H&B RADIO

CATALOGUE No. 85

RADIO DISTRIBUTORS

for

Alden Mfg. Co.
American Brand Corporation
Barkalew Electric Mfg. Co.
Benjamin Electric Mfg. Co.
C. Brandes Incorporated
Carter Radio Co.
Central Radio Laboratories
Dubilier Co.
Exide Battery Co.
F. A. D. Andrea Incorporated
Fahnestock Electric Co.
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General Radio Co.
H. H. Eby Mfg. Co.
Jewell Electrical Instrument Co.
John A. Roebling Sons and Co.
L. S. Brach Mfg. Co.
Magnavox Co.
National Carbon Co.
Radio Corporation of America
Rauland Mfg. Co.
Timmons Radio Products Corp.
Towers Mfg. Co.
Tuska Co., C. D.
Western Electric Co.
Weston Electric Co.

FOREWORD

Based on a fairly dependable estimate there are close to two million Radio Receiving Sets of all types now in use. While this might seem to be a tremendous number of sets, in reality, it represents approximately only one set to every twelve families.

When we consider the almost miraculous advancement in Radio and the feverish growth it has experienced during the past three years, and yet, only one out of every twelve families have radio sets, we begin to realize that the surface has merely been scratched by the radio dealer.

From these figures it is quite apparent that the possibilities of "first sale" of radio receivers are practically unlimited. Practically every family in America is able to own a Radio Receiver of some kind. The types and ranges in price are so varied that the sale of a set usually lies in the appeal—in creating a desire—rather than in providing a means, or seeking a medium.

Twenty-five to fifty per cent of owners of older sets, are already looking for new and more recently developed ones, and there is the vast number who have not as yet ever owned a radio receiver, at least fifty per cent of whom can be considered as potential buyers.

There are several hundred concerns making Radio Receiving Sets of one kind and another, but only a very few of sufficient capacity to attempt national distribution, and with the steady advancement shown in the art as well as the more intelligent buying of the public who are demanding instruments of definite character and performance, the question is how shall one decide on an instrument of real merit, and what are the several and vital points to be considered.

REPUTATION

The public in general cannot always know what is best. Most of us buy upon recommendation—reputation—simply because it is practically impossible for the average individual to learn the things that should be known in making a choice. It is therefore that fidelity becomes an important factor in our every day transactions—in practically everything we buy.

Realizing this fact, certain legitimate concerns have made it their policy to build up good-will and insure the confidence of the public by manufacturing, advertising and selling only products of the highest quality—articles of recognized value, making it possible for even the most untrained buyer—the ordinary person, to match dollars against merchandise, and know that he is exchanging money for value received.

It has always been the policy of Hendrie & Bolthoff to represent this class of manufacturers, sponsoring products that actually have a recognized value—products that will stand the actual test of service, and perform the duties for which they are intended. This policy has prevailed in every department of the firm, however, as pioneers in the distribution of Radio Apparatus this policy has been adhered to with the strictest precaution, until now we represent, instead of a number of manufacturers, only a very few of the best reliable ones upon whom we have learned to rely. These are firms that maintain radio engineers who understand the subject both from the theoretical and practical point of view, and as a result, they manufacture radio apparatus with the most exacting precision, keeping it always abreast of the latest developments. Such apparatus we are only too glad to sponsor, and offer to our friends of the Rocky Mountain Region.

It is, therefore, hoped that the following pages will serve to enable the people to select Radio Receivers and Apparatus with a feeling of confidence that they have obtained products as near perfect as the latest developments of the art can produce, in which event this catalogue shall have served its purpose.

TERMS

ALL SALES AND CONTRACTS MADE BY US ARE EXPRESSLY SUBJECT TO THE FOLLOWING TERMS:

Stenographical and clerical errors subject to correction.

Prices subject to change without notice.

Quotations, unless otherwise stated, are for immediate acceptance.

All agreements made contingent upon strikes, fires, accidents or causes beyond our control.

Our liability from all causes is limited to the value of the goods sold or furnished.

If goods are defective, we will not be responsible beyond the value of the defective piece at the factory.

We will not otherwise be responsible for any damages or expenses occasioned by defective goods.

Claims for shortage, or deductions for erroneous charges, must be presented within ten days of receipt of goods.

Boxing and cartage will be charged at cost.

RETURNED GOODS

Do not return goods without writing us first. When permission is obtained, carefully mark your name, town and state on outside of package. Write us the same day, inclosing express receipt or original freight bill of lading, and mention day of invoice on which goods were billed you. Observance of this suggestion will save you annoying delays and much correspondence.

When any goods are shipped to us to be repaired, they should be tagged with the full name and address of the owner.

CANCELLATION OF ORDERS

Orders can not be countermanded without our consent; this especially applies to goods other than standard.

REGARDING ORDERS

Buyers located away from the railroads should be careful to specify to what point goods should be shipped and by what route, and should also give postoffice address to which invoice should be mailed.

Full shipping instructions should be given in each order.

If reference is made to a previous order, the date of same should be given.

Where parties unknown to us desire goods shipped C. O. D., an amount sufficient to pay transportation charges should accompany order.

We use Western Union Telegraph Code (Universal Edition).

DESCRIPTIONS AND ILLUSTRATIONS

We reserve the right to make any changes in detail on our goods without reference to the descriptions and illustrations contained in this book, which may, in our opinion, develop an improvement or gain convenience for the purchaser.

SPECIAL NOTICE

Our goods are all packed securely by experienced men, and are shipped at the risk of the Owner or Consignee. We can not be responsible for loss or damage after we take the Railroad Company's receipt. If goods arrive at destination damaged or in bad order, receipt should be given accordingly, so that recourse may be had on the Transportation Company.

We are not responsible for delays in delivery by Transportation Company.

PURCHASING DEPARTMENT

We wish to call the attention of our out-of-town customers to the fact that we are always willing to accommodate them in supplying their wants when goods are desired outside of our line, and will buy and furnish them at regular market prices.

OUR OFFICES AND SALESROOM—"OPPOSITE THE UNION STATION"

DENVER—THE JOBBING CENTER

OF THE WEST

A new country grows with leaps and bounds and its ambitions usually keep pace with its growth. Yet the great secret of success and commercial importance of a country depends not on its rapidity of growth or its high ideals and worthy ambitions. Its location, its geographic position and natural resources are certainly potential factors in ushering in a continuous growth, and commanding for it recognition in commerce and industry.

We of the west are proud of our position in the nation. Our thirty-five million people constitute one-third of the nation's population and more than that proportion of the nation's buying power.

Despite the so-called "abnormal times," this is an era of general growth and expansion in the west. An expansion that calls for a growth in population, more extensive agricultural pursuits, a stimulation of industry and a general forward stride of the west in every pursuit.

To foster this growth the thirty-five million people of the west demand service. Denver, assisting and ever pushing forward with its population of more than 256,000 inhabitants, advantageously located at the foot of the Rocky Mountains and at the edge of the plains, is in a position to give that service.

Denver, like the hub of a wheel, is in more than one respect, the center of the west. With its nine railroads radiating out to all parts of the west, Denver commands the vast area from the Pacific coast to the Mississippi; from tho Canadian Border to the Gulf of Mexico. Together with this great steel web, transporting its thousands of cars to and from Denver, we have adequate transportation facilities by motor trucks for a radius of more than 100 miles, in addition to interurban lines that are ready avenues of quick transportation. These advantages make Denver the logical shipping center, a manufacturing center, a central assembling point, the logical jobbing city—certainly the center of the west.

Dealers everywhere in the west can safely depend upon Denver for their wants. Denver jobbers and manufacturers give immediate attention to out-of-town orders and strive in every way to satisfy. There are no delays in transportation that are so often occasioned by congested terminals and heavy traffic in the east. Goods radiating out over the nine roads are in the hands of the purchaser with only a minimum of delay. A majority of the orders are shipped out of the Denver stock the day the orders reach the jobber and very often the dealer even receives his goods the same day.

Why buy elsewhere when Denver can give service together with quality of goods at a reasonable price—when "Denver is the Middle of the West."

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HOWE CRYSTAL RECEIVERS

The neatest, most attractive set made, possessing unusual selectivity. Has a range of 200 to 600 meters, with a receiving radius of over 25 miles. There are no exposed or loose wires and the coil element is complete in itself. It can be removed by unloosening one screw. Coil wire is wound by a special process to prevent shifting of wire. Fool-proof and trouble-proof.

Only the best materials are used in the Howe Radio Receiver. The metal case is strong and compact and is beautifully finished in antique verde.

Binding posts are riveted and neatly recessed in the back of the case and cannot pull out. They are plainly marked for aerial, ground and phone plugs. Only high grade crystals are used. The detector can be easily and quickly adjusted in any direction. Stations can be logged by numbers if desired. Complete installation directions are included with each set. Size, base 3x3⅛ inches. Height, 3¾ inches.

Furnished in individual boxes. Six sets packed in an attractive two-color counter display case. Four dozen to a fibre shipping carton.

Price ..... Each, $1.75

RADIOLA JUNIOR

Radiola Junior is a complete radio receiving outfit. Its range varies from ten to twenty miles. The only adjustments necessary include the occasional finding of a "sensitive spot" on the crystal detector and the simple turning of a tuning control arm to cover the wave-length range of 190-500 meters. Built in a very substantial and attractive wood cabinet, the receiver has a compartment for storing the telephone receivers when the set is not in use.

This instrument includes a tuner, a fixed condenser, a super-sensitive crystal detector, and a high-grade set of head telephones.

Radiola Junior may ordinarily be employed for receiving from the broadcasting stations up to a maximum distance of twenty miles; often it will pick up broadcasting over greater distances.

Complete with head phones, spare crystals, and full instructions.

Radiola Junior ..... Price, each, $18.00

RADIOLA III

RADIOLA III

A two-tube regenerative receiver, dry battery operated, of an improved type, and at a price which will make it a rapid seller in the radio market.

Radiola III is a complete outfit, which goes to the consumer with two WD-11 Radiotrons and a pair of head telephones, at an exceptionally low price. Vast quantity production has made the price reduction possible.

Radiola III will operate a loud speaker on local stations and on long distance stations during the favorable months of the year. With head telephones it will receive over a range of approximately 2,000 miles.

A special feature of Radiola III, which has been needed but not previously available, is a "selective" tuning adjustment enabling the broadcast listener to select one of a group of local stations without over-lapping; but merely by changing the position of the switch, broader tuning and greater sensitiveness are provided, thus permitting reception from far-distant stations.

Radiola III is arranged for use with aerials of different lengths. Unlike former types of receivers of this class, it can be used with aerials up to 150 to 160 feet in length, thus providing strong signals. Radiola III is the ideal receiver for the rural and suburban districts.

Price, Each

Radiola III, with two WD-11 Radiotrons, one pair of head telephones (less batteries) $35.00

RADIOLA III BALANCED AMPLIFIER

A two-tube improved amplifier unit of the "push-pull" type, which, when added to Radiola III, constitutes a **four-tube receiver,** second to none in performance, and which operates a loud speaker under all conditions.

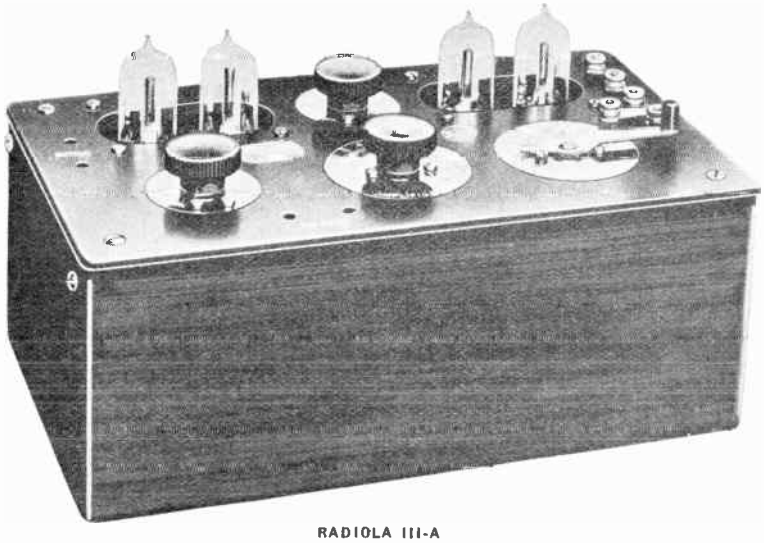
Radiola Balanced Amplifier gives the pure tone reproduction of the more expensive R. C. A. sets.

Price, Each

Radiola III Balanced Amplifier, including two WD-11 Radiotrons (less batteries) $30.00

RADIOLA III AMPLIFIER

RADIOLA III-A



RADIOLA III-A

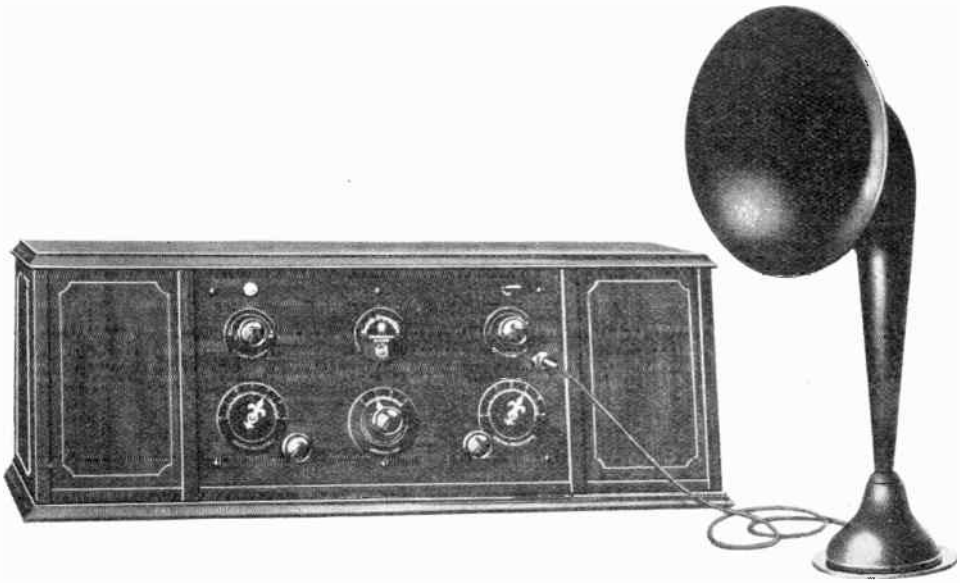
A four-tube regenerative receiver consisting of the Radiola III and the Radiola III Balanced Amplifier mounted in one unit, which goes to the public at half the price of former types of regenerative receivers. Large quantity production has made possible a marked price reduction.

This receiver combines all of the latest improvements known in single-circuit regenerative receivers, and its capabilities are such that they exceed even the excellent results obtained with the Radiola Grand or Radiola IV.

Radiola III-A is equipped with dry battery Radiotron tubes so that a sturdy and sensitive long range receiver is now available at a price well within the reach of those who have need for just such a set. Performing entirely from dry cell batteries, Radiola III-A will very satisfactorily operate a loud speaker, and is, therefore, a truly universal receiver, as applicable to use in isolated farm sections as in city apartment houses.

	Price, Each
Radiola III-A, with four WD-11 Radiotrons and one pair of head telephones (less batteries)	$ 65.00
Radiola III-A, including four WD-11 Radiotrons, one pair of head telephones and Radiola Loud Speaker (less batteries)	90.00

RADIOLA REGENOFLEX



RADIOLA REGENOFLEX

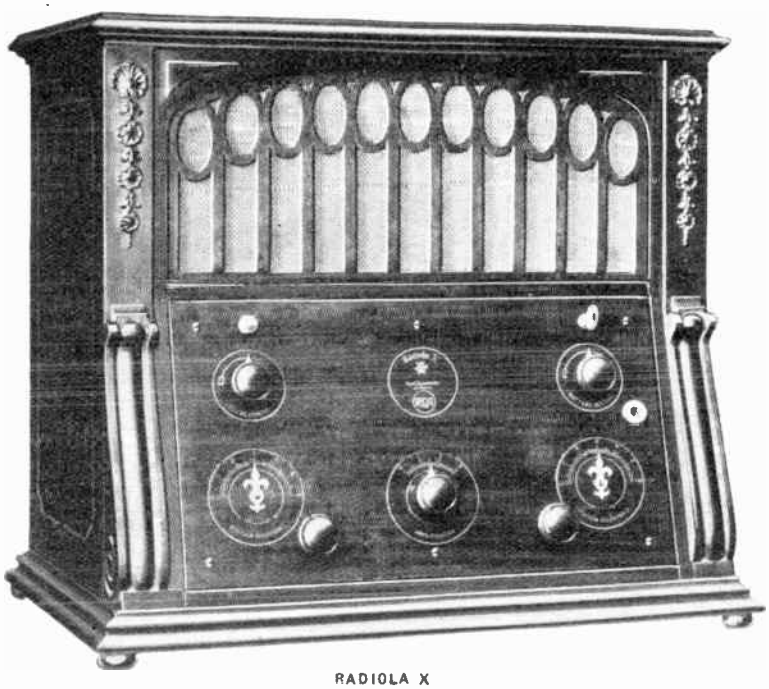
A table type of highly selective and "non-radiating" regenerative receiver for use with external loud speaker. Radiola Regenoflex has a greatly improved regenerative circuit and when used with a good aerial and ground affords almost startling results in both distance and volume.

Radiola Regenoflex is operated entirely from dry cell batteries and the cabinet has sufficient space for mounting these batteries inside. Connections to the aerial and ground are made from the rear, thus doing away with all unsightly wiring.

Radiola Regenoflex will rapidly take precedence over all former types of receivers within its price range when its capabilities are fully known.

	Price, Each
Radiola Regenoflex, less all accessories	$150.00
Radiola Regenoflex, with tubes, less loud speaker	166.00
loud speaker (less batteries)	191.00

RADIOLA X



RADIOLA X

A four-tube dry battery operated Regenerative Receiver, highly selective and "non-radiating," for use with an aerial, embodying extraordinary improvements which will prove a revelation to the broadcast listener. It provides selectivity capable of meeting the requirements in congested broadcasting zones.

It is a "non-radiating" receiver, employing a new discovery in radio circuits—the "Regenoflex" circuit. Thus, R. C. A. provides a regenerative receiver which prevents the broadcast listener from interfering with his neighbor's entertainment, and reciprocally he is not interfered with by his neighbor when the use of these "non-radiating" sets becomes universal.

On a suitable antenna Radiola X will receive across the continent, and it enables the reception of far-distant broadcast stations while local stations operate. It is mounted in an unusually handsome cabinet with a self-contained loud speaker which operates on a new principle, providing more melodious reception than anything hitherto produced. The new loud speaker muffles background noises, hisses, etc., giving unusually quiet operation and tonal quality like a "seasoned" violin.

Of equal importance, the tuning circuits of Radiola X have been adopted to aerials of various lengths. Very long aerials may be used without loss in selectivity, thus giving volume over long distances.

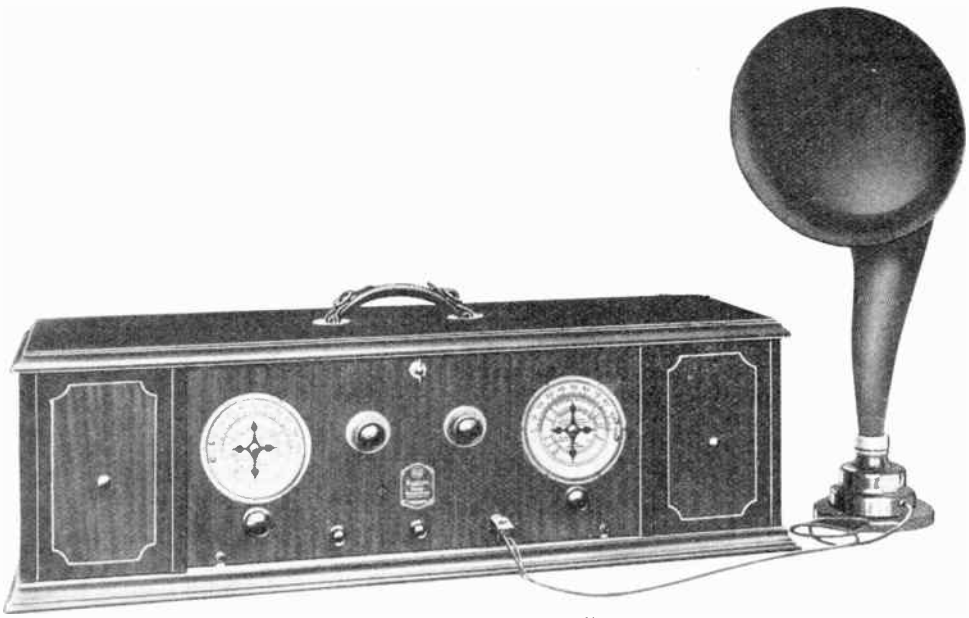
The great ease with which stations may be picked up, the extreme selectivity which Radiola X provides, the unusual quality of loud speaker reproduction, and the pleasing proportions of the cabinet, together with dry battery operation, will rapidly put Radiola X to the foreground in every home where an aerial of suitable proportions can readily be erected.

Price, Each

Radiola X, including four WD-11 tubes and enclosed loud speaker (less batteries) $245.00

RADIOLA SUPER-HETERODYNE

SECOND HARMONIC



RADIOLA SUPER-HETERODYNE

An instrument destined to achieve universal popularity amongst those who desire equipment that can be moved from point to point. Radiola Super-Heterodyne is a new six-tube super-heterodyne set, simplified for everybody's operation, having but two tuning controls, and is housed in a semi-portable cabinet with a self-contained fixed loop of small dimensions. Neither aerial nor ground is necessary. Space is provided in the cabinet to accommodate all the necessary dry batteries. The loud speaker is mounted externally. A leather handle provides portability.

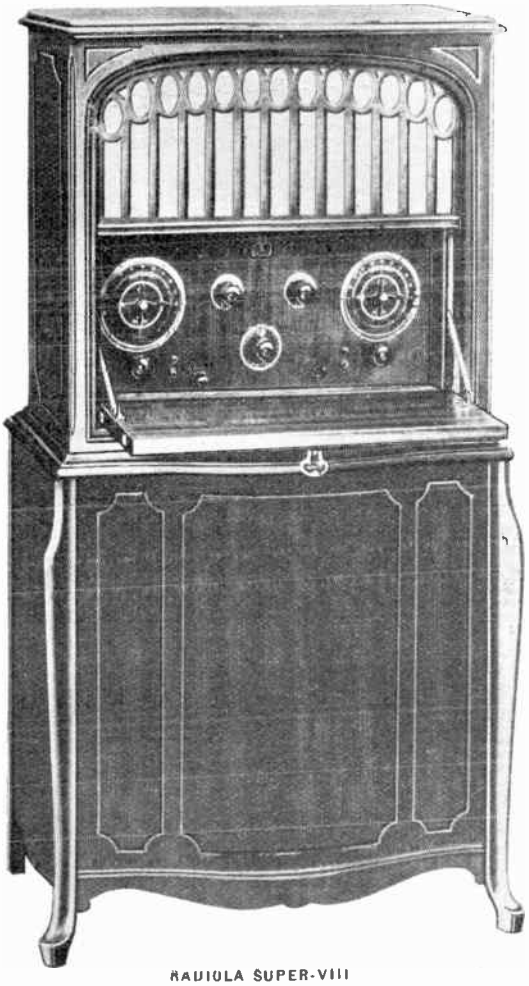
Radiola Super-Heterodyne operates a loud speaker, during the favorable periods of the year, up to 2,000 miles; but with a suitable external loop, will provide loud speaker performance over a range of approximately 3,000 miles.

Radiola Super-Heterodyne may be carried from room to room in the home; it may be transported from point to point in an automobile and actually operated while the automobile is in motion. It may be taken to the seashore, to the golf links, to your neighbor's home, thus justifying a new slogan, "Take Your Radio Entertainment With You."

	Price, Each
Radiola Super-Heterodyne, less all accessories	$220.00
Radiola Super-Heterodyne, with tubes, less Loud Speaker	244.00
Radiola Super-Heterodyne, with six UV-199 Radiotrons and Loud Speaker (less batteries)	269.00

RADIOLA SUPER-VIII

The de luxe instrument of the new line. A six-tube, dry battery operated super-heterodyne, utilizing a new principle—the Second Harmonic Oscillator—yet simplified for everybody's operation. Only two tuning controls need manipulation to bring in entertainment from local and far-distant stations. Local broadcast stations need only be heard when desired, for the super-heterodyne provides selectivity unattained by any other known principle.



RADIOLA SUPER-VIII

Radiola Super-VIII requires neither aerial nor earth connection. A self-contained loop of the rotating type mounted in the base of the cabinet does the trick, giving loud speaker volume over long distances, and during the favorable periods of the year a range of reception up to 3,000 miles is possible. It goes to the home ready to operate, and calls for no initial installation expense.

Radiola Super-VIII has new amplifying transformers, resulting from new discoveries, which accentuate the lower base notes and the higher treble tones, thus giving purer and better reproduction of broadcasted speech and music.

Radiola Super-VIII is a receiver of the "non-radiating" type. Several sets may be operated in the same room, each tuned to a different station.

You will be especially pleased with the finish and the attractive appearance of the cabinet, its accessibility, and a host of other features, all tending toward better and easier operation.

Price, Each

Radiola Super-VIII, including six UV-199 Radiotrons, built-in loud speaker (less batteries) $425.00

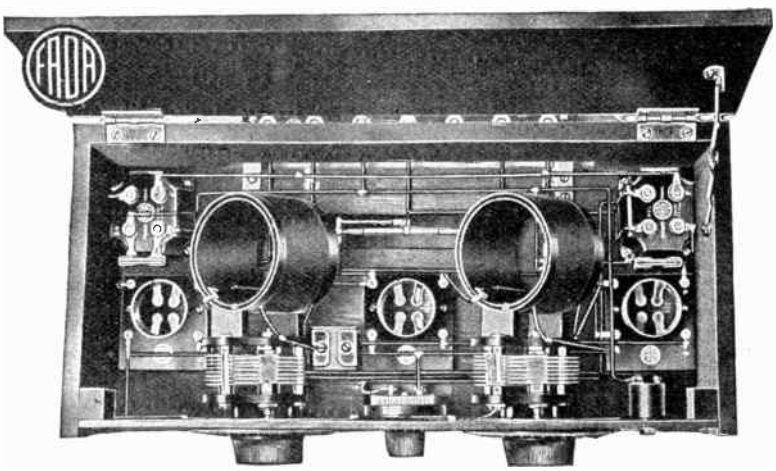
FADA "NEUTRO-JUNIOR"

No. 195-A

The Fada "Neutro-Junior" completes the line of Fada Neutrodyne receiving equipment, adding a three tube receiver to the present four tube, "One-Sixty" and the five tube "Neutroceiver" and "Neutrola" series.

The "Neutro-Junior" uses three tubes in a special improved circuit, arranged so that one stage of radio frequency amplification, detector and two stages of audio frequency amplification are obtained.

Only two tuning controls are necessary on the panel front in addition to the rheostat and the telephones may be plugged into "horn" jack. All binding posts are mounted through the rear of the panel on a bakelite terminal block. The cabinet is of mahogany, very beautifully finished and provided with a hinged top.

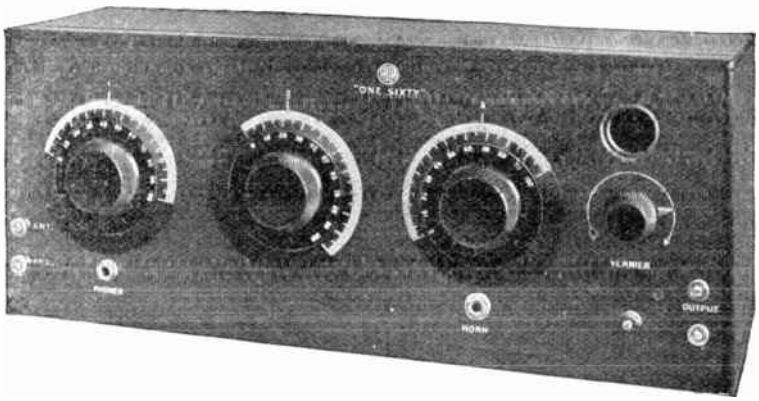


INTERIOR VIEW No. 195-A

The approximate dimensions are 17 inches long by 7 inches high by 8¾ inches deep. Approximate shipping weight, 13 pounds.

No. 195-A—Fada "Neutro Junior".....Price, each, $75.00

FADA "ONE-SIXTY" NEUTRODYNE RECEIVERS



No. 160-A FADA

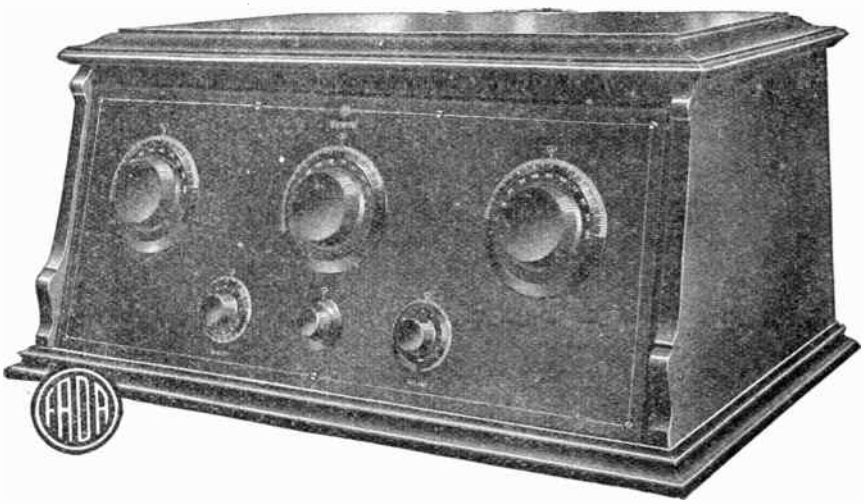
In actuality, the Fada "One-Sixty" Neutrodyne Receiver is "the receiver that has taken the country by storm," for it was the most modern and most successful radio receiver manufactured during 1923 and early 1924. Over 30,000 of them are in the hands of satisfied users. It is a receiver which gives highly satisfactory radio broadcast reception over both local and long distances up to and well over 1,000 miles. Such a receiver of exceptional merit is priced so that it is within the reach of the pocketbooks of everyone.

The four vacuum tubes used provide two stages of radio frequency amplification, detector and two stages of audio frequency amplification, as one of the tubes does double duty.

The receiver is encased in a piano-finished mahogany cabinet with hinged cover. All battery binding posts extend on a bakelite shelf through rear of cabinet. Approximate dimensions: 19 inches long, 8 inches high and 8 inches wide. Supplied less tubes, batteries, etc. Appproximate shipping weight, 18 pounds.

No. 160-A—Fada "One-Sixty".....Price, each, $120.00

FADA "NEUTROCEIVER"



No. 175-A

The Fada "Neutroceiver" is one of a series of new models of Fada Neutrodyne receivers developed by Fada engineers during the past year and a half. Five tubes are used, providing two stages of radio frequency amplification, detector and two stages of audio frequency amplification.

The "Neutroceiver" has a black bakelite panel mounted at an angle into a beautiful mahogany cabinet. The cabinet top is hinged for insertion of tubes. The cabinet also provides ample room for containing batteries.

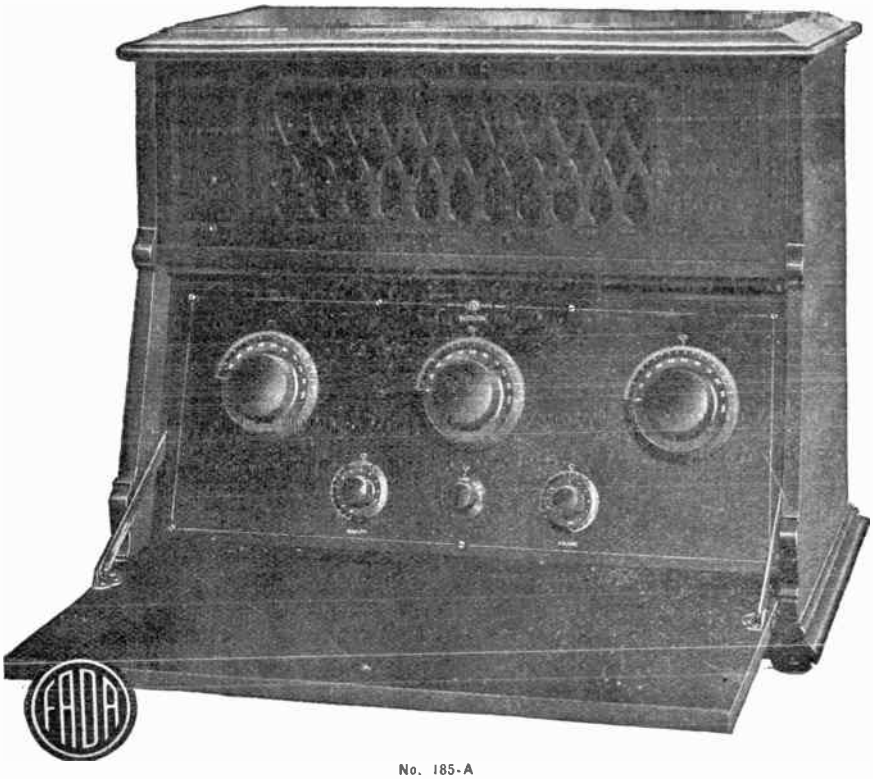
To use the "Neutroceiver" turn the knob directly beneath the second or center tuning dial, to the right. This lights the tubes and makes the broadcasted program comfortably or extremely loud, as desired. This is the simplest control ever evolved for Neutrodyne receivers and is of enormous value. Only three tuning dials are used having the exclusive Neutrodyne advantage of their readings being practically identical. The two dials marked "clarity" and "volume" provide for a variation of the intensity and quality of music and speech reproduction.

Supplied less tubes, batteries, etc.

Dimensions: 25 inches long, 17 inches deep and 12 inches high. Approximate shipping weight, 23 pounds.

No. 175-A—Fada "Neutroceiver".....Price, each, $160.00

FADA "NEUTROLA"



No. 185-A

The very last word in the radio art. The five-tube Fada "Neutrola" Neutrodyne receiver is a most modern and desirable radio receiver for home entertainment. It is a receiver which appeals to the experienced or semi-technical radio fan as well as to the housewife and the younger children.

In addition to the wonderful use of the Fada "Neutrola" as an instrument for pleasure and entertainment, its next most dominating appeal is its appearance. The receiver is encased in a beautifully finished mahogany cabinet, the inclined Neutrodyne receiver panel unit being enclosed by a drop desk-door. The desk-door and the upper part of the receiver cabinet which contains the loud speaker is very artistically decorated with a wooden inlay.

Provision is also made in the "Neutrola" cabinet for containing batteries. The self-contained loud speaker needs no adjustment and gives a surprising purity of tone reproduction. The five tubes used provide two stages of radio frequency amplification, detector and two stages of audio frequency amplification.

Supplied less tubes, batteries, etc. Dimensions: 27 inches long, 17 inches deep and 21 inches high. Approximate shipping weight, 35 pounds.

No. 185-A—Fada "Neutrola".....Price, each, $220.00

FADA "NEUTROCEIVER GRAND"

No. 175/90-A

The Fada "Neutroceiver Grand" comprises the combination of a Fada No. 175-A "Neutroceiver" and a Fada No. 190-A Neutrodyne Table Cabinet.

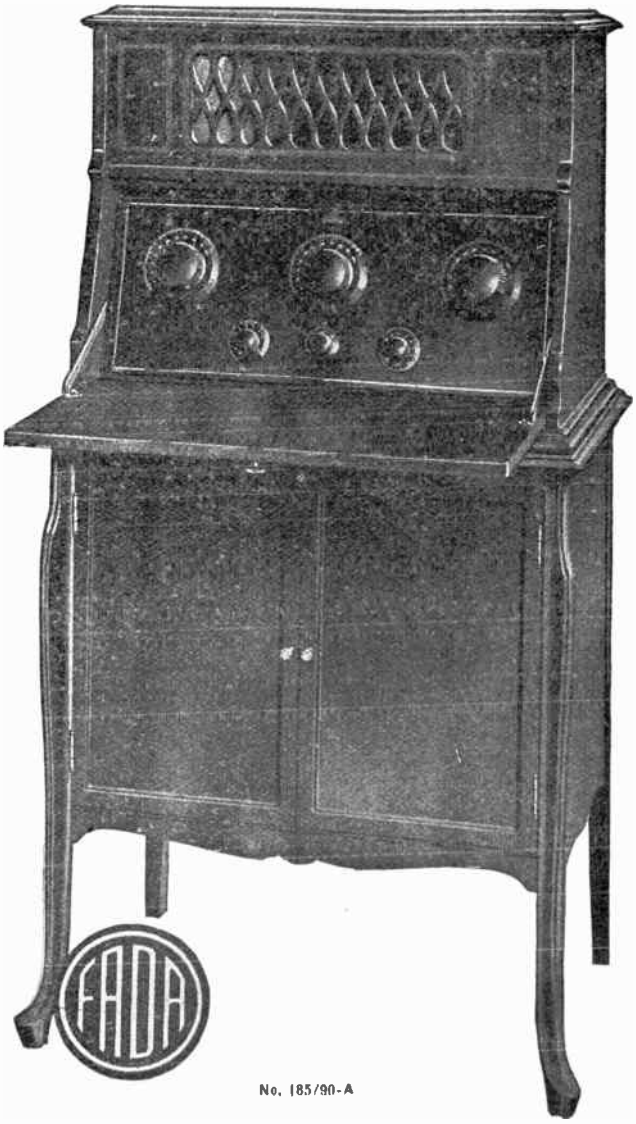
For the radio enthusiast who has passed the stage of frenzied experimentation and who possibly at the good wife's request, likes to cover up his wires and batteries and battery charging equipment, the "Neutroceiver Grand" is the answer.

One has the great advantages and superiority of the Fada "Neutroceiver" with the unsightly batteries, etc., enclosed in the table cabinet.

Approximate overall dimensions: 27 inches long, 44 inches high and 18 inches deep. Approximate shipping weight, 65 pounds.

	Price, Each
No. 175/90-A—Fada "Neutroceiver Grand"	$235.00
No. 190-A—Neutrodyne Table Cabinet (only)	75.00

FADA "NEUTROLA GRAND"



No. 185/90-A

The Fada "Neutrola" Grand consists of the combination of the Fada No. 185-A "Neutrola" Neutrodyne receiver and a Fada No. 190-A Neutrodyne Table Cabinet.

This combination of course provides in addition to the No. 175/90-A "Neutroceiver Grand" the advantage of the enclosed loud speaker and of the drop desk-door enclosing the receiver panel.

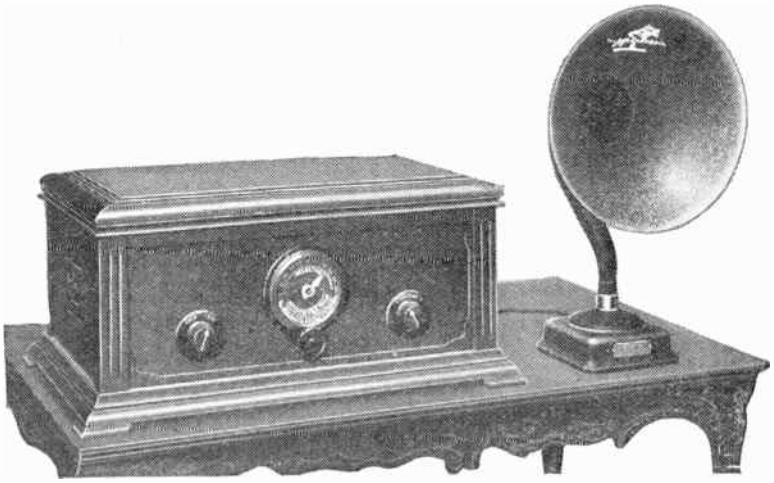
The Fada "Neutrola Grand" is undoubtedly a type of radio receiver and base, the general design of which will be followed for a period of years.

Picture this beautiful Fada "Neutrola Grand" receiver and the family circle at "fireside time" eagerly listening to radio entertainment and you have grasped the spirit of this new design. To provide a Fada receiver of marvelous utility and with an appearance that makes the expression "they buy them because they love nice things" inadequate, we believe has been attained.

Approximate overall dimensions: 27 inches long, 51 inches high and 18 inches deep. Approximate total shipping weight, 80 pounds.

No. 185/90-A—"Neutrola Grand".....Price, each, $295.00

MAGNAVOX BROADCAST RECEIVERS



TRF-5

MAGNAVOX RECEIVER TRF-5

Here at last is the perfected instrument permitting you to enjoy simultaneously the most desirable elements of broadcast reception—features which no one model ever combined before. To produce the Magnavox, radio science, musical research and furniture design each contributed of its latest and best.

The distinctive Magnavox tuned radio frequency circuit is characterized by exceptional clearness and volume as well as selectivity. Perhaps the most gratifying feature of Magnavox Radio is its unique method of balancing the constants so as to bring the several circuits into resonance, whereby tuning is done by a single dial.

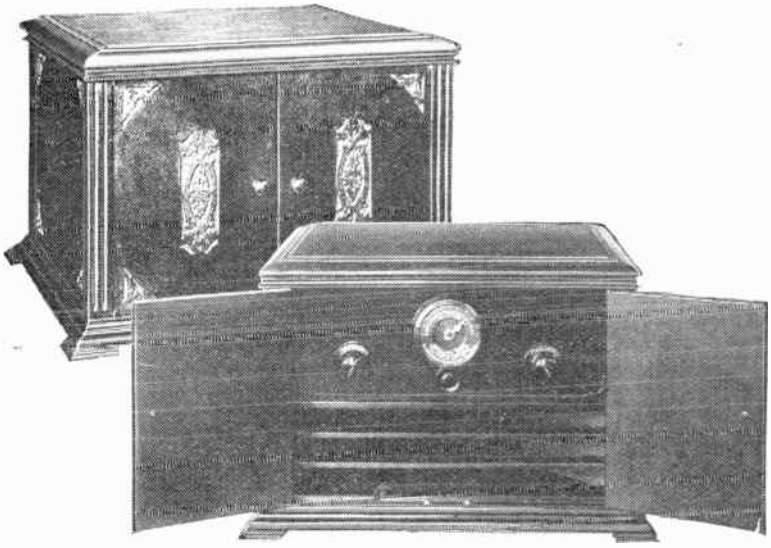
As illustrated, the panel carries only three knobs: the on and off switch, the selector (Magnavox Unit Tuner) and the volume control. This last dial permits any desired volume instantly and without de-tuning or altering the superb character of reproduction in any way.

Magnavox Radio TRF-5 is identical with the TRF-50, shown on the following page, but is encased in a smaller cabinet without built-in reproducer. Height, 9⅝ inches; length, 20½ inches; depth, 14¾ inches.

Price, Each

With M-4 Reproducer, without tubes or batteries.....$125.00

MAGNAVOX BROADCAST RECEIVERS



No. TRF-50

MAGNAVOX RECEIVER TRF-50

In designing these new broadcast receivers, Magnavox has successfully interpreted the radio needs of the American home.

Three decisive advantages go with the Magnavox: unequalled simplicity of control, reproduction of exceptional clearness in any desired volume, a handsomely carved period cabinet designed for quiet dignity and convenience without burdensome cost.

The Magnavox Unit Tuner does away with all complicated dialing, and places the novice on the same footing as the radio expert. In point of selectivity and distance, Magnavox Broadcast Receivers also satisfy the most discriminating.

TRF-50, illustrated above—a 5-tube tuned radio frequency receiver in carved cabinet with built-in Magnavox Reproducer Unit and space for "B" batteries.

Without tubes or batteries.....Price, each, $150.00

NEUTRODYNE SETS UNASSEMBLED

No. 165-A

To provide the radio experimenter with the absolutely necessary parts for Neutrodyne Receiver construction, 3 Fada No. 163-A Neutroformers and 2 Fada No. 164-A Neutrodons are packed in a combination package together with a Fada book "How to Build a Fada Neutrodyne Radio Receiver."

The Neutroformers supplied in this combination package may be mounted using two types of Fada Variable Condensers either type of which has been designed for high efficiency for use with Neutrodyne Receiver circuits.

The Fada 76-page book "How to Build a Fada Neutrodyne Radio Receiver," Fifth Edition, includes 38 pages and 44 illustrations on the actual construction of a 5-tube Neutrodyne receiver. In addition 29 pages and 28 illustrations covering the general subject of "Troubles that may be experienced in Radio Receiver Operation and Their Remedies."

No. 165-A Fada Neutrodyne Parts.....
.....Price, each, $25.00

FADA IMPROVED KNOCK-DOWN FIVE-TUBE NEUTRODYNE RECEIVER PARTS

Based on past experience with Neutrodyne Receiver Parts and on the letters received from 10,000 radio fans who have written the manufacturer concerning their construction work, an improved model of a 5-tube knock-down Neutrodyne receiver has been designed.

The improvements are mainly from the point of view of making the receiver more easy to assemble and wire and adjust, and to guarantee the home constructor successful results. To this end the circuit itself has been changed in detail to secure greater stability and the phenomenal results obtained with the former No. 166-A and No. 167-A Neutrodyne Receiver have been retained.

No. 169-A

A great assistance in the construction of this receiver is the Fada 76-page book "How to Build a Fada Neutrodyne Radio Receiver"; 38 pages of actual construction information, and 44 illustrations tell how to build a 5-tube Neutrodyne receiver. In addition 29 pages and 28 illustrations cover information under the general heading "Troubles that may be experienced in Radio Receiver Operation and their Remedies." Included in the book is a nearly full-size picture wiring diagram making wiring very simple.

A No. 169-A complete set of receiver parts consists of: 1 Bakelite Panel, $\frac{3}{16}$x7x24 inch drilled and engraved; 1 Wooden Base Board, $\frac{5}{8}$x6$\frac{3}{4}$x19 inches; 1 Metal Shield, 4x13 inches; 2 8-ohm Rheostats No. 153-A, complete with screws; 2 Single Sockets No. 118-A, complete with screws; 1 Triple Socket, No. 123-A, complete with screws; 1 Neutrodyne Parts Package, No. 165-A, consisting of 3 Neutroformers No. 163-A, 2 Neutrodons, No. 164-A, 1 Handbook "How to Build a Fada Neutrodyne Radio Receiver"; 1 "Phones" Telephone Jack, Closed Circuit Type; 1 "Horn" Telephone Jack, Three Spring Automatic Filament Control Type; 1 "A" Battery Switch; 1 .00025 mfd. Grid Condenser; 1 2 Megohm Grid Leak; 1 By-Pass Condenser (may be .02 to .25 mfd. or larger); 2 Audio Frequency Amplifying transformers, No. 171-A; 1 Terminal Block, 7 Post, No. 149-A; 3 Instrument Dials, No. 137-A; 1 Box miscellaneous screws, nuts, etc.; 22 ft. Bus Bar Wire; 20 ft. Insulating Tubing.

Overall dimensions of carton, 28x11x6 inches. Shipping weight, 16 lbs.

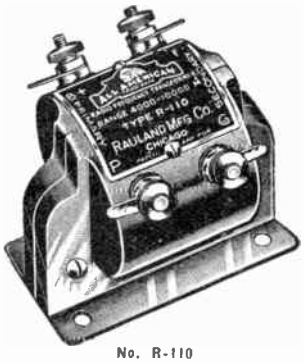
No. 169-A Improved 5-Tube Knock-Down Neutrodyne Receiver.....Price, each, $72.00

SUPER-HETERODYNE SETS UNASSEMBLED

LONG-WAVE (4,000 TO 20,000 METERS) TRANSFORMER

This intermediate-frequency transformer, now known and relied upon everywhere for 100 per cent reliable inter-stage amplification at beat-frequencies, is made in the new All-American plant at Chicago, to the same high-precision standards of manufacture as the well-known All-American Audio Transformers. The Long-Wave Transformer provides maximum amplification at 30 Kilocycles (10,000 meters), but works at very nearly as high efficiency at any point between 15 and 75 kilocycles (20,000 to 4,000 meters).

No. R-110 ..... Price, each, $6.00



No. R-110

No. R-120

10,000-METER SHARP-TUNED TRANSFORMER (FILTER OR INPUT TRANSFORMER)

Very much of the excellence of beat reception depends upon the quality of the filter used. The All-American filter is built with the utmost accuracy to pass a beat-frequency of 10,000 meters (30 Kilocycles) together with the side-band resulting from modulation—approximately 26 to 34 Kilocycles. Other frequencies are efficiently dropped out, resulting in a selectivity which will surprise even the seasoned experimenter.

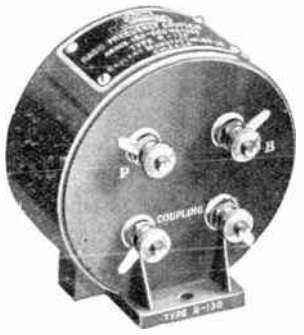
No. R-120 ..... Price, each, $6.00

SHORT-WAVE COUPLER, RANGE 150-650 METERS (OSCILLATOR COUPLER)

The All-American Coupler makes possible a uniform output of the oscillator at any frequency within the range of the instrument—namely, from 150 meters to 650 meters (2,000 to 462 Kilocycles).

This instrument, like the Type R-120 above described, is housed in a polished bakelite case of practical and pleasing design, being thus effectively protected from all injury by dust, heat, moisture, or mechanical damage.

No. R-130 ..... Price, each, $5.00



No. R-130

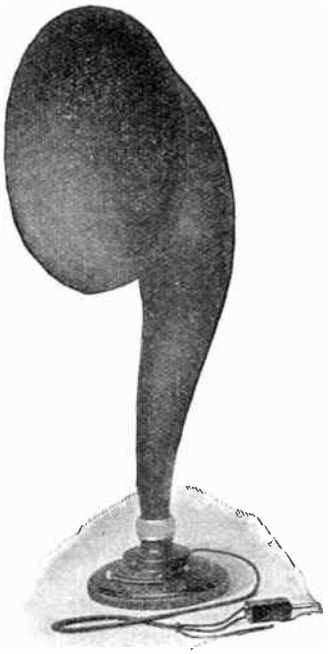
SUPER-FINE KITS

The All-American Super-Fine Kit is composed of the following special parts for building a Super-Hetrodyne Set: 3 R-110 Long Wave Transformers; 1 R-120 Radio Frequency Filter; 1 R-130 Radio Frequency Coupler; 1 Instruction Booklet.

	Price, Each
Super-Fine Kit	$26.00
Alamax Jr., 1-tube Reflex Kit	22.00
Alamax Sr., 3-tube Reflex Kit	42.00

RADIOLA LOUD SPEAKER

MODEL UZ-1325



No. UZ-1325

As a result of extended research and study of the science of reproducing voice and music by the great laboratories at its disposal, the Radio Corporation of America offers the Radiola Loud Speaker, which provides a greater acoustical range than any type heretofore produced.

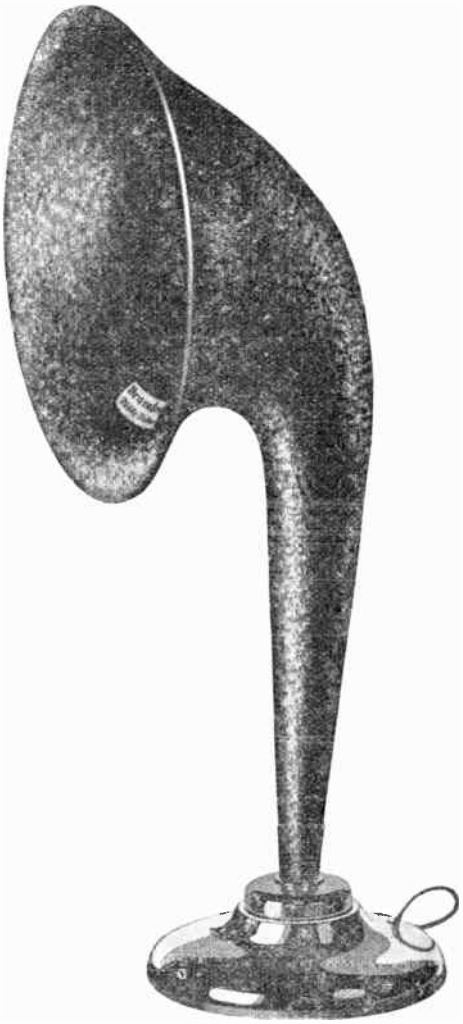
An analytical investigation of the undesirable characteristics of former types brought to light many important discoveries. It was determined that the size of the diaphragm, the area of the air chamber at either side of the diaphragm, the shape of the horn and the material of which it is made, all had to be scientifically co-ordinated to achieve that high quality of reproduction which the Radiola Loud Speaker now embodies.

Unusually intelligible speech reproduction, faithful translation of the higher and lower notes of the musical scale and the recreation of the complex tonal vibrations of the orchestra or the band are the outstanding features of this new device. It is a scientific achievement and an artistic revelation, giving forth the renditions of the artists in all their true beauty just as they are given in the broadcasting studio.

All of the Radiolas put out by the Radio Corporation were designed specifically to fit the operating characteristics of this new loud speaker, thus giving more pleasing translation of broadcasted entertainment than anything heretofore produced.

No. UZ-1325—Radiola Loud Speaker, complete with cord and plug.....Price, each, $25.00

BRANDES TABLE-TALKER



BRANDES TABLE TALKER

The Table Talker was designed by the makers of the famous Brandes Matched Tone Headsets, after two years of research into the development of a high quality loud speaker device to entertain a group of people in the average-sized room and to sell at a reasonable price.

The mellow tones and full volume of the Table Talker are characteristic of the quality the manufacturer has built into it. The horn of the Table Talker is matched to the unit so that the air resistance produced by the horn will exactly balance the mechanical power of the diaphragm. This produces remarkable uniformity of tone, enabling the Table Talker to reproduce all instrumental music and the human voice with equal clarity, mellowness and reality.

The Table Talker is just 22 inches high. Small enough to be inconspicuous in a room, large enough to produce adequate tone to fill the largest room in the home. Finished in a good shade of neutral brown, it will harmonize beautifully with almost any decorative scheme, and its lines are pleasingly simple. A felt-padded base protects the furniture on which it is placed and no batteries are required for its operation. The Table Talker is simply plugged in to replace the head phones.

Brandes Table Talker complete with polarity-indicating cord. . Price, each, $10.00

MAGNAVOX RADIO REPRODUCER R-3

MAGNAVOX REPRODUCER R-3

This instrument recreates broadcast programs with all the marvelous quality of the famous Magnavox electro-dynamic reproducer, and with a minimum of current consumption.

The new Model R-3 Reproducer here shown can be operated at any point between .1 ampere and .6 ampere when supplied with 6 volts from the "A" battery. It can also be connected to a 3-volt battery of either dry cell or storage type—when current consumption averages ¼ ampere. For dry battery operation, connect four cells in series parallel to give 3 volts, thus connsuming ⅛ ampere from each cell.

Another valuable feature is the volume control, a simple switch that controls the volume of reproduction from very loud to very soft with a corresponding decrease in current consumption, thereby adapting the instrument to every possible place, time and condition.

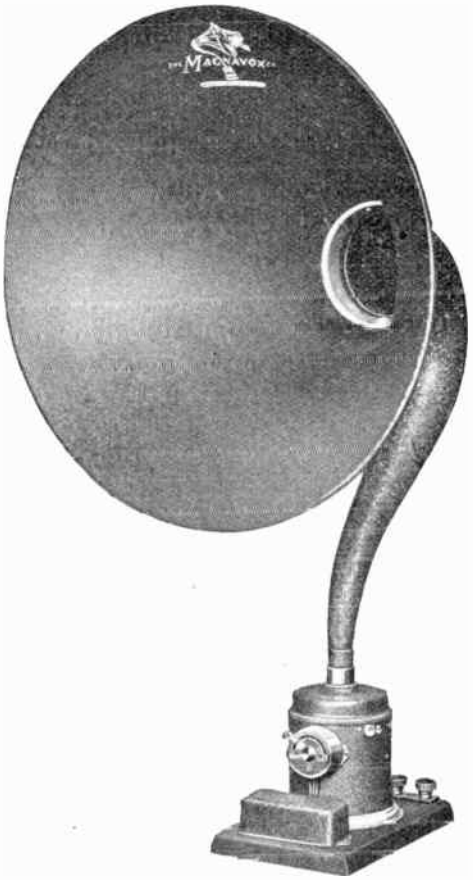
Magnavox R-3 can be used with all types of vacuum tube receiving sets. The control switch disconnects "A" battery when in off position. Entire instrument attractively finished in special crystallized enamel with satin gold plated fittings.

Constant progress in the interest, value and variety of radio programs makes it imperative to equip your receiving set with the most sensitive and accurate reproducer.

Magnavox instruments (the original radio reproducer) are designed on true scientific principles, and in their construction unusually high precision standards are observed.

No. R-3—Magnavox Reproducer.....Price, each, $35.00

MAGNAVOX RADIO REPRODUCER R-2



THE MOST PERFECT REPRODUCING APPARATUS EVER DESIGNED

Of great interest to all radio users are the improvements which make Magnavox Reproducer R-2 even more useful than ever—and consumption of current from "A" battery is so reduced that it is an unimportant factor.

Reduced current consumption. As the result of improvements in the magnetic circuit, R-2 Magnavox Radio Reproducer now operates with minimum current consumption.

Volume Control. A switch that affects the sensitivity and controls the volume of reproduction from very soft to very loud. This enables the Magnavox to be operated at any point between a minimum of .1 ampere and a maximum of .6 ampere, when supplied with 6 volts. Can be connected to a 3-volt battery of either dry cell or storage type. Average current consumption one quarter of an ampere.

Increased efficiency. The movable coil, the "heart of the Magnavox Reproducer," has been re-designed and the diaphragm constructed of thinner metal, considerably increasing the sensitivity of the instrument.

The popularity of the Type R Magnavox Radio Reproducers proves that the electro-dynamic principle is absolutely fundamental to the accurate reproduction of radio programs. The new R-2 Magnavox models embody this principle in its highest efficiency.

Magnavox Reproducer R-2 has been designed for those who desire the very utmost quality in the reproduction of broadcast programs over the widest range of operating conditions. This Magnavox model is recommended for all radio installations expected to give the fullest satisfaction.

No. R-2—Magnavox Reproducer with 18-inch horn, equipped with special switch to control the "A" battery circuit.....Price, each, $50.00

MAGNAVOX M-4

(NO BATTERY REQUIRED)

No. M-4

The Supreme Achievement of Magnavox Engineers Represented in a Reproducer of Truly Exquisite Tone Quality

The efficiency, the appearance and the price of this new instrument clearly reflect the research and production facilities of the Magnavox Company, largest builders of radio reproducing equipment in the world.

Its exquisite tone quality results from a further perfecting of the Magnavox semi-dynamic operating principle—magnetically balanced armature, improved diaphragm and extremely high resistance winding.

The use of this new principle enables this instrument to overcome all limitations common to loud speakers, and qualifies it as a Magnavox Reproducer, obviating the use of a battery for its operation.

This new semi-dynamic principle insures for dry battery receiving sets the utmost in reproduction, a result which has heretofore only been possible by the use of the electro-dynamic reproducers R-2 and R-3, which require for their operation a storage battery.

Beautifully finished in dark enamel with gold high lighting, the graceful appearance of M-4 suggests its use in the most dignified surroundings.

The amazingly low price of this Magnavox Reproducer establishes an absolutely new standard of value in the radio industry.

No. M-4—Magnavox Reproducer.....Price, each, $25.00

MAGNAVOX COMBINATION SETS

Another advance by Magnavox engineers is represented by Magnavox Radio Combination Sets. They incorporate the famous Magnavox electro-dynamic Reproducer in the same case with a Magnavox audio-frequency Power Amplifier.

This combination forms a highly desirable unit for addition to any radio receiving set, giving the user the utmost in appearance and adaptability incorporated in an instrument capable of a high degree of efficiency in audio-frequency amplification and sound reproduction.

The rheostats (maximum resistance 30 ohms) and circuits are so arranged in Magnavox Combination Sets that 5-watt transmitting tubes or any type of amplifying tube may be successfully used, thus covering the widest possible range of operating conditions, from the smallest home to the concert hall.

No. A-1-R

No.	Description	Price, Each
A-1-R	This new model consists of Magnavox Reproducer with 14-inch curvex horn and 1-stage Magnavox Power Amplifier, in new acoustic finish, as illustrated. Equipped with a modulator to control volume—a unique Magnavox feature	$59.00
A-2-R	This new model consists of Magnavox Reproducer with 14-inch curvex horn and 2-stage Magnavox Power Amplifier, in new acoustic finish, as illustrated. Equipped with modulator to control volume	85.00

No. A-1

MAGNAVOX ONE-STAGE AMPLIFIER

A new model to meet the demand for a 1-stage power amplifier. Special finish metal case, as illustrated. Connections efficiently provided for by Bakelite terminal board on back.

No. A-1—One-stage Power Amplifier...Price, each, $27.50

MAGNAVOX POWER AMPLIFIERS

MODEL "C"

No. AC-2-C

No. AC-3-C

These audio-frequency Power Amplifiers when used with a Magnavox Radio Reproducer will greatly enhance the value of any radio receiving installation. Their use is recommended wherever volume of reproduction is a requisite and when properly used give a maximum of volume without the addition of transformer or other objectional noises.

Magnavox Radio Power Amplifier shown here may be equipped with any standard make of amplifying vacuum tubes, such as Radiotron UV-201-A. Whatever type or make of tube is used should be operated at the plate and filament voltage values specified by the tube manufacturers. Voltage values are never dependent upon characteristics of Magnavox Amplifiers, but are dependent on the tube characteristics.

The "A" battery current used to supply filament of tubes in Magnavox Power Amplifiers may be supplied from the battery used for the receiving set tubes. The "B" battery voltage, however, should always be obtained from a separate block of batteries from that used on receiving set tubes.

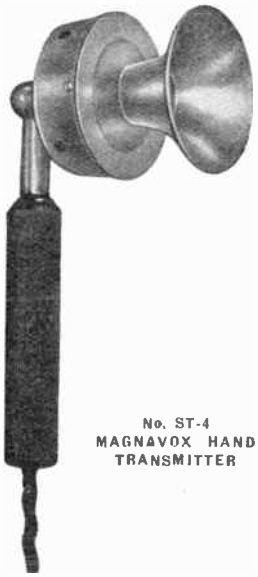
Magnavox Power Amplifiers offer the most ideal method for the amplification of audio-frequency waves before they are reproduced into sound. They are recommended for use with any vacuum tube receiving set for replacement of or in addition to the ordinary audio-frequency amplifier.

The ideal radio receiving installation would be any good tuner and detector unit equipped with a Magnavox Radio Power Amplifier and Reproducer. This Magnavox apparatus may be used in addition to 2 stages of ordinary audio-frequency amplification, but more than one is not recommended and a detector tube input is best. Type R-3 or R-2 reproducer may be used with either 2 or 3 stage power amplifier.

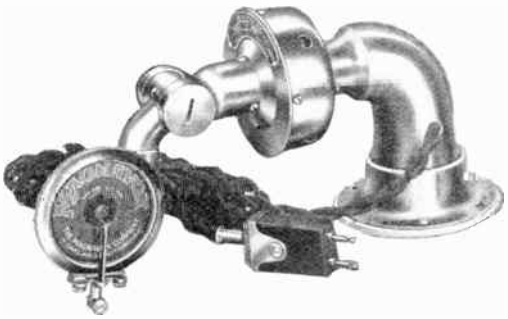
Magnavox Power Amplifiers are beautifully constructed, completely equipped with switches and rheostats. Tubes need not be burned in stages not in use. The cabinet is of polished hardwood, panel is heavy bakelite and all fittings are nickel plated.

No.	Description	Price, Each
AC-2-C	Standard Magnavox type 2-stage Power Amplifier with bakelite panel, in highly finished hardwood case	$50.00
AC-3-C	Standard Magnavox type 3-stage Power Amplifier with bakelite panel, in highly finished hardwood case	60.00

MAGNAVOX HAND TRANSMITTERS AND TONE ARMS



No. ST-4
MAGNAVOX HAND
TRANSMITTER



No. MT-4 MAGNAVOX TRANSMITTING TONE ARM

Magnavox Hand Transmitters ST-4 are ruggedly constructed, incorporating a four-button carbon microphone capable of modulating a large amount of current without impairing the efficiency of the transmitter; complete with cord and plug.

No. ST-4—Magnavox Hand Transmitter.....Price, each, $20.00

Magnavox Tone Arms No. MT-4 will fit and play records on any standard make of phonograph. These tone arms are equipped with a Magnavox microphone requiring for its operation from 4 to 8 volts.

The reproducing head is equipped with a large mica diaphragm and the tone arm comes complete with cord and plug.

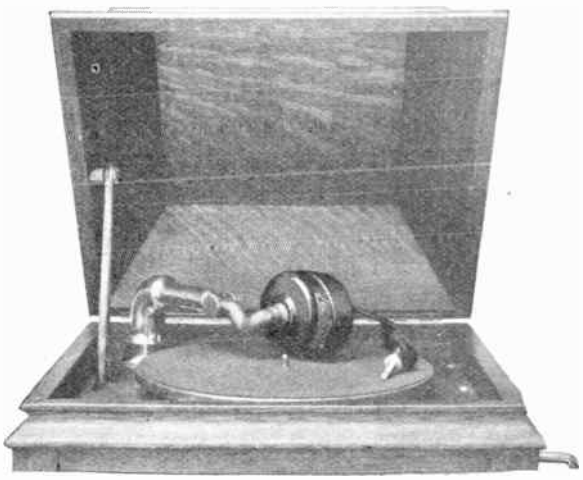
No.	Description	Price, Each
MT-4	Magnavox Transmitting Tone Arm	$30.00
SCT	Magnavox Pick-up Microphone	30.00

PHONOGRAPH ATTACHMENTS

Magnavox Phonograph Attachment PM-4. This new Magnavox phonograph attachment has the same dependable characteristics as the Magnavox M-4, but is designed especially to move a heavy column of air through the large horns with which phonographs are equipped. Everyone will understand the utter impracticability of connecting a small headset to such a large sound chamber and will therefore readily appreciate the ability of this new addition to the Magnavox line.

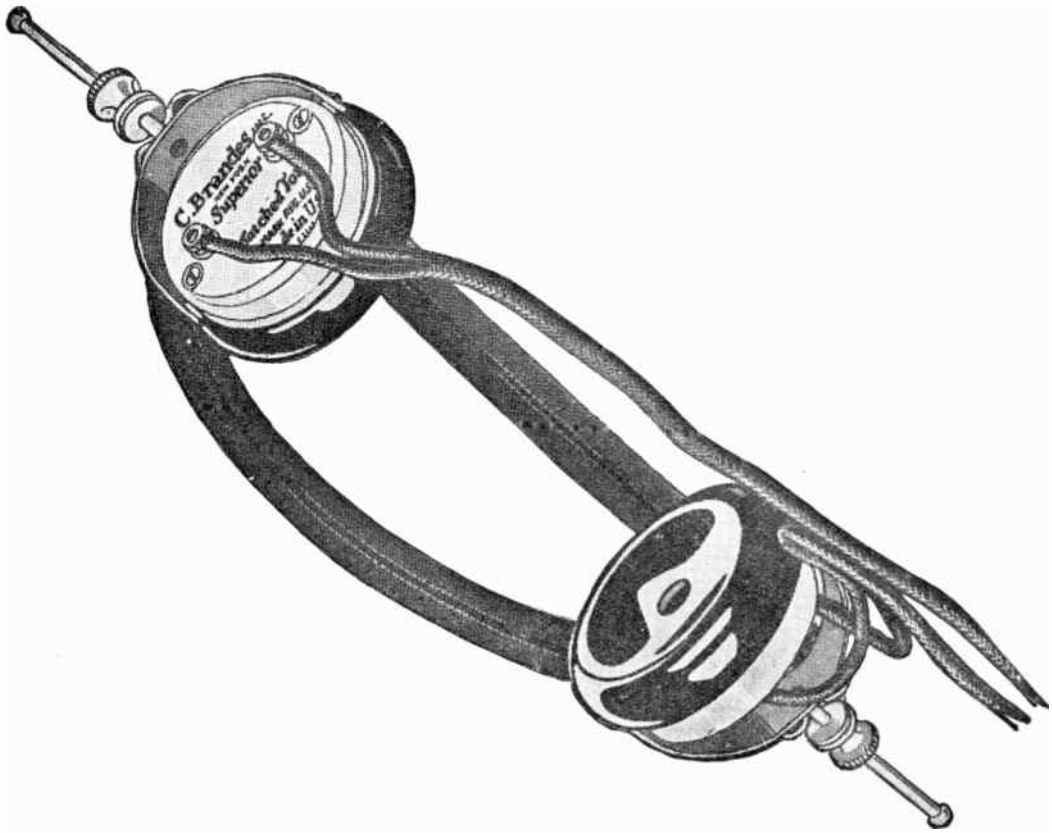
The PM-4 will be supplied with an attachment without extra cost to fit any standard make of phonograph, and orders should specify what type of adapter is wanted.

No. PM-4 Magnavox Phonograph Attachment.....Price, each, $15.00



No. PM-4

SUPERIOR MATCHED TONE HEADSET



No. R-1179

The Superior Matched Tone Headset has been a popular leader for years. More than a million of these comfortable headsets are in use by enthusiastic radio fans all over the world. It is included in the leading types of complete equipped receiving sets.

Brandes Superior Headset is matched in tone. This means that both ears hear the exact same sound at the same instant, and that reception is improved both as to distance and clarity. The "Featherweight" headband makes fitting to the head easy and comfortable.

The 6-foot "Nonoise" conducting cord has a red tracer interwoven into the lead, indicating a positive terminal for connection with the positive side of the plate circuit in the tube set.

All materials used in Brandes Matched Tone Headsets have been specially developed by C. Brandes, Inc., and the highest manufacturing ideals control the quality of the product.

No. R-1179—Brandes Superior Phones.....Price, each, $6.00

NAVY TYPE MATCHED TONE HEADSET

No. R-1180

The distinctive feature of Brandes Navy Type Matched Tone Headset is the third cord which leaves the receiver as a center cord, having been attached to the metal cup. It surrounds the other two cords from end to end, ending as a third terminal, longer than the others, to be connected to the (—) side of the "A" battery. This shield around the cord prevents radio-frequency currents from entering the cord and thereby eliminates cord capacity howls and similar detoning effects, allowing clear, pure and undisturbed reception.

The inside terminals of the Navy Type Headset make it very neat in appearance.

The tone of the two receivers is perfectly "matched," so that the user hears the same sound in both ears at the same instant. The clutch on the headband allows comfortable adjustment to the head.

No. R-1180—Brandes Navy Phones.....Price, each, $8.00

Due to enormous production the manufacturers of the Towers Scientific Headsets have found it possible to turn out a headset of good quality at a remarkable price. This headset is as sensitive as many now on the market at twice the price, and the quality of tone is very high. It is supplied with an adjustable headband which fits the head comfortably, and an excellent 5-foot black cord. The ear caps are made of a hard rubber composition and so shaped as to insure comfort. The shells are of polished aluminum and the entire headset weighs only 8 ounces; 20,000 turns of fine enameled wire are used, which gives an efficiency equal to average high grade 3,000-ohm phone. The magnets are very strong and will not lose their power.

These phones are guaranteed for five days in the hands of the user and in the event of damage factory will repair at a nominal charge.

Towers Scientific Headset.....Price, each, $2.95

CARTER IMPROVED PLUGS

The Carter "Tu-Way" Plug will fit any standard Radio Jack and take any kind of cord tips. Bare tinsel and wires can also be connected to the plug. The large knurled screw heads permit cord tips to be attached without tools. The wide screw slot permits screw to be tightened by screw driver or a coin.

No. 30

Price, Each

No. 30—Carter Tu-Way Plugs $1.00
No. 31—Carter One-Way Plugs ..... .50

WESTON RADIO PLUGS

Above all else, the Weston Radio Plug is simple. There is nothing that needs to be taken apart. No tools are required. Changing from loud speaker to earphones calls for only a pressure of the fingers and an instant of time. Contact is absolutely positive. The case is of moulded Bakelite. Every plug is individually tested, both mechanically and electrically, before it leaves the factory.

Weston Radio Plug ..... Price, each, $0.75

BARKALEW PLUGS

FOUR-PHONE PLUGS

FOR SETS WITH STANDARD JACKS

SERIES CONNECTED

With this Four-Phone Plug any number of headsets from one to four can be connected to any radio set employing standard telephone jacks.

The cord tips are held firmly in holes in the front by an improved spring grip which makes good contact with all standard tips.

There are no nuts or screws to tighten or to lose.

Whether two, three or four headsets are in use they are all connected in series.

No. 616

It is small, simple, of sturdy build and adds to the appearance of any set. The diameter of the insulating case is but 1¼ inches.

No. 616—Improved four-phone plug with insulated case, connects four phones or less in series to any radio set employing standard telephone jacks ..... Price, each, $1.00

FOUR-PHONE POSTS

WITH SPECIAL ADAPTER FOR RADIOLA III, III-A

SERIES CONNECTED

No. 624

Radiola III and III-A are made with jacks that take standard phone tips. This is convenient for a single headset but makes it difficult to attach more than one.

The prongs on this post fit the jacks through the holes in the face of the panel. Push it down until the housing rests on the panel.

It will take any number of headsets from one to four, and all in series.

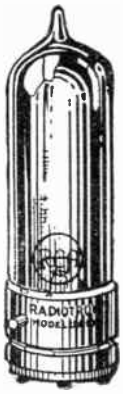
The cord tips are held firmly in holes in the front by an improved spring grip which makes good contact with all standard tips.

No. 624—Four-Phone Post ..... Price, each, $1.00

RADIOTRON VACUUM TUBES FOR RECEIVING

No. WD-11

No. WD-12



No. UV-199

RADIOTRON WD-11

This is a mighty useful and efficient vacuum tube, designed for operation entirely on dry cells. The filament, which should glow not brighter than a dull red, consumes just about a quarter ampere. This extremely low consumption makes possible filament operation on a single dry cell —a most important consideration where portability is desired, and where storage battery charging facilities are not available.

A single 22½ volt "B" battery unit will prove very satisfactory in the plate circuit, though potentials up to 80 volts may be employed.

Perhaps the strongest recommendation which can be made for Radiotron WD-11 is its absolute freedom from tube noises. It is also very stable in operation. The electrical characteristics are such that WD-11 will work very successfully with any audio frequency transformer.

No. WD-11—Radiotron Tube.....Price, each, $4.00

RADIOTRON WD-12

This tube has the same electrical characteristics as the Radiotron WD-11. The construction is also similar, with the exception of the base which is of the regular type, such as is used on Radiotron UV-200, and will fit in all standard tube sockets.

No. WD-12—Radiotron Tube.....Price, each, $4.00

RADIOTRON UV-199

The new Radiotron UV-199 is a high-vacuum tube designed for use as an amplifier or detector. It contains a new type of tungsten filament. These new tubes have much the same operating characteristics as Radiotron UV-201-A, but are less critical in adjustment.

The filament of Radiotron UV-199 is designed for operation from three No. 7111 dry cells in series. Smaller sized dry cells may be used, but are not so economical.

Since the filament current of this tube is only 60 milliamperes (.06 ampere), rheostats of 2 to 10 ohms ordinarily employed are not suitable for use with this tube. Therefore, when using three dry cells in series, a filament rheostat of at least 30 ohms should be employed,.

No. UV-199—Radiotron Tube .....Price, each, $4.00

RADIOTRON UV-200

Radiotron Vacuum Tube UV-200 is especially designed for detection. This tube is of the gas content type, extensive experience having clearly demonstrated that tubes of this class make the best detectors. The proper operation of the vacuum tube is obtained by a careful regulation of the plate and filament voltages. This is readily accomplished by the use of a tapped plate battery or a potentiometer or both on the plate, and the use of a rheostat on the filament. By the proper variation of these two factors the results obtained with this tube are far beyond any previously possible. Customary practice employs but one Vacuum Tube UV-200, in the receiving circuit. This tube acts solely in the capacity of a detector. Vacuum Tube UV-201-A being used for radio or audio frequency amplification.

No. UV-200—Radiotron Vacuum Tube...Price, each, $4.00

RADIOTRON DETECTOR VACUUM TUBE
No. UV-200

No. UV-201-A

RADIOTRON UV-201-A

Radiotron UV-201-A is a new and improved high vacuum tube suitable for detection, radio frequency amplification, and audio frequency amplification. It contains a new tungsten filament, the characteristics of which are long life, low power consumption, and low operating temperature; and it consumes only one-quarter of an ampere (0.25 ampere).

(1) The electron emission from the filament of this new tube averages about five times that of the ordinary amplifying tube and it, therefore, gives improved loud speaker operation.

(2) This tube is an excellent detector, although it does not equal the UV-200 for this purpose.

(3) As an audio frequency amplifier it delivers at least 50% more energy.

(4) The tube has a very high vacuum. This insures uniform characteristics and quiet operation.

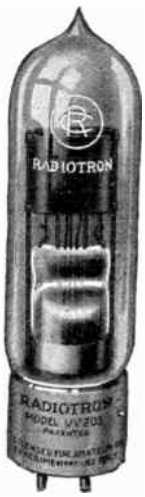
(5) In its operation as detector or amplifier in a radio receiving set the results are exceptionally independent of filament adjustment. Critical adjustments of grid leak and condenser are not required.

(6) It can be used in any equipment which at present uses the ordinary tube and give improved results.

No. UV-201-A—Radiotron Amplifier Vacuum Tube.....Price, each $4.00

RADIOTRON VACUUM TUBES FOR TRANSMISSION

Continuous wave telegraphy and telephony is now universally recognized as the best method of transmission. The difficulty of clear transmission through static and interference is greatly overcome by the use of this type of signal. Prior to the introduction of the vacuum tube, the generation of continuous waves was extremely difficult. The introduction on the market of the Vacuum Tube UV-202 has simplified and rendered possible this extremely valuable method of communication.



RADIOTRON POWER VACUUM TUBE No. UV-203

RADIOTRON VACUUM TUBE NO. UV-202

Radiotron Vacuum Tube UV-202 is similar in appearance to UV-201-A, but is slightly larger. It is designed for use in small continuous wave telegraph sets, self-rectifying sets, and telephone sets. Delivering an output of 5 watts, the combination of two or three of these tubes permits of reliable communication over distances up to 50 miles.

No. UV-202—Radiotron Vacuum Tube.....Price, each, $8.00

RADIOTRON VACUUM TUBE NO. UV-203

Radiotron Vacuum Tube UV-203 may be used for the same purposes as the smaller tube. Delivering as it does an output of 50 watts, communication, when using 2 or more of these tubes, may be carried on over distances as great as 1500 miles.

	Price, Each
No. UV-203—Radiotron Vacuum Tube.....	$30.00
No. UV-203-A—Radiotron Vacuum Tube.....	38.00

KENOTRON RECTIFYING TUBE, 20-WATT

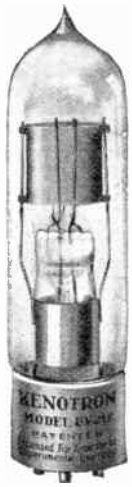
Kenotron UV-216 is primarily intended for use with the 5-watt power tubes, and is rated at 20 watts. The output energy is at a maximum for these tubes when the load is such that the D.C. voltage is between 350 and 400 volts. Using two tubes in a full wave rectification circuit the D.C. current and the 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.

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 UP-542.

The voltage of filament source is 10 volts; the filament terminal voltage, 7½ volts; the filament current, 2.35 amperes; the A.C. input voltage, 550 volts; the D.C. output, 20 watts at 350 volts D.C.

No. UV-216—Kenotron Rectifying Tube.....Price, each, $7.50



150-WATT KENOTRON TUBE No. UV-217

KENOTRON RECTIFYING TUBE, 150-WATT

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.

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.

Kenotron UV-217 is identical in appearance with Radiotron UV-203, and it may be used in the same type of socket, Model UP-541. There are, of course, no connections to the grid binding post of the socket.

Voltage of filament source, 12 volts; the filament terminal voltage, 10 volts; the filament current, 6½ amperes; the A.C. input voltage, 1250 volts; the D.C. output is 150 watts at 1000 volts D.C.

No. UV-217—Kenotron Rectifying Tube.....Price, each, $26.50

EVEREADY BATTERIES

No. 771

4½ VOLT "C" BATTERIES

This Eveready "C" battery contains three large radio cells giving 4½ volts. Three Fahnestock spring clip connectors give 1½, 3 or 4½ volts.

The use of a "C" battery prolongs the life of the "B" battery and improves the quality of sound reproduction. This battery may also be used as an "A" or a "B" battery under certain conditions which are explained on the label.

Length, 4 inches; width, 1⅜ inches; height, 3 inches; weight, 14 ounces.

No. 771—"C" Battery ..... Price, each, $0.60

22½-VOLT (SMALL) "B" BATTERIES

Designed and recommended for use in Radiola Regenoflex and Radiola X, also portable sets. Length, 4 1/16 inches; width, 2 9/16 inches; height, 2¾ inches; weight, 1 pound, 9 ounces.

No.	Description	Price, Each
768	Small Size "B" Battery	$1.90
763	Small Size (Fahnestock Connectors)	1.50

No. 768

No. 764

22½-VOLT MEDIUM—VERTICAL "B" BATTERIES

This vertical-type 22½-volt "B" Battery occupies practically the same small table space as the No. 763, but because of its larger cells, it has over twice the service capacity. It gives much more economical service than the small battery, and is especially suited for use in portable sets where floor space is limited. Will supply current to as many as three tubes operating at not more than 45 volts without being overloaded. Provided with two Fahnestock spring clip terminals, located accessibly on top, making battery installation in small spaces extremely easy.

Length, 3¼ inches; width, 2¾ inches; height, 5⅝ inches; weight, 2½ pounds.

No. 764—Medium Size, Vertical ..... Price, each, $1.75

22½-VOLT LARGE—HORIZONTAL "B" BATTERIES

Because of its larger cells, this is the most economical form of the 22½-volt battery. It is equipped with six Fahnestock spring clip connectors, giving variable voltage from 16½ volts to 22½ volts in 1½-volt steps, making this the ideal "B" battery for receiving sets using a soft detector tube, such as UV-200 or C-300. Two or more of these 22½-volt No. 766 "B" batteries connected in series will provide higher voltages as required.

Length, 6¾ inches; width, 4⅛ inches; height, 3 3/16 inches; weight, 5 pounds.

No. 766—Large Size, Horizontal ..... Price, each, $2.00

No. 766

EVEREADY BATTERIES—CONTINUED

45-VOLT LARGE—HORIZONTAL "B" BATTERIES

This battery has twice the number of the same large-size cells as those in the large 22½-volt "B" battery No. 766. Seven Fahnestock spring clip connectors make current available at 16½, 18, 19½, 21, 22½ and 45 volts. Recommended for use with sets requiring 45 or 90 volts. The variable taps make it also suitable for use with such sets employing a UV-200 or C-300 detector. This battery can furnish current to as many as three tubes operating at 90 volts without a "C" battery or four tubes at 90 volts with a "C" battery without being overloaded.

Length, 8 inches; width, 6¾ inches; height, 3 1/16 inches; weight, 8 pounds, 11 ounces.

No. 767—Large, Horizontal.....Price, each, $3.75

No. 767

45-VOLT LARGE—VERTICAL "B" BATTERIES

No. 772

In number and size of cells, this vertical battery is the same as the 45-volt "B" battery No. 767, but is arranged to stand on end, thus making it more suitable for use where table space is limited, and in cabinets of self-contained receiving sets. This battery is recommended for the Radiola Super-Heterodyne receiver and fits in its cabinet perfectly. Three Fahnestock spring clip connectors provide voltages of 22½ and 45 volts, making this battery especially suitable for receiving sets which do not require a tapped "B" battery.

Length 8 3/16 inches; width, 3¼ inches; height, 7⅛ inches; weight, 9 pounds.

No. 772—Large, Vertical.....Price, each, $3.75

45-VOLT EXTRA LARGE—VERTICAL "B" BATTERIES

This heavy duty "B" battery contains extra large radio cells making it especially suitable for use on heavy current sets and power amplifiers which impose serious overloads on "B" batteries made of smaller cells. Intended for use on multi-tube sets having 4 tubes operating at 90 or more volts without a "C" battery, and on practically all sets with five or more tubes using 90 volts or over, with or without a "C" battery. When used with such heavy current sets or with power amplifiers, this heavy duty "B" battery will greatly outlast and give much more economical service than "B" batteries made of smaller cells. Provided with three Fahnestock spring clip connectors giving voltage of 22½ and 45 volts.

Length 8 3/16 inches; width, 4 7/16 inches; height, 7 3/16 inches; weight, 13¾ pounds.

No. 770—Extra Heavy Duty.....Price, each, $4.75

No. 770

EXIDE BATTERIES

FOR RADIO SERVICE

No. 3-LXL-9-1

Every enthusiastic radio fan is continually striving for better results from his receiving set.

In accomplishing this purpose, an increasing number are discovering the important effect that storage batteries have upon their tubes.

The full power, constant voltage and pleasing absence of noise that feature the use of storage batteries, permits him not only to reach out after the distant stations but to hold them and bring in their programs with surprising clearness.

Among the Exide Radio Batteries described herein he will find the one that is best suited to the particular type of tube he is using.

The fact that it is designed and built by the world's largest manufacturers of storage batteries for every purpose is assurance that it will operate his tubes at maximum efficiency.

The 6-volt Exide Radio "A" Battery is basically the same fine product that received such a warm reception from fans in the past. The plates and separators are the same. It is full of the same power and dependability that established its good name from the very start. But it has been refined.

It has a new composition case which has the appearance of fine leather. The case, with its compartments and handles, is moulded in a solid block. The cell covers are sealed with a heavy application of sealing compound, rendering the battery entirely leak-proof.

The connectors and terminals have been lowered and the terminals and terminal nuts equipped with square threads, practically eliminating the possibility of their being stripped. The terminal nuts are of the same composition that is used in the case. Filling plugs may be removed or fastened in position by a quarter turn to the left or right.

This 6-volt Exide Radio "A" Battery comes in five sizes to meet all requirements—50, 75, 100, 125, 150 ampere-hours capacity.

A large attachable handle is furnished with every 6-volt Exide Radio "A" Battery to be used in transporting it from one place to another.

DESCRIPTION OF EXIDE 6-VOLT BATTERIES

No.	Length	Weight	Capacity	Price, Each
3-LXL- 5-1	6½"	24½ lbs.	50 a. h.	$18.24
3-LXL- 7-1	8 3/16"	33½ lbs.	75 a. h.	21.10
3-LXL- 9-1	9⅞"	42½ lbs.	100 a. h.	23.88
3-LXL-11-1	11 9/16"	51 lbs.	125 a. h.	27.60
3-LXL-13-1	13¼"	59½ lbs.	150 a. h.	31.20

Height of all 3-LXL Batteries, 9 inches. Width of all 3-LXL Batteries, 6 3/4 inches.

EXIDE LOW VOLTAGE BATTERIES

No. 1-KZR-5

This battery known as Type 1-KZR-5, consists of a single, hard rubber cell containing five sturdy plates, well insulated from each other by separators of the best quality of wood and perforated rubber. Because of the thickness of these plates, a steady, even flow of current is delivered to the tube filament, and the full rated capacity of the battery (24 amp. hrs.) is assured.

Inasmuch as the average 1.1 to 1.5-volt tube consumes but ¼ ampere this battery will heat the filament for approximately 96 hours on one charge.

The cover of this cell has a double flange which fits snugly over the top edges of the case and a thorough application of sealing compound renders the joint absolutely leak proof. Soft rubber gaskets, compressed by sealing nuts, prevent leakage where the terminals extend through the case.

A plus and a minus sign, moulded in the rubber case, clearly indicate the positive and negative terminals, both in this battery and the others described on this page.

DESCRIPTION

No.	Length	Width	Height	Weight	Chg. Rate	Capacity	Price, Each
1-KZR-5	4½"	2 5/16"	6 13/16"	5 lbs.	2 amp.	24 a. h.	$6.72

No. 2-KZR-3

The tubes for which this battery was designed, operate on 3 to 3.6 volts and consume but .06 ampere.

Consequently, though the rated capacity is only 12 ampere hours, this battery (Type 2-KZR-3) will heat the tube filament for approximately 200 hours on one charge.

Its plates are of the same size and thickness as those of the 1.1-volt battery. But instead of one cell with five plates, this battery has two cells each containing three plates. Yet withal, it is only 5/32-inch wider overall.

Filler plugs in both batteries are removed for the addition of water or for testing, by a quarter-turn to the left; a similar quarter-turn to the right secures them in place.

Brass wing nuts and bolts, heavily coated with lead, are fitted to the terminals of both batteries, making it but an instant's work to hook them to the set.

DESCRIPTION

No.	Length	Width	Height	Weight	Chg. Rate	Capacity	Price, Each
2-KZR-3	4½"	2 15/32"	6 13/16"	6 lbs.	1 amp.	12 a. h.	$9.12

EXIDE STORAGE "B" BATTERIES

Type 12-RB-2 Exide "B" Battery was produced to meet the demand for a storage "B" battery that would give the necessary high voltage, be absolutely quiet and dependable in use and still be small enough to fit in the usual space provided for "B" batteries. The same high class construction is followed throughout in Exide "B" batteries as in Exide "A" batteries.

The novel feature of this battery is the manner in which it is prepared for shipment. Though filled and charged at the factory, the electrolyte is poured off before shipment, and the battery reaches the customer practically dry. All that the user need do is fill the cells with distilled water and it is ready for service.

With each battery a specially designed syringe is furnished for filling the cells with distilled water and for testing the height of the water in these cells.

Rated at 4,000 milliampere hours and occupying only a small amount of space, this battery is ideal for sets where space is limited.

The case of this battery with its 12 compartments is moulded in a solid block. Each cell has a soft rubber cover which is sealed with a heavy coating of sealing paint.

The terminal posts are equipped with non-corrosive alloy wing nuts.

No. 12-RB-2

No. 12-LR-2

"B" BATTERY VISIBILITY

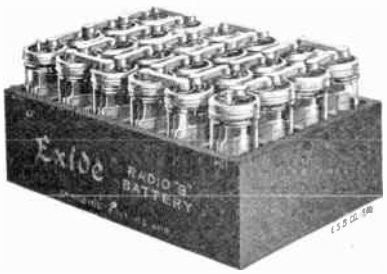
With the increase in popularity of the 3- 5- and 9-tube sets has come a demand for a "B" battery of greater capacity.

The makers of Exide have done more than meet this demand. They have made a "B" battery of 6,000 milliampere-hours capacity which can be obtained either in 24- or 48-volt units. As a matter of fact, it is so designed that by adding or subtracting the individual units the voltage may be adjusted to any desired point.

Surroundod by a wood case thoroughly coated with acid-resisting paint, the thick glass jars which house the elements are safe from breakage under any normal condition.

Visibility of the electrolyte, plates and separators is, of course, a valuable feature of this new member of the Exide line.

Regardless of your "B" battery needs, you are sure to find complete satisfaction in the selection of the proper Exide Radio "B" Battery.



No. 24-LR-2

DESCRIPTION

No.	Height	Length	Width	Capacity	Price, Each
12-RB-2	4¼″	12 3/32″	2 7/16″	4,000 m.a.h	$12.48
12-LR-2	7¼″	9 7/16″	7″	6,000 m.a.h	14.66
24-LR-2	7¼″	13 13/16″	9 3/16″	6,000 m.a.h	28.50

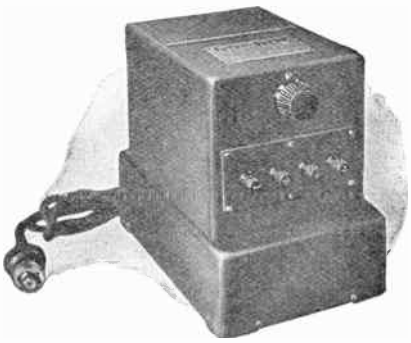
Rectifier

EXIDE RECTIFIERS

TO CHARGE "B" BATTERIES

Exide Rectifier.....Price, each, $2.80

DUBILIER SUPER-DUCON



The current you need for your radio set has always been right there in your electric house wires—but there has never been a safe, efficient, economical way of getting out just the right amount for radio use.

Now the Super-Ducon takes out just the voltages you need—delivers them to your set in a steady flow. Just attach the Super-Ducon instead of batteries—plug it into any socket—and listen in. The reception is better, the cost is lower, and the current supply is always there—always ready—always steady.

No Changes Whatsoever Needed

The Super-Ducon fits any radio set, of any circuit. It requires no change whatsoever in the set—is merely attached where you formerly attached the "B" batteries.

	Price, Each
No. 800—A. C. type; operates on 110 volts, 60 cycles	$47.50
No. 801—D. C. type, 110 volts	30.00

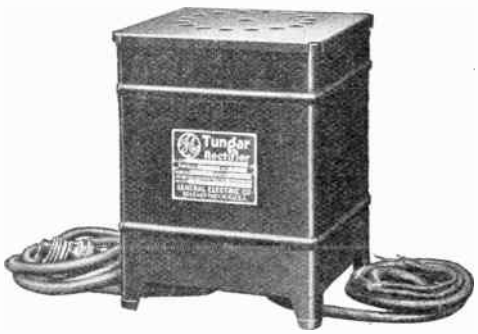
RADIO HYDROMETERS

These Radio Hydrometers are durably constructed of the best available material for hydrometer uses. Unlike the ordinary types they can be used for testing storage "B" batteries as well as the large batteries.

Radio Hydrometers.....$0.75

G-E TUNGAR RECTIFIERS

FOR BATTERY CHARGING



When a source of alternating current is available, the simplest and least troublesome device for battery-charging is the Tungar Rectifier.

The Cat. No. 195529 Two Ampere Tungar has a capacity of 15 watts and will charge a 3-cell storage battery at two Amperes or a 6-cell storage battery at one Amperes.

The Cat. No. 219865 Five Ampere Tungar has a capacity of 45 Watts and will charge a 3-cell storage battery at five Amperes or a 6-cell, or two 3-cell, batteries at three Amperes.

Both types are for use on 110 volts, 60-cycle alternating current. They cannot be used on direct current.

No.	Description	Price, Each F. O. B. Factory	F. O. B. Denver
195529	2-Ampere Tungar Rectifier	$18.00	$18.75
219865	5-Ampere Tungar Rectifier	28.00	28.75
	The prices on the above Tungar Rectifiers include one bulb.		
195528	Renewal Bulb, D. C. Amps. 2, D. C. Volts 15		$4.00
189048	Renewal Bulb, D. C. Amps. 5, D. C. Volts 15		8.00

STORAGE "B" BATTERY CHARGING ATTACHMENTS

Our "B" battery charging attachment has been designed for use with any of the 2 or 5 ampere Tungar rectifiers. With this attachment a standard Tungar can be used to charge a 20-24 cell storage "B" battery at approximately .1 ampere charging rate, or 10-12 cells at approximately .2 amperes.

This device consists of a small resistance unit of approximately 100 ohms mounted in a metal casing which is so constructed that it can be readily attached to the side of the Tungar. Connection is made by means of two leads which are equipped with spring clips. The short lead goes to the 115-volt primary terminal on the Tungar and the long lead to the positive terminal of the "B" battery. The negative terminal of the battery is connected to the regular negative lead of the Tungar.

	Price, Each
No. 248237	$3.00
No. 260013 "A" or Filament Battery Charging Adapter	1.25

EVEREADY "A" BATTERIES

No. 7111

Dry Batteries for radio service present the most perplexing problem ever encountered by experts in dry battery fabrication. They must not only have very long shelf life but must stand up under hours of continual drain at their maximum capacity. They must furnish a very steady current, or the set in which they are used will be noisy. These requirements have been studied for several years by the engineers of The National Carbon Company, and the results of their research are embodied in the Eveready Radio "A" Battery.

This battery will give more service when used for radio purpose than any other type. For greatest satisfaction they should be used as shown below.

Type Tube	No. Cells per Tube	Connection
WD-11	2	Parallel
WD-12	2	Parallel
C-11	2	Parallel
C-12	2	Parallel
UV-199 } C-299 }	3	Series
UV-201-A } C-301-A }	8	Parallel Series

Maximum service can be expected only when used as above.

Dry batteries are the most economical source of supply for UV-199, WD-11 or WD-12 and can be used for 6-volt tubes of the "A" type.

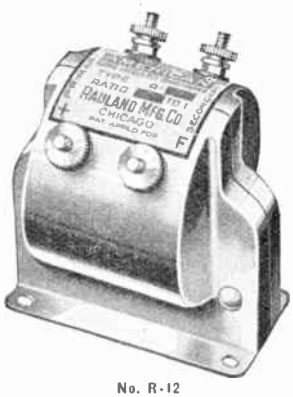
No. 7111—Eveready Radio "A" Battery.....Price, each, $0.50 F. O. B. Denver

NO. 6 COLUMBIA IGNITORS

Occasionally a dry cell is required which will serve any place where dry cells are used such as in radio receivers, for door bells, gas engine ignition or portable lamps. The cell admirably adapted for this purpose is the Columbia No. 6 Ignitor. These cells are the best all purpose batteries available though they are not as economical or satisfactory for radio service as the No. 7111.

No. 6—Columbia Ignitor .....Price, each, $0.50

No. 6



No. R-12

"ALL-AMERICAN" TRANSFORMERS

AUDIO FREQUENCY

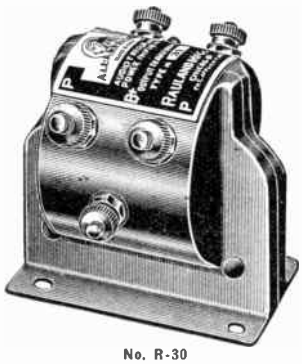
"All American" Amplifying Transformers are designed to give a maximum volume with clear, pure, and distortionless tone. Being quiet in operation and free from extraneous noises, music and speech from distant broadcasting stations can be reproduced through good loud speakers with wonderful exactness.

No.	Ratio	Price, Each
R-12	3 to 1	$4.50
R-21	5 to 1	4.75
R-13	10 to 1	4.75
R-500—Lyric Transformer		9.00

PUSH PULL TRANSFORMERS

The addition of power amplification to the ordinary amplifier solves the problem of faithfully reproducing broadcast programs with greater volume. You will surely be delighted with the purity and richness of tone that this form of amplification develops in any good loud speaker. After extensive research work "All-American" laboratories have designed and perfected power transformers especially adapted for the well known "Push Pull" form of amplification.

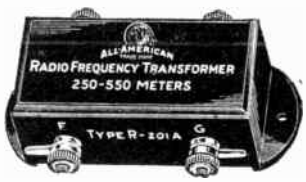
No.	Description	Price, Each
R-30	Input Transformer	$6.00
R-31	Output Transformer	6.00



No. R-30

"ALL-AMERICAN" SELF-TUNED RADIO-FREQUENCY TRANSFORMERS

SHORT WAVE



No. R-201-A

Assuming the availability of the proper transformer, amplification of radiocast reception at radio frequencies should be accomplished with the same simple circuit used in audio amplification, and with the same simplicity and reliability. For, given a transformer which will amplify frequencies from 550,000 to 1,350,000 per second as readily as a good audio transformer handles alternations one thousand times slower, there is no need of any resonance tuning of the amplifier. and consequently the bogie of internal tube capacity is conquered.

This problem of design has been solved in the construction of the Self-Tuned All-Americans. An important development is the abandonment of what has usually been regarded as a necessary feature in transformers—the ability to function with various types of vacuum tubes. Since almost all amplifiers now use tubes of either the 199 or 201-A types, All-American has now adopted a policy of building a transformer to suit exactly each of these two types of tubes. The result is a uniformity in the amplification characteristic which has never before been attained in a short wave transformer. Each of the two instruments work at high efficiency at any radio frequency from 250 to 550 meters (1200 to 545 kilocycles).

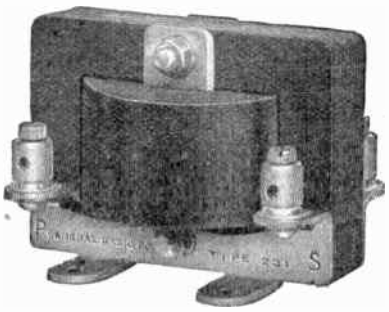
No.	Price, Each
R-199—Self-Tuned Radio Frequency Transformer	$5.00
R-201-A—Self-Tuned Radio Frequency Transformer	5.00
R-140—Universal Radio Frequency Coupler	4.00

GENERAL RADIO AMPLIFYING TRANSFORMERS

The Amplifying Transformer illustrated has been designed with a view toward best suiting the new type vacuum tubes. The amount of iron in the core is sufficient to handle the primary current and to deliver the energy undistorted in wave form to the secondary and the grid of the amplifying tube. The core construction is such that the magnetic leakage is low, obviating the difficulties sometimes introduced by the stray fields set up, with resultant "howling" of the amplifier. The secondary winding is made with a low distributed capacity, permitting the maximum potential being applied to the grid of the tube. The following constants are given for the primary and secondary windings:

	Resistance D. C.	A. C. at 1,000 cycles	Impedence 1,000 cycles
Primary	1,100 ohms	11,100 ohms	66,000 ohms
Secondary	5,500 ohms	130,000 ohms	700,000 ohms

No. 231-A—Amplifying Transformer.....Price, each, $5.00



No. 231-A

No. 271

GENERAL RADIO MEDIUM FREQUENCY TRANSFORMERS

The Type 271 Medium Frequency Transformer is designed for the amplification of wave length in order of 30 K.C. (10,000 meter), such as are used for transoceanic communication and in super-heterodyne circuits.

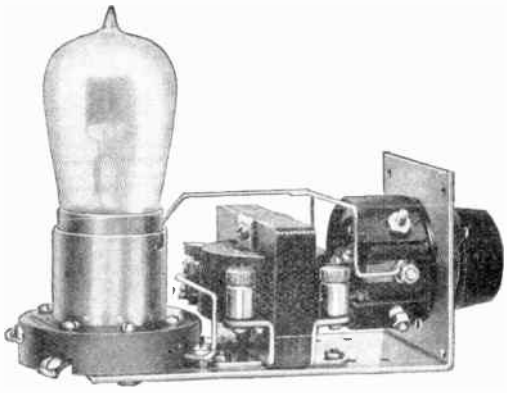
No. 271—Medium Frequency Transformer.....Price, each, $5.00

AMPLIFIER UNITS

Simplicity in an amplifying unit is just as essential as in any other part of a radio receiver. The experienced radio man now recognizes that best results are obtained consistently by the correct use of properly designed instruments, rather than resorting to complex, and often unreliable, circuits.

With this idea of simplicity we have developed a convenient and efficient audio frequency amplifier unit. This unit is self-contained except for the batteries and receivers. It is ready for connection to your detector set, and it may be used with crystal or tube detector with equal efficiency.

This unit is so arranged that it may be used on a table or mounted behind a panel. When mounted behind a panel, only the rheostat knob is visible in front of the panel. Convenient mounting holes are provided for either panel or table installation.



No. 300-D

For persons building their own sets, these units are very convenient because of the panel mounting feature. As the bracket is self-supporting, it is only necessary to screw the unit to the panel. Two or more of these units may be used to obtain multi-stage amplification.

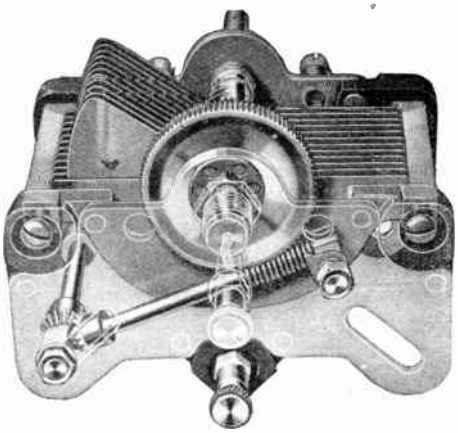
The parts used in this unit are standard instruments, a detailed description of which will be found in the following pages of this catalogue. All necessary wiring has been provided. The mounting bracket is of heavy brass with a white nickel finish. With each unit there is supplied a sheet showing a wiring diagram and giving operating instructions.

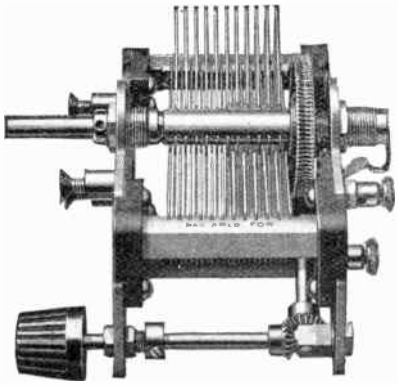
This unit is made up in two models, 300-D for the standard base tubes, such as UV-201-A, and 300-C for the UV-199 tubes. The only difference is in the socket. Both of these tubes may be operated from dry cells.

No.	Description	Price, Each
300-C	Amplifier Unit for UV-199 Tubes. Dimensions, 6½x2½x2¾ inches. Weight, 1½ lbs.	$7.75
300-D	Amplifier Unit for Standard Base Tubes. Dimensions, 6½x2½x2¾ inches. Weight, 1½ lbs.	8.00

AMERICAN BRAND VARIABLE CONDENSERS

As a special feature, this condenser has a hundred to one worm drive ratio geared vernier adjustment. This allows a micrometer adjustment of the entire set of movable plates. This is the highest ratio gear adjustment so far known to be used on variable condensers with this adjustment the plates may be moved so slowly that the motion is hardly noticed by the eye. This is especially important for the radio fan who is seeking distant stations.





The construction of the geared arrangement is an excellent mechanical job. It cannot get out of order and keeps the plates from moving at their own free will, when mounted on the panel. The dial adjustment for all of the plates, however, may be moved in a coarse manner when tuning rapidly over the condenser scale. This worm drive vernier adjuster is provided with an extra black knob which will come out to the front of the panel. The back panel of this condenser is adapted for the mounting of any coil desired to use in a set.

The zero capacity of the 23 plate type of condenser is very low, and is in the neighborhood of 24 MMF at this setting. The figures shown below give some idea as to the capacity range of the 23 plate type of American Brand condenser. These figures were submitted by the Bureau of Standards, Washington, D. C., and are accurate to plus or minus 2 micro-microfarads.

Condenser Setting	Capacitance in Micro-Microfarads	Condenser Setting	Capacitance in Micro-Microfarads
5	38	60	306
10	61	70	355
20	112	80	403
30	161	90	449
40	209	95	473
50	257	100	491

The phase angle difference of this condenser is less than 20 inches and the insulation resistance is 6 ohms at approximately 1,000 cycles. This will give some idea as to the quality of this new type of condenser.

These condensers are furnished in the following sizes or capacities. When ordering please specify the capacity needed.

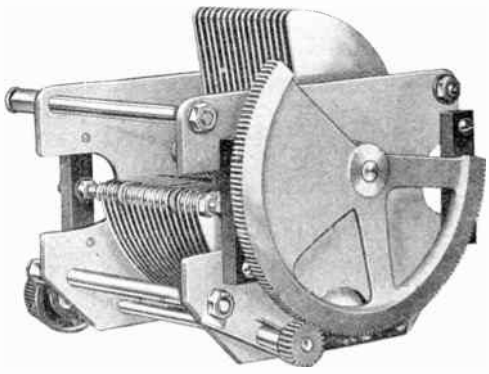
100 TO 1 WITH WORM DRIVE VERNIER

Description	Price, Each
13 plate .00024 mfd.	$4.60
17 plate .00035 mfd.	4.75
23 plate .0005 mfd.	5.00
44 plate .001 mfd.	6.00

WITHOUT THE WORM DRIVE VERNIER

Description	Price, Each
13 plate .00024 mfd.	$3.75
17 plate .00035 mfd.	3.85
23 plate .0005 mfd.	4.00
44 plate .001 mfd.	5.00

GENERAL RADIO VARIABLE CONDENSERS



TYPE 239-G

In order to have available a condenser which would meet the general laboratory requirements and the rigid requirements of carefully designed radio sets, General Radio has developed the rugged, low-loss condenser shown.

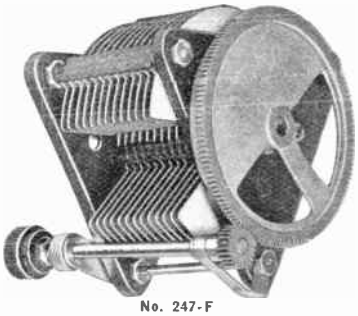
It has metal end plates, locked cone bearings and is rigidly supported. The only solid dielectric material used is in the form of supporting strips for the fixed plates. These strips are of carefully selected hard rubber, and are placed in a weak and uniform electrostatic field.

The rotary plates are grounded in order that capacity effects of the hand when adjusting the condenser may be reduced to a minimum. The plates are of heavy aluminum and are so shaped as to give a nearly uniform wavelength variation.

All types of this condenser are provided with a counter weight and when so desired, may be equipped with a slow-motion gear so that settings to a fraction of a division on the scale may be obtained with ease. This is a distinct advantage when tuning to continuous wave stations.

No.	Description	Price, Each
239-H	Condenser, Less Vernier (43-plate)	$10.00
239-G	Condenser, Less Vernier (43-plate)	13.50

VARIABLE AIR CONDENSERS



No. 247-F

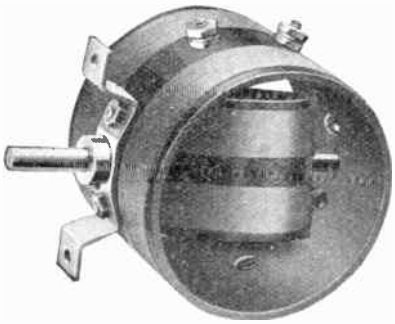
Experimental radio receiving sets require condensers whose quality is high and whose price is reasonable. It is easy to manufacture low-priced condensers, as is evidenced by the large number now available. It is more difficult, however, to construct a condenser which is electrically and mechanically good, and yet at the same time to keep the cost of construction low.

The value of a good condenser in a receiving set is not always fully appreciated. The dielectric losses of the condenser are equivalent to adding a series resistance in the oscillating circuit. To add a series resistance in the oscillating circuit means loss of energy, which, in turn, means broad tuning and diminished signal strength. It is thus important that the dielectric losses in condensers be kept low. In this condenser these losses are kept low by using a high-grade hard rubber for the solid dielectric. They are further kept low by using only a small quantity of this dielectric and so placing it with respect to the electrostatic field that the dielectric hysteresis losses are kept to a minimum.

This is just one of the points which have received careful attention in the design of this condenser. It has brass plates soldered together. The end pieces are of pure hard rubber and counter balance is provided for rotor which may be replaced by vernier gear.

No.	Description	Price, Each
247-F	500 MMF, unmounted, without gear; dimensions, 4x4x4⅛ inches; weight 1 pound	$3.25
247-G	500 MMF, mounted, with gear; dimensions, 5x5x5⅛ inches; weight, 2 lbs.	7.25
247-H	500 MMF, unmounted, with gear; dimensions, 4x4x4⅛ inches; weight, 1⅛ lbs.	5.00
247-K	250 MMF, unmounted, without gear; dimensions 4x4x4 inches, weight, ⅞ lbs.	3.00
247-M	250 MMF, unmounted, with gear; dimensions, 4x4x4 inches; weight, ⅞ lb.	4.75
	Knob and dial, without capacity graduations, and indicator button for use with unmounted condenser	.50
	Gear, pinion, pinion shaft and mounting supports, per set	1.75

GENERAL RADIO VARIO-COUPLERS



No. 268

Broadcast reception is nearly all included by the wavelength band of 150 to 600 meters. The circuits designed for this class of reception nearly all require an efficient, compact vario coupler. Such an instrument is available in the Type 268.

Both the rotor and the stator forms are of moulded bakelite and are cylindrical in shape. A wide separation is provided between the rotor and the stator in order to permit the extremely loose coupling so often required. The windings are of green silk covered wire which, with the polished bakelite forms, gives the vario coupler an unusually attractive appearance. The metal parts are finished in nickel.

It was formerly considered good practice to have a large number of taps in vario coupler primaries. In many recent receiving sets taps have been omitted entirely. With the condensers and circuits now in general use taps on a vario coupler are really of little importance. There are times, particularly in controlling regeneration, when a single center tap is an advantage. Thus to make this vario coupler efficient, yet simple in operation, a single center tap has been brought out on the stator.

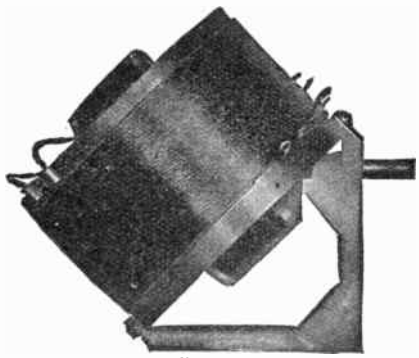
	Price, Each
No. 268—General Radio Coupler	$3.50
No. 269—Variometer	5.00

FADA VARIO-COUPLERS

The Vario Coupler is one of the most used pieces of radio tuning apparatus. Together with variable condensers it enables a multitude of receiver amplifier circuits to be used.

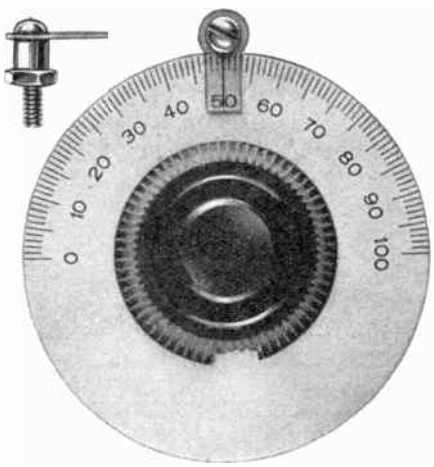
Fada Vario Couplers are as perfect as can be made. The stator winding of 82 turns of silk covered wire is on a genuine bakelite tube. It has 14 taps so that a turn by turn adjustment can be made. The wave length range of the stator winding allows the reception of all broadcasting stations between 200 and 600 meters wave length range.

The rotor turns through a full 180 degrees, doubling the efficiency of old type 90-degree vario-couplers. It is made of moulded black bakelite, a stop being moulded integral. Wound with 48 turns of silk-covered wire. Connections to rotary flexible and unbreakable. Special thrust adjustment and die-cast bracket provides long bearing for ¼-inch shaft. Overall dimensions, 5x4x4 inches.



No. 135-A

	Price, Each
No. 135-A—Vario-Coupler, 200-600 meters	$4.75



TYPE 310

DIAL AND INDICATOR

The Type 310 dial and indicator combination permits precise dial setting and is a great help in logging stations. The dial is of brass with a frosted silver finish and graduated scale in black. The knob is of bakelite. The indicator of transparent celluloid with fine line, is mounted by a nickel finished screw and nut.

	Price, Each
Type 310—2¾ in. Dial and Indicator	$0.50
Type 317—4 in. Dial and Indicator	1.50
Type 302—2¾ in. Vernier Dial, for ¼ in. Shaft	1.50
Type 303—4 in. Vernier Dial, furnished for ¼ in. Shaft	2.50

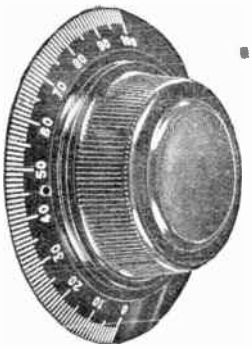
TUSKA KNOBS AND DIALS

Tuska Knobs and Dials are moulded in one piece. The appearance is striking, with finely engraved figures, and graduations filled with pure white.

No.	Diameter, Inches	Size of Shaft	Price, Each
210-1	3⅞	Flush, ¼ in. diam., with external set screw	$1.25
210-2	3⅞	Flush, $\frac{3}{16}$ in. diam., with external set screw	1.25
212-1	2⅞	Flush, ¼ in. diam., with external set screw	.85
212-2	2⅞	Flush, $\frac{3}{16}$ in. diam., with external set screw	.85

No. 210

NA-ALD DIALS



No. 3044

SUPER DE LUXE DIALS

4-INCH DIALS

A beautiful creation in which the graduations are scientifically determined so that it is possible to turn more quickly with ease and positiveness to a degree or fraction of a degree. The correct length and width of graduations, numerals on the bevel and the generous size of knob produce this result. Genuine bakelite, patented construction, with positive gripping set screw in brass bushing. Each dial in individual carton.

No. 3044—De Luxe Dial, ¼-inch shaft..... Price, each, $0.75

No. 3784

3⅞-INCH DIALS

Exceptional value in a genuine bakelite dial. Processed to give combined strength and permanent fast color and lustre. Brass bushed, trued with diamond, and hole reamed after moulding for perfect trueness, which applies to all Na-ald dials.

No. 3784—¼-inch Shaft..... Price, each, $0.50

No. 3004

3-INCH DIALS

Combines value and distinctive form in a three-inch dial with patented construction, brass bushing and large set screw. Permanent color enamel.

No. 3004—¼-inch Shaft..... Price, each, $0.35

No. 3024

2-INCH DIALS

Dial for rheostat and potentiometer use matching larger sizes. Graduations and numerals on bevel, so that fingers do not cover.

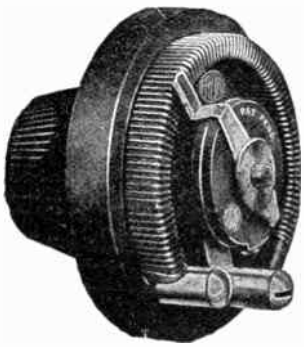
No. 3024—¼-inch Shaft..... Price, each, $0.35

FADA RHEOSTATS AND POTENTIOMETERS

No. 120-A

Fada rheostats allow operation of radio receivers at maximum efficiency. Their adjustment is free and smooth providing a precision variation of filament current affording most efficient detection or amplification.

Fada rheostat bases are made of molded insulation which will stand heat up to 600 degrees Fahrenheit. Base diameter is 2⅛ inches, with mounting holes for 6-32 screws, 1 inch center to center. Into a concentric groove in the base is inserted a hard fibre strip wound with resistance wire. The phosphor bronze contact lever passes over each individual turn of the resistance wire. Standard Fada knob is used which covers up the heads of the mounting screws. Pointer on the panel front is heavily nickel plated and buffed.



No. 150-A

Fada rheostats are made in several sizes for use with all standard vacuum tubes. Fada No. 151-A Vernier Attachment is a simple device which may take the place of the contact lever in Fada rheostats and provides a very smooth running precision vernier attachment. The attachment may be used to convert practically any rheostat having a 3/16-inch shaft into a vernier type.

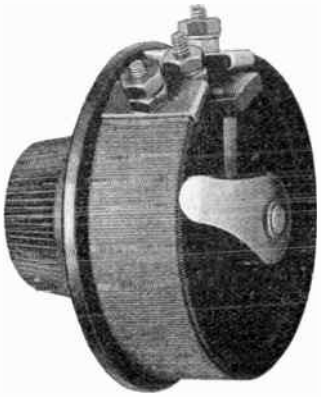
Fada Potentiometers are practically identical with Fada rheostats but are wound with many turns of a fine resistance wire to give a high resistance of 200 or 400 ohms. They are ideal controlling device for radio frequency amplifying, reflex circuits, etc.

No. 152-A

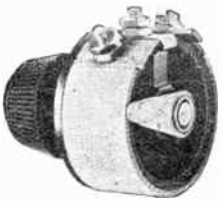
No.	Price, Each
120-A—Receiving Tube Rheostat	$0.75
121-A—Power Tube Rheostat	1.20
150-A—Vernier Rheostat	1.25
151-A—Vernier Attachment	.50
152-A—Potentiometer (200 ohm)	1.00
153-A—8-ohm Rheostat	1.00
154-A—Potentiometer (400 ohm)	1.00
155-A—8-ohm Vernier Rheostat	1.50
156-A—60-ohm Rheostat	1.00
157-A—30-ohm Rheostat	1.00

GENERAL RADIO RHEOSTATS AND POTENTIOMETERS

Rheostats used in vacuum tube circuits must be so constructed and the contact so arranged that there is no possibility of a momentary opening of the circuit, or a sudden change of resistance in the circuit. Either of these would result in an objectionable click in the telephone receivers. The resistance should also change uniformly throughout the entire range of the rheostat. This is necessary to secure the same degree of control for all working conditions of the battery. With the tubes now available, and with the gradual change of resistance provided by our Types 214 and 301 rheostats, no vernier attachments are necessary.



No. 214



No. 301

The resistance units of both types of rheostats are tightly wound on specially treated fibre strips. Moulded bakelite, not an inferior substitute, is used for the base. The tapered moulded knob is provided with a pointer indicating the position of the contact arm. The shaft is ¼ inch in diameter and is arranged to fit panels up to ⅜ inch thick.

Where the best in rheostat construction is desired, and for laboratory use, the Type 214 is recommended. This rheostat is made in two types—214-A for back of panel mounting, and 214-B for front of panel or table use.

Although smaller in size, the Type 301 rheostat is similar in general construction to the Type 214. It is a practical rheostat for general use.

Many of the circuits now in common use require potentiometers to control the grid potential. Both the Types 214 and 301 are supplied with high resistance windings and a third connection to enable them to be used as potentiometers.

No.	Description	Price, Each
214	—Potentiometer (400-ohm)	$3.00
214-A	—Rheostat (7-ohm)	2.25
214-B	—Rheostat (20-ohm)	2.25
214-C	—Rheostat (50-ohm)	2.25
301	—Potentiometer (200-ohm)	1.25
301-A	—Rheostat (10-ohm)	1.25
301-B	—Rheostat (30-ohm)	1.25

TUBE SOCKETS

GENERAL RADIO TUBE SOCKETS

No. 156

A vacuum tube socket must be more than a tube mounting device. It must meet with the rigid requirements of radio. The best features of socket design are incorporated in the General Radio 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.

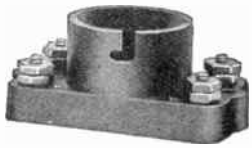
These contact springs are heavy enough to carry, without arcing or heating, the heavy filament current of five-watt oscillator tubes.

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.

No. 156—Standard Base Socket.....Price, each, $1.00

GENERAL RADIO SOCKET FOR RADIOTRON UV-199

No. 299 socket is designed for use with Radiotron UV-199. The special base on this tube requires a socket different in construction from the standard sockets and a GR-299 socket will meet this demand in every particular.



No. 299—GENERAL RADIO UV-199 SOCKET

No. 299—Molded Socket.....Price, each, $0.50
No. 299-S—Sponge Rubber Cushion for above " " .25

BENJAMIN SOCKETS

No. 8645

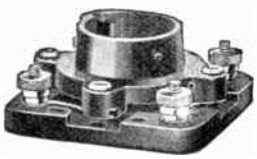
Mechanical vibrations which interfere with clear reproduction by the radio tube are of two classes, those which are perceptible to the normal sense and those which are imperceptible due to distance or lack of volume.

All mechanical vibrations set the tube filament in motion and are microphonically reproduced as very offensive noises.

It is the ability of the Benjamin Cle-Ra-Tone Socket to eliminate these noises which makes it of great value.

Following are additional advantages:

Shock absorbing feature protects tube.
Not affected by stiff bus wiring.
Indispensable for portable sets.
Tube Terminals automatically cleaned by slots in springs.
Made of moulded bakelite.
No rubber parts to deteriorate.



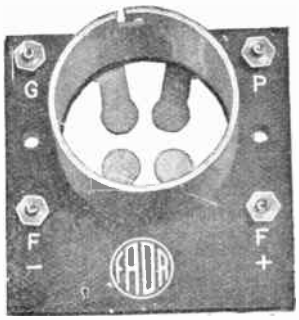
No. 8646

The Cle-Ra-Tone Socket is made in two sizes—one for standard base and the other for UV-199, etc., tubes.

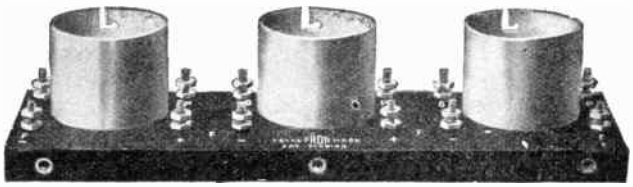
No.	Description	Price, Each
8645	For Standard Base Tubes	$1.00
8646	For UV-199, etc., Tubes	1.00

TUBE SOCKETS—CONTINUED

FADA SOCKETS



No. 118-A—SINGLE SOCKET



No. 123-A—TRIPLE SOCKET

Fada Sockets are supplied in one and three tube types particularly for panel mounting. The socket tube shell is offset from the socket base allowing the mounting of rheostats between the socket and the panel to which it is mounted.

Fada single and triple sockets are moulded of genuine black bakelite. Bases 2½ inches wide, their lengths varying from 2½ inches for the one tube to 7½ inches for the three tube. Contact springs are of phosphor bronze securely held in moulded grooves in the bottom of the bakelite base. The brass socket shell with the bayonet joint is securely moulded into bakelite base. Socket shells in multiple tube types are 2½ inches center to center. All types may be mounted on base boards if desired as screw holes are provided. Connection points plainly designated.

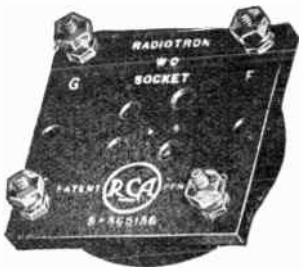
	Price, Each
No. 118-A—Single Tube Socket	$1.00
No. 123-A—Triple Socket	2.70

RADIOTRON WD-11 SOCKETS

Those who are planning to build receivers or amplifiers in which Radiotron WD-11 will be used for either detection or amplification, will need this socket. It is simple, rugged, and, what is very important, easy to get at when making connections.

All connections are clearly marked by initials on the bakelite base, and it is impossible to make improper contact, since the prongs are so arranged that they may only be inserted in the proper holes.

"RCA" WD-11 Socket .....Price, each, $0.75



"RCA" WD-11 SOCKET

No. 44-WD-11

SOCKET ADAPTERS

R. C. A. WD-11 ADAPTERS

Especially designed to adapt WD-11 tubes to standard sockets thus avoiding a change in sockets.

No. 44—WD-11 Adapter.....Price, each, $0.65

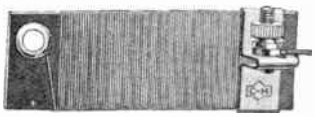
NA-ALD 199 ADAPTERS

This Adapter is exceptionally well constructed of mahogany bakelite and incorporates a particularly efficient system of spiral spring contacts. It provides for convenient and quick changes from standard base tubes to dry cell 199 tubes.

No. 429—Na-Ald 199 Adapter.....Price, each, $0.75

No. 429

RESISTANCE UNITS



RESISTANCE UNIT

The UV-201-A tubes require a rheostat of larger resistance than that furnished by the standard 4 to 6 ohm types used for the control of the old style one ampere triodes.

When using a fully charged six-volt battery for the filament, a rheostat resistance range of approximately 30 ohms is necessary, and the C-H variable Resistance Unit of 25 ohms in conjunction with any standard 4 to 6 ohm rheostat gives perfect control without modifying your existing panels. It saves the cost of new rheostats and can be installed in two minutes.

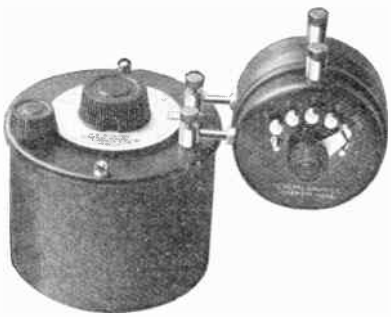
No. H-12—25-Ohm Resistance Unit.....Price, each, $0.25

GENERAL RADIO WAVEMETER AND FILTER

A very convenient direct-reading wavemeter, range 150 to 500 meters, is formed by a special Type 247 condenser connected to an inductance unit. A nearly uniform wavelength scale, etched directly on the condenser dial, results from the use of specially shaped condenser plates. The accuracy of calibration is 2%.

The selectivity of a receiving set is greatly improved by a radio Filter. The Type 247-W wavemeter is ideally adapted for this purpose, since it is provided with a variable coupling coil located beneath the wavemeter winding. This coil may be connected either in series or parallel with the receiving set.

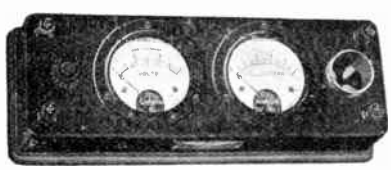
A single interfering broadcasting station may be cut out by using the series connection. The parallel filter is used to reduce interference from spark stations, static, and similar sources. A full set of instructions accompany each instrument.



No. 247-W—WAVEMETER

No. 247-W—Wavemeter and Filter.....Price, each, $10.00

JEWELL TUBE CHECKER



No. 110

Because of its essentially delicate construction, it has become evident that a tube may become inoperative by the time it reaches the dealer's counter. Thus the dealer must provide a means of protecting his customer if he is to retain his share of business.

This instrument will, when the filament of the tube is excited by applying the rated voltage and impressing upon the plate the proper amount of potential, indicate directly on an accurate milliammeter the current flowing from the plate. No uncertainty as to whether the operator is applying the correct values to the elements is possible as the fundamental current is indicated on the Jewell filament voltmeter and the plate voltage is constant. No curve is necessary. Simply a quick reading of the milliammeter—and the quality and efficiency of the tube is determined.

Every radio dealer should have one of these tube checkers.

No. 110—Tube Checker.....Price, each, $35.00

BATTERY TESTING INSTRUMENTS

JEWELL VOLTMETERS

Many of the troubles with receiving sets may be traced to low batteries, and a convenient voltmeter for checking batteries is becoming a necessity. No. 57 combination voltmeter fills this demand, having a double range to cover both "A" and "B" batteries.

The heavy lines show the connections for checking the "A" battery on the 12-volt scale. When the voltage drops to less than 5.3 volts for a 3-cell storage battery a recharge is necessary. The dotted lines show the connections for the "B" battery test, and a dry battery may be considered as completely discharged when its voltage drops 20% from its rating. Storage "B" batteries should be recharged when they show less than 22 volts for a 12-cell unit.

The instrument is finished in bright black enamel, and is equipped with insulated binding posts and a zero adjuster.

No. 57—For Direct Current: 0-10-50, or 0-10-100, or 0-12-120 Volts $10.00

No. 57


No. 489

WESTON RADIO D. C. VOLTMETERS

The heart of the radio receiving set is the tube.

The quality and intensity of reproduction can be made perfect only if the tube is operating under correct filament and plate voltage. This cannot be sensed. It must be measured by means of a voltmeter designed for the purpose.

Tubes last longest when operated at their rated voltage. Here again a dependable voltmeter is indispensable.

In selecting a voltmeter for radio use certain fundamentals must be borne in mind.

First, the voltmeter must be designed to maintain its accuracy and dependability. Then, it must read equally well on the low filament voltage and the high plate voltage. The use of the double range eliminates the necessity for having two instruments.

For a true reading the resistance of the voltmeter must be as high as possible.

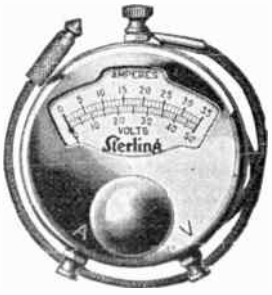
No. 489—Weston Voltmeter.....Price, each, $13.50

STERLING POCKET INSTRUMENTS

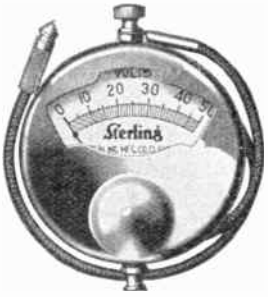
VOLTAMMETERS

No. 45 Voltammeter, 0-35 amp., 0-50 volt. This combination is especially designed for testing the amperage of "A" battery cells and voltage of "B" batteries both dry and storage.

No. 45—Voltammeter.....Price, each, $3.75



No. 45



No. 34-C

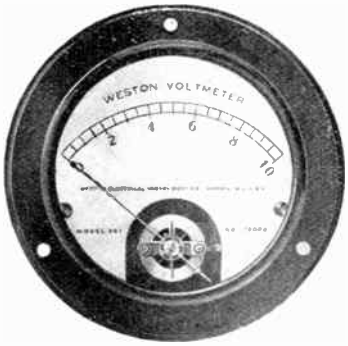
VOLTMETERS

These instruments are specially designed for the measurement of "B" battery voltage. They may be used on either the dry cell or the storage type of battery. The resistance of these meters, about 800 ohms, is such that they truly indicate the ability of a battery to deliver and sustain its voltage.

There is no other way to determine the condition of a "B" battery. Never apply an ammeter to the terminals of a "B" battery. It forms a short circuit and drains the battery. Cheap low resistance voltmeters tend to do the same thing.

No. 34C—Voltmeter.....Price, each, $2.50

WESTON INSTRUMENTS FOR THE RADIO AMATEUR



No. 301

FILAMENT VOLTMETERS

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.

No.	301			
Price ..... Each	$8.00	$8.00	$8.00	$8.00
Range ..... Volts	7	8	10	15

FILAMENT CURRENT AMMETERS

This instrument is admirably adapted for the service of regulating the current passing through the filament circuit of Detector or Amplifier Tubes.

No.	301				
Price ..... Each	$8.00	$8.00	$8.00	$8.00	$8.00
Range ..... Amperes	1.5	3	5	10	15

Other ranges will be furnished upon application.

PLATE VOLTAGE VOLTMETERS

The more anxious one becomes to obtain the best possible results from a Receiving Set the more necessary it is to pay proper attention to the plate voltage applied to the tubes. In Detector tubes the most desirable voltages 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.

No.	301					
Price ..... Each	$8.00	$13.00	$17.00	$24.00	$30.00	$36.00
Range ..... Volts	50	100	500	1000	1500	2000

WESTON ANTENNAE AMMETERS

(THERMO-AMMETER PRINCIPLE)

The Antennae or Radiation Ammeter, as it is often called, is an instrument that is absolutely essential in connection with Transmitting Apparatus. The effectiveness and character of transmission depends upon the current flowing through the Antennae Circuit and the nature of the high frequency antennae circuits is such that a special type of instrument is required for accurate and dependable measurements of current strength.

No.	425				
Price ..... Each	$17.00	$17.00	$17.00	$18.00	$18.00
Range ..... Amperes	1.5	3	5	10	20

PLATE MILLIAMMETERS

We list and describe this instrument because it is of frequent demand in professional radio work and is used to a large extent by advanced amateurs and by experimenters.

Lest it be thought that we urge the average amateur to buy one of these instruments for his set, we state very frankly that unless some special work is contemplated, we believe the Plate Milliammeter to be an unnecessary expense. By the use of plate milliammeters with a little experience one can determine whether the tubes are functioning properly either as oscillators or amplifiers. In receiving sets, the most desirable range is 5 milliamperes.

This instrument is exactly similar in size and appearance to other Model 301 instruments listed above, and, therefore, is not illustrated.

No.	425		
Price ..... Each	$10.00	$8.00	$8.00
Range ..... Milliamperes	5	100	200

JEWELL RADIO INSTRUMENTS

The case of patterns 54, 64 and 74 instruments are 3 inches in diameter with ⅜-inch flange for panel mounting.

The case of pattern 53 instruments is 2½ inches in diameter with ⅜-inch flange for panel mounting.

Specify which of the standard range scales is desired when ordering.

These instruments are particularly applicable to receiving and transmitting sets where a low priced instrument is desired.

PATTERN 53 D. C. AMMETER, MILLIAMMETERS, VOLTMETERS

Standard Ranges	D. C. Volts	3	7.5	10	15	20	25	30	40	50			
	D. C. Amps	1	1.5	2	2.5	3	4	8	10	20	30	40	
	D. C. Milli-Amps	10	15	20	30	50	75	100	200	250	300	500	

Pat. No. 53, D. C., standard ranges ..... $ 6.00

Other Ranges:
- Pat. No. 53, for D. C., 0- 500 volts 14.00
- Pat. No. 53, for D. C., 0-1000 volts 21.00
- Pat. No. 53, for D. C., 0-1500 volts 27.00
- Pat. No. 53, for D. C., 0-2000 volts 33.00
- Pat. No. 53, for D. C., 0-2500 volts 41.00
- Pat. No. 53, for D. C., 0-3000 ..... 48.00

PATTERN 54 D. C. AMMETERS, MILLIAMMETERS, VOLTMETERS

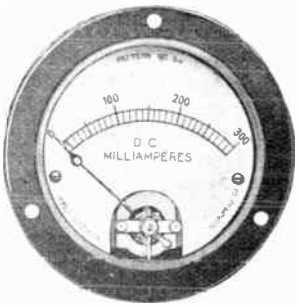
The Pattern No. 54 instrument is our direct current model and can be supplied as an ammeter for filament current, a voltmeter for filament control, a high voltage voltmeter for plate control or as a milliammeter for measuring the plate or space current.

Standard Ranges

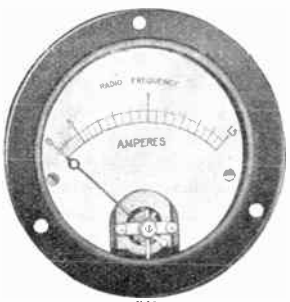
D. C. Volts	3	7.5	10	15	20	25	30	40	50	75		
D. C. Amps	1	1.5	2	2.5	3	4	5	8	10	20	30	40
D. C. Milli-Amps	3	5	10	15	20	30	50	75	100	200	250	300	500

Pattern No. 54, standard ranges ..... $ 7.50

Other Ranges:
- Pat. No. 54, for D. C., 0- 500 volts 15.50
- Pat. No. 54, for D. C., 0-1000 volts 22.50
- Pat. No. 54, for D. C., 0-1500 volts 28.50
- Pat. No. 54, for D. C., 0-2000 volts 34.50
- Pat. No. 54, for D. C., 0-2500 volts 42.50
- Pat. No. 54, for D. C., 0-3000 volts 49.50



PATTERN No. 54



PATTERN No. 64

PATTERN 64 ANTENNA AMMETERS

The Pattern No. 64 instrument is a thermo-couple type of antenna ammeter and is the most satisfactory which has been produced by any manufacturer. It has no appreciable temperature error, nor has it any zero shift as in the hot wire instrument. It is the most responsive thermal instrument made and will show modulation which it is impossible to read on other instruments. The overload capacity is large but, of course, overloading is not recommended, and instruments should be chosen of sufficiently large capacity to make overloading a rare occurrence.

Standard Ranges—Radio Freq. Amps. 1 1.5 2 2.5 3 4 5 8 10

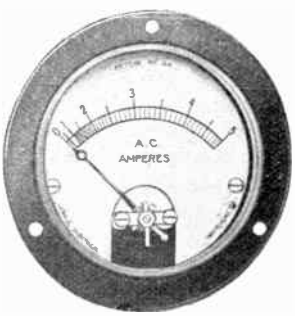
Pattern No. 64, standard ranges ..... Price, each, $12.00

PATTERN 74 A. C. AMMETERS AND VOLTMETERS

The Pattern No. 74 alternating current instrument is particularly valuable for filament control on power tubes and is usually supplied as an 0-10 or 0-15 voltmeter, although other ranges are regularly supplied. This instrument is well damped and very accurate.

Standard Ranges	A. C. Amps.	1	1.5	2	2.5	3	4	5	8	10	15	20	25	30
	A. C. Volts.	10		15	20		25	30	40	50	75			

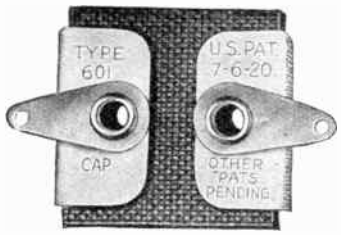
Pattern No. 74, standard ranges ..... Price, each, $7.50



PATTERN No. 74

DUBILIER FIXED CONDENSERS

MICADON TYPE 601



TYPE 601

The fixed condenser is a small but most important unit in a radio receiving set, the proper functioning of the set depending almost entirely upon its accuracy, dependability and constancy.

These three characteristics are an integral part of each Dubilier Micadon, resulting in the most efficient condenser for radio circuits.

The Micadons illustrated on this page are used by amateurs, radio engineers and set manufacturers, and can be adapted to fill a wide range of uses in radio sets. The various types of Micadons offer a simple and effective means of placing condensers in radio circuits with a minimum amount of work and without spoiling the appearance of the finished product.

The original Micadon, while accurate to a high degree, was not flexible, in so far as only one type was available. The newer Micadons have been constructed with a view towards facilitating their assembly in modern radio sets either factory built or home made.

The Dubilier Micadon is unquestionably the world's most popular unit of capacity because the Dubilier Company has been quick to add needed conveniences and has maintained the high quality which has made the Dubilier Micadon the standard condenser of radio.

Below are listed capacities and prices of the type 601 Micadon as shown above.

Capacity	Price, Each	Capacity	Price, Each	Capacity	Price, Each
.00005	$0.35	.001	$0.40	.003	$0.50
.0001 mfd.	.35	.0015	.40	.004	.50
.00025 mfd.	.35	.002	.40	.005	.60
.0005	.35	.0025	.40	.006	.75

Below are modifications of the Standard Micadon Type 601, equipped with special mounting clips. Capacities carried in stock are listed under each.

MICADON TYPE 601-G

Micadon Type 601-G has clips to hold fixed grid-leaks (Grid-leaks not supplied with Micadons).

Stocked in capacities, .00025 and .0005.

TYPE 601-G

PRICE, EACH

Type 601-G—(Add 10 cents to price of 601 Micadon).

BY-PASS CONDENSER

THE BY-PASS CONDENSERS

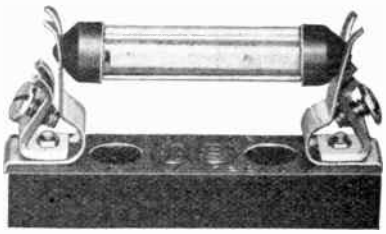
This condenser is used as a by-pass for the radio frequency currents around the high internal resistance "B" battery. Because of this reduced resistance, louder signals may be obtained. It is also used to control the fluctuating current delivered by a partly run down "B" battery, thus insuring a uniform flow of current and the elimination of noises.

Capacity	Price, Each	Capacity	Price, Each
.1 mfd.	$0.70	2 mfd.	$1.75
.25 mfd.	.75	3 mfd.	2.75
.5 mfd.	.90	4 mfd.	3.75
1 mfd.	1.25		

TUBULAR GRID AND PLATE CONDENSERS

These Tubular Grid and Plate 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. In this way a variety of capacity ranges may be obtained from any variable condenser.

The complete condenser unit is sealed in a glass tube fitted with end caps, in the same manner as the Standard Grid Leaks.


MOUNTED TUBULAR GRID AND PLATE CONDENSERS
No. UC-570 WITH UX-543

No.	Description	Price, Each
UC-570	Tubular Grid and Plate Condenser, .0025 mfd.	$1.50
UC-569	Tubular Grid and Plate Condenser, .001 mfd.	1.50
UC-568	Tubular Grid and Plate Condenser, .0005 mfd.	1.50
UC-567	Tubular Grid and Plate Condenser, .00025 mfd.	1.50
UX-543	Tubular Grid and Plate Condenser Mounting	.50

GRID LEAKS FOR RECEIVING SETS

GRID LEAK MOUNTED
No. UP-509 WITH UX-543

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 the filament. The character of the control depends directly upon the bias 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.

Experience has demonstrated that the use of the grid leak is the more practical method of controlling the grid potential of a vacuum tube. 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. Different detection and amplification circuits require grid leaks of different value; therefore grid leaks of different resistance are made as shown below.

It cannot be told off-hand just what value of grid leak unit should be used with any particular amateur receiving set. It depends upon the design of the apparatus, the type of antenna and ground system, grid condenser and other factors. The proper capacity for the grid condenser should be determined by experimenting with different values between .0002 and .0004 mfd. Various values can be obtained by purchasing three (3) grid leaks, listed below, approximately ½, 1 and 2 megohms, respectively. The experimenter can then try three (3) 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.

No.	Ohms	Megohms	Price, Each	No.	Ohms	Megohms	Price, Each
UP-509	50,000	.05	$0.40	UP-519	1,000,000	1	$0.40
UP-510	100,000	.1	.40	UP-520	1,250,000	1.25	.40
UP-511	150,000	.15	.40	UP-521	1,500,000	1.5	.40
UP-512	200,000	.2	.40	UP-522	1,750,000	1.75	.40
UP-513	250,000	.25	.40	UP-523	2,000,000	2	.40
UP-514	300,000	.3	.40	UP-524	2,500,000	2.5	.40
UP-515	400,000	.4	.40	UP-525	3,000,000	3	.40
UP-516	500,000	.5	.40	UP-526	4,000,000	4	.40
UP-517	600,000	.6	.40	UP-527	5,000,000	5	.40
UP-518	750,000	.75	.40	UP-531	7,000,000	7	.40

No. UX-543—Grid Leak Mounting.....Price, each, $0.50

C. R. L. ADJUSTABLE GRID LEAKS

FOR PANEL MOUNTING

No. 107

C. R. L. Adjustable Grid Leak is designed for mounting on the panel through a single hole. Its use permits the adjustment of the grid potential to the exact value that provides the maximum signal strength. By turning the polished black knob, the resistance of the leak can be gradually and smoothly changed to any desired value between ¼ and 8 megohms.

The instrument has a bakelite base on which is mounted a fabric strip, the ends of which are connected to the two binding posts. This strip is impregnated with a high resistance compound of tested permanence. The current from the grid leaks along this strip, the amount being regulated by adjusting the area of contact of the strip with a curved phosphor-bronze spring that is held in position by a compression block. This compression block is operated by a screw attached to the operating knob.

No	Description	Price, Each
107	Adjustable Grid Leak (with condenser)	$1.85

TRANSMITTING GRID LEAKS

No. UP-1718

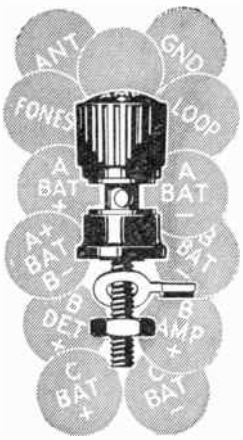
These transmitting grid leaks are used to limit the potential accumulating on the grid of an oscillating tube and thus govern the output to the antenna and also the character of the antenna oscillations.

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, Catalog No. UP-1719, is for use with 5-watt Radiotrons; its resistance is 5,000 ohms, with mid-tap 2,500 ohms. Size 5x1¼ inches.

Grid Leak, Catalog No. UP-1718, is for use with 50-watt and 250-watt Radiotrons; its resistance is 5,000 ohms, with mid-tap at 2,500 ohms. Size, 8½x1½ inches.

No.	Description	Price, Each
UP-1719	Transmitting Grid Leak	$1.10
UP-1718	Transmitting Grid Leak	1.65



BINDING POSTS

THE ORIGINAL "READ 'EM" BINDING POSTS

"The Name is on Every Post"

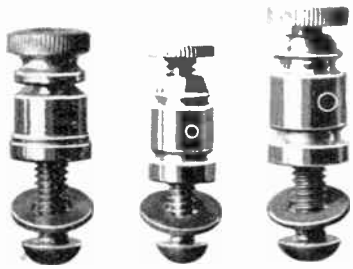
ALL-MOULDED—KNOBS IRREMOVABLE

The new Read'em Binding Posts are of the irremovable-knob type and both the knob and the collar are moulded. The stem is cross-drilled so that connections can be easily and quickly made without the usual twisting of wires. The illustration shows the different styles and these can be had either assorted or in complete sets. The name Read'em is copyrighted and will be found on all moulded terminals. These are the lowest priced binding posts of their kind on the market and since their recent introduction have become practically a standard.

Read'em Binding Posts.....Price, each, $0.15

NICKEL-PLATED POSTS

No.	Description	Price, Each
B-11	Binding Post	$0.08
C-17	Telephone Post	.09
C-18	Telephone Post	.10



No. B-11 No. C-17 No. C-18

EBY BINDING POSTS

401 404 403 402 405 406

No.	Description	Price, Each
401	Commander	$0.25
402	Ensign	.20
403	Ace	.10
404	Sergeant	.18
405	Buddy	.12
406	Midget	.10

SWITCH STOPS AND POINTS

No.	Description	Price, Each
4	Stop	$0.04
S-5	Point	.03
S-7	Point	.04
S-8	Point	.04
S-9	Point	.04
S-10	Point	.04

S-10 S-9 S-8 S-7 S-5 STOP

KNOBS

No. 771
FULL SIZE

No. 809
FULL SIZE

No. 945
FULL SIZE

These Electrose parts will be found very convenient for use by the amateur when constructing their own radiophone sets. They are highly finished, glossy black, and present an attractive appearance.

No.	Description	Price, Each
771	Electrose Knobs, tapped for 8/32 Machine Screw	$0.05
809	Electrose Knobs, tapped for 8/32 Machine Screw	.06
945	Electrose Knobs, tapped for 8/32 Machine Screw	.12

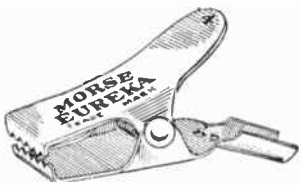
FADA "FIT-THE-FINGERS" KNOBS

Recognized at sight by its conical shape which makes it the easiest and most convenient to use of any knob. Made of molded insulating material with threaded 8/32 metal insert. Top diam., 1 inch; bottom, 1¼ inch; height, ¾ inch. Black with highly buffed finish.

No. 114-A—"Fit-the-Fingers" Knob.....Price, each, $0.16

No. 114-A

TEST CLIPS

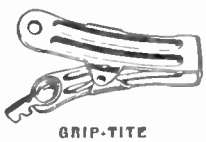


No. 4 TEST CLIP

No.	Description	Price, Each
4	Test Clip	$0.08
36	"Pee-Wee" Test Clip	.06

No. 36 "PEE-WEE"

GRIP-TITE BATTERY CLIPS

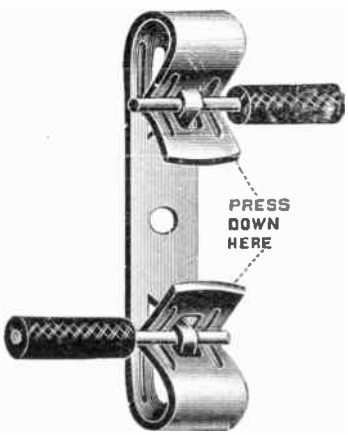


GRIP-TITE

This clip makes a very efficient connector for storage batteries, it is 2¼ inches long, heavy and leaded to prevent corrosion.

Price, ...Each, $0.15

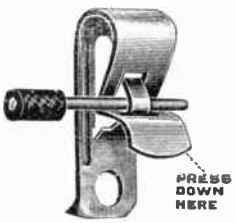
FAHNESTOCK CONNECTORS



No. 9 FULL SIZE

No. 15 SMALL SIZE

No. 10 FULL SIZE



No. 3 FULL SIZE

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.

No.	Size of Wire No.	Length Over-all, Ins.	Width, Ins.	For Size Screw, No.	Price, Each Nickl'd Brass	Nickl'd Bronze
15	16	½	7/32	4	.....	$0.03
10	14	¾	5/16	6	$0.06	.....
3	12	⅞	⅜	6	.06	.....
5	10	1 1/16	⅜	8	.07	.....
9	10	2 1/16	⅜	8	.10	.....

SWITCH LEVERS

No. 109-A

PANEL TYPE

No. 111-A

FADA SERIES PARALLEL SWITCHES

Fada Series Parallel Switches are usually used to change the variable condenser in the antenna circuit from a series to a parallel connection. In addition, these switches can be used for changing from short to medium wave receivers, from vacuum tube to crystal detector, from receiving to sending, from first to second stage of amplification.

No. 109-A—Fada Series Parallel Switch only.....Price, each, $0.55

FADA INDUCTANCE SWITCHES

The Fada Inductance Switch is rugged and mechanically well constructed. The panel bushing and adjustment collar are made of brass to clear ⅜-inch hole. They are bored for ⅛-inch shaft. The shaft is held in place by a collar, and a 6-32 machine screw. The switch blade and points are made of phosphor bronze with a radius of 1¼ inches.

No. 111-A—Fada Inductance Switch only.....Price, each, $0.40

No. 139-A

GENERAL RADIO SWITCHES

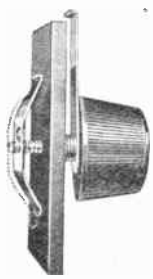
A Multiple Leaf Switch Lever with a 1⅜ inch radius—designed to meet the demands of a better grade of merchandise.

139-A—Multiple Leaf Switch 1⅜ inch radius.....
.....Price, each, $0.95

"MINUTE MAN" SWITCH LEVERS

In presenting the Minute Man Switch Lever, we are offering the very latest ideas in these accessories. It is especially designed for quick mounting and its panel collar consists of six small nickel-plated washers, so that it can be used with all types of switch points. To secure the proper blade-tension all that is required is to use the proper number of washers. The patented spring behind the panel is easily slipped into place insuring positive connections at all times. The illustration shows the standard lever although it can be made in various styles of knobs and blades.

Minute Man Switch Lever.....Price, each, $0.25



No. 115

CARTER INDUCTANCE SWITCHES

1-15 CONTACTS

Self-contained. Mounts back of panel. Only one panel hole drilled. Solder terminal and contact one piece. Adjustable stop pin. New type knob dial eliminates panel numbering. Pig tail connection eliminates sliding contacts.

No. 115—15-point Inductance Switch, Single Arm.....
.....Price, each, $2.00

BATTERY SWITCHES

PORCELAIN BASE

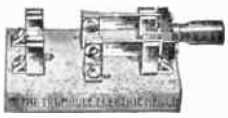
No. 707

No. 708

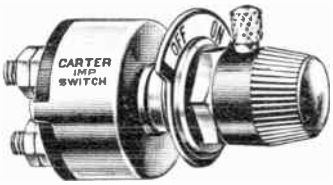
No. 709

These switches will be found very convenient for use by the radio amateur. They are well constructed, having easily accessible binding posts and positive connections.

No.	Description	Quantity in Carton	Standard Package	Price, Each
707	Single Pole, Single Throw	10	150	$0.30
708	Single Pole, Double Throw	5	100	.45
709	Double Pole, Single Throw	10	100	.50
710	Double Pole, Double Throw	5	50	.75
711	Three Pole, Single Throw	5	50	.84
712	Three Pole, Double Throw	5	50	1.35



No. 710



CARTER "IMP" BATTERY SWITCHES

Quarter Turn Snap Switch makes positive contact. "On and off" name plate and pointer indicate position of switch. Compact and quiet in operation. One hole mounting.

Price .....Complete, $0.65

"EASY ON" PUSH AND PULL SWITCHES

To Install—Drill a ¼-inch hole in panel. Remove knob, and knurled nut from switch; insert stem through hole and replace nut and knob, and the installation is complete.

The simplicity of installation of this switch makes it a big labor saver.

Presto "Easy On" Push and Pull Switch..Price, each, $0.60

No. 431

"IMP" CORD TIP JACK

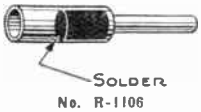
Replaces binding post for phone cord; provides easy method of connecting any circuit using standard phone cord-tips or "Imp" plugs. Nickel-plated. Phosphor-bronze spring. Mounted in ⅜-inch hole. Cut half size.

Cord Tip Jack.....Price, each, $0.35

"IMP" PLUGS

Can be attached to tinsel cord or wire without soldering.

Imp Plugs .....Price, each, $0.15



No. R-1106

WIRE TIPS

These Wire Tips are 1⅜-inch overall, and the small tip is ½-inch. The hole in the large part is filled with solder to facilitate soldering.

No. R-1106—Wire Tip.....Price, each, $0.05

REPLACEMENT PARTS FOR HEAD SETS

Description	Price, Each
Caps for Brandes Superior Headset	$0.40
Caps for Brandes Old Type Navy Headset	.40
Caps for Scientific Headset	.25
Caps for New Navy Type Phones	.40
Diaphragms for Brandes Superior Headset	.20
Diaphragms for Scientific Headset	.10
Diaphragms for Brandes Old Type Navy Headset	.20
Diaphragms for New Navy Type Phones	.20
Double Cords for Brandes Superior Headset	1.00
Double Cords for Brandes Old Type Navy Headset	1.00
Double Cords	.65
Double Cords for Scientific Phones	.50
Single Cords	.65
Shielded Cord for New Navy Phones	3.00
Loud Speaker Extension Cord	1.75

CARTER HOLD-TITE JACKS

Insulation is Westinghouse "Micarta" tested to withstand 1,000 volt breakdown test. No leakage.

Frame, nickel-plated and polished on all sides is tapered and so shaped that usual troublesome high insulation stack-up between frame and springs is totally eliminated.

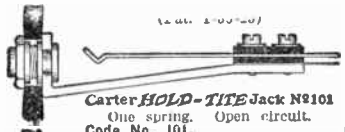
Contact points are pure silver.

Wide-spaced tinned terminals facilitate soldering.

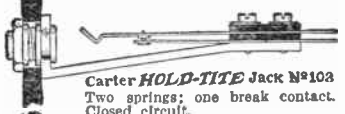
Self-adjusting lock-nut eliminates spacer washers in mounting jacks on panels of varying thickness.

Jack thimble provides at all times a fixed distance between shoulder of plug and contact tip of jack spring. Perfect connection of plug in the jack always thus assured.

Springs are long, tapered, phosphor-bronze.

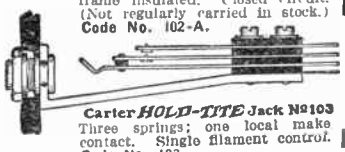


Carter *HOLD-TITE* Jack №101
One spring. Open circuit.
Code No. 101. **70c Each**

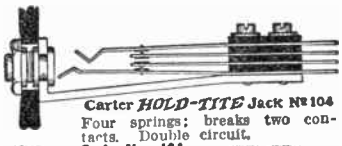


Carter *HOLD-TITE* Jack №103
Two springs; one break contact. Closed circuit.
Code No. 102. **80c Each**

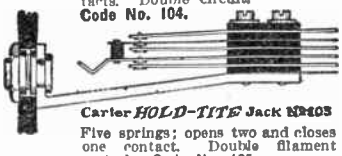
Carter *HOLD-TITE* Jack №102A.
Two springs; one break contact; frame insulated. Closed circuit. (Not regularly carried in stock.)
Code No. 102-A. **80c Each**



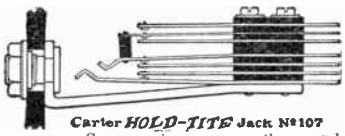
Carter *HOLD-TITE* Jack №103
Three springs; one local make contact. Single filament control.
Code No. 103. **90c Each**



Carter *HOLD-TITE* Jack №104
Four springs; breaks two contacts. Double circuit.
Code No. 104. **$1.00 Each**



Carter *HOLD-TITE* Jack №105
Five springs; opens two and closes one contact. Double filament control. Code No. 105. **$1.10 Each**

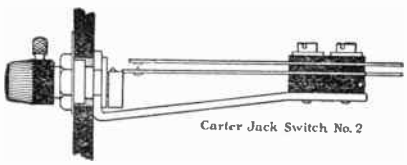


Carter *HOLD-TITE* Jack №107
Seven springs; opens three and closes one contact. Double circuit, double automatic filament control. (Not regularly carried in stock.)
Code No. 107. **$1.30 Each**

CARTER JACK SWITCHES

For opening and closing the "A" battery circuit; mounts same as standard jack; ¼ turn of knob opens or closes the circuit; furnished with "On and Off" etched name plate.

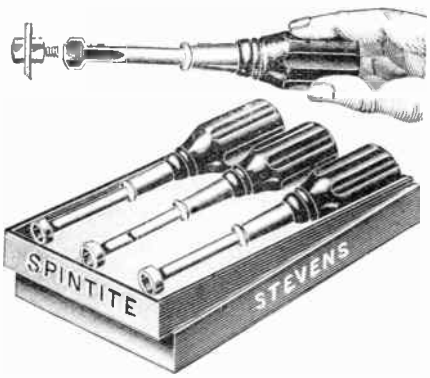
	Price, Each
No. 2—Jack Switch	$1.00
No. 3—Jack Switches. Same as No. 2, but single pole single throw action	1.15



Carter Jack Switch No. 2

RADIO TOOLS

HEX SPINTITE SET T-71



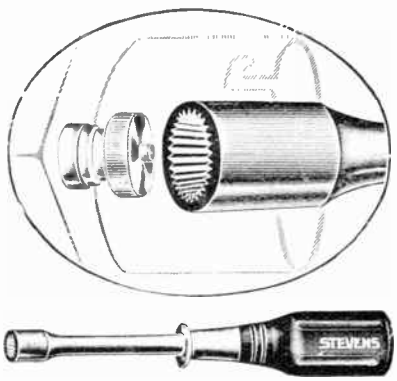
This Spintite gets a full grip on the hex nuts—hollow stem goes over projecting screws—ebonized handle for comfortable leverage—easy to reach cramped corners.

The bit is machined from one piece of steel and hardened to give lasting service.

It contains the three most popular sizes of Hex Spintites. No. 4, ¼-inch; No. 5, $\frac{5}{16}$-inch, and No. ½, $\frac{11}{32}$-inch.

Hex Spintite Set No. T-71.....Price, each, $1.00

STEVENS SPINTITE WRENCHES FOR ROUND NUTS



The Round Spintite is a new, but thoroughly tested, design. Its sharp teeth are spiralled and tapered to get a firm, solid grip on the knurled Round Nut with but slight pressure and to release easily. It doesn't damage the nut.

Shank machined from one piece of steel and hardened for constant service.

T-825—Set of Round Spintites, 3 sizes, $\frac{5}{16}$, $\frac{3}{8}$, $\frac{7}{16}$-inch, tapered so as to fit all round radio nuts.....Price, each, $1.00

"YANKEE" RADIO TOOLS

This is the handiest set of tools ever made for radio work. It appeals at once to all radio enthusiasts as well as manufacturers and no expense has been spared in design, workmanship, materials or finish to make it equal to all other "Yankee" tools, conceded to be the finest in the world.

SET NO. 105 CONTAINS

No. 230 Ratchet Screw Driver (6¼ inches over all) holds all attachments.

Blades—5½x$\frac{3}{16}$-inch, for long reach into box, between wires, etc.

—3½x⅛-inch, for small screws on dials.

—2½x¼-inch, for heavy screws—putting up aerials, etc.

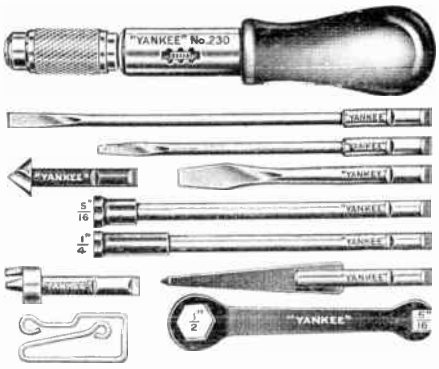
Countersink—for countersinking, for heads of screws.

Sockets (two) ¼-inch and $\frac{5}{16}$-inch hex, with 4-inch shanks. Cover all small nuts.

Reamer—for enlarging holes in panel from ⅛-inch to ½-inch.

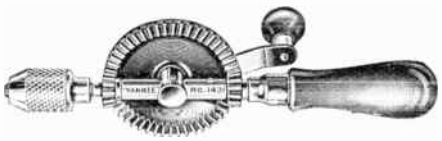
Wrench—one end, $\frac{5}{16}$-inch, square or hex. Other, ½-inch hex for jacks.

No. 105—Tool Set.....Price, each, $3.40



No. 105

RADIO DRILLS



No. 1431

Specially designed for radio work. A beautifully balanced, small, powerful drill, with 4 to 1 ratio of gears for speed. Special radio chuck, $\frac{5}{32}$-inch capacity to take largest drill furnished with radio drill sets. Length overall, 9½ inches.

No. 1431—Radio Drill.....Price, each, $3.20

PLIERS

OBLIQUE CUTTING PLIERS

Klein Pliers forged from high grade crucible steel with polished jaws and cutting blades.

No. 202-5—5-inch Oblique Cutting Pliers.....Price, each, $2.25

No. 202-5

No. L-25

CRESCENT THIN STRAIGHT-NOSED PLIERS

Designed to be used on check nuts and similar work inaccessible with regular pliers. Dropped forged from the finest tool steel, oil tempered, nickel-plated.

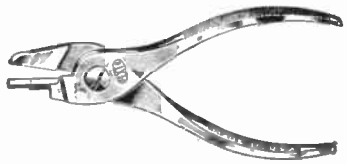
No. L-25—Crescent Thin Straight Nose Pliers.....Price, each, $0.50

LONG NOSE SIDE CUTTING PLIERS

Klein Pliers made from the best high grade forged crucible steel.

No. 203-5—5-inch Long Nose Side Cutting Pliers...Price, each, $2.20

No. 203-5

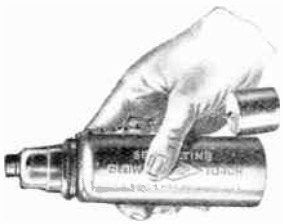


PEXTO RADIO PLIERS

This plier, drop forged steel, full polished, will form accurately the terminals or loops on buss-bar wire. Equipped with wire cutter.

Pexto Radio Plier.....Price, each, $1.15

SOLDERALL



No. 40 SOLDER-ALL TORCH

This Solderall combination set consists of Solderall Torch and small tube of Solderall, which will be found very convenient for soldering wires and connections in the amateur radio station. It uses denatured or wood alcohol.

No. 2 SOLDERALL

No.	Description	Price, Each
40	Solderall Torch, only	$2.00
2	Solderall (small tube), 2 oz.	.25

SOLDER

Description	Price, per Lb.
Bar Solder (50-50)	$0.75
Wire Solder (50-50)	.75
Rosin Core Flux Solder	1.25
Kester (Radio) Rosin Core Solder (10 boxes to carton), per carton	2.50

SOLDER PASTE

Description	Price, Each
Nokorode Solder Paste	2-oz. can, $0.25
Allen Solder Paste	2-oz. can, .20

INSULATING TAPES

Description	Price, Each
General Electric Friction Tape, ¾-inch	Per ½-lb. roll, $0.40
Corona Rubber Tape, ¾-inch	Per ½-lb. roll, .60

WHITE BEAUTY SOLDERING IRONS

A reliable soldering iron at a price within the reach of everyone. Nickel chromium element—mica insulation. Consumes less than one ampere of current and will solder in two minutes. Fully guaranteed. Furnished with solder and box of soldering paste.

No. 650—White Beauty Outfit..Price, each, $2.00

"AMERICAN BEAUTY" ELECTRIC SOLDERING IRONS

No. 3138

To be of value any tool must do the work for which it is intended easier, quicker and better than the article it replaces. If it does any of these three things it will probably prove a valuable investment, providing of course, it is designed and constructed in such a manner as to function for a considerable length of time.

The fact that many, many thousands of "American Beauty" Electric Soldering Irons are in daily use is ample proof that these irons are all that could be wished for.

No.	Description	Price, Each
3138	American Beauty Soldering Iron, 18 oz.	$ 8.00
3158	American Beauty Soldering Iron, 26 oz.	9.25
3178	American Beauty Soldering Iron, 42 oz.	11.50

ROEBLING'S MAGNET WIRE

This magnet wire is of the highest quality, and can be used satisfactorily by the amateur who is constructing his own apparatus.

¼-POUND SPOOLS

Size	Price, per Spool	Size	Price, per Spool
20-SCC	$0.32	30-DCC	$0.72
22-SCC	.34	20-SSC	.41
24-SCC	.36	22-SSC	.46
26-SCC	.44	24-SSC	.54
18-DCC	.32	26-SSC	.64
20-DCC	.34	20-DSC	.56
22-DCC	.38	22-DSC	.64
24-DCC	.44	24-DSC	.76
26-DCC	.50	26-DSC	.94
28-DCC	.56		

ENAMELED ¼-POUND SPOOLS

Size	Price, per Spool	Size	Price, per Spool
18	$0.26	26	$0.32
20	.28	28	.34
22	.30	30	.44
24	.30		

If ordered on larger spools charge will be made for spools, and credited upon return of spools in good condition. Special sizes quoted on application.

ROEBLING'S SOLID HARD-DRAWN COPPER AERIAL WIRE

Many amateurs prefer this wire on account of its high conductivity and comparatively low price. It is not, however, as easy to work as stranded wire.

No. 14—Solid Hard Drawn Copper Wire, not tinned.....Per 100 ft., $0.75

ROEBLING'S STRANDED COPPER AERIAL WIRE, NOT TINNED

A very flexible wire of high conductivity; standard size is No. 14, which is composed of 7 strands of No. 20 B. and S. gauge.

No. 14—Stranded Copper Aerial Wire.....Per 100 ft., $1.00

ROEBLING'S STRANDED COPPER AERIAL WIRE, TINNED

This wire is selected by the discriminating amateur and is very efficient for aerial purposes.

No. 14—Stranded Tinned Copper Aerial Wire.....Per 100 ft., $1.10

ROEBLING'S BUS WIRE

No. 14—B. and S. Solid Copper Tinned Bus Wire.....Per 100 ft., $1.00

No. 14—Square Tinned Bus Bar Wire, 2-foot lengths, per length..... .04

GROUND WIRE

	Price, per 100 ft.
No. 14—Single Braid Rubber-covered Wire	$ 2.00
No. 4—Solid Double Braid Rubber-covered Wire	10.00
No. 4—Stranded Double Braid Rubber-covered Wire	12.00
No. 18—Roebling's Twisted Pair Lamp Cord	3.00

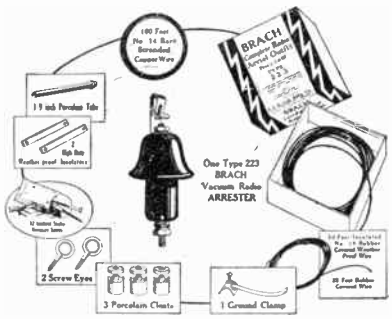
ANTENNA EQUIPMENT

NO. 1104 COMPLETE ANTENNA EQUIPMENT

A complete Antenna Equipment can be furnished if desired and will be found a very satisfactory medium priced aerial equipment. This outfit consists of:

100 ft. No. 14 Stranded Copper Aerial Wire.
2 No. 1107 Aerial Insulators.
50 ft. No. 14 Single Braid Rubber Covered Wire for Lead-in.
1 $\frac{5}{16}$"x8" Porcelain Tube.
3 No. X130 Split Porcelain Knobs.
1 Adjustable Ground Clamp.
1 No. 200 Brach Lightning Arrester.
1 No. 708 S. P. D. T. Switch.

No. 1104—Complete Antenna Equipment.....Price, each, $5.00



No. 223

BRACH COMPLETE ANTENNA OUTFIT

100 Feet No. 14 Bare Copper Wire
1 9-inch Porcelain Tube
2 Aerial Insulators
2 Screw Eyes
1 Package of Screws and Staples
50 Feet No. 14 S. B. R. C. Wire
25 Feet Rubber Covered Wire
1 Ground Clamp
3 Nail-it Knobs
1 No. 223 Arrester

No. 223—Antenna Equipment....Price, each, $6.00

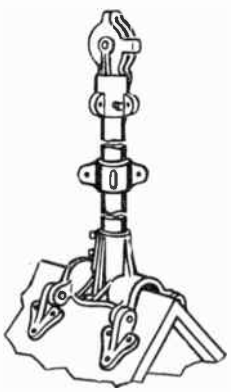
DUCON LAMP SOCKET ANTENNA

For the convenience of those desiring an inside antenna we are supplying the Ducon lamp socket aerial which is a compact condenser mounted on a standard plug so that it can readily be used in any electric light receptacle.

This type of antenna is satisfactory for long distance work in practically all residences. It eliminates an outside aerial entirely. Binding posts are mounted on the plug so that it can be used as a loop aerial, if desired.

Ducon Lamp Socket Antenna.....Price, each, $1.50

"FREIDAG" AERIAL MAST PIPE FIXTURES



No. 60

These fixtures consist of a cap with a sheave pulley and lugs for guy wires, a collar with lugs, and a universal mast head with loop for securing aerial cable. Our Nos. 60 and 65 sets use 1-inch standard pipe, while our Nos. 70 and 75 sets use ½-inch pipe. The pipe does not require threads on either end, and can be purchased from your local plumber in the length you require. One-inch pipe is $1\frac{5}{16}$-inch outside diameter, while one-half inch pipe is about ⅞-inch outside diameter.

The Freidag Aerial Fittings were designed to take the place of the unsightly, poorly installed wood pole or tower usually used for aerial supports. A well made, substantial aerial is necessary to the successful operation of your receiving set. Our sets Nos. 60 and 65 are used where long, heavy 2 and 3 wire, and also hoop type aerials are installed.

Sets Nos. 70 and 75 are generally used for single wire aerials or short multiple wire aerials.

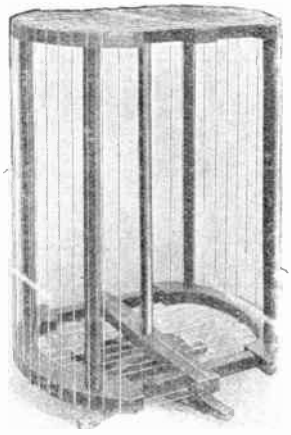
	Price, Each
No. 60—Aerial Mast Pipe Fixture for 1-inch Pipe.....	$3.50
No. 65—Aerial Mast Pipe Fixture for 1-inch pipe.....	3.50
No. 70—Aerial Mast Pipe Fixture for ½-inch Pipe.....	1.00
No. 75—Aerial Mast Pipe Fixture for ½-inch Pipe.....	1.00

LOOP ANTENNAS

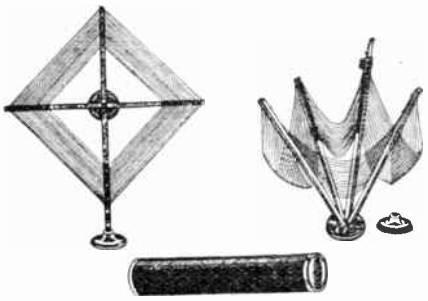
NO. AG-814

A. G. 814—Loop designed for use with the Radiola Super Hetrodyne.

AG-184—Loop ..... Price, each, $12.00



No. AG-814



PORTENA

The Portena Loop Aerial has a natural period of 145 meters and when shunted by a 23-plate variable condenser will respond to a wave length of from 190 to 650 meters. It is super-sensitive and very selective, has correct electrical characteristics and its collapsible feature make it an ideal Loop for all occasions.

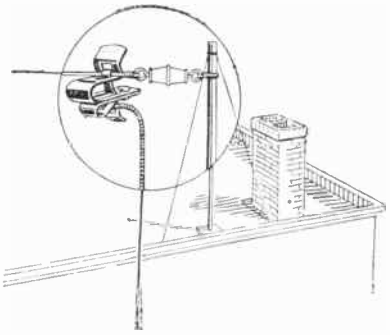
Portena Loop Aerial..... Price, each, $7.00

FAHNESTOCK ANTENNA CONNECTORS

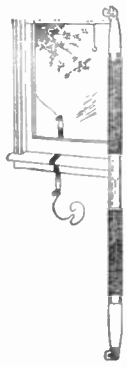
Eliminates splicing and soldering of wires. Snap larger connector over antenna wire; insert lead-in wire into smaller clip and a perfect connection is the result.

Made of the finest quality phosphor bronze.

No. 31..... Price, each, $0.10



No. 31

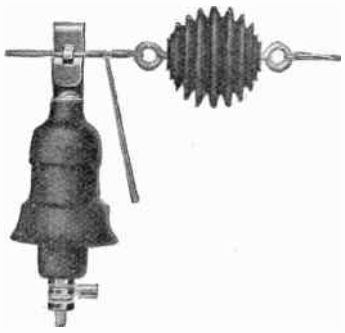


ELECTRAD LEAD-IN

A flat lead-in which takes the place of the porcelain tube and makes drilling the window unnecessary. Goes under the window. Electrad Lead-in is covered with fire-proof insulating material, which prevents grounding of circuit on wet window sills. You can close and lock the window on it. Equipped with Fahnestock Clips.

Electrad Lead-in..... Price, each, $0.40

LIGHTNING ARRESTERS



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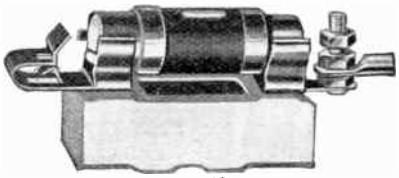


No. 200

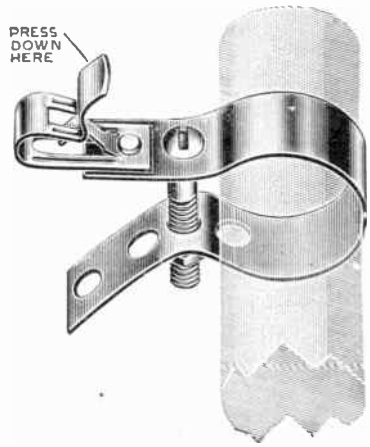
Vacuum Gap Tube Protectors for receiving circuits are used for protecting instruments from damage by lightning, heavy static, or neighboring systems. The National Board of Underwriters now approve the use of vacuum-gap tube protectors in radio telegraph or radio telephone receiving circuits in place of the grounding switch formerly required. All that is necessary is to connect the vacuum protector across the receiving set between the antenna lead-in and the ground wire.

The presence of the vacuum tube protector does not reduce the loudness or strength of incoming signals, whether telegraph or telephone. In transmitting sets, two (2) vacuum-gap protectors may be connected in series across the primary power mains, the mid point being grounded. This is a low-priced and most effective kick-back preventer.

No.	Description	Price, Each
200	Brach Vacuum-Gap Protectors for inside use	$2.00
223	Brach Vacuum-Gap Protectors for outside use	2.50
	Replacement Tube only for above	1.75

FAHNESTOCK IMPROVED GROUND CLAMP

FOR RADIO USE ONLY

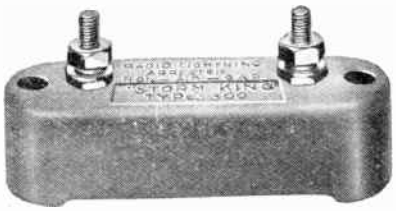


No. A

Made from soft copper ⅝-inch wide with a phosphor bronze spring binding post, also a screw and nut attached.

No. "A"—For ⅜ to 1-inch pipe to take No. 10 B. & S. wire. Price, each 10c

STORM KING ARRESTER



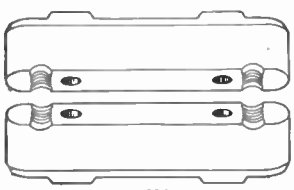
STORM KING

The Storm King Arresters are made and designed by the engineer of the S. S. Brach Manufacturing Co., makers of the famous Brach Protector. A very efficient and economical arrester.

Storm King.....Price, each, $1.00

PORCELAIN TUBES

Description	Price, Each
Porcelain Tube, 5/16x3 inches	$0.05
Porcelain Tube, 5/16x4 inches	.08
Porcelain Tube, 5/16x6 inches	.11
Porcelain Tube, 5/16x8 inches	.15



No. 334

PORCELAIN CLEATS AND KNOBS

No.	Description	Price, Each
334	Regular Two-wire Porcelain Cleats	$0.06
	Nail-it Knobs	.08

AERIAL INSULATORS

No. 1107

No. 4500

No. 4502

No. 4507

These insulators will stand considerable tension, are unaffected by ordinary degrees of heat, cold, moisture and acids, and have the highest insulating properties. Numbers 1107 and 4500 are the most popular types for small amateur aerials.

No.	Diam., Inches	Length of Body, Inches	Diam. of Opening of Eye, Inches	Overall Length, Inches	Electrical Value Dry, in Volts	Electrical Value Rain, in Volts	Net Weight, Each	Price, Each
1107	1 1/8	2	1/4	3 1/2	40,000	10,000	2 oz.	$0.15
4500	2 1/8	1 3/4	1/4	3 1/4	40,000	25,000	5 oz.	.40
4502	1 1/2	2 1/2	1/2	4	40,000	12,000	9 oz.	.50
4507	1 1/2	7	5/8	10 1/2	90,000	55,000	1 lb.	.90

PORCELAIN AERIAL INSULATORS

No.	Description	Price, Each
500	Strain Insulator	$0.15
8184	Strain Insulator	.12

ELECTROSE LEADING-IN CONNECTORS, ROD TYPE

These insulators are used in leading the aerial wires through the walls of a building. Perfect insulation is absolutely necessary at this point where long distance transmission or reception of messages is an object. They are made of Electrose, which is the very best insulating material.

No.	Length of Body in Inches	Overall Length	Diameter of Rod	Electrical Value Dry, in Volts	Electrical Value Rain, in Volts	Net Weight, Each	Price, Each
6833	5 7/8	7 7/8	5/16	30,000	15,000	13 oz.	$4.00
6815	6 1/4	9 1/4	1/2	50,000	20,000	2 lbs.	5.60

ELECTROSE LEAD-IN BUSHINGS

These bushings are used where it is desired to lead the antenna lead-in directly into the house without cutting the wire.

No.	Overall Length	Outside Diameter Inches	Diameter of Hole	Electrical Value Dry, in Volts	Electrical Value Rain, in Volts	Net Weight, Each	Price, Each
6204	4 1/16	2	1/4	40,000	20,000	8 oz.	$2.00
6206	6 1/4	2 1/2	1/2	50,000	20,000	1 1/2 lbs.	4.00

SPAGHETTI

No.	Description	Price, Each, Per Length
205	1/16-inch, Yellow, 2-foot lengths	$0.10
205-A	1/16-inch, Black, 2-foot lengths	.10
206	3/16-inch, Yellow, 2-foot lengths	.10
206-A	3/16-inch, Black, 2-foot lengths	.10

SHEET COPPER TERMINALS

Illustrations, actual size

No. 21

No. 22

No. 19

No. 35 N.P.

No. 32

In selecting this line of merchandise we have endeavored to include a complete list of terminals suited for radio purposes.

No.	Description	Price, per 100
19	Sheet Copper	$0.55
21	Sheet Copper	.55
22	Sheet Copper	.60
32	Sheet Copper	.75
35	Nickel-plated	.50

FORMICA

Made from Anhydrous Bakelite Resins
SHEETS TUBES RODS

Formica is unaffected by the weather, by oil or alkalies. It is chemically inert and extremely resistant to moisture. For these reasons its finish will remain unmarred and unaffected by conditions after long use.

Formica machines easily and encourages neat workmanship. It may be turned, milled, drilled, and tapped in any direction. When slightly heated, the grades used for radio may also be punched.

Formica has high tensile strength and is not brittle.

Formica for radio purposes is made of an especially prepared cotton rag paper, impregnated with a very high percentage of anhydrous Redmanol Resins. This gives it the utmost dielectric strength and insulation qualities. It is formed by presses into a solid rock in which the original limitations entirely disappear. It is somewhat harder than wood, but softer than steel in its final form.

STANDARD CUT SIZES

Size, Inches	Price, Each	Size, Inches	Price, Each
6x 7	$1.06	7x21	$3.45
7x 9	1.51	7x22	3.61
7x10	1.64	7x24	3.94
7x12	1.97	7x26	4.27
7x14	2.30	7x30	4.91
7x18	2.95	8x40	7.49

The above panel is $\frac{3}{16}$-inch thick supplied in black, walnut or mahogany.

No.	Description		
208	Full sheet 36x42x¼ inches (black only)	Per lb.,	$2.00
	Cut to size	Per sq. in.,	.03
209	Full sheet 36x42x$\frac{3}{16}$ inches (black, mahogany, walnut)	Per lb.,	2.00
	Cut to size	Per sq. in.,	.02
210	Full sheet 36x42x⅛ inches (black only)	Per lb.,	2.00
	Cut to size	Per sq. in.,	.015

FORMICA TUBING (NATURAL COLOR)

No.	Description	Price, per Foot	No.	Description	Price, per Foot
980	2½-inch (I-D)	$1.33	983	3½-inch (I-D)	$1.60
981	2¾-inch (I-D)	1.41	984	4 -inch (I-D)	1.69
982	3 -inch (I-D)	1.48			

CARDBOARD TUBING

No	Description	Price, Each
202	3 -inch (O-D)	$0.15
203	3½-inch (O-D)	.18
204	4 -inch (O-D)	.20

ROTOR BALLS

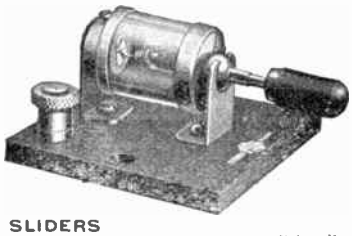
No.	Description	Price, Each
131	3½-inch Wood Rotor Balls	$0.50
012-B	Rotor Moulded, 3$\frac{1}{8}$-inch diameter	.75
012-B	Rotor Moulded, 3¼-inch diameter	.55
014-B	Rotor Moulded, 2¾-inch diameter	.65

CRYSTAL PARTS

FADA CRYSTAL DETECTOR STANDS

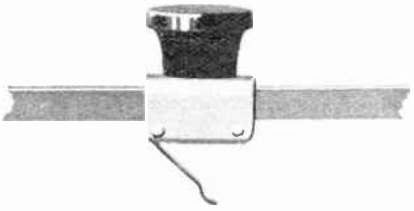
While it is obvious that the vacuum tube is now recognized as the best detector, the crystal detector, however, is still greatly used. Indeed, in many applications such as laboratory work and extremely portable receiving sets and wave-meters still use this type. The Fada Crystal Detector Stand is certainly convenient to operate. A ball-and-socket joint through which pass the rod varying the spiral contact-making spring, makes it possible to touch any part of the crystal. The crystal cup is designed to take the standard navy galena crystal, lastly the elements of this crystal detector are protected by a clear glass casing which excludes moisture and dust.

No. 102-A—Fada Crystal Detector..Price, each, $2.00



SLIDERS

No.		Price, Each
207-A	$\frac{3}{16}$-inch Sliders	$0.10
207	$\frac{1}{4}$-inch Sliders	.15



CRYSTAL CUPS

No. 133—Nickel-plated Crystal Cups with Set Screw. Price, each, $0.20

DETECTOR CRYSTALS

No. 134

The crystals for use in crystal detectors are of the highest quality, and have been thoroughly tested.

No. 134—Mounted Dutec Crystals.....Price, each, $0.30

CATWHISKERS

A small piece of phosphor bronze wire used with various crystals in the making up of crystal detectors.

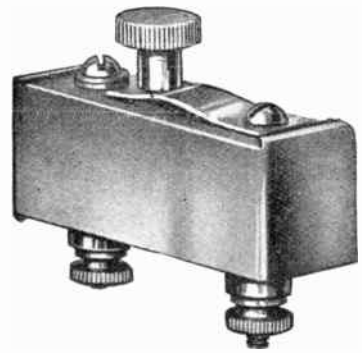
No. 135—Catwhiskers.....Price, each, $0.10

SENDING KEYS

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, and is designed to permit an operator to secure the utmost speed possible. The frame and other metal parts are brass, finely lacquered.

No. UQ-809 Key .....Price, each, $3.00

UQ-809



No. 178

HIGH FREQUENCY BUZZERS

This buzzer has been designed for laboratory and all radio circuits where pureness of tone, simplicity of adjustment and duration of operation are the essential features. An exceptional buzzer for wavemeter circuits.

No. 178—High Frequency Buzzer....Price, each, $2.00

RADIO BOOKS

FADA BOOK, "HOW TO BUILD A FADA NEUTRODYNE RADIO RECEIVER"

No. 183-A

A fifth, revised and enlarged edition of the Fada "How-to-Build-It" Neutrodyne book originally published during 1923 and early 1924. Over 165,000 copies of these first 32-page editions were sold.

The present revised edition is a 76-page book of which 38 pages and 44 illustrations cover in detail the assembly, wiring, neutralization and use of a five tube Neutrodyne receiver made by using Fada No. 169-A knock-down Neutrodyne receiver parts. In the rear of the book is a full sized paper panel drilling template and a practically full sized picture wiring diagram.

In addition, 29 pages and 28 illustrations of the book cover the general subject of "Troubles That May Be Experienced in Radio Receiver Operation and Their Remedies." The information given in this section is of value on any and all radio receiving equipment and this section alone is more than worth, to the radio experimenter or broadcast listener, the purchase price.

No. 183-A—Fada Neutrodyne Book ..... Price, each, $0.50

THE RADIO KEY BOOK

This big 48-page book of Radio Facts is useful to beginner and expert. Contains practical articles, tested "hook-ups" and hints on receiver construction. If you have not yet ordered your copy, do so now.

Radio Key Book ..... Price, each, $0.25

RADIO MAPS

Giving location and call letters of every Radio Casting Station in the United States, Canada, Mexico and Cuba, showing divisions of time.

Radio Maps ..... Price, each, $0.10

THE ACRE CABINETS

The Acre Cabinet is an exquisite piece of furniture. The solid mahogany used is finished a rich brown. It will add grace and charm to the most beautifully furnished home. No extra table is needed. Its convenient size, 16x14½x13½ inches, makes it possible to place it on a library table or small stand. The sloping panel makes for great ease of tuning. Ample space is provided for the radio receiver, four No. 6 dry cells for "A" battery, four medium size 22½-volt "B" batteries, and large "C" battery. The loud speaker is built in. No unsightly horn, batteries and radio set spread all over the table.

The Radiola-III with balanced amplifier exactly fits into the panel opening. The Radiola-III "A" fits the panel opening also, with the addition of two narrow mahogany panels. This latter set is usually supplied in conjunction with the Acre Cabinet. These sets are merely inserted into the panel opening. No tools, or fitting, are required.

The horn in the Acre Cabinet was developed by a prominent engineer who has had 15 years' experience designing phonograph horns and loud-speaking telephone equipment. It is acoustically correct. Its quality and volume are a revelation. It is made entirely of selected spruce, such as used in organ contruction. No metal whatever is used. The bushing at the small end will fit 95% of all loud speaker phone units. Adjustable phone units are easily accessible by lifting the cover.

Carefully selected solid mahogany is used in the Acre Cabinet. No plywood or veneered panel is used. All joints are glued and fastened with screws or cement-coated nails.

The Acre Cabinet with its Built-in Horn, but without phone unit.....Price, each, $19.50

THE TIMMONS "B"-LIMINATOR

WHAT IT IS

The Timmons "B"-Liminator replaces all "B" batteries. The function of the "B" battery has been to create what corresponds to an electrical vacuum on the plate of your tube. To do this, high voltages are required, from 22½ and sometimes less on detector tube, up to 135 volts on amplifier tubes. The filament of your tube gives off electrons which are drawn by the plate of your tube very much as a magnet draws steel filings. The whole affair is one of extreme balance and sensitivity.

How to make available the electric house current to supply this plate voltage, with proper regulation for the tubes, has been the problem worked on by many engineers for a long time.

The Timmons Laboratories have at last solved this with the "B"-Liminator, which supplies direct current, corresponding to that of "B" batteries. In practically all homes, alternating current (110 volts, 60 cycle) is used for lighting, and it was necessary to change this into direct current for proper results.

The Timmons "B"-Liminator is small, measuring 8 inches high, 6¾ inches deep, and 2½ inches across. It weighs 5¼ lbs.

The Timmons "B"-Liminator.....Price, each, $35.00

HOW TO GET THE MOST OUT OF YOUR "B" BATTERY

A "B" battery is the most convenient source of energy for the plate circuit of a radio set. It supplies all the energy directly responsible for the sounds produced by the headphones or reproducer. The greater the volume produced by the radio set the greater the amount of energy used from the "B" battery.

The life of a "B" battery is determined by its quality, its size, the use to which it is put, and the volume you wish to secure.

If you are satisfied with less volume your batteries will last you much longer. Also the shorter the period in which you use your set the greater number of the opportunities the "B" battery has to recuperate, which circumstance greatly lengthens the life of the battery. Great care should be exercised in hooking the battery up to the set as an accidental short circuit will drain large quantities of energy from the battery which it cannot regain. Likewise the use of an ammeter in testing the battery is not advisable, as the ammeter has such a low resistance that it constitutes a short circuit. The ammeter does not show the amount of energy in the battery but only the amount which it may deliver for a very short time in a circuit of very low resistance. Just as an automobile battery which is capable of delivering several hundred amperes for starting is not the most efficient for radio use, it is not the battery giving the highest reading on the ammeter that will last longest. Similarly, the dry cell used by the telephone companies for long service in circuits where the current used is small is different from the hot ignition battery, the latter often giving a reading on an ammeter 15 amperes higher than the former, although the former has been found to last almost twice as long.

The life of a "B" battery may be lengthened greatly by the use of a "C" battery. This small battery cuts the useless flow of current to a minimum without cutting the volume of signals.

The use of a "C" battery is often necessary for the satisfactory operation of a radio set. It will often increase the volume available without distortion. In radio frequency circuits it is usually not necessary to use more than 45 volts of "B" battery. No appreciable increase in volume will be noticed when 67½ or 90 volts are used, while the amount of current used will often be four times the current used at lower voltages.

The battery with the largest cells is always the most economical in the long run. For example the energy in a No. 763 Eveready Midget "B" battery costs four times as much as the same amount when purchased in a No. 766, the latter being cheaper to build per unit of energy.

LOOP ANTENNA WITH 3-STAGE RADIO AND 2-STAGE AUDIO FREQUENCY AMPLIFIER

Fig. 1 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 almost non-existent, 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.

The loop should be shunted by a variable condenser having a capacity of .0004 to .0006 mfd.

With this arrangement, the incoming signals are of an intensity slightly greater than is obtained with an ordinary outdoor 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 very materially reduced.

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 of operation.

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 5,000 to 25,000 meters. The length of the case of the UV-1716 is 2 inches, or ½ inch longer than the UV-1714.

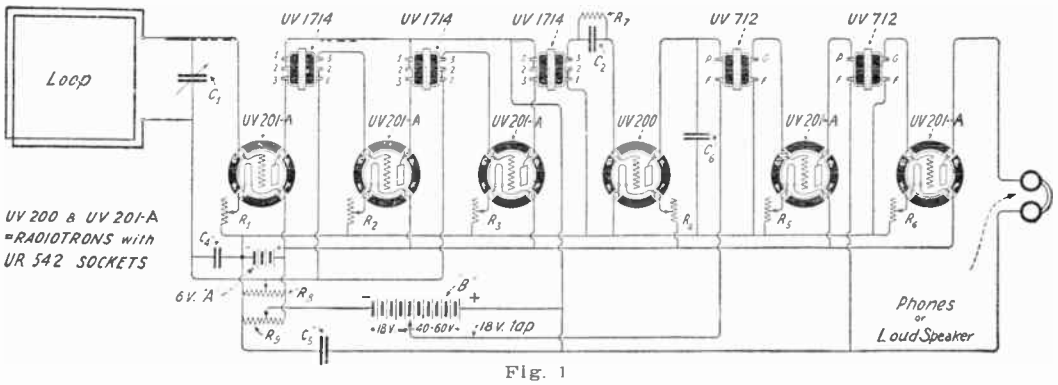


Fig. 1

A—Storage battery (6 V-120 ampere-hour capacity).
B—Standard 22.5 volt plate batteries with 18 volt tap.
C1—Variable loop tuning condenser UC-1820 .0006 mfd. max.
C2—Grid condenser (fixed or variable) .00025 mfd., UC-567, with mounting UX-543 or UC-1820.
C2—(Not shown in diagram) .0025 mfd. UC-570 with UX-543 mounting, may be connected across head phones when used. The use of this condenser is optional.
C4, C5, C6—.005 mfd. condensers, fixed.
Loop Antenna.
R1, R2, R3, R4, R5, R6—Standard filament rheostats PR-535.
R8, R9—Standard "A" Battery potentiometer PR-536.
R7—Standard grid leak. .5 to 2 megohms, UP-516, 519, or 523, with UX-545 mounting.

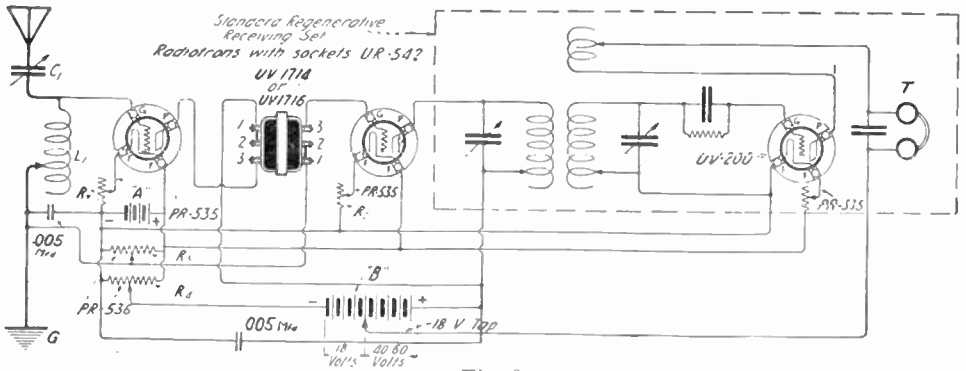
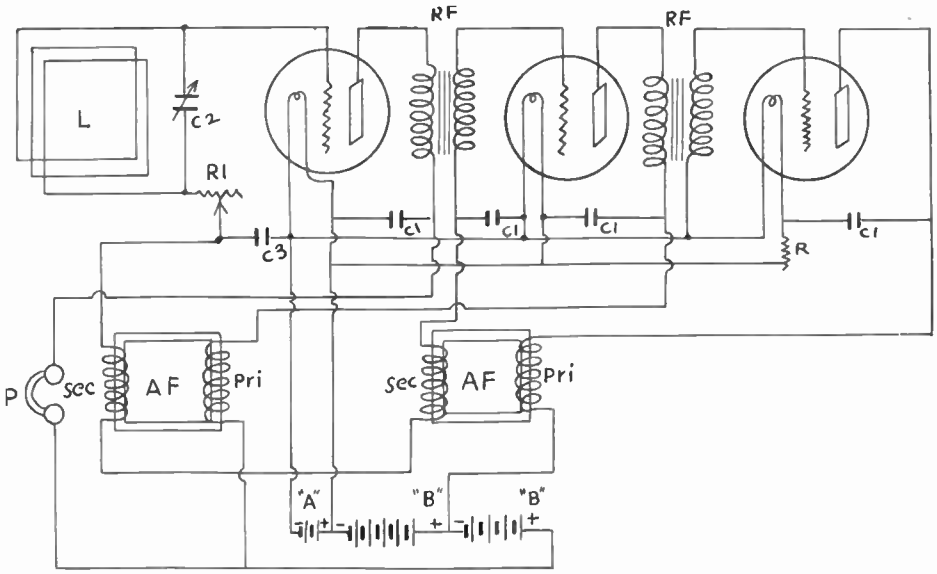


Fig. 2

"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.).
L1—Simple tuning coil, either tapped or fitted with a slider.
R1, R2—Standard filament rheostats, PR-535.
R3, R4—Standard "A" battery potentiometers, PR-536.

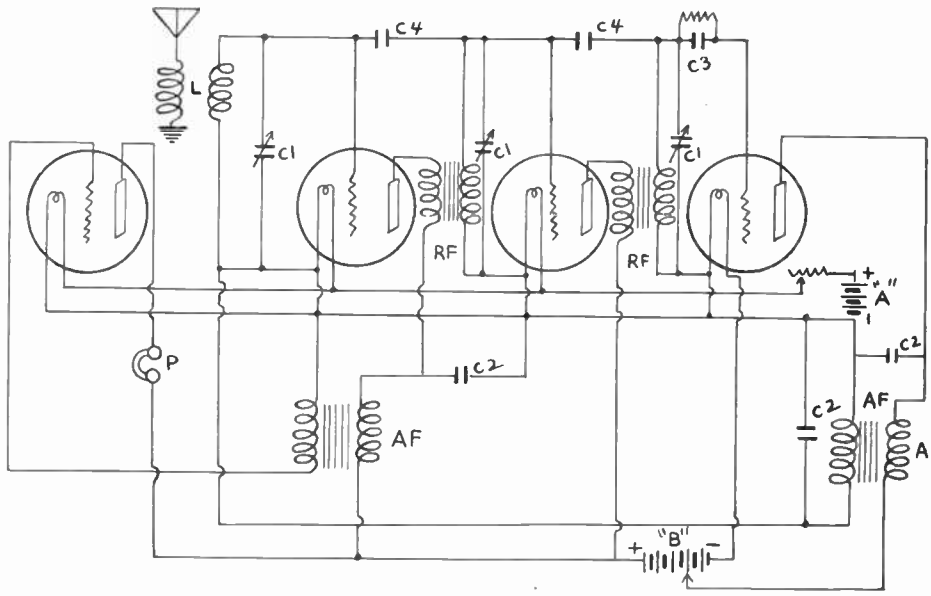
NOTE—The circuit within the dotted lines is a standard regenerative circuit.

REFLEX CIRCUITS



C1—No. 601 Micadon condensers, .001.
C2—23-plate variable condenser vernier.
C3—No. 601 Micadon condenser, .00025.
L—Loop aerial.
R—Rheostat.
R1—400-ohm variable resistance.
P—Brandes head set.
AF—R. C. A. audio frequency transformers.
RF—R. C. A. radio frequency transformers.
A—"A" battery.
B—"B" battery, 22½ volts.

REFLEX NEUTRODYNES



L—Remler vario-coupler with dial.
C-1—23-plate variable condensers with vernier .0005 mfd.
C2—No. 601 Micadon condensers, .001 mfd.
C3—C. R. L. variable grid leak and condenser.
C4—Fixed condensers, approx. .000015 mfd. (neutralizing capacities).
AF—R. C. A. audio frequency transformers.
RF—R. C. A. radio frequency transformers.
R—Vernier rheostat.
A—"A" battery.
B—"B" battery.

SUGGESTIONS TO AMATEURS

Few people realize that within the last few months, practically all of the large manufacturers of radio apparatus have started a free broadcasting service which transmits from various stations the news of the day, speeches by prominent persons, sermons, operas and popular music. By the installation of the correct radio-phone receiving set, these speeches, sermons, operas and popular music may be received in your own home as loudly as on a phonograph, provided a loud speaker is used. When a loud speaker is not purchased, a telephone head set may be used; and while, of course, with telephone head sets only one of two persons may listen at a time, the speeches and music will be received perfectly.

With this recent development, there has been much misunderstanding, both among dealers and consumers, of what Radio-phone Receiving Sets would actually do. Many consumers have been sold sets that are absolutely unsuited for their particular conditions. In the following article, we will endeavor to explain in a non-technical way just what the Radio-phone will do and what should be purchased to accomplish given results.

WHAT RADIO-PHONE RECEIVING SETS WILL DO

The proper receiving set will receive loud, clear speech, maintaining all voice characteristics. The individual voice characteristics are maintained to a much greater degree than through any ordinary telephone, permitting immediate identification of the speaker and also permitting the conveyance of the true intent of the message through voice inflection.

Messages can be received over land, water, mountains or valleys. There is no character of topography which will not permit the Radio-phone Receiving Sets being used although, of course, the distance from which messages can be received by a given equipment is affected by the topography. They will receive through sun, rain, fog or other atmospheric conditions, except for short periods when static interferes, the duration of which depends upon the particular locality and the season of the year. The static interference is a variable factor but, in general, messages can be received at least 99 per cent of the time. Messages will be received stronger in winter time than in summer time, and also stronger at night than in the day, because the light rays tend to neutralize the wave currents.

The services of an expert or a license are not required to operate the ordinary Radio-phone Receiving Stations. Anyone, with a few hours' practice, can receive Radio-phone messages and music perfectly.

The necessary requirements for a Receiving Station are as follows:

THE AERIAL OR ANTENNA

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. 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 the 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 sendings 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 360 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 wave length is, can by the use of loading, duo-lateral or honeycomb coils have their wave length increased to any desired point to receive signals from stations transmitting on a greater wave length. Many amateurs confuse wave length with distance, and it should be distinctly understood that wave length has nothing to do with the distance that a set will receive. Most small assembled crystal detector sets may by the addition of a coil of the necessary capacity be made so that they will receive signals from stations operating on a higher wave range than could normally be received. They would not, however, receive these signals from a greater distance than they would receive low wave length signals, provided, of course, that both stations operate on the same power. Naturally, you will receive signals from a high-powered station for a further distance than you would from a low-powered station.

Insulation is of utmost importance. Leakage of current through faulty insulation means a large loss of power. If this leakage is large the aerial circuit will not operate, and it will be impossible for the station to receive any messages.

The height of the aerial is important. It should be located either on the roof, or as high as possible from the ground. This is particularly important where there are high buildings or high trees in close proximity. It should in all cases be higher than surrounding buildings and trees to secure the best results.

Where the aerial is erected over a tin or metal roof it is desirable to have it at least 8 to 10 feet above the roof.

It is impossible in the small space available to give data concerning "Transmitting Aerials." We have, however, a corps of experts who will be glad to give advice as to the best method of installing a transmitting aerial.

THE THEORY OF RADIO COMMUNICATION

The atmosphere is composed of atoms of oxygen, nitrogen, helium, and other gases, suspended in what the average individual terms "nothing," or a vacuum. This "nothing," however, is known to radio engineers as the ether. To this ether can be given a wave motion similar to that which occurs in water.

THE THEORY OF RADIO COMMUNICATION—CONTINUED

To transmit radio signals it is necessary, therefore, to first create waves in varying groups and of varying strength; and second, to intercept them with apparatus capable of changing them to sound waves.

To create the waves, it is necessary to have two surfaces separated by a distance of from ten to several hundred feet, and to create between them an electrical pressure which changes its direction (first toward one surface, then toward the other) hundreds of thousands of times a second. It is the common practice to use the ground for one surface and provide another surface by erecting a structure composed of one or more wires, insulated from the earth and suspended many feet above it. Between these, by means of suitable transmitting equipment, we create an electrical pressure of from one to twenty thousand volts, which starts waves radiating out in all directions.

These pressure waves are, however, only part of a radio wave. From any wire in which current is flowing are radiated electromagnetic waves, and radio waves are made up then of both electromagnetic and pressure (static) waves.

The creation of these waves may be compared to the action of hurling a large rock into a pool of water. The amperes of current put into the antenna correspond to the size of the rock, while the volts of electrical pressure are equivalent to the force with which the rock is hurled. The larger the rock, and the greater the force behind it, the bigger the splash and consequent waves. The more amperes of current flowing in the antennae circuit, and the greater the pressure (volts) between antenna and ground, the stronger the waves radiated.

These radio waves have similar characteristics to another class of waves—sound waves. When the note C is struck on the piano, the sound waves vibrate 256 times per second, and either a C tuning fork or a wire tuned to C, and in the immediate vicinity, will vibrate 256 times per second also. The two wires are said to be in resonance. The waves radiated by a radio transmitter always have a definite number per second, and in order to hear a station the receiving equipment must be put in resonance with the waves radiated by the transmitter. This operation is known as tuning.

EXPLANATION AND USE OF RADIO APPARATUS

As explained in the foregoing paragraphs, it is necessary to put into the antenna as much current (amperes) as possible at high voltage (pressure) and a high frequency. By high frequency is meant that the current changes its direction of travel in the wire from several thousand to several million times a second. The trend of popular use is toward what are known as continuous wave (C. W.) and modulated continuous wave (M. C. W.) transmitters, so we will not, in these pages, touch on spark transmission.

For continuous wave (C. W.) and modulated continuous wave (M. C. W.) we use, to generate the waves, what are known as vacuum tubes of large size. Their construction and theory are outlined on the opposite page. By means of these tubes we create vibrations of current in a circuit in which are a coil composed of a single layer of wire, and an instrument called a "condenser." The coil of wire provides "inductance" and the condenser provides "capacity," these two factors being necessary to a vibrating circuit. A condenser is always made up of sheets of brass, aluminum, copper or tinfoil, separated by sheets of insulating material, such as paraffined paper, glass or mica, or by air. Between the sheets of metal there is created a static pressure similar to that occurring in the antenna circuit, as explained above. To control the vibrations in this circuit, and, in turn, the waves radiated from the antenna-ground circuit, we employ either a key or a microphone transmitter into which one talks. The latter, of course, permits of transmission of the human voice.

When purchasing transmitting equipment, the assembler finds it necessary to buy four principal parts—vacuum tubes, inductance coils, condensers, and either a key or microphone. These are the essentials, and, in addition, there must be numerous controls of current, controls of the tubes, controls of the vibration—so much for transmitting apparatus.

For receiving, four essentials are necessary. Coils (inductance) and condensers (capacity) for tuning, a "detector" and telephone receivers. A detector is essential, because the human ear is not responsive to vibrations above a few thousand per second. The detector changes the high frequency current to impulses traveling in one direction in the circuit to the number of 100 to a few thousand per second. There are two types of detector in use today. One is known as a "crystal" detector, the other as the "audion" or "vacuum tube" detector. It was found early in radio work that certain minerals contained the property of permitting current to pass in one direction but not in the other, and were, therefore, well suited to radio work. Galena, silicon and carborundum are the names of three of the crystals used. The vacuum tube is described in the following paragraph. The purpose of the head receivers is to change the impulses of direct (one-way travels current to sound waves which can be heard. As with transmitting sets, there are numerous controls of inductance, capacity, tubes and currents necessary.

THE THEORY AND USE OF THE VACUUM TUBE

The audion, or vacuum tube, is the most interesting instrument which has been developed during the progress of the radio art. It is one of the most sensitive instruments known to science yet it does not require more than an elementary knowledge to use it in radio reception. The vacuum tube consists of a glass bulb, similar in shape to an electric lamp, evacuated to a high degree, and containing three elements—the filament, the plate and the grid. The filament is a piece of high-resistance wire which is heated by current to brilliancy, as in an electric light. When this filament is heated it throws off millions of little electrical units known as negative ions. Around the filament is constructed a small sheet of metal (the plate) to which the ions can go, and so return to the circuit. Ions can travel only from the hot filament to the comparatively cold plate, and cannot reverse and go the other way. It is this property which is utilized when employing the vacuum tube as a detector for changing the radio waves of vibrating current into direct-current impulses. It is necessary to have some means of controlling the number of ions which reach the plate, and for this the "grid" is inserted. The grid consists of a closely wound spiral or finely woven screen of wire surrounding the filament, and through which the ions must pass to reach the plate. Interposed in the path from filament to plate, any electrical charge put upon it from the antenna circuit will either increase or decrease the ions reaching the plate and the current through the head receivers.

Another characteristic of the vacuum tube is utilized when the tube is employed as an amplifier of signal strength. A tube, when properly connected, will not change the form of signals passing through it, but will add current, from a battery connected in one of the circuits, to the signals, making them much louder when passed through head receivers or a loud speaking horn.

The vacuum tube is used in yet another way for transmitting. In receiving, we change the incoming high-frequency currents to direct current. For transmitting, we reverse the procedure, and use large tubes to change 350, 500, 1,000 or 2,000 volts direct current into alternating current, vibrating at radio frequencies of 50,000 to 200,000 per second.

When purchasing parts, always bear these facts in mind: You are handling minute currents. Every bit of energy must be put to useful work. Each additional instrument means additional loss of current. Make sure that you have nothing which is not absolutely essential to the circuit. Do not sacrifice for flexibility of control. Simple sets are easier to handle and less liable to cause trouble by going out of order than complicated apparatus.

DIRECTIONS FOR CHARGING STORAGE BATTERIES

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 Discharged.

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. Incandescent lamps are convenient for this purpose, when direct current is available. When only alternating current supply can be procured it is necessary to use a Tungar 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 decreased in proportion.

RADIOTRON UV-200 VACUUM TUBE DETECTOR FOR AMATEUR AND EXPERIMENTAL WIRELESS STATIONS

Radiotron UV-200 is a vacuum tube in which quality is the predominating factor. UV-200 was designed specifically for the amateur. It is a product of the great Research Laboratories of the General Electric Company. For the first time the experimenter has at his disposal a supersensitive detector tube which will operate from one standard plate battery. This tends toward economy, and eliminates one of the objections to former types of tubes, some of which required from three to five standard plate batteries to furnish the requisite plate voltage.

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 in the range, 5 to 5.4 volts.

Note that the normal filament current of Radiotron UV-200 is approximately 1 ampere, the maximum allowable current being about 1.1 amperes.

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

RADIOTRON UV-201-A VACUUM TUBE FOR RADIO AND TONE FREQUENCY AMPLIFICATION

Complex amplifying circuits for the magnification of radio and audio frequency currents require an amplifying Vacuum Tube of rigid operating characteristics. There is an increasing demand among radio experimenters for a vacuum tube amplifier which will magnify the telephone currents in a radio receiving set, and which can be shifted from one socket to another in a cascade outfit without loss of signal audibility. Moreover, the amplifier must be free from the tube "noises" accompanying the use of improperly designed vacuum tubes.

Radiotron UV-201-A of the new series of Vacuum Tubes designed by the engineers of the Research Laboratory of the General Electric Company for the Radio Corporation, possesses the qualifications outlined above, and it should be a part of every experimental radio receiving station. UV-201-A may be used as a detector, or as an audio frequency or radio frequency amplifier.

In cascade radio frequency amplifying circuits, UV-201-A can be adjusted to magnify without distortion. The use of such circuits is on the increase in amateur stations, particularly where long-distance communication is desired on short wave lengths (600 meters or less).

The normal plate voltage of Radiotron UV-201-A is 40 volts, although increasing amplifications can be obtained at plate voltages up to 100. At 40 volts on the plate, the amplification constant varies from 5.5 to 7.5; at 100 volts on the plate, from 6.5 to 8.5. The output impedance varies from 20,000 ohms at 40 volts, to 14,000 ohms at 100 volts plate potentials. The normal filament current for Radiotron UV-201-A is approximately ¼ ampere.

To obtain maximum amplification with UV-201-A, means should be supplied for placing negative potentials on the grid, although good amplification may be secured without any special provision for such potentials. The requisite negative grid potential for the use of UV-201-A in amplification circuits can be secured by connecting a standard "C" battery of two or three volts in the grid circuit, shunted by a 200 to 400-ohm potentiometer; or by connecting the filament resistance in series with the negative terminal of the filament and connecting the "low potential" terminal of the tuner secondary to the negative pole of the battery. The latter method will give a negative grid bias of about 1 volt.

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.

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 load 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.

SAFETY GAPS AND GENERAL PROTECTIVE MEASURES

In 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 Radiotron power tubes ultra high frequency oscillations develop in the plate and grid circuits, 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.

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 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 amplifier. 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 current 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.

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 tubes to one-fourth, whereas, by operating the filament at 95 per cent. 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 any 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 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 will increase their life in the ratio of three to one.

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 key in series with the grid leak resistance.

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.

TENTATIVE UNDERWRITERS' RULES FOR ANTENNA CONSTRUCTION

RULE 86—NATIONAL ELECTRICAL CODE

Specifications (For Receiving Stations Only):

ANTENNA.—a. Antenna outside of buildings shall not cross over or under electric light or power wires of any circuit carrying current of more than six hundred 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.

Antenna should 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.

Antenna installed inside of buildings are not covered by the above specifications.

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 gauge except that approved copper-clad steel not less than No. 17 B&S gauge may be used.

LEAD-IN WIRES.—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 building 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 gauge, and if approved copper-clad steel it should not be smaller than No. 17 B&S gauge. 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 incasing wires to comply with this rule.

RECEIVING EQUIPMENT GROUND WIRE.—f. The ground conductor 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.

Regulations covering sending stations have also been drawn up and copies may be secured from the National Board of Fire Underwriters.

INSTRUMENT GROUND CONNECTION

Every outfit, in addition to having an antenna connection must have an instrument ground connection. This ground connection should not be confused with the protective or lightning ground. This connection can be made to a water pipe or steel radiator pipe by a suitable ground clamp. Care should be taken to scrape off any paint or corrosion outside of the pipe before installing the ground clamp. It is recommended that No. 14 wire be used for the ground, and the connection to the ground clamp be soldered, if possible.

ASSEMBLED CRYSTAL RECEIVING SETS

Many misunderstandings and much annoyance has been caused by the fact that sometimes small assembled crystal receiving sets have been sold with the understanding that they would receive music and voice distinctly from broadcasting stations located in some cases as far as 100 miles away. This they absolutely will not do. They never can be used satisfactorily for the reception of music and voice from broadcasting stations located over 25 miles away; in fact, under certain conditions, particularly where there are a large number of high steel buildings near by, small crystal receiving sets will not operate satisfactorily over 15 miles from broadcasting stations. On assembled crystal receiving sets there is nothing required beyond the receiving set, a pair of telephone head receivers, the antenna, and ground equipment. There are no batteries used, and there is nothing to get out of order or be renewed, with the exception of the crystal, which costs very little.

Amplifying units can be used in conjunction with crystal receiving sets, but when amplification is desired it is more practial to use a Vacuum Tube Detector Set.

ASSEMBLED VACUUM TUBE RECEIVING SETS

The assembled sets using vacuum tube detectors, of which there are many styles and types listed in this catalog, are by far the most satisfactory receiving sets for general use, and while they are considererably more expensive than the lower priced crystal sets, they have many advantages which offset by far their additional cost.

Amplifying units can be used in conjunction with all receiving sets using vacuum tube detectors. When a loud speaker is used it will be found necessary in most cases to use 2 stages of amplification.

AMPLIFYING UNITS

Several different types of amplifying units are listed in this catalog and they will all give satisfactory results when properly used. When amplifying units are used with vacuum tube detector sets, the same storage and "B" batteries that are used with the vacuum tube detector may be used with the amplifier. A 45-volt "B" battery is usually used on each stage of amplification. Sometimes it is claimed that better results are obtained by using two "B" batteries connected in series on each stage of amplification. This, however, is a matter that can best be decided by individual experiments. When using more than one stage of amplification, the same "B" batteries can be used for all stages. Under no conditions should more than 30 volts be used on the plate of a UV-200 Detector Vacuum Tube.

Amplifying units use Amplifier Vacuum Tubes, Cat. No. UV-201-A.

IMPORTANT NOTE.—Batteries must be kept charged, for when discharged below certain limits no Receiving Set will operate.

LOUD SPEAKERS

There are several makes of "Loud Speakers," shown in this catalog, all of which will be found to operate with satisfaction when properly used.

The Magnavox Loud Speakers employ a special movable coil in the base which requires a battery to be used in conjunction with it. They are made for use in large rooms, stores and other places where there is considerable open space. They are made in two types; one with a 14-inch horn for large rooms and medium sized stores, and one with a 22-inch horn for use in auditoriums and churches.

The Western Electric Loud Speaker is of the balanced armature type, and is particularly desirable where great volume of sound is advantageous.

HANDY DICTIONARY OF COMMONLY USED RADIO TERMS

ACOUSTIC. That which pertains to sound.

ACOUSTIC WAVES. Commonly called Sound Waves. Waves due to the expansion of a solid, liquid or gas after a temporary compression. Propagation of sound through water depends on this class of wave, hence the name. In air, their velocity is 1090-1132 feet per second at 075° Fahr.

AERIAL. That part of an antenna system composed of one or several wires suspended above ground and insulated from all surrounding objects. Used to facilitate generation of ether waves for radio transmission or absorb same for reception.

AERIAL INSULATION. Insulation between aerial and its supports. Does not refer to any covering of the aerial wire, which is generally bare.

AERIAL SWITCH. A switch used to change over from transmission to reception, also called change-over switch.

AERIAL TUNING CONDENSER. Variable condenser in antenna circuit. Used to vary oscillation constant of antenna system.

AERIAL WIRE. Wire forming the aerial.

AIR CONDENSER. One having air as the dielectric.

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. Instrument for measuring current in amperes. It is connected in series with the circuit.

AMPERE. Unit of current. Is that current which, when passed through a certain solution of silver nitrate in water deposits .001118 gramme of silver per second. Flow of one coulomb per second. One ampere flows through one ohm when one volt is applied.

AMPERE-HOUR. Commercial unit of quantity. Is that quantity which flows in one hour through a circuit, carrying a steady current of one ampere.

AMPLIFIER. A device used to magnify small radio or audio frequency currents. Several of these devices may be used in series, making a two or multi-stage amplifier.

AMPLIFIER TUBE. A highly evacuated three element tube usually used in amplifier units.

ANTENNA. Complete aerial and ground connection.

ANTENNA CIRCUIT. Consists of aerial and earth connection, including all coils and condensers which may be between these, forming a direct path from aerial to earth.

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.

BUZZER. Similar to an electric bell with hammer and gong removed. Used to adjust receiving detectors by exciting the local detector circuit. Also used for tone or buzzer modulated transmission.

CAGE AERIAL. One consisting of a number of component wires held in position by hoop spreaders. Used during the war on naval vessels, because of the facility with which they could be replaced when shot away in battle.

CAPACITY. Power of containing. A condenser has unit capacity (farad) when a charge of one coulomb creates a difference of potential of one volt between its terminals. This farad, being too large for practical purposes, the microfarad (one millionth of a farad) is used.

CARRYING CAPACITY. Amount of current a conductor can safely carry without becoming unduly heated.

CASCADE. Term applied to a number of pieces of apparatus connected up in series.

CHOKE COILS. Coils wound to have great self-inductance. Usually wound over an iron core, composed of a bundle of wires, or laminated sheets, insulated from each other to prevent eddy currents. Their function is to check by re-actance the amount of current flowing in the circuit. The choking effect is called impedance.

CHOPPER. Another name for ticker or tone wheel.

CIRCUIT. The continuous path in which a current of electricity may flow.

CIRCULAR MIL. Is the diameter of the wire in .001 of an inch squared.

CLOSE COUPLING. Exists where primary and secondary of oscillation or receiving transformer are very close together when inductively coupled; or if direct coupled when a large proportion of the turns are common. Causes much mutual inductance.

CONDENSER. Two or more sheets of metal separated by an insulator called the dielectric, which form a collector of electrical energy.

CONTINUOUS CURRENT. Direct current, D. C. One flowing constantly and regularly in one direction.

CONTINUOUS WAVES. C. W. A Wave train whose amplitudes are constant. One having no damping. In practice is produced by an arc discharge in place of spark, also by an oscillating vacuum tube or H. F. alternator.

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."

CRYSTALS. Bornite, Carborundum, Copper Pyrites, Galena, Graphic Tellurium, Iron Pyrites, Nagyagite, Perikon, Silicon, Sylvanite, Tellurium, and Zincite. Used for rectification of detection of small radio frequency currents.

CRYSTAL DETECTOR. One depending upon the fact that certain combinations of metallic crystals or of crystals and metals permit a current to pass more readily in one direction than the other thus having a rectifying effect upon a train of oscillations, converting it into an intermittent direct current which may be made to work a sensitive telephone receiver.

CYCLE. The period in which the current starting from zero rises to the maximum in the positive direction and falls to a maximum in the negative direction, then returns to zero.

DAMPING. The dying down of amplitude in a train of waves. Due to radiation from the resistance of a circuit.

D. C. Abbreviation for Direct Current.

D. C. C. Abbreviation for double cotton covered.

D. S. C. Abbreviation for double silk covered.

DEAD BEAT. Instruments whose pointers move to their final position steadily without undue oscillation.

DECREMENT. Rate of damping. Natural log of successive current amplitudes in the same direction.

DIAPHRAGM. Thin disc in a telephone receiver unit which sets up the audible sound waves from vibrations caused by the periodic attractions of the telephone magnets.

DIRECT COUPLING. A coupling in which the inductance coils of both circuits are metallically connected. One in which all or part of turns are common to both circuits.

DIRECT CURRENT. Current flowing continuously in one direction. Continuous current.

DOUBLE POLE SWITCH. One which simultaneously makes or breaks two wires of a circuit.

ELECTRICITY. From Greek word "Elektron," meaning amber. One of the earliest known methods of producing electric charges was by rubbing amber with silk. The word was first used by Dr. Gilbert of Colchester, in the year 1600.

ELECTRON. Ultimate or final particle of negative electricity. An atom plus an electron is a negative ion. An atom minus an electron is a positive ion.

ELECTRON FLOW. The electron emission from a heated filament in the vacuum tube.

E. M. F. Electromotive force. Unit is volt, which is that electric pressure necessary to force a current of one ampere through a resistance of one ohm.

FADING. Phenomena causing distant radio signals to vary in intensity. Caused by atmospheric conditions.

FARAD. See Capacity.

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. The frame of wire or perforated metal plate placed between and insulated from the plate and filament of a vacuum tube. Also refers to leaden framework holding paste of storage battery plates.

GRID-LEAK. A very high resistance used in connection with the grid condenser and vacuum tube to allow negative ions collected on the grid to leak off to the filament.

GROUND. Earth connection.

GROUND CIRCUIT. One employing earth as one "wire." The earth is generally used for the negative or return side of a circuit.

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.

H. F. CHOKE. High frequency choke coil. Similar to choke coil, except with air core.

HENRY. Unit of Inductance. Is that inductance in a circuit when current is changing at rate of one ampere per second and producing a difference of potential of one volt across the inductance.

HORSE POWER. Power required to perform 550 foot-pounds of work per second. 746 watts equal one horse-power.

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 COIL. A coil of wire wound over a soft-iron core. See Choke Coil.

INDUCTANCE COIL. A coil of wire so arranged as to have a large amount of inductance. Also called Choke, Reactance, or Retardation Coil.

INDUCTION. The transfer of electric or magnetic energy from an electrified body by proximity without contact.

INSULATOR. A material through which electricity will only pass when under great pressure. In many cases, apparently, not at all.

KEY. The transmitting key is a switch by which the primary circuit of transformer may be readily and rapidly made and broken.

KILOWATT. One thousand watts. (Abbreviated K. W.)

LEAD-IN. That portion of the antenna circuit from aerial to instruments.

LEAD-IN INSULATOR. Any form of insulator used for passing down-leads of the aerial through the roof or walls of operating room.

LOADING COIL. An inductance coil used to artificially "lengthen" an aerial.

LOOP AERIAL. A large coil used in place of an antenna system to intercept radio signals.

MAGNET. A piece of iron or steel, having the power to attract other small pieces.

MEGOHM. One million ohms.

METRE. Fundamental unit of length in the metric system. Equal to 39.37 inches. Used in radio for the measurement of wave length or space covered by one cycle of transmitted electrical energy.

MICROFARAD. Mfd. Practical unit of capacity. One millionth of a farad.

MICRO-MICROFARAD. One millionth of a microfarad. Used for rating exceedingly small capacities for radio frequency circuits.

MICROPHONE. A sound magnifier or an instrument used in both wire and radio telephony to vary the current in circuit by means of speech.

MIL. Unit of small length, one one-thousandth part of inch.

MILLI-AMP. One-thousandth part of an ampere.

MODULATION. Variation of amplitude of radiated energy from a continuous wave sending station. May be done with buzzer, chopper, microphone, external oscillator, etc.

MOTOR GENERATOR. Consists of a motor directly coupled to and driving a dynamo.

NATURAL WAVELENGTH. Length of wave produced by aerial's own induction and capacity.

OHM. Unit of Resistance. A circuit has a resistance of one ohm when one volt is required to force a current of one ampere through it. Voltage divided by amperage gives ohms.

OHM'S LAW. Current in amperes is equal to pressure in volts, divided by resistance in ohms.

OPEN CIRCUIT. One whose extremities are not connected to each other. A battery is on "open circuit" when it is neither charging nor discharging, i. e., idle. Electrically incomplete.

OSCILLATING CURRENT. Alternating current having a frequency of hundreds of thousands, or even millions, per second.

PARALLEL. When two or more paths are open to a current, they are said to be in parallel. The term is more correctly used when the various paths are of nearly equal resistance.

PHASE. An alternating current is in phase when maximum E. M. F. and current are reached at same moment. Two things are in phase when they occur at the same time.

PLATE CIRCUIT. That circuit in a vacuum tube receiver in which the amplified current flows.

POTENTIOMETER. A device for tapping off any desired fraction of a voltage applied to its terminals. Distinct from an ordinary variable resistance, inasmuch as it is shunted across circuit whose potential it is required to regulate.

PRIMARY CIRCUIT. A circuit supplying current to another which is called the secondary circuit.

RADIATION. The energy in watts dissipated from an antenna system during transmission. Often incorrectly applied to the antenna current.

RADIATION RESISTANCE. The total resistance of the antenna system, including the direct current resistance and A. C. impedance. The factor determining the radiated current.

RADIO-FREQUENCIES. Frequencies higher than audio-frequencies, that is, over ten thousand cycles per second.

RADIO-TELEPHONY. Transmission of speech by means of electromagnetic ether waves.

REACTANCE. The impedance, experienced by a current in a coil of wire other than the ohmic resistance due to that current acting back on itself by induction.

RECTIFIER. An apparatus which converts alternating current (A. C.) into pulses of direct current (D. C.). Tungar, Rectigon and Kenotron apparatus are employed for rectifying purposes. Certain metallic crystals also have rectifying action when used as detectors in radio reception.

RESISTANCE. The inherent opposition a conductor offers to the flow of an electric current. The unit is an ohm which allows but one ampere to flow when one volt is applied.

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 used in series to vary current flowing in a circuit.

SELECTIVITY. Having the power of selecting any particular wave length from a number, to the exclusion of the others.

SERIES. A number of instruments or cells connected up in a circuit so that the current must pass through each conductor successively.

SHARP TUNING. Exists where a very slight alteration of the tuner produces a marked effect in the strength of received signals.

SHORT CIRCUIT. One having a very small amount of resistance.

SLIDER. The sliding contact used for varying amount used of an inductance, resistance coil or potentiometer.

SLIDING INDUCTANCE. The variable inductance in the closed oscillatory circuit used to make final slight adjustment to the required frequency of that circuit.

S. C. C. Abbreviation for single cotton covered.
S. S. C. Abbreviation for single silk covered.

TELEPHONE RECEIVER. An instrument having a disc of soft iron (diaphragm) held over and near to an electromagnet, whose windings are such that very weak electric currents will cause disc to be actuated. Attraction and retraction of this diaphragm producing audible sound waves. Those used in radio generally have a permanent steel magnet with projecting soft iron pole pieces, which serve as the cores of the electro-magnets. Thus the diaphragm is always slightly attracted and even a weak current passing through the windings will cause a considerable vibration to be set up.

TELEPHONE CONDENSER. A small capacity condenser used to by-pass radio frequency currents around the telephone receiver.

THERMO-AMMETER. One in which current to be measured is caused to heat the junction of a thermo-couple, the voltage so generated indicating strength of passing current. Should not be confused with Hot Wire Ammeter, which are much less reliable or efficient.

TRANSFORMER. An instrument similar in action and construction to an induction coil, inasmuch as there are two separate coils, one having few turns and the other many turns, placed close together to permit of induction and having a common laminated core. No core is used when employed to transform radio frequencies.

TUNER. An instrument capable of various adjustments of inductance and capacity in the receiving circuit, thus permitting the reception of widely varying wavelengths.

TUNING COIL. An inductance coil used to "tune" a circuit in order that it may respond to oscillations of various frequencies.

UNDAMPED. A train of oscillations of constant amplitude. Having no damping.

VACUUM TUBE. A device composed of cathode (filament), anode (plate), and grid, enclosed in a highly evacuated glass tube. Operates as a rectifier, amplifier or detector of small alternating currents when the cathode is heated and the correct potential applied between the cathode and anode. For detection, the bulb usually has small gas content which increases the sensitivity.

VARIO-COUPLER. Term broadly applied to any device for regulating the amount of energy transferred from one circuit to another by alternating the degree of coupling between these two circuits. Circuits may be either direct or inductively coupled.

VARIOMETER. A continuously variable inductance made by revolving a coil within another about a diametial axis of both.

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. That electric pressure which steadily applied to a resistance of one ohm allows a current of one ampere to pass.

VOLT-METER. Instrument for measuring voltage of circuit. Connected across mains.

WATT. Unit of Electric Power. To find power, multiply voltage by amperage. Kilowatt equals thousand watts, 746 watts are one electric horsepower.

WATT-HOUR. Commercial unit of electric work. Is work done in one hour by current of one ampere flowing between two points of a conductor having a difference of potential of one volt.

WAVELENGTH. Distance between two successive antinodes in same direction. An antenna tuned to receive is determined by the length of antenna circuit and loading inductance capacity.

WAVE-METER. A variable tuned circuit consisting of inductance and capacity in series with an indicating device to show resonance with an excited circuit. Calibrated in meters or cycles (frequency) for determination of transmitted wavelength of a sending station.

INTERNATIONAL MORSE CODE AND CONVENTIONAL 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 À (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) • • • — • —

INTERNATIONAL RADIOTELEGRAPHIC CONVENTION

LIST OF ABBREVIATIONS TO BE USED IN RADIO COMMUNICATION

ABBREVIATION	QUESTION	ANSWER OR NOTICE
PRB	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? • • • — • for adjustment?	I am receiving badly. Please send 20. • • • — • 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.
QSG	.....	Transmission will be in series of 5 messages.
QSH	.....	Transmission will be in series of 10 messages.
QSJ	What rate shall I collect for.....?	Collect.....
QSK	Is the last radiogram canceled	The last radiogram is canceled.
QSL	Did you get my receipt?	Please acknowledge.
QSM	What is your true course?	My true course is.....degrees.
QSN	Are you in communication with land?	I am not in communication with land.
QSO	Are you in communication with any ship or station (or: with.....)?	I am in communication with..... (through.....).
QSP	Shall I inform.....that you are calling him?	Inform.....that I am calling him.
QSQ	Is.....calling me?	You are being called by.....
QSR	Will you forward the radiogram?	I will forward the radiogram.
QST	Have you received the general call?	General call to all stations.
QSU	Please call me when you have finished (or: at.....o'clock)?	Will call when I have finished.
*QSV	Is public correspondence being handled?	Public correspondence is being handled. Please do not interfere.
QSW	Shall I increase my spark frequency?	Increase your spark frequency.
QSX	Shall I decrease my spark frequency?	Decrease your spark frequency.
QSY	Shall I send on a wave length of..... meters?	Let us change to the wave length of..... meters.
QSZ	.....	Send each word twice. I have difficulty in receiving you.
QTA	.....	Repeat the last radiogram.
QTE	What is my true bearing?	Your true bearing is ..... degrees from .....
QTF	What is my position?	Your position is .... latitude .... longitude.

*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.

Radiotron Characteristics

Radiotrons	Output	Filament Circuit Data			Plate Voltage		Dimensions Overall		For Detection		Plate Impedance (Approximate) in Ohms	Amplification Constant (Approximate)	Mutual Conductance in Micro-Mhos.	Plate Current in Milliamperes (With Zero Grid)	
	Watts (Rated)	Battery Source Voltage	Filament Terminal Voltage	Filament Current	Detector	Amplifier Except Notes	Height Maximum	Diameter Maximum	Grid Leak Megohms	Grid Condenser Mfd.				Plate Voltage	Plate Current
WD-11	.....	1.5	1.1	0.25	20 to 45	40 to 100 see Note (2)	$3\frac{3}{16}$"	$1\frac{3}{16}$"	2 to 3	.00025	19,000 at 40 Volts 17,000 at 80 Volts	6.5	340*	20 40 80	0.3 1.2 3.9
WD-12	.....	1.5	1.1	0.25	20 to 45	40 to 100 see Note (2)	$3\frac{5}{16}$"	$1\frac{1}{4}$"	2 to 3	.00025	19,000 at 40 Volts 17,000 at 80 Volts	6.5	340*	20 40 80	0.3 1.2 3.9
UV-199	.....	4.5	3.0	0.06	20 to 45	40 to 100 see Note (3)	$3\frac{1}{2}$"	1"	†† 2 to 9	.00025	18,500 at 40 Volts at Zero Grid 16,000 at 80 Volts with minus 4.5 Volt Negative Grid	6.25	340*	20 40 60 80	0.25 1.1 2.4 3.9
UV-200	.....	6.0	5.0	1.0	15 to 23.5	.....	$\frac{45}{64}$"	$1\frac{3}{4}$"	$\frac{1}{2}$ to 2	.00025 to .0005	9,000	.....	.....	Detector: 0.25—1.0	
UV-201-A	.....	6.0	5.0	0.25	20 to 45	40 to 120 see Note (1)	$\frac{45}{64}$"	$1\frac{3}{4}$"	†† 2 to 9	.00025	16,500 at 40 Volts at Zero Grid 12,500 at 100 Volts with minus 6 Volt Negative Grid	8.0	485*	40 60 80 90 100	1.0 2.6 4.8* 6.0 7.5

NOTE 1

UV-201-A

Plate Voltage	Negative Grid Bias Voltage or "C" Battery
40	0.5 to 1.0
60	1.0 to 3.0
80	3.0 to 4.5
100	4.5 to 6.0
120	6.0 to 9.0

NOTE 2

WD-11 AND WD-12

Plate Voltage	Negative Grid Bias Voltage or "C" Battery
.....	.....
45	0
60	1.5
80 to 100	3.0
.....	.....

NOTE 3

UV-199

Plate Voltage	Negative Grid Bias Voltage or "C" Battery
.....	.....
40	0.5 to 1.0
60	1.0 to 3.0
80	4.5 to 6.0
100†	6.0 to 7.5

Note: These figures on Impedance, Amplification Constant, Mutual Conductance do not apply when tube is oscillating.

Note: All of above values are based on approximate averages taken over a long period of time. Individual tubes may vary somewhat from figures shown.

Note: The Amplification Constant in itself is not a direct measure of the amplification given by the tube. The mutual conductance more nearly represents the amplification given in ordinary circuits

* Mutual Conductance Values are at 40 Volts on Plate and Zero Grid.

† This voltage is not recommended for ordinary service. 80 volts (or four 22½ volt blocks) should not be exceeded except in very special cases.

†† A grid leak resistance between two and five megohms is satisfactory for average work. A resistance between five and nine megohms is somewhat better for very weak signals.

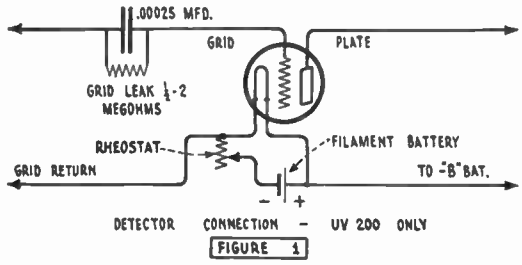
RADIOTRONS FOR DETECTION AND AMPLIFICATION

For the proper operation of Radiotrons as detectors it is of utmost importance that the various connections and the values of the apparatus be as shown in figure 1, and the accompanying table "Radiotron Characteristics." As shown in the diagrams, the grid return lead for Radiotrons UV-199, UV-200, UV-201-A, WD-11, and WD-12 connects with the positive side of the filament battery.

Another point of great importance is the value of the grid leak. For UV-200 the value is ½ to 2 megohms, for WD-11 and WD-12 it is 2 to 3 and for UV-199 and 201-A to 5 megohms is satisfactory for average work while 5 to 9 is somewhat better for detecting very weak signals.

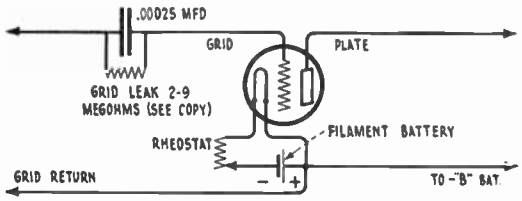
When Radiotrons are used as amplifiers small changes in the voltage of the signals as applied to them between grid and filament, cause large changes in the plate current, and in order to obtain faithful reproduction of voice and music, the grid at no time should draw any electron current. Should this occur, the plate current, during this interval would be less than normal, while during the remaining time it would be normal. Naturally, such an action would result in unfaithful reproduction or distortion. In order to obviate this, the grid must be maintained at a constant negative value in respect to the filament. This is known as biasing the grid. Where ½ to 1 volt negative bias is required (see notes 1, 2 and 3 on Characteristic Table), the connections should be as shown in Fig. 2. Where greater values are necessary a "C" battery is connected as shown in Fig. 3.

By consulting these diagrams, the accompanying text and the table of characteristics, the user is assured of the very finest results obtainable with vacuum tubes.



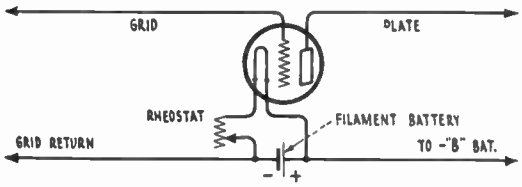
DETECTOR CONNECTION - UV 200 ONLY

FIGURE 1



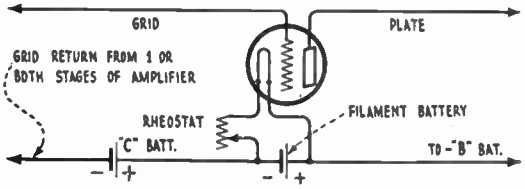
DETECTOR CONNECTIONS - WD 11, WD 12, UV 201 A, UV 199

FIGURE 2



EMPLOYING GRID BIAS AS OBTAINED FROM RHEOSTAT ½ TO 1 VOLT ONLY

FIGURE 3



EMPLOYING GRID BIAS AS OBTAINED FROM "C" BATTERY

FIGURE 4

SEE RADIOTRON CHARACTERISTICS TABLE FOR PROPER VALUES

PRACTICAL EQUATIONS FOR RADIO CIRCUITS

1 *For Condensers in Parallel*

$C = C_1 + C_2 + C_3$ (etc.)

where C = Resultant Capacity

C_1, C_2, C_3 = Capacity of individual condenser units

2 *For Condensers in Series*

$$C = \frac{1}{\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}}$$

where C_1 C_2 C_3 = Capacity of individual condenser units

3 *For Wave Length of an Oscillating Circuit*

$\lambda = 1.885 \sqrt{LC} \times 10^9$

λ = Wavelength in meters
L = Inductance in henries
C = Capacity in farads

4 *For Capacitance of an Aerial*

$$C = \frac{\lambda_1^2 - \lambda_2^2}{\lambda_2^2} \times C_1$$

C = Capacity of aerial in microfarads
λ_1^2 = Square of natural wavelength of the aerial
λ_2^2 = Square of the wavelength of the aerial with C_1 in series
C_1 = Condenser of known capacity connected in series with the aerial

5 *For Inductance of an Aerial*

$$L = \frac{\lambda_1^2}{\lambda_2^2 - \lambda_1^2} \times l$$

L = Inductance of aerial system in centimeters (1 Henry = 10^9 centimeters)
λ_1^2 = Square of natural wavelength of aerial
λ_2^2 = Square of wavelength of aerial with "l" connected in series
l = Inductance coil of known value

6 *Capacity of a Flat Plate Condenser*

$$C = \frac{KA\ 2248\ (N - 1)}{T \times 10^{10}}$$ (Measurements in inches)

or

$$C = \frac{KA\ (N - 1)}{4\pi\ T \times 10^7}$$ (Measurements in centimeters)

C = Capacity in microfarads
A = Area of 1 plate
N = Number of plates
T = Thickness of dielectric
K = Dielectric constant of insulating medium (Air = 1, paraffined paper = 1.75 to 2, castor oil = 4.8, mica = 5 to 8)

7 *Inductance of a Circuit by Voltmeter and Ammeter Method*

$$L = \frac{\sqrt{E^2 - I^2R^2}}{I^2(2\pi F^2)}$$

where L = Inductance in henries
E = Potential applied
I^2 = Square of Current flowing
R^2 = Square of Resistance of coil or circuit in ohms
F = Frequency in cycles per second

8 *For Radiation Resistance of a Flat Top Aerial*

$$R = 1600 \frac{h^2}{\lambda^2}$$

R = Approximate resistance in ohms
λ = Wave length of aerial in meters
h = Height of aerial in meters

9 *Watts Radiated from a Flat Top Aerial*

$$W = \frac{h^2}{\lambda^2} I^2 \times 1578$$

Where h = Height of aerial in meters
λ = Wave length of aerial in meters
I^2 = The square of the hot wire ammeter reading in amperes at the base of the aerial

10 *Ohms Law for Direct Current*

$$I = \frac{E}{R}$$

Where I = Current in amperes
E = Electromotive force in volts
R = Resistance in ohms

Similarly $R = \frac{E}{I}$ and $E = I \times R$

11 *Watts in a D. C. Circuit*

$W = I \times E$
Where W = Watts
I = Current in amperes
E = Electromotive force in volts
Also $W = I^2 R$
Where R = resistance in ohms

Again $I = \sqrt{\frac{W}{R}}$

12 *Ohms Law for Alternating Current*

$$I = \frac{E}{Z}$$

I = Current in Amperes
E = Electromotive force in Volts
Z = Impedance in Ohms

Also $Z = \frac{E}{I}$ and $E = I \times Z$

13 *For Impedance*

$Z = \sqrt{R^2 + (2\pi FL)^2}$
where Z = Impedance in ohms
R = Resistance in ohms
$2\pi FL$ = Reactance of circuit in ohms

14 *For Reactance*

$X = 2\pi FL$
where X = Reactance of Circuit in ohms
F = Frequency of current in cycles per second
L = Inductance in henries
or $X = \sqrt{Z^2 - R^2}$

UNITED STATES GOVERNMENT WIRELESS TELEGRAPH REGULATIONS GOVERNING THE AMATEUR

The Radio Regulations are easily understood and complied with.

The regulations governing the amateur are as follows:

A receiving station alone requires no license, no matter how large or small it may be, or the location thereof.

A transmitting station requires a license, which may be obtained free of charge from the Radio Inspector in charge of the district, and located at the Custom House in the following cities:

1. Boston, Mass.
2. New York, N. Y.
3. Baltimore, Md.
4. Savannah, Ga.
5. New Orleans, La.
6. San Francisco, Cal.
7. Seattle, Wash.
8. Cleveland, Ohio
9. Chicago, Ill.

Address: Radio Inspector, care Custom House, in the city named above which is nearest you.

Power used for transmitting must not exceed 1 kilowatt, and when a station is within five miles of a Government Wireless Station the power is limited to ½ kilowatt.

The transmitting wave length of the station must not exceed 200 meters. A copy of the "Radio Communication Laws" of the United States may be had from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 15 cents a copy. Every amateur will be benefited by reading this bulletin.

WIRE TABLES

B. & S. GAUGE

Gauge No. B. & S.	At 20° C. Dia. in mils	Dia. in inches	Area Cir. mils	Square inches	Ohms per 1000 ft. at 77° F. or 25° C.	Max. Dia. C. 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 inch S.S.C. (G.E. Co.)	Turns per inch D.S.C. (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	9.64	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	16.35	.....	.....	...	...	18
17	45.26	.04526	2048	.001609	5.163	51.26	18.20	55.3	18.08	.....	.....	...	...	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	21.91	45.30	23.04	39.90	19.00	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	16.08	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	335.50	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	3.145	.00311	9.888	.000007766	1069.00	9.145	130.00	11.15	102.50	5.00	7.00	200	140	230

WEIGHTS OF SMALL SIZES OF MAGNET WIRE

G. E. CO.

Size B. & S.	Approx. Weight in Pounds per 1000 Feet S.C.C.	D.C.C.	S.S.C.	D.S.C.	Enamel
10	.....	31.9	.....	.....	.....
13	.....	16.0	.....	.....	.....
14	12.684	12.918	.....	.....	12.684
15	10.082	10.274	.....	.....	10 053
16	8.012	8.176	.....	.....	7 973
17	6.375	6.510	.....	.....	6 322
18	5.081	5.188	.....	.....	5 009
19	4.043	4.130	.....	.....	3 966
20	3.215	3.289	.....	.....	3.136
21	2.569	2.628	.....	.....	2.475
22	2.055	2.106	.....	.....	1.970
23	1.630	1.676	1.57	1.604	1.555
24	1 297	1.344	1.24	1.298	1.232
25	1.036	1.082	.991	1.040	.980
26	.825	.873	.791	.833	.777
27	.661	.703	.631	.666	.616
28	.524	.562	.499	.521	.485
29	.421	.457	.397	.416	.381
30	.336	.372	.315	.332	.303
31	.271	.307	.254	.267	242
32	.215	.248	.203	.214	.192
33	171	.201	.161	.172	.152
34	.141	.161	.130	.140	.121
35	.12	.137	.110	.119	.101
36	.099	.112	.089	.096	.081
38	.....	.....	.058	.065	.051
40	.....	.....	.037	.040	.031

MAGNET WIRE

APPROXIMATE FEET PER SPOOL

Size of Wire	Size of Spool	Single Cotton	Double Cotton	Single Silk	Double Silk	Beld-Enamel	Silk-Enamel	Cot-Enamel
16	1 pound	125	122	127	126	126	122	125
	½	62	61	63	63	63	61	62
	¼	31	30	32	31	32	31	31
	⅛	16	15	16	16	16	15	16
18	1 pound	197	191	201	199	201	194	198
	½	98	96	101	100	100	97	99
	¼	49	48	50	50	50	48	50
	⅛	25	24	25	25	25	24	25
20	1 pound	311	296	319	315	319	305	313
	½	155	148	160	158	159	153	157
	¼	78	74	80	79	80	76	78
	⅛	39	37	40	39	40	38	39
22	1 pound	488	461	506	499	508	472	489
	½	244	231	253	249	254	236	244
	¼	122	115	127	125	127	118	122
	⅛	61	58	63	62	63	59	61
24	1 pound	767	715	802	786	803	749	779
	½	382	358	401	393	402	375	390
	¼	192	179	200	197	201	187	195
	⅛	96	89	100	98	101	94	97
26	1 pound	1,200	1,094	1,265	1,235	1,275	1,167	1,235
	½	600	547	633	617	637	583	617
	¼	300	274	316	309	319	292	309
	⅛	150	137	158	154	160	146	154
28	1 pound	1,878	1,646	2,008	1,946	2,024	1,825	1,946
	½	939	823	1,004	973	1,012	912	973
	¼	469	412	502	486	506	456	486
	⅛	235	206	251	243	253	228	243
30	1 pound	2,941	2,528	3,165	3,003	3,221	2,813	3,035
	½	1,471	1,264	1,582	1,502	1,610	1,406	1,517
	¼	735	632	791	751	805	703	759
	⅛	368	316	396	375	403	352	379
32	1 pound	4,484	3,704	4,762	4,608	5,102	4,259	4,728
	½	2,242	1,852	2,381	2,304	2,551	2,129	2,364
	¼	1,121	926	1,190	1,152	1,276	1,065	1,182
	⅛	561	463	595	576	638	532	591
34	1 pound	6,766	5,187	7,752	7,082	8,130	6,447	7,413
	½	3,383	2,593	3,876	3,541	4,065	3,224	3,709
	¼	1,691	1,297	1,938	1,771	2,033	1,612	1,859
	⅛	846	648	969	885	1,016	806	930
36	1 pound	10,060	7,348	12,150	10,870	12,887	9,416	11,468
	½	5,030	3,674	6,075	5,435	6,443	4,708	5,734
	¼	2,515	1,837	3,037	2,718	3,222	2,354	2,867
	⅛	1,258	919	1,519	1,359	1,611	1,177	1,434

HENDRIE & BOLTHOFF

Mfg. and Supply Company

Denver ~ Colorado