

# RADIO ENGINEERING

*The Technical Magazine of the  
Radio Trade - Edited by M.B. Sleeper*

*Now—Real Reproduction*

JUNE, 1926

Complete Details of the 210 Amplifier

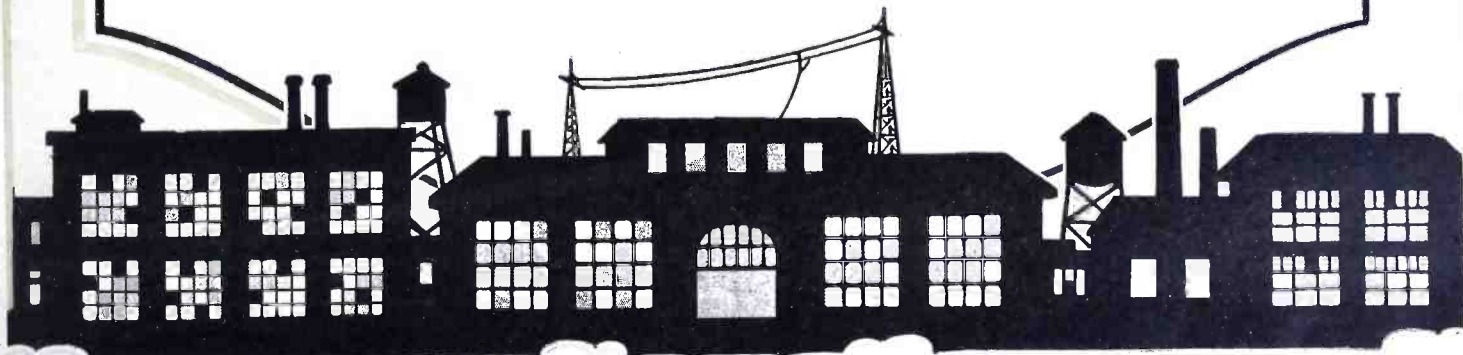
Describing the 210 Power Amplifier, which delivers 20 times  
the energy to the loudspeaker that is obtained from 201-A's

Loop Operation for the Neutrodyne Circuit

In which is shown the first high-power Neutrodyne set  
to be designed for reception on a small loop antenna

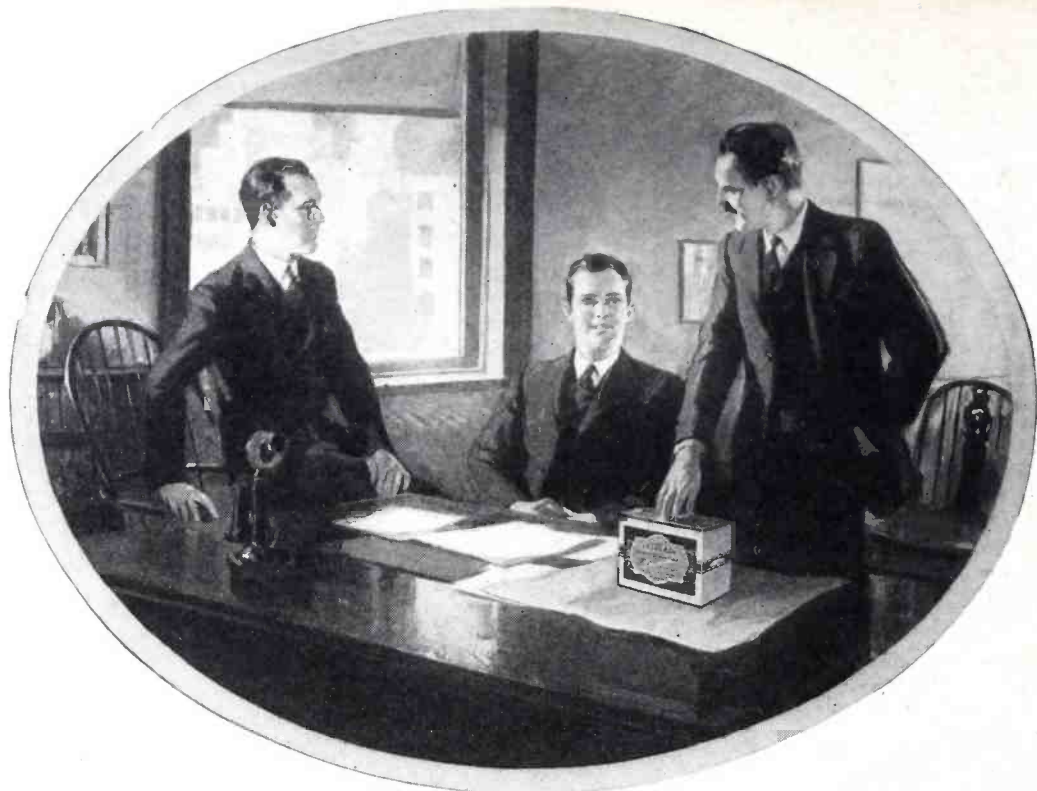
Installing Short Wave Equipment at Home

Further information about the 5-N-1 receiver and the  
US-76 B battery operated telephone transmitter



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VOLUME VI                      NUMBER 6  
Sixth Year of Publication



*"I've just had a lesson in radio economy, and, believe me, it's illuminating"*

"I WENT into my radio dealer's this noon for a couple of Eveready 'B' Batteries and said, 'Tom, give me a pair of Eveready 45-volt "B" Batteries No. 772's.'

"'How many tubes in your set, Jim?' he asked.

"'Five,' I answered.

"'Then what you want is a pair of Eveready Layerbilt No. 486's.'

"'Why?' I asked.

"'Because the Eveready 772's are meant for sets having one to three tubes. With average use of the set, and used with a "C" battery\*, they should last a year or longer. But on a five-tube set, with average use and with a "C" battery, they will only last about four months.

Anyone with a four or five tube set should buy a pair of Eveready Layerbilts No. 486. Used with a "C" battery they should last eight months or longer.'

"'Yes, but the 772's cost only \$3.75 each,' I said, 'and the Layerbilt \$5.50. There's some difference.'

"'Well, figure it out for yourself,' said Tom. 'Two sets of 772's should last you about eight months, and will cost you \$15. One set of Eveready Layerbilts should last about eight months, and will cost you only \$11.'"

The simple rules for this satisfaction and economy are:

*On 1 to 3 tubes—Use Eveready No. 772.*

*On 4 or more tubes—Use the Heavy Duty "B" Batteries, either No. 770, or the even longer-lived Eveready Layerbilt No. 486.*

*On all but single tube sets—Use a "C" battery.*

When following these rules, the No. 772, on 1 to 3 tube sets, will last for a year or more; and the Heavy Duties, on sets of 4 or more tubes, for eight months or longer.

We have prepared a new booklet, "Choosing and Using the Right Radio Batteries," which we will be glad to send you upon request. This booklet also tells about the proper battery equipment for use with the new power tubes.

\*NOTE: A "C" battery greatly increases the life of your "B" batteries and gives a quality of reception unobtainable without it. Radio sets may easily be changed by any competent radio service man to permit the use of a "C" Battery.

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**NATIONAL CARBON COMPANY, Inc.**  
 New York San Francisco  
 Canadian National Carbon Co., Limited  
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Tuesday night means Eveready Hour  
 —8 P. M., Eastern Standard Time,  
 through the following stations:

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WJAR—Providence	WTAM—Cleveland
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WTAG—Worcester	WGN—Chicago
WFI—Philadelphia	WOC—Davenport
WGR—Buffalo	wcco { Minneapolis
WCAE—Pittsburgh	{ St. Paul
	KSD—St. Louis



LEFT—No. 486,  
for 4, 5 or more  
tubes. \$5.50.



RIGHT—Ever-  
eady Dry Cell  
Radio "A" Bat-  
tery, 1 1/2 volts.

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## Radio Batteries

—they last longer

RCA power Radiotrons

**bigger  
volume**

without  
**distortion**



Radiotron  
UX-112  
storage battery  
power tube . . . \$6.50

Radiotron  
UX-120  
dry battery pow-  
er tube . \$2.50

*One of these tubes,  
in the last audio  
stage, uses extra  
batteries and  
gives greater vol-  
ume of tone.*



DRIVE a car uphill be-  
yond its power—and the  
motor knocks. Drive a  
radio set beyond its power  
—and the last tube chokes,  
the loudspeaker blasts. The  
RCA power Radiotron  
has just one function—  
to stand the strain the last  
tube gets. More *power* can  
flow through it without  
choking or blasting, and  
it means a decidedly clearer,  
finer tone—at a greater  
volume.

**Use quality you know**

You would not use any but a MAZDA lamp. Why use any but an RCA Radiotron? They are made by the same skilled workers, backed by the same research laboratories. But the Radiotron is far more delicate to make. Be sure all the tubes in your set are Radiotrons. And keep a spare handy.

RADIO CORPORATION OF AMERICA  
New York Chicago San Francisco



**RCA Radiotron**

MADE BY THE MAKERS OF RADIOLAS

# EDITORIAL

**A**NYONE who hasn't found this the busiest summer that radio has ever known is very much out of the running.

One big thing was the R.M.A. Convention at Atlantic City. For actual productive effort, and useful results, it was successful beyond all expectations. Everyone was there—the heads of practically all the manufacturing concerns, both members and non-members, an important group of engineers, a representative gathering of jobbers, and, of course, a collection of magazine and newspaper men to keep an eye on the proceedings.

Unstinted praise belongs to B. W. Ruark, Executive Secretary, to whom goes the credit for the arrangements so carefully planned.

Thirty-five member-companies were added during the convention. This ties in almost every radio company of any consequence. And what a range of topics they brought along for discussion! Everything from the \$94,000,000 which the public lost last winter on bad radio securities to standard tests for vacuum tubes. There were regular meetings in the convention hall, special committee meetings, informal discussions in the rooms, and small arguments all along the side lines.

Then there was the Second District Convention in New York. If you are doubtful about big business on short wave equipment for this fall, a trip to the exhibit at the Engineering Building would have settled that. Glenn Browning came over from Boston with a beautiful short wave telephone transmitter, and F. J. Marco brought a shielded short wave receiver from Chicago.

The biggest boost the parts business has had in three years is the short wave equipment. In another six months there will be more interesting things to hear below 200 meters than above.

A.C. operation is certainly going to have its share of sales. And what is of greater consequence, in a way, is the power amplifier, working from A.C. Unless you are prepared to build a power amplifier, don't try one on your set, for what you haven't heard you'll never miss, but once you do hear the power amplifier, even with an ordinary loud-speaker, you'll put your set in a class with the one-lung automobile.

And the beauty of the power amplifier is that it works on any kind of a set that has one stage of good A.F. amplification. So startling is the difference between a two-step amplifier with 201-A's and an amplifier with one 201-A and a UX-210 on high voltage that sets described in RADIO ENGINEERING hereafter will have a jack at the first stage to permit the connection of a separate power stage.

The advent of an 80-mil rectifier tube opens up further possibilities for A.C. operation of 199 tube filaments. Three 199's followed by a power tube, the filament of which takes 5 volts A.C., will give plenty of volume for all ordinary purposes.

For all the increased use of A.C. supply devices, B battery and storage battery sales will increase, largely because of their low unit cost. Short wave transmitters, running on four to six heavy duty B batteries, have added another sales outlet of no small magnitude.

With this and other new things ahead of us, what excitement there is to be this fall. At last, the weak sisters among the manufacturers have been pretty well weeded out, leaving the road open, for those who have the elements of success in their organizations, to the biggest, busiest, and most profitable season we have known—and starting earlier than ever before.

M. B. SLEEPER,  
*Editor.*

# RADIO ENGINEERING

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Vol. VI. JUNE, 1926 No. 6  
Sixth Year of Publication

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## Double Issue for July

With the July issue, RADIO ENGINEERING will step up to double the size of the largest issue we have ever published. This will make it possible to present an unusually wide range of articles on subjects of current importance, written by some of the best known engineers in the radio field.

There will be a complete official reference table on Raytheon eliminator circuits, technical descriptions of the Stromberg-Carlson set and the Grebe short wave receiver, construction dope about a new device from Silver-Marshall, and a special section on 1927 model receiving sets.

## In the August Issue

We have been asked not to disclose the feature articles for the August number because they describe recently developed equipment which the manufacturers are not yet ready to announce, but they will have these various things on the market ready for early fall delivery. August will be one of the most important issues of the year, containing much advance information of importance to manufacturers, the trade, and the set builders.

## RADIO ENGINEERING

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# Unipower wins the unqualified approval of experts

*How this better "A" supply solves an important power problem*

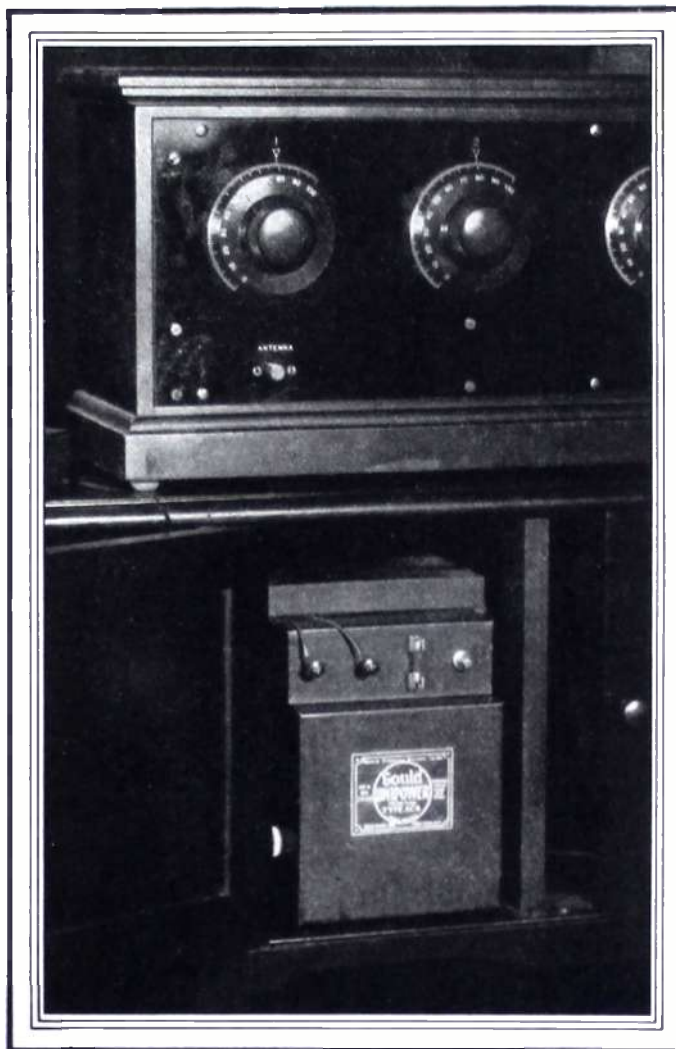
**T**HE failure of "A" batteries—the constant recharging and replacing of storage batteries and dry cells—these are frequent worries that have caused one of the most serious problems in radio. Now they are eliminated. The important problem of "A" power supply is finally solved.

Three years ago the engineers of the Gould Storage Batteries Company developed a new source of permanent "A" current power—the "trickle charge" principle. The result was Unipower—radio's first complete "A" power unit. The "trickle charge" principle, perfected in Unipower, has received the unqualified endorsement of both the Institute of Radio Engineers and the Associated Manufacturers of Electrical Supplies.

Unipower embodies every feature necessary to the efficient and economical performance of the "A" circuit in any radio set. It not only assures the set owner of continuous, quiet "A" power, always at full voltage; but the Unipower master control switch—an exclusive feature—makes it possible to coordinate both the "A" and "B" circuits under one control.

Attempts have been made to duplicate Unipower. But the reliability of such a "trickle charge" installation depends upon the proper relation of all elements involved. Simply to approximate the "trickle charge" principle does not mean that the battery will not become overcharged, or that the "A" current supply will not fail when it is wanted most.

In Unipower only are all these features



incorporated. In Unipower only have those qualified to know found the final answer to the "A" power problem.

THE GOULD STORAGE BATTERY CO., Inc.  
250 Park Avenue, New York

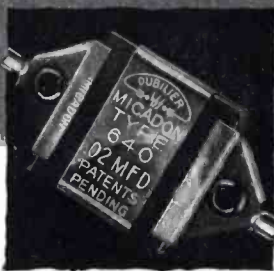
The standard Unipower operates from alternating current, 110-125 volt—60 cycle. The 4 volt type is for sets using 199 tubes or equivalent and retails for \$35.00. The 6 volt type is for sets using 201-A tubes or equivalent and retails for \$40.00. West of the Rockies, prices are slightly higher. (Special models, 25-50 cycle are available.) Unipower contains a Balkite charging unit of special design.

*Free! Write for interesting booklet, "Unipower, a triumph in radio power."*

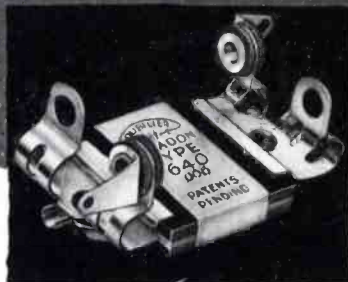
# Unipower

TRADE MARK ~ *Off when it's on—On when it's off*

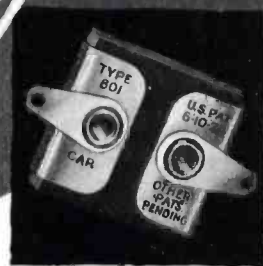
# in radio little micadons make a big difference



**MICADON 640**  
An improved design making possible a wider range of capacities.



**MICADON 640A**  
Compactly made for use in resistance coupled amplifiers.



**MICADON 601**  
The standard fixed condenser of radio.

**THERE** doesn't seem to be much to a Micadon when you look at it. The infinite care that is given to every detail in the manufacture of Dubilier Micadons is your assurance that they will always do their job.

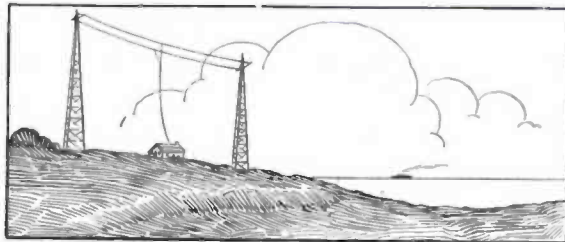
Micadons are a small item in the cost of any radio set. But the difference between clear and poor reception, and the change from noise to natural tones may often depend upon their use.

*Send 10c for our booklet which shows fourteen ways in which you can improve your set by simple applications of fixed condensers.*

Address: 4377 Bronx Blvd., New York

# Dubilier

CONDENSER AND RADIO CORPORATION



# LOOP-OPERATED NEUTRODYNE

*Complete shielding has made possible the operation of the Neutrodyne circuit with a loop antenna. Other features of the Howard set are described—By Leland H. Hansen\**

**W**HEN Professor Hazeltine first disclosed the details of the neutrodyne circuit in a paper read before the Radio Club of America at Columbia University, he recommended the use of a short single wire antenna, and mentioned the fact that, while a loop could be used with a neutrodyne, it was not recommended because of the coupling between the loop and the tuning inductances in the set.

That, however, was long before the development of shielding for radio sets. It has been the ambition of neutrodyne manufacturers to build loop-operated sets in order to take advantage of the reduction in interference and interfering noises which the loop makes possible. That is one of the principal reasons for our concentration on loop set design for the last year.

Shielded construction and loop operation, if combined with R. F. amplification of extreme sensitiveness, increases the signal level above the noise level to such an extent that great distances can be covered and, what is equally important, distant stations can be brought in with a quality of speech that hitherto has been restricted to locals.

\* Chief Engineer, Howard Radio Co.

High R. F. amplification, we found, called for four tuned circuits, and, since we did not consider four tuning dials practical from the point of view of the average operator, it was necessary to combine three stages under one dial, with the loop tuned by another independent dial.

You can see in the accompanying illustrations at a glance details on which we spent weeks and weeks to work out to a conclusion which we were willing to consider satisfactory.

The gang control was no small problem in itself. We decided against the operation of three condensers on one shaft because we preferred the mechanical arrangement which you can see in Figs. 2 and 3. That brought special problems of single control, methods for which had to be considered from many angles. We decided finally upon the link motion as being the most positive, and the most lasting.

The specifications given us by our sales department called for construction throughout which would be as near proof against damage in transit and wear in use as could be made. You may think that the bearings in the link motion arrangement are very liable to become loose over a period of time, but when you examine the set

you will see how that has been taken care of. Each bearing is conical in shape, and each shaft is spring mounted, so that, if the bearing does wear, the shaft is simply pushed in a tiny bit farther. Thus the link motion will be absolutely free from play after years and years of use.

We are rather proud of the dial arrangement. That is shown in Fig. 1.

The knob which controls the loop condenser rotates one of the scales behind the window, while the gang control operates the other. All the mechanism is mounted on a sub panel.

You may wonder why the tuning inductances are mounted at the regular neutrodyne angle when they are put in shields. The necessity for this was brought out in a very complete investigation on shielding in which we found that the most perfect shielding is not 100%. In order to make these investigations, we built right in the factory a shield room, large enough to accommodate a big test bench and several workers. Except for two very small openings necessary for ventilation, the room is perfectly shielded. The door is closed by big clamps such as are used in refrigerators. Even the little openings have fine copper screening on them. An interesting effect which we noticed during the first tests

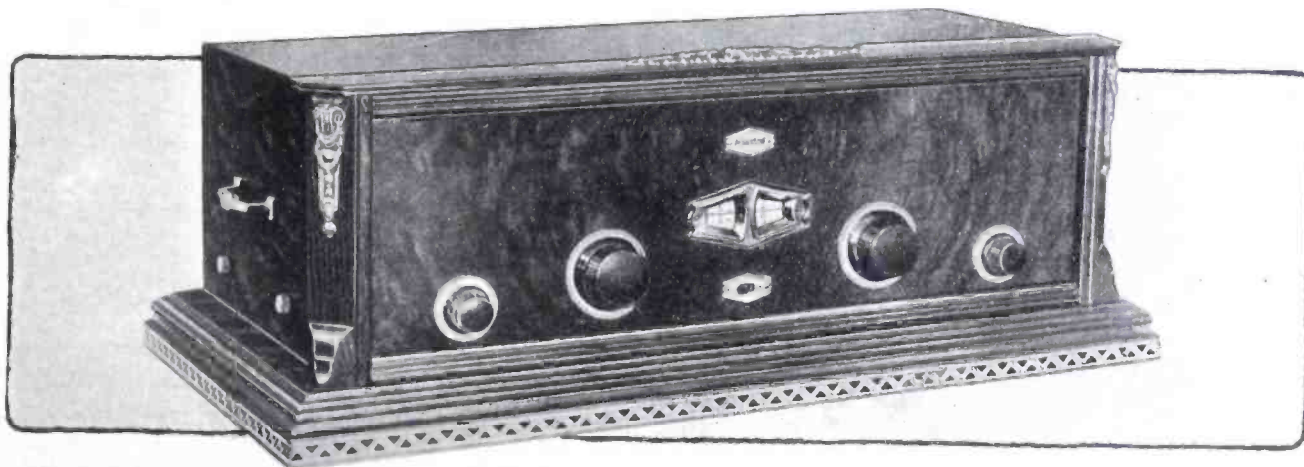


Fig. 1 The two large controls regulate the tuning. Dial settings are indicated at the double window in the center of the panel

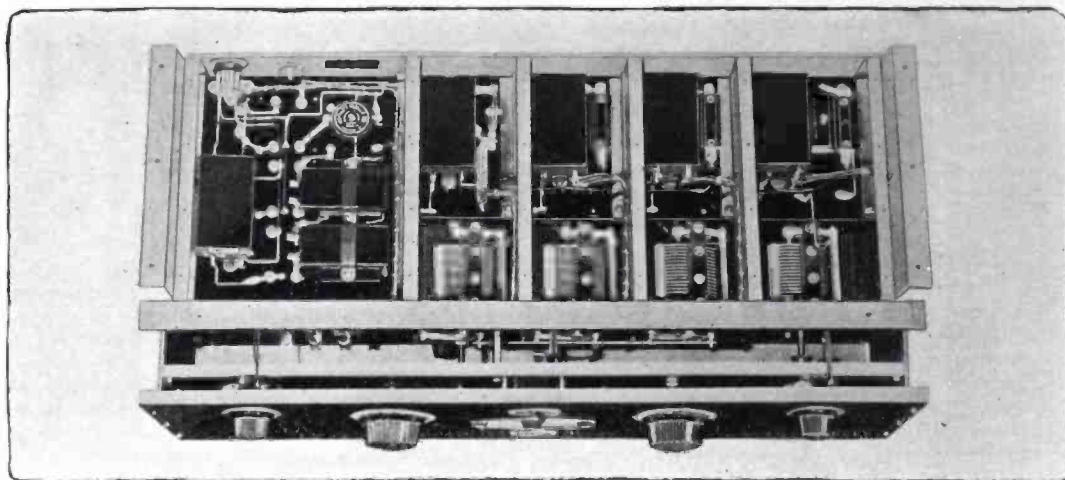
was that, when a loop receiver was set up in the shielded room, no signals could be heard, even from powerful stations. Opening the door as much as half an inch, however, let in sufficient energy to give loudspeaker reception. Even then it was necessary to orient the loop in order to pick up the broadcasting. Now that the loop

plate circuit of one tube while the other coil is used as a gridleak between the grid and filament of the following tube. Additional coupling is obtained by a fixed condenser between the plate and grid terminals. This method, we have found, gives the efficiency of a transformer, and the quality of impedance amplification.

addition, the cabinet weighs only a fraction of the weight of a wooden cabinet. This is important not only because it makes the set easier to handle in the home but it greatly reduces shipping expense which, finally, must be borne by the consumer. The base and frame are inlaid wood.

These sets are furnished for table

Fig. 2. Underneath the set, with the bottom shield removed. Notice the large by-pass condensers with which each audio and radio stage is provided. You can see the neutralizing condensers next to the side walls. Battery connections are made with a Jones Multi-Plug



sets are in production, this shielded room is used for the final neutralizing operations. The work can be done much more accurately because all extraneous noises are eliminated.

The audio end has three stages of combination transformer - impedance coupling. One coil of the transformer is connected as an impedance in the

An interesting innovation is introduced in the cabinet design. The front panel and the top, rear and sides of the cabinet are all aluminum, beautifully stained and grained to give a rich walnut finish. This finish, by the way, is put on in such a way as to be much harder than the finish on wood, so that it does not wear or scratch. In

mounting, with the loop secured to the cabinet, or they can be obtained in a variety of console cabinets ranging in designs which are fairly reasonable in price up to the most expensive period designs which harmonize in character and finish with the furnishings of any living room or music room.

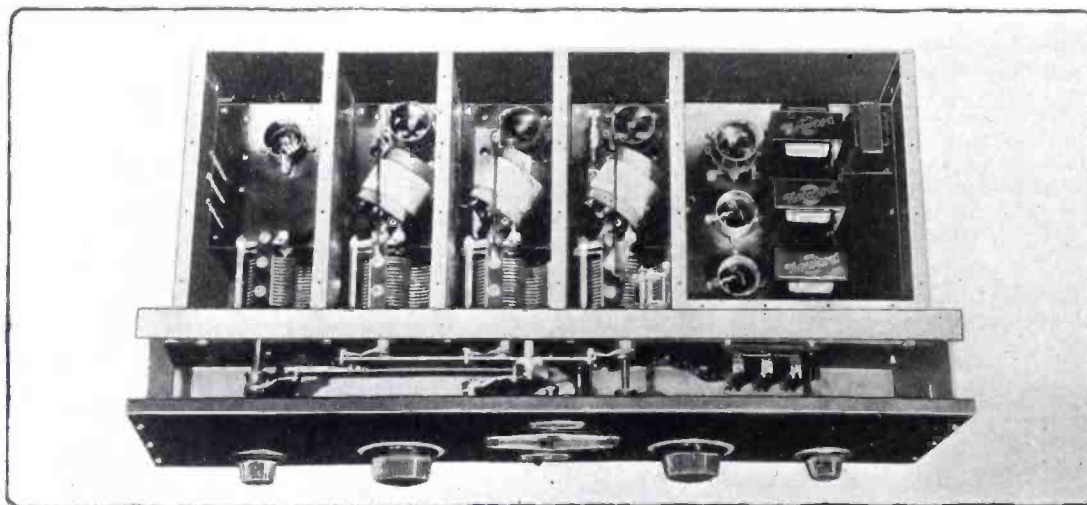


Fig. 3. Each R. F. stage and the detector has its own compartment, while the three audio stages, equipped with combination transformer - impedance coupling, are grouped in the fifth compartment. The top shield has covered openings through which the tubes can be inserted or removed

## What is Lignole?

Lignole is a product new and different from anything that now appears upon the market. It is made by impregnating woods or fibres with a material of highest insulating qualities. The material, or dope, as it is called, is forced all through the pores to such an extent that after treatment the wood or fibre forms but a holder or conveyor for the dope. This dope is

of such a character that it will not support itself in suspension, but requires some sort of auxiliary structure. We might use as an example the honeycomb made by the bee to hold the honey. The honey is the real product. That is true of the dope.

In the construction of radio panels, a five-ply laminated wood panel is used as the carrier.

Lignole adapts itself to any finish required or demanded from the plain lacquered finishes as well as the solid colors, to the imitation marble and antique effects. Lignole is, however, most attractive in the natural wood finishes. The natural beauty of wood has never been improved upon by the application of various imitation effects.





Fig. 1. Have you a short wave installation in your home? The 5-N-1 and US-76 waiting for you to talk to your friends while you sit comfortably at home

## Short Wave Installation

*Additional data on the 5-N-1 short wave receiver and the US-76 'phone transmitter—By S. W. Nichols*

**E**VEN grown-up children get a thrill from playing with a private telephone line. When it is a line without wires and allows conversation with an unlimited number of other stations it becomes more than a toy; it is a pass into the fraternity of the air, a source of instruction, and a practical means of communication. On Sunday afternoons in every town and city the air is full of amateur phone conversations and in the evenings after supper until quiet hour at eight. They talk not only about their apparatus and DX conquests but of countless large and small matters such as any telephone operator might hear by listening in. But there is no operator to limit the talk to five minutes nor anyone else eavesdropping—every one is too busy talking to do any idle listening. Except, when some ambitious ham calls up his Y. L. on the air.—Y. L. is feminine for ham or old man.—Then everyone listens, barring those who are expert enough to tune their transmitters to the wave on which one of the parties is listening, to break in with H! M! and other appropriate remarks. Willful interference is pro-

scribed by the Regulations but all's fair in love and war correspondence.

Although you cannot broadcast with your own phone transmitter—there is no one to listen—your station is a perfect miniature of WDPQ and all the other 500 applause-card solicitors. You learn from your set just how a broadcasting station operates and you display your distant reception record just as proudly as the local broadcaster preserves the letter which a listener munched 300 miles by dog-sled to the nearest postoffice. You can even add a line phone to your equipment and put your voice on the air by remote control.

Or the short wave phone can be used to replace a land line in an emergency, or for temporary use, or where wires cannot be strung from want of right-of-way or accessibility. Fig. 1 shows the combined transmitter and receiver units, the 5-N-1 and the US-76, set up for communication between the Radio Engineering laboratory and office.

Some have asked why a standard desk type of microphone and receiver are not used. The reason is one of convenience. Hand microphones, with

receivers attached, are used on commercial telephones where available, and oftentimes desk phones are provided with a headband receiver.

The change-over switch is a little inconvenient but is necessary except where elaborate installations are possible. Where radiophones have been installed on trains and ships an operator generally is in attendance to supervise the manipulation of the switch as the parties talk back and forth. By using a telephone cam-switch for the purpose, the transfer from sending to receiving, and back, is made with only a flip of the hand, a slight click in the phones and without loss of time. In the picture the switch can be seen under the edge of the table. It is a doublepole-double-throw type, connected as shown in Fig. 5.

Tuning the set is just as easy, or perhaps easier than tuning a receiver. It is a matter of turning the aerial condenser to the point which gives the highest reading on the hot-wire ammeter. The primary condenser is first set at the wave on which it is desired to transmit, as determined by listening on the receiver. Usually the transmitter is adjusted to a convenient wavelength and left always at the same point. If, however, a station at the other end happens to be on the same wave the two condensers can be shifted a few degrees temporarily. When transmitter and receiver are working at the same wavelength, the receiver picks up an excessively strong signal which is hard on the tubes and on the ears, hence the QSY—change of wave.

The short wave outfit requires no special accessories beyond those provided for the broadcast receiver. Both units, transmitter and receiver, operate from the same batteries; the transmitting tubes are semi-power tubes, UX-112 or UX-171, requiring 5 volts on the filament and as much B battery as convenient. The connections in Fig. 5 show the lower end of the transmitter radiating through a counterpoise. A ground connection can be substituted, temporarily at least, but a counterpoise pays for the slight trouble of erecting it, by better radiation. It only needs to be a single wire about the same length as the aerial and separated from it, vertically or horizontally, as widely as possible.

The real fun comes in with duplex work, where a local station can be worked two-way without the change-over switch. This is possible where the other station can be heard without an aerial on the receiver and is on a wave far enough from your own to be heard with your transmitter still on. This is possible up to a surprisingly great distance due to stray coupling which brings signals in to the receiver from the aerial connected to the transmitter. The system can be stretched still farther by using a separate aerial for the receiver, connected permanently without any switch.

Such an aerial can be put up indoors, but is better, of course, when it is located at some distance from the transmitting aerial and in a direction which gives minimum coupling of the two, at right angles, as if they were two Browning-Drake coils.

By using harmonic tuning, the set can be operated on practically any length of aerial which a man has facilities to put up. If the aerial is comparatively short, the tuning adjustment giving best radiation current will be at its natural, full wavelength. A comparatively long aerial can be made to radiate at a harmonic or fraction of its natural wavelength, such as one-third, one-fifth, etc. The even harmonics, half, quarter, etc. are difficult to use because they tend to radiate strongly on the natural wave. For instance, a 240 meter antenna gives a good antenna current when the set is tuned to 80 meters, a 200 meter antenna at 40 meters, or a 120 meter antenna at 40 meters. In this way, regardless of the size of the aerial and the wave band on which the set is transmitting, a resonance point is easily found. When radiation current is not readily obtained, the switch cutting out the antenna condenser is closed and the final tuning done with the primary condenser.

These harmonic effects are encountered mostly on the 40 and 20 meter bands where only code work is allowed, since an aerial three times 180 meters long is more than the average person has space for, and would cause interference in the broadcast band if radiation should occur accidentally on the fundamental.

Operating on the 40 and 20 meter bands with straight C. W. signals, the range of the transmitter is practically unlimited, that is, limited only by interference. DX records are made when the air is free of other stations. Experts agree that 10 watts will carry as far as ten thousand if it will carry

at all. Whether it will carry at all depends upon reflection from the conducting layer of the upper air. The only necessity for high power is to break through interference. A low power set operating on a pre-arranged schedule will reach just as far when the air is quiet.

As the conducting layer is com-

paratively low and varies under the effect of the sun, a signal travelling any great distance is reflected between this layer and the earth surface several times. Where the signal finally "comes down," therefore, depends upon the length of the wave chosen for the transmitter.

able filament current can be saved by providing a switch to turn off the transmitting tube when listening only. The key goes in the B battery lead between the set and the B— terminal. A switch must be closed across it when working with phone.

When using the set for C. W. signalling the modulator tube is not needed nor the microphone. The tube can be turned out by removing the Amperite ballast from the clips. Since the periods of silence are longer than during a phone conversation, consider-

able filament current can be saved by providing a switch to turn off the transmitting tube when listening only.

The key goes in the B battery lead between the set and the B— terminal. A switch must be closed across it when working with phone.

So popular is short wave reception already that, by next winter, a well-equipped station will have to have a short wave transmitter and receiver as well as a set for bringing in the broadcasting stations.

This makes it quite a game to choose the proper wave band 20, 40, or 80 and the proper part of the band, to reach a given distance. Listening in on the various bands tells what dis-

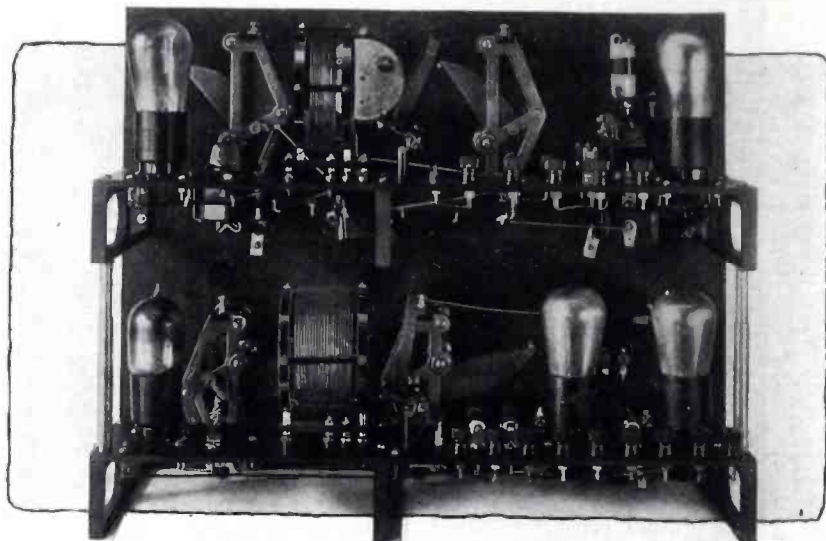
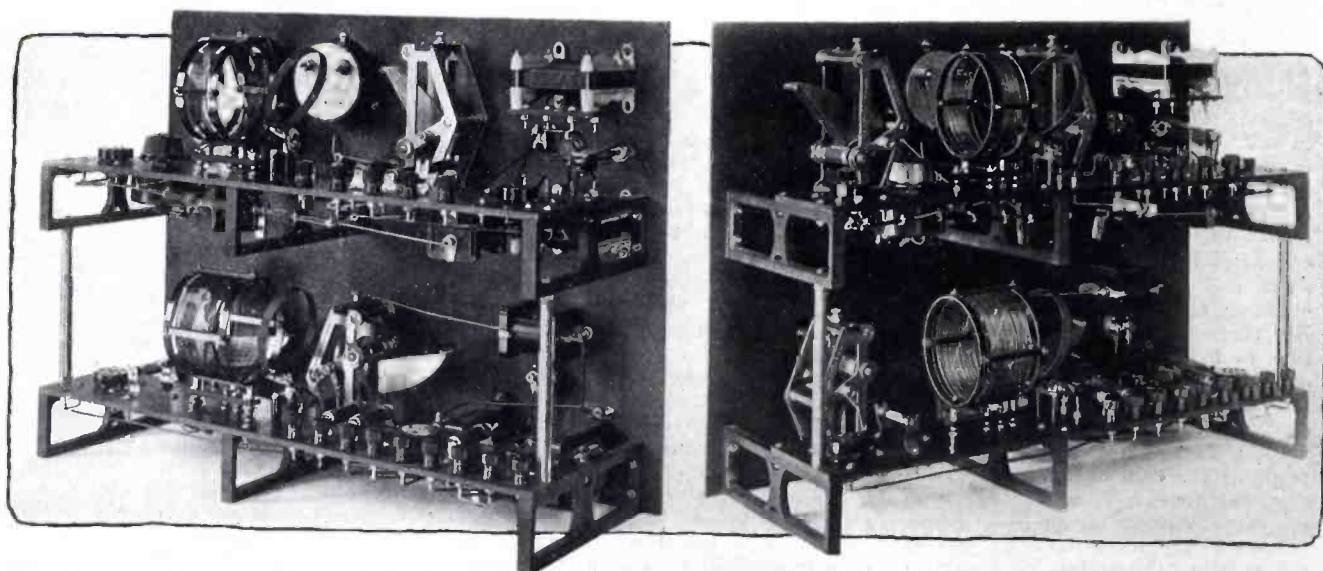


Fig. 2. For convenience and compactness, the transmitter was mounted above the receiver. The change-over switch, a Federal cam type, was put on a small panel under the table.



Figs. 3 and 4. Bright gold and polished nickel, in combination with the black Celeron panel make this the prettiest job you ever saw—too attractive to enclose in a cabinet—although it needs protection against dust

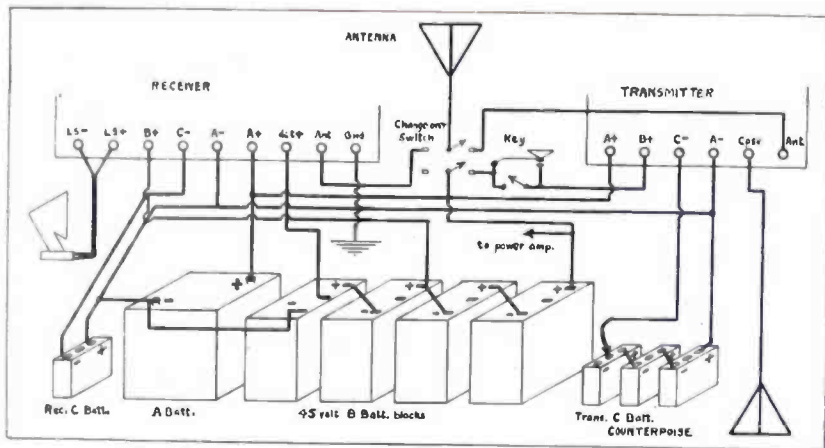
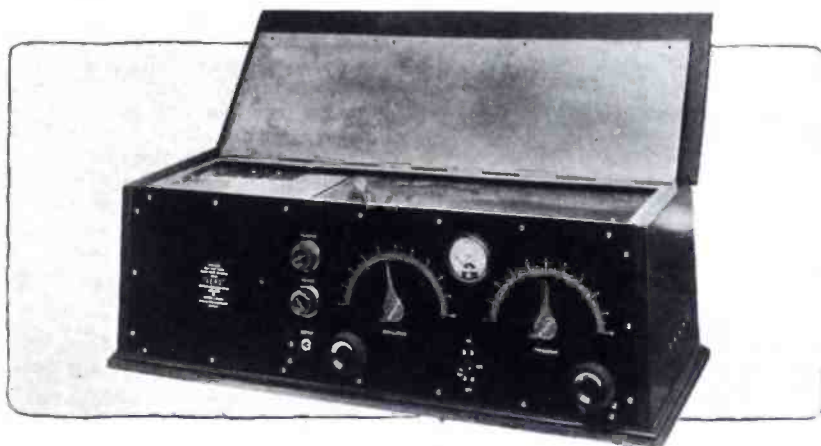


Fig. 5. Power supply circuit for the short wave installation.

And so astonishing are the results achieved with short wave receivers that a great many people seem entirely confused about short waves. In the first place, it is not possible to combine the reception of short and long waves in a single set. They can't work together.

The results obtained with short wave receivers, on wavelengths up to

80 meters, have nothing to do with the receiving ranges of broadcast sets. Where a broadcast receiver with six tubes may not cover more than a few hundred miles, a little short wave receiver will bring in several thousand miles on three tubes. Similarly, a 10-watt short wave transmitter may send farther than a 5,000-watt broadcasting station.



## Shielding for S. W. Sets

Here is F. J. Marco's own short wave receiver, brought on from Chicago for the 2nd District Exhibit

One of the most interesting sets at the exhibit of the Second District, held in New York on May 13th to 15th, was F. J. Marco's shielded short wave receiver.

It is a 3-tube set, using exactly the same circuit system as the standard 5-N-1 set. The arrangement of controls, however, is somewhat different, as you will see in the accompanying illustration. A meter has been added so as to obtain accurate control of the filament current.

The wooden cabinet contains a metal case divided into three compartments. At the left, is a storage battery and Elkon trickle charger. There

is a receptacle at the left hand end of the cabinet into which the 110-volt A. C. line can be plugged. That takes care of the A battery supply.

Then there is a narrow center section, just large enough for the small 45-volt vertical B battery. 45 volts is entirely sufficient for operating the set. The main compartment, at the right, contains the coils, sockets, transformers, and other equipment of the receiving set proper. So low is the current drain on the B battery that it should last for months. This makes the set almost self-contained, requiring only the connection to the 110-volt supply.

LAST December, when the Operadio Corporation, of Chicago, secured the services of Mr. William H. Fortington as Director of Research in the Operadio Laboratories, they acquired a man whose wide range of experience is unusual among radio engineers.

Mr. Fortington, born in Birmingham, England, was one of the first amateurs of the British Isles, for in 1912 he was on the air with a six-inch spark coil.

Following an engineering course at King Edwards School, University of Birmingham, he was radio instructor, from 1914 to 1916, in the Officers Training Corps. From that time until 1919, as research officer in the radio



W. H. Fortington, Director of Research, Operadio Company.

division of aircraft communication, he carried on a wide range of work on vacuum tube and arc transmitters, ranging from 1 K.W. to 150 K.W. in power.

Later, working on automatic calling and recording devices for aircraft alarm systems, and equipment for communication between airplanes and moving railway trains, Mr. Fortington built the first successful aircraft telephone transmitter of 50 watts to establish two-way communication over a distance of 800 miles.

During the coal strike and panic in England, in 1920, when communication was so badly tangled, Mr. Fortington was personally commended by Lloyd George for his services during this crisis.

Operating under the English call GAG, Fortington's amateur station was well known throughout Western Europe.

Mr. Fortington is now well known in the United States, as a result of his lecture and broadcasting tours in which he covered 37 broadcasting stations and 11 colleges.

The Operadio Company found him last winter in New York, where, as a consulting engineer, he had been specializing in high frequency measurements.

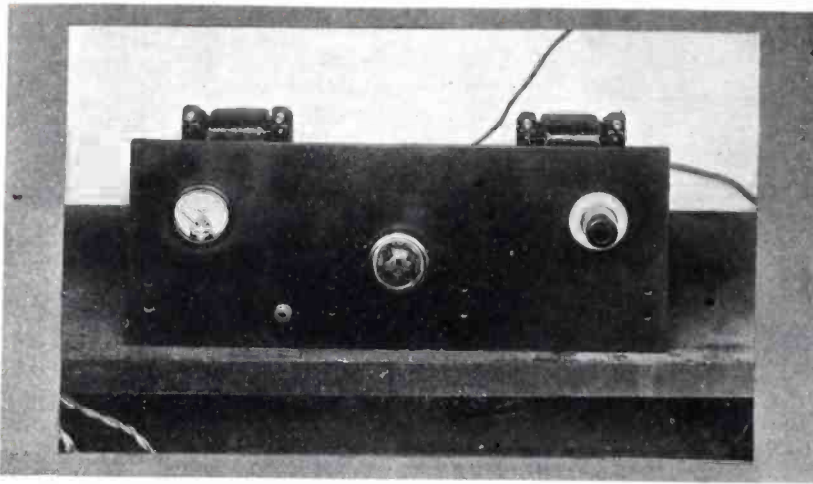


Fig. 1. The Power Amplifier can be put under the bench or in the battery compartment. It does its work without any attention or adjustment

## Now—for Real Quality

*The answer to the amplification problem is not one of coupling, but of tubes. If you are using a 201-A in the last stage, you haven't ever heard real quality—By M. B. Sleeper*

**T**UNE in one of the better local stations, close your eyes and try to imagine the music as coming from a phonograph. "A wonderful phonograph," you say. But try to visualize it as if the loudspeaker were a window into the room where the microphone is. Then there is no doubt of its being just "a radio" unless you have a power amplifier.

You may say that, since you get plenty of volume from your set and the quality is excellent, there is no need for adding a power amplifier. Fine as the quality may sound to the ear, especially the ear which is accustomed to a particular receiver, when compared with the original program or with a more faithful reproducing system, it becomes unbelievably flat and colorless.

To play a drum or to bow a bass viol requires a considerable expenditure of energy; an amplifier tube which can just comfortably handle violin music has no capacity for reproducing the tones of the heavier instruments. Even if the transformers are bringing the low frequencies through, they emerge at the loudspeaker with much less than their fair proportion of volume. It requires a power tube to make available the true strength of the drums and all the other deep tones which form the background of an orchestra and supply the realism which you may not miss until you listen to your set alone after hearing it with a power amplifier.

And even if the deepest tones are heard, unless the high frequency overtones at the other extreme are present, the reproduction still has that characteristic sound which is just as

irritating as the radio cynic, and justifiably so. Some of the high frequency audio currents run over into the range of radio frequency; they escape by every possible capacity path and accumulate in resonance loops just as 600-meter currents do. To transmit them impartially with the middle frequencies means employing transformers possessed of low-capacity windings, low inter-coil capacity, and minimum overall distributed capacity. The overtones represent the characteristic individuality of piccolo or tuba, cello or organ. They represent the ring of the piano, particularly from the bottom of the keyboard, which is hardly audible to the average ear—notes which are heard on the organ only by beats.

A first class power amplifier for use on an alternating current supply is simple to build and inexpensive to acquire and to maintain. The illustrations of the amplifier show that there is nothing complicated about the construction even when made into a compact panel mounted unit rather than spread out on a baseboard. The unit is absolutely self-contained, requiring no batteries, auxiliaries or cross connections. Two cords and a jack provide terminals for A. C. supply, audio input, and loudspeaker plug.

On the front panel are located the power switch, bias regulator, plate meter, and jack. None of these parts are live, and when the set is enclosed in the cabinet there is no chance of shock from even the 110-volt supply. The jack is isolated from the plate and high voltage by a 3 mfd. high-test condenser. The input cord makes it un-

necessary to reach inside the unit for connecting to the receiver or for any purpose except inserting tubes.

The frame of the set is constructed of Celoron panels and Radlon brackets. The components are:

- 4—Garfield Radio brackets.
- 1—Amertran PF-52 transformer.
- 2—Amertran 854 chokes.
- 2—Dubilier 3-mfd. high voltage condensers.
- 1—Dubilier 2-mfd. high voltage condenser.
- 1—Jewell 50 M. A. pattern 135 meter.
- 1—Amertran second stage DeLuxe transformer.
- 1—Aerovox 200,000-ohm Lavite resistance.
- 1—Aerovox 0.1-megohm resistor.
- 2—Daven single resistor mountings.
- 2—General Radio UX sockets.
- 1—Dubilier 1 mfd. by-pass condenser.
- 1—Federal No. 25 potentiometer.
- 1—Electrad or Frost open circuit jack.

The power transformer is mounted in the center of the set with its 4-point snap switch projecting through the front panel. The cord running out of the switch passes down under the set to the rear. On either side of the transformer are located the tube sockets so that the leads can be connected directly without splicing. A sub-panel running across the lower edge of the brackets carries these parts. Two other sections of the sub-panel are fastened to the upper surface of the brackets and support the chokes and resistors at the back. Between the two sets of sub-panels the large fixed condensers are clamped. They just fill the space between brackets.

As most receivers are laid out from left to right, the input transformer (2nd stage DeLuxe) is placed at the extreme left, the input side of the unit, and immediately beside the amplifier socket. This spaces the amplifier parts away from the rectifier and A. C. parts. A short phone cord with polarity tracer is connected to the transformer primary for input from the set.

To simplify the circuit and cut down the cost, a so-called single stage filter is used, as shown by the diagram. This is possible because the rectifier is not used to supply B power for the receiver proper. There is no hum from the filtered D. C. perceptible in the amplifier output. The 200,000-ohm fixed resistance is for the purpose of providing a steady load on the filter; it also protects the condensers from rising voltage in case a failure of the amplifier tube removes the load.

When the amplifier is connected to a receiver, its input cord displaces the loudspeaker which is then plugged into the front of the amplifier. There are no other connections. Generally one stage of audio in the receiver proper is sufficient, especially if the characteristics of the amplifier are not particularly good. The amplifier grid

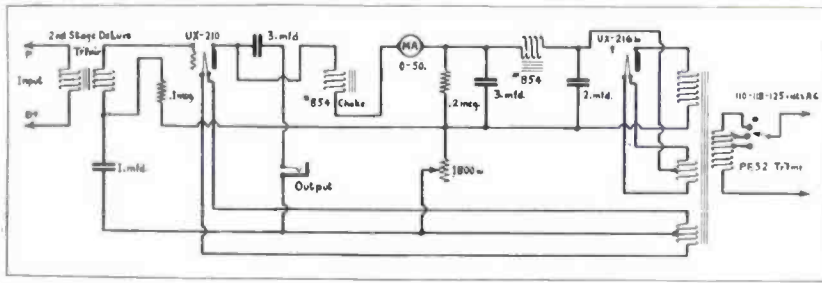


Fig. 2. Complete schematic diagram, giving all the constants of the circuit

bias potentiometer is regulated by reference to the milliammeter. The potentiometer (opposite the meter on the right) is increased until the meter reads 20 to 25 milliamperes. The taps on the primary power switch increase the secondary voltage as it is advanced from first to third position. Sometimes, but not always, a ground on the B minus is necessary to eliminate a slight hum. B minus is the common connection to the grid-leak and filter condensers. The value of gridleak can also be experimented with; usually the value given is satisfactory.

Dataprints on the power amplifier are now available. They give the panel patterns, picture and schematic diagrams, assembly instructions, and all information necessary to assemble the device successfully. If you can afford it, a power amplifier is the only way of settling definitely the question of choosing the best method of amplification. Whatever may be said concerning the relative merits of various types, the power amplifier is in a class by itself. Of course, it is expensive to make. Most good things are.

The power amplifier should be connected either after the detector or after the first stage of amplification in your set. The type of coupling used

for the first stage does not make any appreciable difference as long as it is reasonably good. The power amplifier takes care of all the rest. That is because the volume at the detector or at the first stage amplifier is not great enough, ordinarily, to overload a 201-A tube.

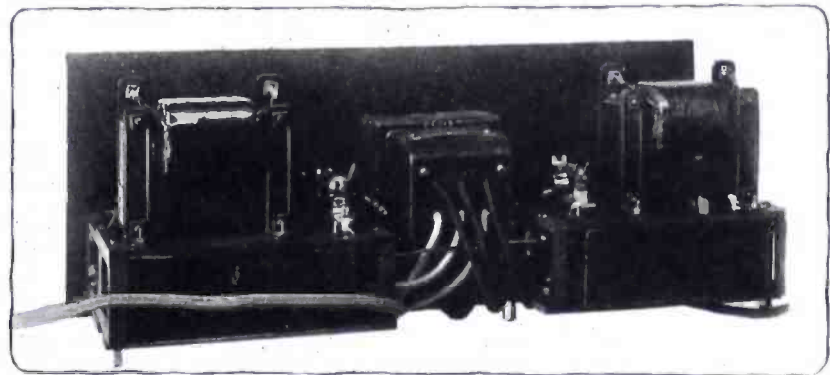


Fig. 3. Rugged and compact. It lasts forever, and can be used for years to come, on any kind of a receiving set

Another thing about the device as it has been designed is that no direct current flows through the loudspeaker. When there is no signal, there is no current in the magnets of the speaker,

tend to by-pass the high audio frequencies.

You may wonder why this amplifier is not built to provide plate voltage for the radio set. There are good reasons for this. The amplifier has been designed in such a way that it can be built and operated successfully by an absolute novice, simply added to the set as something interposed between the output of the receiver and the input to the loudspeaker. It does not change the operation of the receiving set. It simply makes it very much better. There is nothing to get out of order, and there is no danger of being shocked.

With the power amplifier you only need at most a stage of R. F. amplification, detector, and one of A. F. Consequently, you can use 199 tubes in the set. Then the storage battery will last four or five times as long, or you can run the 199's from dry cells, eliminating the storage battery altogether.

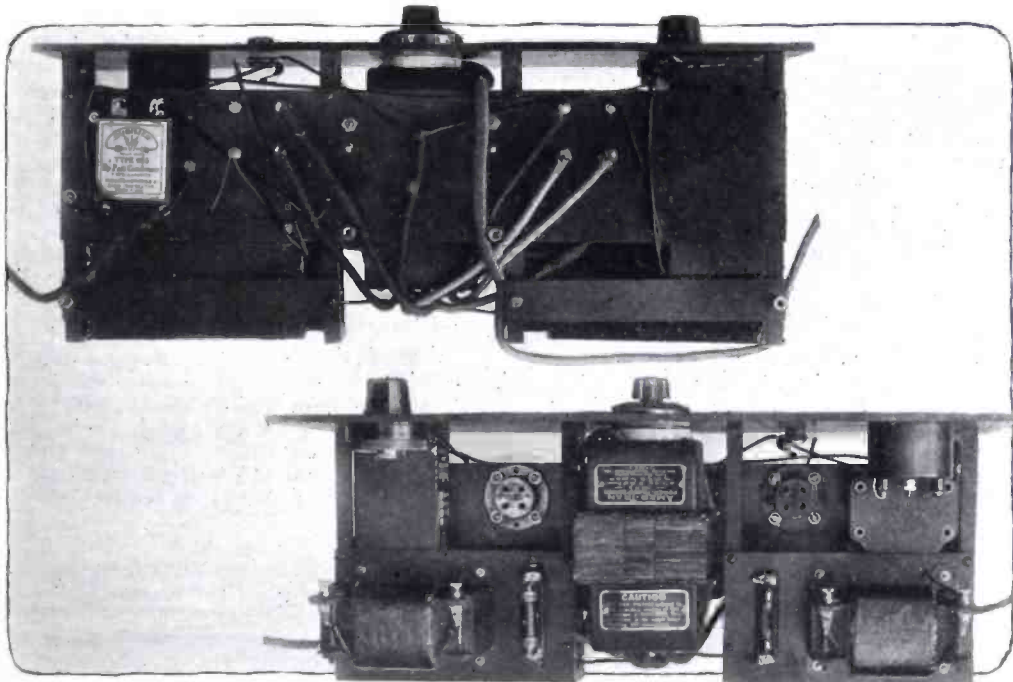


Fig. 4. Top and bottom views of the 210 Power Amplifier. All high-voltage leads are inaccessible, making it perfectly safe to use

# A.M.E.S. Radio Standards

Standards of practice adopted by the Associated Manufacturers of Electrical Supplies—Part 1

## Impedance of Radio Head Sets

**26000:** The impedance of standard radio head sets shall come within the limits of 9,000 ohms minimum and 25,000 ohms maximum, when measured with an alternating current of 800 cycles per second.

## Radio Head Set, Polarity Marking and Cord Connection

**26001:** The terminals of each telephone ear piece of a standard radio head set shall be marked with a plus sign (+) to denote the terminal to which the "positive" connection shall be made and with a minus sign (-) to denote the terminal to which the "negative" connection shall be made.

**26002:** When these standard head set ear pieces are connected to an A. M. E. S. standard radio head set cord, one of the ear pieces shall have the "solid brown" conductor connect to the "+" terminal and the "brown with white tracer" conductor connect to the "-" terminal, and the other ear piece shall have the "brown with white tracer" conductor connected to the "+" terminal and "black with brown tracer" conductor to the "-" terminal.

## Polarity of Radio Jacks and Plugs

**26031:** The standard polarity indication on the radio plugs shall be a "+" marking on or adjacent to the terminal that connects to the sleeve of the plug. All jacks used in radio receivers for the connection of head sets and loud speakers shall be so wired to the receiver circuits that positive (+) polarity of "B" battery shall be connected to the "sleeve" or body of the plug, when the plug is inserted in the jack.

## Cord for Radio Loud Speakers

**26042:** The standard cord for connecting a radio loud speaker to a radio plug or to the terminals on a radio receiver shall have a total length, from terminals to terminals, of 5 feet and shall be provided on the plug or radio receiver end with A. M. E. S. standard pin type cord tips. Both ends of this cord shall be provided with "stay" or strain cords not less than 5 inches long. The color of the outer braiding shall be "telephone brown" as specified for the standard radio head set cord and the conductors shall have polarity designation as follows:

(a) Solid brown for the conductor that connects the positive (+) terminal of the loud speaker to the positive (+) terminal (sleeve) of the

radio plug or to the positive (+) terminal of the radio receiver.

(b) Black with brown thread tracer for the conductor that connects the negative (-) terminal of the loud speaker to the negative (-) terminal (tip) of the radio plug or to the negative (-) terminal of the radio receiver.

## Voltage Breakdown Test for Cords, Plugs and Jacks

**26061:** The standard voltage breakdown test for radio cords, plugs and jacks will be the application of 500 volts, 60 cycle, alternating current for a minimum time of 2 seconds and for a period not to exceed 10 seconds, application being made as follows:

(a) Cords: Between one conductor and each of remaining conductors.

(b) Jacks: Between the jack frame and each contact spring in turn. Also, between each insulated spring and adjacent insulated spring.

(c) Plugs: Between one terminal and the other terminal.

## Voltage Breakdown Test for Loud Speakers

**26062:** The standard voltage breakdown test for all radio loud speakers, designed for use with radio-cast receivers, shall be the application of 500 volt, 60 cycle, alternating current for a minimum time of 2 seconds and for a period not to exceed 10 seconds, application being made as follows:

(a) Between the magnet core and each terminal of the winding in turn.

(b) In no case shall this test be made directly across the two terminals of the loud speaker, as this would tend to demagnetize the permanent magnet, if the loud speaker is so equipped.

## Color Designation for Cord and Cable Conductors Used for Outside Connections on Radio Receiving Sets

**26071:** The standard color designation for cord and cable conductors used for outside connections on radio receiving sets shall be:

For conductors that are individual to one circuit only:

Circuit	Potential	Solid Color	Tracer Thread
Loud Speaker	High Side (+)	Telephone Brown	None
Loud Speaker	Low Side (-)	Black	Brown
"B" Battery	Highest Voltage (+)	Red	None
	Intermediate Voltage (+)	Maroon & Red Diagonal Weave	None
	Detector Voltage (+)	Maroon	None
	Negative (+)	Black	Red
"A" Battery	High Side (+)	Yellow	None
	Negative (-)	Black	Yellow

"C" Battery	High Side (+)	Green	None
	Negative (-)	Black	Green
Antenna (or high loop side)		Blue	None
Ground (or low loop side)		Black	Blue
Battery Jumpers		Black	None

For conductors that are common to two or more circuits:

Circuits	Potential	Solid Color	Tracer Thread
Loud Speaker	Low Side (-)	Black	Brown
"B" Battery	High Voltage (+)	Red	Brown
	Negative (-)	Yellow	Red
"A" Battery	High Side (+)	Green	Yellow
"C" Battery	High Side (+)	Black	Green
"C" Battery	Negative (-)	Black	Blue
Ground or loop	Low Side	Black	Blue

(The standard color designations, as shown on the standard color card of America, Sixth Edition, issued by the Textile Color Card Association of the United States, Inc., 50 West 42nd Street, New York, are as follows: GREEN—Emerald S-5005, RED—Geranium S—2035, YELLOW—Orange S-3005, BROWN—Gold Brown S-3285, BLUE—Bluebird S-6065, MAROON—Magenta S-7285.)

This color designation scheme uses solid colored outer braiding to indicate the high or positive side and tracer thread colors in a black braided background to indicate the low or negative side of the circuits.

When one conductor is common to two or more circuits, the colors corresponding to the particular circuits are combined by using color tracer threads and a color background to indicate the circuits involved.

## Standard Machine Screws

**26091:** Standard machine screws for assembling and mounting of radio apparatus shall conform to the standard dimensions for medium fit screws approved by the American Engineering Standards Committee as American Standards.

(American Engineering Standards Committee: American Standard Screw Threads; B-1a, 1924.)

## Screw Size for Mounting Apparatus on Panels

**26092:** Apparatus designed for mounting on radio receiver panels by machine screws shall use a No. 6-32 standard machine screw, wherever possible.

**26093:** It is recommended that No. 6-32 American Standard machine screws be used for mounting apparatus on radio receiver panels.

## Receiving Set Control Markings

**26102:** The standard marking for the knob, dial or pointer controls on radio receivers shall be as follows:

(a) For tuning controls—

Either

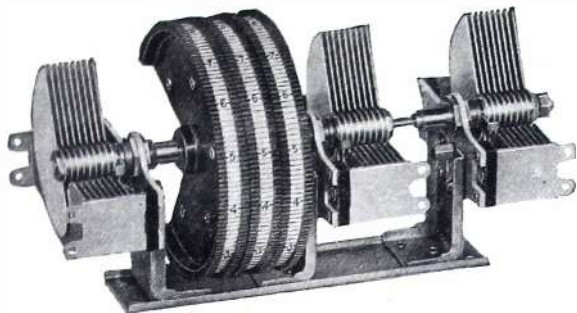
STATION SELECTOR 1, STATION SELECTOR 2, STATION SELECTOR 3, etc.

or

SELECTOR 1, SELECTOR 2, SELECTOR 3, etc., at the option of the manufacturer.

(b) For regeneration adjustment controls INTENSITY.

(c) For signal volume adjustment controls VOLUME.



Alden localized-control condenser. Any unit can be adjusted by its corresponding wheel, or all three can be revolved together

## With the Manufacturers

Current news about the activities and plans of the radio manufacturers and concerns which make things used by the industry

### Alden

**A**LDEN MANUFACTURING COMPANY, Springfield, Mass., has some interesting items. They include a vernier dial, the type 112 Connectorald, and the triple localized-control condenser.

The 112 Connectorald was originally designed so that the new power tubes could be put into present day receivers without re-wiring. Flexible leads are brought out so that an additional 45 volts can be put on the plate of the power tube, and the C battery can be inserted. No changes are made in the battery connections to the binding posts of the set.

One of the cleverest instruments we have seen for a long time is the triple localized-control condenser. This unit consists of three variable condenser sections, but, by using separate concentric shafts, each rotor can be turned independently of the other two. When the unit is mounted behind the panel, the shaft is parallel to the panel. Three knurled discs, side by side, come through the panel to give a thumb setting. Because the three discs are close together, they can be turned all at once, or, since there is enough separation between them, any one can be turned by itself. This is just the thing for those who want the convenience of single control with the advantages, in efficiency, obtainable by separate adjustment of the condensers.

Alden also has a line of gang sockets for 4, 5, and 6 tubes. The filament leads are moulded into the sockets, while the grid and plate terminals are isolated. Stationary or spring mounting can be used.

Another important feature of summer activities at the Alden plant is their obtaining a Donle license for Harold P. Donle's audio amplifying system. This device will be marketed as the Triphonic audio coupler. It is designed to compete in price with resistance amplification, and to produce exceptional quality with greater

volume than can be obtained with resistance amplification.

### Yaxley

The Yaxley Manufacturing Company, Chicago, Ill., has added the Junior Jack and Junior Jack Switch to their line. In general construction, it is made with the same heavy springs



Yaxley Junior switch and jack

and frame that the standard type has, except that it is much reduced in size. The Junior Jack is made in all spring combinations from 1 to 7, and takes any standard radio plug.

The Junior Jack Switch, made in all combinations up to 6 springs, is just like the jack except that it is actuated by a knob at the front of the panel.

These designs are particularly well adapted to sets where the space is greatly limited.

### Ferguson

J. B. Ferguson, Inc, formerly of 41 East 42nd Street, New York City, has now moved to 225 West 57th Street, New York City. The factory is still at 3542-41st Street, Long Island City.

At the new quarters, the Ferguson Company will have a splendidly equipped display room for demonstrating the Ferguson receiving equipment.

### Canotex

The Canotex Company, of New York and Chicago, is manufacturing at their

factory, Auburn, New York, the parts originally designed by the Walbert Mfg. Company. This arrangement has been made under license so that the Canotex Company will market the Univernier dial, S.L.F. dial, safety rim socket, and the Isodon balancing condenser.

### Excello

Excello Prods. Corp., Cicero, Ill., is now ready to make deliveries on an unusually handsome line of console



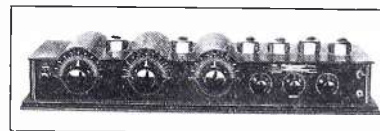
One of a number of new Excello console models

cabinets. These are made with built-in loudspeakers and compartments for batteries or eliminators.

Exceptional taste is displayed in the cabinet work and in the use of handsomely grained woods.

### Neutrowound

Among the 1927 type sets now in production is the Neutrowound receiver, a 6-tube tuned R.F. receiver, with three stages of transformer coupled A.F. amplification. S.L.F. condensers are used for tuning. The set



Neutrowound 6-tube receiver, 1927 model

is mounted in an all-metal shield which serves as the cabinet and also protects the instruments from mechanical damage. A list price of \$85.00 has been announced for this set. The Neutrowound Radio Mfg. Company, is located at Homewood, Illinois.

### Clapp-Eastham

All the old-timers will be pleased to hear that the Clapp-Eastham Company has been reorganized and has now

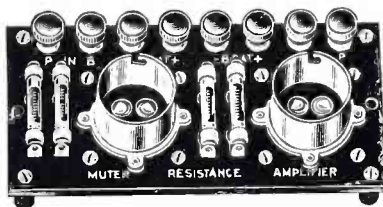
completed the equipment of a factory in Long Island City, New York.

The Clapp-Eastham Company, probably the oldest exclusive radio manufacturer in the world, was organized twenty years ago. At that time it was under the management of Melville Eastham, who later left the Clapp, Eastham Company to organize the General Radio Company, which is still operated under his direction.

The new Clapp-Eastham Company will probably take advantage of its license under the Armstrong patents to use a regenerative circuit but in such a way as to prevent radiation.

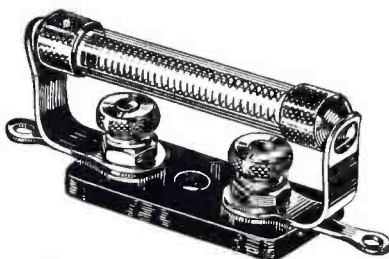
### Muter

Leslie F. Muter Company, Chicago, Ill., has four new items. The fixed condenser, made with metal ends and brass electrodes, has mica insulation



Two-stage Muter resistance amplifier

clamped between Bakelite plates. The 2-stage Muter resistance amplifier is specially designed for use with one stage of transformer amplification. The special resistance unit is designed



Muter tube-control resistor

to provide manufacturers with an inexpensive method for eliminating rheostats. It is made in practically any resistance value, and can be used to control oscillations. Muter fixed rheostats are adaptable to use with single tubes or multiple up to four.

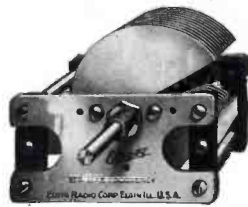
### Stevens

To protect dealers and jobbers handling the Stevens Conoidal loud-speaker, Stevens & Company, Inc., New York City, have taken out a defensive contract with the American Patent Protection Corp., New York City, by which the trade is protected against all claims of patent infringement, legal costs, and judgments. This appears to be the first time that litigation insurance has been used to protect the radio

trade in cases where patents are in question.

### Elgin

Elgin Radio Corp., Elgin, Ill., is building an S.L.F. condenser of par-



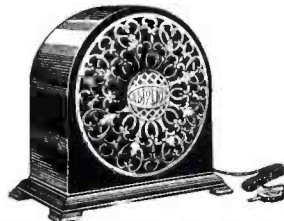
The new Elgin S.L.F. condenser

ticularly small size in capacities of 0.00025, 0.00035, and 0.0005 mfd.

Of the low-loss construction, they are very reasonably priced at \$2.75 to \$3.00.

### Amplion

Amplion Corp. of America, New York City, has engaged Mr. Herbert E. Mills as production manager at their new plant. Mr. Mills is an Eng-



The latest type of Amplion loudspeaker

lishman, previously associated with the Rolls Royce Company. In the United States, he was with Brandes, Inc., for three years.

### Radio Production

Aby-pass condenser winding machine has been developed by the Radio Production Machinery Company, New York City. It winds layers of paper 0.0005-in. thick and tin foil 0.00025-in. thick. These sizes are used in order to obtain high capacities in very small space.

### \$1,000 in Prizes

From the Northwestern University School of Law comes the announce-

ment of prizes totalling \$1,000.00, to be paid by the Charles C. Linthicum Foundation for the best essays or monographs, to be entered by March 1st, 1927, on "The Law of Radio Communication."

Complete details as to the contest can be obtained from the University.

### Amsco

Amsco Products, Inc., 416 Broome Street, New York City, now has a complete line of resistor mountings and resistances of the Metaloid type.

The Metaloid resistor has an outer glass tube of slightly more than the customary diameter, in order to accommodate another glass tube on which the resistance metal is deposited. This construction makes it possible for the resistors to dissipate over 1.0 watt of energy continually without an appreciable variation in the value of the resistance.

The Metaloid resistors, made in low values for B battery eliminators, fit all standard gridleak mountings.

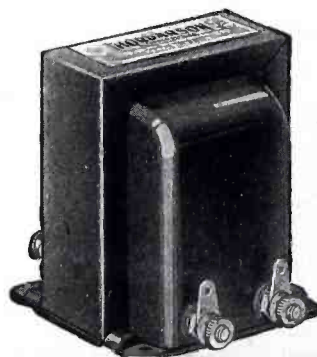
### Hawkeye

The Hawkeye Radio Company, Cedar Rapids, Iowa, is making an antenna reel. It consists of a round pocket-size case containing 100 ft. of  $\frac{1}{4}$ -in.

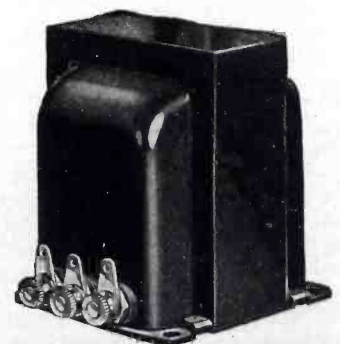


A 100-ft. antenna is contained in the Hawkeye reel

hard drawn flat copper wire. A cord and plug are provided for connecting to the set. The case is  $4\frac{1}{4}$ -ins. in diameter, and the complete outfit weighs 21 ounces. This device is very convenient for portable work or indoor installations. Salesmen demonstrating sets will appreciate the usefulness of this device.

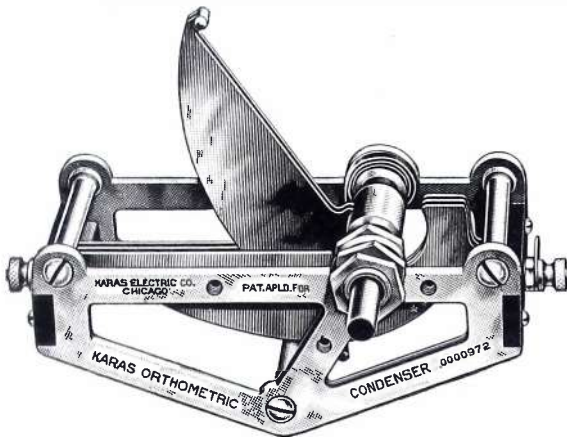


The latest devices produced by Thordarson for A. F. amplifying circuits—the big transformer and the Autoformer





# Play Safe With Karas



## Karas Orthometric Short Wave Condensers

5 plate.....	.0001.....	\$6.50
7 plate.....	.00014.....	\$6.50
11 plate.....	.00025.....	\$6.50

## Karas Orthometric Broadcast Condensers

17 plate.....	.00035.....	\$6.75
23 plate.....	.0005.....	\$7.00

## Harmonik the Favorite — Why

The Harmonik was the original audio transformer with a sufficiently large primary and core to pass the entire range of musical frequencies. With the introduction of Karas Harmonik, radio listeners heard perfect reproduction for the first time. That larger primary and larger cross section core give tone quality and freedom from lost notes. It is this principle of design, evolved by Karas, that other makers of better grade transformers are trying to incorporate.

"High voltage amplification per stage" may be something you know little about, but its presence means volume plus. This higher amplification per stage, without distortion, is one of the exclusive features that makes the Harmonik the most popular transformer in the country.

Now that we have power tubes for the last stage of audio frequency amplification, with characteristics such that this last stage can handle all the energy impressed on it by one preceding tube and two Harmoniks, you can obtain full, round volume every time. Low notes and high notes, vital overtones and rich harmonics at all frequencies, pass through such a system without that slighting of some and over-emphasizing of others, which so long gave to Radio reproduction that "canned" effect.

## Order Through Dealer, or Direct on This Coupon

Karas Condensers in the 23, 17 and 11 plate sizes are sold by good Radio Parts Dealers in most cities. The 7 and 5 plate sizes are not so widely stocked by dealers. Orders will be filled direct, or may be placed through your dealer and his jobber. If you prefer to order direct, use this coupon. Send no money. Just pay the postman the price plus a few cents postage.

## KARAS ELECTRIC CO.,

Manufacturing Plant: N. Rockwell St.

Offices: 1060 Association Bldg.,  
Chicago, Ill.

When you undertake the construction of a multi-tube receiver (such as is necessary today), you are investing quite a sum of money in parts. Also many hours of drilling, assembling and wiring—and your reputation as a set builder.

It's a temptation to save a little on certain items—too often condensers. But—can you tell by **looking** at a condenser whether it is efficient, whether it will lose much of the picked up energy in leakage and absorption? **Hardly!**

Lieutenant Schnell of the A. R. R. L. has **tested** many condensers—and he uses Karas Orthometrics. Milton B. Sleeper of Radio Engineering has **tested** them—and he recommends Karas. Scores of other well-known leaders in Radio, with facilities for tests, are enthusiastic about Karas Orthometrics.

Because every Karas condenser is as electrically and mechanically perfect as such equipment can be today, you know there will be minimum possible losses when Orthometrics are used. The higher cost of a Karas condenser is "the price of perfection"—made necessary by quality materials, finest workmanship and most rigid inspection.

The Orthometric condenser has an exceptional minimum to maximum capacity range. It turns smoothly and evenly throughout that range. The skeletonized end plates are far from the stator plates. The active plates themselves are made entirely of brass. And, with the proper coil, an Orthometric gives an absolutely equal 10 kilocycle separation of broadcast channels between 200 and 550 meters.



Karas Harmonik Transformer, price \$7.00

Karas Electric Co.,  
1060 Association Bldg., Chicago.

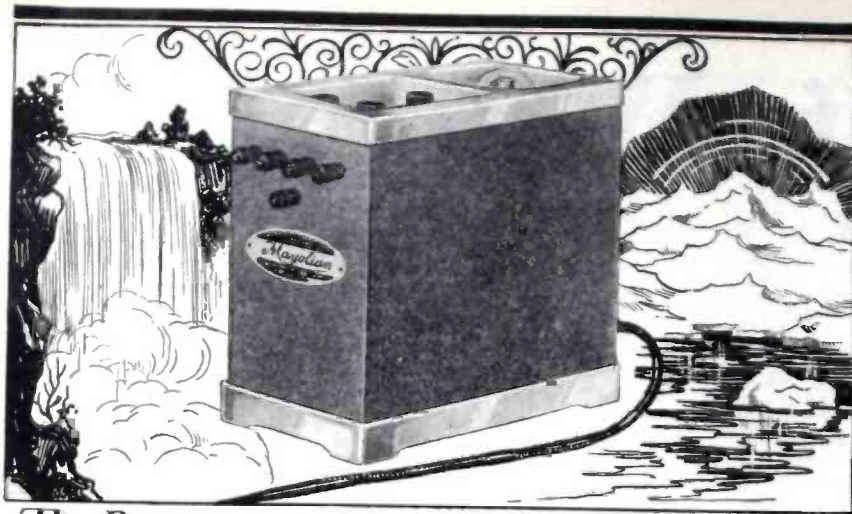
Please send me ..... Karas Harmonik Transformers and ..... Karas Orthometric Condensers, sizes as checked below. I will pay the postman the price plus postage upon delivery. It is understood that I have the privilege of returning these condensers and transformers for full refund any time within 30 days if they do not prove entirely satisfactory.

..... 5 plate; ..... 7 plate; ..... 11 plate;  
..... 17 plate; ..... 23 plate.

Name .....

Address .....

If you send cash with orders we'll ship condensers and transformers postpaid.



*The Power  
of Niagara*

*The Quiet of  
an Arctic Night*

# Mayolian

"B" SUPPLY

## The "B" Without a Buzz

Ends Your "B" Battery Problems Forever

THE annoyance and expense of periodically replacing "B" batteries is now a thing of the past. Mayolian, built by the pioneers in battery elimination, improves the tone quality of any receiver because all voltages are adjustable to the characteristics of your tubes, or the operating characteristics of your set. Delivers 180 Volts maximum—the highest "B" output.

Employing the dependable Raytheon tube each Mayolian is a laboratory-built product, every part of which is made by us especially for this Unit. The transformer in a Mayolian is designed to withstand a 100% overload. This, together with carefully made condensers and chokes, make it possible for us to guarantee Mayolian unconditionally for one year—provided seals remain unbroken.

Mayolian is endorsed by leading receiver manufacturers and engineers. You can always depend upon it for continuous, uniform, noiseless "B" supply that means truer tone fidelity—greater volume—and a saving of its cost over again every year.

- Type 609, 110 Volts, 60 Cycles complete with tube, \$55.00
- Type 607, 110 Volts, Direct current, complete . . . 25.00
- Type 610, (for Export) 220 Volts, 60 Cycles complete with tube . . . . . 67.50

Have the nearest Mayolian Dealer demonstrate in your home, or write us

**MAYOLIAN RADIO CORPORATION**

*Pioneers in Battery Elimination*

1991 BROADWAY

NEW YORK, N. Y.

**Absolutely Silent Operation**

**Constant, Dependable Voltage**

**Greater Volume—Better Tone**



Operates at half the cost of a 25-Watt lamp



## OFFICIAL DATAPRINTS

*Assure Your  
Success*

5-N-1  
Short Wave  
Receiver

\$1.00  
Postpaid

US-76  
Short Wave  
Telephone  
Transmitter

\$1.00  
Postpaid

KB-8  
Non-Regenerative  
Browning  
Drake

\$1.00  
Postpaid

210  
Power  
Amplifier

\$1.00  
Postpaid

RX-1  
The Set for  
the Donle  
Tube

\$1.25  
Postpaid

Official Dataprints include full-size panel patterns, picture wiring diagrams, parts list, all instructions

**M. B. Sleeper, Inc.**  
A-52 Vanderbilt Ave.,  
New York



JEWELL RADIO SERVICE—SET No. 117

# SERVICE—

- ☞ Radio engineers, experimenters and service men have felt the need for a complete radio service set and Jewell has met this need by the development of the No. 117 set illustrated in this ad.
- ☞ Two separate sections, one containing instruments, rheostat, tube socket, etc., and the other for batteries.
- ☞ The only complete set of this kind on the market. Send for special circular No. 700.

Order from Dealer

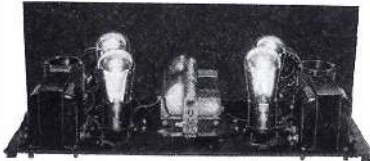
**Jewell Electrical Instrument Co.**

1650 Walnut St

Chicago

## The **S-C** SILVER COCKADAY "All Wave Receiver"

**ENDORSED  
AND  
APPROVED**



By Radio Engineering, Radio News, Radio Age, Radio, On the Air, Popular Science Monthly, Christian Science Monitor and Newspapers throughout the country . . . The S-C Receiver, designed by Silver and Cockaday and sponsored by Popular Radio Magazine goes to the Set Builder with an overwhelming introduction. The daily flood of letters praising this startling new receiver proves that this universal endorsement is fully merited by the S-C.

The parts manufactured by the following reputable concerns are recommended for the S-C by the designers, and can be obtained in a complete Kit from any Radio Dealer

- Belden Mfg. Co.—S-C Wiring Harness
- Central Radio Laboratories—Centralab Resistance
- Polymet Mfg. Corporation—Fixed Condensers, Leak and Leak Clips
- Poster & Co.—Drilled and Processed Front Panel and Drilled Sub-Panel
- Silver-Marshall, Inc.—Variable Condensers, Coil Sockets, Coils, Tube Sockets, Vernier Dial, Mounting Brackets
- Thordarson Elec. Mfg. Co.—R200 Power Transformers
- Yaxley Mfg. Co.—Rheostat, Jacks, Switch

GET The S-C Instruction Booklet from your dealer or send 25c to the following address.

**S-C MERCHANDISING CO.**

286 S. Peoria St.

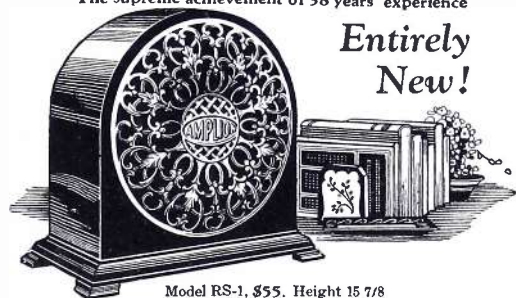
Chicago

Radio Engineering, June, 1926

# Radiolux AMPLION

The supreme achievement of 38 years' experience

**Entirely  
New!**



Model RS-1, \$55. Height 15 7/8 in. Beautiful mahogany finished cabinet, oxidized silver grille.

**CLEARER, louder, more sensitive and more realistic in tone, by actual comparison, than any other existing type of radio reproducer, this newest addition to the Amplion family—the beautiful Radiolux-Amplion—is, in every acoustic and artistic sense a revelation!** Outwardly resembling the distinctive English bracket clock, inwardly the Radiolux-Amplion

is a radical and complete departure in acoustic design. Hear the Radiolux-Amplion in comparison and you will agree it gives the most faithful reproduction of radio you have ever enjoyed. Price \$55.00. Six other popular models of Amplions, \$12 to \$42.50, equipped with cords and panel plugs. Write for full particulars and "Amplion Pedigree."

**THE AMPLION CORPORATION of AMERICA**

Executive Offices: Suite W, 280 Madison Ave., New York City

Chicago Branch: 27-29 No. Morgan Street

Amplion Corporation of Canada, Ltd., Toronto

A Point on the Dial for  
EVERY STATION

# METRALIGN

(Straight Line Tuning)

The Condenser That  
Prevents Jamming



Straight Line Capacity Condensers crowd stations on the low wave lengths. Straight Line Frequency Condensers crowd stations on the high wave lengths.

## METRALIGN

Straight Line Tuning is the only condenser which is equally efficient on both high and low and intermediate wave lengths—and by spreading out the stations evenly over the entire band it naturally makes any receiver much more **SELECTIVE**.

The METRALIGN (S. L. T.) is rigid and compact, much smaller than other condensers, yet possesses the accuracy and precision of laboratory standards.

The METRALIGN (S.L.T.) Condenser makes it possible for the owner of any type set to bring in stations which he never heard before.

We have prepared a very useful booklet, written in everyday language, covering everything you want to know about condensers. It's **FREE**—Write for it.

### GENERAL INSTRUMENT CORP.

Manufacturers of "Bureau of Standards" Variable Primary Condensers

477 Broadway, New York City.

Manufacturers-Distributors—Write for full specifications on METRALIGN (SLT) Condensers.

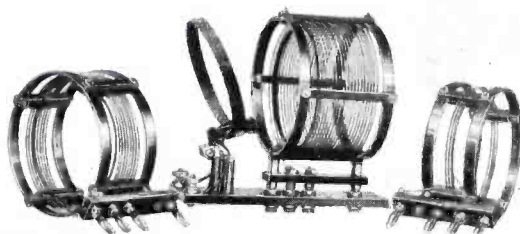
## Immediate Delivery on DONLE TUBES

For louder signals  
better signals on  
all types of sets  
using Neutrodyne, Tuned R.  
F. or Regenerative  
circuits.

PRICE \$5.00

**Dealers:** To give you a chance to introduce the Donle Tubes to your trade, we will ship 2 Donle Tubes upon receipt of your check for \$7.00 provided the order is on your business stationery, and signed by the manager. On subsequent orders, 30% discount will be given only in lots of six tubes—cash with order.

C. J. BROWN, Authorized Agent  
17 West 51st St. New York City



Short Wave Kit—15 to 133 Meters \$12.00 Complete

## AERO COILS Specified Again!



Coil No. 4  
125-250 Meters  
Price \$4.00



Coil No. 5  
235-550 Meters  
Price \$4.00

Read in this issue of Radio Engineering about the 5-N-1 short wave Receiver. Aero Coils are again specified in this set.

Whenever utmost efficiency is desired, radio experts and set designers specify Aero Coils. These accurate inductances are interchangeable and give you a range of 15 to 550 meters.

If you plan to build the 5-N-2 receiver or want to improve your present receiver, obtain Aero Coils from your dealer or direct from us today.

**AERO PRODUCTS, Inc.**  
1772 Wilson Ave., Department 17, Chicago, Ill.

# THE EQUAMATIC SYSTEM

(TRADE MARK)

## Radio's New Automatic Focus

A SIMPLE and positive method of automatically equalizing and balancing all radio circuits at all broadcasting wave-lengths, has been the aim of radio engineers since the inception of radio receiving.

*This aim is now realized in the Equamatic System.*

1. The Equamatic System gives maximum and equal sensitiveness and amplification over the entire tuning range.
2. It develops greater selectivity without distortion or loss of harmonics.
3. It assures perfect balance on all wave-lengths without employing "losser" methods.
4. It accomplishes greater effective wave-length range for any given inductances and condensers.
5. It conserves the life of "A" and "B" batteries.
6. It simplifies operation of all sets by perfect synchronization of the first dial with the others.
7. It eliminates fundamental wavelength antenna absorption.
8. It provides simple adjustment to meet varying conditions, permitting perfect balance of tubes, antenna, and associated apparatus.

The Equamatic System is easily adapted to present day radio production methods without increasing manufacturing costs. It is fundamentally correct in design and adaptable to all types of tubes and receivers.

The Equamatic System is destined to replace the present "losser" methods of control. Once the public recognizes the superiority of radio receivers embodying the Equamatic System, an ever increasing demand is assured.

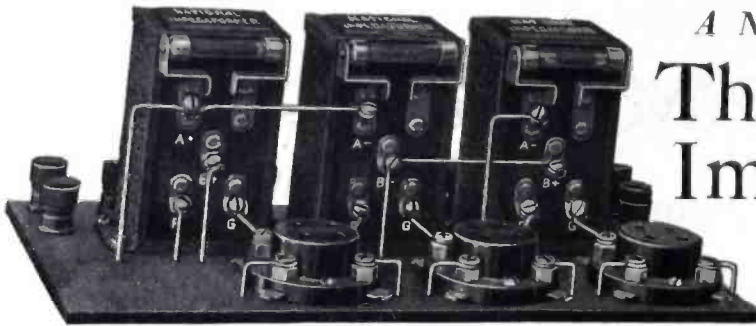
Licenses for the rights to use the Equamatic System in the manufacture of sets and kits will be issued to a limited number of established radio manufacturers.

*Before you have completely formulated plans for the coming season, investigate the exclusive advantages of the Equamatic System. Demonstration and tests may now be arranged by appointment.*

U. S. and Foreign Patents Pending

THE EQUAMATIC SYSTEM, 10 ARGYLE RD., BROOKLYN, N. Y.





A New National Radio Product

# The NATIONAL Impedaformer

marvelously improves  
the home-built set

The Illustration Shows the Assembly of Three Impedaformers  
as They Would Appear in a Set

### Inductive Audio Flat Curve

The NATIONAL Impedaformer is an inductance-capacity-resistance unit that actually gives a flat curve over the entire audible frequency range.

Includes choke coil, grid condenser and grid leak built into a single unit so that its connections are the same as an ordinary transformer.

Made in two types: Type A (choke coil only). Price \$4. Type B contains choke coil with grid condenser and grid leak. Price \$5.50.

Our advertising in leading radio publications is directing customers to your store for this new NATIONAL product.

Send for Bulletin 108 RE

### The Impedaformer Sets a New Standard of Radio Reproduction

*"I have just heard the finest reproduction of voices over the radio," writes a well-known radio expert to the National Company. "The set was equipped with the new impedaformer. I was amazed at the refinement of delivery."*

With these units an impedance coupled audio amplification system can be constructed which will truthfully and uniformly reproduce in all its richness and purity each and every note sent out by radio-casting stations.

The tone quality is simply superb. The volume is greater than with resistance-coupled amplification. And this is accomplished with no more B battery voltage than is usually used on a transformer system and with a minimum of storage battery consumption.

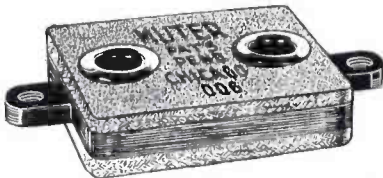
## NATIONAL COMPANY, Inc.

W. A. READY, President  
110 Brookline St., Cambridge, Mass.

# MUTER

## DEPENDABLE FIXED CONDENSERS

MICA INSULATION  
BRASS ELECTRODES  
ACCURATE CAPACITIES



Used by Leading Set Builders

SAMPLES AND QUOTATIONS  
PROMPTLY FORWARDED

**LESLIE F. MUTER COMPANY**  
76th AND GREENWOOD AVE.  
CHICAGO ILLINOIS





## New Models

### B-Power Unit



Specification No. 1582  
for Standard Raytheon Tubes  
\$11.00 List

A distinct advancement in B-Eliminator construction—the new Dongan B-Power unit, sturdily built into a handsome steel case, assures the most perfect operation of your set with the Raytheon Type-B Full Rectifying Tube.

Also Dongan Transformers and Chokes for use with R. C. A. and other proved types of Full and Half-Wave Tubes.

Order from your dealer or send money order to us direct.

### Audio Transformers



Semi-Mounted  
for Set Manufacturers  
Specification No. 117

This new Semi-Mounted, with half shell, Audio Transformer combines the finest features of Dongan design with a compact, finished appearance for the finest sets—at a new low price. Ratios 2 to 1, 3½ to 1 and 5 to 1. Samples and engineering cooperation available immediately to set manufacturers.

### Raytheon Tubes \$6.00 List

Transformers and Chokes  
for the new B H Raytheon  
Tube now available.

Audio Transformers for all types  
of receivers—exclusively for Set  
Manufacturers.

Quotations and samples ready.

**DONGAN ELECTRIC MANUFACTURING CO.**

2995-3001 Franklin St.

Detroit, Mich.

**TRANSFORMERS of MERIT for FIFTEEN YEARS**

# Push Out for Radio the Year 'Round



LET'S get away from the thought that Radio is a winter sport. Stop thinking that way. The broadcasters give us good programs. Except possibly for distance, reception is as good, on the average in Summer as it is in the Fall and Winter. True, the nights are shorter, but our facilities for enjoying them are greater—on porch, in the garden, in camp and resort. And as for vacations, it is a fact that comparatively few people are away at any one time.

As for the home-set builders, the longer days give them more hours in which to plan and work. There might be some let-up in completed sets, but there should always be a good market for parts.

Benjamin Radio Products, so far as increasing sensitivity, aiding selectivity and building up volume are concerned are built for all year 'round radio. Benjamin advertising is geared to urge Summer set building. Don't put all your expectations into a short season. Make the business pay its way all the time.

You should be on our mailing lists for our Better Radio Literature. We'll be glad to add your name



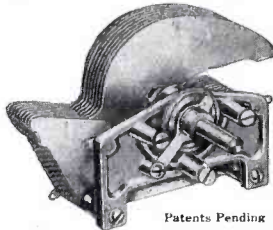
Patented July 25, 1925  
May 2, 1911

Benjamin Cle-Ra-Tone "Push" Type Socket



Licensed Under Levejoy Patent Nov. 3, 1926

Benjamin Tuned Radio Frequency Transformers



Patents Pending

Benjamin Straight Line Frequency Condenser

## Benjamin Electric Mfg. Co.

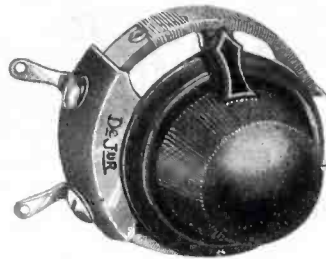
New York 120-128 S. Sangamon St. San Francisco  
247 W. 17th St. Chicago 448 Bryant St.

Manufactured in Canada by the Benjamin Electric Mfg. Co. of Canada, Ltd., Toronto, Ontario

# BENJAMIN

TRADE MARK

## DeJUR AIR-COOLED RHEOSTAT



One Hole Mount

A highly efficient low-cost resistance-unit. Operates without any noticeable temperature rise at constant coefficient of conductivity. Filament voltage can be built up slowly and held at right point for most efficient operation. Sliding contact arm is adjustable and resistance is exposed on all sides. Genuine Bakelite Knob.

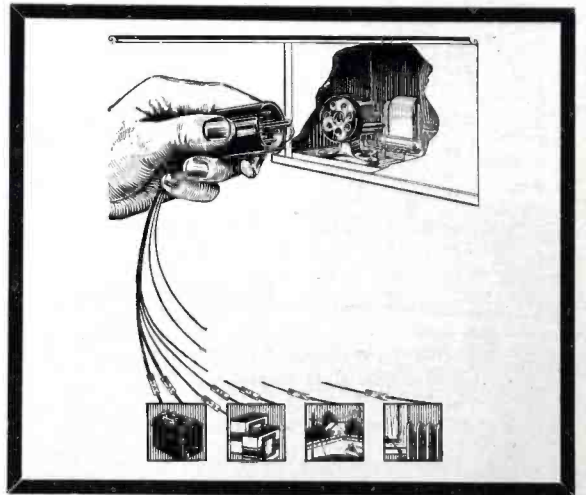
DeJUR  
Power  
Rheostat

A high-carrying capacity rheostat specially made for power sets, or wherever high resistance capacity is required. One to 2000 ohms. Genuine Bakelite base and knob. Enamelled high resistance wire. Scientifically designed; mechanically and electrically perfect.



Write for Complete DeJur Catalog  
**DeJUR PRODUCTS CO.**  
199 Lafayette St. New York City

## There is One Best Way!



# Jones MULTI-PLUG

THE STANDARD SET CONNECTOR

HOWARD B. JONES  
618 So. Canal St. :: Chicago

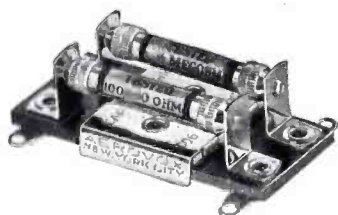


**for  
good panels  
—brass**

Sheet BRASS used as panels does not split or warp. Its easy fabrication assures economical production.

BRASS can be readily marked, engraved or etched and will take permanent finish in any color or style.

**COPPER & BRASS  
RESEARCH ASSOCIATION**  
25 Broadway, New York



**AEROVOX**

**"Built Better"  
RESISTOFORMERS**

Tested and approved by M. I. T., Yale, Radio News, Popular Radio, and Popular Science. Used by over 200 of America's leading set manufacturers.

**AEROVOX WIRELESS CORP.**  
489-491-493 Broome St., New York

*Branch Offices:*

St. Louis, Mo., Syndicate Trust Building  
Cincinnati, O., 304 Palace Theatre Bldg.  
Chicago, Ill., 53 W. Jackson Boulevard  
Boston, Mass., 94 Portland Street  
Los Angeles, Cal., 324 N. San Pedro St.

**NEW**  
**!**

for  
**Manufacturers**  
of  
**Receivers—Speakers**

THE  
**BEST**  
CONE TYPE UNIT

is now in production. The economy of cost and improvement in tonal quality is such that you must inspect this new development.

ALSO  
**BALANCED ARMATURE  
UNIT**

which by rigid tests, made by recognized laboratories in different parts of the world surpasses **any** unit now made. You should have further information.

Complete assortments on all types. Built-in designs, etc.

*Special Designs to Specification*

*Reputable Jobbers and Dealers—Write!*

**BEST MANUFACTURING COMPANY**

1200 Grove St.

Irvington, N. J.

*"All That The Name Implies."*

Sales Department

The Hartzell Sales Company

961-50 Church Street, New York City, N. Y.

U. J. Herrmann  
Managing Director

G. Clayton Irwin Jr.  
General Manager

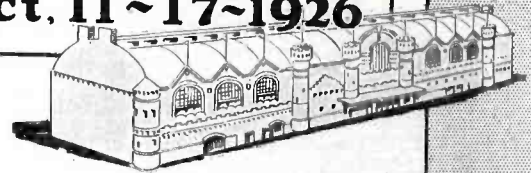
# Radio Manufacturers' Show Association

Presents

Third Annual  
**RADIO WORLDS FAIR**  
Madison Square Garden  
New York City  
Sept. 13-18-1926



Fifth Annual  
**CHICAGO RADIO SHOW**  
Coliseum  
Chicago  
Oct. 11-17-1926



The World's Foremost Radio Exhibition  
Held in  
The World's Foremost Exhibition Halls

Displays of new fall lines by every representative radio manufacturer. Special business sessions for the trade. Every progressive radio merchant must visit this exhibition to keep posted on the newest developments and trend of the industry.

## SM

## TYPE 220

### Audio Transformer

Better than resistance or Impedance Audio



Unbiased laboratory tests,—not one but many—prove the complete superiority of the new SM Type 220 Audio Transformers. They give more perfect reproduction than resistance, impedance or other transformer audio amplifiers. No loud speaker on the market will reproduce the low notes they deliver. SM Audio Transformers guarantee greater amplification with less distortion than any other ever manufactured. Big—sturdy—rigid with a quality unequalled and tone purity beyond belief. Try a pair of SM 220s—you'll find them to be the finest \$12 worth of radio equipment you ever purchased. If they're not just twice as good as any audio amplifier you've ever used—return them and get your money back.

LIST PRICE \$6 EACH

See SM parts at your dealers

**SILVER-MARSHALL, INC.**

854 W. Jackson Blvd.

Chicago

A Universal Range Variable Resistor

## CLAROSTAT



Endorsed By

RAYTHEON  
DONGAN  
GEN'L RADIO  
THORDARSEN  
FANSTEEL  
SILVER-MARSHALL  
AMERTRAN  
Etc., Etc.

\$2.25

for A and B Battery Eliminators

DEALERS and JOBBERS—

Power supply is the biggest development this year.

Raytheon publicity in scores of magazines and newspapers has specified Clarostat as the *only* variable resistor for battery elimination. Your customers will demand it this fall. *Write us now.*

MANUFACTURERS—

Clarostat has a universal resistance range of from practically 0 to 5,000,000 ohms—a current-carrying capacity of 20 watts—is absolutely noiseless in operation—and requires but one hole for mounting.

Special types of Fixed and Variable Resistors to meet any and all requirements of Receiver and Power Supply Manufacturers.

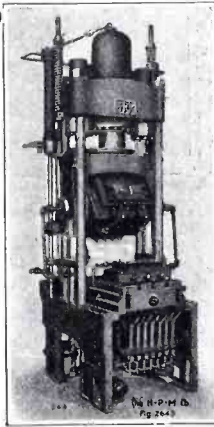
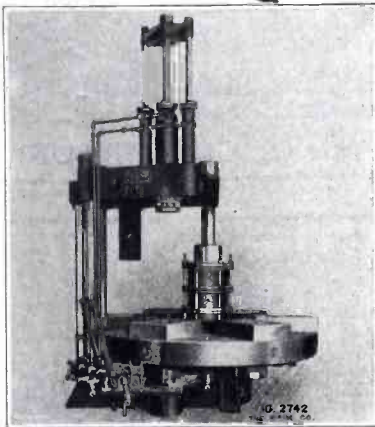
Bring Your Resistor Problems to CLAROSTAT!

American Mechanical Labs., Inc.

285-287 N. Sixth St., Brooklyn, N. Y.  
Resistor Dept.



# PRODUCTION PRESS EQUIPMENT FOR THERMO-PLASTICS



With the rapid expansion in plastic molding, there is need of really efficient machinery for molding in large quantities. H-P-M is meeting this need with presses such as are illustrated here.

On the left is an H-P-M Composition Molding Press, Six Station Turret Type for such products as storage battery boxes. Among its production advantages over plain single presses are:—more production, less investment per unit of output, less labor.

On the right is an H-P-M Bakelite Molding Press, revolving head—sliding table type, with Full Automatic Timing Control. It will turn out perfect molded parts with no attention from an operator during the molding cycle. One unskilled attendant can serve several of these presses in placing the raw powder and removing finished parts.

Submit your production molding problems to H-P-M.

**THE HYDRAULIC PRESS MFG. CO.**  
ENGINEER BUILDERS SINCE 1877  
MOUNT GILEAD, OHIO

**H-P-M**  
**HIGH PRESSURE HYDRAULIC**  
PUMPS **PRESSES** VALVES

"FOR YOUR PRESSING NEEDS"

Radio Engineering, June, 1926

# ELECTRAD

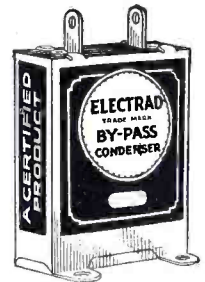
Dependability  
Is Built Into  
These Better  
Rheostats



**EXAMINE** Electrad Certified Rheostats as carefully as you desire—subject them to every test—you will find them absolutely dependable in every respect.

Resistance element guaranteed to within 5%. Milled shaft with squared hole in contact arm insures rigidity. No wobble of shaft. Extra long metallic bearings. Highest grade *Bakelite* insulation, maximum radiation and mechanical strength. Single-hole or three-hole mountings. For three-hole mounting, base is tapped, eliminating use of nuts behind panel. Phosphor bronze spring contact arm insures perfect contact. In every respect a better rheostat—6, 10, 20 and 30 ohms. List, \$1.25—in Canada, \$1.75. Potentiometers, 200 and 400 ohms, list, \$1.50—in Canada, \$2.00.

## ELECTRAD Certified By-Pass Condensers



Supplies the demand for a superior and dependable by-pass condenser. Has low power factor, low radio frequency resistance and negligible D. C. leakage. Guaranteed working voltage 250 A. C. Every condenser given one minute test of 1,000 volts—not flash test, which is not accurate. Impregnated with paraffine under high vacuum. Paper used has higher dielectric strength than any other known—developed and used exclusively by Electrad. List, 60c to \$3.75—in Canada, 85c to \$5.25.

Write for details on our square dealer proposition, that helps you sell and protects your profits.

Write for information on the Electrad 500,000-ohm compensator for perfect control of tone and volume. 428 Broadway, New York City.



# ELECTRAD

Page 257

*Never pass up an Advantage merely because you're not sure you'll need it—if it costs no more.*

All black moulded materials look much alike. But color and surface appearance are *not* insulating values.

RADION, a special hard rubber compound, has distinct insulating properties definitely superior for Radio. They are:

1. Lowest angle phase difference.
2. Lowest dielectric constant.
3. Highest resistivity (megohms cm.).
4. Lowest power factor loss.
5. Lowest moisture absorption.

RADION, as an insulation, is serving many manufacturers of sets and parts in the form of Panels, Dials, Sockets, Tubing, Rods and Moulded Pieces of every description.

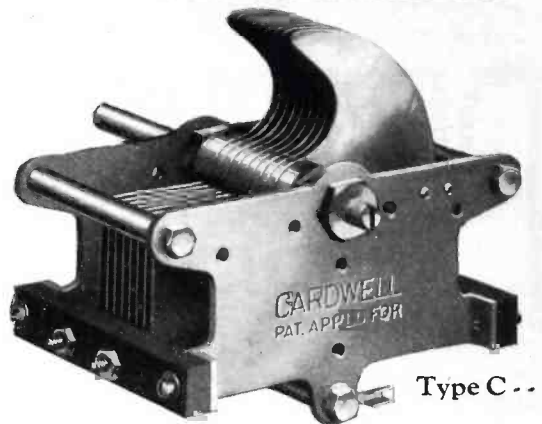
RADION may be the very material you need to get the right insulation results PLUS a wide factor of safety.

We welcome investigation because we can readily convince manufacturers that RADION is a superior material behind which is an adequate organization to produce it.

AMERICAN HARD RUBBER CO.  
11 Mercer Street New York

**RADION**  
*The Supreme Insulation*

## Cardwell Condensers



Type C--

*The Manufacturers Favorite*  
with the Ideal Tuning Curve  
IN SINGLES and MULTIPLES

Send for Quantity Prices

The Allen D. Cardwell Mfg. Corp.  
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"THE STANDARD OF COMPARISON"

## Can You Qualify For the Most Valuable Radio Franchise?

Radio dealers, who can qualify as AUTHORIZED DAVEN SERVICE DEALERS, are making sales where no sales grew before. The Service Dealers, who have already qualified for the Daven franchise, are doing from two to three hundred per cent more business than they did a year ago, at the same time of year.

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A Service Engineer will explain our proposition to you in person.

Better write today, before someone is established in your territory.

**DAVEN**  
RADIO CORPORATION  
*Resistor Specialists*

155 Summit St.

Newark, N. J.

# IMPORTANT TO MANUFACTURERS:

POSITIVE.  
PERMANENT  
FINISH,  
STRENGTH  
IN THE CIRCUIT

*When you think  
of perfect electrical contact  
— as being permanent —  
think of the*

**Lastite**  
it locks!

the bus wire  
the solder  
thin, circular  
flange



tube that  
holds bus wire  
threaded base  
instrument  
or panel

The Standard, tubular Soldering Terminal  
for making radio circuits mechanically strong  
A refinement that saves time and material

Manufactured by  
*W. William Stevens Co.*

27 Hammatt Road, Roslindale Mass.

PATENT APPLIED FOR

The biggest thing of its size in Radio



## Radiohms and Potentiometers

Centralab non-inductive, variable resistances are controls of graphite type that insure smooth, noiseless tuning and permanent service. A single turn of the knob gives stepless variation of resistance from zero to maximum.

Centralab Radiohms have two terminals, and can be furnished with maximum resistances of 2,000, 25,000, 50,000, 100,000 or 200,000 ohms. Centralab Potentiometers have three terminals, and are furnished in resistances of 400, 2,000 and 500,000 ohms. There is a type adapted to every radio circuit for control of oscillation or volume.

*Write for literature describing these and other Centralab super-quality radio Controls.*

**CENTRAL RADIO LABORATORIES**  
25 Keefe Ave. Milwaukee, Wis.

# Centralab



# UNION RADIO TIP JACKS

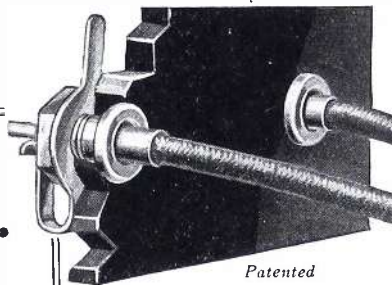
Are Specified and  
Must Be Used in the

## HAMMARLUND-ROBERTS RECEIVER

Retail  
Price

**25c.**

a pair



Patented

Fans everywhere are building the popular Hammarlund-Roberts Receiver. When they buy this circuit—they must buy Union Radio Tip Jacks, because they are specified by the engineers and designers of this Receiver. Panels are drilled for, and will accommodate only Union Radio Tip Jacks.

Set builders appreciate the advantages of these Tip Jacks and their marked improvement over binding posts. They lock securely on the panel and assure a positive, temporary or permanent connection and will not work loose. Soldering lug is provided for permanent fastening. ALL PARTS ARE HEAVILY NICKEL PLATED.

### They Are Used as Standard Equipment in Many of the Best Sets on the Market

Firmly grip all wires from No. 11 to No. 24 B & S gauge. Three sizes for all panels. TYPE A (Standard)—for 3/16" to 1/4" panels. TYPE B (Special) for panels, cabinet walls and partitions from 5/16" to 1/2" thick. TYPE C (Special) for panels up to 5/8" thick. Packed in "self-selling" counter cartons of 1/12", 1/2 and 1 gross pairs. Also in boxes of 5 pairs for the Hammarlund-Roberts Set.

### Other Guaranteed Union Radio Parts

**VERNIER DIAL ADJUSTERS**—In demand by fans for finer tuning. Permit instant adjustment of the dials. Retail price 60c.



**IDENTIFICATION TAGS**—There is a ready sale at all times for these labels. Made of hard, red fibre ovals. Prevents shorting battery or blowing tubes. Marked with proper identifications of battery connections such as A—, B—; B67, B90, etc. Two holes, will take any wire up to 1/4". Packed 100 to a box of one designation only. Retail price \$1.00. Also in set of nine. Retail price 10¢.

### To All Branches of the Trade

Send for literature 'N' and samples of our reasonably priced Guaranteed Radio Products. Get details of our attractive proposition.

**UNION RADIO CORPORATION**  
124 SUSSEX AVENUE, NEWARK, N.J.  
NEW YORK OFFICE 116 WEST 32nd STREET.



# The Donle-Bristol Detector

Type B-6

**\$5**

*"The Only Tube of Its Kind in the World"*

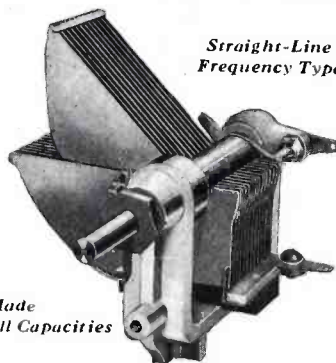
*Send For Descriptive Bulletin*

**THE DONLE-BRISTOL CORPORATION**  
Cambridge & Tremont Sts.  
Meriden, Connecticut

## Why Not Use the Best Condensers The Radio World Affords?

Specialized experience and equipment are required to produce a high-grade condenser at a reasonable cost. Why should you add to your burdens the manufacture of a specialty you can buy for less money?

Hammarlund has built fine condensers ever since the birth of radio, and, for years previously,



*Straight-Line  
Frequency Type*

concentrated on the manufacture of precision instruments for telephone and telegraph use.

Hammarlund is equipped to build for you the best condensers the radio world affords, at an appealing price and will give you prompt deliveries.

*Send us your specifications*

**HAMMARLUND MANUFACTURING CO.,**  
424-438 W. 33rd St., New York City.

**For Better Radio**  
**Hammarlund**  
PRECISION  
PRODUCTS

*Perhaps you would be interested in the booklet, "How to Build the Hammarlund - Roberts Receiver." It will be sent on receipt of ten cents in stamps.*

*The famous Hammarlund solenoid space-wound coils provide the maximum inductance with the lowest losses. Made for every type of circuit.*

## Mr. Radio Engineer

- To—Simplify set operation.
- To—Solve all tube control problems.
- To—Avoid the possibility of distortion in reception.
- To—Decrease servicing need.
- To—Lower production costs.

COMMUNICATE—with an organization that has specialized in filament control ever since Radio was born.

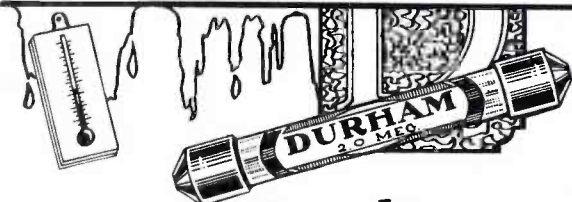
*Radiall Company*

50 Franklin St., New York, N. Y.

Makers of



## DURHAM



*Not Affected by  
Atmospheric Changes*

Durham Resistors are *Metallized* and specially insulated, thus insuring permanence of resistance under all operating conditions. Maintain their resistance-standard because impervious to atmospheric influences. Get the new Durham Mounting—upright, saves space.

500 ohms to 10 megohms

INTERNATIONAL RESISTANCE CO.  
Philadelphia, Pa.

## DURHAM

METALLIZED

## RESISTORS

## A New Development In Panel Material

of major importance to  
Every Radio Manufacturer

The sheer natural beauty of woods, with perfect graining, shadowing and finish, is retained in LIGNOLE Panels. Cabinets can be perfectly matched.

The Variety of Finishes is practically unlimited.



Lignole is a highly di-electric, moisture-resistant product.

It is easily drilled or punched without special machinery.

*Write for information,  
samples and  
prices*

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Chicago, Ill.

Sales Department  
**THE HARTZELL SALES CO.**  
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# BUYERS' GUIDE

## Cabinets

JORDAN CABINET CORPORATION  
Tel. Sunset 4453  
Brooklyn, N. Y.

## Hardware

F. R. ZIERICK MACHINE WORKS  
6 East Howard St., New York City  
*Terminals—Lugs—Ground Clamps—  
Socket Springs—Socket Shells—Bus Bar  
Strips—Angles—Brass and Copper Specialties.  
Metal Stampings by the thousand or million*  
Tel. Canal 0079-1279

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COMPANY  
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D. K. BULLENS CO.  
*Hot Forged Radio  
Magnets*  
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MUNN & CO.  
*Associated since 1846 with the Scientific  
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638 Hobart Bldg., San Francisco, Cal.  
549 Van Nuys Bldg., Los Angeles, Cal.

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Antenna	Bus Bar
Magnet	Annunciator
Litz	Loop Aerial
Lead in	Guy
Flexible Silk	Detector

CORNISH WIRE CO.  
30 Church St. New York City

STRAND—Antennae (plain or enameled)—Double Galvanized.  
WIRE—Antennae (plain or enameled) Connecting and Ground (Rubber) covered, braided or plain.  
BUS BAR—Litzendraht-Loop  
MAGNET (Cotton or Silk).  
JOHN A. ROEBLING SON'S CO.  
Trenton, N. J.

# Why THE METALLIZED RESISTOR



METAL long has been recognized as the best of electrical conductors. The metallized resistor gives conductive resistance and absolutely silent operation.



### Why I entered the RESISTOR Business

In concentrating upon the reduction of losses in coils and condensers, too little attention has been given to the development of an equally vital factor—efficient resistors.

Resistance is, at once, radio's greatest enemy and best servant. It is the balance wheel. It is used to control power houses, radio stations and even radio receivers. We have studied the shortcomings of modern fixed resistors and now offer the result of much research and experimental work—the LYNCH METALLIZED RESISTOR.

Arthur H. Lynch

### FIXED RESISTOR

Arthur H. Lynch  
INC.  
NEW YORK N.Y.

IMEG

### PRICES:—

.25 to 10	Megohms	.50
above .01 to .24	"	.75
.001 to .01	"	\$1.00

The LYNCH METALLIZED FIXED RESISTOR comprises a concentrated coating of metal one-thousandth of an inch thick upon a glass core and sealed within a glass tube. Each Resistor is warranted noiseless, impervious to moisture, and of permanent resistance value.

The LYNCH label is your guarantee of accuracy, dependability and satisfaction. If your dealer cannot supply you, order direct and we will ship postpaid.

### ARTHUR H. LYNCH, Inc.

Manufacturers of Radio Devices

Fisk Bldg., Broadway & 57th Street  
New York, N.Y.

DEALERS—write us!

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# 210 Power Amplifier

**I**T'S time to bring your set up-to-date—so that you can show 'em what a tin can the ordinary radio set is.

That may sound a little harsh, but wait until you hear how your set sounds when you take off the 210 Power Amplifier after you have had it in operation for a few minutes—yes, sir, your own very best set that you imagine is bringing out of the loud speaker every thing that is put into the microphone.

—Not that your set isn't doing credit to the skill and effort you have expended on it, but remember that the Power Amplifier will deliver 20 times as much energy to the loud speaker that a 201-A can give it.

Another thing—The ordinary amplifier sends a steady D.C. current thru the magnets of the loud speaker, keeping a steady pull on the diaphragm or cone. The vibrations are set up only by changes in that pull. The Power Amplifier, however, puts a real alternating current thru the magnets, and only when signals are on.

This not only produces superior quality, but prevents demagnetization and loss of volume.

## 210 Power Amplifier Official Dataprints

You can build the 210 Power Amplifier from the Official Dataprints. Their accuracy is doubly guaranteed, for they are made from the laboratory model built in the Radio Engineering Laboratory, and they bear the o. k. and signature of J. L. Schermerhorn, Chief Engineer of the American Transformer Company, and an expert of national reputation on audio amplification.

### Save a Dollar

Radio Engineering Magazine  
A-52 Vanderbilt Ave., New York

Send me—

- Official 210 Power Amplifier Dataprints, for which I enclose \$1.00.
- Free—Official 210 Power Amplifier Dataprints, and send me Radio Engineering Magazine for 12 months, starting with the July issue, for which I enclose \$2.00.

Name .....

Street .....

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

# FACTS -- on Amplification



**A**FTER endless arguments to prove trans- former, resistance, or impedance simplifi- cation the perfect method, we find that perfect reproduction by any method is limited to the power-handling capacity of the tubes.

If your amplifier is taxed to capacity in repro- ducing a low-power instrument such as the vio- lin, how can it deliver the relatively high- power punch of the drum to your loudspeaker?

A drum can drown out the notes of a violin, but when a violin makes your 201-A's work to ca- pacity, your amplifier cannot make any more noise in reproducing the drum.

The only answer possible is given by the UX 210 tube working on 350 to 450 volts. This delivers about 20 times the energy to the loud- speaker that is obtained from a 201-A.

You can readily understand, then, the electrical reason for the improvement in quality from the 210 Power Amplifier. (The volume can be regulated to suit the room in which the set is installed without loss of quality.)

The 210 Power Amplifier can be attached to any set without altering or upsetting the installation in any way. It takes all its power from the A. C. lighting circuit.

## 210 Power Amplifier Reproduction

**210 KIT.** All parts, with panels drilled and engraved, as well as the blue prints and assembly instruc- tions, are provided in the 210 Power Amplifier Kit.

There is nothing else to buy except the Radiotron UX-210 and UX-216-B tubes.

**ASSEMBLING.** A single evening is required for the assembly of the 210 Power Amplifier. There is nothing complicated about it. It isn't like building a radio set. There are no adjustments to make, practically no moving parts, very few connections. Nothing to shock you, no fire haz- ard. ——— Just enough work to be interesting, and you'll be ready to hear music by radio that will make you realize that your set was running on two cylinders before you had the 210 Power Amplifier.

**INSTALLING.** Whether you paid forty or four hundred dollars for your set, the 210 Power Amplifier will make it sound so much better that you'll never think of listening in without it.

Simply connect the cord to your A. C. lamp socket, plug the input cord into your set, and plug the loudspeaker into the Power Ampli- fier, and turn the switch.

**THEN YOU WILL HEAR MUSIC!**

**PRICE.** The complete 210 Power Amplifier Kit costs \$67.50—that is the cost of radio music which is the music of the studio. Not merely an improvement on what you have been hearing, but music which will make you realize how little your set has been doing for you.

**210 POWER AMPLIFIER**  
Complete except tubes

**\$67.50**

**DURRANT RADIO, Ltd., T-52 Vanderbilt Ave., New York**

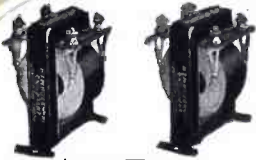
# AMERTRAN

TRADE MARK REG. U.S. PAT. OFF.

## DE LUXE

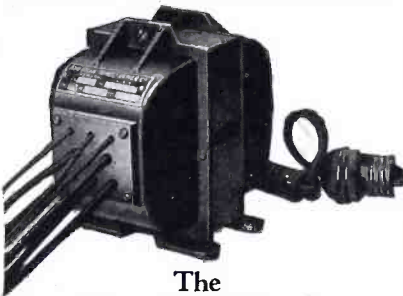


AmerTran DeLuxe  
In two types \$10.00 each



AMERTRAN  
Types AF-7 and AF-6

AmerTran audio transformers Types AF-7 and AF-6 have been considered for years among the leaders in audio amplification. These popular and efficient models may now be purchased at a considerable saving in cost. Types AF-7 (ratio 3½:1)—AF-6 (ratio 5:1) . . . \$5.00 each



The  
AMERTRAN Power Transformer

Type PF-52, 65 VA—60 cycles  
110/118/125—525—8/4-8/4

Type PF-52 is intended for use in converting the standard 110 volt, 60 cycle alternating house lighting current to a higher voltage for the plate and low voltages for filament supply.

AmerTran Power Transformer type PF-45 is another transformer of the AC power type, similar to type PF-52 except that it has a plate winding for 450 volts AC and is without a metal ground shield between the primary and secondary winding.

Price, Type PF-52, \$18.00—Type PF-45, \$15.00



The New AMERCHOKE  
Type 854

Type 854 is a scientifically designed impedance or choke coil of general utility, designed primarily for use in filter circuits. As an output impedance for by-passing direct current from the loudspeaker it is just as efficient and more economical than an output transformer. When used with a 1 mfd. (or greater) fixed condenser, the tone quality equals that of the best output transformer. DC saturation is prevented by two adjustable butt joints in the core. \$6.00 each

FOR more than twenty-five years, the American Transformer Company has specialized in the manufacture of transformers. The transformers used by Marconi in his first trans-Atlantic tests in 1904 were made by this Company.

In 1921 the AmerTran Audio Transformer set a definite standard of excellence in its field.

When the new AmerTran DeLuxe Audio Transformer was recently introduced it put the "audio side" ahead of broadcasting facilities and reproducing instruments. Faithful amplification with natural quality thus has again established AmerTran as the mark of a new standard of excellence. Combined with the new tubes, cone speakers, and clear signals from the detector tube, the AmerTran DeLuxe will reproduce natural volume over the entire audible range.

And now, as Radio Reception is further simplified and refined, the AmerTran Transformer Company offers another major contribution. The AmerTran Power Transformer and the AmerChoke make it possible and economical to use the new 7½ volt power tubes in the last audio stage. The filament of this tube is lighted direct from this transformer. The Power Transformer also has a filament supply winding for the rectifying tube and supplies sufficient plate current, after rectification, for the operation of the set.

As the receiving set of the future is destined to be power operated—the American Transformer Company offers the above apparatus as units which in quality and design are best adapted for the type of audio amplifier required.

For use in building, experimenting and manufacturing—these new AmerTran Radio Products assure dependability and satisfaction—and furnish the most advanced construction in practical radio.

Write for descriptive booklet entitled "Improving the Audio Amplifier".

## American Transformer Company

178 Emmet Street, Newark, N. J.

"Transformer builders for over twenty-five years."

SOLD ONLY AT  
**AUTHORIZED AMERTRAN DEALERS**

*Specified wherever tone quality  
is paramount*



## THORDARSON R-200

The proof of the pudding is in the eating.

The satisfaction you derive from your radio set depends upon its fidelity of reproduction.

Since the institution of broadcasting, Thordarson transformers have been the great outstanding factor of faithful reproduction in a multitude of receivers.

That is why to-day you find more Thordarson transformers in the receivers of leading manufacturers than all competitive transformers combined.

Thordarson R-200 is available at reliable dealers everywhere at a cost of eight dollars.

**THORDARSON**  
ELECTRIC MFG. CO.

**SILENT  
B-ELIMINATOR  
TRANSFORMERS & CHOKES**

We unhesitatingly recommend the Raytheon type B-eliminator for quiet and efficient operation on all types of receivers. Thordarson transformers and chokes are available for this circuit.

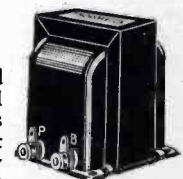


**Transformer  
R-195**

Larger in capacity—  
Will not heat up in  
continuous service.  
Separable plug, 6  
foot cord attached. At reliable  
dealers everywhere, price \$7.00.

**Choke R-196**

Completely shielded  
and mounted in steel  
case. Binding posts  
at base for neat  
assembly. Capacity  
60 milliamperes. 30  
henries inductance.



Price \$5.00.

Write for assembly instructions.

**THORDARSON ELECTRIC MANUFACTURING CO.**  
*Transformer specialists since 1895*  
**WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS**  
*Chicago, U.S.A.*