meters, place wave change switch at point A. Most broadcasting reception will be heard with the switch in this position.

No. 5. For stations between 350 and 965 meters, turn wave change switch to point B. This range includes commercial stations, radio compass stations and many Naval stations.

No. 6. For wavelengths between 925 and 2650 meters turn wave change switch to point C. This range includes Naval stations and special commercial stations, as well as Arlington (Radio, Va.).

No. 7. After wave change switch has been set for the desired wavelength range, adjust detector by pulling movable spring-point away from crystal and then allowing it to come in contact again at various points. While making this adjustment, rotate tuning knob (8) slowly over the scale, listening until sound is heard in the telephone receivers. Temporarily stop adjustment of detector and manipulate tuning knob until maximum sound is obtained. Leave tuning knob in this position and readjust detector. After a short time the operator will become skillful in finding delicate adjustments on this crysal detector. Once the detector is properly set various stations may be heard by simply rotating the tuning handle over scale.

Note: A black deposit sometimes forms on detector crystals, decreasing the sensitivity of the set. This deposit may be scraped off lightly with a penknife.

Complete Radio Concert Receiver, Model AR-1375, 170-2650 Meters, with Head Telephone Receivers, Spare Crystals, Antenna Equipment and Full Instructions..... **$47.50**

Radio Concert Receiver, Model AR-1375, as above, less Antenna Equipment..... **$40.00**

Dimensions: 9¾ in. x 7 in. x 7 in.

Weights: Net, 7 lbs.; Shipping, 12 lbs.; with Antenna Equipment, 18 lbs.

Note: For prices of other Complete Receiver Combinations see other pages.

Model AR-1382 Receiver

This receiver is a two-tuned circuit design, equipped with crystal detector. The antenna circuit comprises a stepwise variable inductance and a variable condenser. The secondary circuit likewise comprises a stepwise variable inductance and a variable condenser. A very wide range of coupling is provided between the primary and secondary and the design is so arranged that the coupling may be swept through a zero value at ten degrees on the coupling scale. This wide range of coupling is for the purpose of permitting the separate tuning of antenna and secondary circuits or a so-called "untuned secondary" arrangement. The receiver has a range of 250-750 meters.

If the secondary condenser is placed at a zero value and the coupling handle thrown to maximum, tuning can be accomplished by the operation of the primary knob alone. If great selectivity is desired, the coupling can then be set to a low value, for example, a setting of 15 degrees and the secondary then brought into resonance with the antenna circuit. The degree of selectivity then depends upon the value of coupling between the primary and secondary circuits.

This receiver is particularly adapted for use with a radio frequency amplifier. In this case the cat whisker is removed from the surface of the crystal, opening the crystal circuit.

Binding posts marked "to amplifier" are arranged for the connection of a radio frequency amplifier, or a tube detector and audio frequency amplifier. The very wide range of coupling included in this set will give a very delicate control of the stability and selectivity of the receiving system.

If, however, it is desired to connect the receiver to an audio frequency amplifier not provided with a tube detector, the amplifier may be connected across the telephone binding posts of the receiver.

Model AR-1382

Model AR-1382 Wireless Specialty Receiver..... **$70.00**

Aeriola Sr. Receiver, Model RF

Like the Aeriola Jr., the Aeriola Sr. is a Westinghouse product designed to fill the popular demand for an inexpensive set for broadcasting reception with a greater range than that of Aeriola Jr. Aeriola Sr. makes use of the Regenerative Circuit. This circuit in conjunction with a vacuum tube detector amplifies radiophone signals many times beyond the strength obtainable with a simple circuit. The outstanding feature of the Aeriola Sr. is the fact that the filament of the vacuum tube may be operated from a single dry cell, the telephones being energized by what is termed a "B" or plate battery of 20 volts or more.

Aeriola Sr., Model RF

Aeriola Sr. for the Farmer

Aeriola Sr. will be found especially useful to the farmer for the daily reception of market and weather reports. These messages are sent out by the U. S. Government stations on a wavelength of 485 meters and are received like regular telephone conversations. It is not necessary for the farmer to know the telegraph code. Thus this instrument proves of great value to the great farming centers of the United States which are served by local radiophone broadcasting stations.

In addition to its longer receiving range, Aeriola Sr. possesses the added feature of a more delicate tuning adjustment. This reduces the possibility of interference from undesired stations. Aeriola Sr. is portable. The upkeep expense is very small. Like Aeriola Jr. its wavelength range is from 190 to 500 meters.

Aeriola Sr. includes the receiver or tuner, an Aeriotron detector tube and a pair of heavy telephone receivers.

Aeriola Sr. for the Boy Scouts

Aeriola Sr. receives over comparatively long distances from low-powered transmitting stations and lends itself particularly for communicating between Scout troops and headquarters or sections of the same troop located in different places.

The set may be carried by one Scout without overburdening him, whether he is on a long hike or not. The Aeriola Sr. with the necessary batteries for its operation, the insulators and wire for making the antenna as well as the wire used for the ground connection may all be placed in a haversack. The total weight is less than 15 pounds.

In addition to being very sensitive, this outfit is easy to operate and is not subject to irregularities sometimes found in fragile receivers.

A well-trained troop can set up the antenna, make the ground connection and have a receiving station in operation in a few moments.

Erecting the Antenna

The simplest way to erect an antenna when afield is the following: Attach an insulator to a long piece of string. This insulator and string is then used as a sling and hurled by a Scout over a branch of a tree or any other convenient object. When the insulator reaches the ground on the opposite side of the tree, it is merely necessary to attach the antenna wire and pull on the string. When the antenna is high enough simply fasten the string to the trunk of the tree or other convenient support.

For communicating over short distances, the ground connection may be made by merely laying a piece of rubber-insulated copper wire along the ground for a distance of about 40 or 50 feet. This arrangement does away with the necessity of driving rods into the earth. However, where the station is to be set up near salt water or in a salt marsh, it is more effective to connect the ground wire with a piece of metal of large surface and to place the metal either in the water or the damp earth. The length of the aerial for such a receiving set may be from 50 to 150 feet.

Operating Instructions for Aeriola Sr.

Text numbers correspond to diagram.

No. 1. First, refer to accompanying sketch, then erect antenna and place protective device in position as described under antenna outfits.

No. 2. Connect a wire leading from terminal marked R on protective device to binding post indicated by arrow for stations below 350 meters.

No. 3. For stations between 350 and 500 meters, connect the above wire to this post.

No. 4. Connect this post with terminal G of protective device.

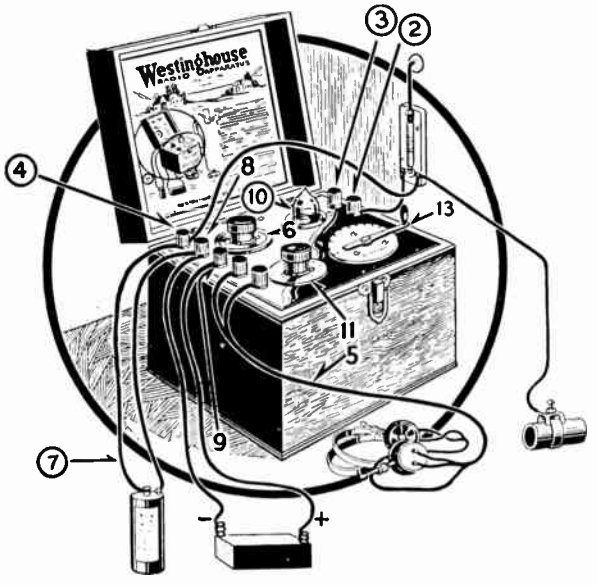
No. 5. Connect telephone receiver to these two posts.

No. 6. Turn rheostat as far as it will go toward tail of arrow.

No. 7. Connect to positive (center) terminal of the single 1.5 volt dry cell.

No. 8. Connect to negative (outside) terminal of the single 1.5 volt dry cell and negative terminal (—) of 22.5 volt plate battery.

No. 9. Connect to positive terminal marked (+) of 22.5 volt plate battery.



No. 10. Insert Aeriotron Vacuum tube in receptacle provided. Note that the four holes in base which receive prongs of tube are not all alike, one being larger than the rest, thus permitting insertion of tube in but one way. Be sure prongs register with holes and then press in firmly.

No. 11. Place "Tickler" pointer at zero point of scale.

No. 12. Turn rheostat (6) toward point of arrow until vacuum tube shows dull red. Do not try to burn too brightly as this materially reduces the life of the filament.

No. 13. Rotate tuning handle slowly over the scale, meanwhile listening until sound is heard in the telephone receivers. Adjust to best position, then increase "Tickler" (11) until mixmum strength of signal is obtained. If tickler is turned too far toward maximum position, signals will lose their natural tone and reception of telephone signals may become difficult.

Complete Aeriola Sr. Broadcasting Receiver, Model RF, 190-500 Meters, with One Aeriotron WD-11-D Vacuum Tube, One Filament Dry Cell, One Plate Dry Battery, Head Telephone Receivers, Antenna Equipment and Full Instructions **$75.90**

Aeriola Sr. Broadcasting Receiver, Model RF, As Above, Less Batteries and Antenna Equipment **$65.00**

Dimensions: 7 in. x 8½ in. x 7¼ in.

Weights: Net, 6 lbs.; Shipping, 12 lbs.; with Antenna Equipment and Batteries, 25 lbs.

Aeriola Sr. Type AC, Two-Stage Amplifier

This latest product of the Westinghouse Company, has been designed to meet an ever-increasing demand for a companion amplifier to the highly popular Aeriola Sr. which will give satisfactory loud speaking results.

The Aeriola Sr. 2-Stage Amplifier has been designed along the same lines as the Aeriola Sr. Receiver; identical in size and general appearance, moulded panel, piano finished solid mahogany cabinet, and—it uses type WD-11 Dry Battery tubes.

Owners of the Aeriola Jr. Receiver who desire increased signal strength will welcome the new amplifier as it has been designed to operate in conjunction with this receiver as well.

The amplifier is fitted with transformers especially designed for maximum amplification, and faithfulness of reproduction. Three telephone jacks are provided to enable the operator to select at will three degrees of signal intensity. This operation automatically disconnects the filament of the tube not in operation thus conserving the battery. A separate filament rheostat is also provided for each tube in order to closely regulate the filament current.

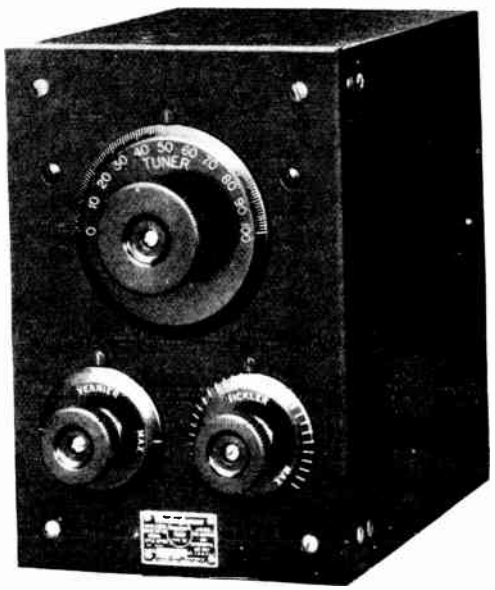
An Aeriola Sr., a type AC Amplifier and a Loud Speaker comprise a most compact Broadcast Receiver, welcomed by anyone, especially those residing in outlying districts where storage battery charging facilities are unobtainable.

Type AC with two WD-11 Dry Battery Tubes..... **68.00**

Complete Aeriola Sr. Receiver, Model RF, with Tube and Brandes Superior Telephones, Aeriola Sr. Amplifier, Model AC, with Tubes, two "B" Batteries, three Dry Cells and Antenna Equipment..... **$147.85**

Short Wave Regenerative Receiver, Model RA

This short-wave tuner, a product of the Westinghouse Company, has been designed to meet the needs of those who require the best form of receiving set available for broadcast reception. Particular attention has been paid to the fact that some Radio enthusiasts desire to carry on experiments of their own, and to incorporate various parts of their receiving equipment. For this reason the terminals are so arranged that either a crystal detector or a vacuum tube detector may be employed. For the former, type DB crystal detector, described under crystal detectors, is recommended, for the latter, type DA Vacuum tube detector and two stage amplifier unit described on next page.



Model RA Receiver

Wide Variety of Uses

The type RA tuner, as used in connection with the average antenna, has a wavelength range of 180 to 700 meters. This range therefore includes practically all that the average person cares to hear—in a word, everything from amateur messages and broadcasted music to ship signals.

This receiver requires but one major adjustment in order to bring in desired stations and cut out undesired stations. Tuning is effected by turning the tuner knob. A minute adjustment of this circuit is obtained by what is known as a "vernier" condenser, which is connected in parallel with the antenna condenser. When a vacuum tube detector is used with this tuner advantage is taken of the amplifying qualities of the Armstrong regenerative circuit. In this case the degree of amplification is controlled by a small knob marked "ticker."

Specifications

Panel—Micarta, finished in black matte.

Cabinet—Natural polished mahogany.

Dials—Polished black micarta with beveled edges. Markings filled in white.

Knobs—Moulded black composition.

Condensers—Rotary plate type, air dielectric. Stationary plates are soldered to three supports, thus making excellent electrical contact and insuring permanent alignment.

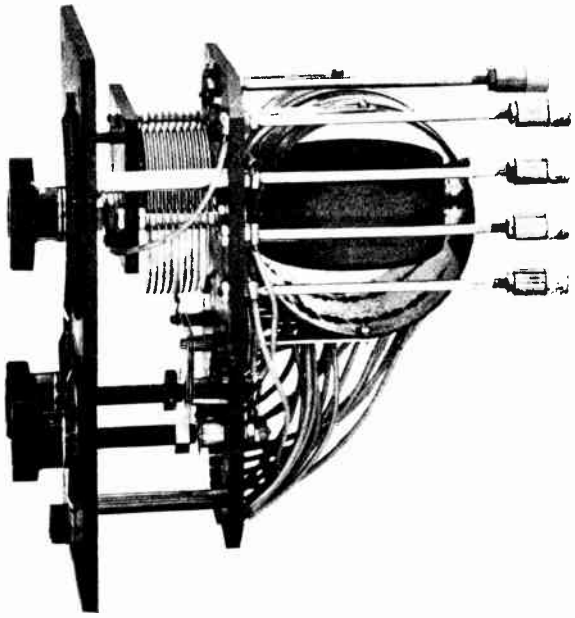
Coils—Single layer wound on micarta tubes. Movable part of variometer connected to stationary coil through wire "pigtail."

Tickler Coil—Wound on same tube as stationary coil of variometer, and suitable taps are insulated with varnished cambric tubing and brought out to a dial switch.

Binding Posts—Moulded insulated posts, brought out at rear.

Fittings—Exposed metal parts on front of panel are brass, nickel-plated. All other screws are black finished.

Wiring Diagram—A wiring diagram showing all connections is furnished together with complete instructions.



Inside View Model RA Receiver

Operating Instructions for Model RA Tuner

When Used with Westinghouse Crystal Receiver Combination No. 5

Text numbers correspond to diagram.

No. 1. First, refer to accompanying sketch, then erect antenna and place protective device in position as described under antenna outfits.

No. 2. Make connections as shown, taking care that the two wires leading to the protective device do not lie close together. These wires should be as short as possible. All wiring may be made with No. 18 rubber-covered copper wire. Carefully remove the cover from both ends of each wire used, scraping clean with a knife, placing the end thus cleaned under the terminal caps shown and tighten cap.

No. 3. Connect headset as shown.

No. 4. Place dial switch in position shown.

No. 5. Adjust pressure type crystal by clasping black handle and pulling the movable crystal away from the stationary one and let it come in contact with it at various points. Crystals should come together with firm pressure. While trying various points, turn the tuner knob (6) slowly over the scale, listening at the same time for sounds in the telephonic receivers.

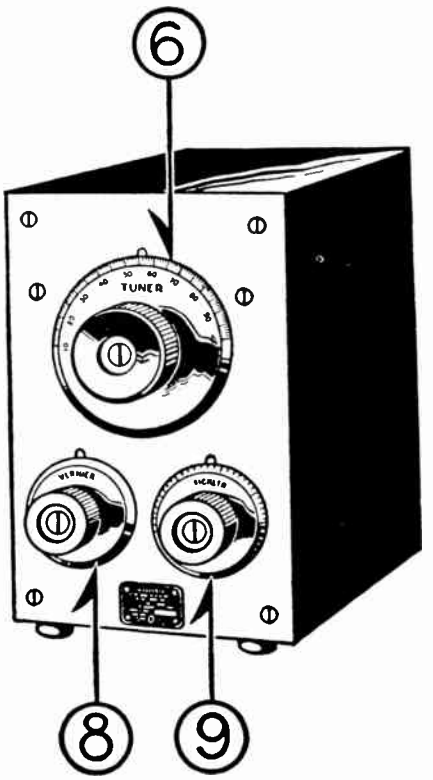
No. 7. By changing the dial switch (4) to the other position this detector may be used. The flexible wire with special tip should be brought into contact with the various points on the stationary crystal, at the same time manipulating the tuner handle (6) as explained under (5) until the sound is loudest.

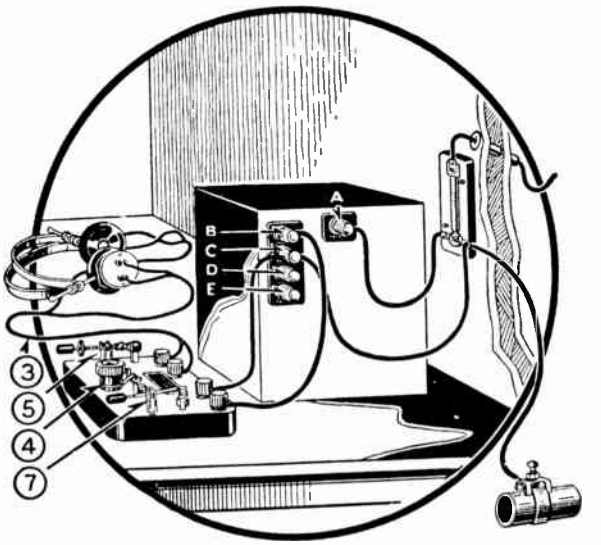
No. 8. Vernier knob may be used as a fine adjustment on tuner knob (6).

No. 9. This knob is not used in this set and should be placed at minimum.

Text numbers correspond to above numbers.

Note: Terminals A, B, C, in upper diagram correspond to antenna, detector, detector-ground. D and E to tickler and plate when the unit is used with amplifier Model DA.





Complete Short Wave Regenerative RA, with Crystal Detector, Model DB, Head Telephone Receivers, Antenna Equipment and Full Instructions $90.00

Short Wave Regenerative Tuner Only (Model RA), with Instructions $68.00

Dimensions of Tuner: 9½ x 8½ x 6 in.

Weights: Net, 6 lbs.; Shipping, 10 lbs.; with complete Antenna Equipment as above, 25 lbs.

Detector and Two-Stage Amplifier, Model DA

This unit is designed along advanced engineering principles and is especially adapted for the use of those who have not made an extensive study of radio but who desire to receive over ranges greater than those of Aeriola Jr., or the RA receiving sets when used without any external amplifying units. Within a very attractive mahogany cabinet equipped with a hinged cover all the elements necessary for a vacuum tube detector and two-stage audio frequency amplifier are found. This device when used in conjunction with the type RA shortwave regenerative tuner as described, forms a combination for radio reception of a very high order for the non-technical user.

Amplifier DA is the logical graduating step for owners of Tuner RA previously described.

Three Vacuum Tubes Are Employed

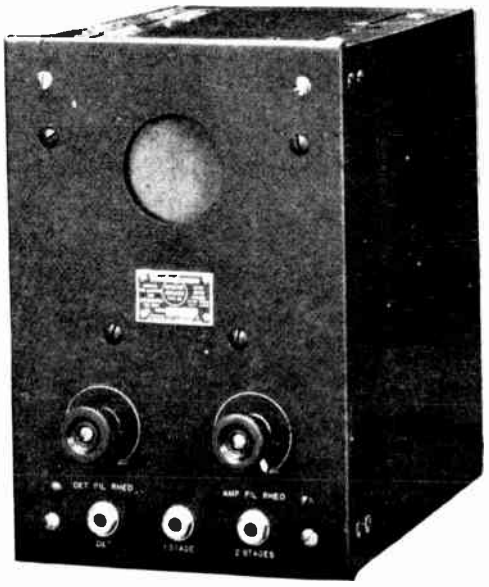
The amplifier acts as a magnifier of the signals received by the detector. With each stage of amplification the incoming signals are magnified many times, so that with this detector and two-stage amplifier, signals which at times cannot be heard with simpler sets, may be received with ease on a loud speaker.

Vacuum tubes require two batteries for their operation, one for the heating of the filament, known as the "A" battery (in this case a storage battery of 6 volts with a capacity from 40 to 130 ampere hours), and the other a dry battery of 40 to 60 volts known as the "B" battery. For the best results it is necessary to regulate the amount of current

supplied by the storage battery to the filament of the vacuum tube. In type DA unit are two rheostats, one of which regulates the current in the detector tube, and the second that regulates the supply to both amplifying tubes.

Three Controls Provided

Three telephone jacks are mounted on the panel and are arranged to control the internal circuits according to the desire of the operator. Thus, by inserting the telephone plug in the first jack the signal is received with the detector tube alone. With the plug in the second jack we have one stage of amplification. The second stage of amplification is made available by inserting the plug in the third jack.



Model DA

A screened window is provided in front of the panel in order that the operator may observe the brilliancy of the vacuum tubes. All the vacuum tube sockets are mounted on the same base which in turn is mounted on heavy rubber shock absorbing supports.

The cabinet is mounted on rubber feet to prevent scratching of the table or desk upon which it is placed.

This instrument will be found entirely satisfactory for amplifying weak radio signals and producing loud signals when used in conjunction with a Vocarola loud speaker (Model LV) for entertainment.

Specifications

Panel—Micarta finished in black matte. An opening protected by metal gauze is provided for ventilation and to give a visual indication of the tubes in operation.

Cabinet—Natural mahogany, varnished and polished. Door provided in top for ready inspection and replacement of vacuum tubes.

Knobs—Moulded black composition.

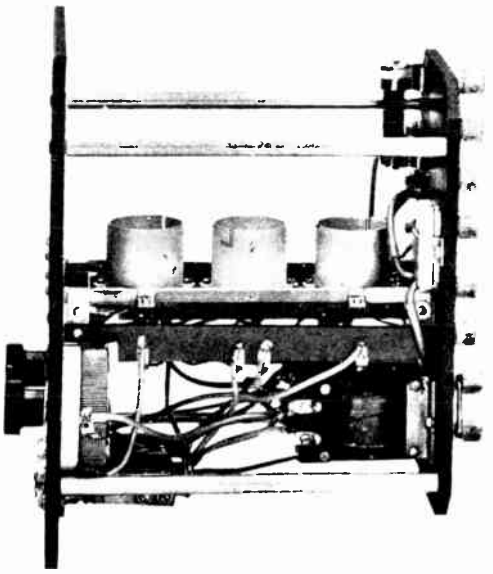
Rheostats—Continuously variable type with open circuit position. Polished nickel pointers.

Sockets—Metal on micarta base with tangential contacts. Shockproof mounting.

Binding Posts—Moulded insulated posts, brought out at rear.

Amplifying Transformers—Closed core type, designed for maximum efficiency with standard tubes.

Wiring—Covered with varnished cambric tubing. All wiring neatly done. All connections soldered.



Back View Model DA

Shielding—Instrument completely shielded on all sides, eliminating capacity effects from operator's body.

Wiring Diagram—A wiring diagram showing all connections is furnished, together with complete instructions.

Detector and Two-Stage Amplifier, Model DA, less Vacuum Tubes, Batteries and Telephone Plug **$70.00**

Dimensions: 9½ in. x 8½ in. x 6½ in.

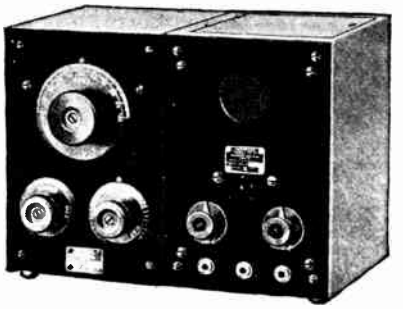
Weights: Net, 10 lbs.; Shipping, 15 lbs.

Models RA Tuner and DA Detector, Two-step Amplifier, less Accessories **$138.00**

Short Wave Regenerative Receiver, Model RC

Combining RA Tuner and DA Amplifier in One Cabinet

The radio broadcast enthusiast or amateur who desires a modern, compact, portable and efficient receiver for general reception, will find these requisites in Model RC short wave regenerative receiver. It is an ideal instrument for use with loud speaking devices and has already found great favor throughout the entire country.



Model RC

Long Distance Features

This receiver comprises a combination of the type RA short wave regenerative tuner, and type DA detector and two stage audio frequency amplifier described on preceding pages. Distant radio telephone, amateur and ship stations may be received on any wavelength within the range of 180 to 700 meters. The addition of Load Coil, model CB, allows the reception of signals on wavelengths between 1800 and 2800 meters where an average amateur outdoor antenna is used. This makes the set suitable for the reception of Arlington (Radio, Va.) time signals, which are broadcasted on 2500 meters at noon and 10 p. m., Standard 75° Meridian time, each day over distances of several hundred miles.

Broadcasting may be received on either detector alone or with one or two stages of amplification by simply changing the head telephone plug connection. Where a Vocarola loud speaker is employed, the entire family may enjoy radio concerts without the use of telephone receivers. The set is metalically shielded so as to prevent undesired noises caused by capacity effects between the set itself and the operator's body.

The specifications for this receiver are identical to those of the RA tuner and DA detector and amplifier, with the exception that both units have been incorporated in one cabinet. All binding posts are mounted on the rear of the panel, permitting connections to be readily made. A wiring diagram and complete instructions accompany each instrument.

Radiotrons Give Best Results

It is recommended that the Radio Corporation's detector and amplifying tubes Radiotron UV-200 and Radiotron UV-201 be used with these instruments.

Operating Instructions for Model RC Receiver

Text numbers correspond to diagram.

No. 1. First, refer to accompanying sketch, then erect antenna and place protective device in position as described under antenna outfits.

No. 2. Connect a wire leading to this post from terminal R of protective device.

No. 3. Connect a wire between this post and terminal G of protective device.

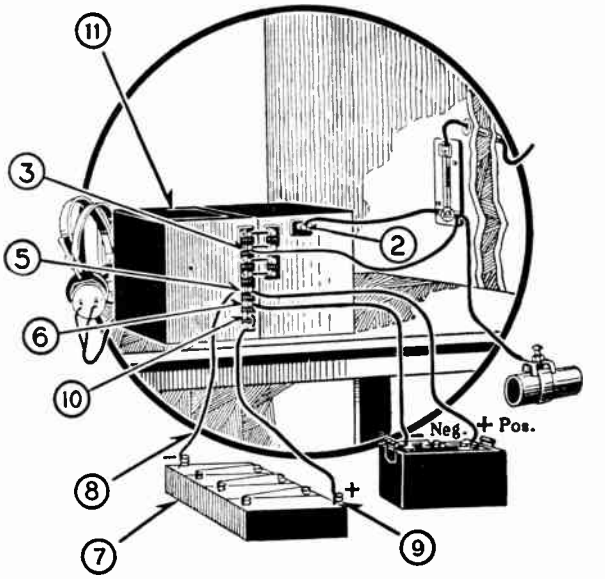
No. 4. Turn rheostats as far as they will go toward tail of arrow.

No. 5. Connect positive (+) terminal of 6 volt storage battery to terminal (+A—B. BAT.) of receiver

No. 6. Connect negative (—) terminal of storage battery to terminal marked (—A. BAT.) of receiver.

No. 7. Connect one positive and one negative terminal of 22.5 volt dry batteries together.

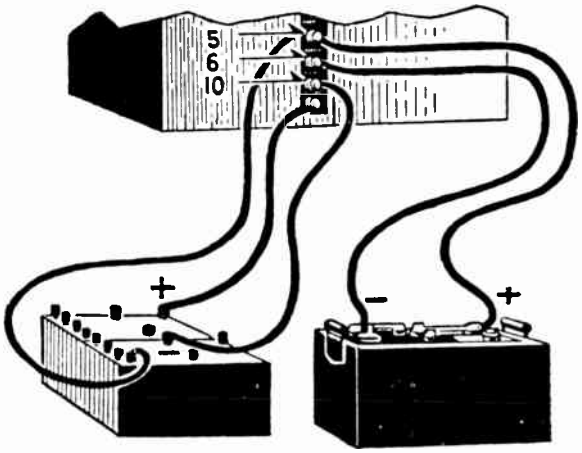
No. 8. Connect remaining negative terminal of 22.5 volt batteries to terminal (+A.—B. BAT.) of receiver.



No. 9. Connect remaining positive terminal of 22.5 volt battery to terminal marked +AMPL. B. BAT.

No. 10. Connect terminals marked +DET. B. BAT. and terminal +AMPL. B. BAT., together.

No. 11. Open door in top and insert three radiotron type UV-201 amplifier tubes in sockets. Catch pin inside of tube base with slot in socket, press down and turn into place.



No. 12. Insert telephone plug in right hand jack and turn both rheostats (4) toward point of arrow until all tubes burn brightly.

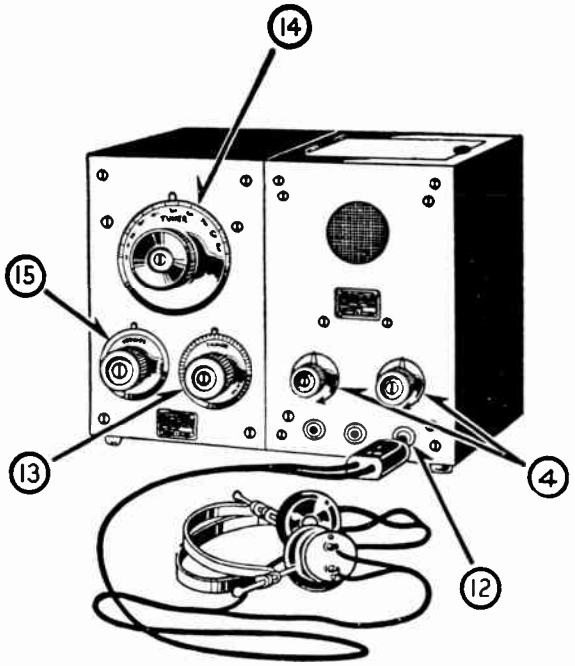
No. 13. Rotate tickler midway between stops.

No. 14. Rotate tuner knob slowly over scale, listening for sounds in telephone receivers. Receiver is very sensitive to adjustments of the tuner knob and care should be taken not to move it too rapidly or the signal will be lost. Signals on short wave lengths will be received near the lower end of the scale, whereas the wave length increases toward the upper end of the scale. Broadcasting stations are generally tuned in between 20 and 40. When the signal is heard, its intensity may be increased by manipulating "Vernier" in one direction or the other and by adjusting the tickler (13). Further adjustment may be made by manipulation of the filament rheostats (4).

For those who desire to operate with a soft type detector tube, radiotron UV-200 may be inserted in the socket at the rear of the cabinet instead of the UV-201, but it is then necessary to alter the connections as illustrated below.

Method of connecting Filament and Plate Batteries.

Complete Short Wave Regenerative Receiver with Detector and Two-Stage Amplifier, 170-700 meters, Model RC, with Load Coil, one Radiotron Detector Tube, two Radiotron Amplifier Tubes, one six-volt Storage Battery Model 6HR-9, Telephone Plug, two



"B" Plate Batteries, Rectigon Battery Charger (5 ampere size), Receiving Antenna Equipment, and Full Instructions.....**$231.75**

Short Wave Regenerative Tuner, Model RC, less all above Equipment.....**$132.50**

Dimensions: 9½ in. x 8½ in. x 8⅛ in.

Weights: Net, 15 lbs.; Shipping, 22 lbs.; with above Equipment, 150 lbs.

Radio Receiver, Model AR-1300

This compact and highly efficient receiver is of the single-circuit type, with a continuously variable air condenser for tuning. Because it is provided with regenerative coil for amplification and oscillation, it is suitable for the reception of all types of radio signals over the wavelength range of 180 to 700 meters. This meets the requirements of present day broadcasting.

The receiver, which is manufactured by the General Electric, is built upon the standard EZKASE plan, which determines the size of case and arrangement of terminals to suit the various standard amplifier and detector instruments.

The variable air condenser is a special type arranged to operate an automatic switch which changes the inductance in the circuit. Therefore a continuous rotation of 360° is utilized for the entire wavelength range.

Crystal or Vacuum Tube Detection

A sensitive crystal detector is provided on the receiver, and a jack for plugging in the telephone receivers. For crystal detector operation, therefore, the unit is complete in itself, and needs no further units except the telephone receivers and the antenna.

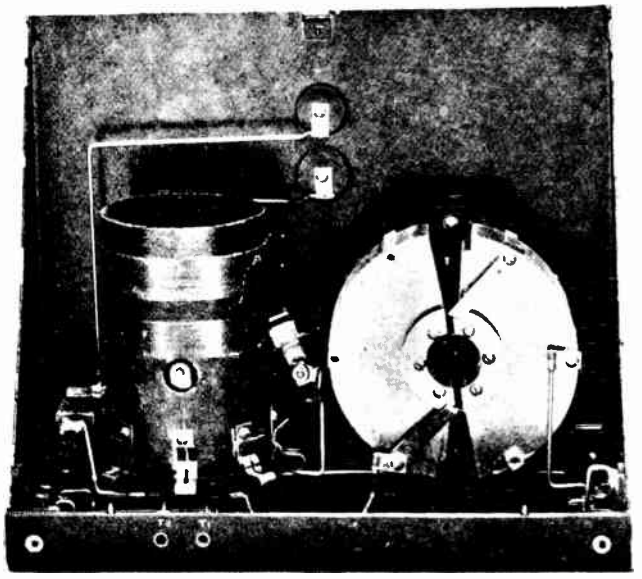
Receiver AR-1300 can be used in connection with an external amplifier unit as embodied in Detector Amplifier, Model AA-1400, described on the following pages. When so used, the crystal detector is switched off and the intensity knob is turned to control amplification by regeneration.

The receiver is enclosed in the EZKASE, which serves the dual purpose of an electrostatic shield and a protection against mechanical injury.

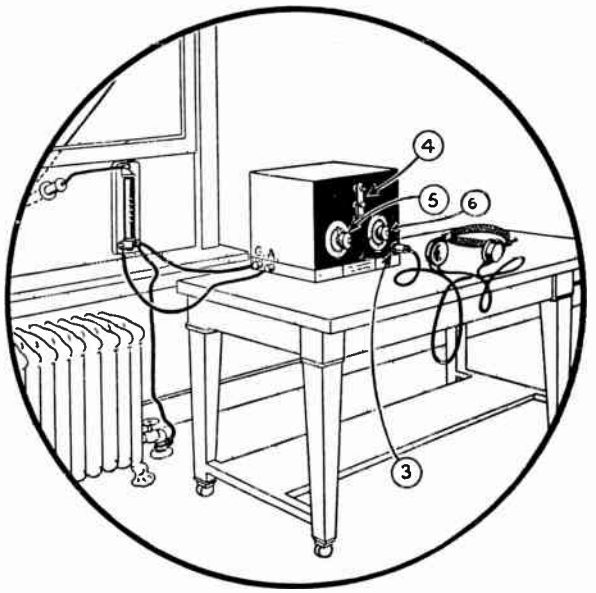
Rear section of case is readily detached after pressing release button on top of case.

Model AR-1300

Receiver AR-1300 when used in combination with amplifier AA-1400 and the Vocarola loud speaker, furnishes all that the average home requires for broadcast reception at medium cost of installation and operation. Moreover, the entire family may "listen in."



Inside View Model AR-1300



Operating Instructions for Radio Receiver AR-1300

Text numbers correspond to diagram.

No. 1. First refer to accompanying sketch, then erect antenna and place protective device in position as described.

No. 2. Connect receiver as shown in accompanying illustration.

No. 3. Insert telephone plug in jack at right hand side of receiver.

No. 4. Adjust crystal detector and rotate tuner arm until signals are heard.

No. 5. Make further adjustment of crystal detector so as to obtain the most sensitive position.

No. 6. Intensity control does not function with this receiver when a crystal detector is used and it should therefore be left at the zero position.

Note: As crystals are rubbed together, a black deposit appears on the movable crystal, decreasing the sensitivity of the set. This deposit may be scraped off lightly with a knife.

G. E. Regenerative Radio Broadcasting Receiver Model AR-1300, less Head Telephone Receivers and Telephone Plugs..... **$50.00**

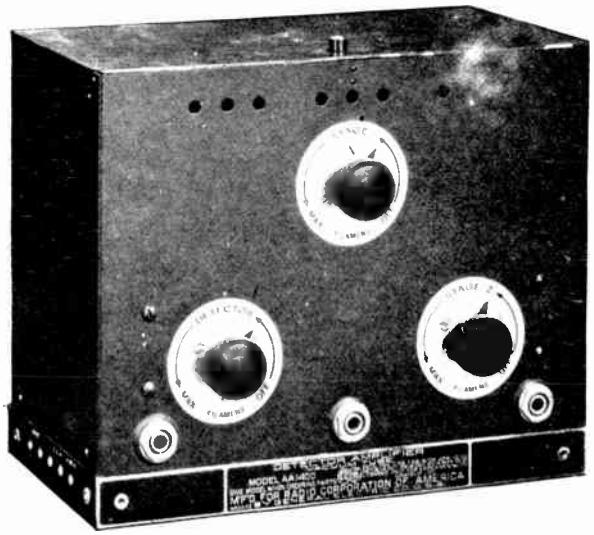
Detector Amplifier, Model AA-1400

Detector-Amplifier AA-1400 is a compact and easily operated amplifier unit. It is also a product of the General Electric Co. and consists of a vacuum tube detector and two stages of audio frequency amplification enclosed in a neat metal EZKASE.

It is especially adapted for use with Radio Receiver AR-1300 when it is desired to greatly increase the strength of the broadcasted concerts such as would ordinarily be received with the simple crystal type detector.

Individual Filament Control

An important feature of Model AA-1400 is the individual filament control system, that is, the three vacuum tubes employed here (a detector and two stages of amplification) are furnished with separate rheostats, thus enabling the operator to obtain individual stage control of the received energy.



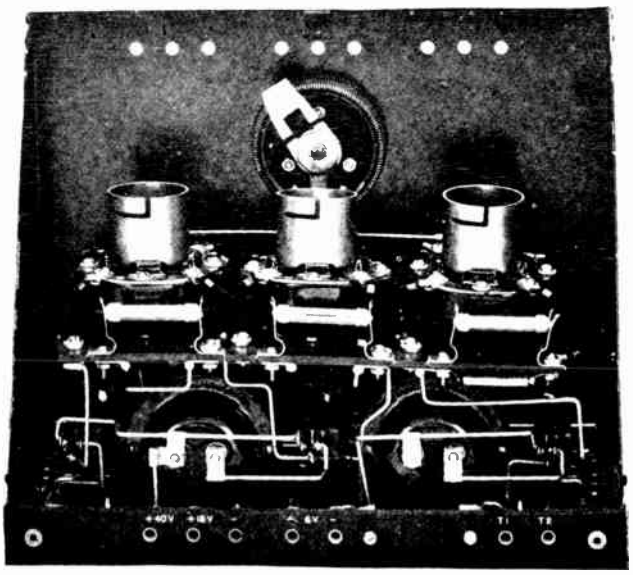
Model AA-1400

Plug and Jack Selection

Another operating feature is the selectiveness furnished by the three telephone jacks. The left hand one is for plugging in on the detector tube only, the middle jack furnishes detection and one stage of audio frequency amplification, while the right hand jack gives maximum amplification output i. e., detection with two stages of amplification.

This feature will be found useful where it is desired to decrease the intensity of signals when receiving from high powered stations over short distances.

Reception may also be continued in emergency with the detector, or the detector and one stage of amplification when the battery has become discharged to such an extent that it will not properly operate the filaments of the three tubes, although this practice should not be generally followed. Means are provided by which the loud speaker is automatically disconected from the circuit when the telephone plug is placed in a jack.



Inside View Model AA-1400

Distortion Practically Eliminated

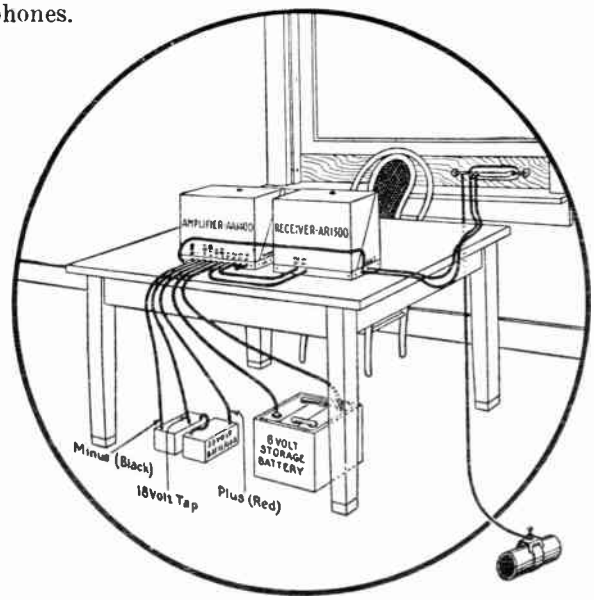
Distortion of broadcasted music or speech and consequent lack of tone qualities so common with many receiving systems is practically eliminated by AA-1400.

The electro-static shielding afforded by the metal case of this instrument as well as the AR-1300 eliminates all disturbances caused by the proximity of the hand or body to the instruments.

Operating Instructions for Detector-Amplifier AA-1400 Used with Radio Receiver AR-1300

No. 1. Make connections as shown in illustration.
No. 2. Separate crystal detector minerals.
No. 3. Insert a Radiotron UV-200 in the left hand socket, and two Radiotrons UV-201 in the remaining two sockets.
No. 4. Turn filament control knobs almost entirely around to the left, bringing the filaments to their proper temperature.
No. 5. Insert telephone plug in left hand jack and set intensity knob on receiver at zero position.
No. 6. Tune with wavelength knob on receiver until signals are heard with maximum intensity.
No. 7. Slowly rotate intensity knob until a maximum signal strength is obtained.

Note: A loud speaker may be connected to the output terminals on right hand end. The loud speaker is automatically disconnected when using head telephones.



G. E. Detector-Amplifier, Model AA-1400, Less Tubes and Batteries $75.00

Complete Regenerative Radio Broadcasting Receiver, Model AR-1300 and Detector, Amplifier Model AA-1400, One Radiotron Detector Tube, Two Radiotron Amplifier Tubes, Head Telephone Receivers, Six Volt Storage Battery, Three Plate Batteries, Rectigon Battery Charger (5 Ampere Size), Telephone Plug. Receiving Antenna Equipment and Full Instructions $220.25

Regenerative Radio Broadcasting Receiver, Model AR-1300, 170-700 Meters, Less All Above Equipment $50.00

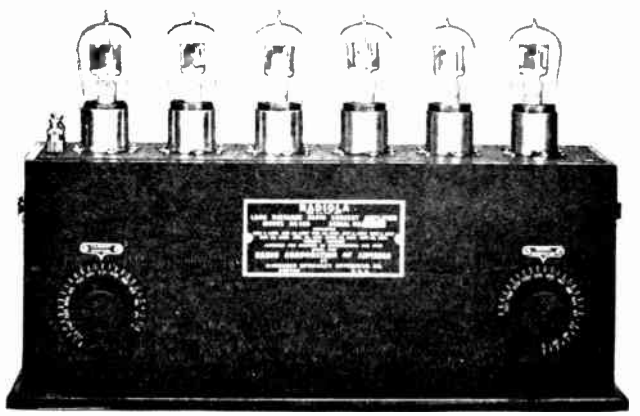
Model AA-1520 Radio Frequency Amplifier

The Model AA-1520, manufactured by the General Electric Company, is of the same general style and construction as Model AR-1300 Tuner. The AA-1520 may be placed between the AR-1300 tuner and the AA-1400 detector-amplifier, making a radio concert receiver which permits reception over long distances.

It also makes possible reception by the loop or indoor aerial. The AR-1300 Tuner may be eliminated and replaced by the indoor loop, AG-1380, in conjunction with the air condenser, Model UV-1820. The combination of the loop, the condensing the radio frequency amplifier Model AA-1520 and detector amplifier Model AA-1400, makes a complete indoor set of unusual capabilities. G. E. 3-stage Radio Frequency Amplifier, 500 meters maximum, less tubes. Price **$80.00**

Model AA-485 Amplifier

This amplifier is one of the most sensitive devices that has been developed for the reception of broadcast signals. It comprises a 6-tube design which has five steps of radio frequency amplification, a vacuum tube detector and two steps of low frequency amplification making the amplifier the equivalent of an 8-tube amplifier. In addition to its sensitivity the amplifier is characterized by its simplicity and stability. The Model AA-485 Amplifier is suitable for use in connection with a loud speaker. It has a sensitivity that is adequate for long distance reception. The amplifier has a range of 200-500 meters. It may be connected to either a loop aerial tuned by a variable condenser or to the usual coupled circuit receiver. When connected to a two tuned circuit receiver, the coupling value between the secondary and antenna circuit should be fairly small and controllable.

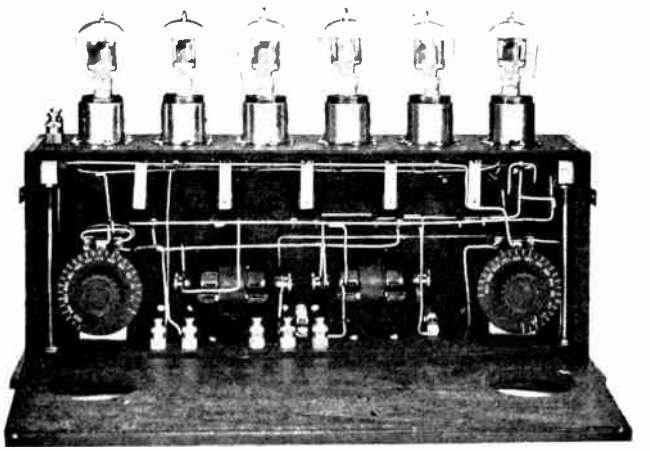


Model AA-485

The radio frequency stages are resonant open iron core transformers each having a different natural period in their tube circuit. The effect of this arrangement of periods serves to prevent the occurrence of adjacent grid and plate circuits of the same frequencies and the consequent initiation of a radio frequency oscillation. In addition to the feature of multi-periods in the radio frequency transformers, a distributed structural damping is provided in them by both a hysteresis loss and ohmic loss.

The grid circuit of the input tube is connected to a damping control which permits of a variation of the mean grid potential of the tube and thereby provides a controllable damping for this tube and a means of stabilizing the amplifier to all conditions of tuning adjustments.

The output of the detector tube is connected to the primary of an audio frequency transformer and the secondary of this transformer is connected in series with the grid circuit of the radio frequency winding of the third tube in the amplifier train. The second audio frequency transformer s connected



Inside View Model AA-485

between the third and fourth tubes in the amplifier train and the output circuit is placed in the plate of the fourth tube.

This "reflex" circuit provides for the double use of the third and fourth tubes in the amplifier train without decreasing the sensitivity of the radio frequency amplification of the amplifier. The radio frequencies are bypassed about the audio frequency transformers and other high impedences by the distributed capacity of these windings, or by condensers placed in shunt of these windings.

All the filaments of the amplifier are controlled by a single rheostat handle. The signal intensifier and filament controls are dependent and should be operated simultaneously to obtain the best results.

The first five tubes in the amplifier should be hard tubes, namely, the UV-201 and the sixth tube in this train should be a soft detector tube, namely, the UV-200. A separate binding post is provided for the plate of the detector tube to permit of the choice of plate potential about the value of 20 volts. The plates circuit of all the amplifier tubes are connected to the binding post marked "plus 80 volts." Voltage as high as 140 volts may be employed for loud

speaker operation. Inasmuch as the filament current is fairly great, we suggest that if a six volt storage battery be used that care be taken to provide heavy and short leads between the battery and its connection to the amplifier.

Model AA-483 Wireless Specialty, 6 Tube (Detector and 7-Stage) Radio-Audio Amplifier, less tubes $160.00

Model AR-1382 Wireless Specialty Tuner for use with Model AA-483 ..... $70.00

Aeriola Grand Broadcasting Receiver, Model RG

Introducing a De Luxe Design in Broadcasting Receivers

Here indeed is the ideal radiophone receiver for home entertainment. For simplicity of operation and compactness, it is unequaled and holds a leading position in the field of radio broadcast reception. Any man, woman or child can easily operate it without the slightest technical knowledge. A simple snap switch starts or stops it and a single tuning lever controls the wave length range. This high grade instrument is a product of the Westinghouse Electric and Mfg. Co.

Aeriola Grand

Anyone Can Install Aeriola Grand

Suitable stands are furnished for Aeriola Grand if desired. These stands are richly finished and harmonize in every way with the Aeriola Grand.

The Aeriola Grand is a complete radio receiver and loud speaker combined, in a high grade mahogany cabinet. It is designed for use in homes near high power broadcasting stations operating on wave lengths below 500 meters. The distance from such a station, under average conditions, should not exceed 50 miles.

The instrument is well adapted for use by the novice. A push button switch, for turning the current on and off the vacuum tube filaments, and a single tuning lever completes the control. The method of amplifying has been developed to a degree where practically no distortion exists. The reproduction of clear speech and music is one of the outstanding features of the Aeriola Grand.

Combines All Radio Essentials

The Aeriola Grand has been especially designed to receive broadcasting stations operating on the standard wave of 360 meters, but provision is made for an additional range up to 550 meters.

All the essentials of radio detection, amplification and loud speaking are embodied in this popular instrument. By means of the loud speaking chamber the entire family may hear broadcasted music and other entertainments. In fact, the complete outfit is arranged in a cabinet very similar to that of the conventional phonograph cabinet.

With Aeriola Grand it is only necessary to connect the antenna and ground wires, turn the current on by means of a small snap switch and tune in the desired signals with a single control handle. A special plug is provided for reducing the volume of the incoming signals when the broadcasted concerts are too loud.

Automatic and uniform heating of the filament of the detector and three amplifier vacuum tubes used for reception in the Aeriola Grand is obtained by means of four ballast tubes.

The workmanship of the Aeriola Grand is unsurpassed. Its parts are housed in a highly polished mahogany cabinet, artistically constructed. Indeed, the instrument forms a valuable addition to the furnishings of any home.

Aeriola Grand is shipped complete with one detector tube, three amplifier tubes, four ballast tubes and the necessary "B" battery. To complete the installation, a 6 volt, 80 ampere-hour storage battery and a Model AD Antenna Outfit are required.

Aeriola Grand Broadcasting Receiver, as above less Stand, Storage Battery, Charger and Receiving Antenna Equipment $325.00

With Stand $350.00

Mahogany Stand Only $35.00

Dimensions: Receiver Cabinet, 21 in. x 17½ in. x 14½ in.; Stand, 31¾ in. high x 22¾ in. x 19¾ in.

Weights: Net, 50 lbs.; Shipping, 70 lbs.; with Stand, 140 lbs.

Clapp-Eastham Receiving Sets

Type HR Regenerative Receiver
Special Features

Wave length, 180 to 825 meters. Antenna condenser built as a vernier. Compartment inside cabinet for "B" battery, or external "B" battery may be used. The control is wonderfully simple—the easiest you have ever used. Notwithstanding its low cost, we guarantee this set to give results equal or superior to any on the market, regardless of price.

Type HR

Specifications

The following specifications will bear the closest inspection by the experienced radio man:

Panel—Condensite, rubbed to a dull finish and machine engraved. Engraving filled with permanent white.

Cabinet—Solid mahogany, highly finished, hinged cover and compartment for "B" Battery, 7¾ inches wide, 9⅜ inches high, 6¾ inches deep over all.

Condenser—Balanced type, two rotary and three stationary plates.

Dials—Type 800 H dials of indestructible metal with black finish and white numerals are used.

Antenna Inductance—Wound on Formica Tube.

Plate Inductance—Wound on moulded ball.

Binding Posts—Rubber composition covered posts are used throughout.

Switch—No. 19 Switch wth fan blade.

Rheostat—H400 Rheostat.

Circuit—Single circuit regenerative, licensed under Armstrong United States Patent 1113149.

Type HR Receiver, complete as illustrated, but without accessories **$40.00**

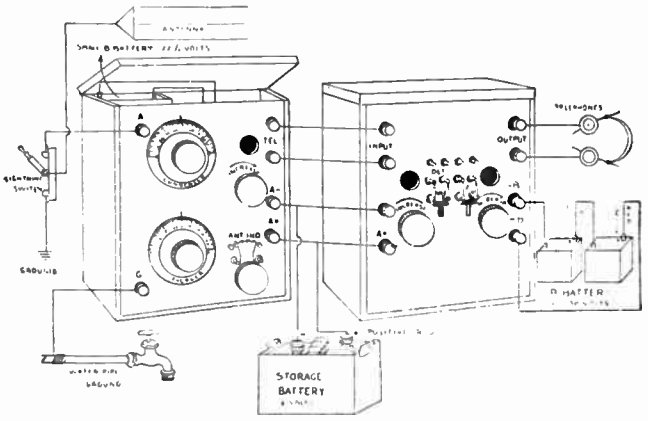
Type HZ Two-Stage Amplifier
Special Features

This amplifier is a companion piece to our HR Regenerative Set. It is equipped with the new "Maximus" amplifying transformers, the last word in amplification. The switches permit the use of detectors only, one stage of amplification or two stages of amplification, and only those tubes actually in use need be lighted.

Signals from any receiving set can often be increased to several hundred times their original intensity, by the use of this two-stage amplifier. This means that faint or distant signals, either telephone or telegraph, almost inaudible, can be made sufficiently loud for clear reception and that near-by or strong signals can be so increased in intensity as to make them audible over an entire room to a large audience. Where it is desired to dispense with the usual telephone head set and employ a loud speaker with horn for the reproduction of music or other radio signals, a two-stage amplifier must be used for satisfactory results. When so used, entertainment may be provided for the entire household or even to an audience in a large hall. This amplifier, while especially designed for use with our HR Regenerative Set, may be equally well employed with any receiving set of any type or manufacture.

It matches exactly the HR set in size and finish, and the binding posts exactly correspond, so that one may be connected to the other without any loose wires. This amplifier is also equipped with the recently perfected "Maximus" transformers which are a new step in advance in the art of amplification. The

Type HZ



same storage battery (A Battery) used for lighting the filament of the receiving set detector may also be used to light the filaments of the amplifying tubes, and the only adjustment required by the amplifier is the small rheostat controlling the brilliancy of filament in the tubes. A "B" battery of 44 volts is required for this instrument, and higher voltages up to 100 may be used with corresponding increase in signal strength.

Specifications

Panel—Condensite, rubbed to a dull finish and machine-engraved. Engraving filled with permanent white.

Cabinet—Solid mahogany, highly finished, hinged cover. External "B" Battery to binding posts. Size 7¾ inches wide, 9⅜ inches high, 6¾ inches deep over all.

Transformers—New Clapp-Eastham Company "Maximus" type. A little better than the best.

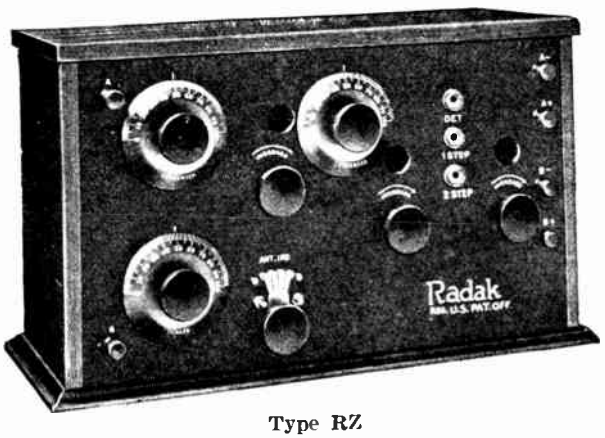
Rheostats—New Clapp-Eastham Company Type 400.
Switches—New Clapp-Eastham Company ZRS6.

Binding Posts—Rubber Composition covered.

Type HZ Two-Stage Amplifier complete as illustrated, but without accessories.....**$40.00**

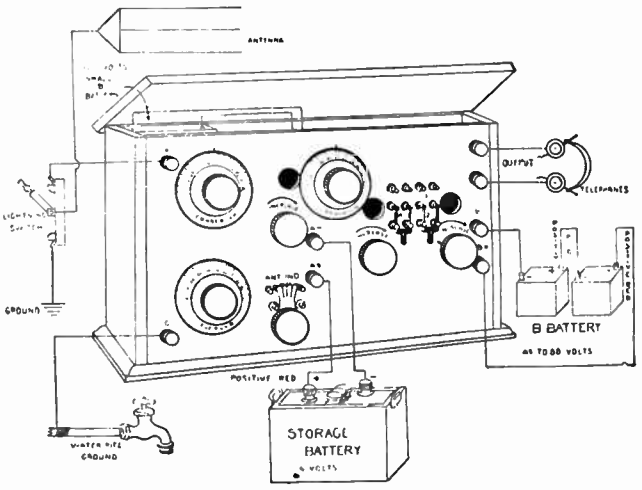
The Ideal Receiver Type RZ

A most efficient home set. Licensed under Armstrong United States patent 1113149. The RZ is our ideal receiver. In order to satisfy your ideal the perfect receiver must be something more than a mere combination of wood, metal and bakelite, although it must be of the best materials. It must not be clumsy, but at the same time, rugged and strong. It must be capable of receiving wave lengths such as are in common use by broadcasting stations, also commercial and government stations, but should not run up to excessive wave lengths as this will cut down the strength of signals on shorter wave lengths. All adjustments should be accessible with the least effort and it should be pleasing in appearance. Above all it should produce results, not the ordinary results obtainable with the ordinary set, but the unusual kind of results which have been beyond your reach before.



Type RZ

The RZ is the ideal receiving set for the home as it not only combines in one cabinet all of the many good features of both the IIR regenerative receiver and HZ two-stage amplifier, but in addition will respond to



wave lengths up to three thousand meters, enabling the owner of the RZ regenerative receiver to listen to Navy and Army stations and even receive time signals from the Great Arlington station.

The RZ like the HR is guaranteed to give results equal to any set on the market regardless of price. It is supplied in solid mahogany cabinets with attractive condensite panels and hard rubber composition binding posts. Without question this is the most attractive addition you could possibly add to your home, because of its beauty and its service in entertaining the entire family.

Type RZ complete as illustrated, but without accessories **$100.00**

Chelsea Regenerative Receiver

The Chelsea Regenerative Receiver was designed primarily for the reception of radio broadcasts. The greatest endeavor has been to attain high efficiency and no expense has been spared to this end. The

Chelsea Regenerative Receiver

wonderful operation of the receiver proves the success.

Next to efficiency we have endeavored to simplify control and have resolved tuning into merely one control each for fine and coarse adjustment of wave-length, and one control for intensity.

The inductance switch is the large wave-length control, and the condensor is the fine control element, tuning in between the large steps. After the signal has been thus located it may be brought to proper intensity by operation of the regenerator dial. The rheostat need only be set once and left alone.

An inspection of the interior of this receiver will show its high quality and unexcelled workmanship.

The case is genuine mahogany, nicely finished; panel, dials, and all insulating material genuine bakelite.

The receiver is a Chelsea Radio product, and employs Chelsea equipment throughout.

It is licensed under Armstrong U. S. Patent No. 1113149, October 6, 1914, for use in amateur and experimental stations only.

Wave-lengths reached by this outfit range from a minimum of 150 meters to a maximum of 770 meters. Full regeneration is obtained on all wave-lengths. This makes accessible to every user the maximum signal possible to obtain from amateur stations, broadcast stations, and ship and commercial stations.

Results in operation exceed its good appearance.

Shipping weight: 7½ lbs.

Size: 10″ x 9″ x 6″.

No. 101, range 150—770 meters, less tube **$40.00**

Complete Radio Telephone Receiving Sets

Combination Receiving Sets

In determining the necessary equipment for a Broadcast Receiving Station the following combinations of apparatus will be found helpful. Any unit may be bought separately. The complete combinations are indicated merely to guide those who wish to purchase a complete receiving set. Thus the technically uninformed enthusiast avoids the risk of buying unnecessary parts. See other pages for loud speaking equipment.

Westinghouse Aeriola Grand Combination No. 1

RG—Aeriola Grand Receiver, 150-550 meters, comprising one Aeriotron Detector, three Aeriotron Amplifiers, four Ballast Vacuum Tubes, and four "B" Batteries	$325.00
Gould Storage Battery, 6 volts, 80 A.H.	19.00
AD—Receiving Antenna Equipment	7.50
285168—Rectigon Battery Charger, 6 amperes	28.00
Total	$379.50

Westinghouse Aeriola Sr. Combination No. 2

RF—Aeriola Sr., Receiver, 190-500 meters, with Brandes Superior Telephones and one WD-11 Aeriotron Detector Tube	$65.00
One Dry Cell for Aeriotron Filament	.40
One "B" Battery, 22.5 volts	3.00
AD—Receiving Antenna Equipment	7.50
Total	$75.90

Westinghouse Regenerative-Vacuum Tube Receiver Combination No. 4

RC—Short Wave Regenerative Receiver, 170-700 meters, less tubes	$132.50
CB—Load Coil	6.00
UV-200—One Radiotron Detector	5.00
UV-201—Two Radiotron Amplifiers	13.00
Gould Storage Battery, 6 volts, 80 A.H.	19.00
UD-790—Brandes Superior Telephones	8.00
UD-824—Telephone Plug	1.75
Two "B" Batteries	6.00
AD—Receiving Antenna Equipment	7.50
285168—Rectigon Battery Charger, 5 amperes	28.00
Total	$226.75

Westinghouse Aeriola Jr. Combination No. 3

RE—Aeriola Jr., Receiver, 150-700 meters, with Brandes Superior Telephones and spare crystals	25.00
AD—Receiving Antenna Equipment	7.50
Total	$32.50

Westinghouse Crystal Receiver Combination No. 5

RA—Short Wave (Regenerative) Tuner, 170-700 meters	$68.00
DB—Crystal Detector	6.50
UD-790—Brandes Superior Telephones	8.00
AD—Receiving Antenna Equipment	7.50
Total	$90.00

General Electric Regenerative-Vacuum Tube Receiver Combination No. 1

AR-1300—Radiophone Receiver, 170-700 meters	$50.00
AA-1400—Detector — 2-step Amplifier, less Tubes	75.00
UV-200—One Radiotron Detector	5.00
UV-201—Two Radiotron Amplifiers	13.00
UD-790—Brandes Superior Telephones	8.00
Gould Storage Battery, 6 volts, 80 A.H.	19.00
2156—Three "B" Batteries, each 22.5 volts	9.00
285168—Rectigon Battery Charger, 5 amperes	28.00
UD-824—One Telephone Plug	1.75
AG-788—Receiving Antenna Equipment	7.50
Total	$216.75

General Electric Crystal Receiver Combination No. 2

AR-1300—Crystal Radiophone Receiver, 170-700 meters, complete	$50.00
UD-790—Brandes Superior Telephones	8.00
AG-788—Receiving Antenna Equipment	7.50
Total	$65.50

General Electric Crystal Receiver Combination No. 3

Radiola 1—Crystal Radiophone Receiver, 300-700 meters, with Telephone Receivers	$25.00
AG-788—Receiving Antenna Equipment	7.50
Total	$32.50

Wireless Specialty Crystal Receiver Combination No. 1

AR-1375—Crystal Radiophone Receiver, 170-2650 meters, with Telephones	$40.00
AG-788—Receiving Antenna Equipment	7.50
Total	$47.50

Wireless Specialty Receiver Amplifier Combination No. 6

RA-1382—Crystal Radiophone Receiver, 250 to 750 meters, with Telephone Receivers, complete	$70.00
AA-485—Wireless Specialty, 6 tube (8-stage) Radio-Audio Amplifier, less tubes	160.00
UV-200—One Radiotron Detector Tube	5.00
UV-201—Five Radiotron Amplifier Tubes	32.50
Two Storage Batteries, 6 Volt, 100 Amp	43.00
746—Two 108 "B" Battery	30.00
766—Two 22½ "B" Battery	6.00
Two Sure-Grip Plugs	3.00
AD—Receiving Antenna Equipment	7.50
285168—Rectigon Battery Charger, 6 Amp	28.00
10A—Western Electric Loud Speaker	161.00
Brandes Navy Telephones	14.00
	$560.00

RC Westinghouse Regenerative Receiver with Western Electric Loud Speaker Combination No. 7

RC Short Wave Regenerative Receiver 170-700 Meters, less Tubes	$132.50
One CB Load Coil	6.00
One UV-200 Radiotron Detector Tube	5.00
Two UV-201 Radiotron Amplifier Tubes	13.00
Two Storage Batteries, 6 Volts, 80 Amperes	38.00
One pair UD-790 Superior Tel. Receivers	8.00
Three No. 766 Eveready "B" Batteries	9.00
One AD Antenna Receiving Equipment	7.50
One No. 285168 Rectigon Battery Charger, 6 Amperes	28.00
One No. 746 Eveready 108 Volt "B" Battery	15.00
One No. 10-A Western Electric Loud Speaker, includes Vacuum Tubes, Amplifier, 2-stage, using 3 Vacuum Tubes, Loud Speaker Receiving Horn and three No. 216-A Amplifying Tubes	161.00
Total	$442.00

Clapp-Eastham Regenerative Vacuum Tube Receiver Combination No. 8

HR—One Clapp-Eastham Tuner and Detector less Tube	$40.00
UV-200—One Radiotron Detector Tube	5.00
One Brandes Superior Telephones	8.00
763—22½ Wet "B" Battery	1.75
One Gould "A" Battery, 6 to 60 Amp	17.00
AD—Receiving Antenna Equipment	7.50
	$79.25

Clapp-Eastham Regenerative Vacuum Tube Detector Amplifier Receiver Combination No. 9

HR—Clapp-Eastham Tuner and Detector Unit, less Tubes	$40.00
HZ—Clapp-Eastham Amplifier Unit, less tubes	40.00
UV-200—One Radiotron Detector Tube	5.00
UV-201—Two Radiotron Amplifier Tubes	13.00
One Brandes Superior Headset	8.00
763—Two 22½ "B" Batteries	2.50
AD—Receiving Antenna Equipment	7.50
Storage Battery, Gould, 6 Volts, 80 Amp	19.00
	$135.00

Clapp-Eastham Regenerative Receiver RZ Combination No. 10

RZ—Receiving Set	$100.00
UV-201—Two Radiotron Amplifier Tubes	13.00
UV-200—One Radiotron Detector Tube	5.00
AD—Antenna Outfit	7.50
One 6-Volt, 60 Amp. Gould	17.00
One Telephone Plug	1.00
One Brandes Superior Telephones	8.00
"766" Two Eveready Batteries	6.00
	$157.50

Chelsea Regenerative Receiver Combination No. 11

Chelsea Regenerative Receiver Unit	$40.00
UV-200—Radiotron Detector Tube	5.00
Gould Storage Battery, 6 Volts, 80 Amp.	19.00
766—Eveready "B" Battery	3.00
One Brandes Superior Telephones	8.00
AD—Receiving Antenna Equipment	7.50
	$82.50

SECTION TWO

Radio Receiving Accessories

Radio Vacuum Tubes

Radiotron Vacuum Tubes for Receiving

Radiotrons form the center of a system of radio communication which would be entirely impossible without them. These vacuum tubes are manufactured by the General Electric Co. and the Westinghouse Lamp Company for the Radio Corporation of America. There are so many shining examples of great distances covered by Radiotron reception and transmission that enumeration here would be impossible. With a single Radiotron, experimenters in Florida and another in Cuba have listened to the concerts sent out by a radio broadcasting station located in the vicinity of New York City.

The Radiotron detector tube was used by Mr. Paul F. Godley in his successful attempt to hear American transmitting stations at the station he erected in Ardrossan, Scotland.

The electrical characteristics of all Radiotrons are practically uniform. This is made possible by the highly standardized method of production utilized by the manufacturers at their various factories for the production of Radiotrons. For this reason, the experimenter, in using Radiotrons, is assured of a uniform reliability, as every tube is made to pass a severe test and is rejected unless the high standard set for it is obtained.

UV-200

There are many functions for the Radiotron to perform in connection with radio reception and only its great versatility permits it to be confined to two forms which cover perfectly the varied tasks they are called upon to perform. These two forms are the detector and amplifier Radiotrons UV-200 and UV-201, respectively.

The UV-200 Detector Tube

Radiotron UV-200 may be called upon to perform a great variety of duties as shown in the accompanying illustrations. In any receiving circuit either simple or complex, Radiotron UV-200 is the detector which embodies all the characteristics necessary for faultless performance. The circuits which appear throughout this book show some of the common uses made of this wonderful vacuum tube which has made communication over thousands of miles a fact by means of the code and speech to say nothing of music. Where long distances are to be covered, where stability of operation is desired, where long life and its resultant low cost are desired, where detector tubes of uniform characteristics are required for critical receiving adjustments, in fact wherever real results are sought, there is but one answer to the detector tube question—Radiotron UV-200.

The Radiotron UV-200 is made with a standard four prong bayonet base designed to fit the Radio Corporation standard VT sockets UR-542, and UP-552.

How to Use Radiotron UV-200

In using Radiotron UV-200 for a detector, a grid condenser of approximately .00025 mfd. or thereabouts should be connected in series with the grid. Many experimenters prefer a variable grid condenser which is of value in regenerative circuits. In addition to the grid condenser one of the Radio Corporation's standard grid leaks should be connected across the grid condenser as shown in diagrams. In this case the Radio Corporation's standard Grid Leak and Condenser Mountings, UX-543, should be employed.

Note: Where the desired voltage is not more than 22½, the "A" Battery Potentiometer PR-536 permits an extension of the life of the "B" battery. When the normal voltage of the 18 volt tap is too low, the connection from the potentiometer may be made to the 22½ volt tap, thus using the cells between the 18 volt tap and the 22½ volt tap previously idle.

It is sometimes necessary to use more than 22½ volts with the UV-200 and when this is the case, instead of connecting the lead through the potentiometer to the 18 volt tap of the plate battery, it should be connected to the negative or 22½ volt terminal of the plate battery. This permits an adjustment of from 22½ to about 28 volts on the plate circuit.

Voltages in excess of 28 to 30 should not be applied to the plate of a Radiotron UV-200.

If the experimenter prefers to adjust the filament by indicating instruments, it should be done by a voltmeter and not by an ammeter. All tungsten filaments show a decrease of current during their life and if constant current is maintained in the filament rather than constant voltage across it, the life will be greatly decreased and no better signals obtained. The normal voltage to be maintained at the filament terminals of Radiotron UV-200 lies within the range of 5 to 5.4 volts.

Where it is desired to use loud speakers, in order to eliminate the necessity of listening to radio with the head telephones, sufficient energy must be provided to actuate the loud speaking device. A most suitable means for providing this energy is found in audio frequency amplification, which is the combination of Radiotrons and amplifying transformers functioning with a local source of current.

The incoming radio signals affect the vacuum tube

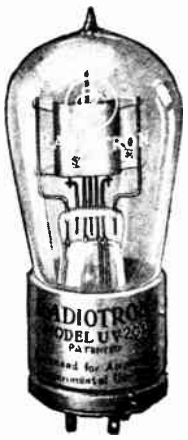
in such a way as to draw current from the local source; this local current is then used to actuate the loud speaking device.

As may be seen from the following description, the amplification factor ordinarily obtained where this method is employed is between 6 and 10; so that for each stage of amplification, the incoming signal is multiplied from 6 to 10 times. Where several stages are used, the signal may reach 36 to 100 times its original intensity.

UV-200	Radiotron Detector Tube	$5.00
C-300	Cunningham Detector Tube	5.00

Radiotrons for Audio and Radio Frequency Amplification

Radio frequency amplification differs greatly from audio frequency amplification in that the increase of the signal intensity takes place before it has been reduced to suitable characteristics for operating a telephone receiver or loud speaker. Both radio and audio frequency amplification and circuits illustrating their most valuable uses, may be found in the section of this book devoted to receiving circuits.



UV 201

For such circuits, the Radiotron UV-201, may be counted upon for reliable performance. Radiotron UV-201 may be used in any circuit where vacuum tubes are used as amplifiers. This remarkable amplifying tube has been designed to function with the Radio Corporation's audio frequency transformer UV-712 and the radio frequency amplifying transformers UV-1714 and 1716, both described elsewhere in this book.

The normal plate voltage of Radiotron UV-201 is 40, although increased amplification is possible with plate voltage up to 100. With 40 volts on the plate, the amplification constant varies between 6.5 to 8, but with 100 volts on the plate, this constant is from 8 to 10. The output impedance of Radiotron UV-201 varies in value from 15,000 to 25,000 ohms, with 40 volts on the plate and from 10,000 to 15,000 with 100 volts on the plate, the normal filament current for Radiotron UV-201 is approximately one ampere. The filament is designed for operation from a 6-volt storage battery with a standard filament rheostat in series.

To obtain maximum amplification with UV-201, means should be provided for imposing negative potential on the grid although good amplification may be secured without this special provision. The requisite negative grid potential for this purpose may be secured by connecting a "C" battery of 2 or 3 volts in the grid circuit shunted by a 200 to 400 ohm potentiometer, or by placing a 2 ohm resistance in series with the negative terminal of the filament and connecting the "low potential" terminal of the tuner secondary to include this resistance in the grid circuit.

Important Facts Concerning UV-201

Because the UV-201 has been designed for use especially with the Radio Corporation's audio and radio frequency transformers, circuits employing these standard units are found to give absolute satisfaction, even under severe operating conditions. The Radiotron UV-201 permits very great amplification without distortion. This feature is especially desirable where reception is carried on at short wavelengths. Heretofore, it has been a very difficult problem to obtain vacuum tubes and radio frequency amplifying transformers which would give satisfaction on the wavelengths used for amateur communication. The perfection of the Radiotron with its allied units now permits radio reception over distances hitherto considered impossible, on all wavelengths.

Circuits and data fully covering the application of Radiotron UV-201 to both Radio Frequency and Audio Frequency Amplification as well as various combinations of both have been presented at length in previous pages.

UV-201	Radiotron Amplifier Tube	$6.50
C-301	Cunningham Amplifier Tube	6.50

Radiotron UV-202—5-Watt

This transmitting tube is a popular one for low power radio telephone sets and for amateur C. W. telegraph sets for transmission up to distances of

UV-202

two hundred miles. Two 5-watt tubes in parallel will put from one and one-quarter to one and three-quarters amperes in the amateur's antenna. Using one of these tubes as a modulator and the other as an

oscillator for experimental radio telephony, distances up to forty miles can be covered, and at least four times that distance when the two tubes are connected in parallel for C. W. telegraphy. Four or five 5-watt Radiotrons can be operated in parallel with increased range.

The 5-watt tubes may also be used as power amplifiers in radio receiving circuits. The energy amplification obtained therefrom is particularly useful for the operation of loud speakers.

Electrical and Mechanical Characteristics

Overall Dimensions	2⅛ in. x 5 in.
Base	Four Prong Standard
Voltage of Filament Source	10 V.
Filament Terminal Voltage	7.5 V.
Filament Current	2.35 Amp.
Plate Voltage	350 V. Normal
Plate Current	.045 Amp.
Output Impedance	4000 Ohms
Amplification Constant	8
Watts Output	5 Normal

Shipment: Radiotron UV-202 is shipped in a standard cardboard carton in which the tube is well protected from mechanical shock or vibration. Shipping weight: 1 lb.

UV-202 Radiotron **$8.00**

Aeriotron Vacuum Tubes

(Westinghouse Products)

Aeriotron Amplifier Tube Model WR-21-A, for Use with Aeriola Grand Receiver

This is a specially designed and carefully selected tube for use in the amplifying circuits of the Aeriola Grand and may be placed in any of the three front receptacles from left to right.

The filament current for this tube is approximately .8 of an ampere and the drop across the filament is about 4 volts. A six volt storage battery with a rheostat or ballast tube control will, therefore, furnish satisfactory power for heating the filament to its normal operating temperature.

The plate impedance of this tube is from 60,000 to 80,000 ohms, making it adaptable to resistance coupled amplification.

WR-21-A Amplifier Tube for Aeriola Grand Receiver **$7.50**

Dimensions: 4½ in x 1¼ in.

Weights: Net, 4 oz.; Shipping, 1 lb.

Aeriotron Detector Tube, Model WR-21-D, for Use with Aeriola Grand Receiver

This tube is designed especially for use with the Aeriola Grand Receiver and when so used gives excellent receiving results. It is provided with a special base which prevents its being used in equipment with which it will not properly function. Aeriotron WR-21-D has a green tip marking and is designed for use as the detector tube in Aeriola Grands, and should be placed in the right-hand front receptacle.

The filament current for this tube is approximately .8 of an ampere and the drop across the filament is about 4 volts. A six volt storage battery with a rheostat or ballast tube control will, therefore, furnish satisfactory power for heating the filament.

Model WR-21-D Aeriotron Detector Renewal Tube for Aeriola Grand Receiver **$7.50**

Dimensions: 4½ in x 1¼ in.

Weights: Net, 4 oz.; Shipping, 1 lb.

Aeriotron Detector Tube Model WD-11, for Use with Aeriola Sr. Receivers

Aeriotron Detector Tube, Model WD-11, is designed for use with the Aeriola Sr. Receiver. It is provided with a special base to preclude the possibility of its being placed in a circuit other than that for which it has been designed.

The filament current consumed by this tube is .25 of an ampere which may be supplied from a single 1.5 volt standard dry cell. However, it is inadvisable to connect the tube directly across the terminals of such a battery, and for this reason a suitable rheostat for controlling the filament temperature is provided with the Aeriola Sr.

The WD-11 Aeriotron tube operates quite satisfactorily as a detector when 22.5 volts are applied to its plate.

Model WD-11 Aeriotron Detector Renewal Tube for Aeriola Sr. Receiver **$8.00**

Dimensions: 4½ in x 1¼ in.

Weights: Net, 4 oz.; Shipping, 1 lb.

Caution: The Aeriotron WD-11 has a special coated filament and must not be burned brighter than a DULL RED.

Aeriotron Ballast Renewal Tube, Model WB-800, for Aeriola Grand Filament Circuits

This vacuum tube has been especially designed for use with the Aeriola Grand Receiver. It functions as a control element in the filament circuit of the detector and amplifier tubes. By the use of these control tubes, accurate adjustment of the filament current is automatically taken care of and filament rheostats are not required.

Model WB-800 Aeriotron Ballast Renewal Tube for Aeriola Grand Filament Circuit **$3.50**

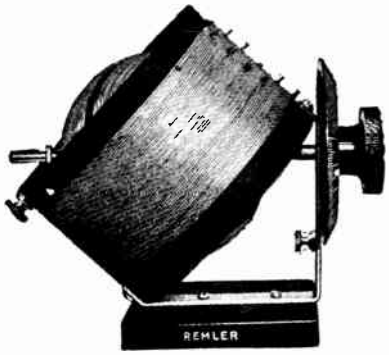
Dimensions: 4½ in x 1¼ in.

Weights: Net, 4 oz.; Shipping, 1 lb.

Vario-Couplers

Remler Types 503 and 504 180° Vario-Coupler

This Vario-Coupler has an exclusive feature—the coupling range is 180 degrees instead of 90 degrees (as is the case with all other vario-couplers). Primary winding green silk covered wire wound on fiber tube 4 in. diameter by 2¾ in. deep. Ten taps are provided. Secondary rotor moulded from bakelite. The bearing construction, of special design, is extremely rigid and is backed up with spring tension to



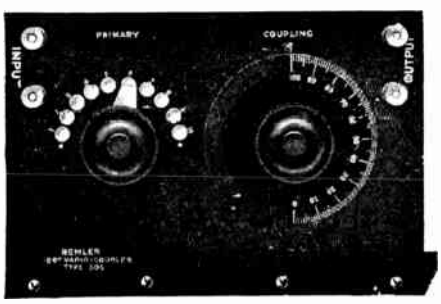
Remler Vario-Coupler No. 504

insure perfect electrical contact at all times. Primary mounted at an angle of 45° on wooden base 4 in. x 3 in. x ⅜ in. Can be readily mounted on either table or panel. Shaft 3/16 in. diameter. Rotor 3⅝ in. maximum diameter. Overall height, including base, 5¼ in.; total width, not including shaft extension, 4⅞ in. This coupler will tune over a range of 150 to 600 meters with secondary variometer and with secondary condenser of .001 mfd. will tune to 700 meters.

Remler Type 503 180° Vario-Coupler..... **$5.40**
Remler Type 504—with No. 100 Bakelite Dial and Knob **6.40**

Remler Panel Mounted 180° Vario-Coupler

Type 503 Vario-Coupler mounted on a bakelite panel 5 in. x 7¼ in. x 3/16 in. finished in glossy black with all lettering recessed and white filled. Input and



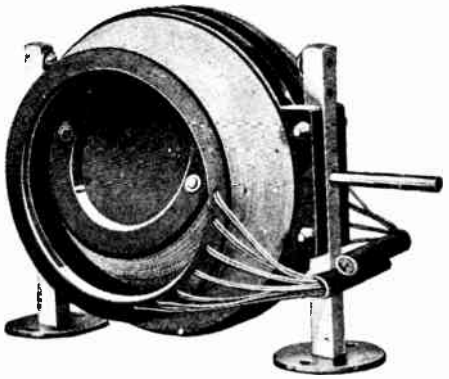
Front View Type 505 Vario-Coupler Panel

output binding posts at opposite ends of panel. Special Remler switch with Bakelite knob to match dial knob varies the primary inductance. All panel wiring is the approved bus-bar type and all connections to the primary taps are soldered. Hardwood base 7 in. x 4 in. x ⅜ in. is finished in black. Matches Type 502 Variometer Panel and Type 330 Detector Panel permitting ready inter-connection.

Remler Type 505 Panel Mounted 180° Vario-Coupler **$12.00**

Atwater Kent Vario-Couplers

This Vario-Coupler consists of moulded condensite forms on which coils are wound. Supports are polished brass.

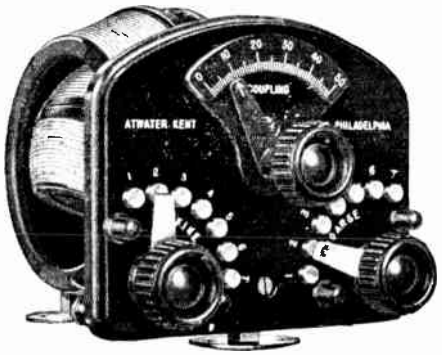


Atwater Kent Vario-Coupler

The special method used in winding the rotor effects a reduction of losses to a minimum such as distributed capacity and high frequency resistance. The parts are proportioned so that an initially loose coupling obtains between primary and secondary, resulting in unusual selectivity.

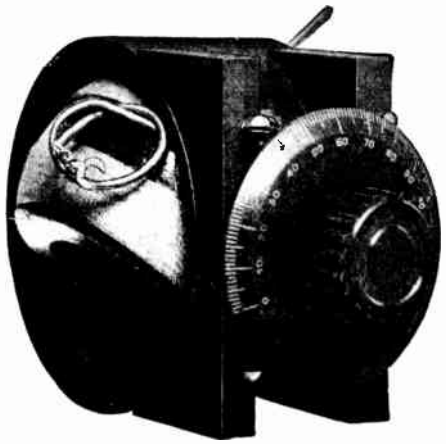
The primary inductance is of such value as to permit reception over the same wave-length range as covered in our Variometer design.

Atwater Kent Vario-Coupler..... **$8.00**



Atwater Kent Mounted Vario-Coupler

Atwater Kent Mounted Vario-Coupler, as shown above **$13.00**



Clapp-Eastham Vario Coupler, Model HRC

Clapp-Eastham Vario-Coupler

The Type HRC vario-coupler is the same in size and general design as the Type HRV variometer shown on page 35, but properly tapped.

Taps are brought out ready for attachment to switch points, to reduce soldering.

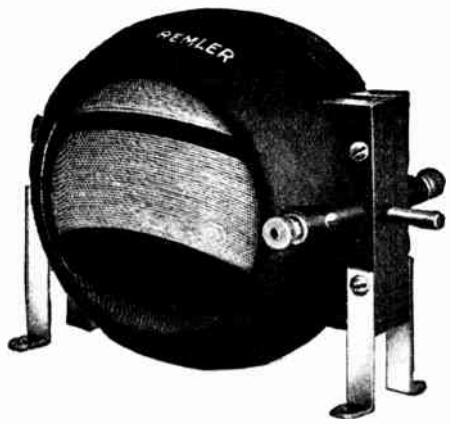
This coupler can be used either for panel or table mounting.

Type HRC Vario-Coupler, complete with knob and dial **$7.50**

Variometers

Remler Molded Variometer No. 500

The Type 500 Variometer is molded entirely of Bakelite, insuring mechanical strength and an accuracy of all dimensions seldom found in the best commercial apparatus. Do not judge this variometer by its price. That is made possible by Remler manufacturing ability and resources. Do not compare this variometer with the many small, cheap types



Remler Variometer No. 500

with which the market is flooded. Note the large dimensions—4" rotor—study the specifications carefully. Your decision must be Remler Variometer and Vario-Coupler for your short wave set.

Specifications

Stator molded in two halves from genuine Bakelite with primary winding molded on the inside, insuring an absolutely rigid winding. Rotor also molded from Bakelite. This all Bakelite molded construction insures accurate mechanical dimensions, strength and precludes the possibility of warping or shrinkage. Large dimensions permit the use of low resistance windings. Maximum stator diameter 5¼ in.; maximum rotor diameter 4 in.; width across stator 3 in.; shaft 3/16 in. diameter. Bearings backed up with spring tension. Wave length range 175-500 meters. Stator drills and tapped for panel mounting. Brackets for table mounting. Polished nickel binding post terminals.

Remler Type 500 Bakelite Molded Variometer..... **$6.50**

Remler Type 501 with No. 100 Bakelite Dial and Knob **7.50**

Remler Panel Mounted Variometer

Remler Type 500 Variometer mounted on polished Bakelite panel 5 in. x 5 in. x 3/16 in. with black hardwood base 5 in. x 3 in. x ⅜ in. Nickeled input

Front View Type 502 Panel Mounted Variometer

and output binding posts at opposite sides of panel. All lettering recessed and white filled. This panel matches Type 505 Vario-Coupler and Type 330 Detector panel permitting ready inter-connection.

Remler Type 502 Panel **$9.75**

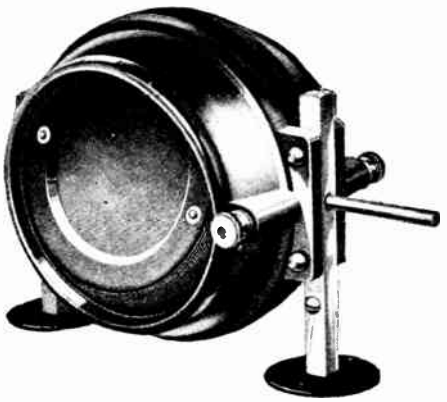
Atwater Kent Variometer

Atwater Kent Variometers and Vario-Couplers have been developed with a view to furnishing radio instruments for use in receiving circuits, which in appearance, quality and efficiency cannot be excelled.

These instruments are manufactured with the same careful attention to detail that has characterized other Atwater Kent products for over 20 years. Manufactured complete in the Atwater Kent plant from molding of the condensite to the final test.

The circular bases of the two instruments are provided for table mounting, but may be easily removed when the instruments are to be mounted on a panel.

Price **$8.00**

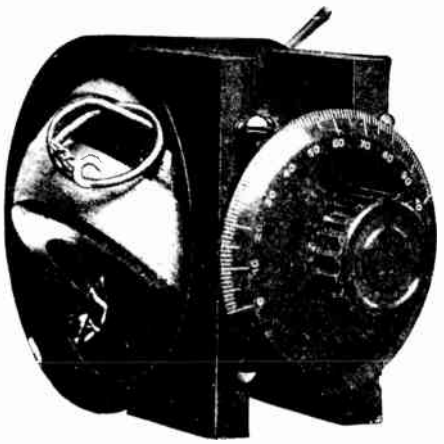


Atwater Kent Variometer

Clapp-Eastham Variometer

In designing this Variometer we have had in mind a unit construction avoiding changes of inductance and misalignment of bearings due to making the outer portion in two parts.

The outer shell is a bakelite tube 4¼ inches in diameter. The inner shell is a moulded ball.



Clapp-Eastham Variometer, Type HRV

The outer winding is made in the form of a section of a sphere and is form wound and supported inside the bakelite tube, while the inner winding is directly on the sphere.

This construction gives very low dielectric losses and, owing to the small clearance between the windings, the range of inductance from maximum to minimum is large for instruments of this type. Maximum inductance is 1.25 millihenry, minimum inductance approximately .1 millihenry.

Type HRV Variometer, size 4¾ inches high, 3¾ inches wide, 6 inches deep **$6.50**

Without Knob or Dial **5.75**

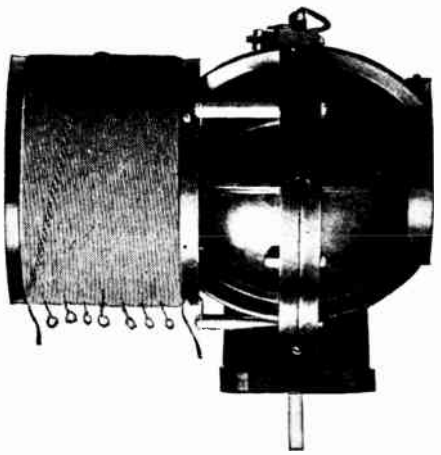
Se-Ar-De Variometer

Se-Ar-De Variometer

This Radiometer is made of genuine molded Bakelite. Wave length range 180 to 580 meters. No friction contact all connections pigtail. Rotor fitted with friction springs and stops. Rotor wound with green silk wire stator of white cotton. Can be furnished for base or panel mounting. Only variometer on the market to which a bank wound inductance can be conveniently attached. Mid tap of stator winding brought out to allow use of single circuit tuner.

Price **$8.00**

Price, with Bank Winding **$13.00**



Variometer with Bank Winding

Tuning Inductances

Frost-Radio Tuning Coil

A standard "two-slide-tuner," having a range of approximately 1000 meters. This double slide tuning coil is 11 inches long, constructed of the best materials, sturdily built, and attractively finished.

The coil is wound with No. 24 green silk magnet wire, on a straight wound seamless tube, which is impregnated in a weatherproof compound. The ends of winding are so fastened as to make it impossible

Frost Tuning Coil

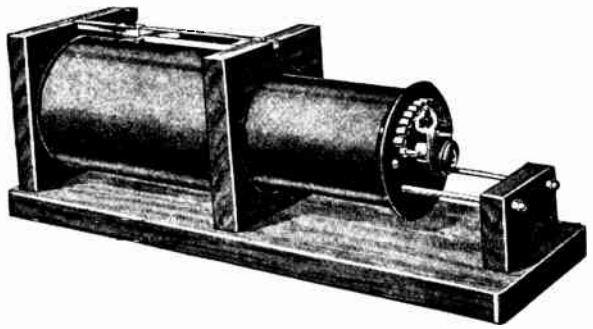
for the winding to become loosened. The slide rods and sliders are the same as used in connection with the receiving transformer. Large, handsome binding posts are used. All metal parts are of brass, and highly polished, nickel plated and buffed.

The coil ends are of birch, with polished mahogany finish. It is a worthy member of the Frost-Radio family, and should prove an extremely popular number, on account of its excellent quality and extremely moderate price.

No. 410—Frost-Radio Tuning Coil.....**$3.00**

Frost-Radio Receiving Transformer

This is a long range loose coupler. On account of its selectivity and accurate tuning it has been possible to secure extraordinary results when installed in connection with detector and two step amplifier. It has a wave length from 200 to 4000 meters.



Frost Receiving Transformer

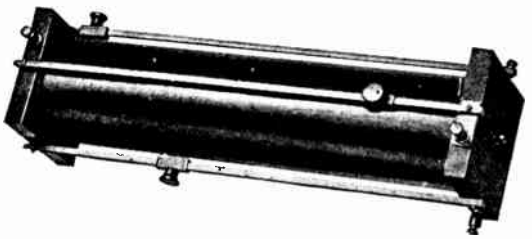
The wood work is birch with mahogany finish. The binding posts, slide rods, and all other metal parts are of brass, highly polished, nickel plated and buffed.

Straight-wound, seamless tubes are used, which are impregnated by immersion in Viscolac, which is a weatherproof finish and has excellent dielectric qualities. Primary and secondary windings are of green silk covered magnet wire. For the secondary coil head a highly polished formica disc is used, four inches in diameter and one-eighth inch thick. The secondary inductance is varied by means of a 12 point switch. The primary is controlled by a slider mounted on ¼ inch brass rod. It operates smoothly and with a minimum amount of wear on wire. The slider is of an improved design and is so selective that it will make contact on a single turn.

No. 400 Frost-Radio Receiving Transformer.....**$8.50**

Signal Three Slide Tuning Coil R-27

The Signal Three Slide Tuning Coil is bare wire wound upon a non-sprinkable tube of 15″ in length. On an ordinary antenna variation of wave length up



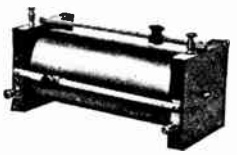
Signal Slide Tuning Coil R-27

to 1,500 meters is secured by means of three slides. The woodwork is of hand-rubbed mahogany finish, the metal parts are of lacquered brass.

No. R-27 Three Slide Tuning Coil.....**$5.20**

Signal Two Slide Tuning Coil

This instrument is well wound with a bare wire winding of No. 24 wire, spaced by machine on a non-



Tuning Coil R-25

shrinkable tube. It will respond to wave lengths of as high as 1,000 meters. Wood parts hand-rubbed mahogany finish. Metal parts are of lacquered brass.

No. R-25, Tuning Coil **$3.10**

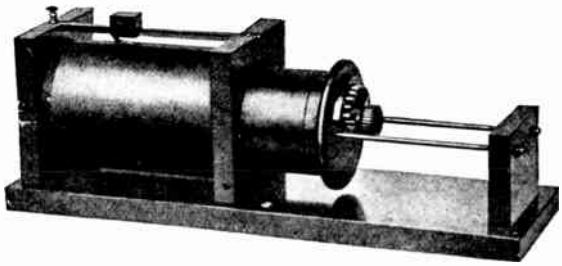
Bank Wound Inductances

Bank wound inductances can be furnished for use with the Se-Ar-De Variometer. The coils are wound inductances and are wound on four inch bakelite tubes with No. 23 DCC wire, 288 turns, four layer with 8 taps.

Price **$4.50**

Signal Arlington Receiving Transformer R-22

The wave length range of the R-22 Receiving Transformer is up to about 3,500 meters when used with the ordinary amateur aerial. The woodwork is finished in dark mahogany. Metal parts are of brass, polished and lacquered. The windings are of silk-covered wire, and are upon specially treated tubes. The primary is No. 22 and the secondary of No. 30. Secondary variation is secured by means of a 12-point switch mounted on a "Formica" plate to avoid any leakage. The primary is controlled by a smooth-working slider.



Signal Arlington Receiving Transformer R-22

R-22, Signal Arlington Receiving Transformer....**$11.40**

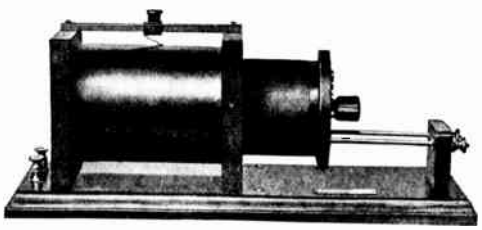
Signal Junior Loose Coupler R-24

The extreme range of this instrument is about 800 meters. Although its price is low, its construction is in no way cheapened. The woodwork is hand-rubbed mahogany finish. The windings are of green silk, wound on treated tubes. Brass parts are polished and lacquered.

Signal Junior Loose Coupler R-24.....**$6.00**

Signal Receiving Transformer R-23

There has always been a steady demand for a receiving transformer of good wave length, strong construction and reasonable price. Our "Signal" No. R-23 Transformer is of unexcelled construction, is finely finished and has a wave length of about 1,800 M. on any average amateur antenna.



Signal Receiving Transformer R-24

Both coils are wound with silk-covered wire upon non-shrinkable tubes. Primary variation is obtained by means of an easy-working slider and the secondary is controlled by an eight-point switch. All metal parts are of lacquered brass.

This instrument makes a fine addition to any station.

No. R-23—Signal Receiving Transformer.....**$8.50**

"Signal" Loading Coil

Many amateurs have small loose couplers of short wave length range. It is their desire to add sufficient wave length to enable them to receive Government time signals. This instrument will add about 800 M. to any loose coupler. The wire is No. 24 bare copper and is on a non-shrinkable tube. Wood parts are mahogany finished and metal parts are of lacquered brass.

Signal Loading Coil R-26

No. R 26, Loading Coil.....**$2.90**

Chelsea Loading Inductance No. 11

The advantages of a loading coil in the antenna are too well known to be enumerated. A feature of great importance, geometrically tapped coil, has been embodied in this instrument. This with the large number of taps permit the very close selection of wave-lengths necessary in tuning to the present day low decrement transmitters. The inductance coil is mounted within the moulded bakelite base, and is adjustable by means of the eleven point switch. Switch points are brass nickel plated with top surface accurately machined after assembly to ensure smooth operation and low contract resistance. Knob of molded bakelite, and specially fitted with lever to the center shaft to prevent any possibility of loosening. The results obtainable together with

its handsome appearance makes this instrument a big asset to any radio station. Fill up the gap in your receiving wavelength range, and hear the many

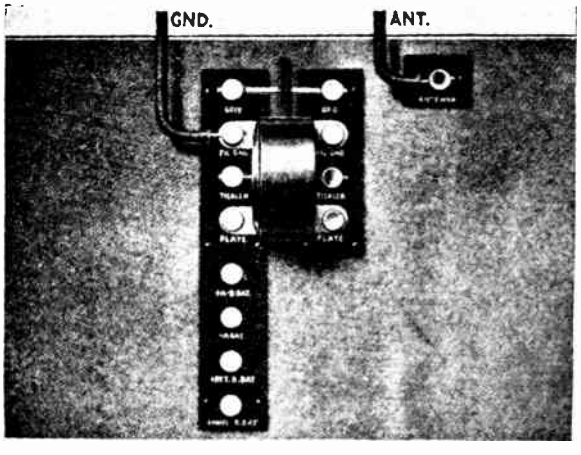
Chelsea Loading Inductance

Navy broadcasts and time signals. Range with normal antenna 3500 meters. Shipping weight, ½ lb. Size, 3½ x 3½ x 1¼.

Price $3.50

Load Coil Model CB (1800-2800 Meters) for Use with RC Receiver or RA and DA Combination

By using this coil in conjunction with the RC receiver or the RA tuner, and DA amplifier previously described, it is possible to receive signals on wave lengths up to 2800 meters. This is particularly valuable as it enables one to hear the time signals from the United States Navy Station at Radio, Va., for distances of several hundred miles. Watch repair shops and jewelers will find this twice-a-day



Load Coil Model CB

service from the United States Observatory in Washington invaluable for checking watches and clocks as the time may be received with less than one-tenth of a second error. Dealers throughout the country are availing themselves of this service, some going so far as to arrange small time balls for their windows by which passers-by are given an opportunity to check their watches.

For wave-lengths between 170 and 700 meters the switch arm shown in the center of the picture should be raised. For wave lengths between 1800 and 2800 meters it is but necessary to push down on this arm. The CB Load Coil is arranged to supply the necessary inductance for both the antenna and tickler circuits.

Caution: It is essential that the ground wire (G and D) be connected exactly as shown in the accompanying illustration.

Load Coil, Model CB, 1800-2800 Meters $6.00

Dimensions: 6 in. x 4 in. x 5 in.

Weights: Net, 8 oz.; Shipping, 2 lbs.

Wireless Specialty Receiver Load Coils

We offer a high-grade, compact and efficient load coil in three different values, namely, 30, 50 and 100 millihenries. These coils consist of two bakelite-dilecto side pieces, between which is mounted a highly efficient wave-wound coil of high frequency cable. The electrostatic capacity of the coil is extremely low. The side pieces are finished square, forming a base for the coil. Close coupling between two or more load coils is possible, as their rear surfaces are flush and close to the plane of the coil.

The coils are ideal units for loading the receivers listed in this catalogue, and in fact any type, to long wave lengths, as they are efficient and permit easy and very wide variation of coupling. A pair of these coils, used in conjunction with two variable air condensers of the type shown on page 67, constitute a receiver. Their values are constant and they may be used as standards and for general experimental purposes.

Load Coil—30 Millihenries; dimensions, 1 in. x 5½ in. x 5¾ in. $10.00

Load Coil—50 Millihenries; dimensions, 1 in. x 5½ in. x 5¾ in. 15.50

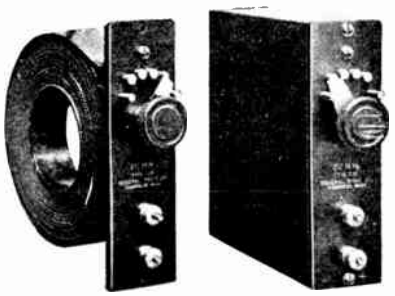
Load Coil—100 Millihenries; dimensions, 1 in. x 5½ in. x 5¾ in. 21.50

Shipping Weight: 2 lbs.

Type 226—Four Step Inductor

General Radio Co. has designed a set of four coils, each with four taps which are particularly adapted for use in radio receiving sets. Although built with four different values of inductance they have the same physical dimensions thus permitting two or more circuits to be coupled together. By working at the extreme limits of each coil it would be possible to cover the range referred to above with three sizes instead of four. The four sizes, however, give a much greater flexibility than do three.

The coils are approximately of Maxwellian shape. The winding is such as to keep the distributed capacitance a minimum. This is a particularly important feature in that it increases the range over which any one coil may be used and what is more important,



G. R. Four-Step Inductances

it increases the efficiency of the coil by keeping the dielectric losses a minimum. These coils are rugged in construction and attractive in appearance. The case is of polished oak with engraved bakelite panel. The metal parts are finished in polished nickel.

One very distinctive feature about these coils is that they are self-supporting and, accordingly, do not require any auxiliary mounting. Coupling between coils is varied by simply changing the distance between coils or by turning through any desired angle. The arrangement of taps is such as to give values of approximately 20, 45, 75 and 100 per cent of the maximum inductance.

These coils are adapted for general laboratory use as well as for radio receiving sets. It is seldom necessary to use a complete set of twelve coils to cover all ranges from 150 to above 20,000 meters. A satisfactory arrangement for this range is the following selection:

3 A Coils, 3 C Coils and 3 D Coils.

The ranges covered by these coils when used with one of their type 247 Condensers, which has a maximum capacitance of 1000 micromicrofards, are shown in the following table:

Type.	Max. Ind.	Resistance	Approx. Range	Price
226A	0.3 M.H.	0.8 Ohm	140- 1000 meters...	**$6.00**
226B	3.0 M.H.	0.9 Ohm	400- 3000 meters...	**6.00**
226C	20.0 M.H.	2.5 Ohms	1100- 8000 meters...	**6.00**
226D	125.0 M.H.	30.0 Ohms	3000-24000 meters...	**6.00**

Dimensions 5″ x 6″ x 1½″. Weight 2½ lbs.

Remler QSA-850 Inductance Coil Unit

This unit consists of an 850 turn coil mounted on a standard plug, with four tops and a rotary lever switch. Work length range, 1.000-15.000 meters.

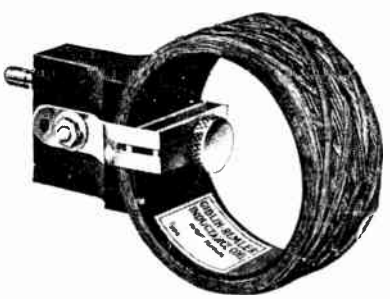
QSA-850 Coil **$6.00**

Inductances

Giblin-Remler Inductance Coils

Made by an entirely new process, Giblin-Remler Inductance Coils are infinitely more effective in operation and superior in workmanship to any coil on the market today. Its performance for concentrated inductance cannot be approached. It is equally efficient on all wave lengths. The self capacity of the

Giblin-Remler G. R. 1000 Coil



Giblin-Remler G. R. 100 Coil

new Giblin-Remler Inductance is 100 per cent less than any previous compact inductance—this low self capacity gives selectivity and sharp tuning for a given coil. This is especially advantageous to the amateur who usually has an antenna of low capacity. The high frequency resistance is lower than any previous type.

Giblin-Remler inductance coils are patentable—they are manufactured by patented machinery.

Characteristics and Prices of Giblin-Remler Coils

Type and Number of Turns, Mounted	Price, Mounted	Type and Number of Turns, Unmounted	Price, Unmounted	Inductance in Milli-henrys at 1000 cycles Accuracy ½%.	Natural Wave Length in Meters, Accuracy ½%.	Distributed Capacity in micro-micro-farads, Accuracy 1%.	Wave Length Range in Meters using Condenser of .001 max. and .00004 mfd. min. Minimum	Maximum	High Frequency Resistance in Ohms at Wave Length Shown 200	500	1000	2000
RG 20M	$1.50	RG 20U	$.70	.030	39	14.3	63	334	.....	1.1	.....	.....
RG 25M	1.50	RG 25U	.70	.041	47	15.2	75	389	.....	1.5	.....	.....
RG 35M	1.50	RG 35U	.70	.083	87	25.4	128	550	.....	3.5	.....	.....
RG 50M	1.60	RG 50U	.80	.169	114	21.6	185	785	.....	8.8	4.4	.....
RG 75M	1.65	RG 75U	.85	.377	163	19.8	266	1170	.....	28.3	12.1	6.2
RG 100M	1.70	RG 100U	.90	.666	217	19.9	358	1550	.....	80.3	26.8	12.6
									1000	2000	5000	10000
RG 150M	1.75	RG 150U	.95	1.503	281	14.8	512	2320	69.8	23.8	7.1	.....
RG 200M	1.80	RG 200U	1.00	2.68	374	14.7	690	3110	.....	50.6	12.5	.....
RG 250M	1.90	RG 250U	1.10	4.20	424	12.1	860	3880	.....	87.5	19.9	.....
RG 300M	2.00	RG 300U	1.20	6.11	494	11.2	1030	4680	.....	141	29.3	13.8
RG 400M	2.10	RG 400U	1.30	11.04	618	9.7	1380	6300	.....	.....	54.6	22.3
RG 500M	2.30	RG 500U	1.50	17.50	747	9.0	1730	7900	.....	.....	93.1	34.9
									2000	5000	10000	20000
RG 600M	2.40	RG 600U	1.60	29.2	1024	10.1	2260	10250	.....	111	43.8	.....
RG 750M	2.65	RG 750U	1.85	39.0	1249	11.3	2660	11850	.....	.....	64	.....
RG1000M	3.40	RG1000U	2.50	71.6	1620	10.3	3570	16000	.....	.....	123	.....
RG1250M	3.80	RG1250U	2.90	108.0	1930	9.7	4380	19700	.....	.....	.....	.....
RG1500M	4.40	RG1500U	3.50	159.8	2300	9.3	5300	23800	.....	.....	.....	.....

These tests have been made by Robert F. Field, of Cruft High Tension Electrical Laboratory, Harvard University, Cambridge, Mass.

Duo-Lateral Coils

Pacent Duo-Lateral Coils

The external similarity between duo-lateral coils and other concentrated inductances has led to some confusion on the part of users. Upon close examination the experienced radio man can immediately identify the characteristic staggered winding of the duo-lateral coil, which leaves the windings closed instead of open; but to the layman this difference is not so evident and therefore, all duo-lateral coils are now plainly marked "duo-lateral" as shown in the illustration.

Prices

US25	$0.50	US300	$1.05
US35	.55	US400	1.20
US50	.60	US500	1.40
US75	.60	US600	1.55
US100	.65	US750	1.80
US150	.75	US1000	2.20
US200	.80	US1250	2.70
US249	.95	US1500	3.20

Useful Data on Pacent Duo-Lateral Coils Wound with Solid Conductors.

C = Capacity in Micro-Microfarads
L = Inductance in Milli-Henrys
λ = Wave Length in Meters

$L = \lambda^2/3553C$ $\quad$ $C = \lambda^2/3553L$

Cat. No. of Unmounted Coil Only	Size of Cond. B. & S.	No. of Turns	D. C. Resistance Ohms	Inductance at 800 cyc. Milli-Henrys	Natural Wave Length Meters	Distributed Capacity Mi.-Mi. Farads	Outside of Coil Inches
US25	24	25	0.42	0.039	65	30	2 3/16
US35	24	35	0.50	0.0717	92	33	2 1/4
US50	24	50	0.88	0.149	128	31	2 3/16
US75	24	75	1.24	0.325	172	26	2 3/8
US100	24	100	1.68	0.555	218	24	2 1/2
US150	24	150	2.56	1.30	282	17	2 5/8
US200	25	200	4.44	2.31	358	16	2 1/2
US249	25	249	5.65	3.67	442	15	2 15/16
US300	25	300	7.11	5.35	535	17	3
US400	25	400	10.7	9.62	656	13	3 1/4
US500	25	500	12.4	15.5	836	13	3 1/2
US600	28	600	27.8	21.6	1045	14	3 1/8
US750	28	750	35.3	34.2	1300	14	3 5/16
US1000	28	1000	50.2	61.0	1700	13	3 3/4
US1250	28	1250	66.9	102.5	2010	11	4 1/16
US1500	28	1500	88.4	155.0	2710	13	4 7/16

Coto-Coil Honeycomb Wound Inductances

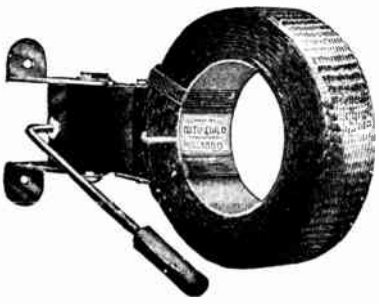
To those interested in experimental radio circuits or in constructing a receiving set the honeycomb coil makes instant appeal. These very popular low priced machine wound inductance units satisfy the need of the amateur and experimenter for a concentrated inductance of low cost and relatively high efficiency. These coils are compact, and permit of easy manipulation. They cover the entire range of wave lengths, without the dead-end losses that exist when a tapped coil is used and have low high frequency resistance and distributed capacity losses. Careful tests show that these coils have not yet met their superior.

Coto-Coil Inductance

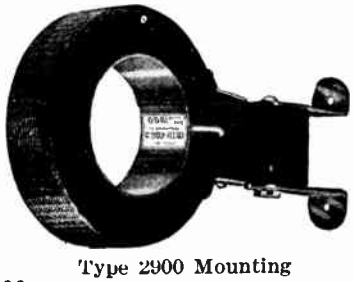
The construction of the coil is such that successive turns of conductor are wound at an angle to preceding turns and spaced therefrom, which gives the coil the cellular structure, from which it derives its name. These air cells and the angular disposition of the turns reduces the losses in the coil to a marked degree. Our standard sizes of these coils have been selected so that with the proper condensers they will cover the entire range of wavelengths. One of these coils is shown above.

Characteristics and Prices of Coto-Coil Honeycomb Wound Inductances

Turns	Pure Inductance in mh.	Distributed Capacity m.m.f.	Natural Wave Length Meters	Wave Length with .0001 mf. Shunt Capacity Meters	Wave Length with .001 mf. Shunt Capacity Meters	Price Unmounted	Price Mounted
25	.03781	26.80	60.0	133	370	$ .50	1.15
35	.07810	30.82	92.5	192	532	.50	1.15
50	.1519	36.38	140.0	278	748	.55	1.20
75	.3160	28.55	179.	386	1062	.60	1.25
100	.5614	35.98	268.	527	1438	.65	1.30
150	1.2915	21.18	312.	771	2160	.70	1.35
200	2.219	18.80	385.	1004	2838	.80	1.45
250	3.450	22.76	528.	1272	3570	.85	1.50
300	6.792	18.72	672.	1739	5015	.85	1.60
400	9.00	17.21	742.	1990	5720	1.15	1.80
500	14.45	17.20	940.	2515	7220	1.30	1.95
600	24.18	19.10	1280.	3300	9380	1.45	2.10
750	32.31	18.19	1445.	3805	10880	1.60	2.25
1000	60.50	16.65	1700.	5200	14600	1.90	2.60
1250	96.18	15.41	2295.	6590	18730	2.20	2.90
1500	143.00	15.70	2825.	8040	22860	2.50	3.00



Type 2901 Mounting



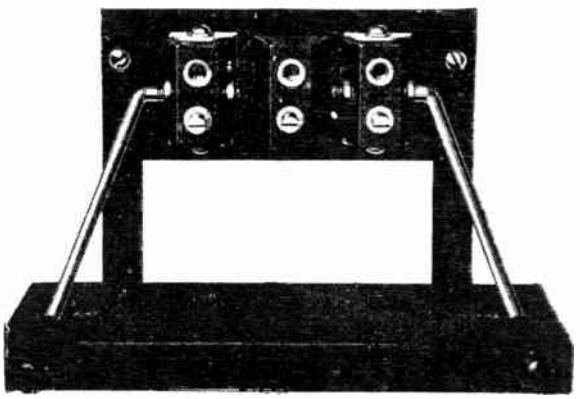
Type 2900 Mounting

Type 2900—Fixed Panel Mounting Bracket.....$1.00
Type 2901A — Trunnion Mounting Bracket, Right Hand 1.25
Type 2901L—Trunnion Mounting Bracket, Left Hand 1.25

Mountings

Remler No. 400 Three Coil Mounting

Number 400 is without doubt the most efficient and low priced standard coil mounting on the market. One stationary and two variable bakelite coil plugs are mounted on a bakelite panel 1⅞ in. x 4½ in. This panel is supported by two black enameled



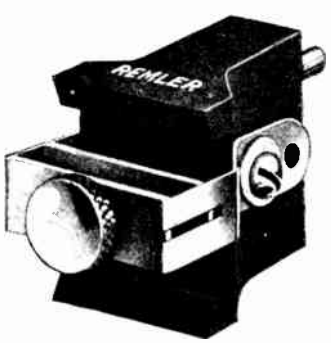
Remler No. 400 Mounting

brass rods 3¼ in. high mounted on a black wooden base 6⅜ in. x 3¼ in. x ⅝ in. Two holes with metal bushings are provided for table mounting. The coil terminals are connected direct (without flexible leads) to six No. 85 polished nickel binding posts at the back of the panel. The variable plugs are fitted with extension handles 5¼ in. in length for varying the coupling. This method keeps the operator's hand far enough from the coils to prevent any body capacity effect. The coupling plug brackets have sufficient spring tension to insure permanency of the coupling position.

Remler No. 400—3 Coil Mounting $7.50

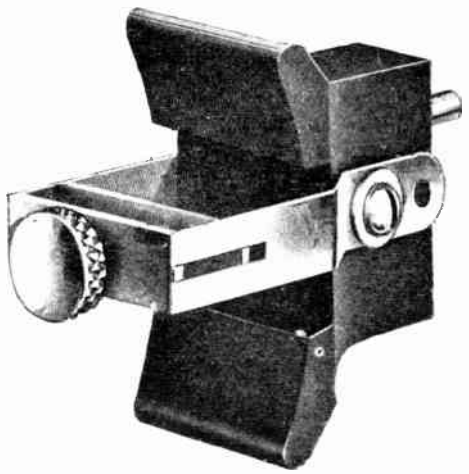
Remler Coil Mountings No. 48 and 49

This new Remler coil mounting with its improved and original features is built especially for the new Giblin-Remler coils. The plug can be used interchangeably with all Remler coil and panel type plugs.



Remler Coil Mounting No. 48

The metal tightening band—an important Remler feature—eliminates the annoying fibre band and assures perfect tightness at all times. By simply



Remler Coil Mounting No. 49

turning the thumb screw the coil is rigidly fastened to the coil contour of the bakelite plug. There is no fibre band to become damp and stretch or to loosen the coil from its mounting.

Built complete by Remler, every operation is checked to insure a smooth working, simple operated plug—a plug with a Remler guarantee.

No. 48—20 to 750 Turn Coils ..... .60

No. 49—1000 to 1500 Turn Coils ..... .75

Remler No. 40 Bakelite Coil Plug

Remler No. 40 Bakelite Coil Plug

Provided with two N. P. metal clamps and screws for securing fiberoid straps. Terminals are of brass and extend through the plugs for making soldered contact to coil leads.

Price $0.60

Remler No. 42 Bakelite Panel Plug

The brass terminals are tapped and provided with

Remler No. 42 Panel Plug

two nickel plated screws to serve both for mounting and terminals.

Price $0.60

Remler No. 46 Bakelite Coupling Plug

Same as No. 43 but provided with No. 85 polished nickel binding posts instead of hexagon nuts. Drill-

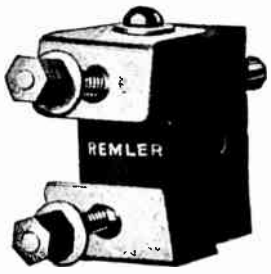
Remler No. 46 Coupling Plug

ing centers ¾ inch. Cross drilled for No. 44 extension handle.

Price $1.00

Remler No. 43 Bakelite Coupling Plug

Used whenever a variable coupling is desired. Brackets are spring brass nickel plated, studs and

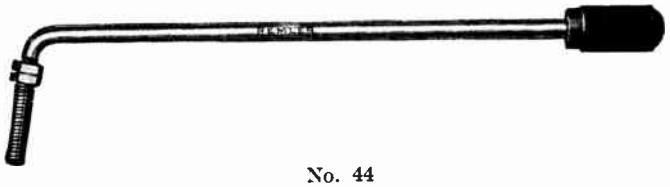


Remler No. 43 Coupling Plug

hexagon nuts provided for mounting and terminals. Drilling centers ¾ inch. Cross drilled for No. 44 extension handle.

Price $0.90

Remler Extension Handle



No. 44

Remler Extension Handle No. 44, for use with Remler Mounting Panel $0.30

Dr. Steinmetz, who is an authority on high power electrical phenomena, was asked the following question during his visit to the Radio Congress. His reply to the inquiry follows.

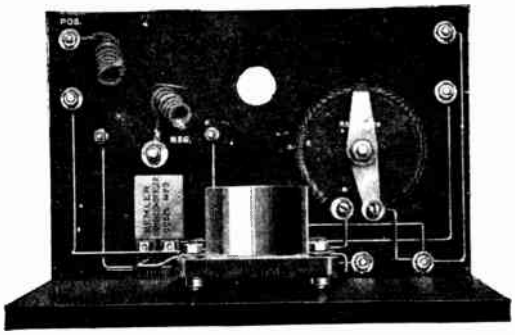
Question: Dr. Steinmetz, many of us have amateur radio receiving sets in our homes. We have heard rumors that the Underwriters consider that there is a fire hazard because of the antenna and the ground connections and that certain restrictions may be placed on amateur installations. We would like to have your opinion as to the real hazard involved.

Answer: There is no hazard in the amateur radio receiving station. It involves no fire risk nor risk to life. It is merely a harmless toy, but is a great deal more than a toy. It is one of the most valuable developments of the last years, by its instructive and educational value and the recreation and pleasure which it supplies. It would, therefore, be very regrettable if by a misguided public opinion obstructions were placed in the way of the fullest and freest developments of the amateur radio station. With regard to the possible lightning risk from the grounded antenna, first—the lightning risk in a city is very remote in any case and, second—the grounded antenna rather acts like a lightning rod and exercises a protective action against lightning. Any danger from the radio power received by the amateur station obviously is ridiculous when considering that the energy of a single pound of coal would be more than enough to operate the radio receiving station continuously for over a thousand years. Certainly this is not enough energy to do harm.

Detector and Amplifying Units

Remler Type 330 Detector Panel with A-Battery Potentiometer Plate Voltage Control

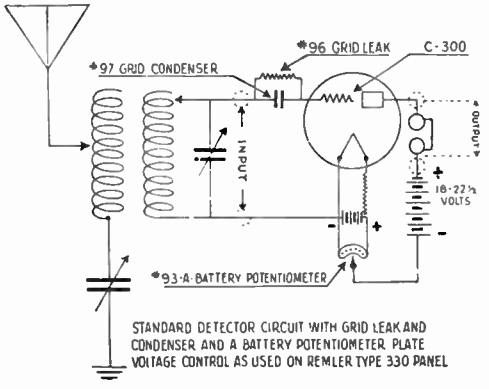
The vacuum tube detector and amplifier is unquestionably a necessity in every up-to-date amateur station. For long distance work and CW reception the vacuum tube is essential. Two batteries-filament and plate are required for vacuum tube operation. A detector tube, due to its operating characteristics, is critical in adjustment; that is, both the A and B batteries must be carefully adjusted for maximum sensitiveness. Therefore, the efficient detector panel should provide for proper control of the plate voltage as well as filament current. Success in tube operation depends largely on the control apparatus. Loose connections, long leads, improper controls, are defects



Back View Type 330 Detector Panel

that are too often responsible for uncertain and inefficient results. Remler Type 330 Panel Control is designed to eliminate these defects and to provide a suitable mounting for the standard four-prong base tubes, especially the new gas content detector such as Cunningham Type C 300.

Remler resources have been devoted to making this type 300 panel control with its exclusive features the greatest value ever offered. It is truly a quality ar-



STANDARD DETECTOR CIRCUIT WITH GRID LEAK AND CONDENSER AND A BATTERY POTENTIOMETER PLATE VOLTAGE CONTROL AS USED ON REMLER TYPE 330 PANEL

ticle at a quantity production price. Study the following specifications carefully, compare with every other panel on the market. Remler is confident of your decision.

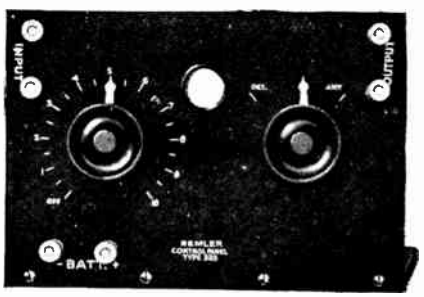
The panel of genuine molded bakelite is 5" x 7¼" x 3/16". The surface is highly polished glossy black, and the lettering and scales are recessed and filled with white enamel. The filament current is controlled by Remler No. 810 Rheostat back mounted and is provided with an open position. Remler No. 93 Potentiometer connected across the storage battery provides the close adjustment of plate potential necessary for sensitive detector action. Terminals at the back of the panel are provided with flexible leads for the B Battery connection. The rheostat and potentiometer knobs are polished bakelite 1⅜" diameter. The grid leak is variable and grid condensor back mounted is the correct capacity for the new gas content detector tubes. Remler No. 92 V. T. Socket is used and supports the tube vertically, insuring maximum filament life. Its all bakelite construction tends to eliminate induction and ground hums. An orifice in the panel permits a view of the filament. Binding posts and all metal parts are finished in polished nickel. The panel is mounted on a hardwood base 7¼" x 3½" finished in black, but can readily be mounted in a cabinet. The wiring is the approved bus bar type, and is laid out so that the input and output terminals are at opposite sides. Two or more panels can therefore be mounted in a line to form any detector-amplifier combination.

Remler Type 330 Detector Panel **$8.50**

Shipping weight, 2 lbs.

Remler Type 333 Amplifier Panel with Rotary Cam Switch

For long distance DX work, clear reception of radio telephone music and news, and the operation of loud speaking telephones amplification is essential. Rem-

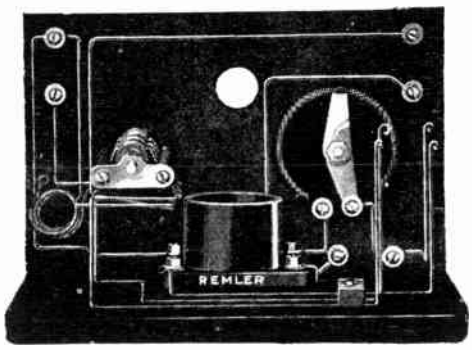


Front View Type 333 Amplifier Panel

ler amplifier panels have been designed to provide an efficient and economical control for the latter, C-300 or the UV-200 and UV-201 and C-301 Cunningham Tubes.

An exclusive feature of the Remler Type 333 Panel is the use of the Remler Rotary cam switch, which does the work of two jacks and plug and has the advantage of a self-cleaning, wiping contact and almost zero capacity. The phones are always permanently connected to the output binding posts of the last amplifier panel.

With the phones attached to the output terminal of the amplifier and the cam switch in the detector position, the phones are actually connected to the detector panel and the amplifier is disconnected. In throwing to the amplifier position the proper connections are made between the detector and amplifier panels and the phone connection is simultaneously transferred from the detector to the amplifier.



Back View Type 333 Amplifier Panel

Call D the detector panel and A, B, C the first, second and third panels in a three step amplifier and detector. The phones are permanently connected to the output of panel C. Turn all cam switches to the detector positions and the phones will then be connected direct to the detector, permitting that tube to be adjusted. Turn switch on panel A to amplifier position and one step of amplification is added. Turn switch on panel B to amplifier position for two steps, etc. By using the Remler cam switch the amplification of each tube in a two or three step amplifier can be compared. Turn switches on panels A and B to detector and on panel C to amplifier. The result is a one step amplifier consisting of panels D and C. Turn switches on panels A and C to detector position and on panel B to amplifier, and the result is a one step amplifier consisting of panels D and B.

Specifications

Types 331 and 333 Panels are of molded Bakelite, the same size (7¼" x 5" x 3/16") and general appearance as the Type 330 Detector Panel. Input and output binding posts are at opposite sides, permitting

Front View Type 331 Amplifier Panel

ready inter-connection of any desired number of panels by simply bridging each adjacent set of output and input binding posts. All lettering is recessed and white filled, and the face of the panel is highly polished glossy black. Remler No. 810 rheostat controls the filament. No plate battery control is necessary. When using Cunningham C-301 Pliotron type amplifier tube, and plate voltage from 40 to 100 can be used. No. 92 VT Socket provides vertical tube support, and its all Bakelite construction tends to eliminate induction and ground hums. An orifice in the panel permits a view of the filament. Binding posts and all metal parts are finished in polished nickel. The panel is mounted on a black hardwood base 7¼" x 3½" x ⅜". All wiring is of Bus-Bar type. Formed terminals are provided with ample space for mounting the transformers on the panel base.

Remler Amplifier Panels are listed without transformer to permit the purchaser to select his own type.

Type 333 Amplifier Panel (less transformer)..... **$9.00**

Shipping weight, 2 lbs.

Remler Type 331 Amplifier Panel

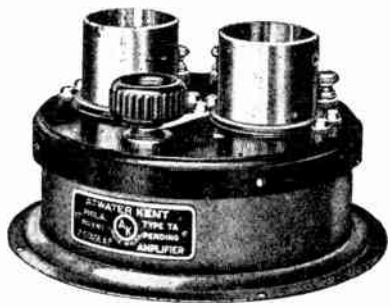
This panel is of exactly the same size and construction as Type 333, except that the No. 60 Cam Switch is omitted.

Remler Type 331 Amplifier Panel (less transformer) **$6.00**

Shipping weight, 2 lbs.

Atwater Kent Type TA Two Step Amplifier

The Atwater Kent two-stage amplifier is without doubt one of the best amplifier units on the market. The outstanding advantages of this instrument are: excellence of reproduction; amplification regulation by small steps; a complete instrument in itself; com-



Type TA Two-Step Amplifier

pactness; regulation entirely by knob; transformers protected by steel housing; short wiring connections eliminate capacity effect; hermetically sealed; absolutely no moisture troubles. The low price is made possible as a result of long experience in quantity manufacture of scientific electrical instruments.

Type TA Two Step Amplifier..... **$16.00**

Atwater Kent Detector Amplifier, Type DA

The Atwater Kent detector amplifier type DA is similar in appearance to Type TA. It is a detector and one step amplifier unit.

Type DA Detector Amplifier, less Tubes..... **$16.00**

Y-1 Detector and Y-2 Amplifier

The Detector contains a tube socket, condenser, grid leak, A battery potentiometer and filament rheostat all mounted on an engraved bakelite panel with binding posts marked so that external connections may easily be made. An attractive mahogany box incloses the condenser, grid leak, rheostat and connections, leaving the nickel plated portion of the tube socket, nickel plated binding posts and engraved panel exposed. The rheostat handle projects on the front of the box and is supplied with a pointer under which is a nickel plated dial divided into degrees.

The A battery potentiometer handle is beside the rheostat handle. This potentiometer is so connected that the B battery voltage may be varied—an operation so essential in detector tubes.

The amplifier contains a tube socket, Acme A-2 Amplifying Transformer and filament rheostat all mounted on an engraved bakelite panel with binding posts marked Input, Output, A and B batteries. The same style and size of mounting is used as with the Detector, and both instruments are ready for use by inserting a tube and connecting the necessary external apparatus.

Those purchasing only a Detector can later obtain a single stage amplifier which when placed beside the detector has its binding posts so located that connections are an easy matter between the detector output and amplifier input and between the two A and B battery binding posts, thus producing a compact detector and single stage amplifier with separate filament control, same A and B batteries, a minimum of connecting wires, and harmony of attractive apparatus. By the addition of another single stage amplifier a detector and two stage amplifier is obtained with the same ease of connection and attractive appearance. If desired, a two stage amplifier can be made with two single stage units and connected direct to any detector already on hand.

Y-1 Detector

Under all conditions the wires used in connecting the various parts of either a single or two stage amplifier with or without detector are reduced to a minimum, a feature so essential to prevent howling and inductive disturbances when amplification is employed.

Y-1 Detector (without tube) **$10.00**

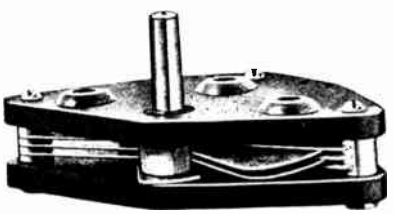
Y-2 Amplifier (without tube) **13.00**

Condensers — Variable

Chelsea Variable Air Condensers

Chelsea variable air condensers are excellent examples of modern methods of mechanical and electrical construction. The two sets of plates, the stationary and the movable, are each die-cast into one solid unit which gives positive assurance of accurate spacing, alignment, and connection of all plates. The top and bottom, as well as the end plates in the unmounted types are of molded bakelite. Integral with these parts are two bronze bearings of sufficient length and bearing area to prevent all side lash and end thrust of the rotor element. The steel shaft which is cast as a part of the rotor is equipped with an end thrust shoulder on the bottom, and with special milling on the top to lock both pointer and knob in position. Other features of merit are large scale reading in hundredths, higher capacity than usual, friction adjustment on the movable plate and ample separation between plates.

Chelsea No. 1



Chelsea Type 6A

The selection of materials and design give assurance of low energy loss and high efficiency, the methods of construction and careful workmanship of long life and good performance.

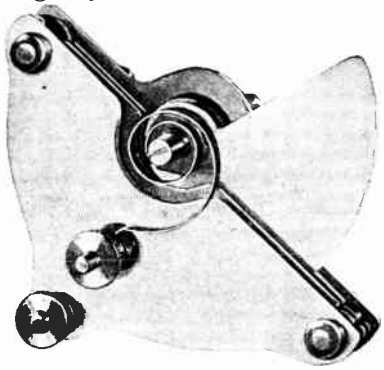
The Nos. 6 and 6a are commonly known as Vernier condensers, and are an auxiliary means of tuning only.

Chelsea No. 3

No. 1—.0011 m.f. Mounted; 4⅝ x 4⅝ x 3¼; 1¾ lbs. $5.00
No. 2—.0006 m.f. Mounted; 4⅝ x 4⅝ x 2⅜; 1¼ lbs. 4.50
No. 3—.0011 m.f. Unmounted with dial; 4¼ x 3 x 4; 2 lb. 4.75
No. 3A—.0011 m.f. Unmounted without dial; 4¼ x 3 x 4; 2 lbs. 4.35
No. 4—.0006 m.f. Unmounted with dial; 4¼ x 3 x 3½; 1¼ lbs. 4.25
No. 4A—.0006 m.f. Unmounted without dial, 4¼ x 3 x 3½; 1¼ lbs. 3.85
No. 5 .00025 m.f., with dial, 4½x3x3, 1 lb. $3.75
No. 5a .00025 m.f., without dial, 4½x3x3, 1 lb. 3.35
No. 6 .00008 m.f., with dial, 4½x3x2½, ¾ lb. 2.90
No. 6a .00008 m.f., without dial, 4½x3x2½, ¾ lb. 2.50
No. 7—Vernier Condenser, Mounted, .00118 m.f. combination of No. 1 .0011 m.f. and No. 5 .00008 m.f. 6.75
No. 8—Vernier Condenser, Unmounted, .00118 m.f. combination of No. 3 and No. 5 with dial and Vernier Knob 6.50

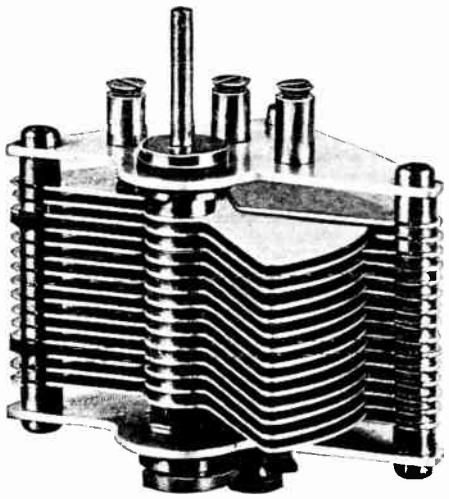
The Na-Ald Condenser

The Na-ald Condenser is designed for the most discriminating buyer. Made in 3 plate, 13 plate, 23



NA—Ald 3 Plate

plate, and 43 plate sizes, it is particularly adapted to the Reinartz circuit. The plates are of the shape laid down by the Bureau of Standards and spaced in machine cut grooves in slotted posts, which prevents the accumulative error noticed in condensers using space washers. Made of Duraluminum (the Signal Corps Specifications), they are extremely strong, springy, not easily bent, although light. The pig-tail connection is another outstanding feature. When spring connections and bearings are depended upon for contact, looseness and metallic oxide often cause poor connections with their attendant annoyances. The convenient binding posts and the location of the machine screw so that the dial covers it,



NA—Ald 43 Plate

should also receive attention. The capacity increases uniformly as the condenser is rotated, whereas, the ordinary condenser increases abruptly when the movable plates begin to enter the fixed.

3 Plate with Dial, .00008 m.f. $2.50
13 Plate with Dial, .0003 m.f. 3.50
23 Plate with Dial, .0006 m.f. 4.00
43 Plate, .0012 m.f., with Dial 5.00

General Radio Variable Air Condenser Type 247

The General Radio Co. have designed a condenser of unusual merit and at the same time have been able to keep the cost remarkably low. In addition to the regular degree graduation of the etched metal dial,

GR Type 247 Mounted

GR Type 247 Unmounted

this dial has marked on it a scale showing capacities in micromicrofarads. This scale enables the operator to know at all times just what capacity he is using. In order that the plate resistance may be kept constant and that the capacity will always remain the

same, the plates of each unit are soldered together. The plates are of heavy sheet brass adequately spaced. A special spring bearing is used to insure good contact being made with the rotary plates. The low zero capacity is approximately 20 micromicrofarads, the maximum capacity is 1000 micromicrofarads. The condenser is mounted in a metal case finished in a black crystalline finish. This case is grounded to the rotary plates, thus shielding the condenser and eliminating many of the disturbing effects due to bringing the hand near the condenser.

G. R. Variable Condenser Type 247-A, complete-mounted, size 4½d x 3½"; weight 1¾ lbs..... **$6.00**

G. R. Variable Condenser Type 247-B, unmounted, without case, panel, knob, dial or binding posts, but with counterweight, suitable for back of panel mounting, size 3¾" x 3¾" x 3½"; weight 1 lb..... **3.75**

Knob and Dial, without capacity graduations, for use with Type 247-B Condenser..... **.50**

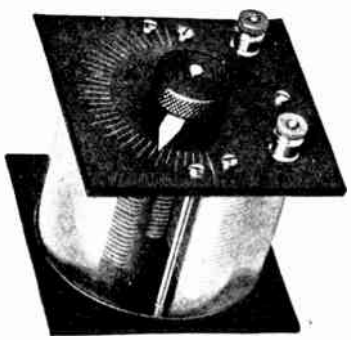
247E Mounted, Condenser, .0005 m.f. **$5.50**

247F Unmounted, Condenser, .0005 m.f. **3.25**

"Signal" Variable Condenser

The rotary variable condenser is a necessity for all experimental wireless work and one or two of them are to be found in almost any wireless station. The two most popular types are the 43 plate and 21

The two most popular types are the 43 plate and 21 plate with capacities of .001 mfd. and .0005 mfd., respectively. The large size has 21 rotary aluminum plates and 22 stationary aluminum plates. The small size has 10 rotary and 11 stationary plates.



Signal R-34

The "Signal" Rotary Variable Condenser has two genuine "Formica" ends, a clear glass case, a ¼" shaft and plates .026" thick of a special grade of aluminum. However, the biggest feature in favor of our condenser is the form of end-piece used. It is square, facing the operator. It is not necessary to look over one's hand to see the scale, as was the case in the old upright type of condenser. The scales on these instruments are calibrated to 2 degrees.

We recommend the 43 plate condenser for primary and secondary tuning on sets of fair range and for use in oscillating circuits. The 21 plate condenser is well adapted to short wave tuning for use in small wave meters and a great variety of work calling for a small variable capacity.

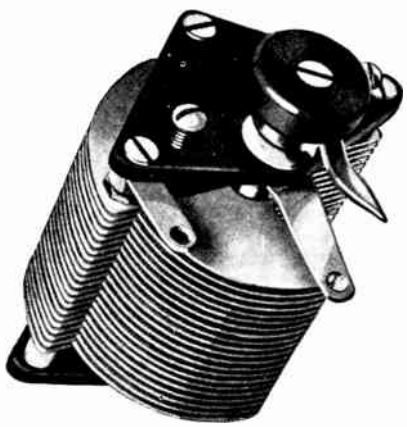
Do not be fooled by an instrument that is "just as good." These are, to date, the best condensers on the amateur market.

No. R-35—21 plate—.0005 mfd. **$4.00**

No. R-34—43 plate—.001 mfd. **5.00**

Back Mounted Variable Condenser

The constant demand for a condenser for panel mounting has caused us to manufacture these three models. These condensers have eactly the same construction, with minor modifications, as our R-34 and R-35 Variable Condensers. They are so constructed as to permit mounting on any panel from ⅛" to ⅜" in thickness. Two machine screws are furnished for fastening the instrument to the panel, so it is only necessary to drill three holes to place them. Each instrument is furnished with a metal scale calibrated to 180°. The knob and the pointer



Signal Back Mounted R-76

are removable by means of a single flat head machine screw. It will be noticed that the construction is very rigid.

We wish to call attention to the fact that the material used in our plates is aluminum .026" thick. The bearing plates are 3/16" black Formica. Two connection strips are furnished.

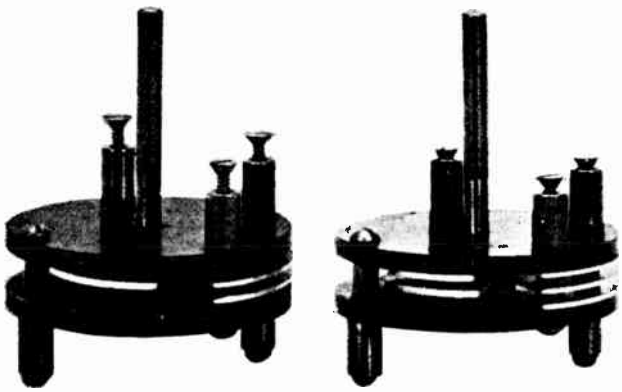
R-76—43 Plate Condenser. Capacity approximately .001. Price..... **$4.50**

R-77—21 Plate Condenser. Capacity approximately .0005. Price..... **$3.60**

R-78—11 Plate Condenser. Capacity approximately .00025. Price..... **$3.00**

New E. R. A. Three and Five Plate Condensers

This three plate Vernir Condenser is made of high grade aluminum discs evenly spaced and easily adjusted with a set screw in the back of the condenser.



Vernier 3 Plate

Vernier 5 Plate

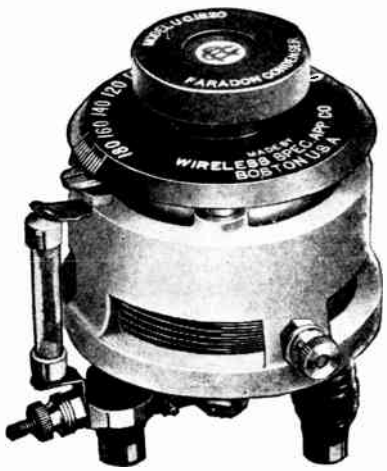
Along with these big features, it is very small, covering a space of only two square inches, which makes it instantly popular.

3 Plate Vernier $1.50

5 Plate Vernier 1.75

Faradon Precision Variable Condenser Model UC-1820

In any radio circuit where a variable capacity from .00004 to .0012 mfd. is required, the Faradon Condenser UC-1820 will be found indispensable. This condenser has a capacity range from .00004 to .0006 mfd., but it is so constructed that it is possible to join two condensers together controlling them from a single dial knob. By such an arrangement, three distinct maximum capacities may be found by the condenser units of .0003, .0006, and .0012 mfd. respectively, as shown in the accompanying sketches.



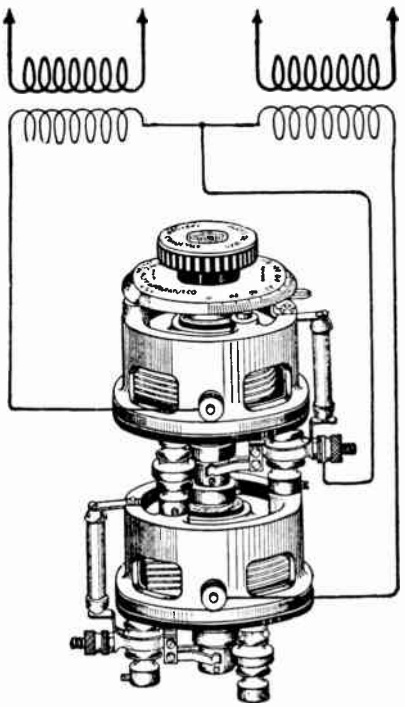
Model UC-1820

Adding Other Capacities

Additional capacity variations may be obtained by adding to the variable condenser unit the Radio Corporation's tubular condensers UC-567-8-9-70 having capacities of .00025, .0005, .001, and .0025 respectively, the variable condenser acts as a vernier in this instance. The UC-1820 is provided with clips into which these fixed condensers may be placed. With these condensers it will be seen that the capacity range of the UC-1820 combination cannot be duplicated by any other condenser or combination of condensers now on the market.

There are quite a few important properties that may be obtained by the chain connected condensers. One very marked advantage is that the system will permit simultaneous tuning of two circuits with one knob.

If the circuits have a common lead an inductance may be connected between the fixed system of one condenser to the common movable system and a second equal inductance system may be connected between the fixed system of the second unit to the movable system as shown in the figure. If the dial is rotated the periods of both circuits will vary simultaneously.



Illustrating the use of two Faradon UC-1820 nested on a single shaft for controlling two circuits simultaneously.

Construction

The movable and fixed elements comprising the UC-1820 are die castings exact to 1/1000 of an inch. The housing of the condenser is likewise cast with great exactness. The movable element is fastened to a steel shafting. This shafting is fitted with bronze bearings and a suitable arrangement is provided for the centering of the fixed and movable ele-

ments. The spacing between the plates is 10/1000 of an inch. The insulation between the fixed and movable system for their relative support has been reduced to a minimum area in order to avoid dielectric losses. Connection from the movable system is made from a double split brush fitted to one of the base insulators.

Clip Mounting Feature

The clip mounting, in addition to furnishing possible variations of capacity by the use of fixed condensers as previously described, furnishes a ready means for inserting a standard Radio Corporation grid leak resistance. (UP-507 to UP-509) where the UC-1820 is used as a variable grid condenser. This method permits a rapid change of grid leak resistance as well as a variable grid capacity, making for very accurate control of this circuit.

This condenser may be mounted in any position and provision is made to allow for panel thickness up to 5/16 of an inch, or on a base of any thickness.

Faradon condensers have an efficiency of over 99—7/10% and they represent a standard of quality and efficiency that is rarely attained in any electrical device.

Faradon Precision Variable Condenser

Model UC-1820 ..... $7.50

Capacity: .00004—.0006 mfd.

Dimensions: 4 in. x 3¾ in.

Weights: 10 oz. Shipping, 2 lbs.

Faradon Variable Mica Condenser Model UC-1819

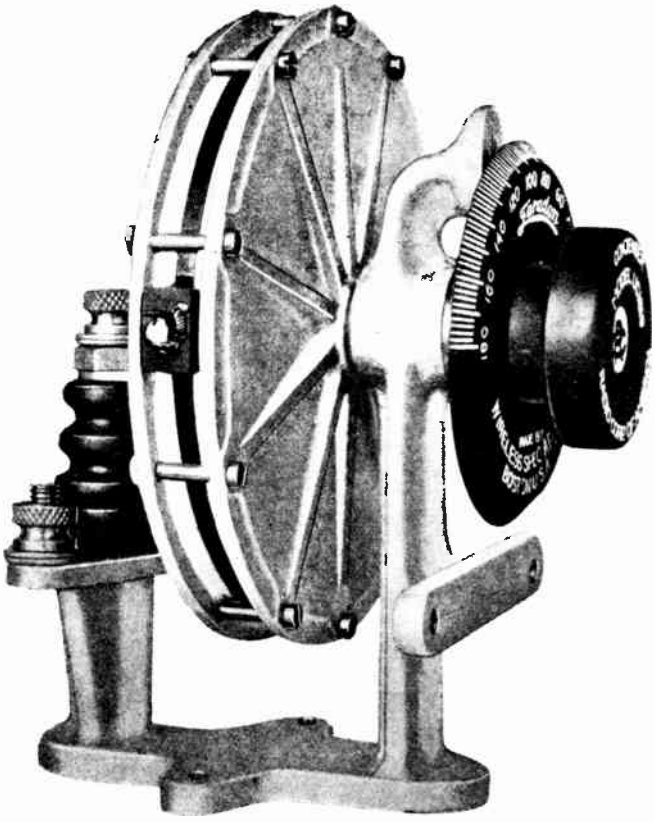
It is impossible to realize without having used one of these condensers, the satisfaction it makes possible in any form of receiving circuit for accurate, reliable and selective operation. A very marked difference between variable condensers of the older typ and this new condenser is the fact that the capacity from minimum to maximum is increased in a uniform manner dependent upon the position of the variable element with respect to the fixed or stationary element. This relation is controlled by rotating a single calibrated control knob.

Another and equally astounding fact concerning the Faradon UC-1819 is the very great range of capacity it covers—from .0001 to .005 mfd., which is a ratio of 50 to 1. No other condenser of similar size covers any such range as this.

A special grade of selected mica forms the dielectric of this condenser which is vastly different from the forms of mica condensers heretofore used, in that the capacity is continuously variable while the older types were variable in certain fixed steps, necessitating changes in the wiring or operated by a switching device.

Scientifically Constructed

The Faradon UC-1819 is the embodiment of advanced construction methods coupled with supreme engineering technique. Every detail has been scientifically considered and the completed unit marks a new period in radio reception. Here, at last, is a condenser which may be counted upon to perform satisfactorily under the most trying receiving conditions.



Model UC-1819 Condenser

The Faradon UC-1819 condenser is of the form shown in the accompanying illustration. It lends itself to any style of mounting, for it may be attached to the surface of any panel up to 5/16 of an inch in thickness with the shaft projecting through or it may be screwed to a base where that form of mounting is preferred. In either case an indicator is included to facilitate the lining up of the rotary element with the calibrated dial knob..

Faradon UC-1819 Variable Mica Condenser..... $8.75

Capacities: .0001—.005 mfd.

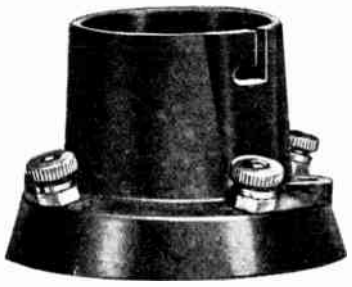
Dimensions: 4½" x 6" x 4¼".

Weights: 14 oz. Shipping 2 lbs.

Sockets

No. 100 Sockets

This socket has been placed on the market to satisfy the demand for a molded bakelite socket more substantial than those heretofore available. We have incorporated in the manufacture of this socket certain features that will appeal to every user. Note the rugged strength incorporated in this article, especially the reinforced wall where the tube locks into



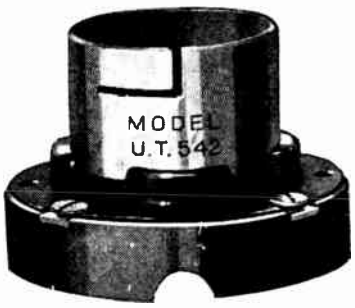
Eureka No. 100

the socket. This point has strength sufficient to stand any strain occasioned when seating the tube in the socket. Contacts of heavy phospher bronze, are of large size and so constructed as to obviate the possibility of short-circuiting or burnings out of the tube when being inserted. Bases on the socket-base permit of fastening screws or bolts being inserted straight. Substantial nickel-plated binding posts are plainly marked for filament grid and plate connections. You will find this the ideal socket for use with radio frequency amplification or the new super-regenerative hook-up. In fact, the design, mechanical and electrical features, and practicability, will recommend this socket as being without doubt the best molded bakelite socket on sale today.

No. 100 Socket, each $0.75

Porcelain Socket UR-542

Model UR-542 is designed to accommodate radiotrons UV-200, UV-201 and UV-202, as well as Kenotron UV-216.



Model UR-542

Porcelain Socket, UR-542 ..... $1.00

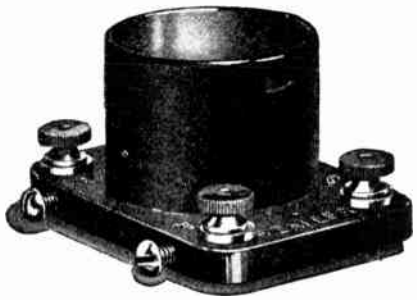
Size: 2¾ in. x 2 in.

Shipping Weight: 8 oz.

Remler No. 92 Bakelite Molded VT Tube Socket
Panel or Table Mounting

The entire socket is bakelite. The base of the socket is of sufficient depth to allow clearance between contact fingers and table.

The contact fingers are nickel plated spring brass. Nickel plated binding post terminals are marked.



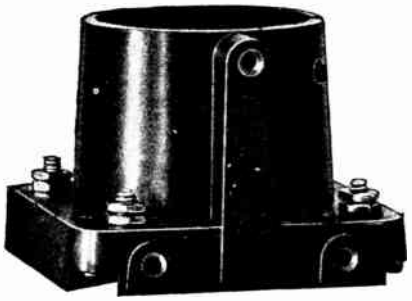
Remler No. 92

Nickel plated screws are provided for panel mounting and holes drilled for table mounting. Base is 2¼" x 2¾", and the height 1½". Shipping weight, 6 oz.

Remler No. 92 Bakelite Molded VT Socket, Panel or Table Mounting $1.00

Universal Tube Socket

Universal Tube Socket fills a long-felt want in the amateur radio field, being so designed that it can easily be mounted directly on the back of the panel without brackets or shelf. It can also be used on the table or attached to any flat surface with two wood screws. The Clapp Eastham Socket has bind-



Universal Tube HT Socket

ing posts on top of the base for making connections, and for those who prefer a soldered joint has holes on the outside end of each contact spring for making a soldered connection. It is molded in one piece entirely of condensite, and does not have the usual objectionable metal tube.

HT Universal Tube Socket $1.00

Type 156 Vacuum Tube Socket

The base is of heavy molded bakelite providing adequate insulation. The springs are of bronze, nickel finished. They are so arranged as to make positive contact on the sides of the tube prongs. As a wiping, spring contact is made, a clean, positive connection is assured.

These contact springs are heavy enough to carry, without arcing or heating, the heavy filament current of the 5-watt oscillator tubes.

Type 156 Vacuum Tube Socket

The tube and terminals of this socket are of brass with polished nickel finish. The arrangement of the base is such that this socket is adapted to any of the standard American four-prong tubes; including those transmitting tubes which have the locating pin placed 45 degrees away from normal.

Type 156 Socket **$1.25**

Dimensions: 2½" x 2½" x 1¾".

Weight: 4 oz.

Signal Socket No. R-75

The base of this socket is Formica. the tubing is brass, highly nickel-plated.

The springs of this socket are phosphor bronze.

Signal Socket R-75

Dimensions: 2¼" x 2¼" x 1⅝" high.

No. R-75 Vacuum Tube Socket **$1.00**

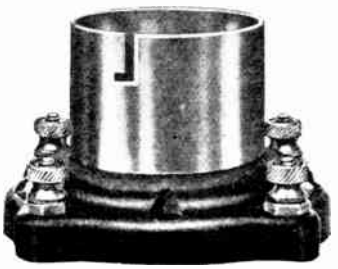
Socostat

The Socostat is a combination Socket and Rheostat; can be used for either panel or table mounting.

Socostat **$2.50**

Bakelite Socket No. 60

The base of this socket is genuine bakelite and supports four readily accessible binding posts. The



Chelsea No. 60

tube recepticle is highly polished nickel and will take any standard make of detector or amplifier tube as well as a smaller size power tube.

Price **$1.00**

Size: 2½" x 2½" x 1¾".

Shipping Weight: ¼ lb.

2 V. T. Brass Sockets, nickel plated, mounted on single insulated base with phosphor bronze contacts **$2.00**

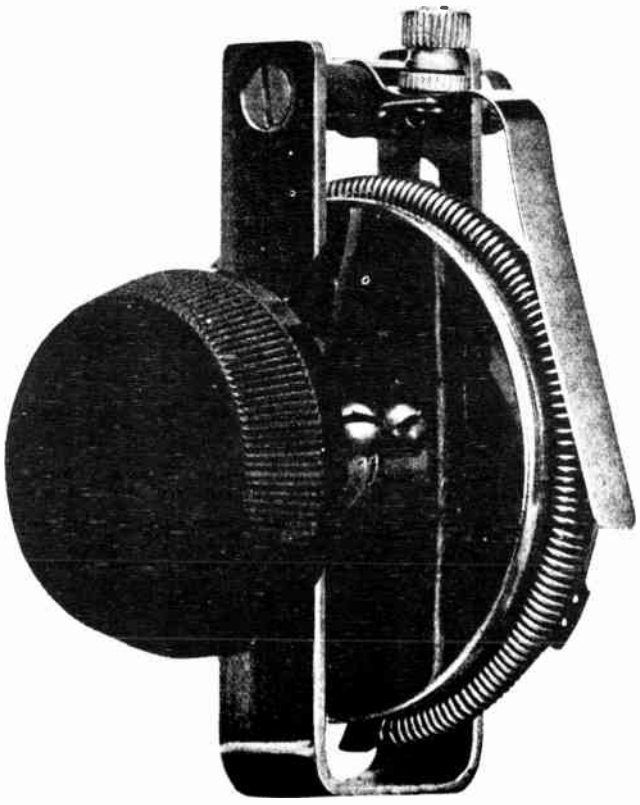
3 V. T. Brass Sockets, nickel plated, mounted on single insulated base with phosphor bronze contacts **$3.00**

Cutler Hammer V. T. Rheostats

Cutler Hammer V. T. Rheostats

The Cutler Hammer Manufacturing Co. has gone to the heart of your set with a rheostat which is designed to control, protect and assist your tubes to give their best to you. Maximum detector action cannot be obtained without extremely close adjustment of filament voltage. We strongly advocate the use of the Vernier Rheostat for detector tube control.

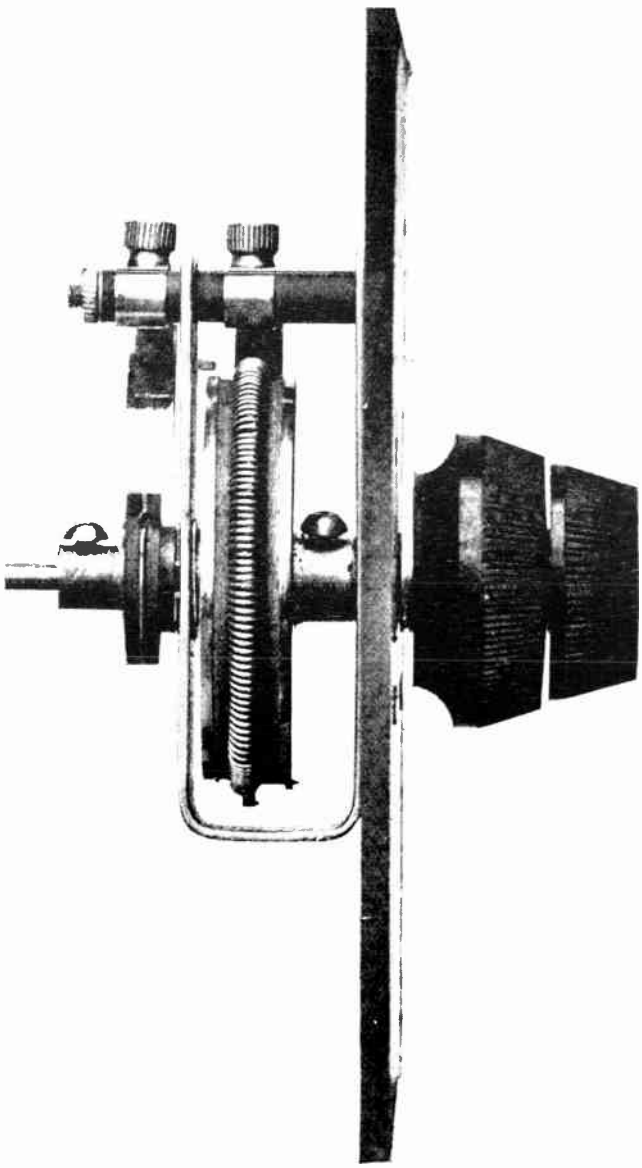
Type 11601-H1 Vernier Rheostat is a necessity in this circuit, it interposes a graduated stepless resistance between each turn of the main resistance. This provides a method of adjusting the detector filament voltage to millivolts and the smooth acting mechanism of the entire rheostat insures detector action at its best.



Type 11601-H2

The amplifying tube does not require such critical control and the C. H. Type 11601-H2 rheostat without vernier has been developed for this circuit.

Both types of rheostats are designed for individual tube control and are entirely suitable for use with all types of receiving and amplifying tubes. The rheostats are made for panel mounting and can be adjusted for panels of from ⅛" to ½" in thickness. When mounted, a nickeled pointer travels with a circular motion on the face of the panel. Stops are provided so that the rheostat body comes to rest at zero and at full resistance positions. A large number of turns of small resistance each provides minute gradation of control. This minimizes any tendency to click or sound in the receivers when adjusting filament voltage. Tension on contact spring may easily be adjusted with locknut. The off position eliminates any necessity for additional switches on the "A" battery circuit. Cone shaped knobs are provided which do not cramp the fingers. The brush contact fingers are so mounted that the spring lies in the direction of travel of the resister. This insures smooth, quiet and positive regulation. Each rheostat is guaranteed free from mechanical or electrical defects and will replace or repair it without charge in case such defects develop within six months from date of shipment.



Type 11601-H1-Mounted on Panel

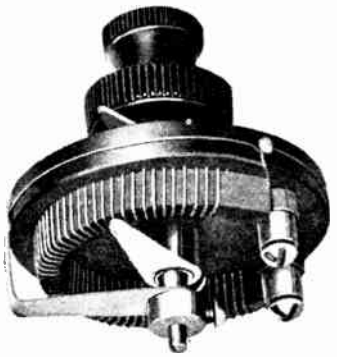
Type 11601-H1, with Vernier **$1.50**

Type 11601-H2, without Vernier **1.00**

Rheostats

Teco's Vernier Rheostat

This Rheostat makes it possible for you to obtain and hold that necessary fine adjustment of filament current to render your receiving circuits in their most sensitive condition.



Teco Vernier Rheostat

The contact is operated by means of a small knob, the shaft of which passes through the hollow shaft of the larger control knob, which regulates the resistance by turns. The elements of the rheostat are so built that, with one ampere flowing in the circuit, one complete turn of the Vernier control only changes that current one-tenth of an ampere. With such a small change, it is easy to obtain a variation of as small as one milli-ampere.

The Vernier Rheostat eliminates the necessity of a B-battery potentiometer and the extra space it requires. After all, it is not a fine control of either plate or filament sources that we require for our detectors, but a finely adjustable balance of the two, which will allow us to operate on the best point of

Teco Plain Rheostat

the filament-current, plate-voltage characteristic to obtain maximum efficiency in detection. This consideration is quite necessary in using the later types of vacuum tubes which are very critical in operation.

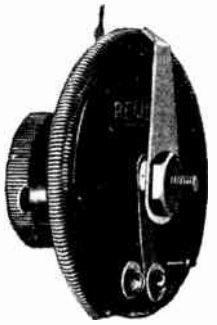
Specifications

Diameter of rheostat, 2″; resistance, 6 ohms; bases made of real bakelite; special alloy wire to reduce loss in heat.

No. 2 Teco, Plain Type, with Knob and Pointer...**$1.00**
No. 3 Teco, Vernier Type, with Knob and Point. **1.50**
No. 4 Teco, Plain Type, with Dial..... **1.50**
No. 5 Teco, Vernier Type, with Dial..... **2.00**

Remler Panel Type Rheostats, Nos. 811 and 813

Remler No. 813 Rheostat has been specially designed to meet the requirements of vacuum tube work and is made for back of panel mounting. It is as smooth running as a coupler switch and the resistance (6 ohms), gives unusually close filament temperature adjustment on either 4 or 6 volt vacuum tubes—an essential feature if maximum sensitiveness is to be had in tube operation. Current carrying capacity is 3 amperes, making this rheostat suitable for filament control of 5 watt transmitter tubes or three amplifier tubes. The resistance unit is a special non-corrosive alloy mounted on a bakelite supporting disc 2¾″ in diameter and cemented in place to



Remler Rheostat

prevent creeping. Contact is made by a nickel plated double laminated lever. Two bakelite bushings provide clearance between the panel and resistance unit. The resistance unit can be readily renewed at slight cost—an exclusive feature. All metal parts are satin nickel and those showing in front of panel are bright hand polished nickel. Furnished complete with Remler 1⅜″ bakelite knob, shaft, pointer and screws. Supporting shaft and supporting screws permit use of panels up to ½″ thick. This rheostat is neat appearing, smooth running, light weight and unbreakable. It cannot be compared with a built-over porcelain type. Shipping weight, 7 ounces.

Over 20,000 Remler rheostats now in use testify to the wonderful value and quality of Nos. 813 and 810.

No. 813 Remler, Panel Type Rheostat, 3 amp. capacity **$1.75**
No. 811, 1½ amp. capacity **1.75**
No. 811 or 813 RU Resistance Unit Renewal..... **.25**

Remler Jr. Panel Type Rheostat No. 810

Remler Jr. Rheostat No. 810 is similar in design to No. 813. The resistance unit of 4 ohms resistance with a carrying capacity of 1½ amperes is mounted on a bakelite disc. 2″ in diameter. It is especially designed for filament control of vacuum tubes operating on 4 or 6 volts. The resistance unit is a non-corrosive alloy and can be readily renewed—an exclusive Remler feature. All metal parts are nickel plated and those showing in front of panel are bright polished nickel. An off position is provided, obviating the necessity of a filament switch.

Furnished complete with Remler 1⅜" Bakelite knob, with metal insert, shaft, pointer and supporting screw.

Detector tubes must be carefully adjusted for maximum sensitiveness and signal audibility. Remler No. 810 will increase your detector sensitiveness because of its ease of adjustment and the close control it provides.

Over 20,000 Remler rheostats now in use testify to the wonderful value and quality of Nos. 813 and 810.

No. 810 Remler Jr. Panel Rheostat, 4 ohms resistance $1.00

No. 810 RU Resistance Unit Renewal ..... .20

Shipping Weight: 5 oz.

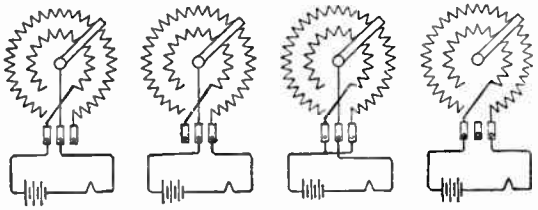
Filament Rheostat PR-535

Rheostat, Model PR-535, consists of a moulded base, approximately 2½ in. in diameter, on which are secured two concentric windings held securely in place by clamping screws. Connection is made to

Rheostat PR-535

these windings by means of two sliding contacts of phosphor bronze, which form a circuit between the outside and inside windings.

Rheostat PR-535 gives four different resistance values depending on connections.



2.5 Ohms	3.5 Ohms	1.5 Ohms	6 Ohms
1.2 Amps.	1.2 Amps.	2.5 Amps.	1.2 Amps.

Filament Rheostat, PR-535 ..... $3.00

Size: 2" x 2½" x 2¾".

Shipping Weight: 1 lb.

Chelsea Rheostats

The resistance element of both the mounted and panel type is made of non-corrosive and indestructible material. All insulating parts together with the knob and dial are genuine bakelite. This instrument has a resistance of seven ohms and current car-

Rheostat No. 22

rying capacity of 1½ amperes, both of these values being just right for the proper regulation of any receiving tube.

Both types are equipped with binding posts.

Chelsea rheostats embody the proper electrical characteristics, highest quality materials and workmanship, and attractive appearance.

Rheostat No. 23

No. 22 Mounted, 2½"x2½"x2", ½ lb. $1.00

No. 23 With dial, 2½"x2½"x2½", ½ lb. 1.50

No. 24 Without dial, 2½"x2½"x2", ½ lb. 1.00

Atwater Kent Rheostat

The Atwater Kent Rheostat for vacuum tube fila-

Atwater Kent Rheostat

ment control consists of high quality resistance wire wound on a substantial fibre strip which is secured to the base. It is a rugged, finely adjustable (re-

sistance 4 ohms) and is beyond influence of temperature usually experienced in connection with the average rheostat. Moulded material does not enter into its construction, except the knob. The rheostat is adaptable to panels up to 3/8" thickness. A polished nickel bushing acts as a bearing for the through shaft.

Price $1.00

Bradleystat

The Bradleystat Perfect Filament Control consists of two small columns of graphite discs enclosed in a porcelain container. The resistance of this type of rheostat varies with the pressure applied to the discs through means of the adjusting knob and pressure screw. There are no contact sliders or wire coils in this rheostat. The current can be controlled to the finest degree so that the characteristic steps in a wire wound rheostat are eliminated. You can get just exactly the current required for the best audibility from the vacuum tubes.

Bradleystat Perfect Filament Control

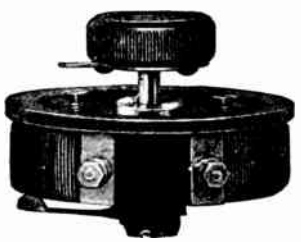
The Bradleystat is for use with ½ and 1 ampere detector or amplifier tubes and with 5-watt power sending tubes. It may be used interchangeably with any of these tubes because of the very wide range in resistance. An internal switch opens the A-battery circuit when the pressure is released from the discs.

Price $1.85

Rheostats and Potentiometers

General Radio Rheostat and Potentiometer

The Type 214 Rheostat is a convenient, practical instrument for experimental service or for permanent installations. It is made in two types, 214A for back of panel mounting, and 214B for front of panel



G. R Type 214

mounting and portable use. The illustration shows the back of panel type. In this type when mounted, only the knob and pointer project through the panel. The shaft may be adjusted for any thickness of panel up to 3/8"

This rheostat is made for three general classes of service. The first type is for the regulation of receiving tube filament currents. This rheostat has a resistance of 7 ohms and a current carrying capacity of 1.5 amperes. The second type is for the regulation of filament currents of 5 watt transmitting tubes. This rheostat has a resistance of 2 ohms and a carrying capacity of 2.5 amperes. It is sufficient for the regulation of a Radiotron UV202 tube on as high as a 12 volt supply source.

The third type of rheostat is the high resistance type. It is carried in stock in resistances of 80 and 400 ohms with current carrying capacities of 0.3 and 0.1 amperes respectively. When equipped with a third binding post with connection to the switch blade, this rheostat makes a very excellent potentiometer for biasing grids of detector tubes and for other purposes.

Dimensions 3" d. x 2¼". Weight 7 oz.

2 ohms	2.5 amp.	$2.25
7 ohms	1.5 amp.	2.25
80 ohms	0.3 amp.	2.75
400 ohms	0.1 amp.	2.75
80 ohms	Potentiometer	3.00
400 ohms	Potentiometer	3.00

Acme Pot-Rheo

It has long been known that the use of a potentiometer across the A battery with center arm connected in series with the B battery brings up the efficiency of detector tubes.

The use of radio frequency amplification require a stabilizer or 200 ohm potentiometer. This potentiometer is put across the filament battery and the grid circuit connected to the movable arm. Naturally, a rheostat must be used for filament control in each case.

Acme Pot Rheo

The Acme Apparatus Co. have devised a unit which combines these two useful pieces of apparatus. The potentiometer and rheostats are concentrically mounted with separate control handles, and terminals. A base is provided for table mounting which can be removed when panel mounting is used.

Both units are tire wound, the potentiometer to a resistance of 200 ohms and the rheostat to 3 ohms. Knobs and dial are provided, making the unit a complete and highly attractive piece of apparatus.

Price $3.00

Remler A-Battery Potentiometer No. 93

Detector tubes for maximum sensitiveness and signal audibility require careful adjustment of both A and B battery voltage. Single cell variation of the plate voltage is generally not sufficient. The ideal B battery control is by potentiometer, but in the past that form of control has shortened the B battery life. The electrical contact between graphite and carbon is also uncertain and variable.

In tube operation the A and B batteries are in series and the plate voltage can therefore be adjusted

Remler No. 94

Remler No. 93

over a six volt range by a potentiometer across the filament or A battery. The new gas content detector tubes, such as Cunningham Type C300, always have a sensitive range between 18 and 22½ volts. On other types of tubes the sensitive point will lie within a six volt range and by the use of the proper fixed B battery voltage Remler Potentiometer No. 93 can be used to adjust the plate voltage.

The resistance unit is molded from a special material developed by Remler and is not brittle like graphite or carbon. Eleven nickeled metal inserts are molded into the resistance material permitting the use of a metal contact arm and providing perfect metal to metal electrical contact. The resistance is approximately 200 ohms and is connected directly across the filament battery. No depreciation, therefore, of the B battery results. With a six volt battery this unit provides 6/10 of a volt adjustment. A 1" radius rotary lever switch, similar to Remler No. 83, but with special lever and washer, can be furnished with each unit.

No. 93 Remler Potentiometer Unit only $0.75

No. 94 Rotary Lever Switch (as illustrated) ..... .45

No. 95 Rotary Switch with 1⅜" Bakelite Knob and ¾" Washer as used on Type 330 Panel ..... .60

"A" Battery Potentiometer, Type PR-536

It is impossible to over-estimate the desirablity of using a potentiometer in connection with the Radio Corporation's gas-content detector, Radiotron UV-200. Only in this way can proper detector action and resulting increase of signal audibility be obtained.

It is inadvisable to use any type of potentiometer across a standard "B" battery, as it will exhaust the cells in a relatively short time. To overcome this difficulty the Radio Corporation developed this instrument.

Model PR-536

In appearance, Potentiometer PR-536 closely resembles the Radio Corporation's Rheostat PR-535. It is provided with three contacts. Two of these are shunted across the "A" battery, while the third is connected to a tap on the negative side of the plate battery, giving eighteen volts. This connection gives a plate voltage variation from eighteen to twenty-four volts.

"A" Battery Potentiometer $2.00

Dimensions: 2" x 1½" x 2 7/16".

Shipping Weight: 1 lb.

Fixed Condensers

Dubilier Micadon, Type 600

The Dubilier Type 600 Micadon is a model of condenser perfection. Embodied in it are all of the features that have made the Dubilier Condenser a recognized standard with the leading governments and radio companies of the world. It is made with the same high grade mica and foil, with the same quality of workmanship and has the same permanency, long life and high efficiency that is characteristic of the large Dubilier condensers used in the broadcasting and commercial stations.

The Type 600-A Micadon has been designed by the Dubilier engineers especially for service in vacuum tube receiving circuits as well as for crystal detector receivers. As an added convenience, model 600-A has been provided with spring clips to accommodate a standard grid leak. The grid leak, however, is not supplied with the condenser.

Type 600

The Micadon Type 600 is not provided with grid leak clips. This model is especially suited as a bridging condenser for telephone receivers, although it

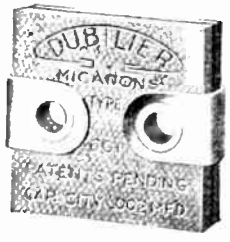
may also be used with an audio frequency transformer to reduce distortion.

Capacity in Mfds. (Type 600)

.0001 with Grid Leak Mounting	$0.75
.00025 with Grid Leak Mounting	.75
.0005 with Grid Leak Mounting	.75
.001 without Grid Leak Mounting	.75
.002 without Grid Leak Mounting	.75
.0025 without Grid Leak Mounting	1.00
.003 without Grid Leak Mounting	1.00
.004 without Grid Leak Mounting	1.00
.005 without Grid Leak Mounting	1.00
Grid Leak Mounting Separately	.35

Dubilier Micadon, Type 601

Dubilier Micadon Type 601 is only a little larger than a postage stamp. Add one micadon Type 601 to another and any desired capacity can be piled up. Dubilier micadons are manufactured according to the same principles that have made the high-voltage Dubilier power-condensers so conspicuously successful. Only carefully selected metal foil and tested India mica are used. Each condenser unit is compressed and impregnated by a special process which is fully protected by basic patents. All condensers are tested to withstand one thousand volts (alternating current), although the average breakdown voltage is three thousand.



Type 601

Capacities in Mfds.—Type 601

.0001 mfd.	$0.35
.00025 mfd.	.35
.0005 mfd.	.35
.001 mfd.	.40
.002 mfd.	.40
.0025 mfd.	.40

Dubilier Micadons, Type 601-C

The Micadon Type 601-C has three terminals, which permit the selection of any one of three capacities for use between the antenna and receiver when connected for one capacity in the top diagram, as shown on page 4. The standard capacities are .0002 and .0006 mfd. Micadon Type 601C of special capacities can also be had.

Type 601-C $0.60

Radio Corporation Tubular Grid and Plate Condenser

There has been an insistent demand in the amateur field for fixed condenser units of various capacities, suitable for amateur receiving sets. The Radio Corporation of America has evolved the four models herein listed, which are designed to fit its Standard Grid Leak Mounting. These condensers are recommended for use in the grid circuit, or as a by-pass condenser in the plate circuit, of standard vacuum tube receiving sets. They are especially useful as a unit of fixed capacity to be shunted to any standard variable air condenser.

Tubular Condenser and Mounting

The complete condenser unit is sealed in a glass tube fitted with end caps, in the same manner as the Standard Grid Leaks. Every amateur station should have at least one complete set for general experimental purposes. Nothing equally satisfactory to the four models listed here has been produced for mounting in receiving set cabinets, for if one value of capacity is found unsatisfactory for the purposes at hand, another suitable value may be immediately inserted in its place.

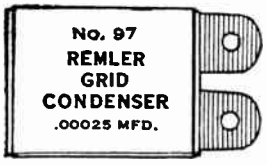
Dimensions: 1⅞" x ⅜".
Shipping Weight: 4 oz.

An Individual Color for Each Capacity

Condenser, UC-570—.0025 Mfd., White	$2.00
Condenser, UC-569—.001 Mfd., Orange	1.50
Condenser, UC-568—.0005 Mfd., Green	1.35
Condenser, UC-567—.00025 Mfd. Black	1.20
Condenser Mounting, UX-543	.50
Price	$0.25

Remler No. 97 Fixed Grid Condenser

The conductors are stamped from copper sheet and are insulated with paraffine paper. The entire unit is encased and impregnated. The terminals are spaced so as to mount at the back of the panel directly on the No. 96 Grid Leak. Capacity .00025 mfd. (approx.), the correct value for the New Type C-300 Gas Content Detector Tube.



Condenser No. 97

No. 97 Fixed Grid Condenser $0.20

"Signal" Mica Grid Condenser

The great demand for a mica grid condenser of exactly the right capacity has caused us to offer this small mica grid condenser to the amatur market. This unit has a capacity of .00025 mfd., which has been found by test to be about right for the average vacuum tube.

Signal R-31

This condenser comes mounted in a small molded composition case with nickel plated binding posts.

No. R-30 "Signal" Mica Grid Condenser (mounted) $0.60

"Signal" Fixed Receiving Condenser

This instrument is invaluable to any radio amateur. It can be used in shunt with the headset to greatly increase the strength of signals or in many other places in a receiving circuit.

Signal R-29

The case is of moulded composition and has two nickel plated binding posts mounted upon it.

Capacity: .0025 mfd.

No. R-29 "Signal" Fixed Receiving Condenser..$0.90

Paper Condensers

Type C-5—.0005 Mfd. Paper Grid Condenser.....$0.20

Type C-25—.00025 Mfd. Paper Grid Condenser... .20

Type CL-5—.00025 Mfd. Paper Grid Condenser and Grid Leak ..... .35

Type CL-25—.00025 Mfd. Paper Grid Condenser and Grid Leak ..... .35

Type C-1—.001 Mfd. Fixed Condenser..... .20

12,000 Ohm Resistance

For use with the Armstrong Super Regenerator Receiver. Price $0.50

Ducon Lamp Socket Aerial Plug

The Dubilier Ducon allows a radio receiving set to be connected to any electric light socket wherever that socket may be. The Ducon is simply screwed into the socket like an electric bulb. Although it is thus connected with the lighting circuit, the Ducon can be handled without shock; it seems electrically dead, and dead it is to the ordinary house current. Its terminals may be connected by a wire without the slightest danger and without causing a short circuit.

When the Ducon is placed in the socket it is only necessary to connect it to the receiving set, after the other usual connections have been made. Music, news, all the entertainment radiated from the broadcasting station is heard. Nothing further is necessary. The tuning is done in the usual manner. All outside wires, poles, ground switches and lightning arrest ers are eliminated.

The Dubilier Ducon must not be confused with the form of inside aerial known as a loop. The Ducon in itself is not an aerial. It is a new invention developed by the Dubilier Condenser and Radio Corporation, which makes it possible for anyone who owns a receiving set to use the lighting wires as an aerial.

Reception with the Dubilier Ducon is just as loud as that made possible with an outside aerial, regardless of the type of receiver used. The very simplest crystal detector set as well as the more elaborate vacuum tube outfits may be used. If the owner of a receiver has an outside aerial, it may be used in combination with the lighting wires by means of the Ducon. When this is done the strength of the signals is often doubled and tripled. The results are amazing.

The Ducon is manufactured by the Dubilier Condenser and Radio Corporation whose condensers are used as standard by the leading governments and radio companies of the world. This should be a guarantee that the Ducon will fulfill the claims made for it.

Price $1.50

Grid Leaks

Radio Corporation Grid Leaks for Receiving Sets

The grid of any vacuum tube, whether employed as a detector or an amplifier, is the controlling member of the tube, that is to say, it controls the current flowing between the plate and filament. The character of the control depends directly upon the bias potential maintained upon the grid. The requisite bias potential for varied conditions of use may be obtained in several ways, the most common of which are: (a) to insert in series with the grid circuit a small battery usually called a "C" battery; (b) to tap one terminal of the grid circuit from a fixed resistance in series with the filament rheostat through which the filament current flows; (c) to employ a Grid Leak connected across the grid condenser or the grid and the filament.

Grid Leak and Mounting

potential maintained upon the grid. Thus one value of grid potential will be found most suitable for radio detection, while still another value must be maintained to secure maximum amplification. The requisite bias potential for varied conditions of use may be obtained in several ways, the most common of which are: (a) to insert in series with the grid circuit a small battery usually called a "C" battery; (b) to tap one terminal of the grid circuit from a fixed resistance in series with the filament rheostat through which the filament current flows; (c) to employ a Grid Leak connected across the grid condenser or the grid and the filament.

The function of the grid leak is to present a leakage path across the grid condenser so that the potential of the grid member in respect to a terminal of the filament may be maintained at some desired value. The potential maintained on the grid is computed by Ohm's Law and it is therefore equal to the grid current times the grid resistance. With a grid resistance of two megohms (2,000,000 ohms) and a grid current of one microampere, the bias negative potential will be two volts.

Different detection and amplification circuits require grid leaks of different values and in order that the experimenter may have access to a complete line of resistance units from 100,000 ohms to 6,000,000 ohms, the Radio Corporation has standardized a number of different values which are certain to meet all the requirements for radio reception.

The proper capacity for the grid condenser should be determined by experimenting with different values between .0002 and .0004 microfarad.

The grid leak unit which will give the proper biasing potential on the grid may vary between ½ megohm (500,000 ohms) and 3 megohms (3,000,000 ohms). Various values can be obtained by purchasing three of the Radio Corporation grid leak units, approximating ½, 1 and 2 megohms, respectively. The experimenter can then try three values by employing them singly, in series, in parallel or in series-parallel. Eight or more different values between ½ to 3½ megohms may in this way be obtained.

The Radio Corporation Grid Leak Units are manufactured in the follow sizes:

Model	Ohms	Megohms
UP-509	50,000	.05
UP-510	100,000	.1
UP-511	150,000	.15
UP-512	200,000	.2
UP-513	250,000	.25
UP-514	300,000	.3
UP-515	400,000	.4
UP-516	500,000	.5
UP-517	600,000	.6
UP-518	750,000	.75
UP-519	1,000,000	1.
UP-520	1,250,000	1.25
UP-521	1,500,000	1.5
UP-522	1,750,000	1.75
UP-523	2,000,000	2.
UP-524	2,500,000	2.5
UP-525	3,000,000	3.
UP-526	4,000,000	4.
UP-527	5,000,000	5.

Grid Leak Mounting, Model UX-543 ..... $ .50

Grid Leak Units, Models UP-509 to UP-527 ..... .75

Chelsea Variable Grid Leak

The Chelsea Variable Grid Leak consists of ten separate values of grid resistances ranging from .5 megohm to 5. megohms in steps of approximately one-half megohm. By proper adjustment practically all tube hissing may be eliminated. Each tube requires its

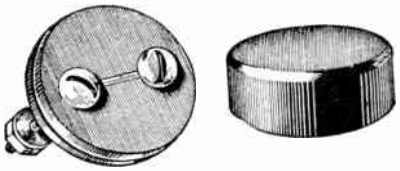
Chelsea Grid Leak

own value of leak resistance, and any particular tube requires different values of resistance, dependent upon its operating characteristics and its use as a detector, amplifier or oscillator. A variable grid leak is indispensable in the operation of oscillating or regenerative circuits. Chelsea Variable Grid Leak No. 21, size 3½x3½x1½, weight ¼ pound.

Price $3.00

Remler No. 96 Variable Grid Leak

A Grid Leak is necessary in the operation of vacuum tube detectors and some forms of amplifiers to permit the negative charge on the grid to discharge. A variable grid leak is most desirable and economical, as the necessary resistance may vary from ½ to 5 megohms. The base of Remler No. 96 grid leak is molded from bakelite and a pencil mark between the contact studs provides the variable resistance or leak. The metal cap is brass finished in black celluloid enamel and the studs are provided with washers and screws for panel mounting.



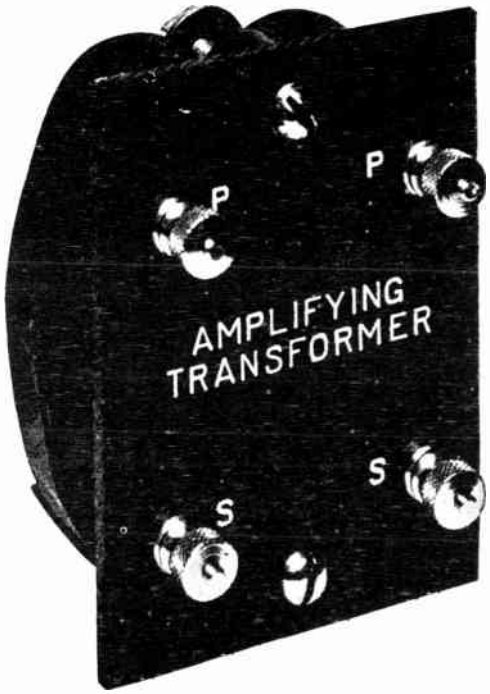
Remler No. 96

No. 96 Remler Variable Grid Leak ..... $ .40

Transformers

Amplifying Transformer No. 400

This amplifier differs in construction from others in the design of the magnetic circuit. The transformer is of the shell core type, with an accepted balanced ratio of turns. The impedence is such that maximum efficiency of operation is provided with standard makes of tubes.



Transformer No. 400

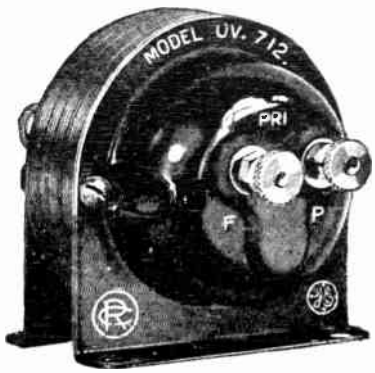
The flux leakage is very low, and as a consequence the tendency to oscillate at audio frequencies is reduced to a minimum. The windings, after being produced on automatic machines, are impregnated by a process which makes them absolutely moisture-proof, and thus guarantees long life. All leads are of heavy stranded wire, and all joints are soldered to the binding posts, which insures permanent contacts at all times.

It is possible to place two of these amplifiers adjacent to each other without any ill effects, such as howling, which quite often happens in other types of transformers on account of promagnetic coupling between terminals. Primary and secondary terminals are brought out on a bakelite panel 2¼"x3⅛", which is engraved and well finished.

No. 400. Price $4.50

Radio Corporation Tone Frequency Intervalve Amplifying Transformer UV-712

It is a well known fact that for maximum amplification the characteristics of an intervalve tone frequency amplifying transformer must be such as to fit the output impedance of the preceding tube in a cascade amplifying set. There is an allowable variation of the constants of the transformer when loaded on the secondary by an amplifying tube, but nevertheless, the maximum signal is obtained from a transformer designed especially to fit the output impedance of the tubes with which it is used.



Model UV-712

Designed for Radiotron Vacuum Tubes

Prior to the introduction of Transformer Model UV-712, amateur experimenters were compelled to employ intervalve transformers of various characteristics, none of which had been designed specifically for the Radio Corporation's detector tube, Radiotron UV-200, and the amplifier tube, Radiotron UV-201. Transformer UV-712 not only has been designed to these vacuum tubes, but special care has been taken to reduce the transformer losses to the lowest possible minimum.

Thousands Now in Use

The accompanying illustration shows the new amplifying transformer, of which there are several thousand now in daily use. Transformer UV-712 has been designed and manufactured strictly on a quality basis. It is precisely the same type used in the Corporation's commercial types of radio receiving sets. It is not to be compared with other types in which efficiency has been sacrificed to obtain compactness or to reduce manufacturing costs. Many experimenters report that the introduction of UV-712 into their receiving sets, has resulted in such a marked increase of signal audibility as to be nothing short of marvelous.

In general, a tone-frequency amplifier transformer should occupy the same position in the output circuit of a vacuum tube as the receiving telephone. The terminals P and F of Transformer UV-712 may be connected to the plate circuit terminals which ordinarily are connected to the telephone receiver. The secondary terminals should connect to the grid and filament of the following tube of a multi-stage amplifier.

In radio amplifier circuits using Transformer UV-712, the insulation of all apparatus connected to the secondary must be as perfect as possible. Leakage from the grid to the filament of amplifier tubes through the socket, mounting, panel, wiring or otherwise, will decrease the amplification. The lead from terminal G should be kept reasonably short and in cascade amplifier sets adjacent transformers should not be mounted too close; a separation of at least four or five inches should be allowed.

Physical Characteristics

1. Totally enclosed.
2. Net weight, 1 lb. 4½ oz.
3. Shipping weight, 1 lb. 7 oz.
4. Overall length, 3⅞ in.
5. Overall height, 2¾ in.
6. Base area, 2x2¾ in.

Electrical Characteristics

1. Ratio of Secondary to Primary Turns, 9/1.
2. Useful frequency range, 60/3000 cycles.
3. Allowable current on each winding, 10 milliamperes.
4. Test voltage between windings and between core and windings, 300 volts at 60 cycles.
5. Terminal voltage limit of secondary winding, 300 volts.

Model UV-712 is the only transformer designed specifically for use with Radiotrons.

Amplifying Transformer, Model UV-712 ..... **$7.00**

Dimensions: 2¾ in. x 3⅞ in. x 2 in.

Shipping Weight: 1 lb. 7 oz.

Chelsea Audio Frequency Transformer No. 50

The transformer is of the shell type embodying a minimum of flux leakage, and hence a negligible effect upon the surrounding circuits and apparatus. This feature enables a number of stages of amplification to be arranged in close proximity, without the customary noises.

The core is composed of a large number of very thin laminations of the best quality silicon steel. Its dimensions were designed with the utmost care to give the greatest value of impedence.

Chelsea No. 50

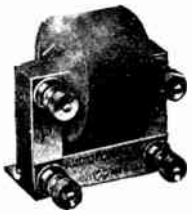
The coil winding, ratio, and dimensions are designed to give the highest amplification possible with the modern type of vacuum tube, and was chosen only after much experimenting with a variety of windings and turn ratios. The coil has a square section winding enabling the turns to be wound much closer to the core than is possible in other transformers and thereby increasing the efficiency to a noticeable extent.

The base as well as the upper terminal block is of genuine bakelite, affording the best insulation possible, thus conserving the very minute currents available.

Price, mounted **$4.50**

Priee unmounted **3.75**

Pacent "Audioformer"



Audiformer

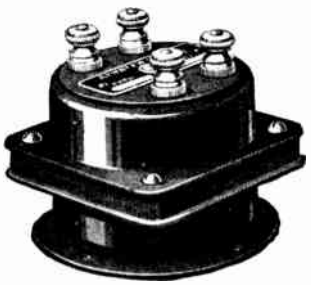
The new Pacent "Audioformer" is the smallest and most efficient audiofrequency transformer in existence. It has been especially designed for the undistorted amplification of radio-telephone music and speech and to insure maximum efficiency at all audiofrequencies. The characteristic curve of this improved transformer is not peaked but **almost flat!**

The unmounted type at the saving in cost should be an attractive feature to those assembling their own equipment.

Cat. No.		Price
25	Pacent "Audioformer" ..... Complete with binding posts and screws.	$5.00
25A	Pacent "Audioformer" ..... Without binding posts or base, suitable for manufacturers and others who prefer to use their own mountings.	4.00

Atwater Kent Transformer

The Atwater Kent transformer is one of the best audio frequency transformers for sale today. The windings and core are protected by steel housing.



A. K. Transformer

The impedance and turn ratio are such as to give maximum efficiency of operation when used with any of the standard tubes.

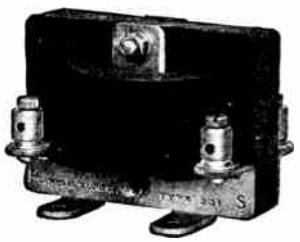
Price $5.50

General Radio Transformer, Type 231-A

The core construction is such that there is little tendency for the setting up of external fields, with the resultant howling in the audio frequency circuit. The distributed capacity of the secondary is low, so that the maximum potential is obtained on the grid of the tube.

The primary has a direct current resistance of 1,100 ohms, an alternating current resistance at 1,000 cycles of 11,000 ohms, and a reactance at this frequency of 66,000 ohms. These figures for the secondary are 5,500, 130,000 and 700,000 ohms respectively.

In order to obtain the best results from an amplifying transformer, certain precautions should be observed. Since what is wanted is the production of the maximum potential, or rather change of potential on the grid of the amplifying tube, it is best to connect the grid to the outside terminal of the secondary of the transformer. This is because the outer portion of the secondary has smaller capacity to ground than the inner portion, due to the proximity of the latter to the primary winding, which is connected to the filament and other low potential parts of the circuit. This capacity effect increases with frequency and therefore reduces the intensity of high notes proportionately more than low ones, thus tending to cause distortion. Howling, or oscillation at audio frequencies, is caused by coupling (either electrostatic or magnetic) of the amplifier grid to some other part of the circuit, and is more troublesome with two or more



G. R. Type 231-A

stages of amplification than with one. If the electrostatic and magnetic couplings are made to oppose each other, the tendency to oscillate is minimized, and when a tansformer is connected into a circuit it is worth while to reverse the leads to the primary to see which connection is better. In some cases, the oscillations are above audibility, but the strength of signals is reduced, nevertheless.

In an oscillating detector circuit the capacity of the telephone cords (which is of the order of 75 M.M.F.) is often sufficient to by-pass the radio frequency current around the high inductance of the phones, but when the primary of an amplifying transformer is substituted for the phones, it should be shunted with a condenser of a few hundred micro-microfarads or more.

Aside from its excellent electrical characteristics, this transformer is well designed mechanically. It is compact, and by means of the four projecting feet, each with a screw hole, may be mounted in any position. The core and coil are finished in black, while the brackets and binding posts are nickeled.
the brackets and binding posts are nickeled. Particular attention is called to the accessibility of both the binding posts and the mounting brackets.

Type 231-A, Amplifying Transformer $5.00

Dimensions: 2⅝" x 2½" x 2½".

Weight: 1 lb.

Acme Audio Frequency Transformer, Type A-2

Acme Audio Frequency Transformers are designed to be used most successfully with those tubes now on the market whose impedances of plate and grid circuits call for a ratio of primary and secondary turns of 1 to 4.25. This ratio is used in the Acme A-2 type. Acme Audio Frequency Transformers are also designed for use on Radio Telephony without distortion,

a feature so essential today. Excellent material and good workmanship are used, and a rigid inspection maintained to insure a uniform well made product.

After hooking up an amplifying transformer it is well to try the secondary terminals connected to the grid and filament first one way then the other and note the difference. It is usually found that the best results are obtained with the outside secondary terminal connected to the grid and the inside to the filament. It is also well to keep the grid at a negative potential in order to prevent grid currents as current flow greatly changes the effective impedance of any transformer.

Acme Transformer, Type A-2

The complete Acme A-2 type of amplifying transformer is mounted as shown in the cut on aluminum supports with engraved bakelite panel, nickel-plated fittings and binding posts. Two other styles are supplied, one having aluminum supports and terminals on a bakelite strip, shown on Page 1, and the other consisting of coil and core assembled.

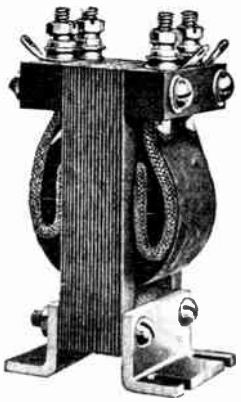
Type A-2—Completely mounted with Engraved panel **$7.00**

Type A-2—Assembled with Supports and Binding Posts (as shown) **5.00**

Type A-2—Core and Coil Assembled **4.50**

Federal Audio Frequency Transformers

The Famous Federal No. 226-W Amplifying Transformer needs little introduction to radio experimenters, as its efficiency and amplifying qualities are well established. The impedance at 500 cycles is the same as the internal impedance of the standard tubes available today. This provides maximum efficiency of operation. The flux leakage is kept at a minimum,



Federal Transformer No. 226

consequently the tendency to oscillate at Audio Frequencies, due to stray fields between circles in cascade amplification, is reduced to a minimum.

No. 226-W Amplifying Transformers, each **$7.00**

Acme Choke Coil

Acme Choke Coil

Acme Choke Coil, for use with the Armstrong Super-Regenerative Receiver **$4.50**

Radio Frequency Amplification

Models UV-1714 and UV-1716

Amplification in radio reception means increased signal audibility. The current developed in a radio receiving set from a distant transmitting station is not always of sufficient intensity to operate a telephone or a loud speaker. It is for this reason that radio frequency, audio frequency amplification or a combination of both must be resorted to. The radio frequency amplifier consists of a group of vacuum tubes in cascade, interconnected by specially designed transformers which increases the intensity of the signalling current in its original form. The audio frequency amplifier, on the other hand, amplifies the output of a detector tube which has changed the amplified high frequency current to a form which will operate a telephone receiver.

Where receiving sets are located within a comparatively short distance from a broadcasting station,

Model UV-1714

ample signal strength may be secured by the use of a vacuum tube detector and a two-stage audio frequency amplifier. However, where the receiving station is more remote, the incoming signal must be built up in order to properly actuate the detector tube. This building up of signal energy is accomplished by radio frequency amplification.

Ordinarily, very weak signals influence the detector so slightly that there is little or no rectification. Under this condition, audio frequency amplification is not always effective.

In general, more than two stages of audio frequency amplification proves unsatisfactory, for there

Radio Frequency Transformer UV-1716

is then a tendency to over-amplify tube noises and inductive disturbances from nearby lighting circuits.

The radio frequency method of amplification described here increases the strength of the incoming antenna current through successive stages until it becomes of sufficient intensity to enable detection to take place. Then with the addition of one or two stages of audio frequency amplification a current of sufficient strength will be generated which may be used to actuate either telephone receivers or loud speaking devices.

The design, however, of a radio frequency transformer suitable for amplification of signals at both long and short wavelengths has always presented a difficult problem, and it is only with the introduction of the Radio Corporation of America's new radio frequency transformers that amateurs and experimenters may take advantage of this means of amplification.

The radio frequency amplifier circuits illustrated and described here have been fully tested, and with the apparatus listed the broadcast enthusiast, the amateur and experimenter can at once enjoy radio reception without the necessity of using a high antenna, at the same time insuring minimum of interference from undesired stations.

Radio frequency amplification also permits the use of frame or loop aerials and provides, even with such limited antennae, a signal of great enough intensity to function properly with audio frequency amplifiers for the operation of loud speakers, within certain limits. It is particularly suited to the reception of radio music and speech for it tends to eliminate the distortion resulting from the use of several stages of audio frequency amplifications. For the longer wave lengths, two or three stages in cascade will produce a very strong signal from foreign stations using an average amateur antenna for receiving.

In former attempts to obtain radio frequency amplification, it has been impossible to obtain maximum results on certain wave lengths without sacrificing on others. This is because transformers with characteristics which would be desirable for the long waves would not function properly on the shorter waves and vice versa. With Model UV-1714, a range of 200 to 500 meters is provided. To permit this very broad range, a tap has been made on each winding and connected to the terminal marked "2." For short wave reception that is, from 200 to 500 meters, the connections illustrated in the accompanying diagrams are to be used. For the longer range of 500 to 5000 meters, the metal strap on each side of the transformer is disconnected and the entire windings from the terminal "1" to the terminals "3" are used.

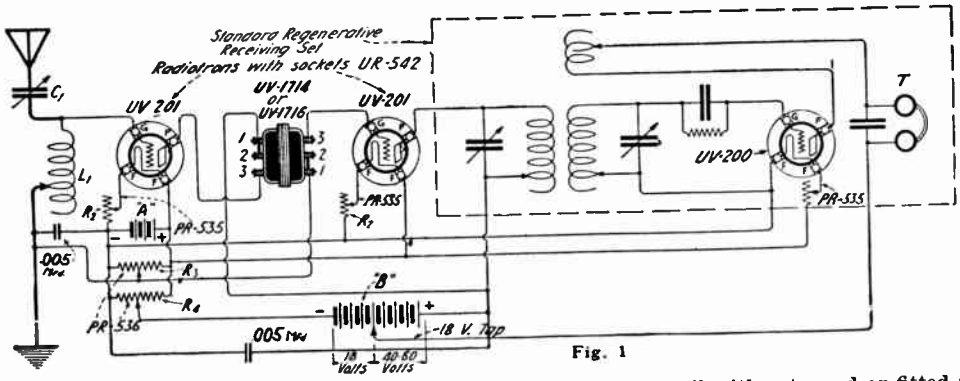


Fig. 1

"A"—Storage battery (6V-80 ampere-hour size or larger).

"B"—Standard 22.5 volt plate batteries, with 18 volt tap.

C—Variable antenna series condenser, UC-1820 (.0006 mfd. max.).

L 1—Simple tuning coil, either tapped or fitted with a slider.

R 1, R 2—Standard filament rheostats, PR-535.

R 3, R 4—Standard "A" battery potentiometers, PR 536.

NOTE:—The circuit within the dotted lines is a standard regenerative circuit.

2-Stage Radio Frequency Amplifier Circuit

Fig. 1 illustrates a satisfactory circuit for use in connection with several stages of radio frequency amplification for the reception of continuous waves.

In this case the antenna is tuned to the wave length of the desired signal and this selected signal is amplified through the primary of a standard receiving set connected to plate circuit of the last frequency amplifier tube. It is then transferred through the secondary circuit to the detector tube, in which regeneration may be controlled as desired.

One decided advantage of using the circuit shown in Fig. 1 is that the oscillations in the detector tube circuit cannot find their way back through the radio frequency amplifier to the antenna circuit, therefore the antenna cannot radiate energy. If potentiometer R-3 is not used, the filament rheostat should be placed in the positive leg of the filament circuit instead of the negative.

Combined Radio-Audio Frequency Circuit

For general reception when an average outdoor amateur antenna and radio frequency amplification are used, the circuit shown in Fig. 2 is most highly recommended. This arrangement is quite similar to that shown in Fig. 1, but instead of the standard regenerative receiver, a vario-coupler and twin variometer receiver is employed and two stages of audio-frequency amplification have been added for operating a loud speaker.

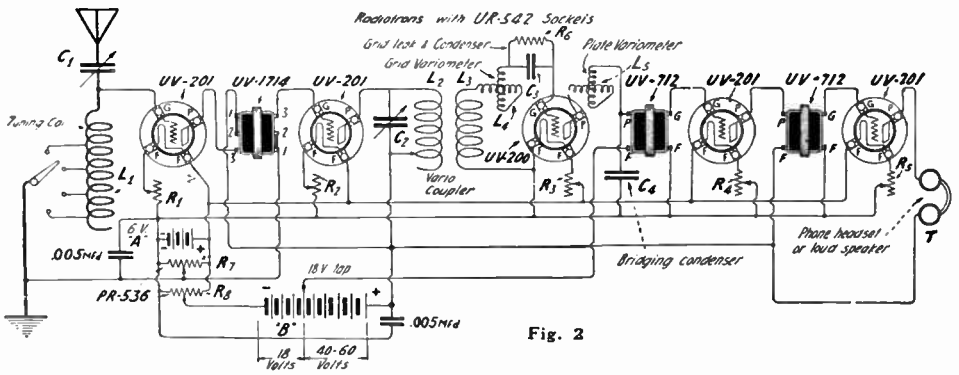


Fig. 2

"A"—Storage battery (6V-80 ampere-hour size or larger).

"B"—Standard 22.5 volt plate batteries, with 18 volt tap.

C 1—Variable antenna series condenser, UC-1820 (.0006 mfd. max.).

C 2—Variable condenser, UC-1819 (.0001 - .005 mfd.).

C 3—Variable condenser (fixed or variable) .00025 mfd., UC-567 with UX-543 mounting or UC-1820.

C 4—Telephone condenser, size optional, UC-567 to UC-570, with mounting, UX-543.

C 5 and C 6—.005-.01 mfd.

L 1—Simple tuning coil, either tapped or fitted with a slider.

L 2—Primary of vario-coupler.

L 3—Secondary of vario-coupler.

L 4—Grid variometer.

L 5—Plate variometer.

R 1, 2, 3, 4, 5—Standard filament rheostats, PR-535.

R 6—Standard grid leak, .5 to 2 megohms, UP-516 519 or 523, with UX-543 mounting.

T—Head telephones.

R 7 and R 8—Standard "A" Battery potentiometers PR-536.

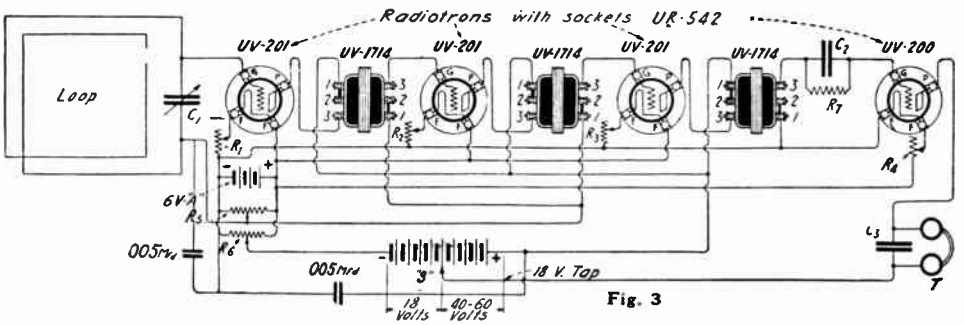


Fig. 3

"A"—Storage battery (6V-80 ampere-hour size or larger).

"B"—Standard 22.5 volt plate batteries, with 18 volt tap.

C 1—Variable loop tuning condenser, UC-1820, .0006 mfd. max.

C 2—Grid condenser (fixed or variable), .00025 mfd., UC-567, with mounting UX-543 or UC-1820.

C 3—Telephone condenser, UC-567 to UC-570, with mounting UX-543. The use of this condenser is optional.

Loop—Fully described above.

R 1, R 2, R 3, R 4—Standard filament rheostats, PR-535.

R 5, R 6—Standard "A" battery potentiometers, PR-536.

R 7—Standard grid leaks .5 to 2 megohms, UP-516, 519 or 523, with UX-543 mounting.

T—Head telephones.

As is the case with the former circuit, the circuit shown in Fig. 2 utilizes separate antenna tuning, by means of the simple tuning coil L1. This tuning coil permits the antenna circuit to be adjusted to resonance with the desired incoming signals, and the signal, thus selected, is carried through the radio frequency amplifier circuit and the primary of the vario coupler to the detector tube circuit, where it is rectified and brought to an audible frequency. This audio-frequency current is then passed through two stages of audio frequency amplification.

In using this circuit, the first two tubes should not be permitted to oscillate, but merely to amplify the incoming signal, for the oscillation and regeneration is most satisfactorily controlled by tuning the detector tube plate variometer in the customary manner. Where this circuit is employed DO NOT GROUND the negative lead of the 6-volt "A" battery. If potentiometer R-7 is not used, the filament rheostat should be placer in the positive leg of the filament circuit instead of the negative.

Loop Antenna and 3-Stage Radio Frequency Amplifier

Fig. 3 shows a method of reception using a loop antenna and three stages of radio frequency amplification. This type of receiving set will bring in signals over several hundred miles and interference is considerably reduced as the loop possesses properties which enable signals to be received from a given direction to the exclusion of unwanted stations. Static is also considerably reduced.

A very satisfactory loop for this purpose may be made by using a frame three feet square wound with five or six turns of No. 14 B. & S. lamp cord, each turn being spaced ½ to ¾ of an inch. A tap should be provided on each turn. The loop should be shunted by a variable condenser (UC-1820) having a capacity of .00004 to .0006 mfd.

With this arrangement the incoming signals are of an intensity slightly greater than is obtained with an ordinary amateur antenna and a single detector tube. By the addition of two stages of audio frequency amplification, we have a method of obtaining a greater signal intensity than is possible with the outdoor antenna, while the interference from undesired stations is considerably reduced. For fine tuning, the condenser shunted across the active turns of the loop should be equipped with a vernier, although this is not absolutely essential.

Where a radio frequency amplifier of two or more stages is desired, it should be built in a metal box, or in a box lined with metal, and should preferably have a separate compartment for each radio frequency amplifier tube and its transformer. In completing such an amplifier, it is also important to ground the negative side of the filament battery, except with single circuit tuners, to the metal case or metal lining. This insures stability.

In general, the foregoing instructions also apply to the radio frequency intervalve transformer, UV-1716, which is designed for use in connection with long wave reception. The turn ratio, however, in this transformer is approximately 1 to 3 for the reason that a step-up is advantageous for the long wave range. No intermediate tap is used on this transformer as it functions satisfactorily over the entire wave length range of 5000 to 25,000 meters.

Note: In figures 1, 2 and 3 it will be observed that there are two additional condensers each designated with a capacity of .005 mfd. It has been found that the use of these considerably improves radio frequency amplification.

Features of Both Models

1. Receiving ranges may be doubled and even tripled.
2. News and music broadcasted by distant stations are received with remarkable clearness.
3. Distortion is greatly reduced.
4. Selectivity is considerably increased.
5. Vacuum Tube noises are practically eliminated.
6. These transformers are designed especially for, and will function at maximum efficiency only, when used with Radiotron Amplifier Tube UV-201.

Physical Characteristics

Model UV-1714

1. Base Dimensions: 2 9/16" x 1 11/16".
2. Overall height: 2¾".
3. Net weight: 7 oz.
4. Shipping weight: 10 oz.

Model UV-1716

1. Base Dimensions: 2 9/16" x 2¼".
2. Overall height: 2¾".
3. Net weight: 12 oz.
4. Shipping weight: 1 lb.

Electrical Characteristics

Model 1714

1. Ratio of primary to secondary turns, 1 to 1.
2. Tap on each winding provides for two wave length ranges: 200 to 500 meters and 500 to 5000 meters.
3. Especially designed for use with Radiotron amplifier tube UV-201.

Model 1716

1. Ratio of primary to secondary turns, 1 to 3 (approximate).
2. Entire wave length range 5000 to 25,000 meters available without taps.
3. Especially designed for use with Radiotron amplifier tube UV-201.

Radio Frequency Amplifying Transformer, 200 to 500 meters, Model UV-1714 ..... $6.50

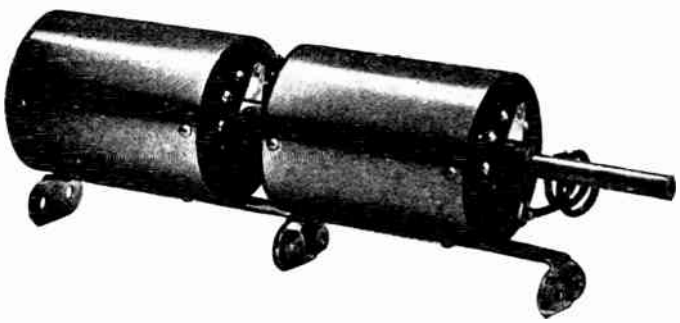
Radio Frequency Amplifying Transformer, 5000 to 25,000 meters, Model UV-1716 ..... 8.50

Coto-Coil Radio Frequency Amplifying Transformer No. 5000

With these transformers loop aerial reception is not only possible but desirable because of the ease with which interfering stations can be eliminated.

The loop aerial also finds many friends in apartment houses and other places where the erection of a suitable antenna is not feasible. With R. F. amplification loop aerials will give excellent results on all classes of work.

This transformer will operate satisfactorily with the standard tubes on the market today. Suggested connection diagrams are given herewith and may be modified at the discretion of the user.



Two Type 5000 Transformers in Tandem for 2 stage control.

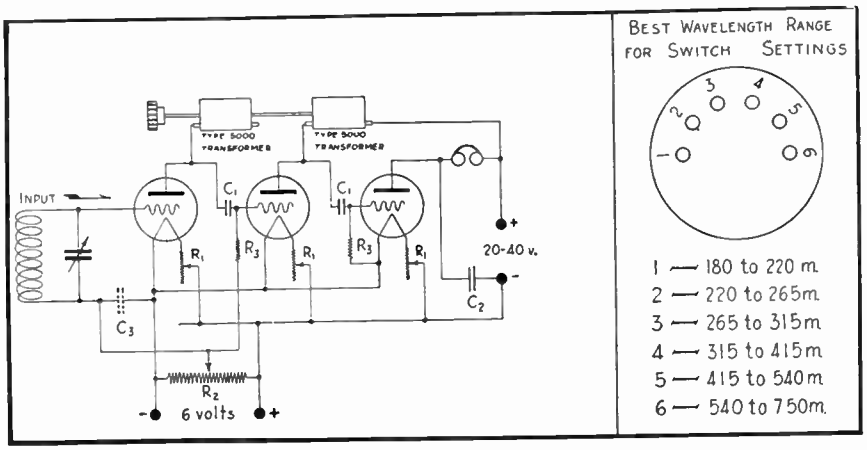
The ranges covered by the various switch settings are given on the diagram. A liberal overlap in these ranges assures high amplification on all wavelengths throughout the range of the instrument.

Remember that radio frequency amplification will bring in signals that it would be impossible to get with just audio frequency amplification, no matter how many stages. Signals otherwise too feeble for the detector to rectify, are brought up by radio frequency amplification to a point where they can be rectified and then amplified by one or more stages of audio.

Due to the varying characteristics of different tubes, greater accuracy of adjustment can be secured by using separate rheostats for each stage. These rheostats should be placed in the positive side of the line. If two or three stages of radio frequency amplification are used, the rheostat adjustment of the first stage is found to be rather sensitive, assisting in controlling the amplifying features of the stages following. The best amplification is obtained by adjusting the filament of each tube to the proper brilliancy and then regulating the potential on the grids, by means of the potentiometer, to a maximum signal strength. They should not, however, be permitted to oscillate.

Provision should be made for tapping off the plate battery, as some detector tubes function better with 16 or 18 volts on the plate. In case a gas tube is used as a detector, the introduction of a second potentiometer into the circuit, for the fine adjustment of the plate battery, will assist in controlling the operation and give better results. The negative side of the "B" battery should be connected to the switch contact of this potentiometer. The two outer contacts are connected across the "A" battery leads in the regular manner.

In the physical assembly of apparatus, it has been found best to space the tubes about six inches apart. Grid and plate leads should not be run parallel. Radio frequency lines should be separated from the "A" battery leads by a distance of three or four inches or should be run at right angles. This spacing permits ample room for the installation of standard grid leaks and condensers and cuts down capacity effects between the various circuits.



Connection Diagram for 2 stage radio and hard tube detector

C 1—.0001 to .0005 Micro-farad (Suggest .00025 Micro-farad) Not critical.

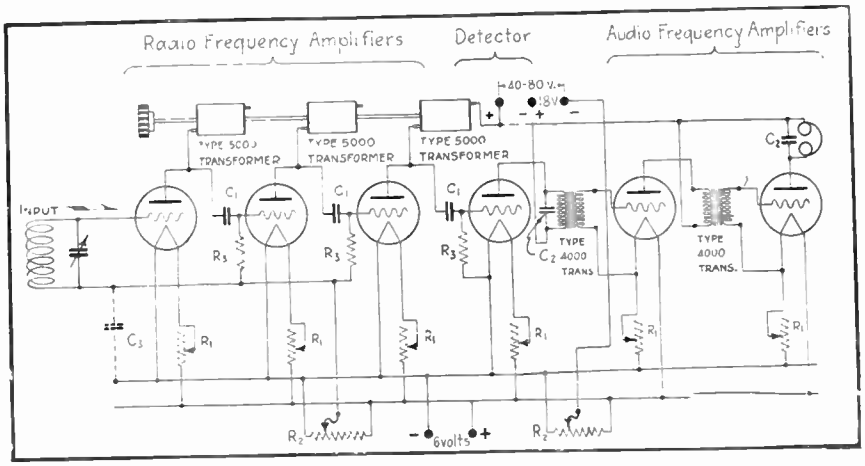
C 2—.001 to .002 Microfarad (Suggest .0015 Micro-farad).

C 3—½ Micro-farad (Paper Telephone Cond.)—Optional.

R 1—Usual Filament Rheostat.

R 2—200 Ohm Potentiometer.

R3—Grid Leaks. The best value is not critical and varies with different types of tubes (1 Megohm Leaks throughout amplifier are suggested). Input of audio frequency amplifier may be connected in place of Telephone.



Connection diagram for 3 stage radio, soft tube detector and 2 stages of audio frequency amplification

If audio frequency amplification is used in conjunction with the Type 5000 Radio Frequency Amplifying Transformer, the rheostats for control of filament current in the audio circuit should be placed in the negative side of the line.

It sometimes happens that trouble is caused by short-circuited paper condensers (C1) or improper grid leaks. In a three-stage amplifier, it may be difficult to localize the trouble unless each stage is checked carefully. The wavemeter offers a convenient method for exciting oscillations in the input circuit. This can be made up of a 35-turn Honeycomb coil and a .001 Mf. Variable Condenser, excited by a high frequency buzzer. The coil of the wavemeter is inductively coupled to the input circuit, and the grid lead is first connected directly to the grid of the detector tube, so as to make sure that this circuit is functioning properly. It will probably be found best to place the wavemeter at a distance of ten or twenty feet from the set, as otherwise the oscillations will be picked up from the buzzer as well as from the coil. After securing a maximum signal intensity in the detector circuit, the grid lead of the input circuit is connected to the grid of the first tube for radio frequency amplification, counting out from the detector. This circuit is then adjusted to the point of greatest amplification. Thus progressing outward from the detector, introducing the grid lead of the input circuit into each stage in turn and adjusting to a maximum as the impulses build up on the preceding stages, a satisfactory working condition is finally arrived at for the entire set. When the grid lead from the input circuit is connected to each stage separately, other leads to the grid should be disconnected, to prevent feedback into the other circuits.

The transformers are easily mounted and make a pleasing appearance. Exposed metal parts are heavily nickeled and the bakelite parts given an oil rubbed finish. Connecting leads 6" long are furnished.

Additional stages are mounted to the same control by loosening the setscrews in the thrust collars, removing the shaft, and inserting an extension shaft of suitable length for the number of stages used. Thrust collar setscrews are then tightened in place, making sure that the switch arms of all transformers are on the same switchpoint when tightened into place. Bolts are provided for fastening one transformer to the next.

Type 5000 Radio Frequency Amplifying Transformer $5.50

Type 5002 Extension Shaft (Two Stage) ..... .10

Type 5003 Extension Shaft (Three Stage) ..... .15

Acme Radio Frequency

The Acme Apparatus Co., pioneer Transformer and Radio Engineers and Manufacturers, have devoted considerable time to the study and development of Amplifying Transformers and Amplifying Apparatus and have become known as specialists on amplification with parts and complete sets.

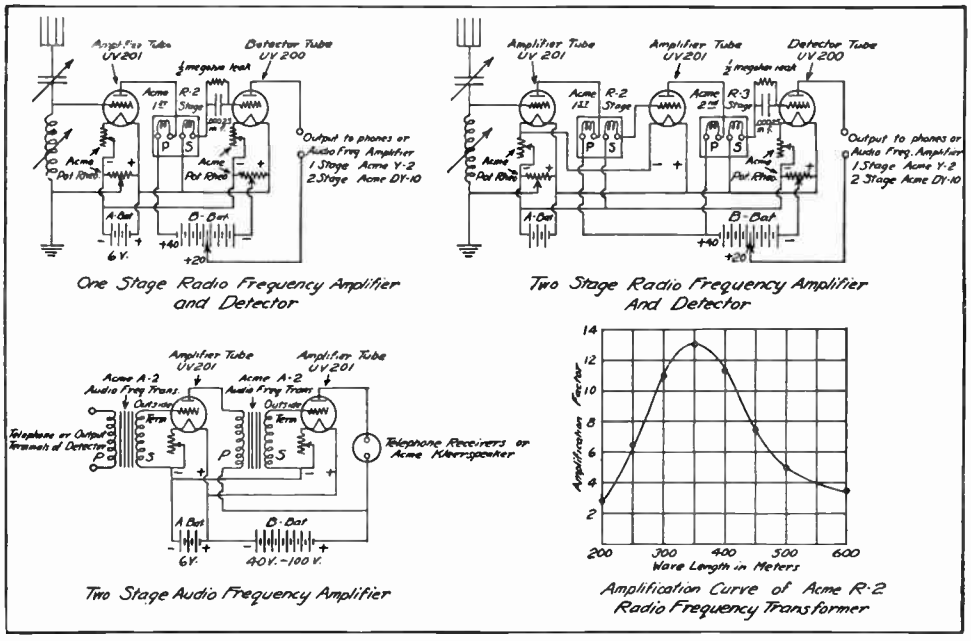
The Acme Apparatus Co. were the first to have an audio amplifying transformer on the market for amateur and experimental use and would have been the first with radio amplifying transformers had they desired to market the transformers made in the early development.

The problems involved in the design and construction of radio amplifying transformers were such that many months were spent by the engineering and experimental departments before a product was developed which it was felt could not be improved.

The functions of a radio frequency transformer in conjunction with tubes is to amplify the received

Acme Radio Frequency Transformer

energy when existing at radio frequencies; this is before detection and the function of audio frequency transformers when the energy exists at audio frequencies or after detection.



It is the feeling of the Acme Apparatus Co. that the limitations of radio should frankly be put forth to the amateur. With efficient audio transformers two and sometimes three stages of amplification may be obtained with a conservative amplification constant for each stage of roughly 10 to 1, using the available tubes. Greater amplification than this may be obtained at each stage by the sacrifice of quality of speech known as distortion. The addition of more stages causes howling due to the wiring and tubes acting as generators of parasitic noises. With Radio Frequency transformers the number of stages of amplification is not so limited, sets having been made with fifteen stages. However, with multistage Radio Frequency amplification a transformer of different electrical characteristics must be used for each stage. The first stage transformer and tube have an amplification constant which varies with the wave length received and for the Acme R-2 is shown in curve. Our experiments show that considering wave length range this is the best that can be done.

The methods of connecting radio and audio frequency transformers are shown in the diagrams and should be followed carefully for maximum results. Keep all the connecting wires as short as possible.

The type of tuner to use does not have much effect, the the following rule should be kept in mind. When using large antennas a coupled primary and secondary tuner gives best results but with small antennas a coil and condenser is sufficient.

Radio Frequency amplification is strongly recommended for small and interior antennas or for long distance reception. For nearby reception on large antennas radio frequency amplification has little advantage on account of the danger of packing the detector tube to its limit which causes distortion.

The stabilizer or potentiometer shown in the diagrams is necessary and used as an adjustment in conjunction with the tuning. We strongly recommend the Acme Pot-Rheo for this purpose. The Acme Pot-Rheo is a combination filament rheostat and potentiometer with concentric control shafts and is adapted for either panel or table mounting.

Acme R-1—Wave length range 100 to 350 meter may be used as a first stage transformer for low wave length reception.

Acme R-2—Wave length range 250-500 meter to be used as the first stage transformer for these wave lengths.

Acme R-3—To be used as the second stage transformer with R-2.

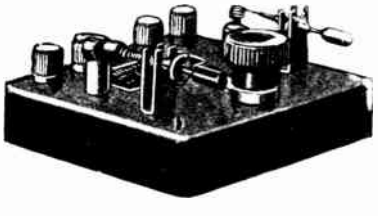
Price, each $5.00

Crystal Detectors

Type DB Crystal Detector, Style No. 307216

In the base of this detector what is known as a blocking condenser is connected across the telephone terminals, thus making a very compact and complete unit.

The two types of detectors used on this unit are what is known as the "Pressure" type and the "Cat Whisker" type. In the former two selected minerals are held in pressed contact with each other. In the



Type DB Detector

second type but a single crystal is used, the adjustment being made by means of a fine wire which may be moved about the crystal to locate sensitive spots.

Westinghouse Supersensitive Crystal Detector, Model DB $6.50

Dimensions: 4⅝" x 4¼" x 2".

Weights: Net, 1 lb.; Shipping, 1½ lbs.

Spare Crystals (Pressure Type), Model DE $1.00

Spare Crystals (Cat Whisker), Model DD 1.00

Note: Crystal Detector, type DB, may be vey satisfactorily employed with any standard receiving outfit and it has been specially designed for use with the type RA Tuner, described elsewhere in this book.

Pacent "Universal" Detector Stand

The Pacent "Universal" Detector Stand sets a new standard in detector construction and is exceptionally reasonable in price. It is dust-proof, rust-proof and fool-proof. Has a molded top and base of insulating material and the crystal, though protected by a glass cover, is instantly accessible. All metal parts are heavily nickeled and highly polished.

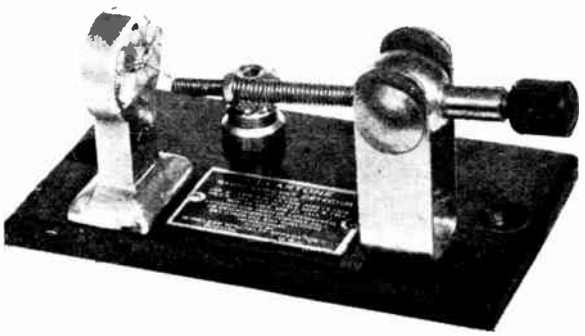
Adjustment easily made and **held.**

A truly beautiful instrument incorporating every feature the ideal detector stand should have.

Cat. No.		Price
30	Pacent "Universal" Detector Stand	$1.50

Wireless Specialty Cleartone Crystal Detector

This supersensitive Galena Detector, made by the Wireless Specialty Apparatus Company, represents the highest development of the crystal detector art, as the manufacturers have designed and built the



Cleartone Detector

"solid rectifier" type of detector for fifteen years.

The very reasonable price of $1.60 is possible only by extremely large quantity production.

This Cleartone Detector is licensed for amateur, experimental or entertainment purposes only under U. S. patents, the property of the Wireless Specialty Apparatus Company.

Price $1.60

Formica Panels

Formica Panels

Formica is an insulating material of the highest possible efficiency for Radio Panels and other insulating parts.

Losses due to dielectric hysteresis are practically eliminated when Formica is used. It has a dielectric strength of 700 to 1300 volts per 1/1000 of an inch,

Formica Panel

and an angle of phase difference of two degrees or less, reducing power factor losses to the minimum.

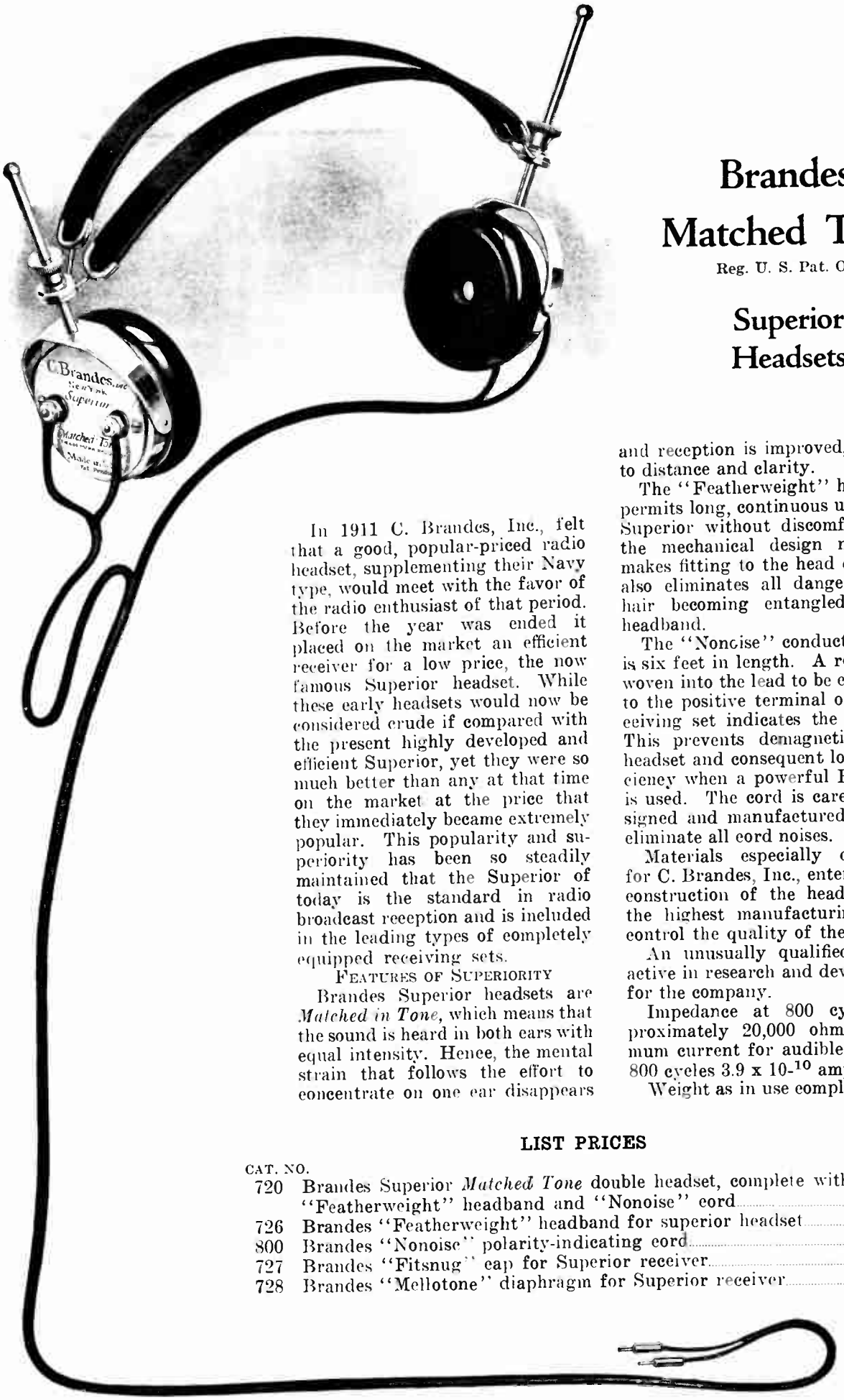
Formica has been adopted by most leading manufacturers of Radio equipment and is widely used by them. It has been approved for Radio purposes by the Bureau of Engineering of the United States Navy —and by the U. S. Signal Corps.

Formica is especially handsome in appearance. It may be had in black with polished or dull surface—and in natural brown with polished surface.

6" x 6" x 1/8	$1.00
6" x 7½" x 3/16	1.80
6" x 10½ x 3/16	2.40
6 x 14 x 3/16	3.00
6½ x 19½ x 3/16	4.70
8 x 14 x ¼	5.30
8 x 18 x ¼	6.20
9 x 14 x ¼	5.80
10 x 16 x ¼	7.30
12 x 18 x ¼	9.40
Full Sheets—36 x 42 x ⅛	26.12
Full Sheets—36 x 42 x 3/16	39.10
Full Sheets—36 x 42 x ¼	52.14

Panels cut to size:

⅛" thick, per square inch	$0.02½
3/16" thick, per square inch	.03½
¼" thick, per square inch	.04½



Brandes Matched Tone

Reg. U. S. Pat. Off.

Superior Headsets

In 1911 C. Brandes, Inc., felt that a good, popular-priced radio headset, supplementing their Navy type, would meet with the favor of the radio enthusiast of that period. Before the year was ended it placed on the market an efficient receiver for a low price, the now famous Superior headset. While these early headsets would now be considered crude if compared with the present highly developed and efficient Superior, yet they were so much better than any at that time on the market at the price that they immediately became extremely popular. This popularity and superiority has been so steadily maintained that the Superior of today is the standard in radio broadcast reception and is included in the leading types of completely equipped receiving sets.

FEATURES OF SUPERIORITY

Brandes Superior headsets are *Matched in Tone*, which means that the sound is heard in both ears with equal intensity. Hence, the mental strain that follows the effort to concentrate on one ear disappears and reception is improved, both as to distance and clarity.

The "Featherweight" headband permits long, continuous use of the Superior without discomfort, and the mechanical design not only makes fitting to the head easy, but also eliminates all danger of the hair becoming entangled in the headband.

The "Noncise" conducting cord is six feet in length. A red tracer woven into the lead to be connected to the positive terminal on the receiving set indicates the polarity. This prevents demagnetizing the headset and consequent loss of efficiency when a powerful B battery is used. The cord is carefully designed and manufactured so as to eliminate all cord noises.

Materials especially developed for C. Brandes, Inc., enter into the construction of the headsets, and the highest manufacturing ideals control the quality of the product.

An unusually qualified staff is active in research and development for the company.

Impedance at 800 cycles, approximately 20,000 ohms. Minimum current for audible signal at 800 cycles 3.9×10^{-10} amperes.

Weight as in use complete, 15 oz.

LIST PRICES

CAT. NO.		
720	Brandes Superior *Matched Tone* double headset, complete with "Featherweight" headband and "Nonoise" cord	$8.00
726	Brandes "Featherweight" headband for superior headset	1.75
800	Brandes "Nonoise" polarity-indicating cord	1.00
727	Brandes "Fitsnug" cap for Superior receiver	.40
728	Brandes "Mellotone" diaphragm for Superior receiver	.20

Brandes Matched Tone

Reg. U. S. Pat. Off.

Navy Type Headsets

Reginald Fessenden, the eminent radio inventor and engineer, designed the Brandes Navy type headset in 1906 for the Schmidt-Wilckes Electric Company of New York, the immediate predecessor of C. Brandes, Inc. Recognition was at once accorded the Navy headset as the lightest and most sensitive, and many new records were established with it in long distance reception. It became, thereupon, standard equipment in every important radio station and in all institutions of learning. On account of the purity of its tone, it was soon found that by matching the two receivers of the set, far weaker signals could be more easily read than with any other existing type, even through static disturbances.

In those days no amplifiers were available, the electrolytic and crystal detectors being almost universally used. Success in long distance transmission was entirely dependent on the efficiency of the headset. The design was so fundamentally correct that except for such developments as the advance in the art has demanded, no great change has been made in the Brandes Navy type to the present day. It still occupies the leading position in the field, and is unequalled for both lightness and efficiency. Its wonderfully pure and mellow tone is especially adapted for the reception of speech and music either as a simple headset or as the receiver element of a loud speaker.

The Brandes special radio frequency cord (patent pending) has been especially developed for use with the Navy type. Equipped with this special cord the Navy type offers the only satisfactory headset available for use with a radio frequency amplifying set. All other typical features of Brandes superiority are embodied in the Navy type headset.

These include *Matched Tone* receivers, "Mellotone" diaphragms, polarity - indicating "Nonoise" cords, "Featherweight" headband and "Fitsnug" receiver caps.

Impedance at 800 cycles approximately 25,000 ohms. Minimum current for audible signal at 800 cycles, approximately 1.6×10^{-10} amperes.

Weight as in use complete, 11 oz.

LIST PRICES

CAT. NO.		
522	Brandes Navy Type *Matched Tone* double headset, complete with "Featherweight" headband and special radio-frequency cord	$14.00
526	Brandes "Featherweight" headband for Navy type headset	1.75
900	Brandes radio-frequency cord	3.00
527	Brandes "Fitsnug" cap for Navy receiver	.40
528	Brandes "Mellotone" diaphragm for Navy receiver	.20

FROST-FONES

The list price of Frost-Fones does not in any way reflect the quality. We invite comparative tests with any metal diaphragm phone on the market regardless of price, and in issuing this challenge we know that the results obtained will be most satisfactory.

Frost-Fones were designed, and are built to a standard consistent with the quality which Frost-Radio has always signified.

Construction of Frost Fones

The FROST-RADIO Head Set consists of two receivers, one Navy type head band, and one standard five foot receiver cord.

In these receivers are incorporated the best mechanical and electrical features which have been proven in our plants through a period of twenty-eight years devoted to the development and manufacture of high grade telephone apparatus. There are certain basic truths which must govern the building of efficient electrical equipment, but the application of these principles will not alone determine the lasting efficiency of a radio receiver. The manufacturer, who, during these earlier days of radio development, has simply copied some existing type of receiver, has found that it is not only a matter of assembling together certain manufactured parts, but that there are numerous details of construction, with which he is not acquainted, the observance of which represent the difference between a good receiver and a poor receiver.

The following details will impress you with the thoughtful care that has been taken in the design to insure a perfectly balanced phone:

The Permanent Magnets are built on the laminated principle and are produced from Tungsten Magnet Steel. Heat Treatment is pre-determined after check analysis of steel and uniform saturation obtained by pyrometer reading. Our treatment has been checked and approved by experts from the laboratories of the Sanderson Works of the Crucible Steel Company. This insures absolute permanency and prevents the diminishing of magnetic strength with consequent weakening of the receptivity.

Our Coils are wound with No. 40 enameled magnet wire. This enables us to secure the maximum number of turns in a minimum space. Each coil,

A Quality Achievement

after being wound to a predetermined number of turns, is tested for resistance by an ohmmeter reading. The cores are made of soft Norway iron, which we reanneal after the blanking and forming processes in order to insure its non-magnetic qualities. These cores are then ground to insure uniformity and to obtain the proper and permanent distance between the pole pieces and diaphragm.

The Diaphragm is made of Selected Telephone Plate or Ferrotype Metal, which is treated so as to make it non-corrosive. This stock must measure exactly .008" in thickness and every diaphragm is rigidly inspected. Unless perfectly flat without kink, dent or warping, it is rejected.

The Cap is designed along special lines so as to provide proper seating of the diaphragm, and so shaped as to fit snugly and comfortably against the ear. The Cap and Shell are made of Lacanite, a material which possesses great di-electric strength, has high polish, and is extremely tough and strong.

Our Navy Type Head Band is constructed with spring wire bands, covered with heavy black webbing, and formed to permit greatest possible comfort. It is adjustable to any size or any shape head, and is extremely light in weight. All exposed metal parts are nickel-plated and highly buffed.

The Standard Five Foot Black Mercerized Receiver Cord is used. It is a high grade cord of so called commercial construction, with imported copper tinsel conductors, double black mercerized braid, reinforced at ends, and trimmed on all ends with standard round tips.

FROST-FONES are made in various types of Double Head Sets and Single Head Sets. The Receivers are also sold separately with or without cords.

No. 162—2000 Ohm Double Head Set Complete... **$5.00**

No. 163—3000 Ohm Double Head Set Complete... **6.00**

No. 164—1000 Ohm Single Head Set Complete... **2.75**

No. 165—1000 Ohm Single Receiver with Cord... **2.50**

No. 166—1000 Ohm Single Receiver less Cord... **2.00**

No. 167—1500 Ohm Single Head Set Complete... **3.25**

No. 168—1500 Ohm Single Receiver with Cord... **3.00**

No. 169—1500 Ohm Single Receiver less Cord... **2.50**

Mesco Phones

The Mesco radio head phones are designed primarily for extreme sensitivity, producing clear speech, clear from distortion. To secure this, it was necessary to use a thin diaphragm. The telephone cords supplied with these are properly marked for polarity, so that they may be connected without fault to the same side of the line at all times, strengthening the magnets by use.

Mesco Phone

No. 2500-2000 Ohms	$6.00
No. 2501-3000 Ohms	7.00

Baldwin Phones

Baldwin Head Sets, complete	$16.00
Baldwin, single unit only	8.00

Western Electric Head Set

In designing the Western Electric head set the dimensions and electrical characteristics of the windings have been fitted to the physical dimensions of the receivers in a manner to insure that the efficiency is practically uniform over the whole audible range of frequencies. The inductance of each of the coil windings is held within exceedingly close limits by measurements made with a special type of alternating current Wheatstone bridge. The two coils employed in each receiver are wound with copper wire to a direct-current resistance of approximately 550 ohms. This gives a total of approximately 2200 ohms P. C. resistance. The alternating current impedance at voice frequencies is about 20,000 ohms.

The pole pieces are made of a special grade of silicon steel which insures the maximum alternating magnetic field with a minimum loss due to eddy currents.

The case of the receiver units is of nickel-plated brass. The ear caps are shaped to provide maximum comfort, and the set may be worn for long periods of time without fatigue. The head-band is made of non-corrosive phosphor bronze spring wire and is covered with a heavy brown webbing. The head band is attached to the receivers by a swivel attachment which insures comfortable adjustment to the head.

Western Electric head sets have been thoroughly tested by the U. S. Bureau of Standards and have been adopted as standard by the U. S. Army and Navy.

Western Electric head set type No. 1002-C complete	$15.00

Pacent Plugs and Jacks

Pacent provides the only **complete** line of plugs and jacks. There is a device available for every possible circumstance involving plug and jack connections. Each of these products are the original items of their kind and are still recognized as the standard by radio authorities. Each one was designed by expert radio engineers with a perfect conception of the duty it must perform. Use this page as an authoritative reference in connection with any of your plug and jack requirements.

Pacent Universal Plug

The Pacent Universal Plug was the first to make an appearance. Since that time, many imitations have been placed upon the market. However, the Pacent plug still stands as the ideal plug because of its protected features.

Special spring clip type of connectors facilitate attaching to any type of cord tips or conductors and give a secure **biting** contact, without the use of tools.

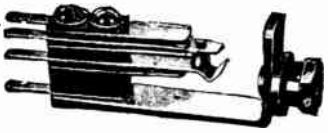
The insulation of the plug is perfect. The composition parts are finished in velvet black and the metal parts are highly polished.

Radio authorities concede the above to be the standard radio plug.

Cat. No.		Price
50	Pacent Universal Plug	$1.00

Pacent Jacks—Automatic Types

The Automatic Jack permits the filament in any part of the amplifier to be automatically cut off when not wanted, without necessitating an additional switch or touching the rheostat. Inserting the usual plug in the Pacent Automatic Jack lights the filament of the vacuum tube in that particular circuit, while withdrawing the plug shuts off the current from the filament. The advantages of this automatic control are immediately obvious. These jacks are made in two styles—3 spring and 5 spring.



Cat. No.		Price
65	Pacent Automatic Radio Jack, 3 spring	$1.00
66	Pacent Automatic Radio Jack, 5 Spring	1.20

Pacent Jacks—Standard Type

All Pacent Jacks are manufactured with booster springs; an additional spring which exerts a constant pressure on the other springs and thus increases the life of the jack. They are rugged, of positive action and perfect mechanical construction. They are made in three styles—for open circuit, closed circuit, and double circuit.

Cat. No.		Price
61	Pacent Radio Jack, Open Circuit	$0.70
62	Pacent Radio Jack, Closed Circuit	.85
63	Pacent Radio Jack, Double Circuit	1.00

Pacent Duo Jack

The Pacent Duo Jack is the latest member to the Pacent Plug and Jack family and fills a heretofore unmet radio need. It is two jacks in a molded unit and is provided with adjustable brass legs so that it can readily be attached to any set of binding posts. A glance at the illustration will immediately suggest many uses for this device.

Cat. No. 53 Pacent Duo Jack $1.50

Pacent Twin Adapter

Receiving sets are usually provided with only one jack, thus limiting the owner to a single head set. The Pacent Twin Adapter will allow a single jack to accommodate two Pacent universal jacks. In this way two pairs of phones can be used or one pair of phones and a loud speaker. Any standard type of plug can be used, although the adapter was designed especially for use with the Pacent universal plug.

Cat. No. 51. Price $1.50

Pacent Multi-Jack

The Pacent Multi-Jack is really three independent jacks built into a single base. When screwed to the side of a receiving outfit it will allow three sets of phones to be plugged in or two sets of phones and a loud speaker. It is shaped so that two or more of them can be placed end to end. All standard plugs can be used. Although it takes the place of three jacks it sells for the price of one.

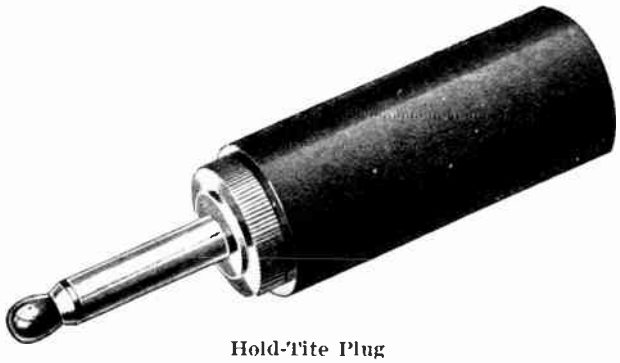
Cat. No. 52. Price $1.50

Hold Tite Plug

A worthy companion to the famous Shur Grip type plug.

Assures a positive secure contact.

No tools necessary to connect.



Hold-Tite Plug

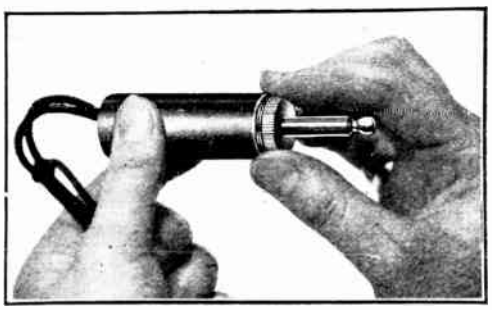
The simplicity and ease with which this plug can be adjusted will instantly appeal to those who desire a practical, efficient telephone plug at a reasonable price.

Type TA Plug $0.60

Sure Grip Plug

A quarter turn of the chuck to the right, and your telephone wire tip is attached.

A quarter turn to the left, and it is detached.



Sure Grip Plug

Screw adjustment of chucks saves time and effort. Positive in operation. Successful in use.

Therefore, it is the most practical and efficient telephone plug on the market for standard jacks.

Hard-rubber insulation bushings — the best non-conductors.

Soft, velvety, black finish, with polished metal parts.

Mechanically correct. Perfect contact assured.

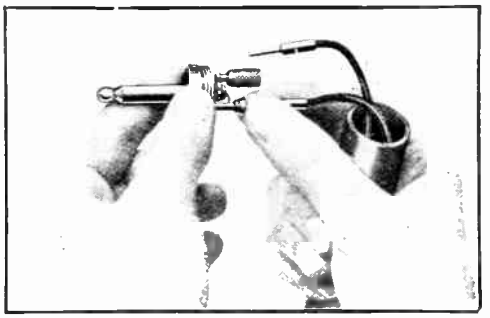
No tools necessary to fasten.

Unnecessary to cut phone tips.

Instant connection or disconnection.

This plug is built to meet the exacting requirements of experts, and is therefore the only plug an amateur should use.

Price $1.50



Inside View Sure Grip Plug

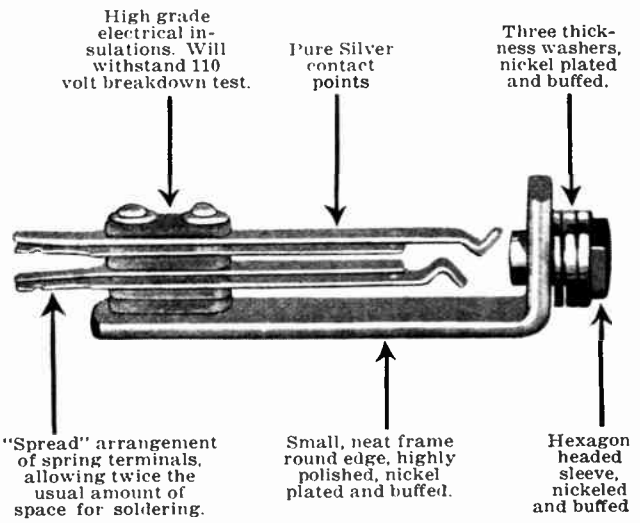
Frost Plugs and Jacks

Frost Radio Plugs and Jacks

As recognized leaders in this field we are offering the smallest, neatest and most perfectly finished jacks and plugs at attractive prices.

No single Radio item, or group of items has ever had wider distribution than Frost-Radio plugs and jacks.

A Frost-Radio jack is easily distinguished due to the fact that it is the only jack on the market having a highly polished and buffed nickel plated frame.

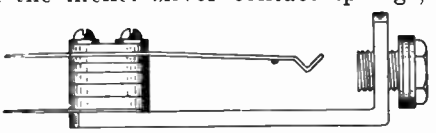


Our three styes of plugs cover every need and consist of the old type standard plug No. 132 suitable for use with straight terminals or loop terminals. You will note this is not a telephone plug in any sense of the word, but is a special Radio plug of the telephone type.

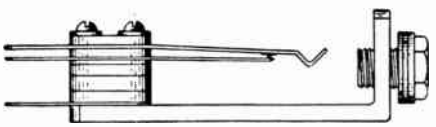
No. 137 plug is a recognized leader in the cord tip class. In making this plug, standard mechanical principles which have been used in the telephone field for years, have been followed. All chance of loose connection has been eliminated as no clutches, springs or other novel terminals have been used.

As shown in the illustration the cord tips are placed in a solid plug body and are held by means of set screws. Once placed on the cord the plug will never need any adjustment or attention.

In the construction of the Jacks, there are a number of exclusive features that make them particularly adapted for radio panel work. The frame is made of round edge flat brass which is highly polished, nickel plated and buffed. To this frame are mounted the nickel silver contact springs, well in-



No. 133



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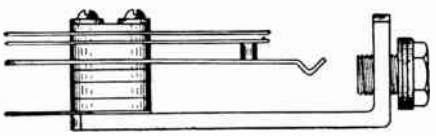

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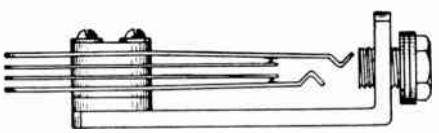

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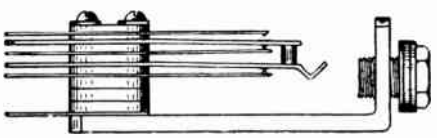
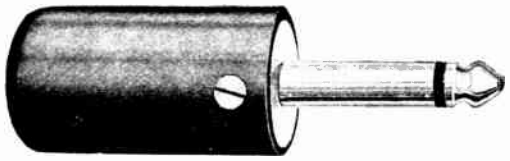


No. 136

sulated by means of 1/16" high grade electrical insulations that will withstand 110 volt breakdown test. The upraised and flat contact points are made of 99% pure Sterling Silver wire. One of the most important features is the "spread" arrangement of the spring terminals, allowing twice the usual amount of space for soldering. These terminals are heavily tinned so as to allow perfect soldered connections. The hexagon headed sleeve or jack thim-

ble is made of free turning brass rod, nickel plated and buffed, as are also the three thickness washers. We furnish three instead of only one washer so that FROST-RADIO Jacks may be used with panels of varying thickness. During the final inspection and test the springs are perfectly adjusted so as to make firm and positive contact with the tip and sleeve of plug when inserted.

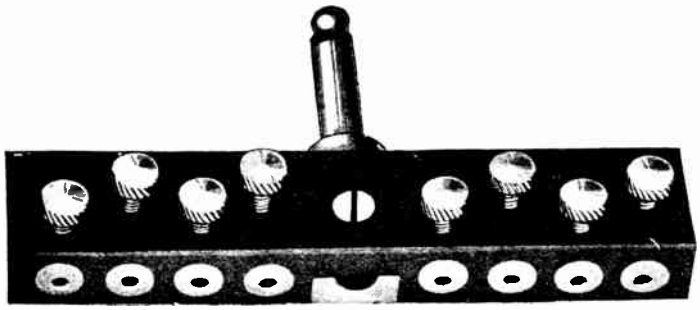


No. 137 Cord-Tip Plug

No. 137 Cord-Tip Plug with Sleeve Removed No. 178

Special attention is called to the sturdy construction of our No. 137 Cord—Tip Plug. The body is milled from solid brass rod and machine turned to accurate dimensions. The plug tip is threaded and then riveted to the needle which we make out of steel so as to prevent wear. The tip is formed so as to "grip" the jack springs and thus insure a perfect electrical connection. The plug is handsomely finished with non-breakable polished hard rubber sleeve.

The No. 138 Multi-Phone Plug is constructed according to a new principle and fills a long felt need. It enables you to install four or less sets of phones with this one plug and one jack. It is constructed so that when two or more receivers are to be connected to your set, they are connected in series. Our tests have shown that better results are obtained when phones are wired in series than when they are wired in multiple. With each multiphone plug we furnish three wire loops, as to complete the series connection it is necessary for all terminals to be occupied.



No. 138 Multi-Phone Plug

This enables you to use one, two, three or four sets of phones if desired.

No. 131—Double Circuit Jack	$ .90
No. 133—Open Circuit Jack	.65
No. 134—Closed Circuit Jack	.75
No. 135—Filament Control Jack	1.00
No. 136—Filament Control Jack	1.25
No. 132—Standard Plug, panel design	1.00
No. 137—Cord-Tip Plug	1.25
No. 138—Multi-Phone Plug	2.50

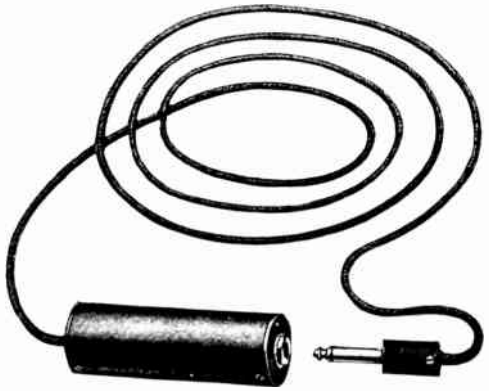
Frost-Radio Extension Cord

A new Frost-Radio product designed to fill a need which has been apparent since the introduction of the loud speaker.

The majority of loud speakers are now used in some part of the home, remote from the receiving apparatus. This is especially true in residences as the receiving set is quite often placed in a back room on the second floor, while the loud speaker is placed in a room down stairs, and another connection may be made to the phonograph. This is also true in apartment buildings where the lead in wire enters through a rear window, while the loud speaker is placed in front of the apartment.

Prior to the time the Frost-Radio extension cord was placed on the market, it was necessary to connect various units by means of unsightly cord, which the owner had to install, making the necessary electrical connection as best he knew how.

Frost-Radio extension cords come in standard or special lengths. One end of the cord is fitted with



Frost-Radio Extension Cord

a No. 137 plug; the other end is fitted with a Frost-Radio jack encased in a hard rubber housing. All that is necessary to connect the loud speaker to the set is to insert the plug end of the cord at the receiving set, and insert the plug used on the loud speaker cord into the special jack housing.

The cord is furnished in two grades, which permits a range in price. The No. 300 series is constructed with tinsel cordage and black mercerized braid, same as regular receiver cord, and although higher in cost, is recommended on account of its greater flexibility. The No. 310 series is constructed with Twisted Pair Telephone Wire, stranded copper conductor, dry oak colored braid.

No. 300— 10 foot, Frost-Radio Extension Cord.	$3.50
No. 301— 20 foot, Frost-Radio Extension Cord.	4.50
No. 302— 30 foot, Frost-Radio Extension Cord.	5.50
No. 303— 40 foot, Frost-Radio Extension Cord.	6.50
No. 304— 50 foot, Frost-Radio Extension Cord.	7.50
No. 305—100 foot, Frost-Radio Extension Cord.	12.50
No. 310— 10 foot, Frost-Radio Extension Cord.	$3.00
No. 311— 20 foot, Frost-Radio Extension Cord.	3.25
No. 312— 30 foot, Frost-Radio Extension Cord.	3.50
No. 313— 40 foot, Frost-Radio Extension Cord.	3.75
No. 314— 50 foot, Frost-Radio Extension Cord.	4.00
No. 315—100 foot, Frost-Radio Extension Cord.	6.50
No. 325—Mounted Jack only	$1.75

Western Electric Loud Speakers

No. 10-A Loud Speaking Telephone Outfit

The widespread interest displayed in the receiving of broadcasted news, music and entertainment by means of private radio telephone installations has brought with it a demand for certain auxiliary types of equipment.

Foremost among these is the loud-speaking telephone outfit which is capable of amplifying the output of a radio receiving set so as to satisfactorily fill a fair sized room with speech or music. In providing facilities for all members of a family group or other gathering to enjoy the entertainment, the greatest satisfaction can usually be obtained by providing a good loud-speaking telephone outfit.

W. E. No. 10-A

The proper design of an efficient loud-speaking telephone and its associated amplifier represents one of the highest achievements in the electrical and acoustical arts as they exist today. For several years past the engineers of the Bell System, that is of the American Telephone and Telegraph Company and of the Western Electric Company, have carried on extensive investigations upon the loud-speaking telephone with the object of developing a wide variety of public address systems. On the basis of these investigations, the Western Electric Company is manufacturing a loud-speaking telephone outfit suitable for use as an accessory to a radio receiving set.

The Western Electric No. 10-A Loud Speaking Telephone Outfit consists of the following:

a. A loud speaking receiver with curved horn.
b. A 2-stage vacuum tube amplifier equipped with three vacuum tubes (Type 216-A).

This outfit, when connected to a well-designed vacuum tube radio receiving set and suppiled with the necessary current, will reproduce and amplify all forms of broadcasted speech and music with the highest degree of clarity and tone quality.

Loud Speaking Receiver

The No. 518-W Loud Speaking Receiver (Fig. 1) is of the balanced armature type, of attractive design and highest efficiency. With the exception of the horn and mounting, it is identical with the receiver used to distribute President Harding's speech during the Armistice Day exercises in 1921.

The magnet system and moving parts are designed to obtain high sensitiveness and at the same time to operate with comparatively large amounts of voice current energy without causing distortion of the reproduced sound.

The receiver is mounted in a metal housing. The curved horn is specially designed to give adequate volume and pure tone.

Amplifier

The No. 7-A amplifier consists of a wooden cabinet approximately 12½ x 10 x 4½ inches, supporting a panel of approved insulating material. Upon this panel are mounted in convenient positions, a battery key to control the filament circuit, a multi-contact switch to control the loudness of sound, sockets for the vacuum tubes and the necessary binding posts for the input and output connections, batteries, etc.

The amplifier has two stages of amplification and employs three No. 216-A vacuum tubes. One tube is used for the first stage of amplification; the other two, connected on the differential principle, for the second stage. The differential connection of the tubes for the second stage insures faithful reproduction of sounds without overloading; also, by employing the particular scheme of connections used, the circuit is compensated in a manner to secure the highest degree of faithfulness in tone and speech reproduction.

The input transformer of the amplifier is connected to the terminals marked "IN". The impedance of the primary winding of the transformer is such that the "IN" terminals of the amplifier may be connected directly to those terminals of the radio receiving set usually employed for the head telephones.

In the construction of the amplifier the greatest care has been exercised to secure a product which embodies a high degree of perfection both electrically and mechanically.

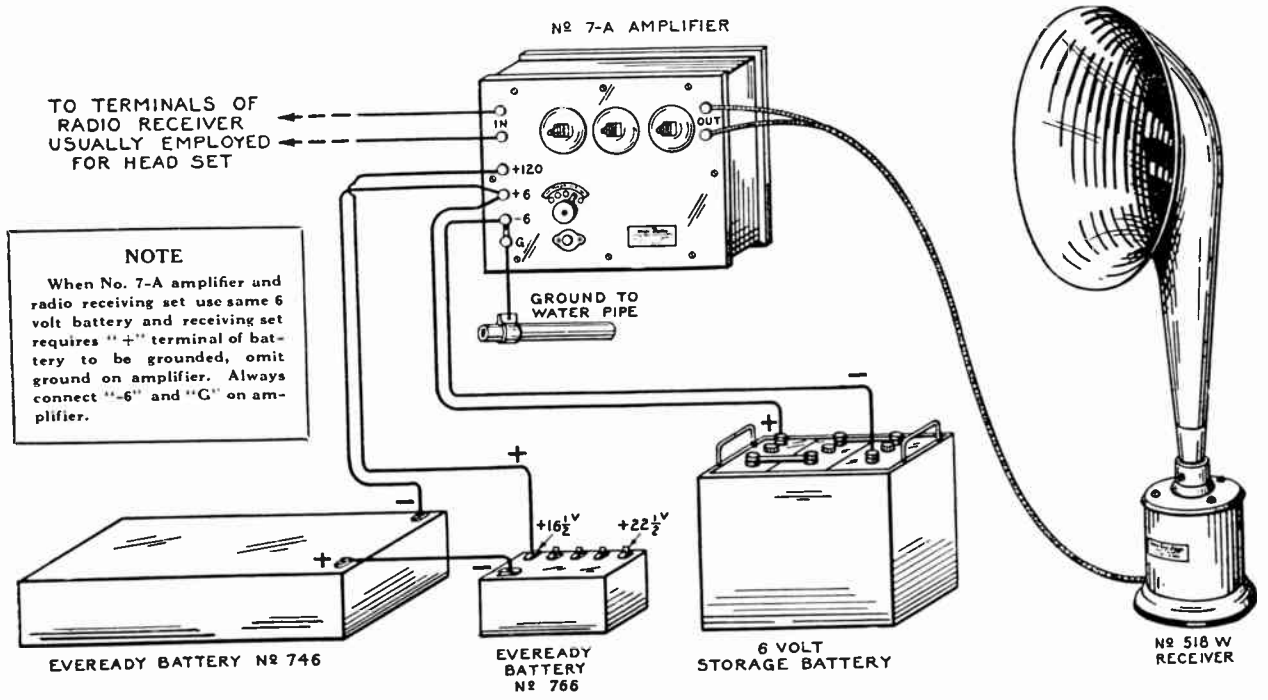
The transformers, grid battery, switches, etc., are secured to and mounted on the under side of the insulating panel.

The transformers used in the construction of this amplifier are specially designed for use with the Western Electric loud speaking receiver No. 518-W; their efficiency is remarkably uniform over a wide frequency range. This insures faithful reproduction by the loud speaking receiver of all of the frequencies used in the talking and musical ranges, including those of the highest and lowest register.

Vacuum Tubes

The vacuum tube is the heart of the amplifier.

Western Electric vacuum tubes make use of a special oxide coated filament which insures the maximum electron emission with minimum filament temperature. This feature under normal operating conditions, insures long life and minimum filament power consumption.



No. 10-A——A Loud Speaking Telephone Outfit

(Diagram of Connections, including Batteries. The batteries are not furnished as a part of the No. 10-A Outfit.)

When in operation the filaments of Western Electric tubes should glow dull red. They should never be allowed to glow as brightly as in the case of tungsten filament tubes.

Only Western Electric Type 216-A vacuum tubes should be used in connection with the No. 10-A Loud Speaking Telephone Outfit. If other tubes are used, it may not be possible to secure satisfactory results.

Operation

A general plan of connections showing the loud speaking receiver and amplifier ready to be connected to a radio receiving set, is illustrated. A diagram of connections of the amplifier itself is supplied with the equipment.

When used with a vacuum tube radio receiving set, the loud speaking telephone outfit described in this bulletin will give sufficient volume to be heard with a requisite degree of loudness in a room forty feet square, provided the radio receiving set, without the aid of the No. 7-A amplifier, gives loud and clear reception when listening with the usual form of telephone head set.

Operating Conditions

(1) The No. 7-A amplifier used with the No. 518-W loud speaking receiver is not a radio tuning set and cannot be used for tuning and detecting purposes.

(2) The loud speaking telephone outfit will not operate properly unless the amplifier is supplied with the necessary filament and plate potentials and is connected to an efficient radio receiving set.

(3) The usual forms of radio head telephone set will generally respond to an audio frequency current as small as .01 of a micro-ampere. Under normal conditions the Western Electric No. 7-A amplifier is capable of increasing the audio frequency energy about one hundred thousand times. Even with this amount of amplification, it will be readily understood that with an input energy of only a fraction of a micro-ampere, the amplifier may not be able to supply sufficient energy to operate the loud speaking receiver in a satisfactory manner.

(4) Under normal conditions when listening with an efficient receiving outfit and a suitable antenna to a radio broadcasting station situated within a radius of 100 miles, the Western Electric loud speaking telephone outfit will operate satisfactorily if the receiving outfit comprises a detector tube and a single stage of amplification. If more than one stage of amplification is supplied by the radio receiving set, the amplification is liable to be so great as to cause "howling."

Placing the Set in Operation

To operate the Western Electric loud speaking telephone outfit, connect the terminals marked "IN" on the amplifier to the terminals of the radio receiving set usually employed for the head telephones. It is assumed in this case, that the head telephones are of the type usually employed for radio receiving purposes and have an alternating current impedance of 15,000 to 20,000 ohms.

To make the proper connections the positive pole of the 120 volt ("B") battery should be attached to the binding post on the No. 7-A amplifier marked

"+120." The negative pole of the 120 volt ("B") battery should be connected to the binding post marked "+6." The positive pole of the 6-volt ("A") battery should also be connected to the binding post marked "+6." The negative pole of the 6-volt battery should be connected to the binding post marked "—6." The terminal marked "—6" should be strapped to the terminal marked "G," which should also be connected to ground. This ground connection may be the same as used for the radio receiving set. It may be a water pipe or a plate buried in the ground at a depth sufficient to insure that it always be moist. If a plate is used it should have an area of not less than four square feet.

The wires used to connect the 6-volt storage battery to the binding posts of the amplifier should not be smaller than No. 16 (American wire gauge). Preferably, a stranded wire should be used in order to obtain flexibility. If the length of the 6-volt battery leads exceeds 10 ft., wires larger than No. 16 gauge should be used.

The terminals marked "OUT" should be connected directed to the loud speaking receiver. The volume of sound emitted by the loud speaking receiver may be regulated by turning the knob of the multi-contact switch immediately above the filament circuit switch. The volume of sound will be increased by turning the knob to the right as indicated by the arrow marked on the nameplate.

Should the loud speaker fail to operate properly the fault is probably in the radio receiver. When this condition is found, disconnect the No. 7-A amplifier from the radio receiving set, connect the head telephone set in place of the amplifier and proceed to correct the trouble. Trouble in the radio receiving set may be due to wrong connections, faulty tubes, tuning, etc.

Battery Requirements

The Western Electric No. 10-A Loud Speaking Telephone Outfit requires a total of three batteries or other suitable sources of current. Assuming that batteries will be used, the requirements are as follows:

A.—Filament circuit battery, 6 volts.

B.—Plate circuit battery, 120 to 130 volts.

C.—Small dry cell battery, 9 volts.

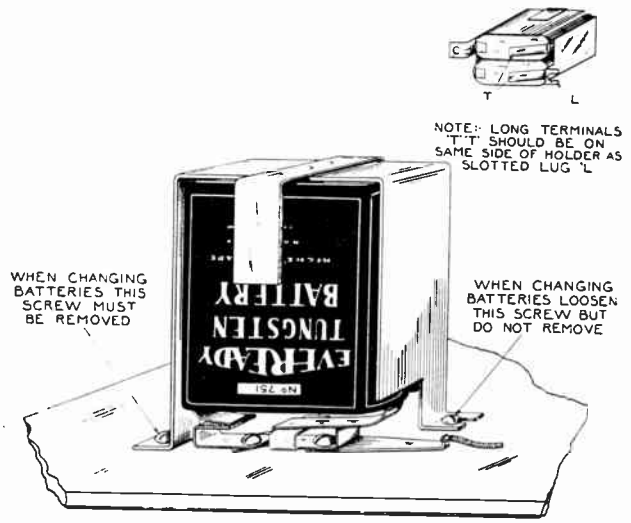
Filament Circuit Battery (Usually Referred to as the "A" Battery)

The filaments of the three vacuum tubes are connected in parallel and require a total current of approximately 3.5 amperes. This current may be obtained from a storage battery. If a storage battery is used, its capacity should preferably not be less than 120-ampere hours on a normal 8 hour discharge basis. A 6-volt 120-ampere hour storage battery, if fully charged will supply filament current to the No. 7-A amplifier for approximately two weeks on the basis of two hours use per day. At the end of this period the battery will need recharging.

Plate Circuit Battery (Usually Referred to as the "B" Battery)

This battery is required to supply a total current of approximately 22 milliamperes. A 72-cell Eveready battery type No. 746 in series with a 15-cell Eveready battery type No. 766, may conveniently be used for this purpose. If we assume an average use of the amplifier for two hours each day, the batteries above referred to should have a life of approximately sixty days.

In many cases the No. 746 Eveready battery will give good results with the Western Electric 7-A amplifier without the use of an additional battery, No. 766. However, in view of the fact that during the life of the No. 746 battery the voltage will decrease gradually from 108 volts to approximately 72 volts, it is desirable to employ the No. 766 battery both to increase the total voltage and as a convenient means for keeping the "B" battery voltage uniform. The No. 766 battery is provided with five voltage taps giving adjustments from 16½ to 22½ volts. A diagram showing the connections of the No. 746 and No. 766 Eveready batteries in the manner described, is given.



Eveready Batteries Correctly Mounted in Amplifier

To avoid confusion, contact plates of only one battery are shown. Make sure that spring terminals on the batteries make good contact with the brass pieces on the amplifier panel.

(Small insert in upper right-hand corner shows two 751 Eveready Batteries in correct position in the holder, ready to be mounted in amplifier.)

Dry Cell Battery (Usually Referred to as the "C" Battery)

The "C" battery is used solely for the purpose of maintaining the grid of each vacuum tube at a negative potential and in view of the fact that no current is drawn from the cells, the battery will last for a period of about six months even under conditions of continuous operation. At the end of this period, even if the amplifier has not been used to any extent, the "C" battery should be replaced . If the "C" battery becomes exhausted the loudness of the sound produced

by the loud speaking receiver will probably be increased, but at the expense of clearness and intelligibility.

If the "C" battery becomes inoperative due to accident or age, a new battery (two type No. 751 Eveready batteries) can be readily substituted. The "C" battery is contained in the amplifier cabinet. When placing a new "C" battery in position, examine carefully the diagram (Fig. 5) which illustrates the proper procedure and follow the instructions closely. Make sure that the terminals of the batteries make firm contact. If the "C" battery terminals fail to make proper contact, the circuit through the amplifier will be opened and the loud speaking telephone will fail to operate.

Replacement Parts

Vacuum Tubes—No. 216-A.

Receiver Cord, for No. 518-W receiver—No. 549.

Receiver Horn—Horn for No. 518-W receiver.

Note—When No. 7-A amplifier and radio receiving set use same 6 volt battery and receiving set requires "+" terminal of battery to be grounded, omit ground on amplifier. Always connect "—6" and "G" on amplifier.

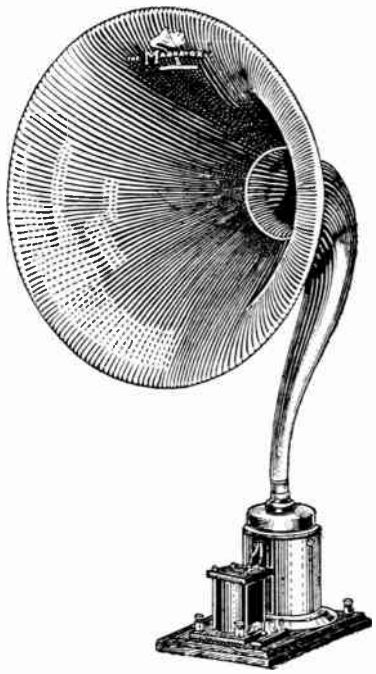
Price complete with 7-A Amplifier, Tubes and No. 518-W Receiver (less batteries) **$161.00**

Magnavox Loud Speakers

R-3 Magnavox Radio with 14-inch Horn

This instrument, constructed on the electro-dynamic principle, is ideal for use in homes, amateur stations, offices, etc. It is furnished with a special metal horn having a 14-inch bell and requires one ampere field current from your filament battery.

Price **$45.00**



R-2 Magnavox

R-2 Magnavox Radio with 18-inch Horn

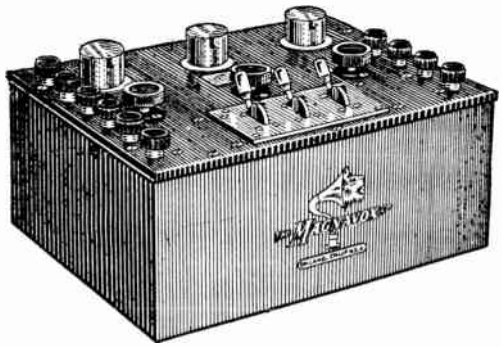
This instrument serves the requirements of professional use for large audiences, dance halls, etc. It is the same in principle and construction throughout as Type R-3, but possessing greater amplifying power and requires only .6 of an ampere for the field.

Price **$85.00**

Model C Magnavox Power Amplifier

To insure getting the largest possible power input for your Magnavox Radio, the use of a Magnavox Power Amplifier is highly desirable.

This apparatus was designed for use especially with



AC-3-C Power Amplifier

the Magnavox Radio, and gives marvelous results in the distortionless amplification and reproduction of radio speech or music.

Switching from stage to stage is made easy by master switches as illustrated. No jacks necessary.

Magnavox Power Amplifiers can be employed with any "B" battery voltage which the power tube may require for best amplification. Handsomely finished in solid mahogany case.

With either type amplifier it is necessary to use an amplifying transformer between your receiving set and Magnavox Amplifier. This your dealer can supply.

3-Stage—AC-3-C, Price **$110.00**

2-Stage—AC-2-C, Price **$80.00**

Dictograph Loud Speaker

The Dictograph Loud Speaker is designed to permit of maximum volume and the elimination of side tones. It is adapted for use in all types of receiving sets in which a detector and two stages of amplification are employed.

The Dictograph Radio Loud Speaker is the last word in a simple, compact, home-type instrument. Its splendid finish and pleasing design made it a valuable addition to any receiving set. The eleven inch burnished copper bell horn is attached to a die cast, black enamelled aluminum tone arm with nickel trimmings. The sound chamber is enclosed in a solid hardwood ebony finish cabinet mounted upon rubber pads to avoid marring highly polished surfaces.

Dictograph Loud Speaker

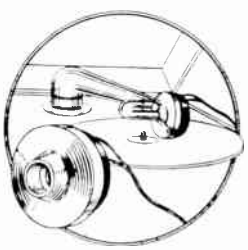
The Dictograph Radio Loud Speaker will enhance many fold the advantages and value of radio at home.

Price $20.00

The Phone-Adaptor (With Baldwin Type C Phone)

A small device that makes possible a radio loudspeaker in every home where there is a phonograph.

Used in conjunction with any make of radio headphones and replacing the reproducer on your phonograph. The Phone-Adaptor takes advantage of the



Phone Adaptor

scientific design of your phonograph horn or sound box, amplifying clearly without distortion or raucous metallic sounds, radio concerts so that everyone in the room can hear them.

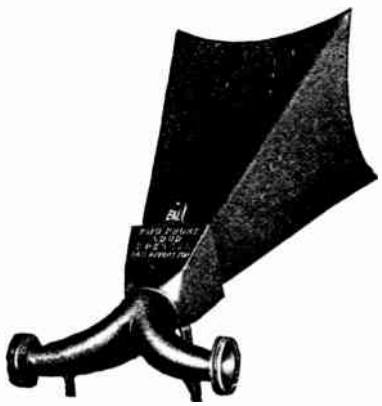
The Phone-Adaptor is a casting made from a nickel-aluminum alloy of very close grain assuring perfect tone qualities. It is highly polished and finished to match the fittings of the most expensive phonograph or radio set. Packed with directions in individual boxes.

In ordering be sure to specify what make of radio head phones you have.

Price $1.00

"Excell" Loud Speaker

A high grade, beautifully finished loud speaker for use with standard Radio head set. With a Western Electric or other good head set clamped in place, the



Excell Loud Speaker

Excell gives a true, rich tone and plenty of volume for home use.

Made with cast tone arms and heavy stamped metal horn. Beautifully finished in green enamel or natural grained mahogany.

Excell Loud Speaker, green enamel ..... $ 8.00
Excell Loud Speaker, mahogany 10.00

Phonograph Loud Speaker Attachments

These attachments are provided with a six-foot telephone cord and an attachment plug which may be inserted in the jack of the amplifier.

Where these loud speaker attachments are employed, it is necessary to use amplifiers

By employing a phonograph attachment it is possible to convert your pohnograph into a loud speaking device for radio reception where the music is to be heard by a number of people throughout the room.

In order to use this new attachment it is but necessary to remove the reproducer or "sound box" as it is called, from the tone arm of the talking machine, replacing it by the phonograph attachment which is designed to easily slip into place. There are two models, one for Victrolas and the other for Graphonolas. The Victrola model, in addition to fitting Victor machines, will fit any other talking machine having the same size tone arm.

Victrola Loud Speaker Attachment, Complete with Cord and Plug, Model LS $18.00
Graphonola Loud Speaker Attachment, Complete with Cord and Plug, Model LS 18.00
Dimensions: 2¾" x 3".
Weights: Net, 1 lb.; Shipping, 1½ lbs.
Note: In ordering, the make of phonograph should be specified.

Eveready Batteries

Eveready "B" Battery, No. 763

Is especially suitable for use where light weight or small space is essential, such as in small portable sets.

No. 763

Contains 15 cells, has five taps from 16½ to 22 volts (taps not shown in cut) enclosed in waterproof cardboard box, equipped with two coil wire leads. Initial voltage of 22½ volts.

Dimensions: Length, 3⅜ in.; width, 2 in.; height, 2½ in.

Weight: 13 oz.

Price **$1.75**

Eveready "B" Battery, No. 766

Is the most popular size in use. Contains 15 cells of larger size and has a long service life. It is

No. 766

equipped with five positive Fahnestock Spring Clip voltage taps, ranging from 16½ to 22½ volts, making it the most desirable type for use with vacuum detector tubes, such as Radiotron, Model UV-200.

Dimensions: Length, 6⅝ in.; width, 4 in.; height, 3 in.

Weight: 3 lbs. 7 oz.

Price **$3.00**

Eveready No. 703, Grid Battery

Eveready 3 Volt Battery for use in the Super-Regenerative Hook-up **$0.40**

Eveready "B" Battery No. 767

Eveready "B" Battery No. 767 is a new type "B" battery enclosed in waterproof cardboard. Initial voltage 45 volts. It is equipped with five positive

No. 767

Fahnestock spring clip voltage taps, ranging from 16½ to 22½ volts for detector tube regulation. Last tap is at 45 volts for amplifier tube.

Price **$5.50**

Eveready "B" Battery, No. 774

Contains 27 cells and has a high voltage rating of 43 volts, with six positive Fahnestock Spring Clip voltage taps at 4½ volt intervals ranging down to 18 volts. This arrangement gives a wide range of plate circuit control. The lower voltage taps make it possible to use this battery on a detector tube requiring 18 or 22½ volts, while also using it on an amplifying tube requiring 43 volts. It is especially suitable for many amplifier tubes such as Radiotron, Model UV-201.

No. 774

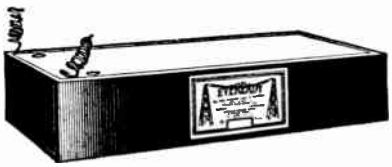
Dimensions: Length, 9 in.; width, 3⅛ in.; height, 3 7/16 in.

Weight: 4 lbs. 14 oz.

Price **$5.00**

Eveready "B" Battery, No. 746

Consists of 72 cells equipped with two coil wire leads enclosed in a wooden box, made airtight. It is made with variable taps ranging from 16½ to 22



No. 746

volts with an additional tap at 45 volts (taps not shown in cut). It gives 108 volts and is most widely used in conjunction with loud speaking devices, such as the Magnavox.

It is especially suitable for theatre and auditorium use, or outdoors, where the message must be carried to the longest distance required.

Dimensions: Length, 17 in.; width, 9 in.; height, 3½ in.

Weight: 20 lbs.

Price **$15.00**

Niagara "B" Batteries

Niagara "B" Batteries are designed with several unique features which make them of especial value to the Radio enthusiast.

All cells are renewable, so that dead cells can be replaced without the necessity of throwing out the entire battery.

The No. 350 Battery is equipped with a lever switch, as an integral part of each battery, which permits a variable voltage on the detector tube plate

No. 4525

of from 15 to 22½ volts without the changing of terminals.

Niagara "B" Batteries are noiseless in operation and of large capacity for size and price. Each battery packed in separate carton to assure against short circuits in shipping.

Cat. No.	Volts	Dimensions	Price Ea.
4525	22½	4½x2¾x2½"	$2.25
350	22½	7x4 5/16x2 9/16", with switch	3.50
8525	45	8½x2¾x2½"	4.50

Gould Radio Batteries

Gould Radio Batteries are designed in a variety of types and sizes to fit the exact requirements of any type of radio service, and in selecting the battery for a particular set care should be taken to choose the type we recommend following. All of these batteries represent the highest quality of material and workmanship and insure a satisfaction in service and a length of life for which the Gould Dreadnaught battery is famous.

Gould "A" Radio Batteries

Gould "A" Radio Batteries are made in four standard sizes with options as to finish and type of handle shown in the table following:

6-60	Single tube, strap handle	$17.00
6-80	Up to 3 tubes, if home charger is used, wire handle	19.00
6-100	Three tubes, wire handle	21.50
6-120	Three tubes with or without home charger, wire handle	24.00
6-160	More than 3 tubes, wire handle	29.00

This table is based on one ampere per tube. Gould Radio folder shows operating hours of each type for various tubes.

Gould "A" Battery

It should be noted that often more satisfaction in service will be had by using a larger size of battery than shown in the table on three tube sets, but in no case is a smaller size recommended.

A detachable strap is furnished, when desired, for use with wire handle batteries, but this strap is not a part of the battery and will be charged for extra.

Either battery black or a dark oak finish is supplied on all types, at option of purchaser. The oak finish carriers a special acid proof coating, but for permanency black is recommended.

The Gould Radio "B" Battery

A large percentage of receiving troubles, variously attributed to "static", weak broadcasting, etc., disappear when a "B" Battery of unvarying voltage,

Gould "B" Battery

free from surface leakage of current, is placed in the circuit.

The Gould Radio "B" Battery gives practically a constant voltage while in operation. No change in adjustment is required in the B circuit once the proper connections are made.

The Gould Radio "B" Battery shown on the last page of this folder consists of twelve-two volt cells, assembled in a compact, hard rubber compartment case. Variable voltage is provided in two volt steps —the voltage of each terminal being plainly marked on the case. The condition of charge can be definitely determined by simple test. It can be easily and cheaply recharged. It will last for several years with ordinary care—without expense of renewal or repairs. It has no concealed, soldered connections liable to corrosion with consequent sudden failure in circuit. Replacements of worn parts are easily made.

Compact; non fragile; free from danger of buckling or short circuiting of plates; free from acid creepage with absolute freedom from extraneous noises due to surface leakage—the Gould Radio "B" Battery not only possesses advantages superior to those of any other "B" Battery now on the market, either wet or dry, but its ultimate cost is considerably less.

Recharging

Any Gould Service Station will recharge Gould Radio "A" or "B" batteries at a nominal cost. All the standard home-charging outfits now provide for recharging both types of storage battery.

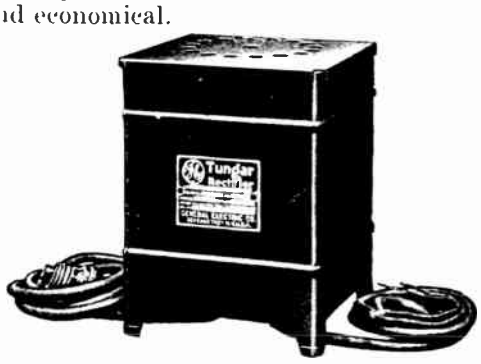
Full directions for the care of Gould Radio Batteries accompany them, and if these directions are followed years of satisfactory service will be had.

Gould Radio "B" Battery, 24-Volt. Price.....$8.50

Battery Chargers

Tungar Battery Chargers

The Tungar Battery Charger forms a very satisfactory means of charging the filament storage battery from an alternating current source. There are no moving parts in this instrument, and it is simple, safe and economical.



Tungar Charger

It is only necessary to connect the Tungar to the proper alternating current (110 volts) electric light socket, and attach the low-voltage direct current terminals to the battery.

Cat. No. 195529: The 2-ampere capacity Tungar is suitable for charging a 40-ampere-hour storage battery from 110 volt, 60 cycle mains. All the larger batteries should be charged with Cat. No. 219865, which is capable of delivering 5 amperes. When 25 cycle is required, note the following table for correct catalogue numbers:

Cat. No.	A. C. Volts	Cycles	No. Cells	D. C. Amps.	Price
219865	110	60	3-6	5	$28.00
221168	110	25	3-6	5	38.00
195529	110	60	3-6	2	18.00
199547	110	25	3-6	2	28.00

Renewal Tubes

Cat. No.	Used with	Ampere Capacity	Price
195528	No. 195529-No. 199547	2	$4.00
189048	No. 219865-No. 221168	5	8.00

Attachment for Charging "B" Batteries from Tungar Rectifier

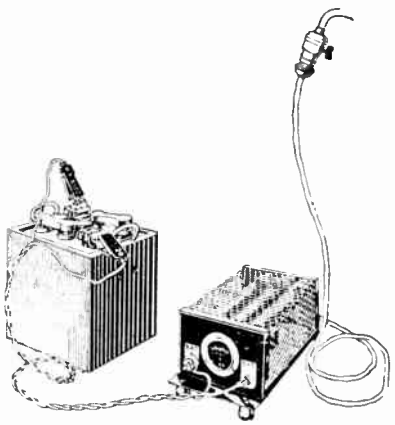
Cat. No.	Price
248237—Radio "B" Attachment	$3.00

Ward Leonard Vitrohm Battery Charger

The Ward Leonard Vitrohm Battery Charger is designed to charge a six or twelve-volt radio battery at approximately a four ampere rate (or 2 six-volt batteries may be charged when connected in series).

This apparatus is furnished with a reliable ammeter and a 6-foot extension cord with separable plug

for connecting to direct current lighting circuit. The ammeter will indicate whether the battery is properly connected to the lighting circuit, and also indicate the rate of charging.



Ward Leonard Charger

Ward Leonard Vitrohm Radio Battery Charger is a substantial device. The resistors used in this charger are the famous Ward Leonard Vitrohm (vitrous enamelled) units which are permanent in value and will last indefinitely. Vitrohm Resistors must not be confused with bare wire or cement covered resistors. Full instructions for the use of Ward Leonard battery chargers are given below.

Directions for connecting Vitrohm Battery Charger to 110-volt d. c. circuit:

1. Connect the "Positive" (+) battery terminal to the binding post on Ward Leonard Vitrohm Charger marked "Bat. +."

2. Connect the "Negative" (—) battery terminal to the binding post on Ward Leonard Vitrohm Charger marked "Bat. —."

3. Screw connection plug in to source of supply (Direct Current 100/125 volts only).

4. If ammeter reads "Charge," then connections are correct. (An all night run will bring the average battery to a fully charged condition.)

5. If ammeter should read "Discharge, separate the connecting plug marked "A," turn it 180 degrees (a half turn) and replace in part "B."

Price **$12.50**

Receiving Antenna Outfits

(With Complete Instructions for Installation)

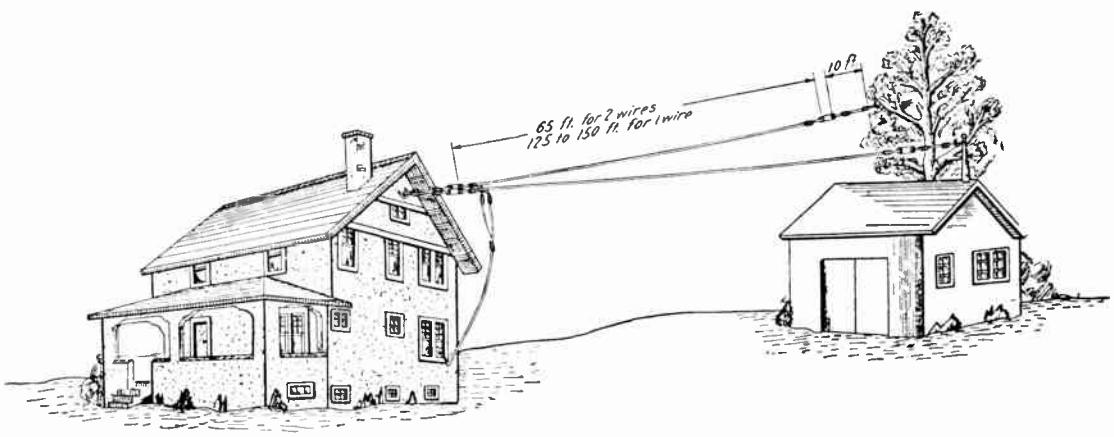


Fig. 1—Illustrating method of installing a one or two wire antenna for broadcast reception.

These antenna outfits have been especially designed for the radio broadcasting sets described in this catalog. The following instructions apply in general to all classes of receivers, but especially to broadcasting reception.

Selecting the Location

The number of miles over which a given broadcasting receiving outfit will respond depends upon a number of important factors. In order to get the most satisfactory results with any of the receiving outfits described here, the antenna, or aerial, as it is sometimes called, should consist of one or two wires 50 to 150 feet long. Good reception often can be obtained with two wires of a shorter length, separated from each other by three-foot wooden spreaders. See Fig. 3. Care should be taken to keep the antenna as far as possible from trees and buildings, especially where the latter have a steel frame-work, and the lead-in wire should never be brought down a narrow air-shaft. Where an antenna is supported by a house at one end and a tree at the other end, care should be taken to have an insulator, such as provided with Model AD outfit, extended a distance of at least 10 feet beyond the tree's branches. Where one end of the antenna is fastened to a building having a metal roof, this same precaution should be followed, for should the antenna come in contact with the objects mentioned, the incoming signals will be reduced in strength by electrical leakage.

Raising the Antenna

The method of raising the antenna after the location has been decided upon, where a single wire antenna is to be used, is as follows: Take one of the screw eyes furnished with the antenna equipment in the building or tree, which is to support the free end of the antenna, that is, the end away from the receiving outfit. A piece of copper wire is passed through this screw eye as shown in Fig. 2. This wire is then left long enough to extend 10 feet beyond the roof of the building or the branches of the tree holding the screw-eye, and to it is attached an insulator. The other end of this insulator is used for fastening the end of the antenna wire itself, as shown in Fig. 2.

The wire is then run from this point to a point directly beneath that section of the house in which the receiving set is to be placed. This end of the antenna is put in place by inserting another screw eye in some part of the house, preferably as high as possible. In this instance the insulator is attached to the antenna wire at a point estimated to be approximately 10 feet from the side or roof of the house. To the opposite end of this insulator is connected another tie wire as illustrated in Fig. 2. The opposite end of this tie wire is then drawn through the screw eye on the house, and fastened by twisting. In this way by tightening the second tie wire the antenna is raised above the ground. It should not be drawn too tight, but a certain amount of slack should be permitted.

The Lead-In Wire

The end of the wire leading to the receiving set must be fastened to the end of the antenna wire before the antenna is raised from the ground. The connection between these two wires is made as follows:

A metal connector is supplied with this type of antenna outfit. In its original condition it resembles two hollow, metal tubes fastened together. Through one of these tubes the end of the antenna wire passes in one direction, while the end of the insulated lead-in

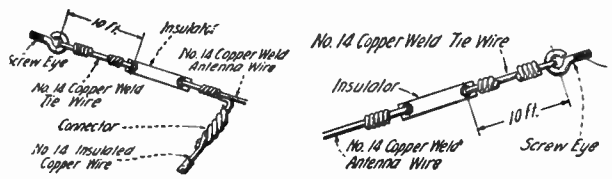


Fig. 2—To the left shows method of connecting the antenna to the lead-in wire. To the right shows the free end of the antenna and manner of fastening to support.

wire, from which six inches of the insulation has been removed, passes through the other tube in the opposite direction. By grasping each end of this connector with a pair of pliers and twisting, the two wires are bound together in this metal sleeve in the manner shown in Fig. 2, eliminating the necessity of soldering.

The lead-in wire should run in as near a direct line as possible from the antenna to the part of the house in which the receiving set is to be placed. Right angle turns in the lead-in wire should be avoided, in so far as possible. Where it is necessary to have the lead-in wire run along the side of a building, it should be raised on porcelain knobs, as shown in Fig. 4. This wire should be isolated from surrounding objects as far as possible.

Where the lead-in wire is to enter the building, it is essential to bore a hole in the wall (if the building is frame), or through the window casing in other types of buildings. This hole may be drilled with a $\frac{5}{8}$-in bit. The insulating bushing furnished with these outfits is then inserted in this hole through the building. The hole through the building should be made on an angle as shown in Fig. 4. The lead-in wire is then passed through the tube from the outside and a small loop should be left outside the building to permit the rain water to drop off both the lead-in and the insulating bushing.

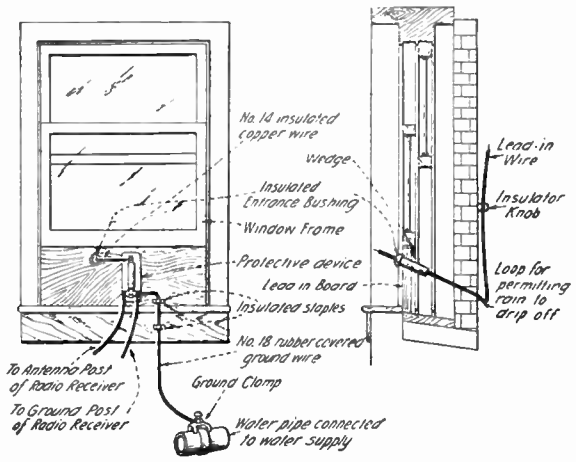


Fig. 4—Window board arrangement for leading in antenna wire to instrument.

Description of Window Board

A suitable method for making connections from a radio receiving antenna is illustrated by Fig. 4. This method is especially desirable in apartment houses for the reason that it obviates the necessity of drilling

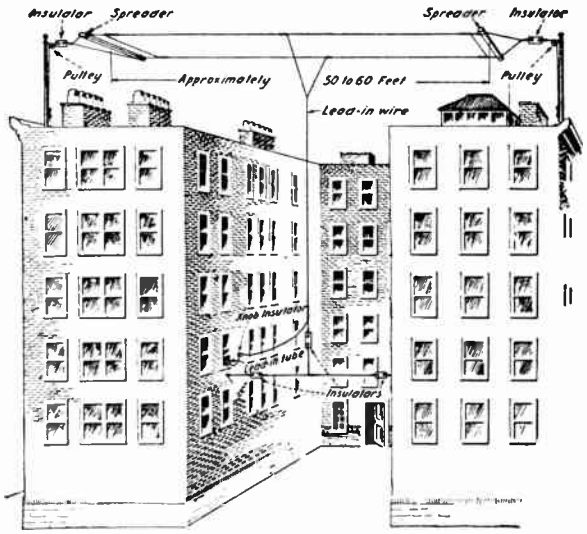


Fig. 3—Illustrating a method of installing an antenna on the roof of an apartment house.

holes through the wall or window frames.

A piece of board 10 or 11 inches wide and just long enough to extend across the window is held in place

by a wedge placed at either side of the window casing as shown. A hole is drilled through the board and the lead-in insulator passed through this hole. The protective device is screwed directly to this board in the position indicated and the lead-in wire is permanently attached to the terminal A of the protective device. The terminals R and G of the protective device are used for connection to the receiving set and the latter is also connected to the ground wire as described elsewhere.

Where this method is employed, the window may be opened or closed without interfering with the lead-in wire or the wires running to the receiving apparatus, and the protective device may be attached to the board without in any way mutilating the window casing or walls of the house.

The Installation of the Protective Device

This device is used to protect the receiving instruments as well as the house itself from possible damage caused by lightning flashes. It is a combination of a very small spark gap and fuse. It should be placed in some inconspicuous place, either on the wall or under the window frame, not far from the point at which the lead-in wire enters the building. The lead-in wire is fastened to one terminal of the protective device as shown in Fig. 4. To the other two terminals are connected the wires which run to the receiving set. It will be noticed in Fig. 4 that one of these two terminals is made to carry two wires. The second wire is called the ground wire and is made from a portion of the 50 feet of rubber-covered ground wire supplied with the antenna equipment. This wire may be run through the house by using some of the insulated staples supplied with the outfit.

Attaching the Ground Clamp and Running the Ground Wire

The ground clamp is a strip of metal made to fasten around a pipe and held in place by a clamping device. It is important that the pipe itself be scraped very clean, either by a knife, file or a coarse grade of sandpaper. After being sure that the pipe to which the clamp is to be attached is thoroughly cleaned, the ground clamp may be installed. It must fit over the pipe as tightly as possible. The ground wire, which runs from one terminal of this clamp to the protective device, as shown in Fig. 4, should be as short as possible. As is the case with the antenna lead-in wire, the ground wire should be as free from angles as possible, the ideal condition being found when the ground wire is very short and straight. With these instructions and references to the accompanying illustrations, no difficulty should be experienced in erecting an antenna which will give satisfaction under almost any conditions.

The Protective Device

The protective device does away with the necessity of having a large antenna grounding switch on the exterior of the building and precludes the possibility of the operator forgetting to throw this switch when the receiving equipment is not in use. This protective device is more thoroughly described elsewhere.

In large cities it is sometimes difficult to find a location where either a single or double wire, as shown in Fig. 1, can be erected. Fig. 3 gives a very good idea of the method which may be used in placing antennæ on apartment houses or office buildings. Where the building is 100 feet high or more and the receiving outfit is to be located on one of the lower floors, a single wire running from the roof to a point opposite, the location of the receiving apparatus will suffice to cover the ranges previously mentioned with regard to the sets described in this catalog. Where a building is lower than this, it is sometimes advisable to run a

Westinghouse Receiving Antenna Outfit

wire across the roof supported by any convenient object such as a water tower, a clothes pole, or a high chimney. This wire is then connected to the lead-in wire, which may be run to the receiving outfit. Where this method is employed, care must be taken to keep both the flat-top section of the antenna as well as the lead-in wire as far as possible from adjoining buildings.

The details of any receiving antenna may be worked out from observation of the foregoing instructions, and no difficulty should be experienced in getting satisfactory results.

The following antenna outfits comprise everything essential for installation. The outfits are packed complete with full instructions.

Antenna Outfit Model AD **$7.50**

Includes 150 feet No. 14 Copper Weld Antenna Wire; 50 feet No. 18 Copper Ground Wire; 50 feet No. 14 Copper Lead-in Wire; 1 PA Protector; 1 Entrance Bushing; 2 Antenna Insulators; 2 Screw Eyes; 1 Ground Clamp; 3 Porcelain Knobs; 1 Connector; 12 Insulated Staples.

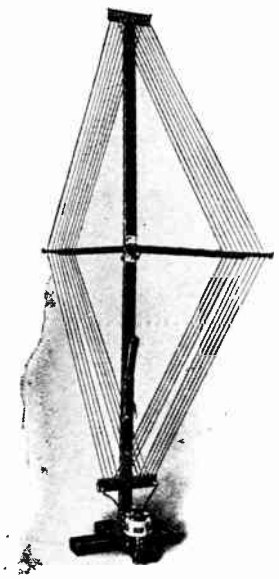
Antenna Outfit, Model AG-788 ..... **$7.50**

Includes 175 feet No. 14 Copper Weld Antenna Wire; 50 feet No. 14 Copper Lead-in Wire; 25 feet No. 14 Copper Ground Wire; 1 Protector; 1 Porcelain Entrance Bushing; 3 Antenna Insulators; 3 Screw Eyes; 1 Ground Clamp; 3 Porcelain Knobs; 12 Insulated Staples; 8 Wood Screws.

Collapsible Loop Antenna, Model AG-1380

(For Indoor Reception)

In general, loop antenna reception is found advisable for use in congested areas where interference from a number of transmitting stations operating at the same time is experienced. The reason for this is that the loop antenna responds only to signals from stations in the direction in which the loop points.



Loop Antenna

One of the difficulties experienced in loop reception is that the distance over which signals may be heard is considerably reduced unless suitable amplifiers are employed.

Loop reception, however, in the highly perfected state it is found in today, is so simple of operation that it is merely necessary to point the loop in the direction of the desired transmitting station, turn on the current and control the reception by a single adjustment. This adjustment is performed by a condenser generally mounted on the base of the loop.

The frame of the loop illustrated is artistically finished in mahogany and is entirely collapsible. The arms are rotated into position on hinges and the assembly is held rigidly in place by two metal hooks. The wire used for the winding of the loop is passed through bakelite cross arms fitted with milled slots. This wire is flexible and rubber covered. An outer covering of woven material is provided to resist wear when the loop is assembled, taken down, or carried about.

This loop has been designed for radio broadcasting reception, and when used in conjunction with the UC-1820 variable condenser and any of the detector-amplifier units described in this book with the necessary batteries, forms a complete short distance receiving station for broadcasting use which marks a distinct advance in the radio art.

While it is possible that loud speaking results may be realized over short distances with such combinations, it is not always to be expected when only audio-frequency amplification is employed. Such results, however, are common where the energy of the incoming signal is built up by means of radio frequency amplification before it is passed on to the detector tube to be rectified and thence amplified by audio frequency units. The construction of radio frequency amplification circuits from component parts is fully described on pages which follow.

Interference from static is greatly decreased by the use of the loop antenna for reception.

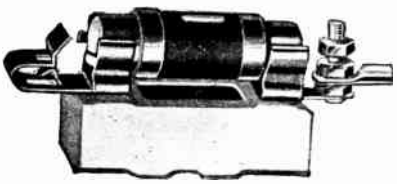
Model AG-1380, less Variable Condenser.....**$25.00**

4 ft. 10½ in.; closed 2 ft. 9 in.; base, 12 x 12 in. 10 lbs.

Lightning Arrestors

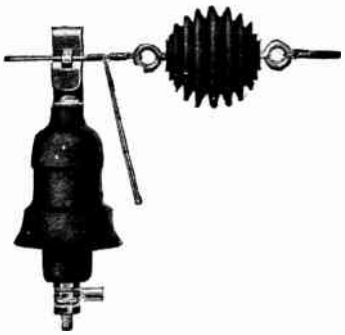
The Story of Lightning Protection

To fully appreciate the value of the Brach Radio gaps for protection from the effects of lightning where radio aerials are used. You must realize that a radio aerial, having its connections brought into the room, offers no less a hazard than if we were to have a lightning rod on a building, and in place of having that lightning rod suitably grounded in the earth, as all lightning rods should be; instead, if we were to bring the lightning rod into the room we would have a similar comparison in effect as what would exist when the radio aerial is brought into the room without suitable protection from lightning.



Brach Indoor Type, No. 200

It should be noted that when we refer to protection from lightning we do not necessarily mean against a direct lightning bolt hitting the aerial wire and following the path of the aerial wire into the building, but we refer particularly to the inductive effects of lightning, which more often occurs than that of a bolt directly striking.



Brach Outdoor Type, No. 223

During the momentary flash between Cloud and Cloud, or Cloud and Earth, a large area in the loca-

tion of the flash becomes charged with static of sufficient power to jump small distances across instrument connections or wires, and creates fires.

The function of the lightning arrester may be compared to a safety valve in a steam system; when the voltage becomes too high for the circuit to safely carry, the lightning arrester will operate, side-tracking this high voltage into the Earth.

On railroad signalling systems where Brach Vacuum Arresters are used, it has been frequently noted that during electrical storms these arresters would momentarily light up with a bluish glow indicating the passing of current through lightning arrester into the ground. Many railroads have adopted this type of arrester as standard after exhaustive tests, owing to the high degree of efficiency of the arrester and the uniformity.

Rule 86, Section C, of the National Board of Fire Underwriters, reads as follows:

> "In radio stations used for receiving only, the grounding switch may be replaced by a similarly mounted and grounded short-gap (⅛ inch or less) or vacuum type lightning arrester. The current carrying parts of devices must be kept five (5) inches clear of the building wall."

Radio engineers recommend the use of the vacuum type arrester on account of the uniformity of protection.

In the case of the air gap types, the efficiency would entirely depend on the closeness of gaps. To safely protect it would be necessary to adjust the gaps very close, incoming radio signals would often be lost either through dust or dirt collecting between the gaps or the metals becoming fused together by reason of lightning discharges. In the case of the vacuum arrester where the gaps are widely separated, they are fully protected against these conditions.

The spacing of Electrodes in the Brach Vacuum Arrester of approximately 3/16 inch has an air gap equivalent of approximately .001 inch in air.

Brach Arresters have been used by the U. S. Government during the war, and since by a number of the oldest and largest radio manufacturers as regular equipment. Brach Arresters will not interfere with incoming signals.

By referring to the rules mentioned above, you may note that the Brach Arresters may be used in place of the grounding switch, thereby protecting the circuits automatically.

Brach, No. 223, Outdoor $3.00

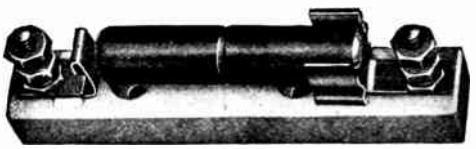
Brach, No. 200, Indoor $2.50

Receiving Antenna Protective Devices

These devices are standard units supplied with R. C. receiving antenna outfits. However, they may be used satisfactorily with any other type of receiving antenna equipment. Their purpose is to supply a means for protecting the receiving station as well as the building in which it is located from any serious effects which might be caused by lightning.

Heretofore, it has been necessary to have a large switch mounted on the outside of the building with a heavy wire running to an outside ground connection. Although this switch formed a satisfactory method for carrying electrical charges to the earth, there was always the possibility of the operator forgetting to throw the switch after he had finished receiving. With the protective device no such possibility as this can arise, for there is no switch to be thrown. Once it has been installed it functions without further attention.

Two types of antenna protective devices are available. Model UQ-1310 is the vacuum type; Model PA, as shown, is the fuse type. Both are suitable for receiving purposes, but not for transmission.



G. E. Lightning Protector

G. E. Receiving Antenna Protective Device, Model UQ-1310 ..... $2.50

Westinghouse Receiving Antenna Protective Device, Model PA $2.00

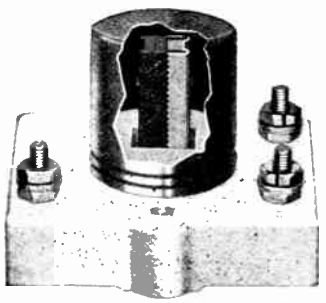
Dimensions: 7½ in. x 2½ in. x 1½ in.
Weights: Net, 10 oz.; Shipping, 1 lb.

Frost-Radio Lightning Protector

Approved by Underwriters' Laboratories under April, 1922, regulations.

Never grounds, no interference, self-cleaning.

Mounts indoors like your telephone protector.



Frost Lightning Protector

Every home Receiving Set must be protected under new regulations.

Price, each $1.50

Ground Switches, Fittings, Etc.

Ground Switches

S. P. D. T. 1¼ in. and 2¼ in. periphery of blade; 5 in. break; on asbestos wood base.

One end connects aerial to ground and protects against lightning. Other ends connects aerial to instruments. Base cannot absorb moisture. Made to meet latest Underwriters' requirements.

Cat. No. 8727

1¼ in. periphery of blade; 5 in. break. 60 amp. stock. Exceeds Underwriters' specifications, which call for ¾ in. periphery of blade.

No. 8727 ..... $2.65

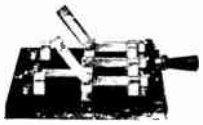
Cat. No. 8729

2¼ in. periphery of blade; 5 in. break. For use when especially heavy material is desired. 100 amp. stock. Center posts are of extremely rugged construction.

No. 8729 ..... $3.15

"Antenna" Switch

30 amp. Slate base. 3 P. D. T. angle blades. Used in receiving and sending wireless messages. Receive



Antenna Switch

on D. P.; send on 3 P. On slate base, 7in. x 8 in. x ¾ in.

Price $3.10

Flexible Varnished Tubing

Flexible varnished tubing commonly called "spaghetti" tubing, is the ideal insulation for covering top wires and protecting form wiring. Its dielectric strength is 7000 volts. Stock colors: yellow, black, red, and green. Special colors to match samples on quantity orders. Made to cover standard B. & S. gauge No. 14 wire.

Price, per foot, any color, No. 8 for 14 wire or smaller ..... $ .09

Price per foot, any color, No. 9 for 10 wire or smaller ..... $ .09

Ground Fittings

The ground cap and point are made to take a ¾ in. pipe and are used on ground rods. The cap is of substantial malleable iron to screw into the top of ground pipe, and prevents the end being tattered out of shape in driving.

Ground Point

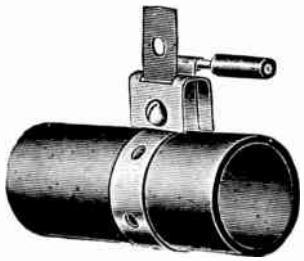
Ground Cap

The point is of malleable iron to fit into pipe to facilitate driving.

Price, Ground Point $0.45

Price, Ground Cap ..... .45

Ground Wire Clamps

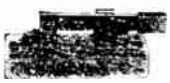


½ to 1" pipe, Type A, each ..... $ .25

½ to 2" pipe, Type B, each ..... .30

½ to 3" pipe, Type C, each ..... .35

Small Knife Switches



No. 707

No. 709

No. 707 Trumbull SP. ST., each ..... $ .40

No. 708 Trumbull SP. DT., each ..... .64

No. 709 Trumbull DP. ST., each ..... .70

No. 710 Trumbull DP. DT., each 1.00

Magnet Wire

Single Cotton Covered

	¼-lb. spools each	½-lb. spools each	1-lb. spools each	Large Spools 5 and 10 lb. per lb.
18	$ .29	$ .39	$ .74	$ .50
19	.29½	.40	.76	.52
20	.30	.42	.80	.56
21	.31	.44	.84	.60
22	.32	.46	.88	.64
23	.34	.49	.94	.70
24	.36	.52	1.00	.76
25	.38	.56	1.08	.84
26	.43	.63	1.20	.96
27	.45	.66	1.28	1.00
28	.47	.70½	1.37	1.09
29	.51	.76½	1.49	1.21
30	.54	.83	1.62	1.34
32	.72	1.36	2.00	1.58

Double Cotton Covered

	¼-lb. spools each	½-lb. spools each	1-lb. spools each	Large Spools 5 and 10 lb. per lb.
18	$ .31	$ .43	$ .82	$ .58
19	.32	.44½	.85	.60
20	.33	.46½	.89	.65
21	.34	.48½	.93	.69
22	.36	.52½	1.01	.77
23	.39	.56½	1.09	.85
24	.41	.61½	1.19	.95
25	.44	.66¾	1.30	1.05
26	.51	.76½	1.50	1.21
27	.55	.83¾	1.64	1.35
28	.59	.92	1.80	1.52
29	.63	.98	1.92	1.64
30	.67	1.07	2.10	1.82
32	.85	1.41	2.62	2.30

Single Silk Covered

	¼-lb. Spools each	½-lb. Spools each	1-lb. Spools each
20	$ .41	$ .61	$1.18
21	.42	.63	1.22
22	.44	.65	1.30
23	.45	.70	1.36
24	.48	.75	1.46
25	.52	.81	1.58
26	.57	.88	1.72
27	.62	.98	1.92
28	.68	1.08	2.12
29	.73	1.19	2.34
30	.84	1.35	2.68
31	.98	1.57	3.02
32	1.09	1.76	3.42

Double Silk Covered

	¼-lb. Spools each	½-lb. Spools each	1-lb. Spools each
20	$ .49	$ .76	$1.48
21	.51	.80	1.56
22	.54	.85	1.66
23	.59	.92	1.80
24	.62	.99½	1.95
25	.69	1.13½	2.23
26	.81	1.31	2.58
27	.89	1.45	2.86
28	1.00	1.65	3.26
29	1.09	1.82	3.60
30	1.24	2.10	4.16
31	1.47	2.47	4.84
32	1.65	2.79	5.48

Stranded Copper Aerial Wire, Tinned or Bare

This wire is selected by the discriminating amateur and is very efficient for aerial purposes.

No. 14 stranded 7 strands (No. 22) Tinned, approximately 13½ lbs. M ft.

100 ft. Coils each	$1.00
200 ft. Coils, each	2.00
50 lb. Reels, per lb.	.75
100 lb. Reels, per lb.	.75

Solid Copper Aerial Wire, Tinned or Bare

No. 14 Solid Tinned, approximately 12½ lbs. M ft.

100 ft. Coils, each	$ 1.00
200 ft. Coils, each	2.00
50 lb. Reels, per lb.	.75
100 lb. Reels, per lb.	.75

Ground Wire

No. 8 S B R C Solid, per ft.	$ .08
No. 4 S B R C Solid, per ft.	.12
No. 14 S B R C Solid, per ft.	.03

Phosphor Bronze Aerial Wire

No. 14 Stranded (7 strands No. 22), per 100 ft. **$2.00**

Miscellaneous Wire

No. 18 Twisted Lamp Cord (cotton), ft.	$ .08
No. 20 Twisted Lamp Cord (cotton), ft.	.08
No. 22 Twisted Bell Cord (silk), ft.	.10
No. 18 Annunciator Wire (150 ft. per lb.)	
½ lb. Coils, each	$ .50
1 lb. Spools, each	1.00
5 lb. Spools, each	4.00
No. 15—Square Tinned Wire, per ft.	.2½

Belden Braided Copper Wire

¼" wide, 240 strands—36 copper, per ft.	$ .15
3/16" wide, 120 strands—36 copper, per ft.	.10
3/32" wide, 48 strands—36 copper, per ft.	.08

Friction Tape

Black Friction Tape, 1 oz. rolls, each	$ .05
Black Friction Tape, 2 oz. rolls, each	.10
Black Friction Tape, 4 oz. rolls, each	.20
Black Friction Tape, 8 oz. rolls, each	.40

Insulators

HOPEWELL

Points the Way to Better Insulation

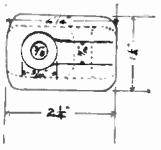
	Length	Price
No. 195 Strain	2½″	$0.25
No. 196 Strain	3″	.30
No. 197 Strain	4″	.50
No. 198 Strain	18½″	4.00
No. 199 Strain	7½″	1.30

No. 195 and 196

No. 197

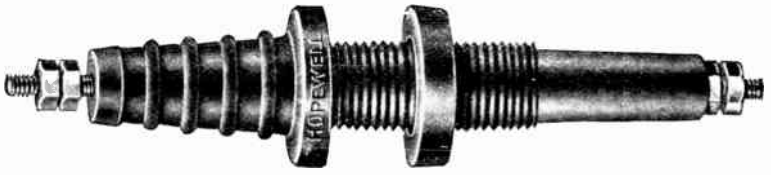
No. 199

	Price
No. 500—Porcelain Ball	$0.20



No. 500

Lead-In Insulators



No. 308

No.	Length Below Shoulder	Height Above Shoulder	Price
No. 304A	2″	1⅝″	$1.20
No. 305	2″	3″	1.40
No. 308A	2 1/3″	3½″	1.70
No. 308B	2 1/3″	3½″	1.70
No. 310A	10″	5½″	3.70

Thomas Porcelain Strain

A particularly sturdy strain insulator of brown glazed porcelain.

No. 7012

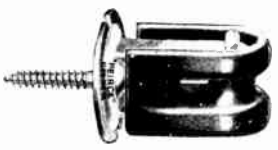
Length, 2¼″.
Width, 1⅝″.

This insulator has three ¼″ flanges with ¼″ separation, increasing its insulation surface.

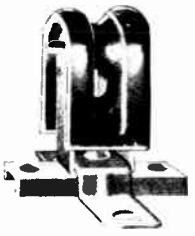
No. 7012	$0.10

Miscellaneous

	Price
No. 190—Hubbard Reg. Short Type Screw	$0.25
No. 191—Hubbard Reg. Type Foot	.25

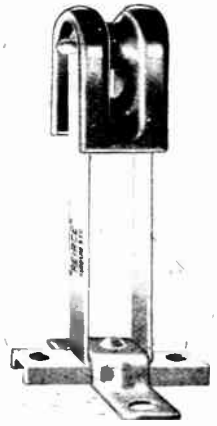


No. 190



No. 191

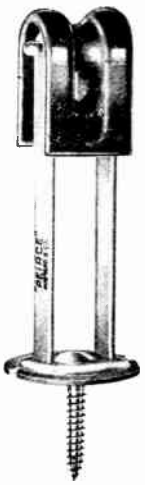
No. 191—Hubbard Reg. 5″ Wall Spacing	$0.60



No. 174

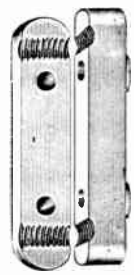
174 Hubbard reg. 5″ wall spacing, foot type	.80

173 Hubbard reg. 5" wall spacing, large	.75	2 Wire porcelain cleats	.05



No. 173

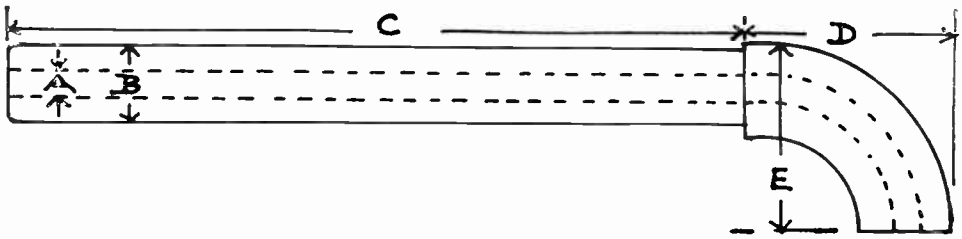
Nail-It-Knob



Cleat

5/8" Porcelain screw eyes	.15	Nail it Knobs	.05
1" Porcelain screw eyes	.25	3" x 5/16" Porcelain Tubes	.05
9420 Ground Wire Knobs, Large	.15	6" x 5/16" Porcelain Tubes	.10
9419 Ground Wire Knobs, Small	.10	12" x 5/16" Porcelain Tubes	.20

Lead-In Insulators



Curved End Brown Glaze Porcelain Entrance Tubes

Wet Process High Tension

Standard Package 100

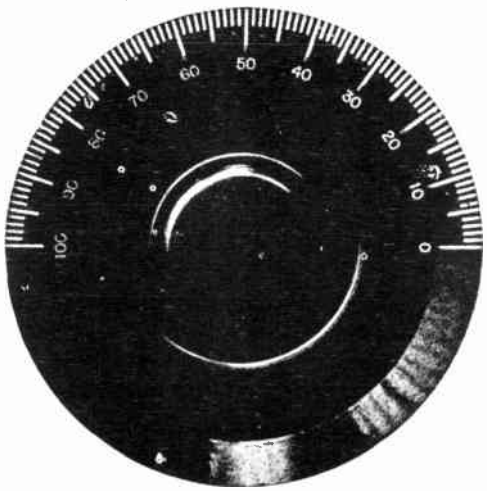
Number	A	B	C	D	Price
8135	3/8 in.	13/16 in.	6	2 in.	$75.00
8136	3/8 in.	13/16 in.	8	2 in.	79.00
8137	3/8 in.	13/16 in.	10	2 in.	83.00
8138	3/8 in.	13/16 in.	12	2 in.	100.00
8139	1/2 in.	15/16 in.	6	2 1/8 in.	83.00
8140	1/2 in.	15/16 in.	8	2 1/8 in.	86.00
8141	1/2 in.	15/16 in.	10	2 1/8 in.	90.00
8142	1/2 in.	15/16 in.	12	2 1/8 in.	110.00

Mica Covered Lead-in Insulators 1.50

Dials

Universal Dials

These dials are made of high-grade black composition. The edge is beveled, and the numerals and radial lines are engraved and filled with brilliant white, in sharp contrast to the highly polished black surface. There are 100 divisions on the scale, running from right to left. A brass bushing insures the dial running true and firm. These dials are made to compete with the best, regardless of price.



Universal Dial

No. 50	2″ Dial, Shaft 3/16″	$0.35
No. 51	2″ Dial, Shaft ¼/	.35
No. 52	3″ Dial, Shaft 3/16″	.35
No. 53	3″ Dial, Shaft ¼″	.35

Na-Ald Dials

The following points will thoroughly convince one of the quality of the Na-Ald Dial:

(1) When fingers are placed on the dial the numerals can be plainly seen.

(2) Numerals are good size and very clear cut.

Na-Ald Dial

(3) The edge of the dial is thin where it meets the panel, facilitating accurate reading.

(4) The numerals are filled with a special enamel, not wax; will not turn yellow.

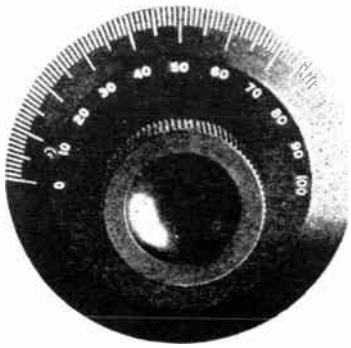
(5) Every dial is true.

(6) Set screw has metal insert.

No. 70	Na-Ald Dial, Diam. 2″, Shaft 3/16″	$0.35
No. 71	Na-Ald Dial, Diam. 2″, Shaft ¼″	.35
No. 72	Na-Ald Dial, Diam. 3″, Shaft 3/16″	.35
No. 73	Na Ald Dial, Diam. 3″, Shaft ¼″	.35
No. 74	Na-Ald Dial, Diam. 3⅞″, Shaft 3/16″	.75
No. 75	Na-Ald Dial, Diam. 3⅞″, Diam. 3/16″	.75

Chelsea Dials

The Chelsea dials are made of genuine bakelite, beautifully finished, and bear a 100 division semi-circular scale. This scale is of white characters and so constructed as to be both deep-set and sharply defined. These divisions and characters are permanent and will neither wear off nor fall out.



Chelsea Dial

The dial is 3¼ inches in diameter, ¼ inch thick, with a long, sloping, easily read marking. The edge is sharp and permits accurate settings to be made. The knob also is of bakelite, 1⅜ in. in diameter, with a fine, straight knurled edge, which greatly aids the making of fine adjustments. These two parts are permanently fastened together by a long brass bushing, which also serves to carry the set screw for attaching to the instrument shaft, and, more important, to give perfect alignment in use. Chelsea bakelite dials run true, and will not warp.

Dial and Knob, complete $0.75

Chelsea Rheostat Dial

The Chelsea rheostat dial reads 0 to 80 and is cali brated .8 of the circle which is just the proper reading for most rheostats.

No. 43-0-80 ..... $0.75

Size: 2⅝″x2⅝″x1½″.

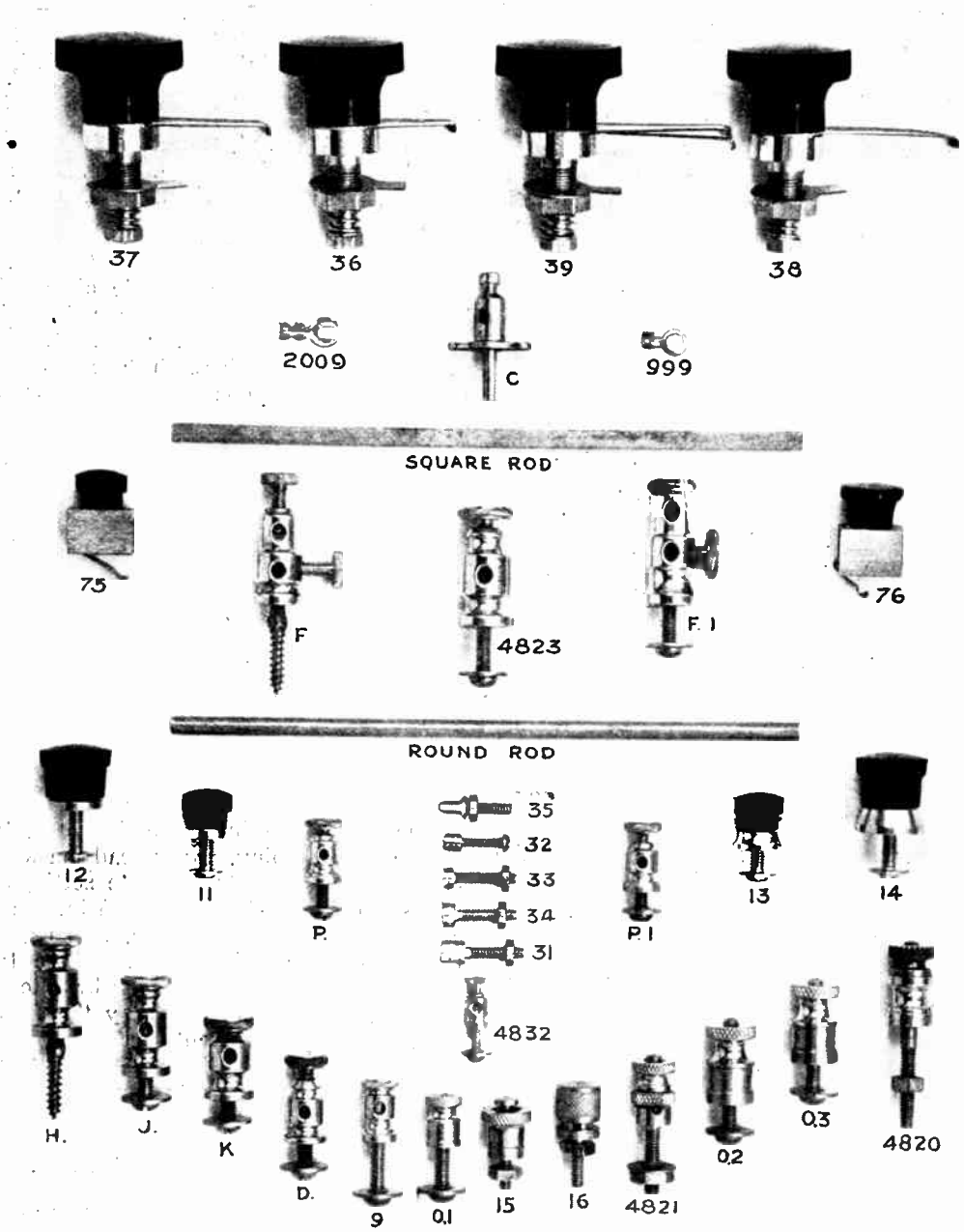
Shipping Weight: ¼ lb.

Remler No. 100 Bakelite Dial

This Remler 3 in. bevel edged dial is molded from genuine bakelite and will not warp or discolor. It is not brittle like composition. The surface is highly polished and will add to the appearance of any panel. The engraving is filled with white enamel and the 100 division scale reads from right to left for clockwise rotation.

No. 100—Remler 3″ Bakelite Dial with knob and bushing, specify 3/16″ or ¼″ shaft $0.75

Switches, Binding Posts, Etc.



No. 37—Rotary Switch Arm, 1½" radius $0.60
No. 36—Rotary Switch Arm, 1⅛" radius ..... .60
No. 39—Rotary Switch Arm, 1¾" radius (Dead-end type) ..... .75
No. 38—Rotary Switch Arm, 1¾" radius ..... .60
No. 2009—Wire Terminal ..... .02
No. C—Binding Post ..... .06
No. 999—Wire Terminal ..... .01
¼" Square Brass Rod, per inch... .02
3/16" Square Brass Rod, per inch. .01½
No. 75—Brass Slider to slip ¼" Square Rod ..... .25
No. F—Binding Post ..... .20
No. 4823—Binding Post ..... .25
No. F1—Binding Post ..... .20
No. 76—Brass Slider to slip 3/16" Square Rod ..... .22
3/16" Round Brass Rod, per inch. .01
¼" Round Brass Rod, per inch... .02
No. 12—Binding Post ..... .10
No. 11—Binding Post ..... .08
No. P—Binding Post ..... .06
No. 35—Switch Stop, with Shank and Nut ..... .03
No. 32—Switch Point, 3/16"x3/16" with Shank and Nut..... .02
No 32A-Switch Point, 3/16"x3/16" with Screw ..... .02
No. 33—Switch Point, 3/16"x1/8" with Shank and Nut..... .02
No 33A-Switch Point, 3/16"x⅛" with Screw ..... .02
No. 34—Switch Point, 1/4" x 1/8" with Shank and Nut..... .02
No. 34A—Switch Point, 1/4"x1/8" with Screw ..... .02
No. 31—Switch Point, 1/4" x 1/4" with Shank and Nut..... .02
No. 31A-Switch Point, 1/4" x 1/4" with Screw ..... .02
No. P-1—Binding Post ..... .06
No. 13—Binding Post ..... .10
No. 14—Binding Post ..... .12
No. 4832—Binding Post ..... .09
No. H—Binding Post ..... .12
No. J—Binding Post ..... .15
No. K—Binding Post ..... .12
No. D—Binding Post ..... .08
No. G—Binding Post ..... .07
No. O-1 Binding Post (Small).... .08
No. 15—Binding Post ..... .15
No. 16—Binding Post ..... .15
No. 4821—Binding Post ..... .22
No. O-2—Binding Post (Medium). .10
No. O-3—Binding Post (Large)... .12
No. 4820—Binding Post ..... .24

EBY Binding Posts

Midget

Cut illustrates the *Midget* post with a threaded stud and nut. This post can also be furnished with a **solid** threaded stem at a slight increase in cost.

The approximate diameter of Midget is 5/16" x ⅜" high when closed. Slot is 1/16" x 1/16" and will readily take a No. 15 bare wire.

List each with stud and nut—

Brass	$0.08
Tumble Nickel	.09
Polished Nickel	.10

Buddy

Amateurs and manufacturers of electrical apparatus will find the *Buddy* posts to be ideal for quick mounting on panels, etc., where thickness of the panel or base does not exceed ¼".

The slot in this post is the same as the Corporal, therefore readily accommodating a standard telephone cord terminal.

Furnished as shown, at the following list prices—

Brass	$0.10
Tumble Nickel	.11
Polished Nickel	.12

Corporal

The *Corporal* post differs from the Buddy only in design of base, it being tapped to take a standard 6-32 machine screw or threaded stud.

The milled slot in this post, in which operates a sliding shoe or member, is 3/32" wide, and will readily accommodate a standard telephone cord terminal or No. 12 wire.

Furnished as shown at the following list prices:

Brass	$0.10
Tumble Nickel	.11
Polished Nickel	.12

Sergeant SS

Sergeant SS is the latest style ½" metal post.

This post is the same diameter and height as the standard Sergeant post, but it is furnished with a solid 10-32 threaded stem in various lengths.

The milled slot is ⅛" or the same dimensions as the Sergeant, and the base is heavily knurled to prevent turning.

Furnished in 3 different finishes and lengths, as follows:

	Brass	Tumble Nickel	Polished Nickel
½" solid stem	$0.16	$0.18	$0.20
⅝" solid stem	.18	.20	.22
¾" solid stem	.20	.22	.24

Sergeant

The *Sergeant* post, while it resembles the Sergeant SS, is furnished with a tapped base, to take a standard 10-32 machine screw or threaded stud.

This post being only ⅝" high when closed, is especially suitable for use on thick panels or bases where a long stud or screw is necessary.

The slot in this post is ⅛", and it will readily accommodate a telephone cord terminal, also a No. 9 bare wire.

Furnished with ½" brass machine screw and washer, at the following list prices:

Brass	$0.15
Tumble Nickel	.16
Polished Nickel	.18

Captain

The *Captain* post is the same design as the Sergeant, with the exception that it is ⅝" in diameter, 1" high when closed, and the square slot is 3/16" wide, and will readily accommodate a No. 6 bare wire.

The base is heavily knurled and tapped 14-24 to take a standard machine screw, or threaded stud.

Furnished with ⅝" brass machine screw and washer, at the following prices:

Brass	$0.35
Tumble Nickel	.38
Polished Nickel	.40

Ace

Manufacturers of miscellaneous small radio sets and apparatus will find the *Ace* post especially suitable for their needs.

Its parts comprise the standard Junior insulated knob and a polished nickel solid brass base threaded on each end, 8-32 thread.

The base of this post, like the other metal posts, is knurled, which prevents turning when mounted. A hole is drilled through upper stem flush with base to accommodate a No. 15 bare wire.

List, each including nut $0.10

Junior "H"

The *Junior H* insulated post resembles the Ensign H in appearance, but like the Ace post, the top is removable.

This post can be used on various apparatus where a cheap, serviceable and good looking post is desired.

A hole is drilled at the base of the 8-32 neck, which accommodates a No. 15 bare wire.

List, each, including nut $0.15

Ensign "H"

The unique design of the *Ensign H* post has won for it the universal approval of the radio trade. In addition to it being attractive in appearance, the cap is non-removable, and the hole drilled at the base of the neck readily accommodates a standard telephone cord terminal.

Its unusually large contact surfaces also permit a positive contact to be made when a fork terminal or looped wire is used. The 6-32 threaded stem is 5/8" long and the base is now provided with a metal insert knurled to prevent turning.

List, each, including nut.....$0.20

Commander "H"

The *Commander H* post having all of the unique features which are embodied in the Ensign H post will be found especially suitable for use on high grade radio sets.

The diameter of this post is 5/8", and height from base to top when closed, 3/4".

The 8-32 threaded stem is 3/4" long, a the base is now provided with a metal sert knurled to prevent turning.

List, each, including nut.....$0.

Commander S

Manufacturers of high-grade instr ments and wireless apparatus will find t *Commander S* to be an ideal insulat binding post.

The interior construction of this post i the same as the Corporal metal post, bein fitted with a slot and sliding shoe, whic operates parallel in the slot.

This unique feature permits a positiv contact to be made on a No. 40 bare wir or on a standard telephone cord tip. Th unusually large circular contact surface also assure a positive connection when standard for terminal or looped wire used.

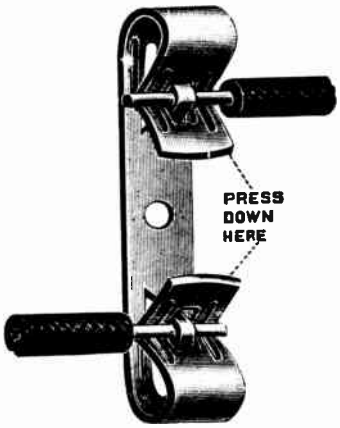
List, each including nut.....$0

Fahnestock Connectors

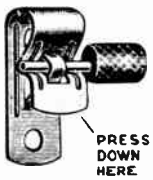
Fahnestock Connectors are manufactured of spring brass which is the best material possible, except when they are used outside, subjected to extreme cold and weather conditions. For this use we recommend Fahnestock Connectors, made of special copper bronze spring metal.

Cat. No.	Size of Wire	Length Over-all	Width	For Size Screw
15	No. 16	1/2"	7/32"	No. 4
10	No. 14	3/4"	5/16"	No. 6
3	No. 12	7/8"	3/8"	No. 6
5	No. 10	1 1/16"	3/8"	No. 8
9	No. 10	2 1/16"	3/8"	No. 8

	Plain Brass	Nickel Brass
No. 3 Connectors, per 100	$4.50	$5.00
No. 3C Connectors, per 100	4.50	5.00
No. 9 Connectors, per 100	6.50	7.00
No. 10 Connectors, per 100	4.50	5.00
No. 15 Connectors, per 100	2.50	2.50



No. 9 Full Size



No. 10 Full Size

No. 15 Full Size

No. 3 Full Size

No. 3-C Full Size

No. 5. Price 25 cents.

The most efficient and reliable switch of its k on the market. The base is of molded composit and waterproof. Fahnestock spring binding r are all wire connections.

No. 5 Full Size

Easy to install and there can be no such thing a loose connection.

No. 6. Double Point Switch. Price 30 cents.

Can be wired up in an instant without the use tools. All metal parts are securely riveted to ba

Remler Rotary Switch Levers

The Remler switches are undoubtedly one of the finest switches manufactured.

All levers are ground to insure smooth running, self cleaning, knife edge contact.

No. 83

No. 95

Laminated levers are formed and ground in pairs. The coil spring tension insures sufficient flexibility for smooth operation. When mounting,(it need not be disassembled, as the lock nut clears the spring

No. 83—Plain Type Rotary Lever Switch. Knurled insulating knob. Polished N. P. washer 3/16" x ½". Price.....$0.45

No. 95 Plain Type Rotary Lever Switch. 1" radius, Remler No. 10, 1⅜" Bakelite Knob, bearing washer ¼" x ¾". Used on Type 330 Detector Panel and Type 505 Vario-Coupler. Price, each $0.60

Universal Battery Clip, No. 24-A

Made of steel; lead-coated to resist acid fumes; screw connection for cord; one jaw with teeth, the other notched so that the clip will stand straight up with no tendency to lop over when applied to round terminal posts.

No. 24A

For use in making a secure connection to "A" and "B" storage batteries; also convenient for tapping off various voltages from "B" batteries.

It is the generally accepted standard for use on rectifier outfits.

No.24A—15 amperes 1" spread of jaws, each..... .15

Universal Test Clip, No. 27

Made of copper; natural finish; 10 ampere capacity; screw connections for cord; spread of jaws 9/16"; jaws with teeth on three sides; flanged and ribbed throughout for strength.

For use as a quick and ready means of connecting: "B" dry batteries, oscillation transformers, helices,

No. 27

tubes, anywhere for electrical contacts, also for holding crystals.

No.27—10 amperes, 9/16" spread of jaws, each...$0.17

Test Clips—Spring

No. 2—Morse Eureka, regular size with side tooth, each ..... .10

No. 4—Morse Eureka, medium size without side tooth, each..... .07½

No. 7—Morse Eureka, small size with side tooth, each ..... .05

No. 8—Morse Eureka storage battery clip, ea. .35

No. 9—Morse Eureka storage battery clip, special metal, each..... .60

Pacent Cam Switch

One of those many features that tend to make the leading radio apparatus of today so practical, as compared with the crude, cumbersome and tiresome apparatus of not so long ago, is the Pacent Radio Cam Switch. This switch permits of switching from one circuit to another by the mere flip of a single key, yet the action is absolutely positive and accurate. The key is turned one way for a given connection, and the other way for another given connection. In the center position he circuits are disconnected. The action has that positive click which is so pleasing to the touch of the real radio man. It inspires confidence, and results in the best work.

The Pacent Cam Switch is designed for radio. Its construction is exceptionally rugged. It is being used by commercial radio companies in their highest grade of apparatus. It is essential for numerous radio purposes.

Cat. No. 71 D.P.D.T. 12 Spring Cam Switch.....$2.80

Cat. No. 72 D.P.S.T. 4 Spring Cam Switch..... 2.55

Cat. No. 73 D.P.S.T. 4 Spring Cam Switch..... 2.55

On the No. 71 and 73 switch the contacts are normally open and on the No. 72 they are all normally closed.

Etched Name Plates

Price, each $0.15

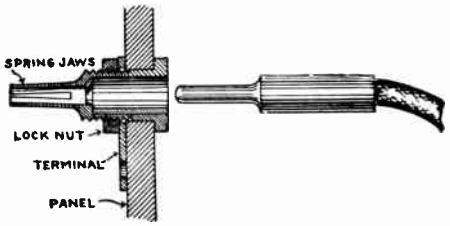
Arrow Increase Current, Price..... .25

"A" Battery
Series
"B" Battery

Primary Condenser
Vacuum Tube
Secondary Condenser
Transmit
Plate Variometer
Receive
Primary
Ground
Secondary
Loading Coil
Grid Variometer
Input
Telephone
Aerial
Output
Tickler
Detector Tube
Coupling
Parallel
Audion
Detector
1st Step
2nd Step
3rd Step
On
Off

Doran Radio Jacks

Made to receive the cord tips direct, these jacks or sockets are becoming very popular. They have spring jaws which engage any standard cord tip,

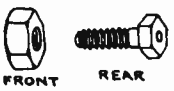


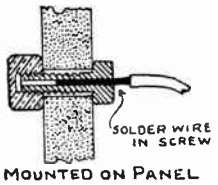
they occupy but very small space on the panel, giving a very neat appearance, and permitting the use of many head sets.

List price, per pair $0.25

Doran Switch Points

These switch points are a radical improvement. The rear screw is drilled so that the tap wire can be securely soldered in. The screw is inserted from the rear, and the contact head is screwed on at the front. This permits quick and easy assembling; prevents





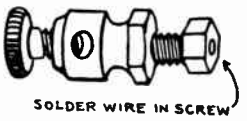
MOUNTED ON PANEL

any abuse of the tap wires; guards against the wires accidentally touching each other; and gives a perfect connection. Doran switch points remove the old tedious difficult task of attaching tap wires with little nuts, and trying to get them tight without having the wires strike each other.

List price, each $0.03

Doran Binding Posts

Doran binding posts are far superior to any others in the method of attaching the interior wires. (They



are mounted in the same manner as the Doran switch points.) The connecting wire is to be soldered into the attaching screw, passed through the panel; and then the binding post screwed on from the front. A hexagon base is provided to permit setting up tightly with a wrench.

We also furnish hard rubber binding posts with this same manner of rear connection.

List price, each $0.10

Seamless Gray Cardboard Tubes

3 in.	Inside dia., 7 in. long, 1/8-in. wall, each	$ .25
3½-in.	Inside dia., 7 in long, 1/8-in. wall, each	.25
4-in.	Inside dia., 7 in. long, 1/8-in. wall, each	.25
4½-in.	Inside dia., 7 in. long, 1/8-in. wall, each	.25
5 in.	Inside dia., 7 in. long, 1/8-in. wall, each	.25

Condensite Celoron Tubes

Inside Diameter	Wall	4" Length	6" Length
2¾	1/8	$ .84	$1.26
3	3/32	.71	1.06
3½	3/32	.76	1.15
4	3/32	.81	1.27
4⅜	1/8	1.09	1.63
4½	3/32	.84	1.25
	3/32	.88	1.32

Buzzers High Pitch

168—Century $2.50
666—Ansonia 1.25

No. R-6A

Telegraph Keys, etc.

R-6A—Signal Wireless Practice Set $2.70
342—Mesco Wireless Practice Set 3.75
344—Mesco Wireless Practice Set 3.25
49—Mesco Wireless Key $1.50
51—Mesco Wireless Key on Base 1.50
80—Mesco Hand Radio Key 4.00

Cutler-Hammer Knobs

No. 13

No. 32

No. 13—Knob, 1¼ in. diameter $0.13

No. 32—Knob (Base), 1⅜ in. diameter ..... .15

No. 6

No. 6—Knob (Base), 1⅜ in. diameter ..... .12

No. 34

No. 35

No. 34—Knob (Base), 1⅜ in. diameter ..... .16

No. 35—Knob (Base), 1 1/16 in. diameter ..... .13

No. 33

No. 7

No. 33—Knob (Base), 1⅜ in. diameter 15

No. 7—Knob, 1 1/16 in. diameter 10

Weston Instruments

Model 301 Filament Voltmeters Dimensions

The greatest need for instruments in amateur radio service is for regulation of the filament current of detector or amplifier tubes used in receiving and transmitting sets. While the vast majority of users are still regulating by controlling the current passing through the filament, the latest practice is that of controlling the voltage of the filament circuit by placing an accurate voltmeter directly across the socket and obtaining the drop over the filament.

The most prominent manufacturer of tubes and other recognized authorities state very emphatically that this means of control is much more satisfactory and economical than using an ammeter for current

Model 301 Filament Voltmeter

control of the filament circuit. Indeed, they claim that by voltage control the life of the tube may be prolonged in the ratio of three to one as compared to the life with current control.

It is advisable to remember that maintaining the current passing through the filament at a fixed value causes the filament to disintegrate more rapidly as its age increases, whereas maintaining a constant voltage may only very slightly diminish the value of the results, but at the same time, it will very greatly prolong the life and usefulness of the tube.

Furthermore, a voltmeter may be readily connected across any one or all of a number of tubes which are usually connected in parallel, whereas with current control, it would be desirable to obtain an ammeter for every tube.

It will, therefore, be understood why we recommend and advocate the use of voltmeters for filament regulation and when it is stated that the voltage should be maintained within a very narrow range it is necessary to state why an accurate and thoroughly dependable voltmeter, that will last a lifetime with reasonable care, is the best kind of an investment, especially when Weston Model 301 voltmeters cost but a trifle more than a single tube.

	Flush	Surface
Case diameter	3.25″	2.75″
Body diameter	2.56″	...
Depth	1.17″	1.23″
Scale length	2.35″	2.35″

Weston Filament Voltmeters

Range, Volts	Code Word	Price
7	Autobax	$8.00
8	Autobail	8.00
10	Autobath	8.00
15	Autobasket	8.00

Model 301 Plate Voltage Voltmeters

	Flush	Surface
Case diameter	3.25″	2.75″
Body diameter	2.56″	...
Depth	1.17″	1.23″
Scale length	2.35″	2.35″

The more anxious one becomes to obtain the best possible results from a receiving set the more neces-

sary it is to pay proper attention to the plate voltage applied to the tubes. In detector tubes the most desirable voltage as shown by the characteristic curves is approximately 21 volts and any large variation from the value will affect the quality and loudness of the reception. In amplifying tubes the loudness of reception is materially increased by increasing the plate voltage which with the ordinary tube should be between 40 and 100 volts. Unless a voltmeter is used there is no quick way of knowing whether the B-battery is in good order. Should there be any failure of the battery or the circuit, the voltmeter indicates the trouble immediately.

It is sufficient to use one voltmeter and provide a selector switch or jack for connecting the voltmeter either to the detector or amplifier plate circuits and for this reason it is desirable to select either a 50-volt or a 100-volt range instrument depending upon the highest voltage used on the amplifier tubes.

Transmitting sets require voltmeters of higher range on account of the higher voltage necessary to obtain proper oscillating characteristics and requisite power output. Depending upon the individual needs, transmitting set voltmeters are furnished with a range of 500, 1000, 1500 or 2000 volts.

Weston Plate Voltage Voltmeters

Range, Volts	Code Word	External Resistor	Price
50	Autobattle	None	$8.00
100	Autobat	A	13.00
500	Autobaton	B	17.00
1000	Autobazux	C	24.00
1500	Autobaway	C	30.00
2000	Autobayou	C	36.00

Model 301 Filament Current Ammeters

Dimensions

This instrument is admirably adapted for the service of regulating the current passing through the filament circuit of detector or amplifier tubes of either receiving or transmitting sets. It may be depended upon for accurate measurements and for permanently reliable results. The latest practice is toward regulation of the filament voltage as distinguished from the

Weston Filament Ammeter

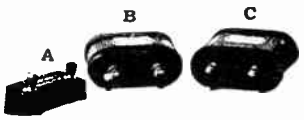
current and in our opinion voltage control has much to recommend it. However, by far the larger number of users are at present regulating by current control and no other instrument of the size and price will equal the performance of this Weston model. It must be borne in mind that the most perfect results are obtained from accurate control and that permanent measurement knowledge can be secured for little more than the cost of a single tube.

The ranges we carry in stock and which should be in the stocks of progressive dealers are the following:

Range, Amperes	Code Word	Price
1.5	Autocab	$8.00
3	Autocoffer	8.00
5	Autocomb	8.00
10	Autocouple	8.00
15	Autocostume	8.00

Multipliers for Models 301 and 431

For the convenience of those who already have a Model 301 of 50-volt range or a Model 431 of 150 or 100-volt range, who desire to extend the range to take



in the higher plate voltages, there is available the following multipliers. These multipliers are arranged for mounting on the rear of the panel or may be used as portable units if so desired.

Multiplier	Range with Instrument Volts	Code Word	Price
A	100	Radial	$5.00
B	500	Radigo	9.00
C	1000	Radios	16.00
C	1500	Radiag	22.00
C	2000	Radime	28.00

Weston Portable Mounting Base for Models 301 and 425 Instruments

A decided majority of those owning tube receiving sets have purchased outfits contained in a box or on a panel so designed that there is no room to mount any electrical measuring instruments. To some extent this condition is also true of transmitting sets.

The Weston Portable Mounting Base illustrated below is specially designed to solve this difficulty of

Weston Portable Mounting Base

how best to mount the Model 301 filament ammeters or voltmeters or any other Weston instrument of the same size.

The mount or base is an attractively finished aluminum casting designed to hold the instrument with its scale plate at an angle of 45 degrees.

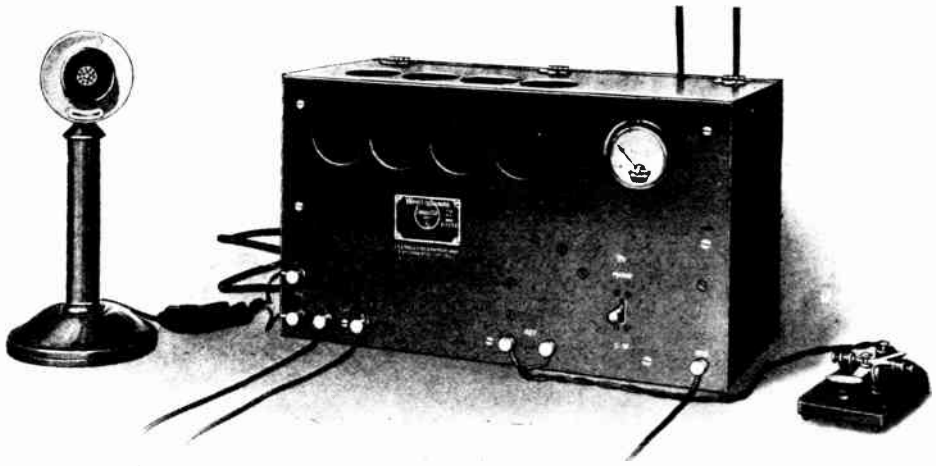
Price of base (without instrument) is $2.75 each.

SECTION THREE

Radio Transmitting Sets and Equipment

Westinghouse 20-Watt V.T. Transmitter, Model T

Vacuum tube transmitter set, Model TF, is de-at the same time effective. There is only one induct signed for radio telephony and continuous wave tel-ance to which the connected antenna, counterpoise, egraphy, a switch on the front of the panel permit-ground, and the plates, grids and filaments of the ting the use of either at will. When used for con-modulator and oscillating tubes are connected. Using tinuous wave telegraphy, four 5-watt oscillatingan antenna 60 to 80 feet long and 25 to 50 feet high, tubes supplying approximately 20 watts of oscillat-the transmitter can be tuned to any wave length be- ing energy are used, whereas when used for tel-tween 180 and 230 meters. When the installation is ephony, two of the tubes are connected as oscillatorsmade the entire tuning operation is accomplished by and two as modulators. adjusting clips on the inductance.



A Complete Vacuum Tube Radio Telephone and Radio Telegraph Transmitter Especially Designed for the Amateur

Works Best with Counterpoise

With each transmitting set there is furnished a microphone mounted on a desk stand and also a telegraph key. The microphone circuit and the key relay circuit require six volts direct current which may be furnished from the six-volt storage battery used to supply the filaments of the receiving tubes or five cells of dry battery connected in series may be used.

The transmitter is provided with a connection for using a counterpoise. A counterpoise is strongly recommended in all cases where it can conveniently be erected as the output and resultant range of the transmitter is considerably increased.

Although it is extremely difficult to make any statements regarding transmitting range, under reasonably good conditions a range of fifteen miles with telephony and one hundred miles continuous wave telegraphy may be obtained.

Simple But Effective Circuit Employed

All of the mechanism of the transmitter proper is contained within a highly polished mahogany cabinet 19 inches long, 8 inches high, and 8 inches wide, provided with a Micarta panel. All of the parts are attached to this panel and may be removed from the cabinet as a unit. The top of the cabinet is hinged to facilitate insertion of tubes and adjustment of tuning.

The circuit that is used is extremely simple and

The filaments are supplied with alternating current from a transformer contained within the cabinet. The primary of the transformer is wound for alternating current of sixty cycles and will accommodate 105 to 115 volts.

The plate voltage is furnished by a motor generator operated from a 110-volt, 60-cycle AC lighting circuit. The generator is arranged to furnish voltages of 350 or 500 volts. A block of resistance is con nected in series with the generator field, two wires being connected to either side of this resistance and brought outside of the machine. By connecting these two wires together, the block of resistance is short circuited and the machine will furnish 500 volts. By disconnecting these two wires the resistance is connected in the field circuit and the machine will then furnish 350 volts. The two voltages that are thus available make it possible to adjust the transmitter to the range desired. For short distances the 350 volt connection is used and for greater distances 500 volts may be used if desired.

Complete Amateur Radio Telephone and Telegraph Transmitting Set, Model TF, including four 5-watt Radiotron vacuum tubes, one desk microphone, one telegraph key and 100-watt motor-generator unit..... **$305.00**

G. E. 20-Watt V.T. Transmitter, Model ET-3619

This radio telephone and telegraph transmitting outfit has been designed for use in conjunction with the Kenotron Rectifier unit described below. This transmitter, however, may be used with direct current where a motor generator set is available.

With the exception of the power supply everything necessary for a 20-watt transmitter is mounted on a sturdy panel and base made of heavy dilecto, artistically engraved, as may be seen from the accompanying photograph. The 20-watt rate on this equipment is based on the same consideration as commercial wireless telephone transmitters, that is, four Model UV-202 5-watt Radiotrons are used as oscillators.

Designed for Radiotron Vacuum Tubes

The transmitter is built for operation on telephone, continuous wave (C.W.) telegraphy or interrupted

G. E. Transmitting Unit

continuous wave (I. C. W.) telegraphy. The method of signalling is controlled by a rotary switch having three positions.

This transmitter requires the following supply for operation at full output: .160 amperes at 350 volts D. C. for the plate supply, and 10 amperes at 8 volts A. C. for the filament supply.

Model ET-3619 transmitter is entirely self-contained with the exception of the following units, which may be connected externally:

(a) Send-receive Switch; (b) Telegraph Key; (c) Microphone Transmitter and Desk stand; (d) Motor Battery. (Not supplied as part of this transmitter.) (e) Microphone Battery.

Kenotron Rectifier Unit Model ET-3620

This equipment has been designed to operate in connection with the above 20-watt transmitter, or as a separate unit for other transmitting circuits. It is designed to give full wave rectification from a 110-volt, 50 or 60 cycles A. C. supply. It utilizes four Model UV-216 Kenotron Rectifier Tubes. The unit contains suitable filter condensers and reactor, so that the rectified A. C. is smoothed out for satisfactory telephone transmission.

This unit also contains a combined plate and filament transformer for supplying power at the proper voltage for heating all the vacuum tube filaments and furnishing the necessary plate potential for the transmitter.

Substantial terminals are provided for connecting the above units in circuit. All these terminals are numbered to agree with the connections indicated in the diagrams which accompany the book of instructions supplied.

Terminals are also provided so that the units not supplied with this transmitter may also be connected in circuit: such as—

(a) Magnetically controlled Send-Receive Switch; (b) Control button for the above switch; (c) Magnetically controlled "Break in" Key; (d) Chopper for obtaining I. C. W. transmission.

G. E. Rectifier Unit

Wave length control is obtained by means of a variable condenser in series with the antenna circuit adjusted by a control on the panel.

G. E. 20-Watt Telephone and Telegraph Transmitter, Model ET-3619 including Transmitting Panel, 4 Radiotrons UV-202, Telegraph Key UQ-809, Send-Receive Switch, W. E. Desk Stand with Microphone 284-W and 4 dry cell microphone battery **$235.00**

G. E. Kenotron Rectifier Unit, Model ET-3620, including 4 Kenotrons UV-216 ..... **150.00**

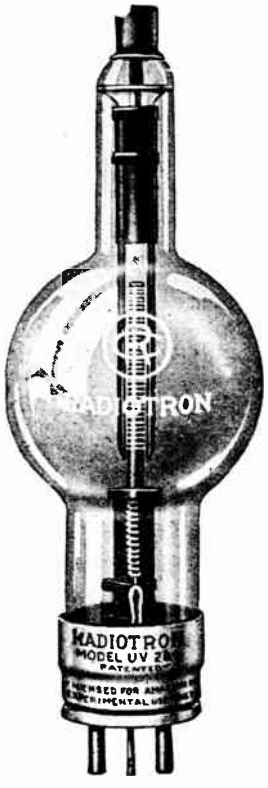
Complete Transmitter and Rectifier as above... **385.00**

Dimensions of each unit: Height, 14 in.; width, 12½ in.; Depth, 11½ in.

Radiotron Transmitting Tubes

Radiotron UV-204—250-Watt Transmitter

Radiotron UV-204 is the most powerful tube of the Radiotron series at present sold for experimental purposes. This tube is equipped with a special filament which gives exceptionally long operating life, and it will be widely used by experimenters desiring to obtain large oscillating outputs. It is particularly adapted for experimental measurements in laboratories and in powerful C. W. radio telegraph and telephone sets for experimental use. Several experimenters using one UV-204 in oscillating circuits have obtained antenna charging currents of from five to six amperes.



Model UV-204

UV 204 will be found serviceable in the self-rectifying and other circuits shown elsewhere in this book, and such a circuit will appeal to experimenters because of its simplicity.

Two points are worthy of special mention—namely, the large current input to the antenna that can be obtained with these tubes, and the greatly increased operating life over former tubes of this type.

This tube has been used constantly at the official broadcasting station of the Bureau of Standards. It was also employed in the powerful radio telephone set installed by the Radio Corporation in the Delaware, Lackawanna and Western Railroad Radio Station at Hoboken, New Jersey, which sent out the news of the Dempsey-Carpentier boxing bout. The Radio Corporation of America employs the same tube in its new types of commercial radio telegraph and telephone sets.

Method of Shipment

Each Radiotron UV-204 is packed for shipment in a separate crate, the dimensions of which are approximately 11″ x 11″ x 25″ high. The net weight of the tube is approximately 1¼ pounds, and the shipping weight, crated, 7½ pounds.

The tubes are suspended in the crate by ticking.

The safest way to store the tubes is in the crates as received.

Do not expose the tubes to the weather.

Handle the crated tube and the tube itself with the same consideration as any piece of expensive glassware.

How to Unpack UV-204

(1) The slats on one side of the crate are fastened with screws. Open this side of the crate by means of a screw-driver.

(2) Remove the three screws which secure the upper strip of ticking and slip the ticking off the upper end of the tube. Then remove the tube from the crate.

(3) In crating a tube to be returned, simply reverse the operations, placing the cathode (the large end) up.

(4) Instructions for operating the tube are inside the crate at the top.

(5) Do not destroy the crate, as tubes returned to us in any other form of packing are not acceptable.

Electrical and Mechanical Data

Overall Dimensions	5″ x 14¼″
Base—Special End Mountings	UT-501 and UT-502
Voltage of Filament Source	12 V.
Filament Terminal Voltage	11 V.
Filament Current	14.75 Amp.
Plate Voltage	2000 V. Normal
Amplification Constant	25
Plate Current	.25 Amp.
Watts Output	250 Normal

Replacement

If a Radiotron UV-204 is returned to our warehouse with a burnt-out filament, but otherwise in perfect condition, a rebate will be allowed on the purchase of another UV-204.

Radiotron UV-204 ..... $110.00

Radiotron UV-203—50-Watt Transmitter

The 50-watt Radiotron is universally used by amateurs for long-distance telephony and telegraphy. Two 50-watt tubes connected in a self-rectifying or in straight D. C. plate excitation circuit will give antenna currents of three to four amperes at amateur wave lengths.

A single tube operated from a D. C. source or a rectified A. C. source will put two and a half to three amperes in the amateur's aerial. Hundreds of these tubes are already in use at amateur transmitting stations throughout the country, and distances up to 1900 miles have been covered by using two tubes in parallel in an appropriate oscillating circuit.

Since these tubes have been specially designed with a view to securing uniformity, several of them

Model UV-203

may be operated in parallel and large antenna charging currents may thus be generated. Using a number of Radiotrons UV-203, speech may be sent out over ranges of hundreds of miles.

A suitable power transformer for use with the 50-watt Radiotron is described on page —

This tube is a favorite with experimental laboratories.

Electrical and Mechanical Data

Overall Dimensions	2" x 7½"
Base	Four Prong Special
Voltage of Filament Source	12 V.
Filament Terminal Voltage	10 V.
Filament Current	6.5 Amp.
Plate Voltage	1000 V. Normal
Plate Current	.15 Amp.
Amplification Constant	15
Watts Output	50 Normal

Shipment

Radiotron UV-203 is shipped to the customer in a standard wooden box in which the bulb is suspended in a special way to protect it from mechanical shocks or vibration. Shipping weight: 1½ lbs.

Radiotron UV-203 ..... **$30.00**

Radiotron UV-202—5-Watt Transmitter

This transmitting tube is a popular one for low power radio telephone sets and for amateur C. W. telegraph sets for transmission up to distances of two hundred miles. Two 5-watt tubes in parallel will

Model UV-202

put from one and one-quarter to one and three-quarters amperes in the amateur's antenna. Using one of these tubes as a modulator and the other as an oscillator for experimental radio telephony, distances up to forty miles can be covered, and at least four times that distance when the two tubes are connected in parallel for C. W. telegraphy. Four or five 5-watt Radiotrons can be operated in parallel with increased range.

The 5-watt tubes may also be used as power amplifiers in radio receiving circuits. The energy amplification obtained therefrom is particularly useful for the operation of loud speakers.

Electrical and Mechanical Characteristics

Overall Dimensions	2⅛" x 5"
Base	Four Prong Standard
Voltage of Filament Source	10 V.
Filament Terminal Voltage	7.5 V.
Filament Current	2.35 Amp.
Plate Voltage	350 V. Normal
Plate Current	.045 Amp.
Output Impedance	4000 Ohms
Amplification Constant	8
Watts Output	5 Normal

Shipment

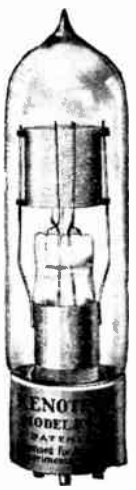
Radiotron UV-202 is shipped in a standard cardboard carton in which the tube is well protected from mechanical shock or vibration. Shipping weight: 1 lb.

Radiotron UV-202 ..... **$8.00**

Kenotron Rectifier, UV-217

Kenotron UV-217 is primarily intended for use with the 50-watt power tubes, to produce a D. C. plate supply from an A. C. source. It is rated at 150 watts. UV-217 should be used in connection with Power Transformer UP-1016, listed on page —. The combination of these two units constitutes the simplest and most practical means of obtaining direct current for the plate circuit excitation of power tubes. Remember that these rectifier valves are manufactured with the same care and accuracy as Radiotron power tubes, under the supervision of the same experts.

The output energy from this Kenotron Rectifier is at a maximum when the load is such that the D.C. potential is between 900 and 1100 volts. At no load, under an A. C. voltage of 1250 volts, the D. C. voltage will rise to about 1750. On short circuit, the current will rise to about three-quarters of an ampere. It is recommended, therefore, that the D. C. circuit from the Kenotron system be properly fused, so as to protect the Kenotrons in case of short circuit.



Model UV-217

Using two Kenotrons UV-217 in a full wave rectication circuit, the D. C. current and watts output will be doubled, but the voltage at which maximum output can be obtained will be between the same limits. The output drops slightly at lower and higher D. C. voltage. This assumes a fixed A. C. input voltage of 1250.

Kenotron UV-217 is identical in appearance with Radiotron UV-203, and it may be used in the same type of socket, Model UT-541. There are, of course, no connections to the grid binding post of the socket.

Electrical Data

Voltage of Filament Source	12 V.
Filament Terminal Voltage	10 V.
Filament Current	6.5 Amp.
A. C. Input Voltage	1250 V.
D. C. Output	150 Watts at 1000 Volts D. C

Shipment

Kenotron UV-217 is shipped to the customer in a standard wooden box in which the tube is suspended in a special way to protect it from mechanical shocks or vibration. Shipping weight: 1½ lbs.

Kenotron UV-217 ..... **$26.50**

Kenotron Rectifier, UV-216

Kenotron UV-216 is primarily intended for use with the 5-watt power tubes, and is rated at 20 watts. The output energy is at a maximum for these tubes when the load is such that the D. C. voltage is between 350 and 400 volts. Using two tubes in a full wave rectification circuit the D. C. current and the watts output will be doubled, but the voltage at which maximum output can be obtained will be between the same limits. The output drops slightly at lower and higher D. C. voltages, so that at 200 and 550 volts it is about 15 watts per tube. This assumes a fixed A. C. input voltage of 550. If the A. C. input voltage is raised, the voltage at which maximum power is obtained will be increased correspondingly. This will decrease the life of the Kenotron, and lower the factor of safety.

At no load, under the A. C. voltage specified above, the D. C. voltage will rise to about 750 volts. On short circuit the current will rise to about 100 milliamperes. The insulation of the Kenotron is designed to withstand the first condition, and the anode will take care of the excess energy of the second condition for a considerable time.

Kenotron UV-216 is identical in appearance with Radiotron UV-202, and it may be used in the same type of socket, Model UR-542.

A special Power Transformer, Model UP-1368, has been developed for use with the 20-watt Kenotron and the 5-watt transmitting tube.

Shipping weight: 1 lb.

Electrical Data

Voltage of Filament Source	10 V.
Filament Terminal Voltage	7.5 V.
Filament Current	2.35 Amp.
A. C. Input Voltage	550 V.
D. C. Output	20 Watts at 350 Volts D. C.
Kenotron UV-216	**$7.50**

Condensers for Transmitting Sets

Model UC-1831 is a variable type condenser essential for tuning of CW transmitters. Designed as a series antenna condenser and will stand five amperes of CW at its maximum capacity setting. Will vary the radiated wave length by 50 to 100 meters. Minimum .0001 mfd, maximum .0012 mfd. This condenser is rated at 400 volts.

UC-1831—.001 .0012 Variable, 4,000 Volts, 5½" x 5¼" x 4½", weight 2 lb..... **9.00**

Model UC-1803 is intended for use as a blocking or coupling condenser, as shown in the various diagrams shown in this book. It is rated at 10,000 volts and has a capacity of .000025 mfd.

Model UC-1803

UC-1803—.000025 mfd., 10,000 Volts, 3" x 3" x 4", weight 1½ lbs..... **5.00**

Model UC-1015, rated at 3,000 volts effective, has three capacities, .0003, .0004 and .0005 mfd. and a current-carrying capacity of 4 amperes at 200 meters maximum. At lower or higher frequencies the current-carrying capacity is greater or less, respectively. This condenser is applicable as a series antenna condenser and an intermediate circuit condenser in circuits using radiotrons UV-202 or UV-203.

Model UC-1015

UC-1015—.0003, .0004, .0005 mfd., 7,500 Volts, 2¼" x 1½" x ⅞", weight 1 lb..... **5.75**

Model UC-1806, rated at 6,000 volts effective, has a capacity of .002 mfd., and is intended for use as a by-pass condenser in circuits in which the voltages rise to 6,000 volts.

Model UC-1806

UC-1806—.002 mfd., 6,000 Volts, 2¼" x 1½" x ⅞", weight 1 lb..... **7.00**

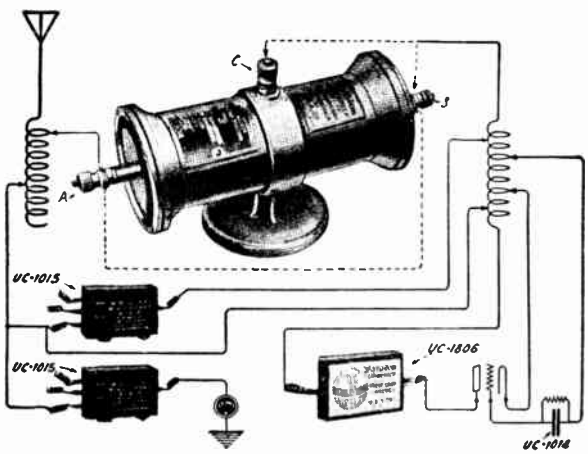
Model UC-1014, rated at 3,000 volts effective, has a capacity of .002 mfd. This condenser was developed primarily for use as a grid condenser, radio frequency by-pass condenser or blocking condenser for circuits utilizing Radiotrons UV-202 and UV-203.

UC-1014—.002 mfd., 3,000 Volts, 2¼"x1½"x ⅞", weight 1 lb..... **$2.50**

Faradon Special Antenna Coupling Condenser

For closer regulation of the antenna circuit than is possible with the 1803 antenna coupling condensers, the use of the UC-1846 is recommended. As may be seen from the accompanying diagram, this condenser permits the use of three distinct capacities, viz., .000018, .000037 and .000075 mfd.

In order to obtain these values, the connections are made as follows: The point A is permanently connected to one adjustable clip of the antenna inductance, while a lead from one end of the oscillating inductance is attached to a two point switch, permitting connection to the points C or B. Where connection is made to the point B, both condensers are in series, and the resultant capacity is .000018. Where connection is made to the point C, one-half of the condenser is employed, having a capacity of .000037. The third possible capacity combination is formed by connecting to the point C, and placing a shunt around the points A B, as indicated by the dotted lines in the diagram with a resultant capacity of .000075 mfd. By this arrangement both halves of the unit are therefore connected in parallel.



Illustrating a constant frequency vacuum tube transmitter circuit employing the Faradon special antenna coupling condenser UC-1846.

UC-1846—.000018, .000037, .000075 mfd., 10,000 Volts, 2⅞" x 4¼" x 8½", weight 5 lbs..... **10.00**

Note: Model UC-1014 bears the same size and appearance as Model UC-1806.

Dubilier Transmitting Condensers

We can supply Dubilier transmitting or special condensers of any size or capacity. Prices will be furnished upon request. Give capacity required and voltage condenser should stand.

Power Transformres for Transmitting Tube Sets

Model UP-1368, Maximum Input 325 Watts, for 5-Watt Tubes.

Model UP-1016, Maximum Input 750 Watts, for 50-Watt Tubes.

In designing the above transformers the engineers of the Radio Corporation have given the amateur radio experimenters two rugged and flexible units which can be utilized in numerous Radiotron circuits.

The transformers permit operation from a 50/60 cycle alternating current source for (1) continuous wave telegraphy, on either a self-rectification circuit, (2) interrupted continuous wave telegraphy, with or without Kenotron rectified A. C., (3) radio telephony.

The use of alternating current provides an excellent and flexible means of supplying power for continuous wave telegraph and telephone sets. It is especially adaptable for the amateur radio experimenter because a wide range of experimentation is opened to him, at a low first cost. These units have no maintenance cost, and their life is unlimited. The advantages over a motor generator set are obvious. Continuous wave energy may be supplied the antenna from an A. C. self-rectification circuit such as shown on page 129. Rectified A. C. may be obtained from such a circuit by rectifying the plate supply with Kenotron rectifying tubes.

Model UP-1016

Plate Winding: Output 450 watts, 3,000 volts between outer wires with midtap at 1,500 volts.

Radiotron Filament Winding: Output 140 watts, 10.5 volts between outer wires with midtap at 5.25 volts. The capacity of this transformer will supply current for two Radiotrons UV-203 (50-watt tube).

Kenotron Filament Winding: Output 140 watts, 10.5 volts between outer wires with midtap at 5.25 volts. The capacity of this transformer will supply filament current for two Kenotrons UV-217.

Primary Winding: Operation from a 50/60-cycle supply at a voltage from 102.5 to 115 volts. Provision is made for voltage adjustment in steps of 2.5 volts between 102.5 and 115 volts, eliminating the need of separate rheostats.

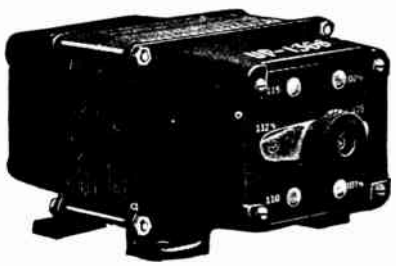
Model UP-1368

Plate Winding: Output 175 watts, 1,100 volts between outside wires, midtap at 550 volts.

Radiotron Filament Winding: Output 75 watts, 7.5 volts, with midtap at 3.75 volts. The capacity of this transformer will supply filament current to four Radiotrons UV-202 (5 watt tubes).

Kenotron Filament Winding: Output 75 watts, 7.5 volts with midtap at 3.75 volts. Windings insulated for 1,100 volts. The capacity of this transformer will supply current for four Kenotrons UV-216.

Primary Winding: For operation from a 50/60 cycle supply with voltage from 102.5 to 115 volts. Provision is made for voltage adjustment in steps of 2.5 volts between 102.5 and 115 volts. This is accomplished by means of taps brought out from the primary winding of the transformer to studs on a dial switch. This feature eliminates the need of filament rheostats, since it provides filament voltage adjustment in steps of approximately 2.5 volts.



Model UP-1368

The model UP-1368 transformer has sufficient capacity to handle safely one to four UV-202 Radiotrons as oscillators. Model UP-1016 will supply one or two UV-203 Radiotrons as oscillators. A winding is provided for lighting the filaments and a winding for the plate source. In addition, a filament winding for the Kenotron filaments is supplied.

A complete rectifier set for tube operation consists of the following:

(1) Power Transformer
  (a) 325 watt, Model UP-1368
  (b) 750 watt, Model UP-1016

(2) Tube Sockets

(3) Kenotron Valves

(4) Filter Reactor

(5) Filter Condensers

Power Transformer, UP-1368—325 Watts.....**$25.00**

Dimensions: 9 3/64" x 5 11/12" x 4¼".
Shipping Weight: 15 lbs.

Power Transformer, UP-1016—750 Watts.....**$38.50**

Dimensions: 9 27/32" x 7⅜" x 6".
Shipping Weight: 30 lbs.

C. W. Plate Transformers

As mentioned before, the ideal way for operating a C. W. set, using transformers for a source, is to use one transformer for the plate circuit and one for the filaments.

If the filament winding is on the same transformer as the plate winding, the filament rheostat must necessarily be able to carry large current values, as a rheostat in the primary affects both filament and plate current, and the key cannot be put in the primary side of the transformer.

The C. W. plate transformers have the following specifications:

500 Watt Transformer—Secondary voltages, 1500 and 1000 either side of center; secondary current, 350 milliamperes. No tertiary windings. This transformer will supply the plate voltage and current for two 50 watt tubes. These values are for continuous duty.

250 Watt Transformer—Secondary voltage, 1100 and 550 volts either side of center; secondary current, 200 milliamperes at 1100 and 400 milliamperes at 550 volts. No tertiary windings. This transformer will supply the plate voltage and current for four to six 5 watt tubes or for one 50 watt tube. These values are for continuous duty.

110 volts primary	60 cycles	25 cycles
250 watt C. W. Plate, Mounted	$20.00	$32.00
250 watt C. W. Plate, Unmounted	16.00	27.00
500 watt C. W. Plate, Mounted	25.00	40.00
500 watt C. W. Plate, Unmounted	20.00	35.00

Acme Filament Heating Transformers

The Acme Apparatus Company has developed a filament transformer to operate on 110 volts 60 cycles, and to deliver two secondary voltages in order to care for tubes requiring different voltages for proper operation and changes in line voltages. A center tap is provided on the secondary or filament winding in order to connect the grid circuit to a point whose potential does not alternately change from plus to minus.

Acme Transformer

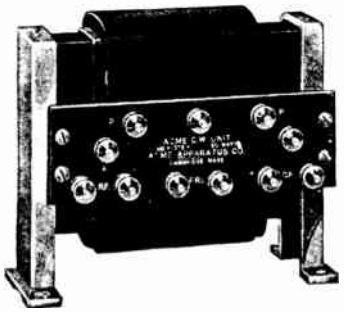
These transformers (mounted type) are provided with a rheostat in the primary for filament control. This control is necessary on account of the variation of line voltage and to care for the drop in voltage when one or more tubes are used. These transformers (mounted type) are also provided with condensers permanently connected across the secondary, or filament windings, to provide a by-pass for high frequency currents.

When using vacuum tubes for the transmission of radio telegraphy and telephony, it is not essential to have the filaments heated by battery current, as the use of low commercial frequencies at the transmitting station does not greatly affect the reception of signals at the receiving station.

110 volts primary	60 cycles	25 cycles
75 watt, Mounted	$12.00	$16.00
75 watt, Unmounted	9.00	13.00
150 watt, Mounted	16.00	23.00
150 watt, Unmounted	13.00	20.00
300 watt, Mounted	20.00	28.00
300 watt, Unmounted	16.00	24.00

Acme C. W. Transformers

Th Acme Apparatus Company saw C. W. transmission coming and had apparatus ready. Acme C. W. transformers were the first on the market and have admirably stood the test of time.



Acme C. W. Transformer

The Acme Apparatus Company has developed transformers which can be used to furnish a high voltage alternating current source, and when used with rectifying devices, choke coils and condensers can supply a high voltage unfluctuating direct current source suitable for both radio telegraphy and telephony. In C.W. transmitting sets it is not necessary to use direct current for filament heating; in fact, it is preferable to use alternating current as the life of the filament is increased.

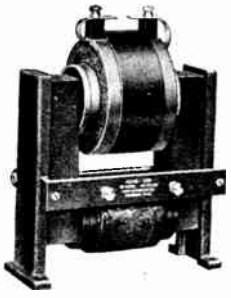
The solution of the problem of interference in amateur radio lies in the use of C. W. transmission, as it is possible for stations in one neighborhood to communicate simultaneously at frequencies which differ by only a few per cent. With spark systems it is necessary to work at widely different wave lengths for success, and even then there is in all probability a longer wave length with sufficient energy to be heard at some distance, all of which energy is lost to the station with which communication has been established.

In using transformers for C. W. transmission, the plate and filament sources may be on the same transformer, or a separate transformer may be used for each. Under either condition, when used on the ordinary power or lighting lines, the line voltage varies from 10 per cent to 20 per cent during the day, and the drop in voltage in the transformer varies with the number of tubes employed. These changes in voltage do not affect the operation of the tubes greatly as far as the plate circuits are concerned, but are of importance to the filaments of power and rectifying tubes. Slight changes in filament voltage have a great effect on the life of the tube.

110 volts primary	60 cycle	25 cycle
75 watt C. W. Power, Mounted	$15.00	$25.00
75 watt C. W. Power, Unmounted	12.00	20.00
200 watt C. W. Power, Mounted	20.00	32.00
200 watt C. W. Power, Unmounted	16.00	25.00
300 watt C. W. Power, Mounted	25.00	35.00
300 watt C. W. Power, Unmounted	20.00	30.00
600 watt C. W. Power, Mounted	33.00	50.00
600 watt C. W. Power, Unmounted	28.00	44.00

110-Volt Acme Spark Transformers

The Acme Apparatus Co., as designers and manufacturers of transformers, produced the present line of non-resonant transformers after considerable experimental work to determine just what the best operating conditions should be in those amateur stations supplied with commercial frequencies and a rotary spark gap. This development work showed that with a given amount of energy and the same station conditions, signals could be read at greater distance, using a non-resonant type of transformer and a rotary spark gap of 700 to 800 sparks per second than a resonant type of transformer at any rotary gap speed. Actual results from many stations substantiate this work.



Acme Spark Transformer

Type	Fully Mounted Low Power	Full Power	Voltage	60 cycle Price	25 cycle Price
Acme 250		250 watts	9,000	$16.00	$22.00
Acme 500	250 watts	500 watts	11,000	22.00	33.00
Acme 1000	500 watts	1000 watts	15,000	33.00	54.00

Without castings, terminal board and binding posts:

Acme 250	$13.00	$18.00
Acme 500	18.00	28.00
Acme 1000	28.00	46.00

220 volts 60 cycles, $1.00 more in each case.

Filament Rheostats

Model PR-535

Rheostat, Model PR-535, consists of a molded base, approximately 2½ inches in diameter, on which are secured two concentric windings held securely in place by clamping screws. Connection is made to these windings by means of two sliding contacts of phosphor bronze, which form a circuit between the outside and inside windings.

Body is composed of insulating material containing a large percentage of asbestos, thereby reducing fire hazard.

Rheostat PR-535 gives four different resistance values depending on connections.

Filament Rheostat, PR-535 ..... $3.00

Size: 2 in. x 2½ in. x 2¾ in.

Shipping Weight: 1 lb.

Model PR-537

Model PR-537 is designed for use with Radiotrons UV-200, 201, 202 and Kenotron UV-216.

Rheostat, Model PR-537, is designed for use with the UV-203 and UV-204 Radiotron transmitting tubes, as well as with Kenotron UV-217. In general the design is the same as Model PR-535, but with increased dimensions.

Rheostat PR-537 gives four different resistance values depending on connections.

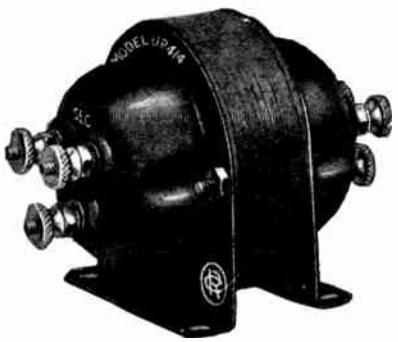
Filament Rheostat, PR-537 ..... $10.00

Size: 4¼ in. x 4½ in. x 2¾ in.

Shipping Weight: 2 lbs.

Microphone Transformer, UP-414

Although the Radio Corporation has developed a magnetic device for modulating the output of vacuum tube transmitters, many amateurs prefer to use prior methods of modulation where one or more bulbs are employed to modulate the plate circuit energy of the oscillating tubes; but, in order to obtain efficient modulation from such circuits, it is necessary to couple the grid circuit of the modulating tube to the microphone through the medium of a voltage amplifying transformer. The turn-ratio of the microphone transformer has been selected to give the most effective excitation of the grid of the modulator tubes based upon the charactertistics of Radiotrons when used as modulators. They are exactly the same type as used in the Radio Corporation's commercial sets.



Model UP-414

The characteristics of the transformer are such that with a suitable microphone and a battery of four dry cells connected in series with the primary coil, a secondary voltage is obtained which will provide effective control of the radiated energy. The transformer is also provided with a side tone winding, which may be connected to the telephone of a receiving set during the periods of speech transmission, thus enabling the operator to check the operation of his microphone.

Model UP-414 has the same appearance and dimensions as the Radio Corporation's intervalve Amplifying Transformer, UV-712.

Microphone Transformer with Side Tone Winding, UP-414 ..... $7.25

Dimensions: 2¾ in. x 3⅞ in. x 2 in.

Shipping Weight: 1 lb. 7 oz.

Type 231-M Modulation Transformer

This transformer is similar in general design to the Type 231-A amplifying transformer, the only difference being in the winding. Its windings have been designed particularly for use with the Radiotron UV-202 five-watt transmitting tubes and other tubes of similar characteristics. To get the maximum modulation, the modulating device should have an impedance somewhat greater than the input impedance of the tube. This impedance is of the order of several hundreds thousand ohms, while that of a telephone transmitter is but a few ohms. A modulation transformer serves to adapt the telephone transmitert impedance to that of the input circuit of the tube. The success of a radio telephone installation depends not only on the value of the antenna current, but also on how completely that current is modulated. Our Type 231-M transformer has been designed to give the maximum modulation which is possible without distortion.

Type 231-M Modulation Transformer $5.00

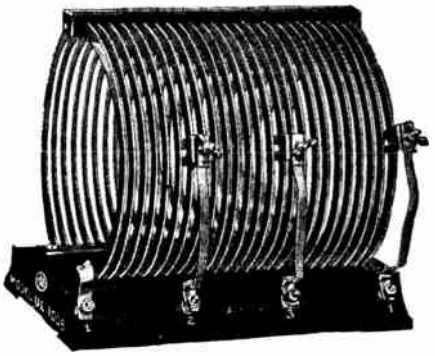
Dimensions: 2⅝ in. x 2½ in. x 2½ in.

Weight: 1 lb.

Oscillation Transformer, UL-1008

This transformer was developed primarily for use in circuits utilizing Radiotrons as generators of radio frequency oscillations. It may be used, however, in any set-up using conductively coupled circuits, such as an oscillation transformer coupling the primary and secondary circuits in spark transmitters.

The transformer consists of 25 turns of .060 in. x 3/8 in. copper strip, nickel-plated, with edges rounded, mounted on a wooden base which includes four binding posts, to three of which are secured flexible conductors and clips for selecting tap points on the transformer.



Model UL-1008

The clips supplied for tapping on the transformer have been specially designed to overcome the difficulties which have been experienced in the past with such connections. These clips are readily connected to or taken off the turns of the transformer, and when secured to the transformer by tightening the wing nut are positive in holding their position on the coil. These clips were developed primarily for use with commercial transmitters, so that the Transformer UL-1008 includes the same form of clip as the Radio Corporation's commercial transmitters. This feature is of fundamental importance, since it is believed that these clips are the first to be developed which include the above features of design.

All metal parts of the transformer are nickel-plated. The base has a polished black finish, and the overall appearance of the unit is very pleasing.

The coil is liberally designed to withstand the potentials developed in circuits utilizing Radiotrons. Holes are provided in the base to permit mounting the transformer in any desired place.

Oscillation Transformer, UL-1008 ..... $11.00

Dimensions: 7⅞ in. x 6¼ in. x 9⅜ in.

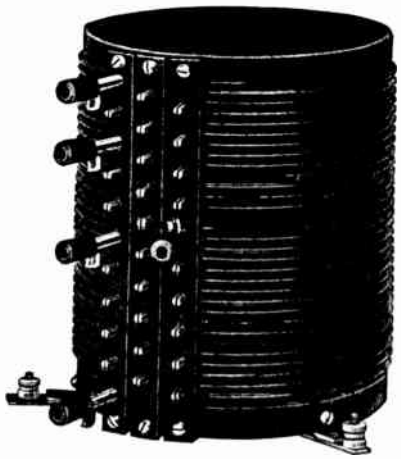
Shipping Weight: 7 lbs.

Acme C. W. Inductance

Since the advent of C.W. telephony and telegraphy, there has been a demand for a rugged, flexible and efficient C.W. inductance.

We have developed the C. W. inductance shown in the cut, which may be easily adapted to those myriad of circuits available to the amateur and experimenter.

The inductance consists of thirty turns of No. 12 B and S copper wire wound on a five-inch slotted bakelite tube. Tapes are brought out at each turn in the form of slotted studs rigidly fastened to the wire and held in place by means of bakelite strips. Five insulated terminals are supplied, which consist of brass tubes in one end of which is screwed a brass (rubber insulated) stud. A copper lug, for fastening leads, is inserted between the bearing surfaces of the brass tube and stud. The brass tubes are of the proper size to slip over the slotted studs, making a rigid, positive radio frequency contact.



No. L-I—C.W. Inductance

By means of these terminals five separate connections may be made on the inductance, each one capable of being varied one turn at a time while the tubes are excited.

Three feet are provided for fastening the inductance in an upright position.

This piece of apparatus is a structure of mechanical and electrical ruggedness.

L-I—C. W. Inductance **$8.00**

Acme Grid Coils

For those circuits which require a grid coil, we have developed a coil consisting of twenty-five turns, tapped at fifteen turns wound on a four-inch bakelite tube.

At the bottom of the cylinder are fastened three nickel-plated brass strips with binding posts and holes for fastening screws. By this means three variations are possible, namely — ten, fifteen, and twenty-five turns.

This coil readily fits within the C. W. inductance, both being held in place with the same screws.

G-1—Grid Coil **$2.00**

Radio Frequency Choke, UL-1655

This is a universal radio frequency choke designed for use in conjunction with the types of transmitting circuits illustrated in this book. Because of its special characteristics, it may be employed in a number of

R. F. Choke Coil

places where, heretofore, it has been necessary to employ radio frequency chokes of different values.

Radio Frequency Choke, Model UL-1655 ..... **$3.85**

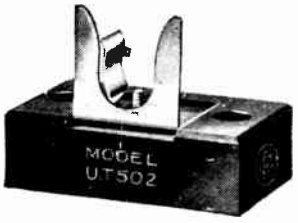
Dimensions: 3¼ in. x 3 in.

Weights: Net, 10 oz.; Shipping, 1 lb.

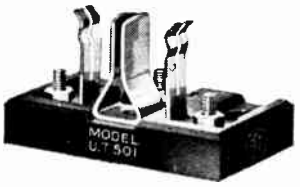
End Mountings for UV-204

These mountings are designed not only to furnish perfect contact with the elements of Radiotron UV-204, but also to act as a substantial support for the tube itself.

One end of the tube is slipped into mounting UT-501, which carries contacts for the filaments and grid connections. The other mounting, UT-502, makes contact with the plate of the tube.



Model U. T. 502



Model U. T. 501

Both ends are firmly held by spring clips. On the filament-end mounting is a safety gap for protecting the tube from transient voltages which might arise if the circuits were not properly adjusted, or if a lead wire were accidentally removed.

Each mounting is provided with two screw holes so that the tube may be mounted in either a vertical or horizontal position.

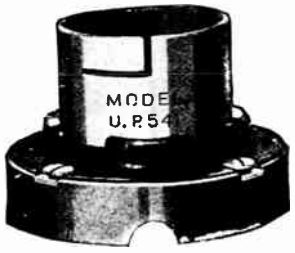
Each **$1.00**

Per pair **2.00**

Porcelain Sockets, UT-541 and UR-542

These two sockets have been specially designed to meet the need for a reasonably priced socket which should at the same time be constructed of the very best insulating material obtainable, and should bear the stamp of quality throughout. They are direct duplicates of the types used in commercial radio sets.

Porcelain is the ideal material for use in these devices, on account of its low specific inductive capacity and its high insulating qualities. Production in great quantities enables us to keep the selling price unusually low.



Model U. T. 541

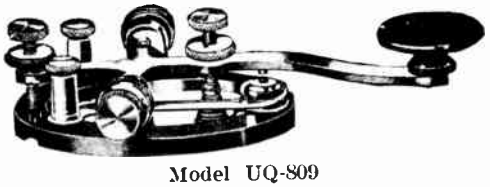
Model UR-542 is designed to accommodate Radiotron UV-200, UV-201 and UV-202, as well as Kenotron UV-216. Model UT-541 is designed for Radiotron UV-203, the 50-watt power tube, and Kenotron UV-217, the 150-watt rectifier tube.

Porcelain Socket, UR-542 ..... **$1.00**
Dimensions: 7⅞ in. x 6¼ in. x 9⅜ in.
Shipping Weight: 8 oz.

Porcelain Socket, UT-541 ..... **2.50**
Dimensions: 3⅜ in. x 2¾ in.
Shipping Weight: 1 lb.

Sending Key, UQ-809

This key is especially serviceable for C. W. transmitting sets. The contacts are made of ⅛-inch sterling silver and, besides being interchangeable, are easily replaced. The lever arm is both light and durable,



Model UQ-809

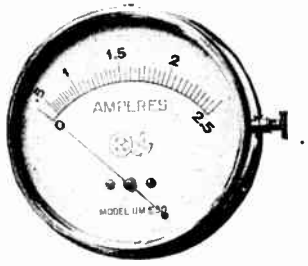
and is designed to permit an operator to secure the utmost speed possible. The frame and other metal parts are brass, finely lacquered.

Sending Key, UQ-809 ..... **$3.00**
Dimensions: 5 in. x 2¾ in.
Shipping Weight: 1 lb.

Antenna Ammeters

An antenna ammeter is a positive necessity in a C. W. transmitting set. Only by the use of such a meter can the amateur hold proper check on the operation of a tube transmitter. At a considerable expense the Radio Corporation has developed a type which, in addition to being low-priced, provides long operating life.

These ammeters are of the hot wire type. They have been designed with a view to accuracy and sensitivity to slight current variations.



Model U. M. 530

As shown in the illustration, the ammeters are so constructed that they may be mounted flush with the transmitting panel, and are of the back-connected type. A special adjustment for taking care of temperature variations has been provided.

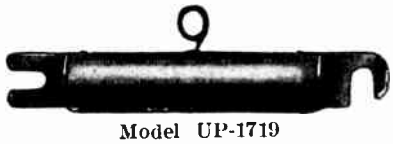
Dimensions: 2 11/32 in. x ¾ in.
Length of Studs: ¾ in. *Shipping Weight:* 1 lb.

Ammeter, UM-530—0-2.5 amp. **$6.00**
Ammeter, UM-533—0-5.0 amp. **6.25**

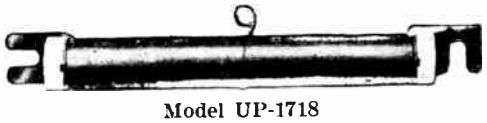
Transmitting Grid Leaks, UP-1718 and UP-1719

The purpose of these grid leaks is to limit the potential accumulating on the grid of an oscillating tube, and thus govern the output to the antenna and also the character of the antenna oscillations.

These resistors consist of a conductor wound upon a heat-resisting silicate compound body developed to resist sudden and extreme temperature changes without becoming cracked, weakened, or in any way injured. After being wound upon this compound, it is embedded in a blue vitreous enamel which is fused to a dense, uniform, glassy structure at a temperature of about 1,000 degrees Centigrade.



Model UP-1719



Model UP-1718

A metal foot is provided at each end of the grid leak, to which the resistor windings are connected, and through which external connections are made. In addition, a mid-tap is provided for securing half the resistance of the whole unit.

Grid Leak, UP-1719 ..... **$1.10**
For use with 5-watt Radiotrons. Resistance—5,000 ohms, with mid-tap at 2,500 ohms.
Dimensions: 5 in. x 1¼ in.
Shipping Weight: 1 lb.

Grid Leak, UP-1718 ..... **$1.65**
For use with 50-watt and 250-watt Radiotrons. Resistance—5,000 ohms, with mid-tap at 2,500 ohms.
Dimensions: 8½ in. x 1½ in.
Shipping Weight: 1 lb.

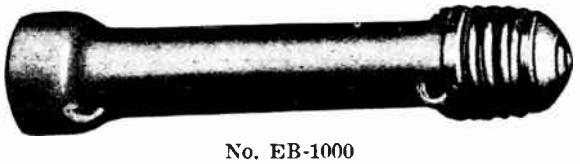
Vitrohm (Vitreous Enameled) Resistor Units

The resistor units consist of a porcelain tube wound with a special resistance wire of practically zero temperature coefficient. The tube after being wound with wire is covered with a vitreous enamel which holds the wire firmly in place. This also makes the entire surface of the tube available for emitting heat energy instead of merely the small surface of the wire, and greatly increases the watt capacity of a tube of given size. The copper connecting wires or terminal leads consist of round copper braids, each composed of a large number of flexible copper wires. Grounding is absolutely impossible, as the support is composed of the most perfect insulating material.

No. HS-2500

The resistance wire on each resistor unit is tested at a maintained temperature of 1200° F during the process of manufacture, which assures that the ohmic resistance of the unit will not change in service, due to molecular changes, aging, etc.

The wire is properly embedded in the special enamel used for these units, and is entirely free from any mechanical strain due to heating and cooling. It is perfectly protected against all oxidation or other chemical depreciation. Oxidation and depreciation



No. EB-1000

are invariably met with, where resistance wires at high temperature are exposed to the air, water or dust at any part of their length, or are embedded in any materials such as cement, japan, shellac or any other insulating material thus far used, with the single exception of enamel.

No. PEB-125

These resistor units are rated on the basis of 2 inches clear air space around each tube and free convection of air. When the conditions are less favorable for the dissipation of the heat energy, the duty should be correspondingly reduced.

Cat. No.	Ohms Approx.	Maximum Amperes	Volts at Maximum Amperes	Price
LS-2000	2000	0.15	300	$0.70
LS-1500	1500	0.17	255	.70
LS-1000	1000	0.21	210	.70
LS- 700	700	0.25	175	.70
HS-4000	4000	0.105	420	.80
HS-3500	3500	0.11	385	.80
HS-3000	3000	0.12	360	.80
HS-2500	2500	0.13	325	.80

"HS" units may be supplied wound to any value up to about 16,000 ohms if desired, and "LS" units in resistance below 700 ohms, if necessary. Price upon application.

These tubes will stand 44 watts for continuous duty, and 156 watts for 20 seconds duty.

Vitrohm (Vitreous Enamel) Resistor Units For Charging Storage Batteries and Testing Load Banks

Vitrohm (Vitreous Enamel) Resistor Units, for charging storage batteries and testing load banks, are manufactured in three capacities, 60 watts, 125 watts and 200 watts. They are furnished with Edison screw

No. DEB-250

base for use in standard socket or receptacle. These resistor units cannot be used on alternating current for storage battery charging.

Cat No.	Ohms	Amp.	Volts	Price
EB- 220	220	0.52	114	$ .80
EB-1000	1000	0.24	240	.80
PEB- 125	125	1.0	125	1.40
PEB- 500	500	0.5	250	1.40
DEB- 62	62	1.80	111	1.50
DEB- 250	250	0.89	222	1.50

Filter Condensers

These filter condensers are manufactured especially for the Radio Corporation of America's Kenotron rectifier sets. They are intended for use with the Reactors Model UP-1653 and UP-1654, described above.

Transmitting circuits, Figs. 1 to 9, in preceding pages, show the manner in which the filter reactors and condensers are connected in rectifying tube sets. The number of condensers required depends upon the type of circuit employed. This is fully explained in the data given under the circuit diagrams.

UC-487—750 volts, Capacity 0.5 mfd..... $1.40
UC-488—750 volts, Capacity 1.0 mfd..... 2.25
UC-489—1750 volts, Capacity 0.5 mfd..... 1.60
UC-490—1750 volts, Capacity 1.0 mfd..... 2.50

Motor-Driven Chopper, PX-1638

Long experience in the use of audio frequency buzzers to modulate the output of a tube set to produce damped wave trains has proven that this method is not entirely satisfactory, principally for the reasons that the operation of the buzzer is not constant, necessitating frequent adjustment, and that great care is required in adjusting the circuit to obtain 100 per cent. modulation.

The Rotary Chopper, PX-1638, has been developed primarily to overcome the above objections. It may, however, be used in numerous circuits for this or other purposes where an interrupter is required. When used to secure I. C. W. telegraphy, the motor-driven interrupter, or rotary grid chopper, has the following inherent advantages over the other methods:

(*a*) Gives positive interruption, requiring no adjustments. The note obtained can be varied to any desired pitch by changing the driving motor speed.

(*b*) This system of securing damped wave trains does not require modulating tubes, the interrupter being used in series with the transmitting key.

(*c*) The system inherently gives 100 per cent. modulation, since oscillations can be completely started and stopped at audio frequencies.

(*d*) The output obtained from a given number of oscillators is in general greater than if some of the tubes are used as modulators.

The equipment includes the following parts:

(*a*) Interrupter Wheel, Model PX-1638.

(*b*) Two Bushings, so that the wheel may be mounted on motor shafts ¼ in., 5/16 in., or ⅜ in. diameter.

(*c*) Brush Holder and Brush.

The interrupter wheel is built with 34 conducting and 34 insulating segments, making 34 interruptions per revolution. The insulating segments are molded in a single piece.

Motor-Driven Chopper, PX-1638 ..... **$7.25**
Dimensions: 4 in. x 1¾ in.
Shipping Weight:: 3 lbs.

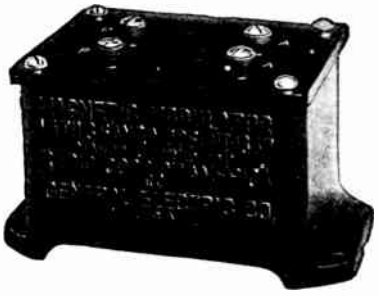
Shaft Bushings, Model PX-1640, for 5/16 in. or PX-1641, ¼ in. Motor Shaft, each ..... **.20**

Magnetic Modulators for Radio Telephony

One of the most important inventions brought forth in the field of amateur radio telephony during the past year is the Magnetic Modulator. This development has resulted from the Radio Corporation's experiments with the Alexanderson Magnetic Amplifier, a device which is used at all its high-power transoceanic stations to control the output of 200-KW radio frequency alternators. The same fundamental principle has been adopted in the three magnetic modulators herewith described, and for the first time the amateur experimenter has at his disposal a simple yet thoroughly reliable means of modulating the antenna oscillations of any low-power vacuum tube radio telephone set.

Require No Adjustment

Once connected to a radio telephone set, these modulators positively require no further adjustment or attention. This assures the experimenter that at all times he is obtaining the best possible results from his apparatus. It makes possible practical and reliable radio telephone transmission from a tube transmitter even on the part of an experimenter having a very limited knowledge of radio telephony.



Model UT-1357

The Radio Corporation's Magnetic Modulator is a device which utilizes the properties of iron at radio frequencies to control or modulate the output of an oscillating vacuum tube or any other undamped wave generator. It is the result of a number of years of research and development work both by the Radio Corporation and the General Electric Company. The device is extremely simple in nature as well as in operation. It simply acts as a variable resistance connected in series with the antenna circuit of any high frequency oscillating system.

Model UT-1367

Ideal for Radiotron Telephone Operation

The great advantage of the Magnetic Modulator over other methods of modulation is that it gives the best and only non-distorting method of controlling the output of a single tube for radio telephony. Furthermore, it permits the parallel use of a number of tubes as oscillators, and thus eliminates the use of special modulator tubes with their necessary additional accessories and critical adjustments.

Practical Uses of the Magnetic Modulator

In general, the Magnetic Modulator functions most satisfactorily in an antenna circuit of less than 15 ohms resistance. It should be connected on the low potential side of a tube transmitter, in the ground lead and as near to the actual earth connection as possible.

UT-1643 Magnetic Modulator, ½ to 1½ amp..... **$9.50**

UT-1357 Magnetic Modualtor, 1½ to 3½ amp..... **12.00**

UT-1367 Magnetic Modulator, 3½ to 5 amp..... **17.00**

Plate Circuit Reactor, UP-415

Standard radio telehone circuits using one or more tubes as oscillators and one or more additional tubes as modulators require a reactor in series to the plate circuit to maintain the D. C. supply voltage to the plate at constant value, even though the output of the set is modulated at audible frequencies.

Model UP-415

Reactor UP-415 was designed for this purpose and for circuits using 5-watt Radiotrons. The reactor, in general, is built on the same lines as Microphone Transformer UP-414. It is intended primarily for use in the common positive plate lead to the oscillating and modulating tubes, and as stated above provides a constant current system of modulation. This unit has an inductance of 1 henry at audio frequencies. The D. C. resistance is approximately 64 ohms. It is well insulated between layers.

Dimensions

Net Weight ..... 1 lb. 3½ oz.
Shipping Weight ..... 1 lb. 6 oz.
Overall Length ..... 3⅞"
Overall Height ..... 2¾"
Area of Base of Mounting ..... 2"x2¾"
Test Voltage between Winding and Core— 1300 volts at 60 cycles
Plate Reactor, UP-415 ..... $5.75

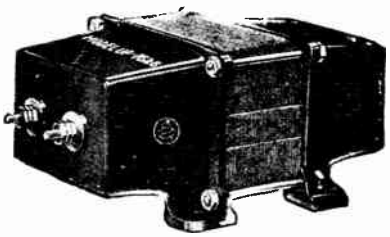
Filter Reactors, UP-1653 and UP-1654

When the plate circuit of a valve transmitting set is energized by a high voltage rectified A. C., using the Radio Corporation's Kenotron valves and power transformers, a suitable filter unit, to smooth out the rectified pulses must be provided. It has been customary heretofore to provide a relatively small inductance unit in combination with a group of condensers of rather large capacity. It is more economical, however, to provide a large inductance unit and a relatively small group of condensers, and as a consequence the two special reactors here listed have been specially developed for the purpose.

These filter reactors are of the "iron clad type," designed for use with Radio Corporation's Kenotron rectifier sets. Liberal copper allowance insures the minimum of losses and no change in value through use. Particular attention has been given to its insulation.

Model UP-1653, 160 milliamperes is designed to operate with any circuit, either A. C. or D. C., employing from one to four 5-watt power tubes, Radiotron UV-202. It can be used in connection with either UC-1631 or UC-1632 filter condensers, on any kind of a circuit within the specified voltage and power rating.

Model UP-1654, 300 milliamperes, is designed to operate on any circuit, either A. C. or D. C., employing from one to two 50-watt power tubes, Radiotron UV-203. It can be used in connection with either of the models UC-1634 or UC-1635 filter condensers on any kind of a circuit within its voltage and power rating. UP-1654 may also be used as a "smoothing out" reactance. For 50-watt tubes, one will suffice; for 250-watt tubes, two in series shoud be employed.



Filter Reactor

Model UP-1653—160 Milliamperes $12.50
Dimensions: 7 31/32 in. x 5 1/16 in. x 4 1/16 in.
Shipping Weight:: 10 lbs.

Model UP-1654—300 Milliamperes $18.00
Dimensions: 9 7/32 in. x 5 11/16 in. x 4 15/16 in.
Shipping Weight:: 18 lbs.

Frost-Radio Hand and Panel Microphones

As a result of extensive tests carried on by one of our distributors in Pittsburgh and another in Indianapolis, the prestige of Frost-Radio Microphones has been very definitely and firmly established. The trade has accepted them as the most efficient micro-

No. 157

phone made for radio telephony. We would like to explain briefly the reasons for this marked superiority.

Our carbon chamber is built with the same accuracy as the parts of a well made watch and adjusted by delicate instruments to insure absolute uniform-

ity. Specially prepared carbon electrodes are used, with surfaces as hard and bright as a mirror. The

No. 156

carbon granules that we use are made from the finest grade of special transmitter carbon. The size, density and hardness of these granules were determined only after exhaustive laboratory tests. Frosted aluminum diaphragms are used, each one subjected to micrometer measurements before passing our rigid inspection. The various parts that constitute the housing are heavily constructed in order that the complete assembly will be rigid and not respond to vibrations which would have a tendency to distort or neutralize the vibration of the diaphragm and carbon granules.

Our construction results in highest efficiency, excellent quality of articulation, and clear, distinct tones.

Frost-Radio Microphones are made in four standard types—

No. 155—Frost-Radio Hand Microphone $6.00

No. 156—Frost-Radio Desk Microphone 5.75

No. 157—Frost-Radio Pony Arm Microphone 4.50

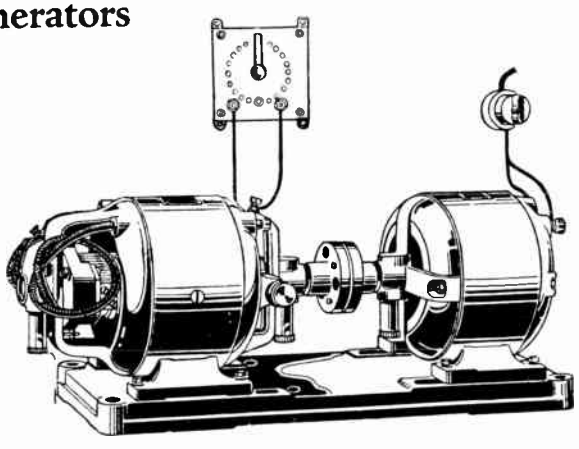
No. 158—Frost-Radio Knuckle Arm Microphone 4.50

Motor Generators

Where it is desired to employ motor generator to obtain the required plate excitation in Radiotron transmission, the Radio Corporation of America offers two Westinghouse units having the ratings of 100 and 250 watts respectively.

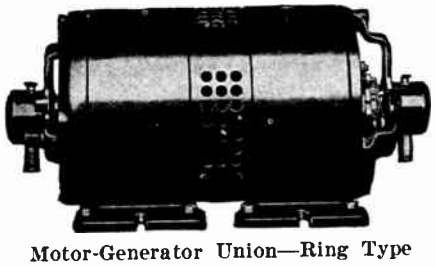
Motor Generator, Model ME, 100 watts, 500 volts, D. C., 110 volts, 60 cycle, single phase Motor, complete $85.00

Motor Generator, Model MH, 250 watts, 1,000 volts D. C., 110 volts, 60 cycle, single phase Motor, complete $170.00



Robbins & Myers Motors and Generators

The R. & M. line of equipment for service with wireless telephone outfits includes 500-volt and 1000-volt generator and motor-generator sets of 100, 200 and 500 watts capacity, for use with vacuum tubes and

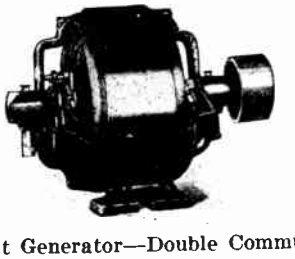


Motor-Generator Union—Ring Type

for other special services, also synchronous motors of 1/8 and 1/6 horse-power ratings for operating the synchronous type of rotary spark gaps.

Motor-Generator Sets: R. & M. motor-generator sets are furnished for operation on 110 or 220-volt, 25, 50 and 60 cycle, single phase, alternating current circuits and on 32, 115 and 230-volt, direct current circuits.

Construction: The motor-generators are of compact construction. The 500-volt outfits are the two-bearing, union ring type, while the 1000-volt outfits are the four-bearing, sub-base type.



500-1000 Volt Generator—Double Commutator Type

Ventilated enclosing towers are provided on the commutator end of all 1750 r. p. m. direct current machines.

The outfits are carefully balanced, insuring freedom from vibration and quiet operation. The large number of bars in the commutators of the generators does away with the objectionable hum which is present when generators are used which have a smaller number of bars in the commutator.

The machines are finished in gloss black enamel, which is baked on, insuring a durable, attractive finish, which is not affected by oils, moisture, etc.

Winding (500-1000-volt Types: All generators are compound wound. In the 500-volt types they have a single commutator. The 1000-volt types have a commutator at each end of the generator, so arranged that the windings can be connected in series for 1000 volts or in parallel for 500 volts as desired.

500-6 Volt and 500-12 Volt Types: These outfits are built to order and are not listed in the table. The generators have two commutators, and deliver 500 volts for charging the plate at one end and 6 or 12 volts for heating the filament at the other end, thus eliminating the necessity of providing a battery for heating the filament.

Lubrication: All motors and generators up to the 500 watt ratings are lubricated by wick oilers; the 500-watt ratings are lubricated by ring oilers. They require no attention other than filling the grease cups or oil reservoirs at long intervals.

Rheostats: All generators have leads brought out for connection to field rheostats where generator voltage regulation is desired. Rheostats are not furnished, however, unless ordered specially.

No starting device is required in the motor circuit, as all of the motors can be started directly from the line simply by closing the switch.

Insulation: The generator and motor windings are heavily taped and thoroughly insulated to withstand voltages many times as great as they are subjected to in service.

Generators for Belt Drive: The generators equipped with pulleys for belt drive are the same in construction as those used with the motor-generator sets, and the description preceding applies to them also.

The larger sizes, Frames 106-C and ½-A, are equipped with sliding bases for adjustment of belt tension. Frame 105-F has slotted feet.

Ratings and Prices

Motor-Generator Sets for Operation on Single Phase A. C. Circuits

Generator Ratings			Motor Ratings						
Watts Output	‡Volts	Frame Number	Volts	Cycles	Frame Number	R. P. M.	List Number	Shipping Wgt. Lbs.	†List Price
100	500	105-F	110	60	18	1750	5152	90	**$70.00**
100	500	105-F	220	60	18	1750	5153	90	**72.00**
100	500	105-F	110	50	18	1400	5154	90	**77.00**
100	500	105-F	220	50	18	1400	5155	90	**79.00**
100	500	105-F	110	25	18	1400	5156	90	**77.00**
100	500	105-F	220	25	18	1400	5157	90	**79.00**
200	500	105-F	110	60	18	3400	5158	90	**75.00**
200	500	105-F	220	60	18	3400	5159	90	**77.00**
200	500	106-C	110	60	19	1750	5160	120	**85.00**
200	500	106-C	220	60	19	1750	5161	120	**87.00**
200	500	106-C	110	50	19	1400	5162	120	**95.00**
200	500	106-C	220	50	19	1400	5163	120	**97.00**
200	500	106-C	110	25	19	1400	5164	120	**95.00**
200	500	106-C	220	25	19	1400	5165	120	**97.00**
200	1000	105-F	110	60	19	3400	5166	160	**175.00**
200	1000	105-F	220	60	19	3400	5167	160	**176.00**
500	1000	106-C	110–220	60	305	3400	5168	220	**200.00**
200	1000	106-C	110	60	19	1750	5169	185	**190.00**
200	1000	106-C	220	60	19	1750	5170	185	**191.00**
500	1000	½-A	110–220	60	305	1750	5171	275	**260.00**
200	1000	106-C	110	25	19	1400	5172	185	**195.00**
200	1000	106-C	220	25	19	1400	5173	185	**196.00**
500	1000	121	110–220	25	307	1400	5174	300	**345.00**

†If wall type generator field rheostat is required, add $15.00 to list prices.

‡1000 volt generators have double commutators and can be connected in parallel or series to give 500 or 1000 volts as desired. 500 volt motor-generators are the union ring, two bearing construction; 1000 volt outfits are four bearing, sub-base construction.

All generators are compound wound.

Frames 18 and 19 A. C. motors are split phase type, Frames 305 and 307 are repulsion-induction type.

Ratings are for intermittent radio work—not to exceed two hours continuously at full load.

Prices for Motor-Generators for operation on Direct Current will be supplied on application.

Ratings and Prices

Generators with Pulleys for Belt Drive

Ratings			‡Volts	List Number	Standard Pulley Dimensions		Shipping Wgt. Lbs.	†List Price
Watts Output	R. P. M.	Frame Number			Diam. Inches	Face Inches		
200	3400	105-F	500	5145	3	1½	50	**$42.00**
100	1750	105-F	500	5146	3	1½	50	**40.00**
200	1750	106-C	500	5147	3	1½	65	**48.00**
200	3400	105-F	1000	5148	3	1½	65	**75.00**
500	3400	106-C	1000	5149	3	1½	80	**95.00**
200	1750	106-C	1000	5150	3	1½	80	**95.00**
500	1750	½-A	1000	5151	4	2	140	**140.00**

Frames 106-C and ½-A have sliding base for adjustment of belt tension.

Synchronous Rotary Spark Gap Motor

The advantages of the synchronous spark gap, which gives uniform amplitude and constant time intervals between successive discharges, are now generally recognized. With this outfit the discharge is held at the peak of the sine wave, the decrement of the

Synchronous Spark Gap Motor for 110 or 220 Volts, 60 Cycles

emitted wave is low and the received signals can be amplified to a much greater value than is possible with non-synchronous gaps.

The R. & M. Synchronous Spark Gap Motor has a rotor which follows the fluctuations of line frequency very accurately and provides a perfectly synchronized spark. The special design of the R. & M. motor gives full 1/6 and 1/8 horse-power outputs on 1/6 and 1/8 horse-power frames, thereby enabling this company to furnish a powerful motor at an unusually low price. Its large power capacity and high starting torque bring the motor up to its full speed very quickly, permitting a quick change from receiving to transmitting.

The motor is made for operation on 110 and 220-volt, 60 cycle, single phase lighting circuits.

Ratings and Price

H. P.	R. P. M.	Frame Number	Volts	Cycles	List Number	Shipping Wgt. Lbs.	List Price
1/8	1800	16	110	60	5192	30	**$30.00**
1/8	1800	16	220	60	5193	30	**31.00**
1/6	1800	17	110	60	5194	35	**35.00**
1/6	1800	17	220	60	5195	35	**36.00**

Radiotron Transmission

The Use of Radiotrons in Experimental Continuous Wave Telegraph and Telephone Sets

Current literature devoted to amateur radio activities affords sufficient evidence that the era of continuous wave transmission has arrived. It has long been known that continuous wave sending apparatus would provide a greater radio transmission range than a spark transmitter of the same power to the antenna, and also that the use of continuous waves would permit the adoption of more efficient methods of reception than the spark system.

The only suitable form of undamped wave generator for short wave transmission is the oscillating vacuum tube. The expenditure of large sums of money in painstaking research conducted by America's foremost scientific experts has enabled the production of reliable and efficient power tubes—radiotrons—which may be employed as generators of continuous oscillations, of any frequency used in radio communication. The vacuum tube is better adapted to radio transmission at wavelengths in the region of 200 meters than the spark system, for the spark system has certain inherent characteristics which place a very definite practical limit upon the amount of energy that can be put into an antenna at short wavelengths and therefore at high frequencies.

The vacuum tube transmitter using the Radio Corporation's power tubes is comparatively simple, both in point of construction and in operation. It is no more difficult to adjust and to maintain than a spark transmitter, and it has many points of advantage over the spark set. There are, however, certain precautionary measures which must be considered in vacuum tube operation, and it is one of the objects of this bulletin to place before the amateur such information as will enable him to secure the maximum results from a tube set. Moreover, as the operation of the tube transmitter becomes better known among amateur experimenters, it will occupy the premier position in amateur radio work.

Two prime advantages of continuous wave telegraphy should not be lost sight of: namely, the high degree of selectivity, and the greatly increased range obtainable. It is usually possible to transmit two or three times the distance that can be covered by a spark set of the same antenna power, and in addition interference is reduced to an absolute minimum.

Continuous Wave Telegraphy (C. W.) Interrupted Continuous Wave Telegraphy (I. C. W.) and Radio Telephone Transmission

Every up-to-date radio experimenter wants a radio telephone; he will also want a long-distance radio telegraph set. With the same set, using the Radio Corporation's power tubes, the amateur can telephone to the neighboring stations over moderate distances, and by shifting a few switches he can adapt the set for continuous wave telegraph transmission and cover distances by telegraphy three to four times those possible by radio telephony. This is the modern way of doing things in the amateur station, and today there are already several thousand Radiotron power tubes in use at amateur stations throughout the United States.

The vacuum tube transmitting not only permits wireless telephony, but also enables the amateur to make use of modulated or interrupted continuous wave telegraphy. Thus, if the energy supplied to an antenna by an oscillating tube set is modulated by a microphone transmitter, telephonic communication is possible; or if the antenna oscillations are modulated by a buzzer or preferably by some form of rotary grid chopper, the antenna will radiate wave trains similar to those sent forth from the antenna of a spark transmitter. By a suitable arrangement of controls, either C. W. transmission, I. C. W. transmission or telephony may be had from the same set, simply by shifting a few switches.

In transmitting to crystal detector receiving stations with a tube transmitter the grid circuit is modulated by a rotary chopper. Such a chopper is nothing more than a rotary interrupter designed to interrupt the grid circuit of an oscillating tube from 600 to 1,000 times per second. Tests have demonstrated that a tube set modulated in this way gives the same reception efficiency as a quenched spark set of the same power to the antenna.

Sources of Energy for Tube Transmission

A vacuum power tube requires a low voltage source to heat the filament and a high voltage source to energize the plate or anode circuit. The requisite e.m.f. for the plate circuit may be obtained in three ways:

(1) From a high voltage D. C. generator.

(2) From a rectified A. C. Source, using the Radio Corporation's Kenotron, or two electrode, rectifier valves.

(3) From an A. C. Source directly applied to the plate (self-rectification circuits).

If only a D. C. source, such as 110 or 220 volts, is available, a high voltage D. C. generator should be obtained. The motor should be supplied with slip rings to provide an alternating e.m.f. for the filament (through the medium of a step-down transformer). The generator should provide high voltage D. C. according to the rating of the power tube.

Amateurs having access to an A. C. source only should obtain an A. C. transformer and two of the Radio Corporation's Radiotron rectifier valves arranged in a suitable circuit to rectify both valves of the A. C. cycle. The transformer should be provided with a high voltage secondary for the plate circuit supply and with two additional secondaries providing a step-down voltage to light the filaments of the power tubes and rectifier valves. In addition, a reactance and condenser must be supplied to smooth out the ripple in the plate current, as shown in Figure 4.

In the third method two Radiotron power tubes may be connected in a type of circuit in which alternating current of suitable voltage can be applied directly to the plate circuits of the tubes. The tubes then act simultaneously as rectifiers and oscillators, using both halves of the impressed A. C. cycle. This is called the self-rectification method. By means of a smoothing-out reactance of suitable design, the variation in amplitude of the antenna oscillations may be reduced to a minimum value, giving all the advantages of C. W. transmission. The self-rectification circuit is recommended for telegraph use only. A suitable D. C. source obtained either from a rectifier unit or a D. C. generator should be used for telephony.

Note on C. W. Power Transformers

The use of separate transformers for the lighting of power tube filaments is highly recommended for the reason that it is only by using such an arrangement that voltage variation in the different circuits is made possible. Where a combination transformer having a single primary winding connected to the power source is used, variation of the voltage is only possible in this primary winding and the secondary windings, regardless of their number, are all affected at the same time. The cost of individual transformer units for this work is approximately 75 per cent. higher than the cost of a single transformer designed to perform a multiplicity of duties. However, more satisfactory operation results and the former is recommended.

The Practical Use of Transmitting Tubes

Although the principles of construction and operation in the larger power tubes are no different from those applying in the case of the smaller ones, many effects that are negligible in the latter are somewhat magnified in the case of the larger tubes, and certain precautions are therefore necessary. The majority of accidents to power tubes and to their auxiliary apparatus occur during the period of development of circuits and testing and adjustment, rather than during operation, and a little care in making these adjustments will prove of advantage.

The following points, briefly enumerated, are all of importance and should be studied by the amateur before putting his set into operation. Limited space prevents us from giving in detail the reasons for some of the instructions herein laid down, but the amateur may be assured that they are the result of practical observation and experiment and that he cannot well afford to ignore them.

Modulation of An Oscillating Tube's Output

One method of modulation employed in a vacuum tube radio transmitting equipment utilizes a tube as a modulator in addition to the oscillator tube the plate current for these two tubes being fed through an audio-frequency reactor. In a radio telephone transmitting equipment the degree of modulation is of equal importance to the amount of antenna current as far as the strength of the received speech is concerned. The antenna ammeter does not usually indicate whether the output is being modulated in a normal manner. One simple method of keeping a check on this is to insert a miniature lamp in the plate circuit of the modulator. This flashes up when the microphone is spoken into and acts as an operating indicator of the microphone and modulation circuits. A type of lamp should be chosen that will show a low degree of brilliancy with the plate currents obtained on the tube used. Even for the 5-watt size of tube such lamps are easily obtainable. Automobile types of miniature lamps are recommended.

Safety Gaps and General Protective Measures

I n order to guard against excessive transient voltages in connection with Radiotrons UV-203 and UV-204 a protective gap should be provided at or near the socket terminals between the grid and terminal and one of the filament terminals. One-sixteenth of an inch is correct for UV-203 and one-eighth of an inch for UV-204.

Occasionally in the parallel operation of the Radiotron power tubes, ultra high frequency oscillations develop in the plate and grid circuit, which prevent the realization of full output, and cause excessive plate and grid currents. This effect may be avoided by inserting an inductance of a few micro-henries (10 turns in one layer on a tube one inch in diameter is suggested) in one or more of the individual grid leads of each tube as close to the grid terminal of the socket as possible. The protective gap mentioned in a paragraph above should be placed between this coil and the grid terminal of the socket. The best arrangement is to mount the gap directly on the socket terminals and one terminal of the coil directly to the grid terminal of the socket.

Tube Suspension

The life of Radiotron power tubes may be prolonged by mounting them in the proper position. Radiotrons UV-202 and UV-203 should be operated in a vertical position, whereas Radiotron UV-204 may be operated in either a vertical or horizontal position. If mounted horizontally, the plates should lie in a vertical plane, with the seal-off tip down.

Oscillating Circuits

In powerful C. W. transmitting sets the circuits should be so arranged that the center tap on the filament coil and also the negative lead of the direct current high voltage source are both at ground potential relative to high frequency potentials in order to insure safety.

Great care should be taken to thoroughly insulate the grid and plate leads to the tube and the coil sections connected to these leads or any apparatus in them.

Inadvisability of Forcing Power Tubes

It is unwise to overload a Radiotron power tube continuously, as its operating life will be seriously curtailed. It is a much better plan and more economical to operate two tubes in parallel than it is to force one tube to deliver a power output far in excess of what it is rated for; in fact, great economy will result from burning tubes slightly below normal brightness. For instance, it can be shown that to double the filament emission will reduce the operating life of the tube to one-fourth, whereas, by operating the filament at 95% of its rated voltage, the life will be doubled.

When first testing the circuit, or when the set has not been operated for some time, it is wise to cut down all voltages to one-third of the normal voltage. This will greatly reduce the possibility of burning out the tube through a wrong connection which has been overlooked, as a fault will then instantly be detected before the damage is done.

In a radio telephone transmitting circuit of the usual type a modulator tube is employed and a buzzer is often substituted for the microphone when it is desired to send out interrupted continuous waves. This imposes voltage strains on the oscillator tube and if an over-voltage is also applied to its plate the voltage between grid and filament may be excessive. The protective gaps described in a previous paragraph are a safeguard against breakdown due to this voltage.

Resistance of the Antenna and Ground Circuit

Remember, it is the antenna charging current at the transmitter that produces the signals at the receiver, and in order to get a large antenna current with tube sets, the resistance of antenna systems must be reduced to a minimum. In addition to the usual metallic earth plate a counterpoise, consisting of a number of wires spread on the ground underneath the antenna will materially reduce the total antenna resistance. The antenna should be constructed and supported so that its electrical period will not vary through swinging, for, as will be seen, most of the tube circuits shown in this catalogue use the antenna as the capacity element of the oscillating system.

Filament Excitation of Power Tubes

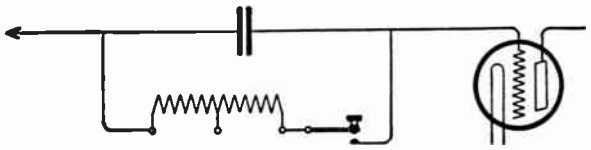
The filaments of power bulbs are preferably energized by alternating current, which gives an added factor of safety and prolongs the filament life.

In adjusting the temperature of a filament the amateur should always use a voltmeter rather than an ammeter, and the voltmeter should be connected directly to the socket connections, in order that the voltage drop across the filament may be measured. If tungsten filaments are operated at constant voltage rather than constant current, it may increase their life by 300%.

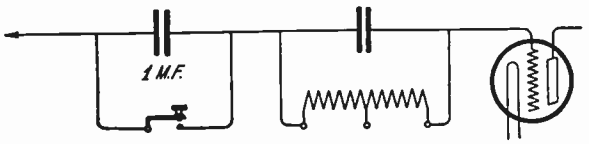
If alternating current is not available the filaments may, of course, be energized from a D. C. source of suitable e.m.f. It is emphasized, however, that the life of a vacuum tube is considerably prolonged by A. C. filament excitation, and particularly if the filament voltage is maintained at constant value.

Location of the Telegraph Key in C. W. Circuits

The proper location of the telegraph key in C. W. transmitting circuits is determined by the size of the Radiotron power tubes used. In circuits employing



one or more UV-202 Radiotrons, satisfactory keying can be obtained by inserting the keys in series with the grid leak resistance as shown in the diagram.



If, however, one or more UV-203 Radiotrons are used, the most satisfactory keying will be obtained if a 1 mfd. condenser is inserted in series with the parallel circuit containing the grid leak resistance and grid condenser, and the key shunted around the 1 mfd. condenser as shown above.

TRANSMITTING TUBE CIRCUITS 12 Pt.

To show the radio amateur or experimenter how to utilize Radiotrons in certain of the well-known oscillating circuits, there is given on the following pages a set of circuit diagrams for radio transmission, together with the component parts of a set for either 5, 50 or 250 watt tubes. Power tubes can be used in a variety of circuits, but the ones shown have been found to give maximum efficiency. Current

radio literature discloses numerous tube transmitting circuits which will be found serviceable.

The attention of the amateur who does not possess a high voltage D. C. motor generator set to supply plate voltage is directed to the self-rectification telegraph circuits shown, in which Radiotrons may be energized directly from an A. C. source. In these circuits power tubes act simultaneously as rectifiers and oscillators. A suitable source of D. C. may be obtained from an A. C. source by the use of the Radio Corporation Kenotron rectifier valves.

Circuit No. 1

Figure 1 shows a simple yet modern type of radio telephone circuit, wherein two Radiotron power tubes are connected in parallel as oscillators. The plate circuit is energized by using full wave Kenotron rectification from an A. C., 110 volt supply. The antenna energy is modulated for radio telephony by the Radio Corporation of America's magnetic modulator.

Circuit No. 2

Figure 2 illustrates a method for using Radiotrons UV-202 or 203 for C. W. and I. C. W. radio telegraphy from a D. C. supply. The filaments of the transmitter tubes in this case are heated by a storage battery and the voltage necessary for the plates is supplied by a special motor generator according to the rating indicated at the foot of the page describing this circuit. Where I. C. W. is employed, the Radio Corporation of America's grid chopper model PX-1638 is employed.

Circuit No. 3

Figure 3 illustrates a full wave self-rectifying transmitter for C. W. telegraphy using A. C. as a source of power throughout. This circuit is applicable to 5 and 50 watt Radiotrons, UV-202 and UV-203, respectively. The plate circuit is energized from the Radio Corporation of America's new high voltage transformer, which is designed to operate from a source of 110 volt, 50 or 60 cycle A. C.

Circuit No. 4

Figure 4 illustrates one of the correct methods for employing a 10-20 or 50-100 watt radio telephone set, using two Radiotrons UV-202 or UV-203, one as an oscillator and the other as a modulator. Two of the Radio Corporation of America's Kenotrons, model UV-216 or model UV-217, provide D. C. plate excitation from an A. C. supply. An R. C. A. microphone transformer with "side tone" winding is used to control the grid potential of the modulator tube, which in turn varies the energy imposed upon the antenna circuit.

Circuit No. 5

Figure 5 illustrates a circuit specially designed to provide constant antenna frequency. This is desirable because it prevents changes in the wave length of the transmitting station and permits consistent operation over longer range distances than is otherwise possible. Two Radiotron power tubes are employed as oscillators, their plates being energized by the Kenotron rectifier combination, which provides full wave rectification from the A. C. supply.

Circuit No. 6

Figure 6 shows a typical radio telephone transmitting circuit, employing three Radiotrons UV-203 as oscillator, modulator, and speech amplifier, respectively. Plate excitation is obtained from a D. C. high voltage generator and the plate potential for normal operation should range between 750 and 1000 volts. This circuit may be employed for C. W., I. C. W., or radio telephone transmission.

Circuit No. 7

Figure 7 illustrates a typical circuit for use in connection with four Radiotrons UV-202 and four Kenotrons UV-216. Two of the Radiotrons act as modulators and two act as oscillators, while the four Kenotrons permit full wave rectification from the A. C. supply. The Radio Corporation of America's power transformer provides the filament and plate current for the eight tubes.

Circuit No. 8

Figure 8 illustrates a suitable arrangement for using full wave rectification for four Radiotrons UV-202 and four Kenotrons UV-216. This is a constant frequency circuit of the same character illustrated in Fig. 5. The coupling arrangement between the oscillation transformer and antenna inductance permits an accurate adjustment by means of the Special Faradon Condenser UC-1846 which provides three different capacities.

Circuit No. 9

Figure 9 shows a radio telegraph transmitting circuit for two Radiotrons UV-204. The energy supply for the plate circuit must be D. C. An individual transformer on A. C. for filament heating supply being used. A circuit of this character may be employed to communicate over long distances by continuous wave telegraphy.

Fig. 1.—Radio Telephone Circuit, Using Full Wave Rectification from A. C. Supply and Magnetic Modulator

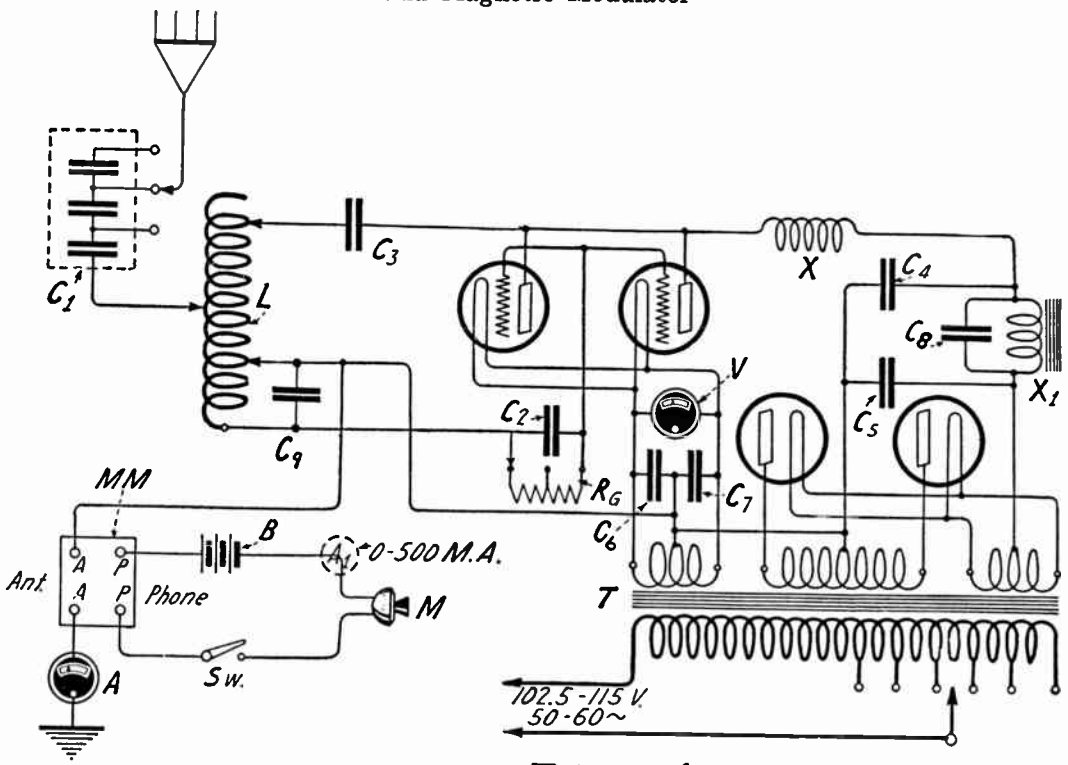


Fig. 1

	LIST OF MATERIAL	Circuit Symbol	RATING OF RADIOTRONS 5-WATT TUBES Model	5-WATT TUBES Price	50-WATT TUBES Model	50-WATT TUBES Price
1	One or more RADIOTRON Power Tubes	.....	UV-202	$8.00 each	UV-203	$30.00 each
2	One or more RADIOTRON Power Sockets	.....	UR-542	1.00 "	UT-541	2.50 "
3	Two KENOTRON Rectifier Tubes	.....	UV-216	15.00	UV-217	53.00
4	Two KENOTRON Tube Sockets	.....	UR-542	2.00	UT-541	5.00
5	Antenna Series Condenser	C^1	UC-1015	5.75	UC-1015	5.75
6	Magnetic Modulator	MM	(See Note 1)	.....	(See Note 3)	.....
7	Magnetic Modulator Battery	*B	6 Volts	.....	6 Volts	.....
8	Microphone	†M	WE-284-W	.....	WE-284-W	.....
9	Antenna Ammeter	A	UM-530	6.00	UM-533	6.25
10	Grid Condenser	C^2	UC-1014	2.25	UC-1014	2.25
11	Blocking Condenser	C^3	UC-1014	2.50	UC-1014	2.50
12	Filter Condenser	C^4	2-UC-490 (In parallel)	5.00	2-UC-490 (In parallel)	5.00
13	Filter Condenser	C^5	2-UC-490 (In parallel)	5.00	2-UC-490 (In parallel)	5.00
14	Transmitter Grid Leak	Rg	UP-1719	1.10	UP-1718	1.65
15	A. C. Filament Voltmeter	V	0-15 Volts	.....	0-15 Volts	.....
16	Power Transformer	T	UP-1368	25.00	UP-1016	38.50
17	Radio Frequency Choke	X	UL-1655	3.85	UL-1655	3.85
18	Filter Reactor	X^1	UP-1653	12.50	UP-1654	18.00
19	Oscillation Transformer	L	UL-1008	11.00	UL-1008	11.00
20	Microphone Milliammeter	A^1	.....	.....	.....	.....
21	Microphone Battery Switch	SW	S. P. S. T.	.....	S. P. S. T.	.....
22	Filament By-Pass Condenser	C^6 & C^7	2-WE-21-R (As shown)	.....	2-WE-21-R (As shown)	.....
23	Trap Condenser	C^8	WE-21-U	.....	WE-21-U	.....
24	Grid Tuning Condenser	C^9	UC-1831	9.00	UC-1831	9.00

Note 1:—Proper Size of Magnetic Modulator.

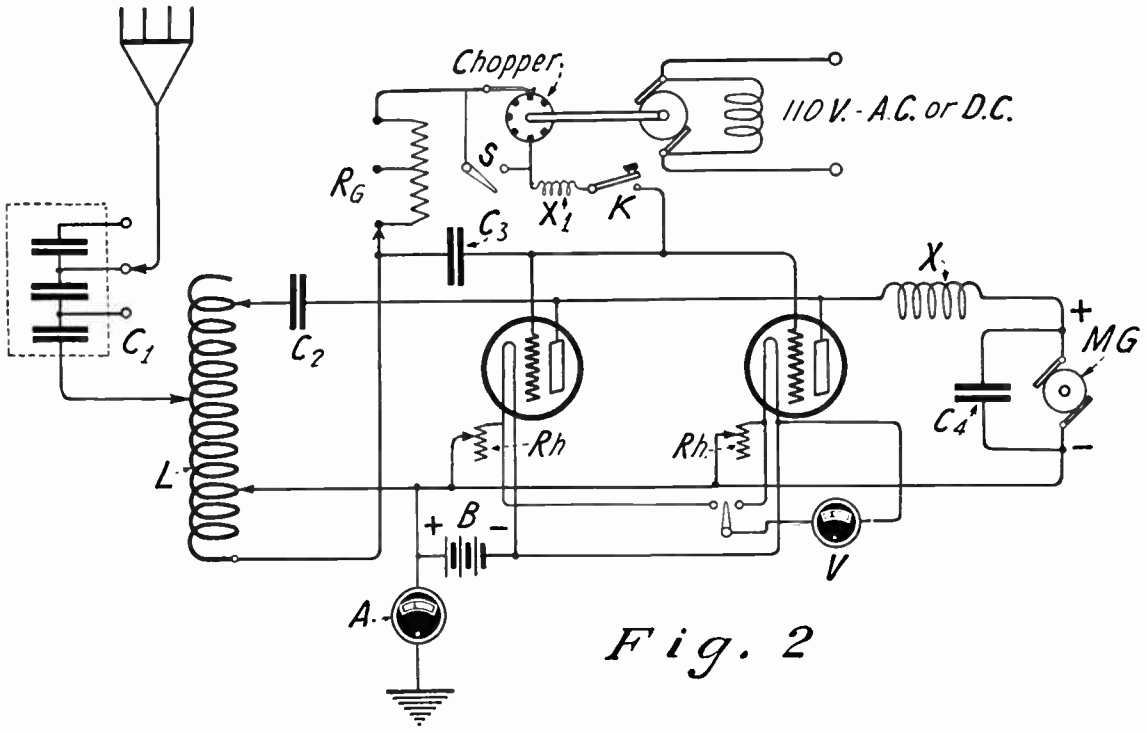
No. of Tubes	UV-202	No. of Tubes	UV-203
1 ..	UT-1643	1	UT-1357
2	UT-1643	2	UT-1367
3	UT-1357	3	UT-1367
4	UT-1357		

* Four Dry Cells or 6-Volt Storage Battery.

† Western Electric No. 284-W is recommended.

Remember—It is not necessary to purchase a motor-genera tor if you have a source of 110-volt A. C. lighting current, for it can be converted to D. C. by using KEN OTRON rectifiers.

Fig 2.—C. W. and I. C. W. (Grid Choppe r) Circuit for Operation from D. C. Supply with Radiotrons UV-202...or UV-203



	LIST OF MATERIAL	Circuit Symbol	RATING OF RADIOTRONS 5-WATT TUBES Model	5-WATT TUBES Price	50-WATT TUBES Model	50-WATT TUBES Price
1	One or more RADIOTRON Power Tubes.....	.....	UV-202	$8.00 each	UV-203	$30.00 each
2	One or more RADIOTRON Tube Sockets.....	.....	UR-542	1.00	UT-541	2.50 "
3	Oscillation Transformer	L	UL-1008	11.00	UL-1008	11.00
4	Antenna Series Condenser	C^1	UC-1015	5.75	UC-1015	5.75
5	Blocking Condenser	C^2	UC-1014	2.50	UC-1014	2.50
6	Transmitter Grid Leak	Rg	UP-1719	1.10	UP-1718	1.65
7	Grid Condenser	C^3	UC-1014	2.50	UC-1014	2.50
8	Transmitting Key	K	UQ-809	3.00	UQ-809	3.00
9	Chopper	Chopper	PX-1638	7.25	PX-1638	7.25
10	Radio Frequency Chokes	X	UL-1655	3.85	UL-1655	3.85
11	D. C. Filament Voltmeter	V	O-15 Volts	.....	O-16 Volts	.....
12	Filament Rheostat	Rh	PR-535	3.00	PT-537	10.00
13	Filament Battery	B	10 Volts	.....	12 Volts	.....
14	Protective Condenser	C	UC-490	2.50	UC-490	2.50
15	Motor Generator	MG	(See Note 1)	.....	(See Note 1)	.....
16	Antenna Ammeter	A	UM-530	6.00	UM-533	6.25
17	Radio Frequency Choke	X^1	UL-1655	3.85	UL-1655	3.85
18	Switch for CW Telegraphy.....	S	S. P. S. T.	.....		

Note 1:—Rating of Motor Generators.

UV-202			UV-203		
No. of Tubes	Watts M. G.	Plate Volts	No. of Tubes	Watts M. G.	Plate Volts
1 or 2	100	350	1	200	750-1000
2 or 4	200	350	2 or 3	500	750-1000

Remember—In general a grid chopper gives the same kind of a signal at the receiving station as a spark set, but usually over much greater distances.

Fig. 3.—Method of Using 5- or 50-Watt Radiotron Power Tubes with 60-Cycle A. C. Source for C. W. Tone Telegraphy—(Full Wave Self-Rectification)

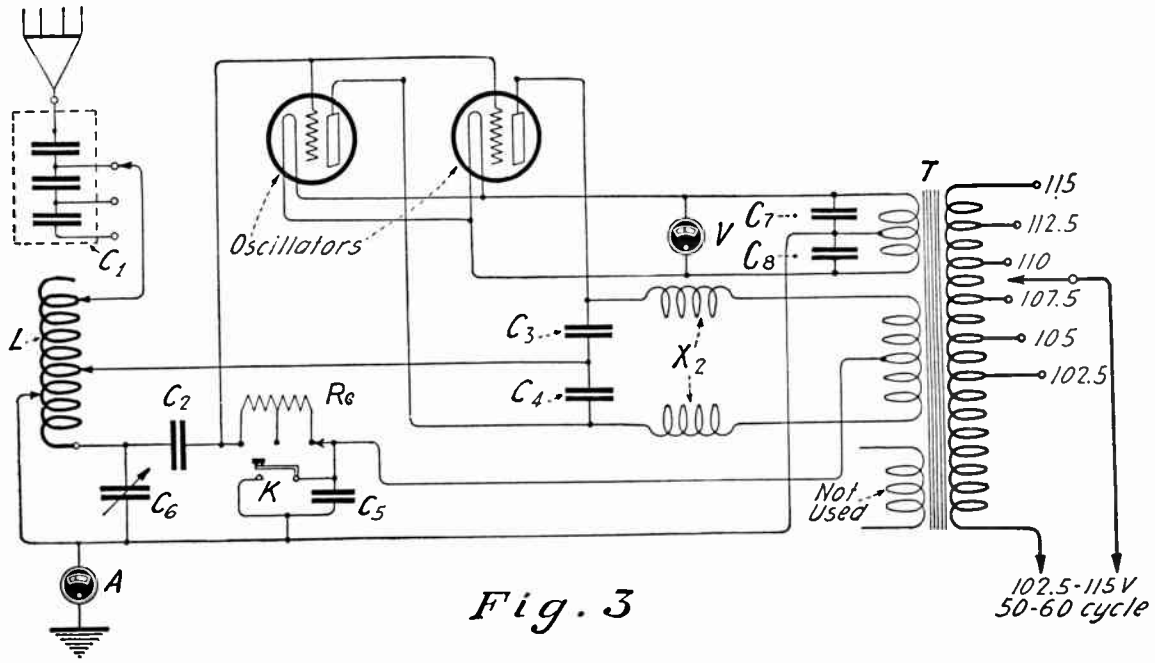


Fig. 3

	LIST OF MATERIAL	Circuit Symbol	RATING OF RADIOTRONS 5-WATT TUBES Model	5-WATT TUBES Price	50-WATT TUBES Model	50-WATT TUBES Price
1	Two RADIOTRON Power Tubes (Note 1)..	.....	UV-202	$16.00	UV-203	60.00
2	Two Power Tube Sockets.....	.....	UR-542	2.00	UT-541	5.00
3	Power Transformer	T	UP-1368 (See Note 1)	25.00	UP-1016	38.50
4	Oscillation Transformer	L	UL-1008	11.00	UL-1008	11.00
5	Two By-Pass Condensers	C^3-C^4	UC-1014	5.00	UC-1014	5.00
6	Grid Condenser	C^2	UC-1014	2.50	UC-1014	2.50
7	Grid Leak	Rg	UP-1719	1.10	UP-1718	1.65
8	Antenna Series Condenser.....	C^1	UC-1015	5.75	UC-1015	5.75
9	A. C. Filament Voltmeter.....	V	0-15 Volts	.....	0-15 Volts	.....
10	Antenna Ammeter	A	UM-530	6.00	UM-533	6.25
11	Key	K	UQ-809	3.00	UQ-809	3.00
12	Radio Frequency Chokes	X^2	2-UL-1655	7.70	2-UL-1655	7.70
13	Keying Condenser	C^5	UC-1014	2.50	UC-1014	2.50
14	Grid Tuning Condenser.....	C^6	2-UC-1014 In Series or (UC-1831) variable	5.00	2-UC-1014 In Series-Fixed or (1UC-1831) variable	5.00
15	By-Pass Condensers	C^7 & C^8	WE21-R (Connected as shown)	.....	WE21-R (Connected as shown)	.....

Note 1:—Transformer UP-1368 is capable of handling a total of four UV-202 tubes in a self-rectifying circuit. In order to obtain a 20-watt set, it is only necessary to add two additional UV-202 tubes, one in parallel with each of the tubes shown in the circuit.

Remember—When using a motor-generator for plate supply to one or more power tubes, be sure that the watts output of the generator is sufficient to supply all the tubes. Do not use a 15-watt generator for plate supply to a 50-watt RADIOTRON. A table indicating the generator watts output for various numbers of tubes is shown under Fig. 2.

Fig. 4.—Complete Diagram for Low Power Radio Telephone Set, Using Constant Current Modulation System with 5- or 50-Watt Radiotron Power Tubes Operating from 110-Volts A. C. Supply

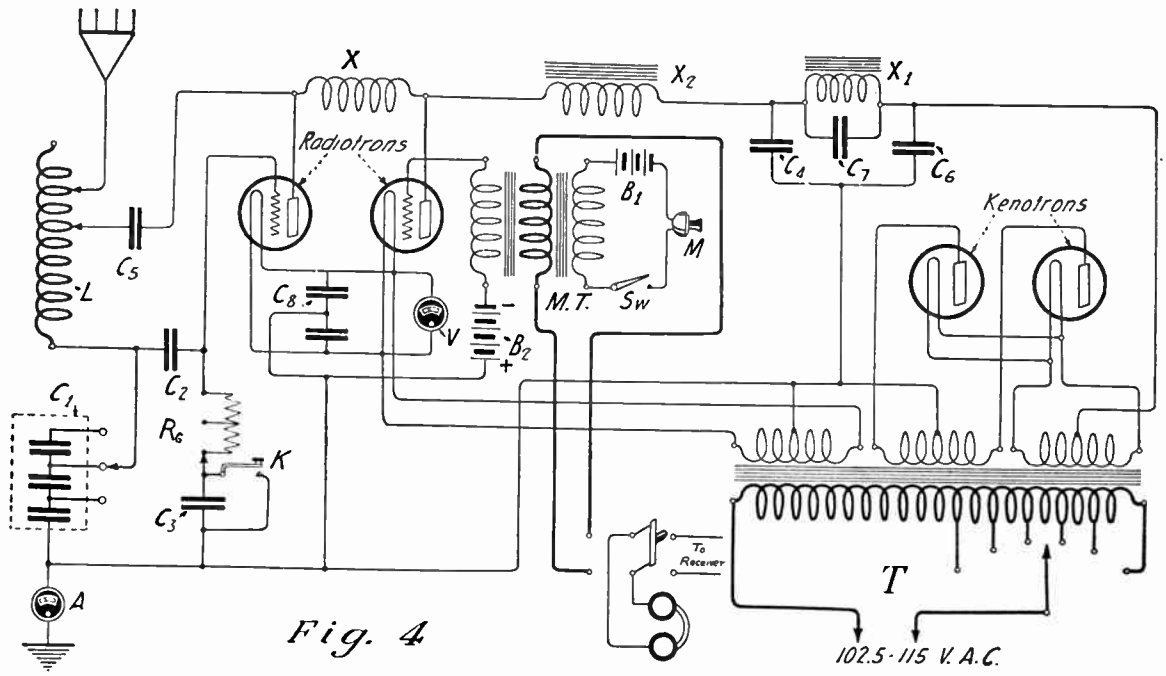


Fig. 4

	LIST OF MATERIAL	Circuit Symbol	RATING OF RADIOTRONS 5-WATT TUBES Model	5-WATT TUBES Price	50-WATT TUBES Model	50-WATT TUBES Price
1	Two RADIOTRON Power Tubes	.....	UV-202	$15.00	UV-203	$60.00
2	Two Power Tube Sockets	.....	UR-542	2.00	UT-541	5.00
3	Power Transformer	T	UP-1368	25.00	UP-1016	38.50
4	Oscillation Transformer	L	UL-1008	11.00	UL-1008	11.00
5	Two KENOTRON Rectifier Tubes	.....	UV-216	15.00	UV-217	53.00
6	Two KENOTRON Tube Sockets	.....	UR-542	2.00	UT-541	5.00
7	Radio Frequency Choke Coil	X	UL-1655	3.85	UL-1655	3.85
8	Plate Reactor	X^2	UP-415	5.75	UP-415	5.75
9	Filter Reactor	X^1	UP-1653	12.50	UP-1654	18.00
10	Filter Circuit Condensers	C^4-C^6	2-UC-490 (In parallel)	5.00	2-UC-490 (In parallel)	5.00
11	Microphone Transformer	MT	UP-414	7.25	UP-414	7.25
12	Microphone Transmitter	*M	WE-284-W	.....	WE-284-W	.....
13	Microphone Battery	*B^1	6 Volts	.....	6 Volts	.....
14	Microphone Switch	SW	S.P.S.T.	.....	S.P.S.T.	.....
15	Grid Bias Battery	†B^2	44 Volts	.....	44 Volts	.....
16	A. C. Filament Voltmeter	V	O-15 Volts	.....	O-15 Volts	.....
17	Transmitter Grid Leak	Rg	UP-1719	1.10	2-UP-1718 (In Series)	3.30
18	Antenna Series Condenser	C^1	UC-1015	5.75	UC-1015	5.75
19	Antenna Ammeter	A	UM-530	6.00	UM-533	6.25
20	Blocking Condenser	C^5	UC-1014	2.50	UC-1014	2.50
21	Grid Condenser	C^2	2-UC-1014 (In Series)	5.00	2-UC-1014 (In Series)	5.00
22	Key Condenser	C^3	.....	.....	UC-490	2.50
23	Trap Condenser	C^7	WE-21-U	.....	WE-21-U	.....
24	Filament By-Pass Condensers	C^8	2-WE-21-R (Connected as shown)	.....	2-WE-21-R (Connected as shown)	.....

* Four Dry Cells or 6-Volt Storage Battery.
† Two Blocks of Burgess' Battery 22½ volts each, No. 2156.

Remember—All of the energy of your power tubes can be efficiently delivered to your antenna on wave lengths of 200 meters and lower.

Fig. 5.—Radio Telephone or Telegraph Circuit, Using Full Wave Rectification from A. C. Supply with Constant Frequency (Intermediate) Circuit and Magnetic Modulator

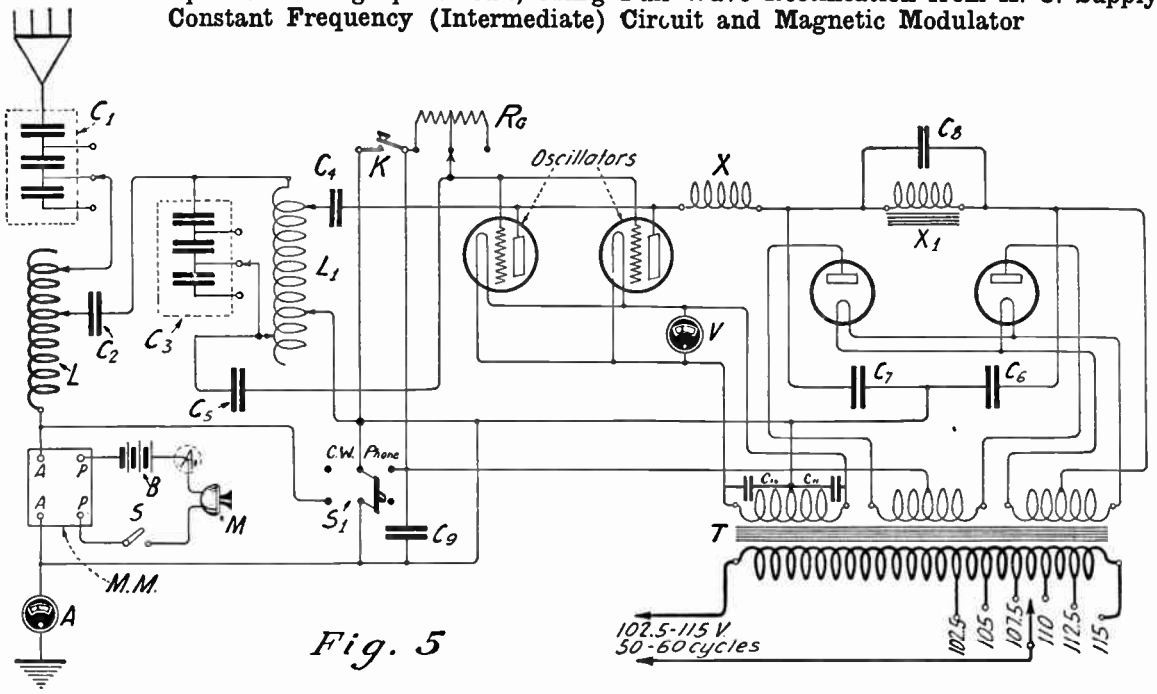


Fig. 5

	LIST OF MATERIAL	Circuit Symbol	RATING OF RADIOTRONS 5-WATT TUBES Model	5-WATT TUBES Price	50-WATT TUBES Model	50-WATT TUBES Price
1	Two RADIOTRON Power Tubes	.....	UV-203	$16.00	UV-202	$60.00
2	Two RADIOTRON Power Sockets	.....	UT-541	2.00	UR-542	5.00
3	Two KENOTRON Rectifier Tubes	.....	UV-217	15.00	UV-216	53.00
4	Two KENOTRON Tube Sockets	.....	UT-541	2.00	UR-542	5.00
5	Antenna Series Condenser	C^1	UC-1015	5.75	UC-1015	5.75
6	Magnetic Modulator	MM	(Note 1)	.....	(Note 1)	.....
7	Magnetic Modulator Battery	B	6 Volts	.....	6 Volts	.....
8	Microphone	M	WE-284-W	.....	WE-284-W	.....
9	Antenna Ammeter	A	UM-533	6.00	UM-530	6.25
10	Coupling Condenser	C^2	UC-1803	5.00	UC-1803	5.00
11	Intermediate Shunt Circuit Condenser	C^3	UC-1015	5.75	UC-1015	5.75
12	Blocking Condenser	C^4	UC-1014	2.50	UC-1014	2.50
13	Grid Condenser	C^5	UC-1014	2.50	UC-1014	2.50
14	Filter Condenser	C^6	2-UC-490 (In parallel)	5.00	2-UC-490 (In parallel)	5.00
15	Filter Condenser	C^7	2-UC-490 (In parallel)	5.00	2-UC-490 (In parallel)	5.00
16	Trap Condenser	C^8	WE-21-U	.....	WE-21-U	.....
17	Grid Leak	Rg	UP-1718	1.10	UP-1719	1.65
18	A. C. Filament Voltmeter	V	O-15 Volts	.....	O-15 Volts	.....
19	Radio Frequency Choke	X	UL-1655	3.85	UL-1655	3.85
20	Filter Reactor	X^1	UP-1654	12.50	UP-1653	18.00
21	Oscillation Transformer	L^1	UL-1008	11.00	UL-1008	11.00
22	Antenna Inductance	L	UL-1008	11.00	UL-1008	11.00
23	Key	K	UQ-809	3.00	UQ-809	3.00
24	Key Condenser	C^9	UC-1014	2.50	UC-1014	2.50
25	Signal Switch	S^1	S.P.D.T.	.....	S.P.D.T.	.....
26	Microphone Battery Switch	S	S.P.S.T.	.....	S.P.S.T.	.....
27	Power Transformer	T	UP-1016	25.00	UP-1658	38.50
28	Filament By-Pass Condenser	C^{10}	WE-21-R	.....	WE-21-R	.....
29	Filament By-Pass Condenser	C^{11}	WE-21-R	.....	WE-21-R	.....
30	Microphone Milliammeter, 0-500 Milliamps	A^1	.....	.....	.....	.....

Note 1:—Proper size of Magnetic Modulator

No. of Tubes	UV-202	No. of Tubes	UV-203
1	UT-1643	1	UT-1357
2	UT-1643	2	UT-1367
3	UT-1357	3	UT-1367
4	UT-1357		

Remember—It is not necessary to purchase a motor-generator if you have a source of 110-volt A. C. lighting current, for it can be converted to D. C. by using KENOTRON rectifiers.

Fig. 6.—D. C. Radio Telephone Circuit, Using Radiotrons UV-203 for the Oscillator, Modulator and Speech Amplifier, with 1,000 Volts D. C. Plate Supply

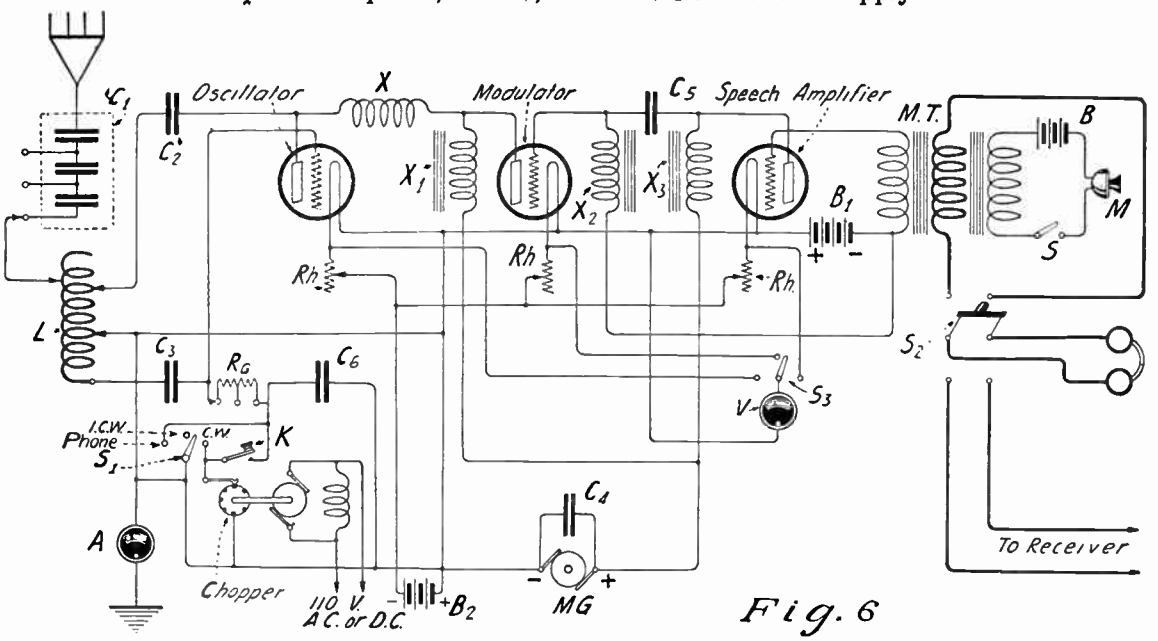


Fig. 6

	LIST OF MATERIAL	Circuit Symbol	RATING OF RADIOTRONS 50-WATT TUBES Model	Price
1	One RADIOTRON "Oscillator"	OSC	UV-203	$30.00
2	One RADIOTRON "Modulator"	MOD	UV-203	30.00
3	One RADIOTRON "Speech Amplifier"	SA	UV-203	30.00
4	Three Sockets	.....	UT-541	7.50
5	Oscillation Transformer	L	UL-1008	11.00
6	Antenna Series Condenser	C^1	UC-1015	5.75
7	Antenna Ammeter	A	UM-533	6.25
8	Blocking Condenser	C^2	UC-1014	2.50
9	Grid Condenser	C^3	UC-1014	2.50
10	Transmitter Grid Leak	Rg	UP-1718	1.65
11	Radio Frequency Choke	X	UL-1655	3.85
12	Plate Reactor	X^1	UP-415	5.75
13	Modulator Grid Reactor	X^2	UP-415	5.75
14	Amplifier Plate Reactor	X^3	UP-415	5.75
15	Protective Condenser	C^4	UC-490	2.50
16	Motor Generator	MG	(Note 1)	.....
17	Grid Bias Battery	*B^1	44 Volts	.....
18	Amplifier Coupling Condenser	C^5	UC-489	1.60
19	Microphone Transformer	MT	UP-414	7.25
20	Microphone Battery	†B	6 Volts	.....
21	Microphone Transmitter	M	WE-284-W	.....
22	D. C. Filament Voltmeter	V	0-15-Volts	.....
23	Keying Condenser	C^6	UC-1014	2.50
24	Key	K	UQ-809	3.00
25	Chopper	Chopper	PX-1368	7.25
26	Three Filament Rheostats	Rh	PT-537	30.00
27	Microphone Switch	S	S.P.S.T.	.....
28	Signal Switch	S^1	S.P.D.T.	.....
29	Side Tone Switch	S^2	D.P.D.T.	.....
30	Filament Battery	B^2	12 Volts	.....
31	Voltmeter Switch	S^3	T.P.S.T.	.....

Note 1: Radiotrons UV-203

No. of Tubes	Watts M. G.	Plate Volts
1	200	750-1000
2 or 3	500	750-1000

* Two Blocks of Burgess' Battery, No. 2156.

† Four Dry Cells or 6-Volt Storage Battery.

Remember—The life of RADIOTRON power tubes depends upon proper operation. Do not use a greater voltage on the filament than that specified, and do not overload the plate by using an excessive plate voltage, that is, IF YOU WANT LONG LIFE.

Fig. 7.—Radio Telephone Circuit, Using Four Radiotrons UV-202 and Four Kenotrons, UV-216, for Telephony, with Constant Current System of Modulation

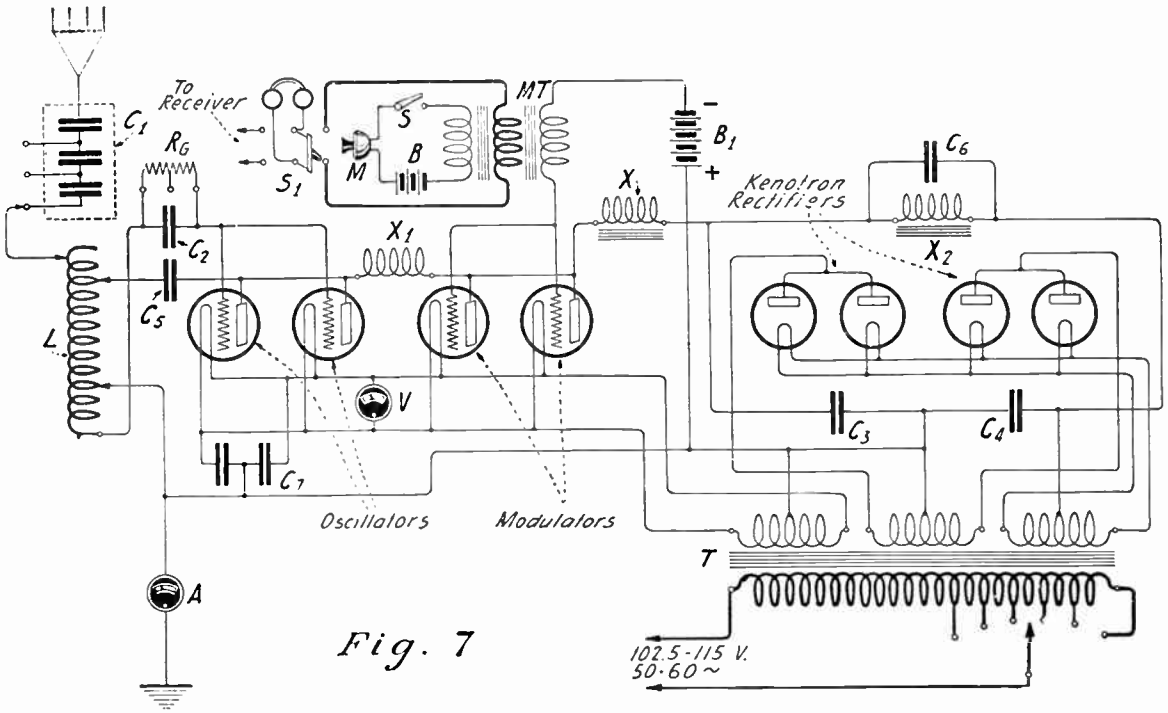


Fig. 7

	LIST OF MATERIAL	Circuit Symbol	RATING OF RADIOTRONS 5-WATT TUBES Model	Price
1	Two RADIOTRON Oscillator Tubes	.....	UV-202	$16.00
2	Two RADIOTRON Modulator Tubes	.....	UV-202	16.00
3	Four KENOTRON Rectifier Tubes	.....	UV-216	30.00
4	Eight Sockets	.....	UR-542	8.00
5	Antenna Series Condenser	C^1	UC-1015	5.75
6	Antenna Ammeter	A	UM-530	6.00
7	Grid Condenser	C^2	UC-1014	2.50
8	Transmitter Grid Leak	Rg	UP-1719	1.10
9	Oscillation Transformer	L	UL-1008	11.00
10	Radio Frequency Choke	X^1	UL-1655	3.85
11	Plate Reactor	X	UP-415	5.75
12	Microphone Transformer	MT	UP-414	7.25
13	Microphone Battery	*B	6 Volts	.....
14	Microphone	M	WE-284-W	.....
15	Grid Bias Battery	†B^1	44 Volts	.....
16	Power Transformer	T	UP-1368	25.00
17	Filter Reactor	X^2	UP-1653	12.50
18	Filter Condenser	C^3	2-UC-490 (In parallel)	5.00
19	Filter Condenser	C^4	2-UC-490 (In parallel)	5.00
20	Blocking Condenser	C^5	UC-1014	2.50
21	A. C. Filament Voltmeter	V	0-15 Volts	.....
22	Microphone Switch	S	S.P.S.T.	.....
23	Side Tone Switch	S^1	D.P.D.T.	.....
24	Trap Condenser	C^6	WE-21-U	.....
25	Filament By-Pass Condenser	C^7	2-WE-21-R	.....

* Four Dry Cells or 6-Volt Storage Battery.

† Two Blocks of Burgess' Battery No. 2156.

Remember—Power tube filament should be burned at constant voltage rather than constant current. This will prolong their useful life.

Fig. 8.—Constant Frequency Circuit, Using Full Wave Rectification for Four Radiotrons UV-202 and Four Kenotrons, UV-216 for Telegraph and Telephone (Chopper and Magnetic Modulator)

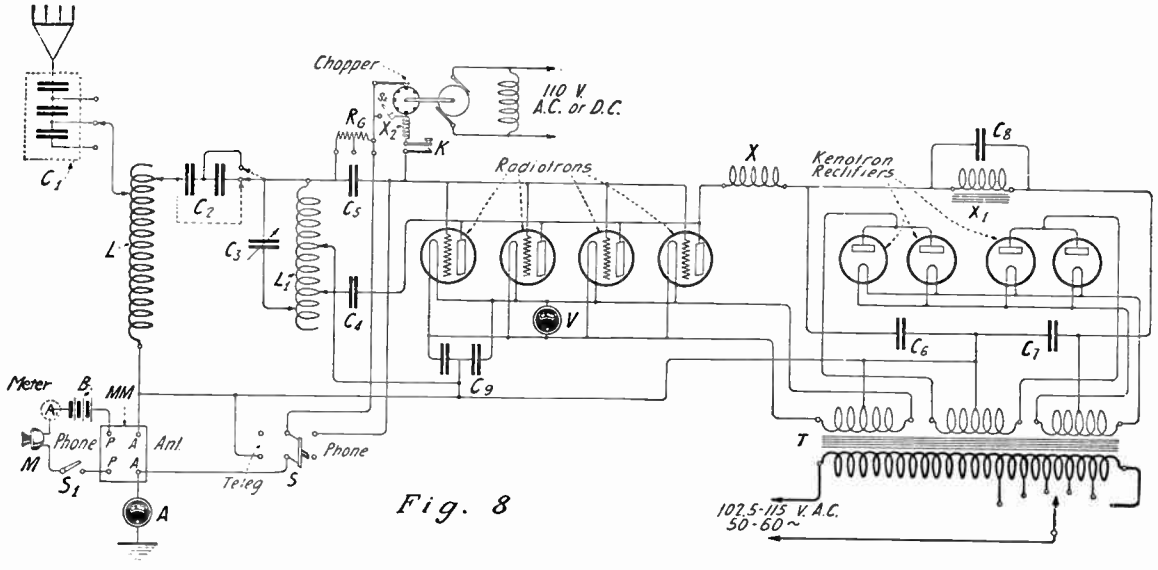


Fig. 8

	LIST OF MATERIAL	Circuit Symbol	RATING OF RADIOTRONS 5-WATT TUBES Model	Price
1	Four RADIOTRON Power Tubes	.....	UV-202	$32.00
2	Four KENOTRON Rectifier Tubes	.....	UV-216	30.00
3	Eight RADIOTRON Sockets	.....	UR-542	8.00
4	Antenna Series Condenser	C^1	UC-1015	5.75
5	Magnetic Modulator	MM	(See Note 1)	.....
6	Magnetic Modulator Battery	*B	6 Volts	.....
7	Microphone	M	WE-284-W	.....
8	Antenna Ammeter	A	UM-530	6.00
9	Coupling Condenser	C^2	UC-1846	10.00
10	Intermediate Shunt Circuit Condenser	C^3	UC-1831	9.00
11	Oscillation Transformer	L^1	UL-1008	11.00
12	Blocking Condenser	C^4	UC-1014	2.50
13	Grid Condenser	C^5	UC-1014	2.50
14	Filter Condenser	C^6	2-UC-490 (in parallel)	5.00
15	Filter Condenser	C^7	2-UC-490 (in parallel)	5.00
16	Antenna Inductance	L	UL-1008	11.00
17	Transmitter Grid Leak	Rg	UP-1719	1.10
18	A. C. Filament Voltmeter	V	0-15 Volts	.....
19	Power Transformer	T	UP-1368	25.00
20	Radio Frequency Choke	X	UL-1655	3.85
21	Filter Reactor	X^1	UP-1653	12.50
22	Telegraph-Telephone Switch	S	D.P.D.T.	.....
23	Grid Chopper	Chopper	PX-1638	7.25
24	Telegraph Key	K	UQ-809	3.00
25	Radio Frequency Choke	X^2	UL-1655	3.85
26	Microphone Milliammeter, 0-500 Milliamps	A^1	.....	.....
27	Trap Condenser	C^8	WE-21-U	.....
28	Filament By-Pass Condenser	C^9	2-WE-21-R (in series)	.....
29	Microphone Switch	S^1	S.P.S.T.	.....
30	Switch for CW-ICW Telegraphy	S^2	S.P.S.T.	.....

Note 1:—Proper Size of Magnetic Modulator.

No. of Tubes	UV-202	No. of Tubes	UV-203
1	UT-1643	1	UT-1357
2	UT-1643	2	UT-1367
3	UT-1357	3	UT-1367
4	UT-1357		

* Four Dry Cells or 6-Volt Storage Battery.

Remember—The life of the filament of RADIOTRON power tubes is dependent upon its temperature. A 3 per cent. increase in filament current will halve the life of your tubes and a 3 per cent. decrease will DOUBLE THE LIFE.

Fig. 9.—C. W. Telegraph Circuit, Using Two UV-204 Radiotrons 250-Watt Power Tubes Westinghouse 20-Watt V. T. Transmitter, Model TF

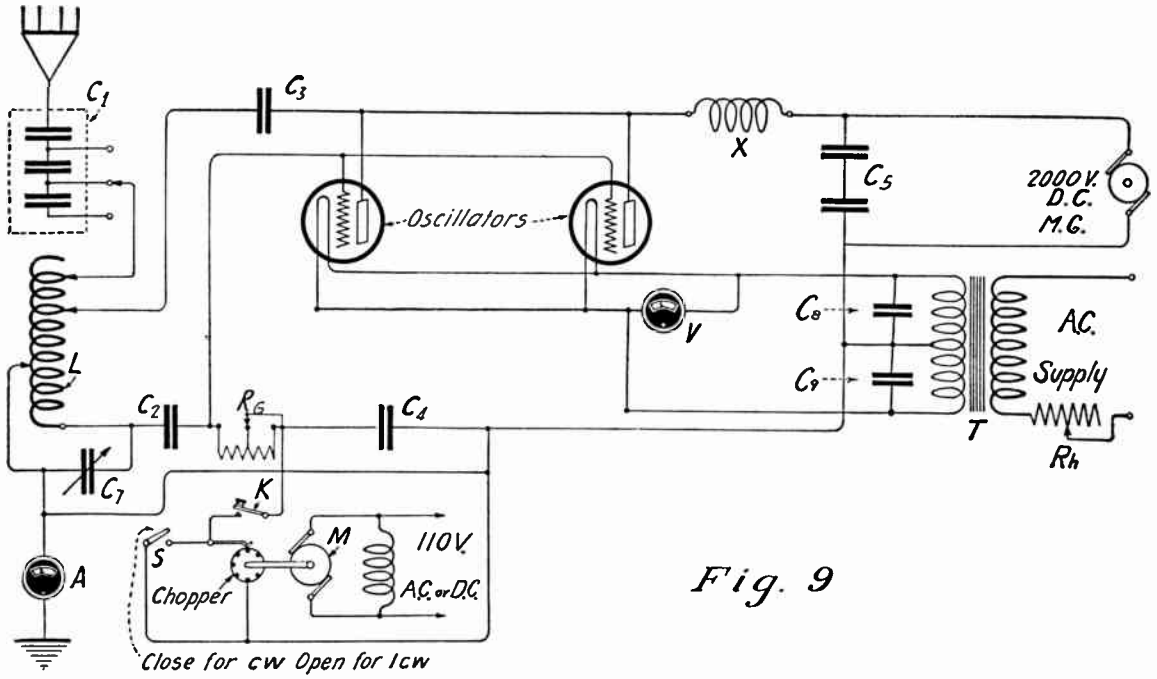


Fig. 9

	LIST OF MATERIAL	Circuit Symbol	RATING OF RADIOTRONS Model	Price
1	One or Two RADIOTRON Power Tubes	.....	UV-204	**$110.00 each**
2	Tube Mountings	.....	UT-501-502	**2.00 pair**
3	Antenna Series Condenser	C^1	10 amps. (See Note 2)	.....
4	Oscillation Transformer	L	UL-1008	**11.00**
5	Tuning Condenser	C^7	UC-1831	**9.00**
6	Blocking Condenser	C^3	UC-1806	**7.00**
7	Grid Condenser	C^2	UC-1014	**2.50**
8	Radio Frequency Choke	X	UL-1655	**3.85**
9	Smoothing Condenser	C^5	2-UC-490 (in series)	**5.00**
10	Grid Leak	Rg	UP-1718	**1.65**
11	Keying Condenser	C^4	UC-1014	**2.50**
12	Chopper	Chopper	PX-1638	**7.25**
13	Key	K	UQ-809	**3.00**
14	Filament Transformer	T	(See Note 3)	.....
15	Filament Rheostat	Rh	(GE. Cat. 1916228)	.....
16	Filament Voltmeter A. C.	V	0-15 Volts	.....
17	Antenna Ammeter	A	0-10 amps.	.....
18	Signal Switch	S	S.P.S.T.	.....
19	By-Pass Condenser	C^8 & C^9	2-WE-21-R	.....
20	Motor Generator	MG	(See Note 1)	.....

Note 1:—The high voltage generator for the above transmitter should be capable of delivering .5 ampere at from 1500 to 2000 volts.

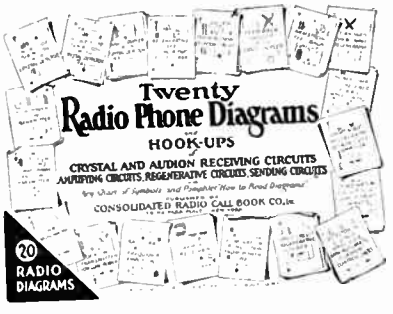
Note 2:—New condenser. .0003, .0004 and .0005 mfd., 10 amps. at 200 meters. Do not use UC-1015. Information on request.

Note 3:—400 watt 12/6 V Transformer, 50-60 cycles, 110/220 volts—not stocked by R. C. A.

Remember—On any tube or group of tubes delivering over 50 watts of alternating current energy, or operating at a plate potential above 2,000 volts, a safety spark gap should be provided between the grid and filament terminals at or near the tube socket or mounting. This gap should be adjusted to between 1/32 in. and ¼ in., depending upon the plate voltage employed and the number of tubes and types of tubes used.

Radio Books and Pamphlets

Title	Author	Price
Practical Wireless Telegraphy	Elmer E. Bucher	$2.25
Vacuum Tubes in Wireless Communication	Elmer E. Bucher	2.25
Wireless Experimenter's Manual	Elmer E. Bucher	2.25
How to Pass U. S. Govt. Wireless License Examinations	Elmer E. Bucher	.75
How to Conduct a Radio Club	Elmer E. Bucher	.75
The Alexanderson System for Radio Telegraph and Radio Telephone Transmission	Elmer E. Bucher	1.25
Practical Amateur Wireless Stations	Compiled by J. Andrew White, Editor of Wireless Age	.75
Radio Telephony	Alfred N. Goldsmith, Ph.D.	2.50
Prepared Radio Measurements with Self-Computing Charts	Ralph R. Batcher	2.00
Radio Instruments and Measurements		1.75
Acquiring the Code	E. P. Gordon	.50
Sound Method of Learning the Code		.50
Elementary Principles of Wireless Telegraphy (in two volumes)	R. D. Bangay	
Volume 1		1.75
Volume 2		1.75
Practical Aviation (including Construction and Operation)	Major J. Andrew White	2.25
Military Signal Corps Manual	Major J. Andrew White	2.25
Continuous Wave Telegraphy. Part 1	W. H. Eccles	8.00
Thermionic Tubes in Wireless Telegraphy and Telephony	J. Scott-Taggart	8.00
Radio Communication	J. H. Morecraft	7.50
Thermionic Vacuum Tubes	Van der Bijl	5.00
Principles of Radio Engineering	Lauer and Brown	3.50
Thermionic Valve and Its Development in Radio Telegraphy and Telephony	J. A. Fleming	5.00
The Oscillation Valve: The Elementary Principles of Its Application to Wireless Telegraphy	R. D. Bangay	2.75
Telephony Without Wires	Philip R. Coursey	5.00
The Wireless Telegrapher's Pocketbook of Notes, Formulae and Calculations	J. A. Fleming	3.50
Wireless Telegraphy and Telephony—First Principles, Present Practice and Testing	H. M. Dowsett	3.50
Handbook of Technical Instructions for Wireless Telegraphists	J. C. Hawkhead and H. M. Dowsett	2.50
Standard Tables and Equations in Radio Telegraphy	Bertram Hoyle	3.25
Wireless Transmission of Photographs	Marcus J. Martin	2.00
Calculation and Measurement of Inductance and Capacity	W. H. Nottage	1.75
Short Course in Elementary Mathematics and Their Application to Wireless Telegraphy	S. J. Willis	1.75
Selected Studies in Elementary Physics (A Handbook for the Wireless Student and Amateurs)	E. Blake	2.00
Magnetism and Electricity for Home Study	H. E. Penrose	2.25
Alternating Current Work (An Outline for Students of Wireless Telegraphy)	A. M. Shore	2.00
Pocket Dictionary of Technical Terms Used in Wireless Telegraphy	Harold Ward	1.00
Useful Notes on Wireless Telegraphy (set of five books), (paper)	H. E. Penrose	2.00
Book No. 1—Direct Current, 67 pages		.50
Book No. 2—Alternating Current, 50 pages		.50
Book No. 3—High Frequency Current and Wave Production, 65 pages		.50
Book No. 4—1½ Kw. Ship Set, 76 pages		.50
Book No. 5—The Oscillation Valve, 52 pages		.50
Experimental Wireless Stations	P. E. Edelman	3.00
High Frequency Apparatus, Design, Construction and Practical Application	T. S. Curtis	3.00
Textbook on Wireless Telegraphy	Rupert Stanley	
Volume 1—General Theory and Practice		5.00
Volume 2—Valves and Valve Apparatus		5.00
The Operation of Wireless Telegraphy Apparatus	A. B. Cole	.35
Wireless Construction and Installation for Beginners	A. P. Morgan	.35
Lessons in Wireless Telegraphy	A. P. Morgan	.35
Experimental Wireless Construction	A. P. Morgan	.35
No. 1 Diagram "How to make a short Wave Regenerative Receiver"		.50
No. 2 Diagram "How to make Detector and Amplifier Units"		.50
No. 14 "Radio Formulae and Diagrams"		.50
No. 20 Twenty Radio Phone Diagrams and Hookups"		.50
"Radio Enters the Home" new Radio Corporation Catalog		.35



SECTION FOUR

Radio Information and Data

A Scientifically Constructed Amateur Station

[Too little attention has been paid by amateurs to the ground wire system of their radio stations. Amateurs whose stations are located appropriately should give attention to the interesting series of experiments described below, conducted by a Special Engineer of the Radio Corporation's High Power Receiving Research Staff, who has found time to apply the principles utilized in high-power commercial radio stations to amateur stations. By following his advice any amateur can duplicate the results he has obtained. He has analyzed and placed before amateurs the "crux" of a successful tube transmitting station.]

Many amateurs have considerable difficulty in getting a low antenna resistance, particularly in locations where the soil is sandy. Under these conditions, a counterpoise must generally be used to get the antenna resistance down to a reasonable figure. In many cases, however, it is possible to combine a ground connection with a counterpoise, in such a manner as to still further reduce the antenna resistance by a large amount.

An article in the "General Electric Review" for October, 1920, describes the Alexanderson system for radio communication. It shows how Mr. Alexanderson has combined a buried wire ground with a capacity ground for more uniformly distributing the earth currents. In Figure 1, the inductance of the helix below the ground tap tunes the capacity ground, while the inductance between the ground tap and the antenna tunes the antenna circuit. The section of the helix above the ground connections may be considered positive with respect to ground, and the section of the helix below the ground connection may be considered negative with respect to ground. By suitable tuning, the total antenna current may be distributed between the capacity ground and the buried wire ground in any desired ratio.

In the case of Station "2BML," at Riverhead, L. I., the soil consists mainly of dry sand under the antenna. There is a small pond near the antenna, but not under it. A good ground was obtained in this pond by running several hundred feet of wire into it. The antenna resistance using this ground was very high, between sixty and seventy ohms at 200 to 300 meters. The writer decided that since the soil under the antenna was sandy, the high antenna resistance was due to the fact that the antenna flux was forced to travel through very high resistance soil for a considerable distance before reaching the low resistance ground wires.

A counterpoise of four No. 14 B. & S. copper wires running parallel with the antenna flat top and directly beneath the antenna was put up, the parallel wires being four feet apart and carefully insulated. The counterpoise extended several feet beyond the antenna at both ends. When the counterpoise was substituted for the ground, the antenna resistance was lowered from about sixty ohms to ten ohms. By combining the ground with the counterpoise as shown in Figure 2, the antenna resistance was still further reduced to about four ohms. The resistance of the helix used to tune this antenna was about three ohms, making a total antenna resistance of seven ohms. The above resistance values were taken at 280 meters wave length.

When the circuits are properly adjusted, removing either the ground connection or the counterpoise connection will not change the antenna wave length, but will change the antenna resistance only. The easiest way to tune up the counterpoise and ground is to first tune to the desired wave length, using the counterpoise alone, then try the ground clip on different turns until the point is found where the wave length is the same as with the counterpoise alone. The ground clip should be adjusted to within a half turn on a large diameter helix. When the ground clip is at the neutral point, the inductive impedance of the helix below the ground point tunes with the capacity impedance of the counterpoise, forming a series-tuned circuit of comparatively low resistance. The total antenna current divides between the ground and the counterpoise inversely proportional to the effective resistances of the ground and counterpoise circuits.

With the counterpoise on the bottom of the helix and no ground connection, the wave length is 336 meters and the effective resistance is about nine ohms. When the ground clip is put on turn No. 1, the total current divides in inverse proportion to the ground resistance and the counterpoise reactance, and, obviously, most of the current will flow in the ground lead. Since the counterpoise has little effect, the wave length is practically determined by the antenna capacity and the helix inductance between the ground clip and the antenna clip. As the ground clip is moved up nearer the neutral point, the wave length becomes shorter, due to the decrease in inductance between the ground and antenna clips, and the counterpoise reactance is partly tuned out by inductance of the helix between the ground and counterpoise clips. The effective resistance decreases as the ground clip is moved up, because the counterpoise is taking a greater and greater portion of the antenna current. When the neutral point is reached, the counterpoise reactance is entirely tuned out, and the counterpoise takes most of the antenna current.

In the case of Station "2BML," the counterpoise capacity was .0007 M.F.D., and the antenna capacity was .0005 M.F.D. When the ground clip was properly adjusted, about 75 per cent. of the total antenna current flowed in the counterpoise lead and the other 25 per cent. in the ground lead. With this combination the antenna resistance was only about 40 per cent. of the value obtained with the counterpoise alone.

Many amateurs already have a counterpoise, and the writer believes if these amateurs will combine their counterpoise with a ground connection as described, their radiation will, in many cases, be

doubled, especially in cases where a good ground connection is available. Very good results should be obtained even if the ground system is not directly under the antenna, as for example a water-main ground.

Figure 1 is a diagram of connections of the apparatus used at the above station. There are no special features excepting the combination of counterpoise and ground described above. A master oscillator is used to keep the frequency as constant as possible. completely. The maximum input in the antenna with a single tube varies from 250 to 450 watts without overheating the tube, and doubtless more energy could be put in by using a higher plate voltage.

The helix consists of a power line lightning arrester choke coil made of 21 turns of 3/8-inch aluminum rod wound in cylindrical form, 15 inches in diameter. Two old 2,000-volt transformers are used for supplying voltage to the Kenotron rectifiers. One is a five K. W. 133-cycle power transformer, while

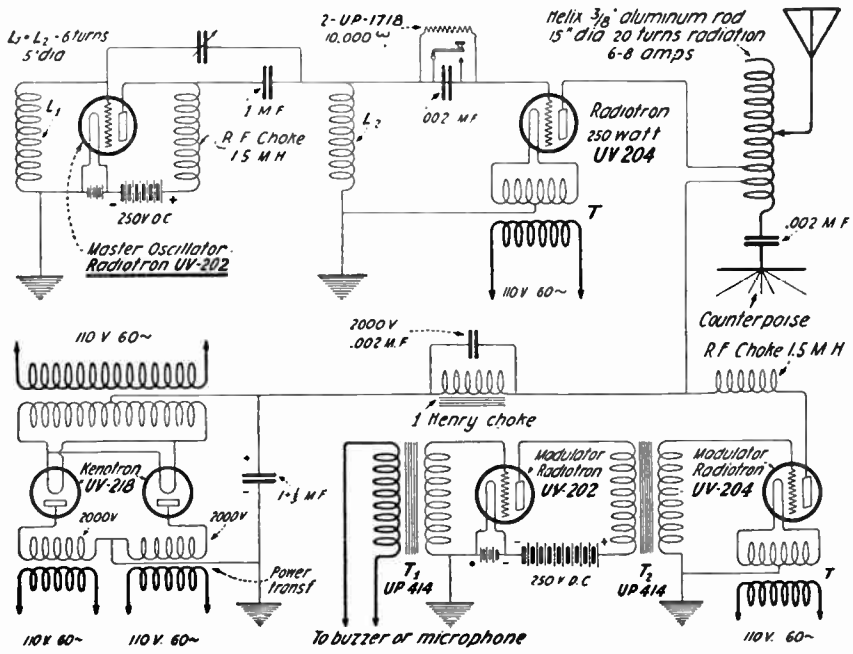


FIGURE 1

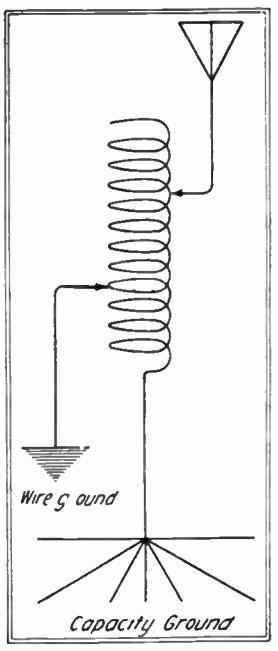


FIGURE 2

It is essential to make the condensers in the ground and counterpoise leads large in comparison with the counterpoise and antenna capacities. The condenser in the counterpoise lead is simply a stopping condenser to keep the plate voltage off the counterpoise. Two 250-watt, type UV-204 Radiotrons are used. One tube is used as the oscillator and the other as the modulator.

The antenna current is six to eight amperes, depending upon the voltage of the local 60-cycle supply. The plate voltage is 2,000, using full wave rectification with two Kenotrons. The smoothing condenser is 1 1/3 M.F.D., but is not large enough to smooth out the 60-cycle ripple, so the modulation is not particularly good and is seldom used, although it has been heard over distances of 300 to 400 miles several times. The Radiotrons draw 600 watts or more from the condensers, so a very large condenser would be required to smooth out the 60-cycle hum the other is a 250-watt potential transformer, both having a 20 to 1 ratio and both delivering the same watts to the rectifiers.

The antenna is also a make-shift affair consisting of a small horizontal cage of three No. 14 wires about forty feet high and eighty feet long.

The station has now been in operation for a number of months, and like many other C. W. stations, the radiation was about one-half ampere at first, but was gradually increased by experimentation until eight amperes was finally reached. Half-wave self-rectification was also tried with both 60 and 300 cycles. The 300-cycle source gave an exceedingly pure, musical note and was very successful, but the available generator was small and the antenna current was only about three amperes with full load on the 300-cycle generator. The C. W. signals from "2BML" have been reported QSA on many occasions from stations within a 1,000 mile radius.

General Information for the Amateur

There are at the present time approximately 35,000 amateur radio transmitting stations in the United States, and probably twenty-five receiving stations to every transmitting station, making a total of 875,000 amateur stations. The large majority of these stations use only a small amount of power for transmitting; consequently, their range is small. There are organizations of amateurs which include primarily those who are interested in the relaying of messages from one station to another, and during the cooler months of the year, when the air is clear of static, it is frequently possible to relay messages through such stations across the continent within a few hours. As a general rule such messages are re-

layed over fairly well established lines of communication, including the most efficient stations operated by the best amateur operators of the country. The "National Amateur Wireless Association," which includes in its membership most of the leading amateurs of the country, is one of the organizations which maintains a national traffic organization and relays messages to all points of the country without charge. The stations which are a part of this relay system of the "National Amateur Wireless Association" include many of the leading amateur stations which employ tube transmitters, and, because they use C. W. transmitters, exceptional results are obtained, the range of these tube stations frequently exceeding 1,000 miles. During the warm months of the year, when there is considerable disturbance from atmospheric electricity due to thunderstorms, repeated tests have proved that tube transmitters can work successfully through heavy static caused by thunder showers, while spark stations of the same power could not be heard.

One of the problems of amateur activities is that of interference between stations. This is largely the result of the use of spark transmitters which radiate their energy over a wide band of wave lengths. In the case of continuous wave transmission the energy is radiated on substantially one wave length, thereby eliminating to a great degree the objectionable interference caused by spark stations. The character of transmitted energy is such that the effect at the distant receiver is much greater, power for power, than a spark set, principally for the reason that the undamped wave transmitter permits the use of highly refined and efficient methods of reception.

Radio Laws and Regulations of the United States

The owner of an amateur radio transmitting station must obtain a station license before it can be operated if the signals radiated therefrom can be heard in another state; and also if such a station is of sufficient power to cause interference with neighboring licensed stations in the receipt of signals from transmitting stations outside the state. These regulations cover the operation of radio-telephone stations as well as radio-telegraph stations.

Station licenses can be issued only to citizens of the United States, its territories and dependencies.

Transmitting stations must be operated under the supervision of a person holding an Operator's License and the party in whose name the station is licensed is responsible for its activities.

The Government licenses granted for amateur stations are divided into three classes as follows:

Special Amateur Stations known as the "Z" class of stations are usually permitted to transmit on wave lengths up to approximately 375 meters.

General Amateur Stations which are not within five miles of a Government Radio Station and are permitted to use a power input of 1 kilowatt and which cannot use a wave length in excess of 200 meters.

Restricted Amateur Stations are those located within five nautical miles of Government radio stations, and are restricted to ½ kilowatt input. These stations also cannot transmit on wave lengths in excess of 200 meters.

Experimental Stations, known as "X" class, and school and university radio stations, known as the "Y" class, are usually allowed greater power and also allowed the use of longer wave lengths at the discretion of the Department of Commerce.

All stations are required to use the minimum amount of power necessary to carry on successful communication. This means that while an amateur station is permitted to use, when the circumstances require, an input of 1 kilowatt, this input should be reduced or other means provided for lowering the antenna energy when communicating with near-by stations, in which case full power is not required.

Malicious or wilful interference on the part of any radio station, or the transmission of any false or fraudulent distress signal or call is prohibited. Severe penalties are provided for violation of these provisions.

Special amateur stations may be licensed at the discretion of the Secretary of Commerce to use a longer wave length and higher power than general amateur stations. Applicants for special amateur station licenses must have had two years' experience in actual radio communication. A special license will then be granted by the Secretary of Commerce only if some substantial benefit to the science of radio communication or to commerce seems probable. Special amateur station licenses are not issued where individual amusement is the chief reason for which the application is made. Special amateur stations located on or near the sea coast must be operated by a person holding a commercial license. Amateur station licenses are issued to clubs if they are incorporated, or if any member holding an amateur operator's license will accept the responsibility for the operation of the apparatus.

Applications for operator's and station licenses of all classes should be addressed to the Radio Inspector of the district in which the applicant or station is located. Radio Inspectors' offices are located in the following places:

First District	Boston, Mass.
Second District	New York City
Third District	Baltimore, Md.
Fourth District	Norfolk, Va.
Fifth District	New Orleans, La.
Sixth District	San Francisco, Cal.
Seventh District	Seattle, Wash.
Eighth District	Detroit, Mich.
Ninth District	Chicago, Ill.

No license is required for the operation of a receiving station, but all persons are required by law to maintain secrecy in regard to any messages which may be overheard.

There is no fee or charge for either an operator's license or a station license.

C. W. Transmission at Amateur Wave Lengths

A great many amateur operators have applied to the Radio Inspectors of the different districts for special amateur licenses, giving as a reason that they wish to use tube transmitters which would not operate properly on 200 meters, the regular amateur wave length. This belief is entirely wrong. Tube sets will generate power on 200 meters, as well as on any other wave length, providing the antenna is of proper size for 200-meter work.

Some experiments with tube sets on wave lengths below 200 meters were made at "2ZL" Station, Valley Stream, L. I., where a separate antenna, considerably smaller than the main antenna regularly used, was employed for this short wave work. This smaller antenna was about 60 feet long over all, and consisted of four wires. It was found possible to do successful work on this antenna using wave lengths between 140 and 200 meters. Considerable work was done on 175 meters, the antenna current on this wave length being two amperes with two Radiotrons UV-203. One hundred miles in daylight could be covered readily on this wave length and with the current mentioned.

When the transmitter was adjusted to a wave length of 175 meters it was found, in at least three instances, that the receiving operators had to adjust their secondary circuit variometers at zero in order to hear the signals. This indicates that many amateur receiving sets will not operate efficiently on wave lengths below 200 meters. After the communication had been carried on for some time on 175 meters, considerable comment was made by other amateur stations on the desirability of working on that wave length in that there was no interference at that wave length. Atmospheric disturbances gave little or no trouble, whereas on wave lengths above 200 meters the interference from this source was very pronounced.

It is entirely possible to work on 175 meters with tube transmitters or on any lower wave length, without trouble, provided the antenna system is of the proper size of that wave length. The belief that tubes will not operate and generate power on 200 meters or below, has evidently arisen through lack of experience. Tubes will oscillate on short wave lengths just as well as on long wave lengths. At "2ZL" Station a 50-watt Radiotron UV-203 was made to oscillate and generate power in a small antenna circuit with a period of only 50 meters.

Radio Rules — National Electric Code

[The following requirements governing the installation of radio receiving and transmitting apparatus were placed in effect on April 29, 1922.

The rules are given out by the Electrical Committee of the National Fire Protection Association, and will appear in the next issue of the National Electric Code, 1923 edition, as Rule No. 86, Radio Equipment.]

For Receiving Stations Only

Antenna—

a. Antennas outside of buildings shall not cross over or under electric light or power wires of any circuit of more than six hundred (600) volts or railway trolley or feeder wires nor shall it be so located that a failure of either antenna or of the above mentioned electric light or power wires can result in a contact between the antenna and such electric light or power wires.

Antenas shall be constructed and installed in a strong and durable manner and shall be so located as to prevent accidental contact with light and power wires by sagging or swinging.

Splices and joints in the antenna span, unless made with approved clamps or splicing devices, shall be soldered.

Antennas installed inside of buildings are not covered by the above specifications.

Lead-in Wires—

b. Lead-in wires shall be of copper, approved copper-clad steel or other approved metal which will not corrode excessively and in no case shall they be smaller than No. 14 B. & S. gage except that approved copper-clad steel not less than No. 17 B. & S. gage may be used.

Lead-in wires on the outside of buildings shall not come nearer than four (4) inches to electric light and power wires unless separated therefrom by a continuous and firmly fixed non-conductor that will maintain permanent separation. The non-conductor shall be in addition to any insulation on the wire.

Lead-in wires shall enter buildings through a non-combustible, non-absorptive insulating bushing.

Protective Device—

c. Each lead-in wire shall be provided with an approved protective device properly connected and located (inside or outside the building) as near as practicable to the point where the wire enters the building. The protector shall not be placed in the immediate vicinity of easily ignitable stuff, or where exposed to inflammable gases or dust or flyings of combustible materials.

The protective device shall be an approved lightning arrester which will operate at a potential of five hundred (500) volts or less.

The use of an antenna grounding switch is desirable, but does not obviate the necessity for the approved protective device required in this section. The antenna grounding switch if installed shall, in its closed position, form a shunt around the protective device.

Protective Ground Wire—

d. The ground wire may be bare or insulated and shall be of copper or approved copper-clad steel. If of copper the ground wire shall not be smaller than No. 14 B. & S. gage, and if of approved copper-clad steel, it shall not be smaller than No. 17 B. & S. gage. The ground wire shall be run in as straight a line as possible to a good permanent ground. Preference shall be given to water piping. Gas piping shall not be used for grounding protective devices. Other permissible grounds are grounded steel frames of buildings or other grounded metallic work in the building and artificial grounds such as driven pipes, plates, cones, etc.

The ground wire shall be protected against mechanical injury. An approved ground clamp shall be used wherever the ground wire is connected to pipes or piping.

Wires Inside Buildings—

e. Wires inside buildings shall be securely fastened in a workmanlike manner and shall not come nearer than two (2) inches to any electric light or power wire unless separated therefrom by some continuous and firmly fixed non-conductor making a permanent separation. This non-conductor shall be in addition to any regular insulation on the wire. Porcelain tubing or approved flexible tubing may be used for encasing wires to comply with this rule.

Receiving Equipment Ground Wire—

f. The ground conductor may be bare or insulated and shall be of copper, approved copper-clad steel or other approved metal which will not corrode excessively under existing conditions and in no case shall the ground wire be less than No. 14 B. & S. gage except that approved copper-clad steel not less than No. 17 B. & S. gage may be used.

The ground wire may be run inside or outside of building. When receiving equipment ground wire is run in full compliance with rules for Protective Ground Wire, in Section d, it may be used as the ground conductor for the protective device.

For Transmitting Stations

Antenna—

g. Antennas outside of buildings shall not cross over or under eletric light or power wires of any circuit of more than six hundred (600) volts or railway trolley, or feeder wires, nor shall it be so located that a failure of either the antenna or of the above mentioned electric light or power wires can result in a contact between the antenna and such electric light or power wires.

Antennas shall be constructed and installed in a strong and durable manner and shall be so located as to prevent accidental contact with light and power wires by sagging or swinging.

Splices and joints in the antenna span shall, unless made with approved clamps or splicing devices, be soldered.

Lead-in Wires—

h. Lead-in wires shall be of copper, approved copper-clad steel or other metal which will not corrode excessively and in no case shall they be smaller than No. 14 B. & S. gage.

Antenna and counterpoise conductors and wires leading therefrom to ground switch, where attached to buildings, must be firmly mounted five (5) inches clear of the surface of the building, on non-absorptive insulating supports such as treated wood pins or brackets equipped with insulators having not less than five (5) inch creepage and air-gap distance to inflammable or conducting material. Where desired approved suspension type insulators may be used.

i. In passing the antenna or counterpoise lead-in into the building a tube or bushing of non-absorptive insulating material shall be installed so as to have a creepage and air-gap distance of at least five (5) inches to any extraneous body. If porcelain or other fragile material is used it shall be installed so as to be protected from mechanical injury. A drilled window pane may be used in place of bushing provided five (5) inch creepage and air-gap distance is maintained.

Protective Grounding Switch—

j. A double-throw knife switch having a break distance of four (4) inches and a blade not less than one-eighth (⅛) inch by one-half (½) inch shall be used to join the antenna and counterpoise lead-ins to the ground conductor. The switch may be located inside or outside the building. The base of the switch shall be of non-absorptive insulating material. Slate base switches are not recommended. This switch must be so mounted that its current-carrying parts will be at least five (5) inches clear of the building wall or other conductors and located preferably in the most direct line between the lead-in conductors and the point where ground connection is made. The conductor from grounding switch to ground connection must be securely supported.

Protective Ground Wire—

k. Antenna and counterpoise conductors must be effectively and permanently grounded at all times when station is not in actual operation (unattended) by a conductor at least as large as the lead-in and in no case shall it be smaller than No. 14 B. & S. gage copper or approved copper-clad steel. This ground wire need not be insulated or mounted on insulating supports. The ground wire shall be run in as straight a line as possible to a good permanent ground. Preference shall be given to water piping. Gas piping shall not be used for the ground connection. Other permissible grounds are the grounded steel frames of buildings and other grounded metal work in buildings and artificial grounding devices such as driven pipes, plates, cones, etc. The ground wire shall be protected against mechanical injury. An approved ground clamp shall be used wherever the ground wire is connected to pipes or piping.

Operating Ground Wire—

1. The radio operating ground conductor shall be of copper strip not less than three-eighth (⅜) inch wide by one sixty-fourth (1/64) inch thick, or of copper or approved copper-clad steel having a periphery, or girth (around the outside) of at least three-quarters (¾) inch (for example a No. 2 B. & S. gage wire) and shall be firmly secured in place throughout its length. The radio operating ground

conductor shall be protected and supported similar to the lead-in conductors.

Operating Ground—

m. The operating ground conductor shall be connected to a good permanent ground. Preference shall be given to water piping. Gas piping shall not be used for ground connections. Other permissible grounds are grounded steel frames of buildings or other grounded metal work in the building and artificial grounding devices such as driven pipes, plates. cones, etc.

Power from Street Mains—

n. When the current supply is obtained directly from the street mains, the circuit shall be installed in approved metal conduit, armored cable or metal raceways.

If lead covered wire is used it shall be protected throughout its length in approved metal conduit or metal raceways.

Protection from Surges, etc.—

o. In order to protect the supply system from high-potential surges and kick-backs there must be installed in the supply line as near as possible to each radio-transformer, rotary spark gap, motor in generator sets and other auxiliary apparatus, one of the following:

1. Two condensers (each of not less than one-half (½) microfarad capacity and capable of with standing six hundred (600) volt test) in series across the line and midpoint between condensers grounded; across (in parallel with) each of these condensers shall be connected a shunting fixed spark-gap capable of not more than one-thirty-second (1/32) inch separation.
2. Two vacuum tube type protectors in series across the line with the mid-point grounded.
3. Non-inductively wound resistors connected across the line with mid-point grounded.
4. Electrolytic lightning arresters such as the aluminum coil type.

In no case shall the ground wire of surge and kick-back protective devices be run in parallel with the operating ground wire when within a distance of thirty (30) feet.

The ground wire of the surge and kick-back protective devices shall not be connected to the operating ground or ground wire.

Suitable Devices—

p. Transformers, voltage reducers, keys, and other devices employed shall be of types suitable for radio operation.

Note on the Care of Minerals

In receiving outfits employing crystal detectors, the effective range depends a great deal upon the sensitivity of the crystal. Some crystals are naturally more sensitive than others, but even a sensitive crystal may be ruined by improper care. The action of the air on these crystals sometimes oxidizes their surface and prevents them from functioning properly, but a more serious trouble is caused by touching the surface of the crystal with the fingers. Where this has been done and the surface of the crystal is found to be less sensitive after continued use, it should be scraped lightly with a pen-knife.

Vacuum Tube Precautions

DON'T handle vacuum tubes roughly or elements may be injured.

DON'T burn vacuum tube filaments above rated amperage and voltage.

DON'T rely solely on an ammeter for proper current consumption—filaments should be burned at constant voltage rather than constant amperage.

DON'T insert vacuum tubes in sockets unless absolutely certain rheostats are turned off or at the proper setting for normal operation.

DON'T make the drastic error of connecting the plate battery to the filament terminals—watch all battery connections.

DON'T use more than one standard block plate battery (22.5 volts) on the plate of Radiotron detector tube UV-200.

DON'T use more than from 60 to 80 volts on the plates of Radiotron amplifier tubes UV-201—60 volts will be found quite sufficient.

DON'T underestimate the value of "A" battery potentiometer PR-536 in connection with Radiotron detector tube UV-200 if you wish to secure maximum signal strength.

DON'T burn out a vacuum tube through carelessness and expect your dealer to exchange it for another.

DON'T use excessive plate voltage on power tubes if you want long life.

DON'T energize the filaments of all the tubes in a cascade circuit at once, unless the circuit has been used before.

DON'T take out one tube of a cascade circuit in which the filaments are in parallel—it causes a rise in current in the remaining filaments and may burn them out. Cut off all the power first.

DON'T make any alterations in your wiring while vacuum tubes are in their sockets. It is quite a common thing for 40 or 60 volts to become twisted up in the filament circuit as a result of this practice. High voltage for the filament spells disaster for your tube.

DON'T expect a continued increase in signal strength as your filament temperature increases beyond normal. You will only reduce the life of your tube. Tubes function best at one particular point—when you increase their filament current beyond this point you do the signal no good and the tube great harm.

DON'T forget that necessary filament current may frequently be greatly reduced by proper manipulation of the tuner circuits, especially the tickler or regenerative circuit.

DON'T expect to have a loud speaker operate from a detector tube—you'll be disappointed. At least one stage of audio-frequency amplification is generally necessary.

DON'T forget that vacuum tubes cost from twenty to thirty times as much as ordinary incandescent lamps—they deserve a little respect.

DON'T expect to get the best results if you use an amplifier tube for a detector, or vice versa.

DON'T be anxious to produce sound with very great volume—it isn't necessary.

DON'T expect your loud speaker to work properly if you have a pair of phones connected to your detector circuit.

DON'T try to use Radio Corporation radio frequency intervalve transformers with other tubes than Radiotrons—you may not be able to make them function properly.

Note on Control of Regeneration

In vacuum tube receiving circuits employing regeneration, some means is generally provided for controlling this action. If the circuit is adjusted to a point where its action is too great, telephone signals will be distorted by oscillations set up in the detector tube itself. When this happens, it is merely necessary to alter the position of the regeneration control member.

Regeneration, when properly employed, has the effect of amplifying incoming signals many times and the best results may be obtained by bringing the regenerator control up to a point just before oscillation starts, or by bringing it to an oscillating point and then reducing it slightly. The point of oscillation may be recognized by a peculiar continuous mushy sound in the telephone receivers and a sharp click may be heard when oscillation starts or stops. Too great a degree of regeneration also has the effect of producing whistling noises.

The regenerative feature in receiving sets when properly employed is of great value, but improperly employed it is not conducive to the best operation. Great care should therefore be taken in employing regeneration, otherwise radio telephone speech and music may become distorted.

Receiving Circuits

A Simple Vacuum Tube Circuit

Contrary to general opinion, receiving circuits in which vacuum tubes are employed are quite simple. The following descriptions include several standard receiving circuits which have proved satisfactory after long usage and which may readily be made up by the experimenter who follows the simple directions.

Fig. 1 is a simple receiving set, wherein a loose coupler is used for tuning. As will be seen, there are two distinct coils in a loose coupler, one called the primary, L 1, and the other the secondary, L 2. One end of the primary is connected to a binding post which in turn is connected to the antenna. The other end of the winding is free, but a sliding contactor is provided in order to connect as many turns between the binding post to which the end of the coil is attached and the free end as may be neces-

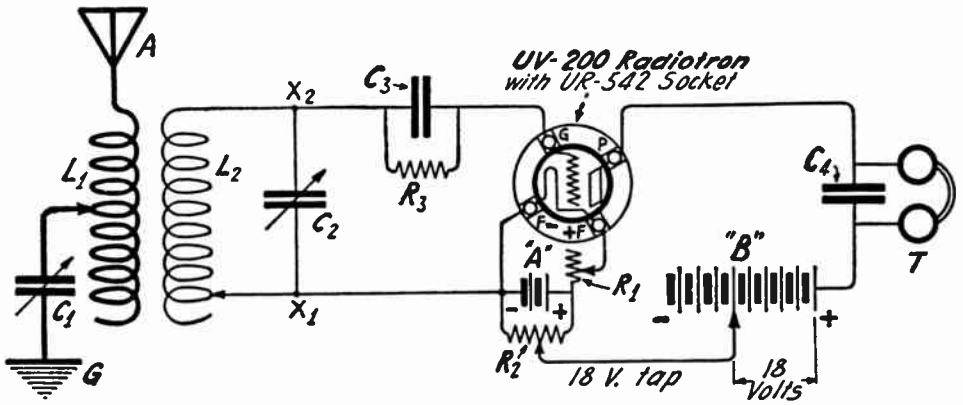


Figure 1—A simple vacuum tube receivin g circuit employing a loose coupled tuner.

C 1—Variable condenser, .0006 mfd. max. UC-1820.
C 2—Secondary tuning variable condenser, .001, .005 mfds., UC-1819.
C 3—Grid condenser (fixed or variable), .00025 mfd., UC-567 with UX-543 mounting or UC-1820 variable condenser.
C 4—Telephone condenser, fixed, value optional, UC-569 with UX-543 mounting.
L 1—Primary of any loose coupler (sometimes called receiving transformer).
L 2—Secondary or loose coupler.
R 1—Filament control rheostat, PR-535.
R 2—"A" battery potentiometer, PR-536.
R 3—Standard grid leak resistance, .5 to 2 megohms, UP-516, 519 or 523 with UX-543 mounting.
T—Telephone receivers, Western Electric No. 1002-A.

sary. This sliding contact is indicated in the diagram by an arrow. A switch is often employed instead of the slider. Such a switch is made with many contact points, each point being connected to a different part of the primary or secondary winding. For the most satisfactory tuning, a variable condenser, C-1, should be inserted between this slider or switch and the ground connection.

A variable condenser, C-2, is placed between the two terminals of the secondary. As indicated by C-3, a small condenser, called a Grid Condenser, because it is inserted in the grid circuit, is placed between the Grid terminal (marked "G") of the socket, UR-542, and one terminal of the secondary.

For the best reception some vacuum tubes require what is known as a grid leak resistance. This is shown in the diagram R-3. Various tubes require different values of resistance in this position. The Radio Corporation grid leaks (UP-509 to UP-527) with the mounting UX-543 are recommended for this work.

The opposite side of the loose coupler is connected to the negative side of the Filament of the vacuum tube indicated in the diagram by F.—. Where a vacuum tube is used in conjunction with a Radio Corporation socket UR-542, this connection is made to one of the binding screws on the vacuum tube socket marked F. To this post, as will be seen, two other connections—one from the minus or negative pole of the six volt storage battery, indicated by "A," and the other from one outside terminal of the "A" Battery Potentiometer, R2, are made. The opposite side of the "A" Battery is connected to one terminal of the Filament Rheostat, R, the second terminal of the rheostat being connected to the vacuum tube socket, UR-542, at the point F+. The remaining outside terminal of the Potentiometer is connected to the positive or plus side of the "A" battery. This Potentiometer is provided with a third terminal which is connected to the 18-volt tap of the "B" battery (Burgess No. 2156). The positive terminal of the "B" Battery is connected to one side of the condenser C-4 with the opposite side of this condenser being connected to the terminal P of the vacuum tube socket, UR-542. The tips of the telephone cords are also connected, one each to the binding posts of the condenser C-4. This completes what is known as a straight vacuum tube detection circuit. A great improvement over this circuit is obtained by using the arrangement shown in Fig. 2, although it is not quite so simple.

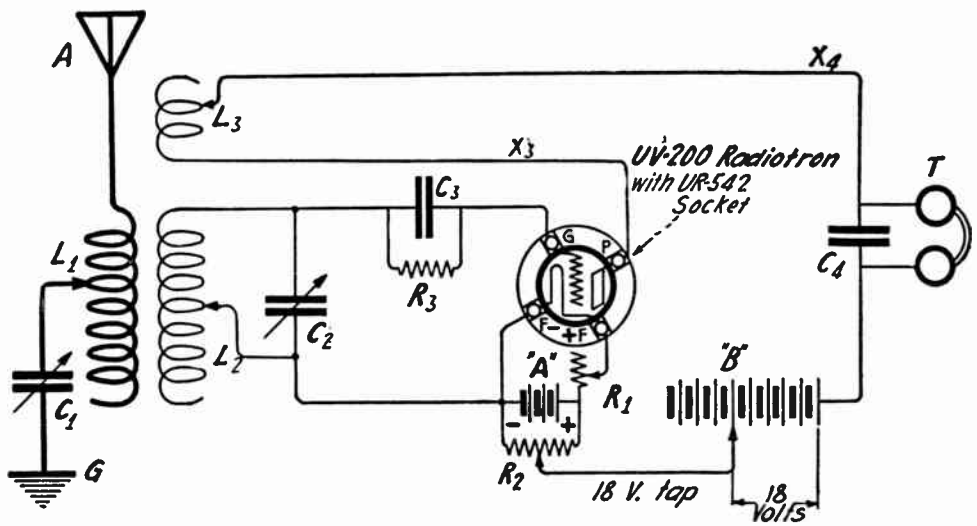


Figure 2—A simple vacuum tube circuit similar to Fig ure 1, but employing a "tickler" coil for regeneration.

C 1—Antenna tuning variable condenser, .0006 mfd. max. UC-1820.
C 2—Secondary tuning condenser, .0001-.005 mfds., UC-1819.
C 3—Grid condenser (fixed or variable), .00025 mfds., UC-567 with UX-543 mounting or UC-1820 variable condenser.
C 4—Telephone condenser, value optional, UC-569, with UX-543 mountings.
L 1—Primary of loose coupler.
L 2—Secondary of loose coupler.
L 3—Tickler coil.
"A"—6-volt filament lighting battery. Exide, 3-LX-9-1.
"B"—20 to 30-volt plate battery. Burgess No. 2156.
R 1—Standard filament rheostat, PR-535.
R 2—Standard "A" battery potentiometer, 04-536.
R 3—Standard grid leaks resistance, .5 to 2 megohms, UP-516, 19 pr. 23 with UX-543 mounting.
T—Telephone receivers. Western Electric No. 1002-A.

Note:—Where the UC-1820 is used for the grid condenser, no UX-543 mounting is necessary for inserting the grid leak resistance, as this condenser is equipped with clips which will fit any of the RC standard grid leak resistance.

A Simple Regenerative Circuit

In Fig. 2 it will be observed that all the important elements are identical to those shown in Fig. 1. However, this arrangement permits very much greater selectivity in receiving as well as providing for amplifying the incoming signals by what is known as the regenerative method.

The only difference between Fig. 1 and Fig. 2 is, that a coil of wire L3, is connected in the circuit between the two points indicated by X3 and X4. This coil is used to carry the current back to the secondary of the loose-coupler and when properly adjusted causes amplification to take place. This coil is called

a "tickler" coil. Its size depends upon the particular class of receiving to be carried on. The size of this coil for these various applications may be obtained by referring to any good book written for wireless experimenters. This circuit forms what is known as a standard regenerative receiver. In some instances the value of the "tickler" or feed-back circuit is made variable. There are several ways of varying this value. Regeneration is generally controlled in this type of circuit by changing the position of L3 with relation to L2, or varying the inductance of the circuit itself.

means of a variometer, V-4. This variometer is placed in the circuit between the points marked X-3 and X-4. It takes the place of the coil L-3 in Fig. 1, and forms one method of changing the value of this tertiary or plate circuit.

Where it is desired to use some form of loud-speaking device or where the distance over which signals are to be received is exceptionally long, the experimenter must use some method of increasing the intensity of the received signal. The most common method for accomplishing this is found in what is termed, "audio frequency amplification."

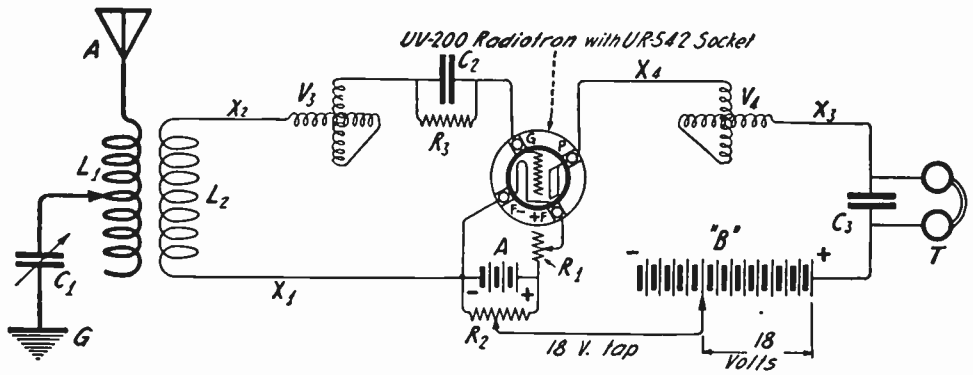


Figure 3—Short wave regenerative circuit employing a vario-coupler and two variometers for controlling wave length and regeneration.

C 1—Antenna variable condenser, .0006 mfd. max. UC-1820.
C 2—Grid condenser, fixed or variable, .00025 mfd. UC-567, with UX-543 mounting or UC-1820 variable air condenser.
C 3—Telephone condenser, value optional, UC-569, with UX-543 mounting.
"A"—6-volt filament lighting battery. Exide, 3-LX-9-1.
"B"—20 to 30-volt plate battery. Burgess 2156.
L 1—Primary of any vario-coupler.
L 2—Secondary of any vario-coupler.
L 3—Grid variometer.
L 4—Plate variometer.
R 1—Standard filament control rheostat, PR-535.
R 2—Standard "A" battery potentiometer, PR-536.
R 3—Standard grid leak resistance, .5 to 2 megohms, UP-516, 519 or 523 with UX-543 mounting.
T—Telephone receivers, Western Electric, 1002-A.

Note:—Where the UC-1820 is used for the grid condenser, it is not necessary to use the mounting UX-543 for the grid leak resistance, for the condenser is fitted with mountaings for standard R.C. grid leak resistances.

Amateur Regenerative Circuit

Fig. 3 shows the circuit generally used where a vario-coupler and two variometers are employed as the variable tuning elements in regenerative receivers. This character of receiving equipment is more or less confined to short waves from 150 to 600 or 700 meters. It will be seen that the inductance, L-2, in this case is not shunted by a variable capacity as was the case in Figs. 1 and 2. However, the variometer, V-1, is employed which comprises one stationary and one movable coil with reference to the stationary coil has the effect of increasing or decreasing the wave length of the circuit and permits a very selective control.

From the points indicated by X-1 and X-2, by making a comparison of Figs. 2 and 3, it will be found that Fig. 3 differs from the first two only in that the condenser, C-2, is not used and the variometer, V-3, is placed between the upper terminal of the secondary of the loose-coupler and the grid condenser.

The third tuning circuit which controls the regeneration or amplification is also made variable by

Where the experimenter wishes to take advantage of audio frequency amplification, there are two means at his disposal, namely: purchasing the amplifying units fully wired and ready for connecting them in the circuit, or procuring the parts which go to make up the units and assembling them. For the benefit of those who desire to assemble their own equipment the circuit shown in Fig. 1 is very strongly recommended for use in sections where receiving stations are closely located to one another. In congested city districts near the broadcasting stations, shunt a wire across the points X-3 and X-4, leaving out the tickler circuit. The circuit depicted in Fig. 4 is quite similar to those shown n Fig. 2 and Fig. 3, but two stages of amplification have been added. As may be observed, this form of amplifier circuit may be added to any form of receiving circuit and need not be confined to the arrangement shown in Fig. 4.

It should be observed from a comparison of the last three circuits under consideration that where the audio frequency amplifiers are brought in play, the place ordinarily occupied by the telephone receivers is taken by the input circuit of the first stage of amplification, and a variable condenser is

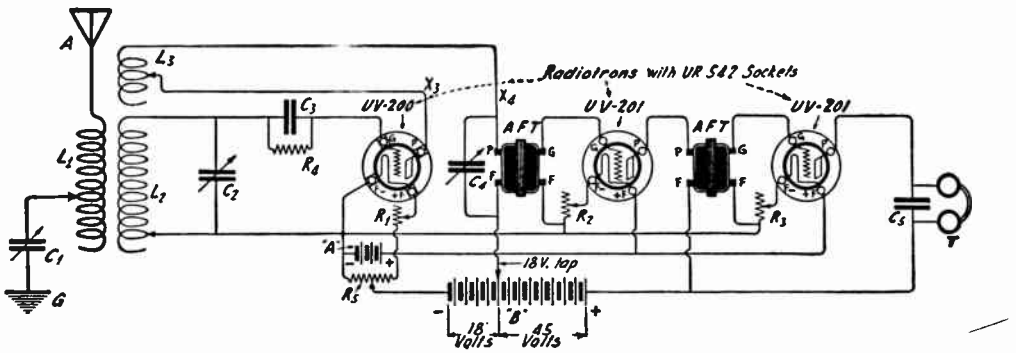


Figure 4—Standard regenerative receiving circuit employing two stages of audio frequency amplification.

C 1—Variable antenna tuning condenser, .0006 mfd. max., UC-1820.
C 2—Secondary tuning variable condenser, .0001-.005 mfds., UC-1819.
C 3—Standard tubular grid condenser, UC-567 with UX-543 mounting or UC-1820 precision variable air condenser.
C 4—Bi-pass condenser, variable, UC-1819 or UC-1820.
C 5—Telephone condenser, value optional, UC-569, with UX-543 mounting.
L 1—Primary of loose coupler.
L 2—Secondary of loose coupler.
L 3—Ticker coil.
R 1,2 and 3—Standard R. C. filament control rheostats, PR-535.
R 4—Standard R. C. grid leak resistance unit, .2 to 5 megohms, UP-516, 519 or 523, with mounting UX-543.
S—Standard R. C. vacuum tube sockets, UR-542.
AFT—Standard R. C. audio-frequency amplifying transformers, UV-712.
T—Telephone receivers, Western Electric, 1002-A.
"A"—6-volt filament lighting battery. Exide, 3-LX-9-1.
"B"—20 to 100-volt plate batteries, made of several Burgess 2156 units connected in series. with a tap taken off at the 18-volt point for operation of the detector tube.
Note:—When UC-1820 precision variable air condenser is used for the grid condenser, no mounting UX-543 is needed for the grid leak, for the mounting is made as a part of the condenser. It will accommodate any of the R. C. Standard grid leak resistances.

substituted for the fixed condensers shown in the other three circuits, to increase the stability of operation. In other respects the fundamental parts of all three circuits are identical.

Regeneration, in this system, is obtained and controlled by the same method described in connection

In order to employ a loud speaker it is merely necessary to remove the telephone receivers from the circuit and connect the two terminals of the loud speaker in their place. Adjustment of the variable condenser, C-4, may be used to clarify the tone of the signals. Some loud speakers require a battery for

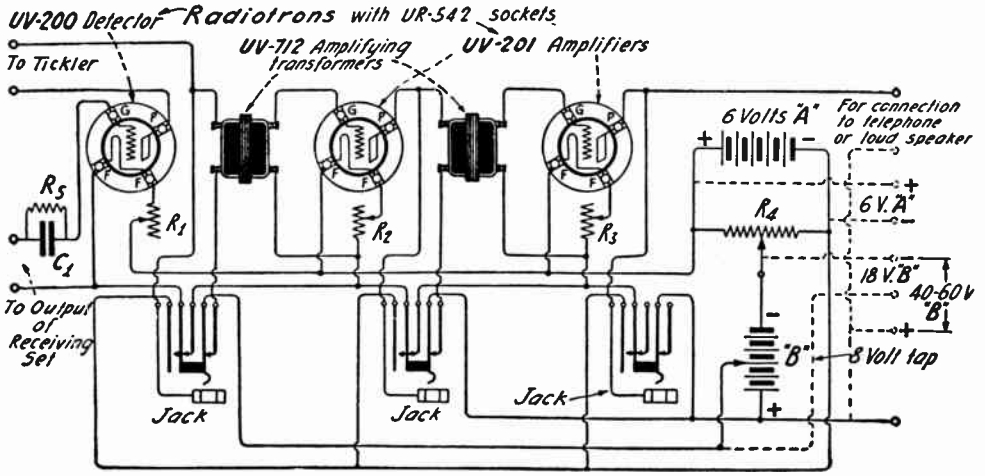


Figure 5—The circuit is made up of one Radiotron UV-200 and two Radiotrons UV-201; three porcelain sockets UR-542; two UV-712 audio-frequency amplifying transformers; a standard Grid Condenser (UC-567 to UC-570), and a standard Grid Leak (UP-509 to UP-527), with two mountings UX-543 and three special telephone jacks having Filament Control Contactors.

with Figs. 2 and 3. In Fig. 4 a standard method of regeneration is illustrated, but the arrangement shown in Fig. 3 may be employed. The circuit as in Fig. 4 shows a pair of telephone receivers in use, but it is often desirable to use a loud speaking device in their stead.

their operation, but the vast majority will function directly from the amplifier. Where the loud speaker does require such a battery, the directions which accompany the device must be strictly adhered to, in order to prevent the possibility of ruining the internal mechanism and connection may generally be

made to the six-volt storage battery marked "A."

The effect of using two stages of amplification is to increase the intensity of the incoming radio signal, whether it be speech, music or code, many times. Each step of amplification increases the signal a certain number of times, depending upon the design and use of the amplifier, so it may be seen that where each step amplifies from six to ten times, the result of using two stages is an increased energy of from approximately 36 to 100 times its original value. In estimating the amplification factor of audio frequency devices it is safe to assume that the higher the voltage applied to the plates of the amplifier tubes, the greater is the resultant amplification. This does not hold true with detector tubes.

Regenerative Amplifier Circuit

The arrangement illustrated in Fig. 4 may be used for obtaining satisfactory results over very long distances and it is recommended because it is simple to assemble and operate. This system is now being used by a great many experimenters throughout the world and one need have no fear of its dependability where the values for the different units comprising the layout are properly followed.

Many modern receiving equipments include one or two stages of audio-frequency amplification. This is especially true where a "loud speaker" is employed or where extraordinary distances are being covered.

Where such amplifiers are used it is often found desirable to use less than the maximum amplification. To accomplish this ordinarily, it is necessary to alter several of the connections. An automatic system has been devised utilizing multi-bladed telephone jacks functioning with the conventional telephone plug. The blades and the jacks are so connected to the circuit that the necessary units are included when the plug is inserted in position.

Amplifier Circuit with Plug and Jack Control

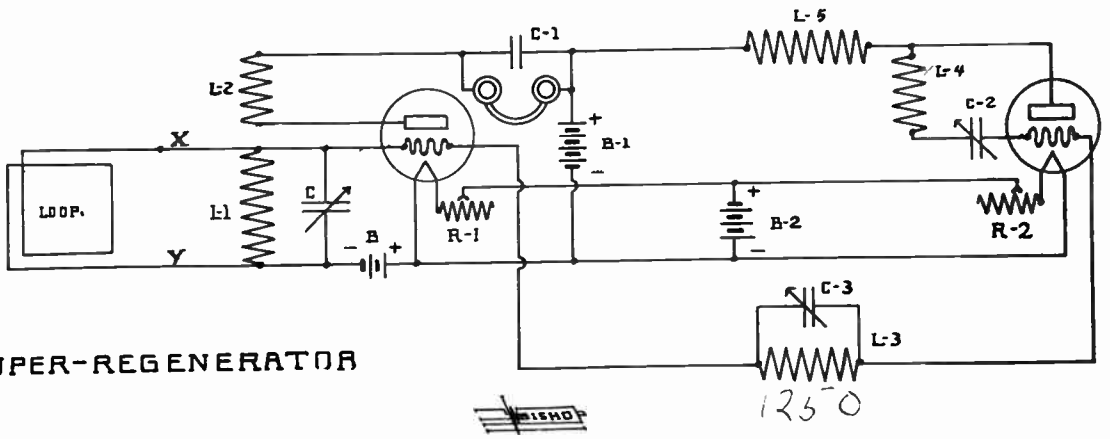
The circuit arrangement shown in Fig. 5 is one employing standard Radio Corporation amplifying parts, with Western Electric telephone jacks. When the plug is inserted in the first jack the detector tube alone functions; when the plug is inserted in the second jack the detector tube and the first amplifying circuit function together; when placed in the third jack three tubes are made to operate. As may be seen from the diagram, the Filament as well as the other circuits are operated by merely inserting the plug.

Where this layout is desired, the circuit should not be made to include the batteries indicated in the diagram, but should be made to run to a series of terminals or binding posts indicated by the dotted lines in the diagram.

Regulation of the voltage on the plate of the detector tube is accomplished by means of a Potentiometer shunted across the "A" battery with the arm connected to the negative terminal of the "B" battery. This Potentiometer when connected to the 18 volt tap of a Standard Burgess No. 2156 plate battery permits a voltage regulation of from 18 to approximately 24 volts. With some detector tubes it is necessary, in order to obtain best results, to connect to the 22.5 volt lead of the plate battery instead of the 18 volt lead. This is especially so with batteries which have been in use for a considerable period. In this case the voltage range is from approximately 22.5 volts to 28 volts.

Armstrong Super-Regenerative Receiver

By Leon W. Bishop



The great demand for radio apparatus has brought forward many new inventions among them the Armstrong Super Regenerator, which we will concede is the most spectacular of them all. This Super circuit requires no outside aerial and greatly conserves (A) battery both of which will be appreciated by the radio fan.

There are many published theories on this circuit but what most of us are interested in is, how can we make one work and that is what we are going to give in as few words as possible, including notes on the proper operation.

This circuit will not work when connected to the regular outside aerial and must be provided with a loop or short inside aerial. The Wireless Specialty loop is best adapted for this purpose.

(L-1) is a 50 inductance, (L-2) is a 100 inductance and is mounted so that the coupling between them is variable, this adjustment is critical and it would be advisable to use a standard two way coil mount. (C) is a variable condenser of .005 M. F. and is used to tune the coil (L-1) to the desired wavelength. (B) is two or three cells of battery which act as a grid bias and the number will have to be determined by trial, starting with two cells. (C-1) is a fixed condenser of .001 M. F. and serves as a phone by-pass. (B-1) is a variable B battery of from 60 to 90 volts and the correct voltage will have to be determined by practice as different tubes require different voltages. (B-2) is a 6 volt storage battery to light the filaments of the two No. 201 Radiotrons. (L-3) is a 1250 inductance, (L-4) is a 250 inductance and (L-5) is 1500 inductance. These coils may be of any standard make of the above given numbers. (C-3) is a .0025 M. F. condenser and may be fixed or a .002 M. F. fixed connected in multiple with a .0005 M. F. variable condenser. (C-2) is a .001 M. F. variable condenser.

Two standard sockets and rheostats (R1 and R2) are provided to control the two No. 201 Radiotron tubes. The circuit should be connected up as per the accompanying diagram with no variations. Care should be observed in this instance with the bias battery (B).

Notes on Operation

For the start connect only one side of the loop to (X) the connection (Y) being open. Turn on both filaments to full brilliancy and adjust condenser (C-2) to almost full capacity, now adjust the coupling between the coils (L-1) and (L-2) until a series of beat notes are audible, then adjust the filament of the first tube in conjunction with the coupling until you hear signals. Once you get music or signals it is an easy matter to tune them in loud.

The point (Y) may be grounded and a short aerial of six or eight feet can be connected to (X) instead of the loop. It is not advisable to connect any part of the circuit to a large antenna and there is little or no use of a ground, but we are all wont to experiment a little so the point (Y) is the most advisable place to ground if any. The writer obtained very good results without aerial, ground or even loop.

When values of battery and adjustments have been obtained we may expect this circuit with an interior aerial to be even louder than a detector and two stages of amplification on a regular outside antenna.

This circuit more or less eliminates induction noises, but static such as produced by electrical storms is noticeable in the summer months.

Directions for Charging with Tungar Battery Charges

Batteries should be kept in a clean, dry place. Keep all small articles, especially metal, out of and away from the battery. Keep terminals and connections coated with vaseline or grease. If solution is spilled, wipe with waste dipped in ammonia water.

Pure water must be added to all cells regularly and at sufficiently frequent intervals to keep the solution at the proper height. The proper height for the solution is usually given on the instruction sheet or name plate of the battery. In all cases the solution must cover the battery plates. For this purpose, use only distilled water, melted artificial ice, or fresh rain water.

To ascertain the condition of the battery, test the specific gravity (density) of the solution in each cell with a hydrometer or storometer. The hydrometer reading will indicate the condition of the battery as follows: 1275 to 1300, battery fully charged; 1175 to 1200, battery half charged; below 1150, battery fully charged.

A battery charge is complete when, with charging current flowing at the rate given on the instruction plate on the battery, all cells are gassing (bubbling) freely and evenly. If a hydrometer is not available for battery testing, the condition of the battery may be obtained approximately with a voltmeter. The average storage battery will register 2.2 volts per cell when completely charged and 1.8 volts per cell when completely discharged. Use only direct current for charging. Limit the current to the proper rate in amperes by connecting a suitable resistance in series with the battery. When only alternating current supply can be procured it is necessary to use a Tungar or Rectigon Rectifier to convert the alternating current into direct current.

When charging a storage battery, connect the positive battery terminal (painted red or marked Pos. P, or Plus) to the positive charging wire and negative to negative. There can be no fixed rule concerning the charging rate of a storage battery, as all manufacturers of batteries make recommendations which apply only to their own product. The charging rate of each battery can generally be found on the name plate or instruction card.

Storage batteries are rated according to the number of ampere hours they will discharge at the rate of 1 ampere per hour. For example, a 60 ampere hour storage battery has a capacity of 1 ampere for 60 hours. If the rate of ampere drain is increased to more than 1 ampere, the number of hours required to discharge the battery is increased in proportion.

To keep a storage battery in its proper condition and ready for use at all times, the owner of a radio set should have a Tungar battery charger in the home where D. C. current is available, and where D. C. current a Vitrohm battery charger. It is also desirable to have a portable volt meter for testing the battery to determine its condition.

Formula Governing Wave Lengths

The antenna absorbs energy in the form of oscillating currents from the ether waves which strike it. For ordinary receiving sets, a single-wire aerial of from 50 to 150 feet should be used. This should be properly insulated at each end by the use of standard aerial insulators. The lead-in wire should be tapped from the end of the aerial; the lead-in wire should be soldered to the aerial wire or secured to it by a DeVeau Antenna Clamp. While it may be tapped from the middle, the length of the aerial will only be the greatest distance from the tap to the insulator, thus losing a large percentage of aerial length. Particular attention is called to the fact that it is not advisable to use too long an aerial for the reception of short wave lengths.

A rough formula, which is subject to considerable variation due to local conditions, for computing the correct length of aerial to obtain given results is as follows:

The length of the aerial in feet, plus the length of the lead-in wire, multiplied by 1½, will give the approximate natural wave length of the aerial in meters. For example: Assume that the aerial is 135 feet long and the lead-in is 15 feet; this, multiplied by 1½, equals 225, which will be the approximate natural wave length of the aerial in meters. It should be borne in mind that the natural wave length of aerial should be, in all cases, approximately 25 per cent below the minimum wave length of the signals which you desire to receive.

It is better to step up to a given wave length than to step down. Most amateurs having sending stations use wave lengths of under 200 meters; hence, an aerial 150 feet including the lead-in would have to be stepped down by the use of a variable condenser in the aerial or ground circuit to receive most amateur signals. An antenna, however, of 150 feet in length including the lead-in would be perfectly satisfactory for the reception of voice and music from broadcasting stations, which usually transmit on a wave length of 300 to 360 meters. Amateurs having small assembled crystal receiving sets should bear in mind that their antenna should conform as closely as possible with the formula given above if they desire to receive music and voice from broadcasting stations.

With the more elaborate sets it will be found possible to step up a comparatively short antenna to the necessary 300 meters to receive broadcasting which would not be possible on the small crystal sets unless they were located very close to the broadcasting station.

Most wireless receiving sets, no matter what their maximum normal length is, can, by the use of loading, duo-lateral or honeycomb coils have their wave length increased to any desired point to receive.

Technical Terms Used in Radio

Aerial—One or more wires insulated from, and suspended at a certain height above the ground, and used to radiate energy in the form of ether waves produced by a transmitter. When used for receiving purposes the correct name is antenna, though both terms are used for either reception or transmission.

Alternating Current (Abbreviated A. C.)—An electrical current flowing through a wire which has the direction of its flow periodically changed. Thus when we speak of a 60-cycle alternating current, we mean one that completely reverses its direction of flow sixty times per second. Alternating current plays a prominent part in practically every part of the radio circuit.

Ammeter—An instrument used for measuring the flow of current in amperes through a given circuit. An ammeter is invariably connected in series with a given circuit.

Ampere—The standard electrical unit of current flow.

Amplifier—This term is used in referring to either an amplifier tube or an amplifier receiving unit. See vacuum tube.

Amplitude—In radio work, this refers to the highest point reached by a wave or oscillation, i. e., the crest of each wave. A wave may, therefore, have a high or low amplitude according to the initial energy which created it.

Antenna—See aerial.

Armstrong Circuit—See Regeneration Circuit.

Atmospherics—Also known as static, strays, X's, "The noises of space." Natural electrical discharges occurring in the ether and in reality miniature lightning storms. Since these discharges travel through the same medium as radio waves, they are readily picked up by receivers and prove very troublesome at times. It is comparatively difficult to tune out these disturbances, for they have no definite wave length.

Audio Frequencies—Frequencies corresponding to vibrations which are normally audible to the human ear. All frequencies below 10,000 cycles per second are termed audio frequencies. See radio frequencies.

Broadcasting—As applied to radio work, the sending of intelligence either by radio telegraphy or telephony from a given central point for the benefit of a great number of receiving stations located within the broadcasting station's range.

Capacity (Abbreviated C)—Capacity is the property of a device to store energy in electro-static form. Capacity, as well as inductance, governs the fre

quency and wavelengths of a circuit. The unit is the Farad, but on account of its size, the micro-farad (M. F.) is used. A micro-farad is one millionth part of a farad.

Cascade Amplification—This refers to high amplification of received radio signals where several vacuum tubes are employed in cascade fashion. Thus, we may speak of a three-step (cascade) amplifier.

Choke Coil—A coil wound so as to have great self-induction. This choking action introduced in a radio circuit is called impedance.

Circuit—In radio and electrical work the path in which an electric current flows from the source, and returns to it, is called a circuit. A circuit may be either open, closed or oscillating.

Close Coupling—A tuning coil, or coils, or transformer are said to be close coupled when the primary and the secondary are very close together, thereby causing large values of mutual inductance.

Condenser—Two or more sheets of metal separated by an insulator called the dielectric. A condenser is used in radio work for storing electrical energy and for bringing circuits into resonance or tuning them.

Counterpoise—One or more wires stretched immediately above the earth, but insulated from it, usually directly beneath the regular aerial and employed in transmission and reception instead of, or in connection with, a "ground."

Continuous Wave (Abbreviated C. W.)—A form of electro magnetic wave used extensively in radio work having a constant amplitude and no damping, as distinguished from the older form of discontinuous, highly damped wave. C. W. makes possible long distance amateur radio telegraphy and telephony.

Crystal Detector—Certain metallic crystals when introduced in a radio receiving circuit have the property of rectifying the incoming signal oscillations so that the resultant intermittent direct current will operate a sensitive telephone receiver.

Detector—Any apparatus which transforms the oscillations received by the antenna into a form of current which will operate a telephone or other recording device.

Direct Current (Abbreviated D. C.)—An electric current flowing continuously in one direction. In a two-wire circuit, for example, direct current always flows from the positive source to the negative return. Therefore, direct current always has a readily determinable polarity, while alternating current (A. C.), which is periodically reversing its polarity while flowing through a circuit, and has no apparent polarity.

Electron—The final sign of negative electricity. An Atom combined with an Electron is a negative Ion; an Atom minus an Electron is a positive Ion.

E. M. F.—Electromotive force, the unit of which is the volt.

Ether—A medium of great elasticity and extreme minuteness, supposed to pervade all space as well as the interior of solid bodies and is the medium through which light, heat and radio waves are transmitted.

Flat-Top Aerial—One whose suspended wires are stretched in a plane parallel to the surface of the earth.

Frequency—In alternating currents, the number of complete cycles of reversal of current through a circuit per second. Thus, we speak of a 60-cycle current as one which has sixty complete reversals per second. See Alternating Current and Audio and Radio Frequencies.

Grid Leaks—A very high, non-inductive, resistance, connected across the grid condenser or between the grid and the filament of a vacuum tube to permit excessive electrical charges to leak off to an external source, thus furnishing stable control under all operating conditions, and governing the action of the grid.

Ground, or Earth—In radio work the ground is the low potential end of the circuit and functions in connection with the aerial or antenna of most sending and receiving systems. The term "ground" is used in any connection to earth, river or sea. See Counterpoise.

Harmonics—In radio, harmonics refer to the incidental waves mostly noticeable in undamped wave operation. These harmonics differ in length and frequency from the true and original operative wave of such transmitters. At times, amateurs will hear the harmonics of high power long wave stations while their tuners are set for much shorter waves.

Henry—The unit of inductance.

Hertzian Waves—Electro-magnetic waves named after their discovery by Prof. Heinrich Hertz, in 1887.

Hot Wire Ammeter—An instrument used in radio transmission work which measures current in amperes by means of a wire expanding in proportion to the heat generated by the passing current.

Impedance—The combination of resistance and retarding action offered by a coil of wire to a varying current on account of the back e.m.f. produced by the varying lines of force. See also Reactance.

Inductance (Abbreviated L)—Inductance, like capacity, plays a very prominent part in radio circuits. It is the property of a coil of wire which tends to prevent any change in the value of current following through it. It governs the frequency and therefore the wavelength of a circuit. The unit of inductance is the Henry. In radio work the millihenry and the microhenry are the more practical terms used.

Induction—The transference of energy from one circuit to another by means of electro-magnetic phenomena.

Insulator — A non-conductive material and one through which electricity will not pass.

Kilowatt (Abbreviated K. W.), meaning one thousand watts.

Loop Antenna—A small frame antenna used for indoor reception thus eliminating both outdoor aerials and ground connections. It gives very marked directional effects.

Loudspeaker—Any receiving device designed to reproduce signals or speech loud enough to be heard without individual use of the conventional telephone receivers.

Megohm—One million ohms.

Microfarad (Abbreviated M. F.)—One millionth part of a Farad and the practical unit of capacity.

Microphone—A sound magnifier is an instrument used in both wire and radio telephony to vary the current in circuit by means of speech.

Milliampere (Abbreviated M. A.)—The thousandth part of one ampere.

Ohm—The unit of electrical resistance.

Ohm's Law—The fundamental law of electricity. It is that the current in amperes flowing through a circuit is equal to the pressure in volts divided by the resistance in Ohms.

Oscillations—Alternating currents of very high frequencies are called electrical oscillations. If the amplitude of a series of oscillations is constant, they are called continuous or undamped waves, but if the amplitude is not constant, as in the spark method, they are called damped waves.

Potential—Referring to electrical pressure. See E. M. F. and Volt.

Radiation—The transmission of energy through space in the form of electromagnetic waves.

Radio Frequencies—Frequencies corresponding to vibrations not normally audible to the human ear. All frequencies above 10,000 cycles per second are termed radio frequencies. See Audio Frequencies.

Reactance—Opposition offered to the flow of a varying current by a condenser (capacity reactance), or an inductance (inductive reactance).

Rectifier—An apparatus which converts alternating current (A. C.) into pulses of direct current (D. C.). Tungar, Reactigon and Kenotron apparatus are employed for rectifying purposes. Certain metallic crystals also have rectifying action when used as detectors in radio reception.

Regenerative Circuit (also known as the Armstrong circuit)—A radio circuit comprising a vacuum tube so connected that after detection, the signal introduced in the plate circuit is led back to or caused to react upon the grid circuit, thereby increasing the original energy of the signal received by the grid and greatly amplifying the response to weak signals. In reception, the leading back of plate energy to the grid for further strengthening is usually accomplished by means of a small coil placed close to the secondary of the receiving tuner. This small coil is frequently called the "tickler."

Resistance—Opposition to the flow of an electric current through a conducting medium. All meals have more or less electrical resistance. Copper is used universally for both electrical and radio work on account of minimum resistance, comparatively low cost and ready availability. The unit of resistance is the Ohm.

Resonance—A very important function of radio circuits. Resonance in a given circuit is said to exist when its natural frequency has the same value as the frequency of the alternating electromotive force introduced in it. The current is then in tune with the natural period of vibration of the circuit. The theory of electrical resonance is the same as that of acoustics, readily demonstrated by the tuning forks, when one tuning fork will not respond to another unless it is of the same key or pitch.

Rheostat—A variable resistance usually employed to control or regulate current flow.

Selectivity—In radio work, the power of being able to select any particular wave length to the exclusion of others.

Sharp Tuning—Where a very slight change of a tuner or tuning system will produce a marked effect in the strength of signals.

Static—See Atmospherics.

Transformer—Any device used in electrical and radio work for the transference of energy from one state to another. Thus we have Power Transformers, Amplifying Transformers, Telephone Transformers, Oscillation Transformers, Tuning Transformers.

Tuning—The act of altering capacity or inductive values in a radio circuit so as to bring the circuit into resonance with an external source of similar character. In radio receiving, the greatest signal strength is possible only when the product of the inductance ——— capacity value of the receiver matches that of the transmitter.

Undamped—A train of high frequency oscillations of constant amplitude such as continuous waves or C. W.

Vacuum Tube (Abbreviated V. T.)—In radio work applies to a glass tube exhausted of air and containing essentially a filament for the creation of electrons, a plate positively charged and to which the electrons are attracted, and a grid, inserted between the filament and the plate, for controlling the amount of electronic flow. This action of the vacuum tube plays three leading functions in radio work, i. e., detection, amplification and generation of high frequency electro-magnetic waves.

Velocity of Waves—Radio, electric and light waves travel through space at the speed of 186,000 miles per second, or 300,000 kilometers per second.

Volt (Abbreviated V)—The unit of electric pressure.

Voltmeter—An instrument for measuring the voltage across an electric circuit.

Watt (Abbreviated W.)—The unit of electric power. To find power in Watts multiply voltage by amperage. 746 Watts equal one horsepower. 1,000 Watts equal one kilowatt (K. W.).

Wave Length—Radio waves in their passage through the ether, travel in undulating wave form similar to the waves at a seashore. When the wind is blowing hard and steady the distance between each wave crest is comparatively long, while if the wind is blowing more mildly and in short spurts, the distance between the wave crests is accordingly shorter and we have short waves. In radio substitute the wind for the transmitter and you have the same action so to speak. Wave length is, therefore, closely allied with frequency, i. e., long wave lengths have low natural frequencies while short wave lengths have greater natural frequencies. In general, short wave lengths are used for short distance low power work, while long wave lengths are employed for long distance high power work, although there is no relation between wave—length and transmitting range.

Note on Filament Regulation

As a general rule most experimenters are tempted to have the filaments of vacuum tubes burn to brightly. The proper brilliancy is the lowest one at which signals are good. Increasing the filament current beyond this point does not increase the signal strength, but does lessen the life of the tubes considerably. A good general rule to follow is that of keeping the filament as low as possible, consistent with good reception.

Moreover, certain types of vacuum tubes operate at very low filament temperatures. It is therefore best for the novice to follow closely the directions furnished with each vacuum tube receiver.

Wire Tables

B. & S. Gauge

Gauge No. B. & S.	At 20° C Dia. in mils	Dia. in inches	Area Cir. mils	Area Square Inches	Ohms per 1000 ft. at 77°F. or 25°C.	Max. C. Dia. S.C. in mi.	Turns per Linear inch S. C. C.	Max. Dia. D. C. C. in mils	Turns per Linear inch D. C. C.	Dia. in Mils S. S. C. (G. E. Co.)	Dia. in Mils D. S. C. (G. E. Co.)	Turns per S. S. C. (G. E. Co.)	Turns per inch (G. E. Co.)	Approx. turns per inch Enameled
6	162	.1620	26250	.02062	.4028	172	5.60	189.	5.44	...	...	...	...	...
7	144.3	.1443	20820	.01635	.5080	154.3	6.23	173.30	6.08	...	...	...	...	...
8	128.5	.1285	16510	.01297	.6405	137.5	6.94	142.5	6.80	...	...	...	...	...
9	114.4	.1144	13090	.01028	.8077	122.4	7.68	127.4	7.64	...	...	...	...	...
10	101.9	.1019	10380	.008155	1.018	117.9	8.55	112.9	8.51	...	...	...	...	...
11	90.74	.0974	8234	.006467	1.284	96.74	9.60	101.7	9.58	...	...	...	...	...
12	80.81	.08081	6530	.005129	1.619	86.81	10.80	91.8	10.62	...	...	...	...	...
13	71.96	.07196	5178	.004067	2.042	77.96	12.06	83.0	11.88	...	...	...	...	...
14	64.08	.06408	4107	.003225	2.575	70.08	13.45	75.1	13.10	...	...	...	...	14
15	57.07	.05707	3257	.002558	3.247	63.07	14.90	68.1	14.68	...	...	...	...	16
16	50.82	.05082	2583	.002028	4.094	56.82	16.60	60.8	18.08	...	...	...	...	18
17	45.26	.04526	2048	.001609	5.163	51.26	18.20	55.3	18.80	...	...	...	...	21
18	40.30	.0403	1624	.001276	6.510	46.30	20.20	50.3	19.90	...	...	...	...	23
19	35.89	.03589	1288	.001012	8.210	41.89	22.60	45.9	21.83	...	...	...	...	27
20	31.96	.03196	1022	.0008023	10.35	37.96	25.30	42.0	23.91	...	...	...	...	29
21	28.46	.02846	810.1	.0006363	13.05	34.46	28.60	38.5	26.20	...	...	...	...	32
22	25.35	.02535	642.4	.0005046	16.46	31.35	31.00	33.3	28.58	...	...	...	...	36
23	22.57	.02257	509.5	.0004002	20.76	28.57	34.30	30.60	31.12	26.00	29.00	38	34	40
24	20.10	.02010	404.0	.0003173	26.17	26.10	37.70	28.10	33.60	23.00	26.00	43	38	45
25	17.90	.01790	320.4	.0002517	33.00	23.90	41.50	25.90	36.20	21.00	24.00	47	41	50
26	15.94	.01594	254.1	.0001996	41.62	21.94	45.30	23.04	39.90	18.00	22.00	52	45	57
27	14.20	.01420	201.5	.0001583	52.48	20.20	49.40	22.20	42.60	17.00	20.00	58	50	64
28	12.64	.01264	159.8	.0001255	66.17	18.64	54.00	20.64	45.50	15.60	18.60	64	53	71
29	11.26	.01126	126.7	.00009953	83.44	17.26	58.80	19.36	48.00	14.00	17.00	71	58	81
30	10.03	.01003	100.5	.00007894	105.20	16.03	64.40	18.03	51.10	12.50	15.00	80	66	88
31	8.928	.00892	79.70	.00006260	132.70	14.93	69.00	16.93	56.80	11.4	13.90	87	71	104
32	7.950	.00795	63.21	.00004964	167.30	13.93	75.00	15.95	60.20	10.50	13.00	95	76	120
33	7.080	.00708	50.13	.00003937	211.00	13.08	81.00	15.08	64.30	9.50	12.00	105	83	130
34	6.305	.006305	39.75	.00003122	266.00	12.31	87.60	14.31	68.60	8.80	11.30	110	88	140
35	5.615	.005615	31.52	.00002476	335.00	11.62	94.20	13.61	73.00	7.60	9.6	130	104	160
36	5.000	.005	25.00	.00001964	423.00	11.00	101.00	13.	78.50	7.00	9.00	140	110	190
37	4.453	.004453	19.83	.00001557	533.40	10.45	108.00	12.45	84.00	...	...	...	...	...
38	3.965	.003965	15.72	.00001235	672.60	9.965	115.00	11.96	89.10	6.00	8.00	160	120	...
39	3.531	.003531	12.47	.000009793	848.10	9.531	122.50	11.53	95.00	...	...	...	...	...
40	3.134	.00314	9.888	.000007766	1069.00	9.145	130.00	11.15	102.50	5.00	7.00	200	140	230

Honeycomb Coils Suggested for Usual Wave Length Ranges

	Wave Length Range Meters	Primary Coil Cat. No.	Secondary Coil Cat. No.	Tikler Coil Cat. No.	Condenser
Amateur	145-350	DL-35	DL-25	DL-35	Series
Special Amateur	305-710	DL-75	DL-50	DL-35	Series
Commercial	635-1660	DL-150	DL-100	DL-75	Series
Navy Calling	845-1970	DL-200	DL-150	DL-100	Series
Arlington Time	1420-2850	DL-300	DL-250	DL-150	Series
Navy Ship Arcs	2550-4250	DL-200	DL-300	DL-150	Parallel
Navy Station Arcs	4200-6300	DL-500	DL-400	DL-200	Parallel
Foreign and Press	6250-14500	DL-1250	DL-400	DL-200	Parallel
Foreign and Press	13600-21000	DL-750	DL-1250	DL-400	Parallel

Frequency and Wave Length Tables

W. L.—Wave Lengths in Meters. F.—Number of Oscillations per Second. O. or v L. C. is called Oscillation Constant. C.—Capacity in Micro Farads. L.—Inductance in Centimeters. 1000 Centimeters—1 Microhenry.

W.L.	F.	O. or vL.C.	L.C.
50	6,000,000	.839	.7039
100	3,000,000	1.68	2.82
150	2,000,000	2.52	6.35
200	1,500,000	3.36	11.29
250	1,200,000	4.19	17.55
300	1,000,000	5.05	25.30
350	857,100	5.87	34.46
400	750,000	6.71	45.03
450	666,700	7.55	57.00
500	600,000	8.39	70.39
550	545,400	9.23	85.19
600	500,000	10.07	101.41
700	428,600	11.74	137.83
800	375,000	13.42	180.10
900	333,300	15.10	228.01
1000	300,000	16.78	281.57
1100	272,730	18.45	340.40
1200	250,000	20.13	405.20
1300	230,760	21.81	475.70
1400	214,380	23.49	551.80
1500	200,000	25.17	633.50
1600	187,500	26.84	720.40
1700	176,460	28.52	813.40
1800	166,670	30.20	912.00
1900	157,890	31.88	1016.40
2000	150,000	33.55	1125.60
2100	142,850	35.23	1241.20
2200	136,360	36.91	1362.40
2300	130,430	38.59	1489.30
2400	125,000	40.27	1621.80
2500	120,000	41.95	1759.70
2600	115,380	43.62	1902.60
2700	111,110	45.30	2052.00
2800	107,140	46.89	2207.00
2900	103,450	48.66	2366.30
3000	100.000	50.33	2533.20
4000	75,000	67.11	4504.00
5000	60,000	83.89	7038.00
6000	50,000	100.7	10130.00
7000	41,800	117.3	13630.00
8000	37,500	134.1	18000.00
9000	33,300	151.0	22820.00
10000	30,000	167.9	28150.00
11000	27,300	184.8	34150.00
12000	25,000	201.5	40600.00
13000	23,100	218.3	47600.00
14000	21,400	235.0	55200.00
15000	20,000	252.0	63500.00
16000	18,750	269.0	72300.00

Magnet Wire

Cotton Covered

Single Wound	Per lb. Feet	Double Wound	Per Lb. Feet
16	124	16	119
17	155	17	150
18	196	18	188
19	247	19	237
20	311	20	298
21	389	21	370
22	491	22	461
23	624	23	584
24	778	24	745
25	958	25	903
26	1188	26	1118
27	1533	27	1422
28	1903	28	1759
29	2461	29	2207
30	2893	30	2534
31	3483	31	2768
32	4414	32	3137
33	5688	33	4697
34	6400	34	6168
35	8393	35	6737
36	9846	36	7877
37	11636	37	9309
38	13848	38	10666
39	18286	39	11907
40	24381	40	14222

Silk Covered

Single Wound	Per lb. Feet	Double Wound	Per Lb. Feet
20	319	20	312
21	398	21	389
22	504	22	493
23	645	23	631
24	795	24	779
25	1004	25	966
26	1240	26	1202
27	1615	27	1542
28	2023	28	1917
29	2625	29	2485
30	3335	30	2909
31	3820	31	3683
32	4876	32	4654
33	6243	33	5689
34	7757	34	7111
35	9660	35	8534
36	11907	36	10039
37	13474	37	10666
38	16516	38	14222
39	22261	39	16516
40	26947	40	21333

International Morse Code and Convention Signals

To Be Used for All General Public Service Radio Communication

1. A dash is equal to three dots.
2. The space between parts of the same letter is equal to one dot.
3. The space between two letters is equal to three dots.
4. The space between two words is equal to five dots.

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

Ä (German) • — • —
Á or Å (Spanish-Scandinavian) • — — • —
CH (German-Spanish) — — — —
É (French) • • — • •
Ñ (Spanish) — — • — —
Ö (German) — — — •
Ü (German) • • — —

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

Period ..... • • • • • •
Semicolon ..... — • — • — •
Comma ..... • — • — • —
Colon ..... — — — • • •
Interrogation ..... • • — — • •
Exclamation point ..... — — • • — —
Apostrophe ..... • — — — — •
Hyphen ..... — • • • —
Bar indicating fraction ..... — • • — •
Parenthesis ..... — • — — • —
Inverted commas ..... • — • • — •
Underline ..... • • — — • —
Double dash ..... — • • • —
Distress call ..... • • • — — — • • •
Attention call to precede every transmission ..... — • — • —
General Inquiry call ..... — • — • — — — • —
From (de) ..... — • • •
Invitation to transmit (go ahead) ..... — • —
Warning—high power ..... — — • • — —
Question (please repeat after.....)—interrupting long messages ..... • • — — • •
Wait ..... • — • • •
Break (Bk.) (double dash) ..... — • • • —
Understand ..... • • • — •
Error ..... • • • • • • • •
Received (O. K.) ..... • — •
Position report (to precede all position messages) ..... — • — •
End of each message (cross) ..... • — • — •
Transmission finished (end of work) (conclusion of correspondence) ..... • • • — • —

Arlington Weather Report—2500 Meters N. A. A.

Sample Report: QSTdeNAA, USWB, S01081—T02261

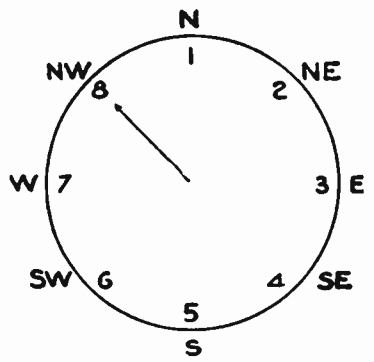
DB 0251—H 00844—C 01261—K 00441—P 01242

EXPLANATION

QST—General call
de—From
NAA—Arlington Station
USWB—U. S. Weather Bureau
"010"—30.10 inches, Barometer
"8"—Direction of wind
"1"—Velocity of wind

		Statute M.P.H.
0	Calm	0—3
1	Light Air	8
2	Light Breezes	13
3	Gentle Breezes	18
4	Moderate Breezes	23
5	Fresh Breezes	28
6	Strong Breezes	34
7	Moderate Gale	40
8	Fresh Gale	48
9	Strong Gale	56
10	Whole Gale	65
11	Storm	75
12	Hurricane	90

Statute Miles per Hr:—1.15.
Nautical—M. P. H.

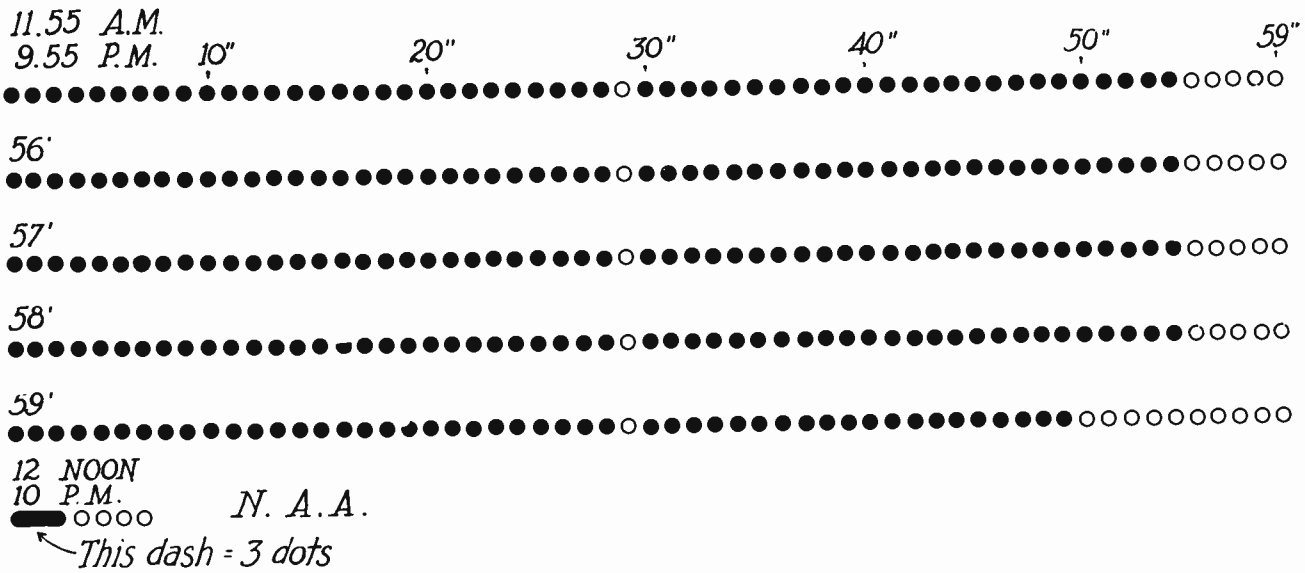


Report is for conditions at 8 P. M. of the day sent out from Arlington. It is sent out 10 P. M.

Du—Duluth G—Green Bay D—Detroit M—Marquette
Ch—Chicago V—Cleveland U—S. S. Marie L—Alpena
F—Buffalo
K—Key West, Fla.
S—Sidney, Nova Scotia.
T—Nantucket, R. I.
DB—Delaware Breakwater.
H—Cape Hatteras, N. C.
C—Charleston, S. C.
P—Pensacola, Fla.
B—Bermuda.

Arlington—Time Signal—2500 Meters

Note: The Arlington Station sends time signals on a wave length of 2500 meters commencing at 11.55 A. M. and 9.55 P. M. every day. Final signals at 12 Noon and 10 P. M. are for the meridian of 75 degrees west of Greenwich. Every tick of the standard clock of the Naval Observatory, Washington, is transmitted as a dot, omitting the 29th second of each minute, the last five seconds of each of the first four minutes, and finally the last ten seconds of the last minute. The 12 Noon and 10 P. M. signal is dash.



International Radiotelegraphic Convention

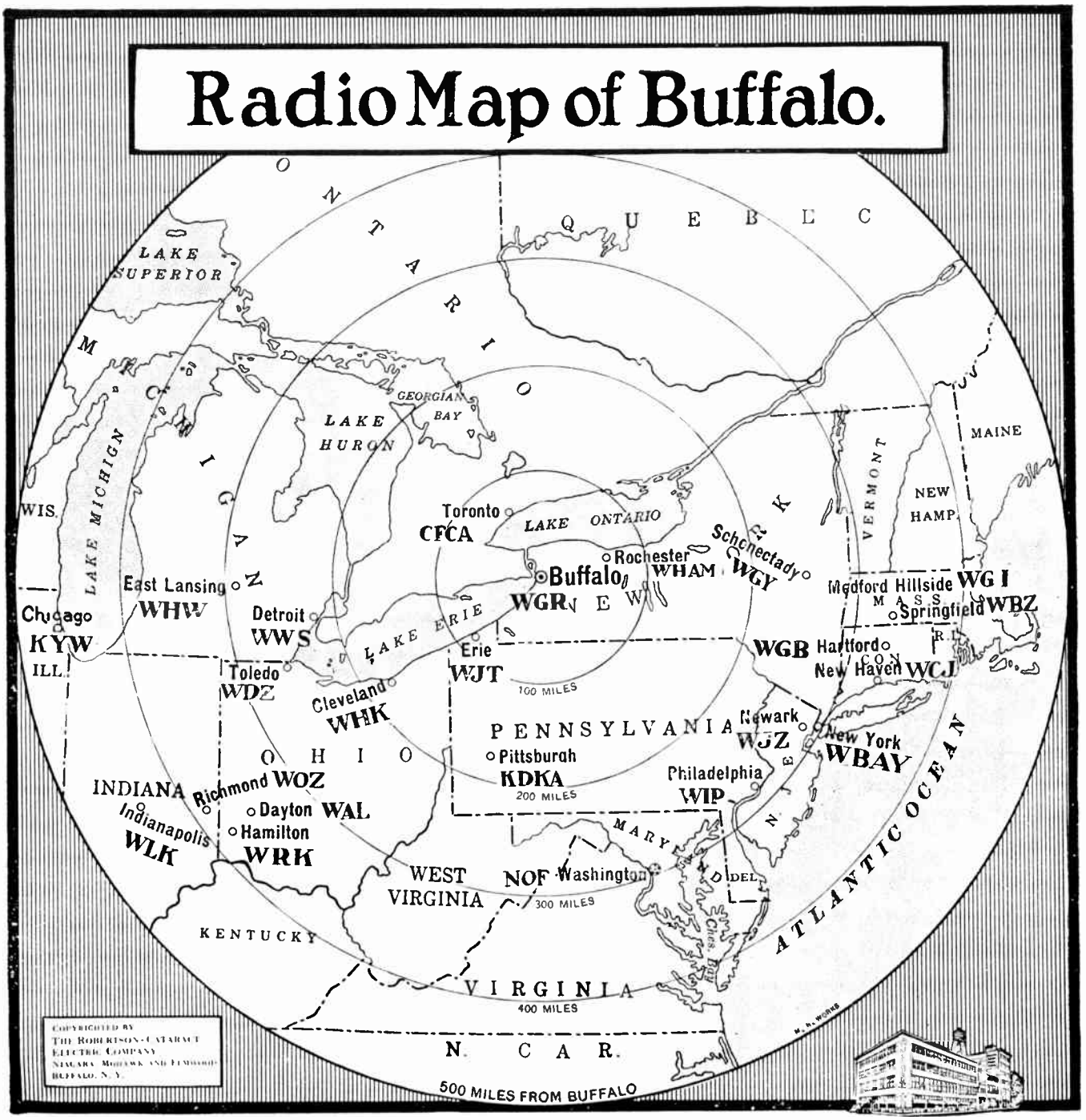
List of Abbreviations to Be Used in Radio Communication

Abbreviation	QUESTION	ANSWER OR NOTICE
QRB	Do you wish to communicate by means of the International Signal Code?	I wish to communicate by means of the International Signal Code.
QRA	What ship or coast station is that?	This is.....
QRB	What is your distance?	My distance is.....
QRC	What is your true bearing?	My true bearing is.....degrees.
QRD	Where are you bound for?	I am bound for.....
QRF	Where are you bound from?	I am bound from.....
QRG	What line do you belong to?	I belong to the.....Line.
QRH	What is your wave length in meters?	My wave length is.....meters.
QRJ	How many words have you to send?	I have.....words to send.
QRK	How do you receive me?	I am receiving well.
QRL	Are you receiving badly? Shall I send 20?	I am receiving badly. Please send 20.
• • • — •	for adjustment?	• • • — • for adjustment.
QRM	Are you being interfered with?	I am being interfered with.
QRN	Are the atmospherics strong?	Atmospherics are very strong.
QRO	Shall I increase power?	Increase power.
QRP	Shall I decrease power?	Decrease power.
QRQ	Shall I send faster?	Send faster.
QRS	Shall I send slower?	Send slower.
QRT	Shall I stop sending?	Stop sending.
QRU	Have you anything for me?	I have nothing for you.
QRV	Are you ready?	I am ready. All right now.
QRW	Are you busy?	I am busy (or: I am busy with.....). Please do not interfere.
QRX	Shall I stand by?	Stand by. I will call you when required.
QRY	When will be my turn?	Your turn will be No.....
QRZ	Are my signals weak?	Your signals are weak.
QSA	Are my signals strong?	Your signals are strong.
QSB	Is my tone bad? / Is my spark bad?	The tone is bad. / The spark is bad.
QSC	Is my spacing bad?	Your spacing is bad.
QSD	What is your time?	My time is.....
QSF	Is transmission to be in alternate order or in series?.	Transmission will be in alternate order. / Transmission will be in series of 5 messages. / Transmission will be in series of 10 messages.
QSG	.....	Collect.....
QSH	.....	The last radiogram is canceled.
QSJ	What rate shall I collect for.....?	Please acknowledge.
QSK	Is the last radiogram canceled?	My true course is.....degrees.
QSL	Did you get my receipt?	I am not in communication with land.
QSM	What is your true course?	I am in communication with.....(through.....).
QSN	Are you in communication with any ship or station (or: with.....)?	Inform.....that I am calling him.
QSP	Shall I inform.....that you are calling him?	You are being called by.....
QSQ	Is.....calling me?	I will forward the radiogram.
QSR	Will you forward the radiogram?	General call to all stations.
QST	Have you received the general call?	Will call when I have finished.
QSU	Please call me when you have finished (or: at..... o'clock)?	Public correspondence is being handled. Please do not interfere.
*QSV	Is public correspondence being handled?	Increase your spark frequency.
QSW	Shall I increase my spark frequency?	Decrease your spark frequency.
QSX	Shall I decrease my spark frequency?	Let us change to the wave length of.....meters.
QSY	Shall I send on a wave length of.....meters?	Send each word twice. I have difficulty in receiving you.
QSZ	.....	Repeat the last radiogram.
QTA	.....	Your true bearing is.....degrees from.....
QTE	What is my true bearing?	Your position is.....latitude.....longitude.
QTF	What is my position?	

*Public correspondence is any radio work, official or private, handled on commercial wave lengths.

When an abbreviation is followed by a mark of interrogation, it refers to the question indicated for that abbreviation.

MEMORANDA



Revised to September 1st, 1922

This map with list of all stations will be supplied to Radio Dealers in quantity upon request.

DISTRIBUTORS

FOR

Acme Apparatus Company
Brach Lightning Arresters
C. Brandes, Incorporated
Chelsea Radio Company
Clapp Eastham Company
Coto Coil Company
Cutler Hammer Manufacturing Company
Dimond State Fiber Company
Dublier Condenser & Radio Corporation
Fahnestock Electric Company
General Electric Company
General Radio Company
Gould Storage Battery Company
H. H. Eby Manufacturing Company
H. H. Frost
Magnavox Company
National Carbon Company
Pacent Electric Company
Radio Corporation of America
Remler Radio Manufacturing Company
Signal Electric Manufacturing Company
C. D. Tuska Company
Trumbull Electric & Manufacturing Company
Western Electric Company
Westinghouse Electric & Manufacturing Company
Wireless Specialty Apparatus Company