

RADIO ENGINEERING

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

DECEMBER, 1926

Important Eliminator Developments

A Elimination for Next Season's Sets

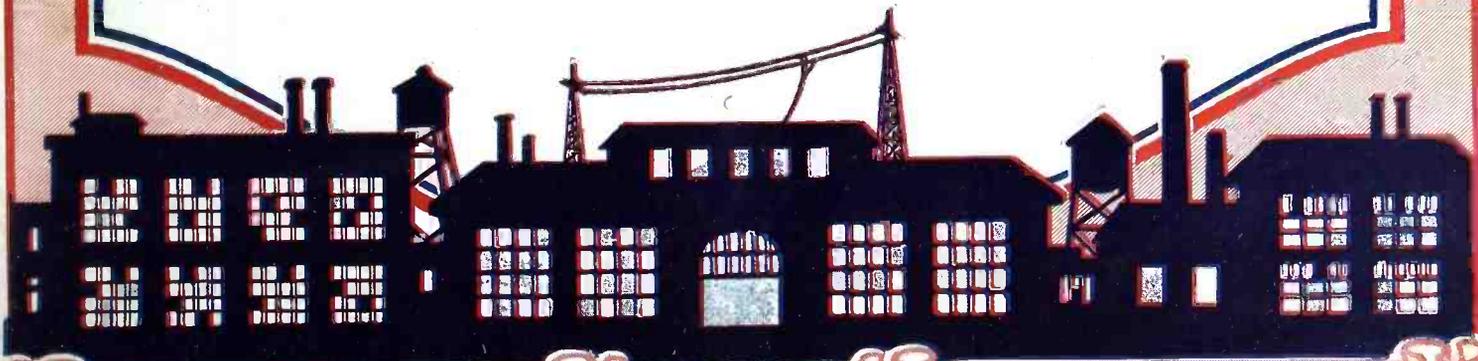
Methods now perfected point the way to successful
A battery elimination in complete sets for next fall

R. M. A. Power Equipment Committee

Full text of recommendations for standardizing A. C. power devices,
as prepared with the cooperation of the Underwriters' Laboratories

Short Wave Transmission Tests

Data tabulated from test reports on short
wave transmitters at Schenectady, New York



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VOLUME VI NUMBER 12
Sixth Year of Publication



Eveready's exclusive Layerbilt
 construction *makes this*
the most economical of "B" batteries

IMPROVEMENT on top of improvement has been the history of Eveready Radio Batteries. Here, in the radically different Eveready Layerbilt, is the "B" battery which tops them all. The ability of this battery to give you unrivaled service and economy is due to its unique internal design. Instead of the usual assembly of round cells, it is built of flat layers of current-producing materials pressed firmly together. This construction makes use of the spaces now wasted between the round-type cells and avoids the usual soldered wire connections. Eveready Layerbilt is every inch a

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This HEAVY-DUTY EVEREADY LAYERBILT BATTERY gives twice the service of the smaller Light-Duty batteries and greatly reduces your "B" battery operating cost.

Use Eveready Layerbilts on any set, and get not only this extra service, but also—the greatest "B" power operating economy—the utmost in "B" power dependability—D. C. (direct current) in its purest form, so necessary for pure tone quality. There is an Eveready dealer nearby.

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WFI—Philadelphia	wcco { Minneapolis
WGR—Buffalo	{ St. Paul
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WSAI—Cincinnati	WRC—Washington

EVEREADY
Radio Batteries
—they last longer



look inside that Christmas Radio Set

THE equipment is as important as the set. The distance reach of a set depends a great deal on the tube in the detector socket. The over-all performance of a set depends very much on the tubes in every socket. The volume and tone quality you will get are dependent upon the tube in the last audio stage. In every point, the tubes are as important as the set. And everyone who realizes this insists on genuine RCA Radiotrons.

The research laboratories of RCA, General Electric and Westinghouse have developed Radiotrons to new accomplishment, year by year. And the manufacturing skill of these same companies keeps RCA Radiotrons far in the lead in accurate making.

Be sure, when you buy a Christmas radio set, that you are getting genuine RCA Radiotrons with it. You can tell by the RCA mark inside the glass at the top. Or take out the tube, and look at its base.



Extra! Extra! Gift Ideas for Radio fans

A "spare" Radiotron—genuine RCA Radiotron, of course—of the type he uses.

A power Radiotron UX-112, UX-171 or UX-210 for bigger volume and finer tone.

A special detector Radiotron UX-200-A for storage battery sets—for longer distance reach.

Ask any dealer all about these Radiotrons—he'll tell you which to get. But be sure it's a genuine RCA Radiotron, if it's to be worthy of gift giving.

RADIO CORPORATION
OF AMERICA
New York Chicago
San Francisco

RCA Radiotron

MADE BY THE MAKERS OF THE RADIOLA

EDITORIAL

WHILE there is no prospect that batteries will be eliminated from the list of radio accessories, there is a definite demand for A. C. operation which, contrary to the expectations of many, was not met in the 1927 models.

The more expensive 1928 receivers, however, must have straight A. C. operation for A, B, and C voltages. This is one of the biggest problems confronting engineers who are already working on next season's designs.

Because present sets are built with the tubes in parallel, it was natural to turn to high-capacity rectifiers which could deliver 1.0 to 2.5 amperes at 5 volts. That, again, is not good practice with the tubes now on the market, for they introduce the practical difficulty involved in heavy current chokes.

At Radio Hill we have developed a combination A, B, and C supply which, in design, price, and operation, offers a genuine answer to what will be an insistent demand next fall. There are no tricks in the design. The price can be made less than for a substantial B eliminator, storage battery, charger, and switch. In addition to providing B and C supply, it can operate the filaments of one to a dozen tubes—if they are put in series.

Your immediate reaction may be strongly against series filament wiring. But, is there really any objection to it? The A, B, C eliminator is not practical as an accessory, of course. Nor is that its purpose. It's field is specialized intended as a part of a complete set, or as a supply for a set built to use it.

Actually, from the point of view of the set manufacturer, the detail of filament connections is of no vital importance. Series operation even has some advantages. Much of the equipment built by the Western Electric Company for the Army and Navy used series filaments. Parallel wiring practice was adopted only because of storage battery voltage limitations.

The O1-ABC unit described in this issue of Radio Engineering, while calling for circuit detail changes, is applicable to any kind of radio set, and meets present conditions with means now available. The fact that the rectifier tubes are easily obtainable for replacement is another point to recommend it to set owners.

Automobile manufacturers make two or more design series. Why not apply the same idea to radio? Then we shall have A. C. sets and battery sets. It is so simple to extend the B eliminator into one supplying A, B, and C. If this change comes about, companies now selling B eliminators to the consumer may be well advised to turn their attention to building A, B, C eliminators for set manufacturers.

With the acceptance of series filament operation it would develop that the consumer who is now able to afford a B eliminator for his set would buy an outfit supplied entirely from A. C., while the man who cannot make a large initial investment, or has no A. C. supply, would buy a set operated from dry cell B batteries and a storage battery.

The idea of the eliminator for series filament operation is not new, for Radio Engineering carried advertisements of a device of this sort two years ago. At that time, however, it was offered as an accessory—which it is not and cannot be. Then, too, special rectifier tubes and filter condensers were required.

But by offering the A, B, C eliminator as a supplementary device for a set designed to use it, an entirely new angle is put upon future designs and merchandising methods, the results of which will be seen inevitably in 1928 models.

RADIO ENGINEERING

The Technical Magazine of the Radio Trade

Edited by M. B. SLEEPER

Managing Editor, HOLLIS de NEEFE

Vol. VI.

DECEMBER 1926

No. 12

Sixth Year of Publication

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In the January Issue

Starting with the January issue, Radio Engineering will present each month a resume of the papers read before the I. R. E. In addition, reports will be given on the radio papers presented before the A. I. E. E.

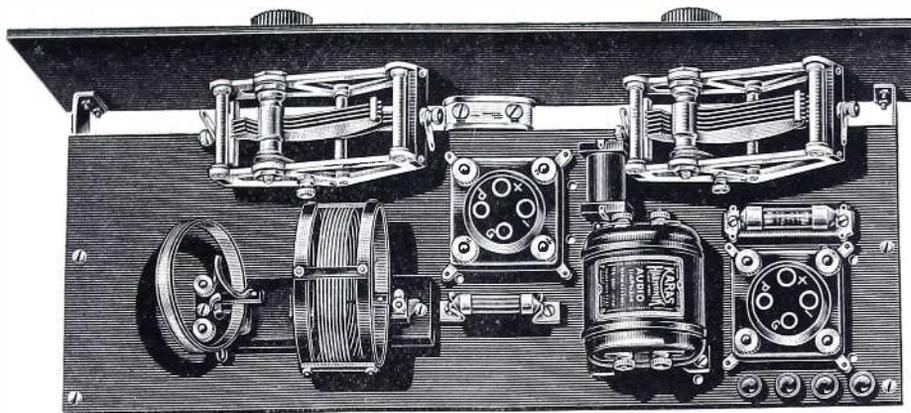
January Radio Engineering introduces, in the Man O' War super-heterodyne, a new set design. This design will be known as the Dreadnought, and it sets a new standard of mechanical layout and electrical efficiency.

Data will be given on the TC on AC. This is a beautiful little receiver using 201 A tubes, and which operates without batteries of any kind.

RADIO ENGINEERING

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New York advertising office, B. S. Davis, 52 Vanderbilt Ave. Chicago advertising office, E. H. Moran, 307 N. Michigan Ave.



Build this 10,000 mile 2-Tube Short Wave Receiver to explore the ether between 15 and 130 meters

Use these KARAS parts in building your short wave set.



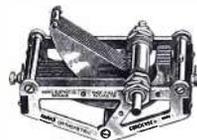
Karas Micrometric Vernier Dials.

Have 63 to 1 ratio and tune to within 1-1000th of an inch. Price, each.....\$3.50



Karas Orthometric Variable Condensers.

One .00014 mfd. 7 plate Karas Condenser is used in this set. Price.....\$6.50



Karas Orthometric Variable Condensers.

One .00025 mfd. 11 plate Karas Condenser is used in the short wave receiver. Price.....\$6.50



Karas Harmonik Audio Transformer.

Great volume, unparalleled clearness and freedom from distortion make Karas Harmoniks best for all audio amplification. Price...\$7.00

HERE is a simple, easy-to-build short wave receiver that you will find amazingly sensitive in bringing in stations between 15 and 130 meters.

While it is but a two tube set, it has marvelous distance getting qualities, and will work well under favorable conditions up to 10,000 miles.

If you want to hear such far-away points as LPZ, Buenos Aires, 2YT, Poldhu, Ireland or G2NM, London, —if you would like to hear England chat with Australia, South America talk to France or Africa converse with Mexico, build this great little receiver and listen in!

A Dependably Uniform Performer

You will find this receiver remarkably dependable because it uses the Weagant circuit in conjunction with Aero Coils and Karas Condensers—a combination of the most efficient coil and the most efficient condenser ever designed. Aero Coils eliminate radio frequency losses, due to their unique construction. Karas Condensers have the lowest possible resistance, resulting in strong, powerful signals. Both of these well known and proven parts cut losses to the absolute minimum. In addition, the use of Karas Straight Frequency Line Variable Condensers provides equal sensitivity from end to end of the dials, and the Karas Harmonik Audio Frequency Amplifying Transformer insures maximum volume with great clearness.

Easy to Tune With Karas Dials

Karas Micrometric Vernier Dials are used in this 2-Tube Short Wave Receiver. They are rapidly becoming standard on all regenerative circuits because of their 63 to 1 gear ratio which gives tuning to within 1-1000th of an inch. With Karas Con-

densers fitted with these split-second tuning dials there isn't much on the air between this set's maximum and minimum limitations that you cannot easily bring in up to half way around the globe.

Complete Instructions FREE

We have prepared a set of complete, simple instructions for building this short wave set which we will gladly send without charge to any address upon request. But the best plan is to secure the necessary parts from your dealer and build this receiver that will enable you to explore the ether below 200 meters. To build this set you will require the Karas parts listed in the coupon below, plus certain other standard parts easily obtainable anywhere. If your dealer is sold out on any of these necessary Karas parts and you are in a hurry you may order them from us by filling out and mailing the coupon. SEND NO MONEY. Just hand the postman the price of the parts plus a few cents postage.

Mail the coupon today so you can begin the construction of this great short wave set without delay.

KARAS ELECTRIC CO.

1099 Association Building, Chicago

Karas Electric Co.,
1099 Association Bldg., Chicago.

Please send me 1 Karas .00014 mfd. 7 plate Orthometric Variable Condenser, \$6.50; 1 Karas .00025 mfd. 11 plate Orthometric Variable Condenser, \$6.50; 2 Karas Micrometric Vernier Dials, each \$3.50; and 1 Karas Harmonik Audio Frequency Amplifying Transformer, \$7.00, for which I will pay postman \$27.00, plus postage, upon delivery. It is understood that I have the privilege of returning any of this apparatus for full refund within 30 days if it does not prove satisfactory.

Name

Address

City State

(If cash accompanies order we will ship postpaid.)

EXPLAINING THE INSTANTANEOUS SUCCESS OF RADIO MECHANICS



IN TWO MONTHS { *First in Public Influence*
Already Second in Circulation



1 ■ ENGINEERS

This limited number of men have sufficient training to understand technical papers.

2 ■ DEALERS, JOBBERS, SALESMEN

These men, in the radio business, read the trade papers.

3 ■ AMATEUR EXPERTS

They have their own A.R.R.L. publication.

4 ■ EXPERIENCED B.C.L.'S

The radio nuts, who know enough about radio to understand the kind of radio magazines which have been referred to as "popular radio publications."

5 ■ UNSOLD PROSPECTS

Representing the hundreds of thousands of prospects for parts, sets, and accessories who can understand Radio Mechanics, but have been made to understand by other magazines that radio is wonderful, but too far beyond their comprehension.

YOU'D DO THE SAME THING——

If you wanted to start right now to publish a magazine that would be an outstanding success among radio publications—

If you had a background of twelve years' concentrated experience with the radio public—

And, starting fresh with no editorial precedents—

And a clear vision as to what both the public and the advertisers have at last found they really want—

You'd realize that the big market for the magazine circulation and for radio advertisers is not in Groups 1 or 2, above, for they are adequately covered now.

You'd keep away from Group 3, because it is too circumscribed. As for Group 4, there are four magazines running circles around this Group, each trying desperately to squeeze out a little more business from a decreasing number of readers.

But Group 5—There's the field! There are hundreds of thousands of men and boys who need only an understanding presentation of radio things to make them customers for sets, parts, and accessories.

They are the ones who have looked at what have been called "popular radio magazines," but put them aside thinking—"It must be wonderful to understand all that!"

Yet there is a new field, absolutely untouched, and totally ignored by the old magazines—just waiting for some publication that has an editorial policy which meets them on common ground.

AND YOU'D DO IT THIS WAY——

To reach Group 5, you'd know that radio must be presented in the light of the fun, and entertainment, and recreation which it offers.

So you'd adopt this editorial policy—We shall run only articles showing things which the average man or boy can do in the average American home.

And you'd plan your illustrations to show this home-activity idea. You wouldn't use blueprint illustrations, because even a slight familiarity with physics and optics would tell you that fine white lines on a blue background are exceedingly trying on the eyes.

You would develop a method of showing connections so simple that the novice would look at the drawings and think—"Why, I can understand that!"

Then to make this magazine effective—for its job is really to make people spend money on radio—you'd plan each article, from the captions to the illustrations and text, to make the readers say—"Gee, I want to do that!"

THEN YOU'D GET THESE RESULTS——

You'd print 100,000 copies, put them on news stands in every good radio section of the United States and Canada, and when the first issue has been on sale for thirty days, you'd have the whole edition cleaned out, and you'd have to hunt for office copies.

While you advertisers would say, as did one of the advertisers* in RADIO MECHANICS, "This magazine has brought us four times as much business as all the other magazines (those appealing to readers in Group 4 above), put together."

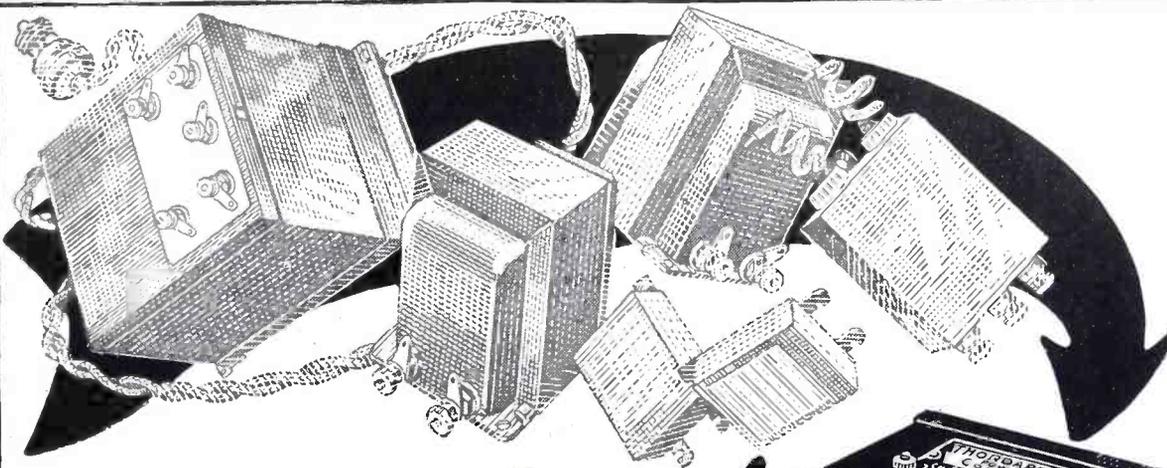
Then advertisers and agencies would discover what they really knew all the time: editorial tie-ups aren't necessary to make advertising pay in a magazine which is doing real things to stimulate new radio business.

* Name on request.



RADIO MECHANICS, Inc. *First in Public Influence*
Already Second in Circulation

OWNED AND OPERATED BY M. B. SLEEPER, Inc.
RADIO HILL, POUGHKEEPSIE, N. Y.



All in One!

THORDARSON POWER COMPACT

TYPE R-171

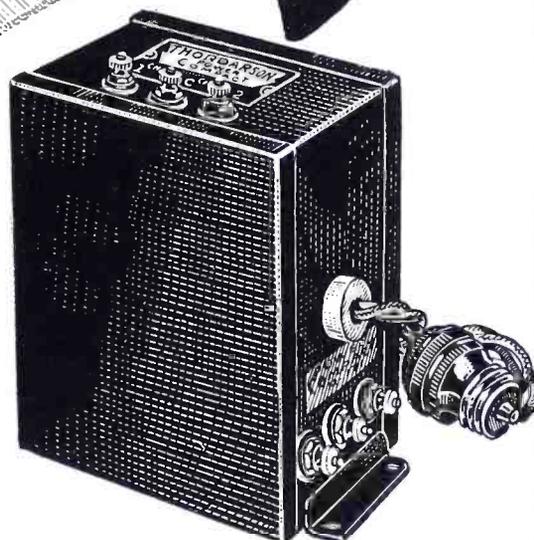
Contains a power supply transformer for Raytheon BH rectifier, 2 filter chokes, 2 buffer condensers, and a filament supply for UX 171 power amplifying tube.

\$15.00

TYPE R-210

Contains a power supply transformer for UX 216-B rectifier, 2 filter chokes, and a filament supply of 7½ volts for UX 210 power amplifying tube.

\$20.00



The Complete Foundation Unit for power amplification and B supply

Simplified Assembly. The Power Compact contains within itself the greater part of the complete B supply unit. With the Type R-171, only 14 leads complete the Raytheon assembly. All terminals are carefully located for the greatest ease of assembly.

Compactness. The only additional apparatus required to build the B supply are the condenser block (Raytheon type), a Raytheon tube BH, and the resistance units. The complete eliminator occupies a space of but 6 in. x 9 in. without crowding.

High Efficiency. The power supply of either Power Compact furnishes the proper current for maximum efficiency of the rectifiers used; the chokes are of sufficient capacity to carry the maximum output. Conservatively rated, will not heat up in continuous service.

High Voltage Output. The R-171 Power Compact assembly will deliver a maximum plate voltage output of 300 volts at 30 milliamperes, or 275 volts at 40 milliamperes.

The R-210 type assembly will deliver 400 volts to the plate of the power tube, and in addition, will supply a constant 90 volts to the receiver at any current drain up to 40 milliamperes.

Silent in Operation. There is no traceable hum, either mechanical in the compact itself, or electrical through the loudspeaker.

Complete Supply for Power Amplification. The Power Compact not only supplies B voltage, but also provides for the filament current and grid bias of the stage of power amplification. *Makes it possible to use power amplification even on sets designed for dry battery operation.*

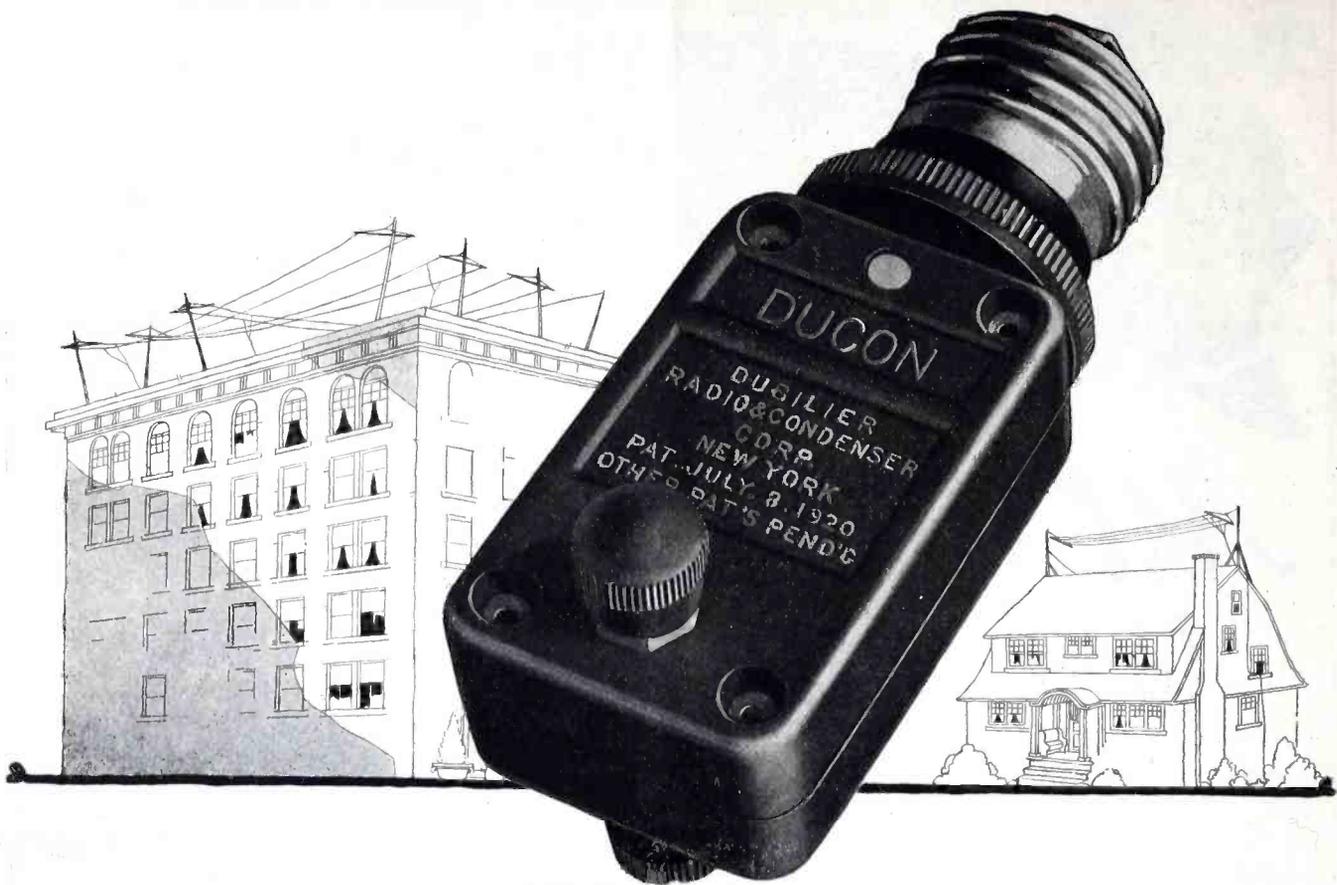
Electrically Centered Filament Supply. The power tube filament supply is *tapped at the exact electrical center for grid return.* The center tap is taken from the common lead of two perfectly balanced windings—completely obliterating the A. C. hum. (An exclusive Thordarson feature.)

Write for instruction booklets SD-49 and SD-50.

If your dealer cannot supply, order direct from the factory.

THORDARSON ELECTRIC MANUFACTURING CO.
Transformer Specialists Since 1895
WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS
Huron and Kingsbury Streets — Chicago, Ill. U.S.A.

3446



Dubilier Ducon—Price \$1.50

Aerials have gone out of style

In the old days, when radio was new, the "fan" was known by crazy festoons of wire that decorated his housetop or yard. These were the old fashioned aerials, and no one has forgotten all the grief they caused.

Modern radio may use the hidden loop, or the short indoor aerial. But there is a better way. The Dubilier Ducon enables you to use the complete wiring system of your house without risk, and with better results than most out door aerials give.

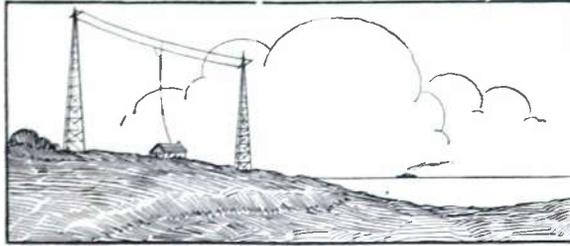
You simply screw a Dubilier Ducon into any lamp socket, and connect it with the antenna binding post of your set. You will find that it increases selectivity—especially in crowded neighborhoods, and will reduce "static" in the summertime.

Try a Dubilier Ducon on your set tonight. They are sold by all good dealers on five days' trial for \$1.50.

Dubilier

CONDENSER AND RADIO CORPORATION

4377 Bronx Blvd., New York, N. Y.



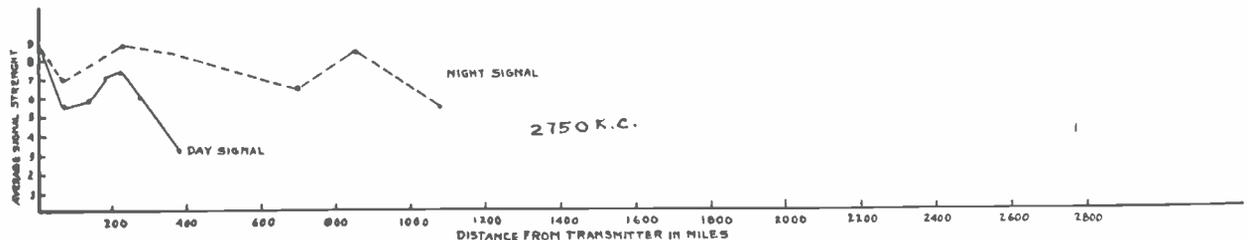
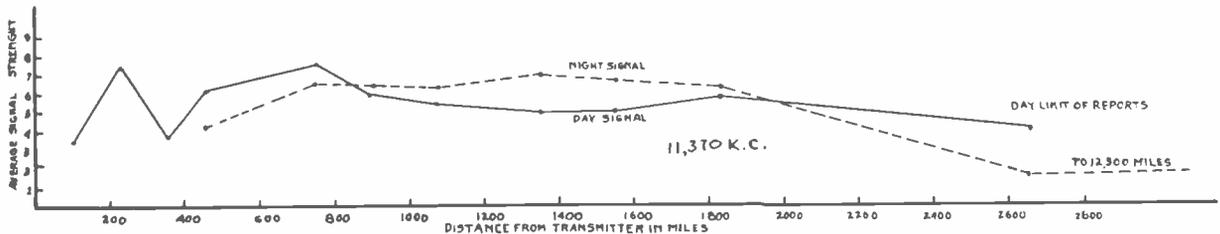
SHORT WAVE PROPAGATION TESTS

*Peculiarities of SW transmission and reception recorded by the General Electric Company—By M. L. Prescott**

DURING the past eighteen months, the Radio Engineering Department of the General Electric Company has conducted a series of investigations for the purpose of securing data pertaining to the propagation of radio waves. The fifty-four acre developmental laboratory, equipped with several transmitters adaptable to operation over a wide range of frequencies and employing various types of antenna systems, has proven itself in

on four different frequencies ranging from 192 K.C. to 7,170 K.C. Following this, a similar trip was made to Malone, N. Y., and a little later a third trip was made in an easterly direction, ending at Boston, Mass. The last trip of the special observers was to Lake City, Florida, 1,000 miles southwest of Schenectady. In order to investigate signal characteristics at distances greater than those which could conveniently be covered by the field men in a truck, another observer

the previous active cooperation of amateur experimenters, and desiring their further assistance in the proposed test, negotiations were begun with the American Radio Relay League with a view to enlisting the aid of several hundred of its members. Accordingly, two thousand letters explaining the proposed test were sent to amateurs. As had been expected, about five hundred replies were received expressing a willingness to assist in observing the test trans-



Although the 2,750 KC transmitter used 10 KW of power, and the 11,370 KC station used but 1 KW, the higher frequencies covered far greater distances.

invaluable aid in conducting this series of investigations. Previous to the test made in April of this year, the major portion of observations were made by field men sent out by the company. These observers were supplied with receiving equipment capable of covering the frequency band under investigation. The field observers, with the requisite apparatus installed in a truck, made a series of trips, each time starting from Schenectady and following a uni-directional course away from the transmitting station. The first of these trips was made in a westerly direction to Buffalo and intermediate points. During this trip comparative signal characteristics were obtained

boarded a steamer bound for Panama and made observations en route.

Throughout this series of tests, additional reports were received from all parts of the world from individuals who either by accident or intent heard the transmissions. These outside reports showed the possibility of utilizing cooperative observers for a future test. The data obtained by the General Electric field men were from a decidedly restricted area, and consequently any generalization of results was exceedingly difficult. It was felt by the engineers in charge of this propagation work that simultaneous observations by a great number of especially instructed listeners located in representative portions of the world would yield information of considerable value. Appreciating

missions. To each of these men the Radio Engineering Department sent detailed recording instructions, especially prepared log sheets, and a schedule of transmissions.

Transmissions were made each week in April from Wednesday noon to Thursday noon, and from Saturday noon to Sunday noon. The transmitters employed were:

Station	Frequency	Power	Control
2XAW	20,000 KC (15 M)	0.6 KW	Self-excited
2XAD	11,370 KC (26.4 M)	1.0 KW	Self-excited
2XAF	9,150 KC (32.79M)	10.0 KW	Crystal
2XAC	5,970 KC (50.2 M)	10.0 KW	Self-excited
2XK	4,580 KC (65.5 M)	10.0 KW	Crystal
2XK	2,750 KC (109M)	10.0 KW	Crystal

Of the reports received approximately 9,500 were complete enough to be used in making the final analysis.

The percentages of the total number of observations received for each transmitter was as follows:

* Radio Engineering Dept., General Electric Co.

2XAW	2.8 per cent
2XAD	11.2 per cent
2XAF	50.8 per cent
2XAC	17.7 per cent
2XK (4,580 KC).....	12.0 per cent
2XK (2,750 KC).....	5.5 per cent

20,000 K. C. Transmissions

As will be noted from the preceding tabulation, a very small percentage of the total reports received were on the 20,000 K. C. transmission. No reports were received on the daylight period within a radius of 900 miles from the transmitter, indicating an apparent skip distance of this magnitude. However, observations made by field men previous to the tests of April, gave an apparent skip distance of 600 miles. This discrepancy has been attributed to seasonal variation and the type of radiator employed. A skip distance of 1,000 miles was indicated for the night period. In the region

down gradient, which might lead to the erroneous conclusion that the useful range was not greater than 3,000 miles. As a matter of fact, reports from observers in New Zealand and Australia indicated better reception than that at most points in the United States.

9,150 K. C. Transmissions

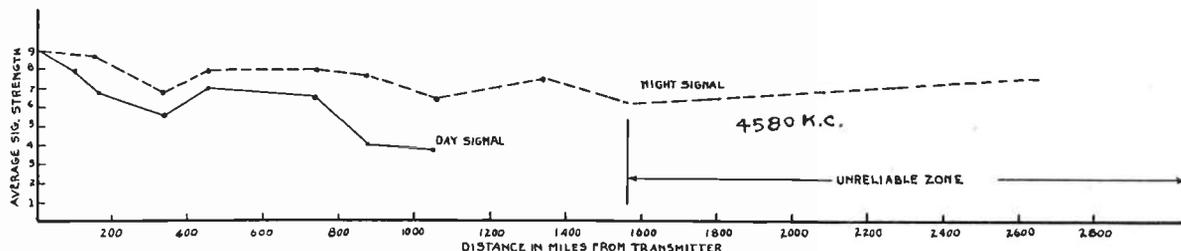
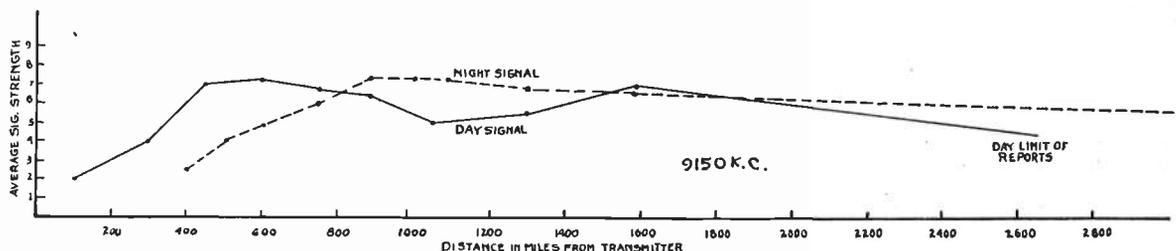
The great popularity of this transmission was largely due to the fact that previous to the April tests, it had become well known, through its broadcasting of the WGY programs. Fifty per cent of all reports received were on this station, 2XAF. These reports contained about 5,000 observations. Analysis showed the day skip distance to be 100 miles. As was observed on the higher frequencies, this distance increased at night, becoming 400 miles.

The limit of the day range for this transmitter could not be established

of 4,580 K. C.—65.5 meters—transmission was not great. At 1,050 miles the strength was still fairly high, indicating that satisfactory reception might be had for 200 or 300 miles further. Actually, this was not true, because fading, static, and other factors which prove detrimental to good reception, caused the signal to become unreliable at points further than 1,000 miles from the transmitter. The night audibility curve shows only slight attenuation at all distances to 2,650 miles. This condition is similar to that existing in the case of the 5,970 K. C. transmission. Again, erratic reports make it impossible to accurately fix the limit of the night range. Accordingly, the region beyond 1,600 miles must be considered as an unreliable zone.

2,750 K. C. Transmissions

This frequency behaved more in conformity with those of the broad-



As recorded on the upper chart, it is interesting to note that the 9,150 KC, or 32.79 meter signals have a skip distance of from 100 to 400 miles.

beyond the day and night skip distances the signal was consistently erratic in its behavior, hence no attempt has been made to plot an average audibility curve similar to those included for transmissions at lower frequencies.

11,370 K. C. Transmissions

About 900 observations were made on this transmission. These indicated a day skip of 100 miles, which at night increased to 450 miles. These limits, however, are not sharply defined, varying considerably from day to day. Although the signal characteristics beyond the limits of the day and night skips were not as erratic as those on 20,000 K. C., the reliability was still low at a distance of 3,000 miles. Beyond the region of uncertainty, the signal became more reliable and more consistent in its behavior.

It was noted that at 2,650 miles the night signal audibility is low and

definitely due to insufficient reports beyond 2,650 miles. Reports on the night transmission were received from all parts of the world indicating fairly consistent high average strength for the maximum distance obtainable, i.e., one-half of the earth's circumference.

5,970 K. C. Transmissions

The day and night audibility characteristics of 5,970 K. C.—50.2 meters—transmission indicate that no skip distance existed at this frequency. The useful day range of this transmission was definitely shown to be 1,100 miles. The curve of night audibility indicates that at 2,650 miles the signal strength was still good, about R-7. The analysis showed that reports from distances greater than 2,100 miles were so erratic as to make it impossible to determine the absolute useful limit of the night transmission.

4,580 K. C. Transmissions

The attenuation of the day signal

cast and commercial channels than did any of the other frequencies used during the test. Day and night audibilities were quite rapidly attenuated, the former reaching a lower useful limit at 400 miles, while the latter was sufficient to furnish a satisfactory signal for 1,000 miles. It will be observed that these audibilities were less at 70 miles from the transmitter than at several of the more remote points. This dip was evidenced by the observations made previous to those of April, thereby strengthening the belief that it is characteristic of this frequency.

Antenna Comparison

At various times during the test different antennas were used for the same frequency. In every case there was a difference recorded between the signal characteristics of each radiator, being more pronounced in some directions than in others. However, analysis of average conditions, for all directions, indicated no pronounced

differences. As an example, consider the vertical half-wave and the horizontal half-wave antennae which were interchanged at various intervals during the 9,150 K. C. transmissions from station 2XAF. The pattern of the vertical antenna was practically circular, indicating uniform radiation, which should have permitted the signal to be received as well in one direction as in another. On the other hand, the radiation pattern of the horizontal half-wave antenna assumed the general shape of a figure 8, giving a maximum radiation north and south, and a minimum east and west. By averaging all the reports received it is observed that the curves are similar, except near the fringe of the skip, where the horizontal antenna gives a slightly higher audibility. For all distances beyond this point, reports indicated the continued superiority of the transmissions from the vertical antenna.

The signal characteristics for the horizontal and vertical half wave antennas on 20,000 K. C. and 11,370 K. C. maintain the same relationships given for the 9,150 K. C. transmission. Consequently, it is deemed unnecessary to include a discussion of them in this article.

Fading

If a complete account of the findings relative to fading were to be included it would be necessary to write a veritable book. A great many interesting phases of fading have been brought out in this analysis.

In corroboration of previous knowledge of short wave characteristics, fading was recorded during both day and night transmissions on each of the frequencies under observation. The occurrence of fading was found to be a function of the frequency, becoming more troublesome as the frequency increased. All of the observations received indicated that the fading was more pronounced at night than during the day, and that for both of these periods an increase in the distance from the transmitter showed a lessening of the fading effects.

Striking Conclusions from Short Wave Tests

From data received from radio amateurs throughout the world, the General Electric Company radio engineers have reached the following conclusions:

Fifteen-meter broadcast transmissions have a day skip distance of from 600 to 900 miles and night skip of 1000 miles.

Reception of 26.4-meter broadcasts better beyond 3000 miles than within the United States. Night skip-distance of 450 miles and day skip of 100 miles. These limits, however, were not sharply defined.

The 32.79-meter transmitter gives a fairly consistent high average strength for the maximum distance, half-way round the earth.

The day and night audibility characteristics of 50.2 meter transmissions, indicate that there is no skip distance. The useful day range was shown to be 1,100 miles and the signal strength, at night, was still good at 2,650 miles.

Transmissions on 65.5 meters are unreliable beyond 1,600 miles, according to reports received.

Day and night audibilities of the 109-meter transmissions were more readily attenuated than those on other wavelengths tested. The day transmission reached a lower useful limit at 400 miles while the night transmission was sufficient to furnish a satisfactory signal for 1,000 miles.

Analysis of average conditions, for

all directions, indicated no pronounced differences when different antennas were used.

In corroboration of previous knowledge of short wave characteristics, fading was recorded during both day and night transmissions on each of the frequencies under observation. The occurrence of fading was found to be a function of the frequency, becoming more troublesome as the frequency increased. All of the observations indicated that fading was more pronounced at night than during the day, and that for both of these periods an increase in the distance from the transmitter showed a lessening of the fading effects.

SW for New Broadcasters

Powel Crosley suggests the use of the short waves to relieve broadcast congestion

THE present chaotic condition of our broadcast channels undoubtedly is doing more to hurt the sales of receivers, parts and accessories than any one other single factor in radio. Owners of receiving sets in congested broadcasting centers, such as New York City, Chicago, and Los Angeles, are blanketed by a barrage of local stations. Receiver users in rural communities are nightly greeted with a chorus of raucous howls and heterodyne whistles, caused by the hundreds of stations on the eighty-odd wave lengths. There is not a single location in the country today where it is possible to obtain, from a dozen different stations, satisfactory and quality reception, unmarred by interference.

A number of solutions for this lamentable state of affairs have been offered. It seems that the most crying need is for adequate legislation, but judging from present indications, this will be slow in passing, and bitterly contested when applied. How is the discrimination to be made so that certain stations can be allowed to continue, while the law disposes of the others? Here is Powel Crosley's opinion:

"The egg that fell from the wall in the oft-quoted Mother Goose rhyme, Humpty-Dumpty, presented no more serious job of unscrambling than the broadcasting stations that are all mixed up now in the bank of wave lengths between 200 and 600 meters. Some 600 broadcasting stations are now overlapping or on top of one another, wrestling and struggling for a place free from interference in a band that can only accommodate eighty-eight broadcasting stations.

"Of course the most serious problem is legislation through which there will be established some authority to control the wave length assignment of these stations and to police the air in

such a way that its use will be most beneficial to the public. Congress will, no doubt, frown upon any idea that will give special rights to any individual broadcasters over and above any other broadcasters. The courts, however, will, no doubt, regard the matter differently, as they should. The rights of priority of pioneer broadcasters will most certainly be recognized by the courts just as the rights of the prospector and the inventor have always been respected under the common law. It should be obvious to any one that the pioneers in broadcasting who invested their money to develop this wonderful thing known as broadcasting, should have some very definite rights to the wave lengths that they have pioneered and made valuable. Now that the value of these wave lengths is well established, it seems unfair that anyone else should come along and destroy the value of the investment of the pioneer broadcasters through causing interference.

"The question then arises, what shall be done with the new broadcasters? Shall they be denied the right to use the air? While it seems logical that they should be deprived of the right to interfere, a way should be devised whereby they can broadcast even though it is necessary to put them in the position of the pioneer broadcasters when they started. The present band occupied by broadcasting stations was set arbitrarily as being the most suited for the purpose several years ago. It was believed at that time that the present eighty-eight channels would be adequate, for no one anticipated the demand that has developed for wave lengths. There are thousands of wave lengths available for broadcasting below 200 meters. These wave lengths are practically entirely undeveloped. They are perhaps even better suited for broadcasting than those

wave lengths in the present band because it is a well known fact that there is less interference from static on the shorter waves, and that greater distances can be obtained with less power on the higher frequencies of shorter wave lengths. It is true that today there are comparatively few homes equipped with receiving apparatus to receive outside of the present band of broadcasting; few receiving sets that will bring in the short wave stations, but is not that the same situation which existed some five years ago when the pioneer broadcasters commenced their work of developing broadcasting? Therefore, would it not be fair to insist that the newcomers in the broadcasting field undertake the same work that was done by the older broadcasters, that is, create a quality of broadcasting on the shorter waves that will in turn create a demand for receiving apparatus to bring in those short waves? It is easy to imagine a situation developing wherein the best of the broadcasting will be done on the short waves that are not now used.

"In deciding what stations are to be transferred from the present band of broadcasting to the new band of shorter waves, two elements should be very carefully considered. First, that which has already been mentioned, priority, which should be considered very carefully in connection with a second element, the service that is being rendered. A station, in order to maintain its prior right to the use of a wave length, should maintain its place in the continued development of radio. It would be unfair to the public to reserve a wave length for an older station on a basis of priority alone, unless that station continued to develop and maintain the service.

"Whether broadcasting is regulated by the Department of Commerce or whether it is handled by a new Radio Commission created by Congress, the agency which controls and directs radio broadcasting must have the power to actually control it. Legislation must, therefore, provide the necessary power to unscramble the present condition which borders on chaos; it must have the power to eliminate from the present band of broadcasting at least five hundred of the present six hundred stations; it must have the power to prevent the further pirating of wave lengths, and it must have the power to assign stations not entitled to wave lengths in the present band to wave lengths in a new band to be created."

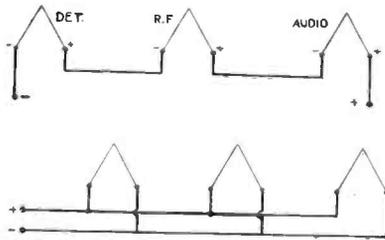
Mr. Crosley has offered a solution, it is true, but who is to start leading the parade down to the short waves? The short waves will not be opened to broadcasting until there is sufficient popular demand to warrant the step. It follows, as a matter of course, that the next thing to do is to stimulate interest in the SW telephone.

The 01-ABC Eliminator

The first application of standard apparatus to eliminate all batteries on 201A circuits—By John Grabar

IT is obvious that the solution for real AC operation does not lie in a substitute for the storage battery, merely because B eliminators have reached their present state of perfection. The need today is for one compact unit, which will supply all the necessary voltages to the receiver. We have been successful in perfecting such an outfit in our laboratory at Radio Hill, and we can now offer it to the radio men as a thoroughly practical device, simple of construction and operation, and sure in results.

This outfit supplies sufficient μ less A power to operate 201 A tubes with their filaments wired in series, and, in addition, it supplies L and C voltages for these tubes. A discussion of the practical and theoretical aspects of the apparatus will be of interest. It also will be well to consider certain points of AC operation as a whole, and to point out why the problem, ordinarily, has been attacked from the wrong angle.



Above: Series filament wiring.
Below: Usual parallel method.

The engineers who have been devoting considerable time and experimental work to battery elimination, or, more correctly, AC operation of receivers using storage battery tubes, seem to have overlooked one very important point. In their very eagerness to be the first to develop a satisfactory method of accomplishing the desired end, they have followed the line of least resistance, and seem to have lost sight or some of the fundamental principles of electricity.

In other words, practically all of them took it for granted that the method of connecting the tube filaments in parallel, as used today in most commercial receivers, was the thing to do. Accordingly, they set out to discover what satisfactory methods could be found, which would permit AC operation, using this method of filament wiring.

As a matter of fact, there seems to be no good reason for connecting filaments in parallel, except that this system fits the storage battery. The

question naturally arises that, if we are out to eliminate the storage battery, why consider it as a precedent, or as a model to follow? It is surely far better to disregard it altogether. That is the course we pursued in our laboratory, during the time we were perfecting the 01-ABC eliminator* described here. We decided upon series filament wiring for several reasons, which will appear later.

Despite the vast amount of energy and time expended by the experimenters and research engineers, who have long sought to solve the problem of complete AC operation on storage battery tubes, it is significant to note that no really simple and inexpensive, as well as practical scheme for eliminating all batteries on tubes of this type has been successful, up to the present time. It remained for Radio Engineering to point the way, and to direct the attention of the manufacturers toward developing more suitable apparatus for the purpose.

To use the house current as a source of B power is not difficult, because the requirements are for a high voltage, and but little amperage, rated, in fact, in thousandths of an ampere. It is comparatively easy to design a choke coil of high inductance, which will pass plenty of milliamperes for the B supply without heating. Further, if the choke has a DC resistance of several hundred ohms, such resistance is negligible here, for the voltage delivered by the rectifier is sufficiently high so that a little loss can be disregarded.

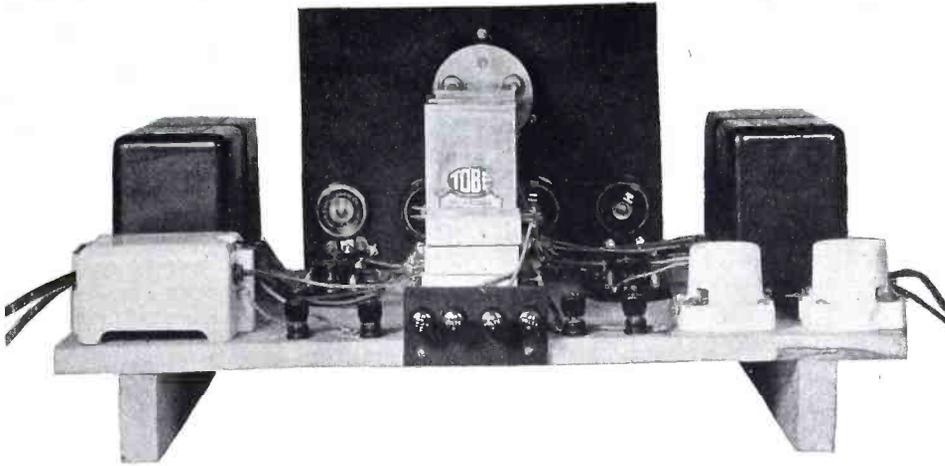
On the other hand, present day rectifiers which are within average reach, and which will supply several amperes of rectified current, do not deliver a high voltage at this output. Therefore, the chokes used to smooth out the pulsating DC, must combine a very high inductance with an entirely negligible resistance, and this is a very difficult combination to achieve. It follows as a matter of course that such chokes would be heavy, bulky, and expensive.

Aside from these faults, further drawbacks are encountered. The source of A current may be perfected, but the B and C voltages are yet to be considered. If a B eliminator is added as a separate unit, and it must be, on account of the low voltages delivered by an A supply of this type, the cost of the equipment is increased far beyond the reach of the average set purchaser.

It is easily understood that series

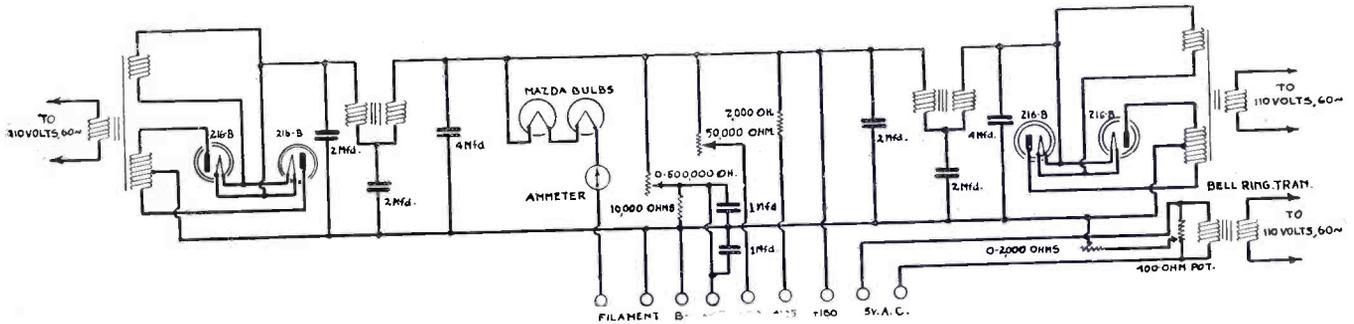
* Complete construction article in January, 1927, Radio Mechanics.

Rear view of the O1-ABC Eliminator. The meter, which is visible behind the row of filter condensers, is a 0-500 milliammeter.



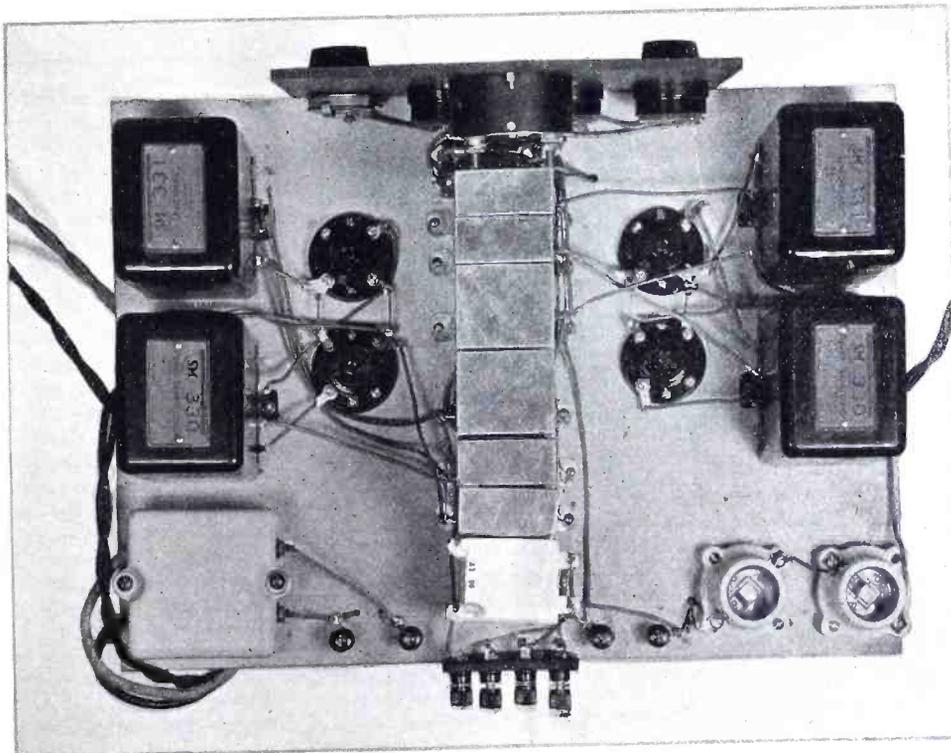
meter, and shows the amount of current delivered by the rectifier to the filaments. Of vital importance to the dealer is the

fact that all apparatus used in this device is standard, and no special parts need be carried in stock.



The complete schematic of the O1-ABC Eliminator. The outfit consists of two equal sections, each of which supplies half of the total output. Each section is filtered independently of the other, and the combined output is used for lighting the filaments. The Mazda bulbs reduce the voltage to the correct value for filaments, and the B voltage is regulated by means of suitable variable resistances.

Airplane view of the assembled O1-ABC Eliminator. The baseboard layout employed permits of the utmost ease of assembly and wiring. The bell-ringing transformer, which



supplies the AC to the power tube filament, is at the lower left hand corner. The four binding posts on the bakelite strip are for various B voltages.

wiring of the filaments reduces the current demand to the value of that required by one tube, although the voltage must necessarily be increased, as the number of tubes is increased. This is exactly the condition we desire, for it is the one that is most easily satisfied. Another condition encountered in series wiring, and one that can be used to good advantage, is that the drop across the filament of one tube can be used to bias the grid of some other tube in the circuit, and thus the C voltage is easily obtained.

When designing this O1-ABC eliminator,* we were guided by a number of requirements. It was vitally important that the outfit be constructed of standard apparatus, which could be procured easily. Further, all freaks of construction had to be avoided, and the assembly and operation reduced to the simplest possible form. It was also very important that the cost be kept down, so that the outlay of cash required would not exceed the amount needed for equivalent storage battery, charger, and B eliminator equipment. How well these conditions have been met can best be judged by a consideration of the actual facts relating to the outfit, and its operation.

The power plant consists of two equal sections, each of which supplies half of the total output. A power transformer applies 300 volts to the plates of two UX 216 B type rectifying tubes, which are here used in a full wave circuit. Since this rectifier tube is rated at 65 mills, we have at least 130 mills., available in each section, or a total of 260 milliamperes of rectified current. The pulsating DC output of each section is fed through a filter choke coil of two windings, which, in combination with filter condenser capacities of 4, 2, and 2 mfd., is designed to be resonant at the 120 cycle fundamental ripple of the rectifier output, and which exerts a brute force action on the remaining harmonics.

At this point, the available voltage is quite high, and is therefore suitable for the B supply to the receiver. Accordingly, suitable variable resistances and one fixed resistance are inserted, and voltages of 45, 90, 135, and 180 are provided. For the A supply, we need from 225 to 250 milliamperes, but the voltage must be reduced to the proper value, depending upon the number of tubes used in the receiver. Since there is so much current flowing, and a high voltage to reduce, it is obvious that there will be considerable energy dissipated in the form of heat. Wire wound resistances would be bulky and expensive, as well as difficult to procure, so 110 volt lamps were chosen for this purpose. These lamps are inexpensive, they will carry the load easily, and they can be used in various com-

binations to obtain any desired value of resistance.

The power tube consumes 500 milliamperes of filament current, and therefore cannot be lighted from the rectifier output. However, it is very easy to light it from raw AC furnished by a small bell ringing transformer, and to balance the grid return by means of a potentiometer across the filament terminals.

The cost of the outfit, including the rectifier tubes, is about the same as the cost of a storage battery, charger, and a good B eliminator. However, considerable advantage rests with the O1-ABC eliminator, for it requires no attention whatever, and is very simply controlled by one switch, which also controls the operation of the receiver.

It is safe to say that the O1-ABC eliminator forecasts a new trend in receiving set designs. There is no good reason why set manufacturers should not bring out two models; one with series filament wiring for AC operation, and the other with parallel wiring for battery equipment. It is most obvious that this eliminator is a distinct step ahead, and in the right direction. It solves successfully, for the first time, the problem of AC operation from inexpensive equipment.

The list of parts used to construct

- the O1-ABC eliminator is as follows:
- 2-Silver-Marshall type 330 Power Transformers;
 - 2-Silver-Marshall type 331 Uni-chokes;
 - 2-4 mfd. Tobe Power Pack type filter condensers;
 - 4-2 mfd. Tobe Power Pack type filter condensers;
 - 4-1 mfd. Tobe bypass condensers;
 - 4-Na-ald spring cushioned sockets;
 - 1-Electrad Royalty variable high resistance, type L;
 - 1-Electrad Royalty variable high resistance, type F;
 - 1-Electrad Royalty variable high resistance, type C;
 - 1-Carter 400 ohm potentiometer;
 - 1-Aerovox Lavite resistance, 10,000 ohms;
 - 1-Aerovox Lavite resistance, 5,000 ohms;
 - 1-Thodarson 10 watt bell-ringing transformer;
 - 1-Coil Belden Colorubber flexible stranded wire;
 - 8-Eby binding posts;
 - 1-Jewell milliammeter, 0-500 milliamperes.
 - 4-UX 216 B, or CX 316 B rectifying tubes;
 - 1-Bakelite front panel, 7 x 9;
 - 1-Wooden baseboard, 1/2 x 12 x 17;
 - Rosin core solder, screws, nuts, lugs, etc.

A Raytheon Eliminator with Constant Output Voltage

Fluctuations in the AC line do not affect the output of this device—By Hollis de Neeffe

SOME dealers in rural communities may have experienced difficulty with B eliminators, due to the variation in line voltages which is most commonly encountered in outlying districts. In the larger cities, where the power companies can afford the latest and most expensive apparatus, the line voltage generally remains constant within very close limits, but this, unfortunately, is not the case in the smaller towns and villages.

We have developed, in our laboratory at Radio Hill, a B eliminator and power amplifier which is specifically designed to overcome these difficulties. This outfit incorporates the most recent improvements, and is constructed from apparatus of the latest design and excellent performance.

In the design presented here, in the Constant Voltage Eliminator*, what is probably the greatest outstanding disadvantage of present day B eliminators has been overcome. It is a well-known fact to the technical men

that many receivers are quite critical as to plate voltage, particularly on the RF end. In fact, many sets made today use a variable high resistance in the plate circuits of the RF tubes to control the oscillatory tendency of these tubes. When such a receiver is used with a B eliminator, and the resistance has been adjusted so as to put the RF tubes in their most highly sensitive condition, a sudden surge in the line voltage will throw the tubes into oscillation, due to the increased plate voltage applied. On the other hand, if the line voltage drops, the received signal will decrease in intensity, and the listener is given the impression that the phenomenon of fading is responsible.

It is not sufficient to follow out and dried methods of procedure, when designing eliminators and power amplifiers. It is necessary to consider the use and function of each part, and to select such parts which will co-ordinate properly. It is well, then, to review the requirements of such apparatus, and to point out how each requirement has been satisfied in this design.

* Complete construction article in Radio Mechanics, January, 1927.

* Complete construction article in Radio Mechanics for January, 1927.

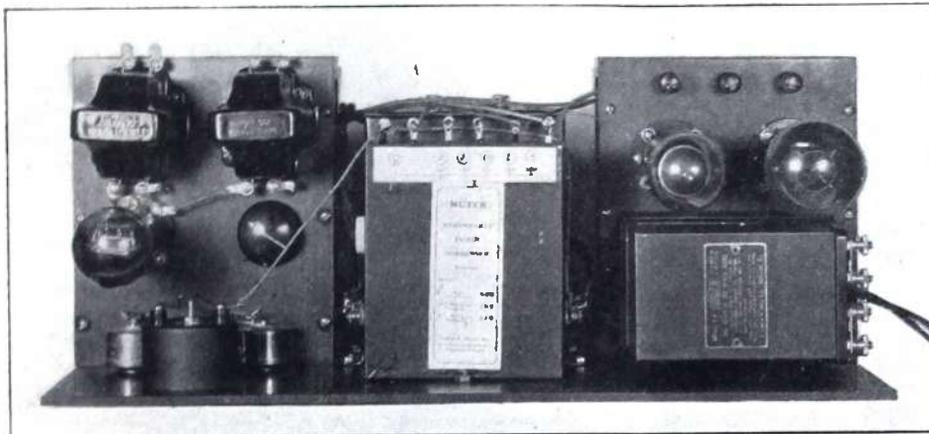
Since constant voltage output may be considered as the most important necessity, it will be interesting to note first how this feature was incorporated. A special purpose tube, known as the UX 874, or CX 374, has been on the market for some time. This tube possesses the unique faculty of changing in resistance with applied voltage, so as to hold a 90-volt source practically constant, regardless of the

210 types. On the other hand, this tube will stand a greater voltage on the grid, without the grid swinging positive, than any other power tube. This fact, of course, is due to the high negative bias used when the maximum plate voltage of 180 is applied.

These characteristics were compensated for, and taken advantage of, in this design, by the use of an input transformer of high ratio, which af-

switch requires no attention whatever, and makes possible the concealment of all the power equipment needed for the operation of the receiver.

The UX 171, or CX 371 power tube, as is used here, is rated for a maximum applied plate voltage of 180. On the other hand, the output of the Raytheon BH rectifier is considerably in excess of this value. Despite this fact,



Top view of the completed outfit. The Glow tube, which holds the 90 volt tap constant regardless of line voltage or current drain, is at the extreme right.

current drains normally drawn from the eliminator.

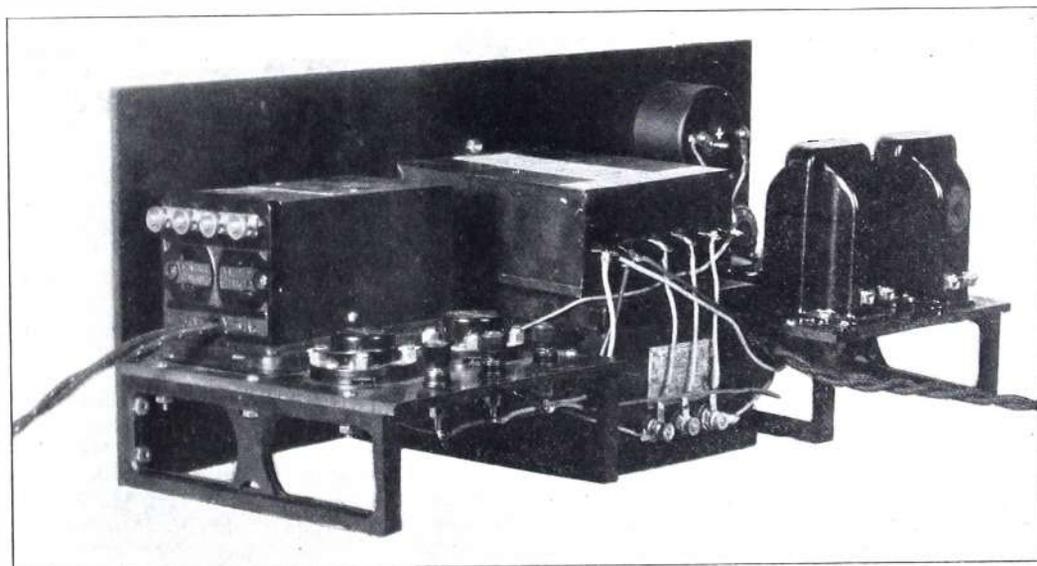
In order to provide the utmost flexibility of control, this tube has been used here, in conjunction with a variable resistor which also controls the 90-volt tap. This is the first application of constant voltage regulation that has yet been made to a Raytheon B battery eliminator circuit.

for, in conjunction with the 171 tube, high amplification and ample handling capacity. The results, particularly as to gain in volume, are noticeably much better than when a low ratio transformer is used for the input.

If the use of a B eliminator and power amplifier is accompanied by the necessity for changing several plugs

it is not uncommon to see circuits where the full output voltage of this rectifier is applied to the 171 tube. Such a method is entirely wrong, because an increase of plate voltage over the maximum rating will afford little increase in volume or handling capacity, but will seriously shorten the life of the tube.

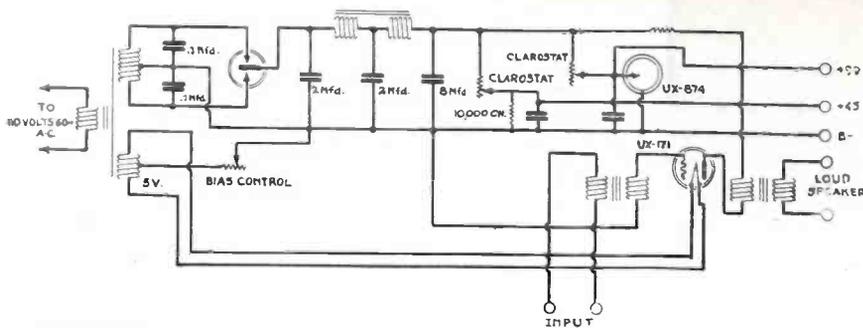
A very nice feature is the automatic control switch, shown just behind the two tube sockets. This control operates the trickle charger and power pack from the filament switch on the receiver.



Another fact usually has not been considered in the design of combination B eliminators and power amplifiers, which use the Raytheon BH for the rectifier and the UX 171, CX 371 for the amplifier. A study of the characteristics of the 171 tube, discloses the fact that its amplification constant is only about 3, as compared to an average of 7.5 for the 112 and

and switches, whenever the outfit is put into operation or disconnected. such a procedure is a decided inconvenience. However, this design incorporates one of the new control switches, which operates the battery charger, B eliminator, and power amplifier automatically, and is controlled by the filament switch on the receiver with which the outfit is used. This

In the outfit presented here, a fixed resistance is in series with the high voltage output of the rectifier, and reduces it to a value which can be applied safely to the 171 tube. This fact serves to illustrate that no item has been overlooked in the design of this apparatus. Everything in conformity with good engineering practice, which



Schematic diagram of the Constant Voltage Eliminator. Note the position of the Glow tube.

improves the performance of the outfit, or which leads to greater reliability and general all around satisfaction. has been used here to good advantage.

It is obvious that the heavy plate current of the 171 tube, which is on the order of 20 milliamperes, would seriously damage the loudspeaker, if this current were permitted to pass directly through the windings. Therefore, an output transformer has been used between the power tube and loud speaker, and effectively keeps the DC out of the speaker windings, although it allows free passage to the AC which actuates the unit.

An output transformer has several advantages over the choke coil and condenser combination sometimes used for this purpose. First, it is lower in cost; second, it is more compact than the ordinary choke and condenser combination; third, it requires fewer connections, and thus permits of easier wiring; fourth, it can be designed so as to match the impedance of the speaker to the impedance of the power tube; fifth, when properly designed, it will afford better reproduction of the low notes. This last statement is easily understood, when one stops to consider that the reactance of a condenser increases as the frequency decreases.

The entire outfit is built around the new Thordarson Power Compact, which comprises, in one case, the power transformer, filter chokes, and two .1 mfd. buffer condensers. The filament lighting secondary of the power transformer is provided with a mid tap for the grid return, and this tap is located at the electrical center by a unique method. Two equal coils are wound side by side on the same core, and the mid tap is taken from the junction of the two coils.

The Power Compact greatly simplifies the assembly and wiring of the outfit. Further, due to the unusual design of the unit as a whole, it is possible to do the greater part of the wiring before the two front panels and the sub panel are joined. The wiring itself has been reduced to the simplest possible form. No binding posts are provided for the input and for the loudspeaker, since these leads can be made directly to the transformers.

The milliammeter indicates the total current drawn by the receiver and power amplifier, and is an accurate indicator for the correct C bias

adjustment on the power tube. In addition, it tells at a glance when distortion and overloading are present. For these reasons, it is most important that a milliammeter be used on a device of this kind.

In the laboratory, we tested this eliminator and power amplifier on a nine tube super-heterodyne. The power amplifier was plugged into the first step of audio, and B supply for all tubes was drawn from the eliminator. Despite the fact that 7 of the tubes in the receiver were drawing on the 90 volt tap, and that an AC voltmeter indicated a variation in line voltage of from 108 to 120 volts, a high resistance voltmeter across the 90 volt tap showed no variation whatever. The power amplifier and eliminator operated without a trace of hum, although the super-heterodyne was working on a loop, and no ground connection was made to any part of the outfit. This was the most severe test that we could impose upon a device of this kind, and indicates what excellent results can be expected from it.

Following is the list of parts, as used on the laboratory model:

- 1 Thordarson Power Compact, type R-171;
- 1 Muter condenser block;
- 1 General Radio audio transformer, type 285, 6 to 1 ratio;
- 1 General Radio output transformer, type 367;
- 3 General Radio UX sockets;
- 4 Radion Brackets;
- 1 Brach Controlit;
- 2 Clarostats;
- 1 Aerovox Lavite resistor, 10,000 ohms;
- 1 Aerovox Lavite resistor, 2,000 ohms;
- 1 Aerovox double resistor mounting;
- 1 Jewell Milliammeter, 0-50 milliamperes;
- 1 Electrad Royalty variable high resistance, type K, 0-5,000 ohms;
- 3 Eby binding posts;
- 1 7 x 18 Bakelite front panel;
- 2 6 x 7 Bakelite or hard rubber sub panels;
- 1 Raytheon BH rectifying tube;
- 1 UX 874, CX 374 Glow tube;
- 1 UX 171, CX 371 Power tube;
- 1 coil Belden Colorubber flexible hookup wire;
- Rosin core solder, bolts, nuts, lugs, Lastites, etc.

Trouble Shooting on B Eliminators

Pointers for the technical men—
By Charles Golenpaul*

WITH the growing use of B eliminators, the technical man must now add to his stock of knowledge at least a practical understanding of rectifiers, filter circuits and controls. And as a contribution to this end, the following trouble-shooting suggestions are offered, based on an extensive survey of B eliminators, their operation and the possibilities of trouble, together with the proper remedies.

It goes without saying that a B eliminator must be properly designed and constructed if it is to give satisfactory service, especially over a considerable period of time. A really good eliminator is costly, for the reason that it incorporates a powerful transformer, equally husky choke coils, liberal condensers, and satisfactory resistances. As with everything else, one gets precisely what one pays for in buying a B eliminator; and trouble starts, of course, with the purchase or the construction of an inferior grade of eliminator. Again, B eliminators are now made in the standard and the heavy-duty models, the former proving quite satisfactory for the usual run of receivers, while the latter is intended for receivers employing the largest power tubes. It is unfair, of course, to expect heavy-duty service from a small eliminator.

For the most part, B eliminators are no longer an experiment. Most offerings are licensed under the Raytheon, the Rectron or the chemical cell rectifier patents, and the buyer is assured of a satisfactory job.

In building a home-made B eliminator, none but the best components should be employed. It is good practice to buy a kit of parts, rather than scattered units, in order to have the benefit of skilled engineering and research. Here again, it is well to remember that good products cost more money but ensure reliable and lasting satisfaction.

Any good B eliminator should operate the usual receiving set silently and satisfactorily. However, if a hum is detected in the reception, it may be due to mechanical vibration from the B eliminator or to electromagnetic induction. In either event, the eliminator should then be placed at some distance from the receiver.

Should the radio set suddenly cease to function, and the filaments of the receiver tubes remain lighted, the

* American Mechanical Laboratories.

“—remarkably good!”



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OWNING AND OPERATING STATION WENR 266 METERS

trouble is most likely in the eliminator. If a filament tube rectifier is employed, such as the Rectron, the filament should be examined. If it is still glowing, showing that it is intact, the trouble may be elsewhere.

The next likely source of trouble may be that one of the filtering condensers has broken down. Each filtering condenser should be tested out with an ear-telephone and dry cell, connected in series, with the open leads put on the condenser terminals. One click should be heard when the circuit is completed through the condenser, and the successive clicks of the same condenser should be barely audible, if heard at all. Contrariwise, if each click is loud, the condenser may be considered defective, and should be replaced by a perfect condenser.

If the volume gradually fades, even over a period of days and weeks, the trouble may be due to a defective rectifying element, whether it be a tube or chemical cell.

There is always the possibility of a broken connection, hence the wiring of the B eliminator should be carefully examined. The terminals and the external wiring should also be examined for loose or broken connections.

Sometimes a B eliminator gives rise to noisy reception which, at first, may be blamed on static. However, if the noise persists even when the receiver is detuned, it is proof that the trouble is with the receiver or its power plant, and not with the atmosphere. Sometimes the cause can be traced to loose or corroded connections on the storage battery which, while not sufficient to show up in the brightly lighted filaments, will nevertheless cause persistent noise. Again, it may be a loose wire in the connecting leads. But as likely as not the noises are due to faulty resistances, especially those of the variable kind. Variable resistances of insufficient current-carrying capacity soon become noisy and even totally inoperative after some length of everyday service, yet the radio enthusiast, in his search for the trouble, will take the satisfactory performance of the variable resistance controls for granted.

It is no uncommon experience to have a radio receiver suddenly or gradually stop working for no apparent cause. Or again, the signals become weaker and weaker, even though the filament current and the B eliminator output appear satisfactory. Yet all the while the trouble may be due to the breakdown of one of the intermediate voltage control resistances, which has escaped detection.

Some B eliminators have eliminated all variable resistances, using fixed resistances instead to obtain the necessary fixed voltages. Such practice, while it may ensure silent and positive operation, has the disadvantage of failing to provide the critical

voltages required by the different circuits for maximum sensitivity, volume and tone quality. It is a fact that the plate voltage on the radio frequency tubes is of great importance as regards the sensitivity of the receiver and the tone quality, especially in regulating reception for powerful local signals, and weak distant signals. The detector voltage makes all the difference between ex-

treme sensitivity with harsh reproduction, or less sensitivity with a mellow reproduction. The plate voltage on the audio frequency tubes enables the proper balance to be struck with the C battery, for distortionless reproduction. All in all, therefore, it is necessary to have variable voltage control for all receiving circuits, provided noiseless and reliable variable resistances are employed.

A Novel B Supply and Power Amplifier

*Resistance and impedance power audio are available with this outfit**

PRESENTED here is the first combined B eliminator and power amplifier that has been expressly designed for use with resistance coupled audio amplifiers. In addition, it incorporates the novel feature of optional coupling, or, to be explicit, a simple switching arrangement so that the power amplifier can be coupled to the receiver, either through resistance or impedance coupling. Due to the flexibility afforded by this arrangement, it is possible to add this apparatus to any existing receiver.

This adaptability is not to be lightly regarded by the dealer. Selling parts for B eliminators and power amplifiers may be somewhat of a gamble, unless the finished outfit can be expected to work under a wide range of varying conditions, and on any receiver, regardless of circuit.

The design of the units comprising this assembly is so ample, and the output is so great, that the B supply is more than adequate, even for the abnormal requirements imposed by receivers using a multiplicity of tubes. The rectifier is rated at 85 milliamperes output at 200 volts. Allowing 20 mills drain for the 171 tube, it can be seen that a reserve of 65 mills is available, which is more than ample for the largest set.

Reference to the schematic will permit a clear picture to be visualized of the simple method by which the change of audio coupling is effected. Since both resistance and impedance coupling use a coupling condenser and grid leak, it is an easy matter to make one set of these items perform the same function for both systems. Now, if the plate of the output tube of the receiver is connected to the resistance, and also to the impedance, it is obvious that the B voltage, applied to either one, will put that form of coupling into effect. To take advantage of this condition, the B plus side of the input has been run to the center of a single pole, double throw switch. One position of the switch applies the

voltage through the resistance, and the other position completes the circuit through the impedance.

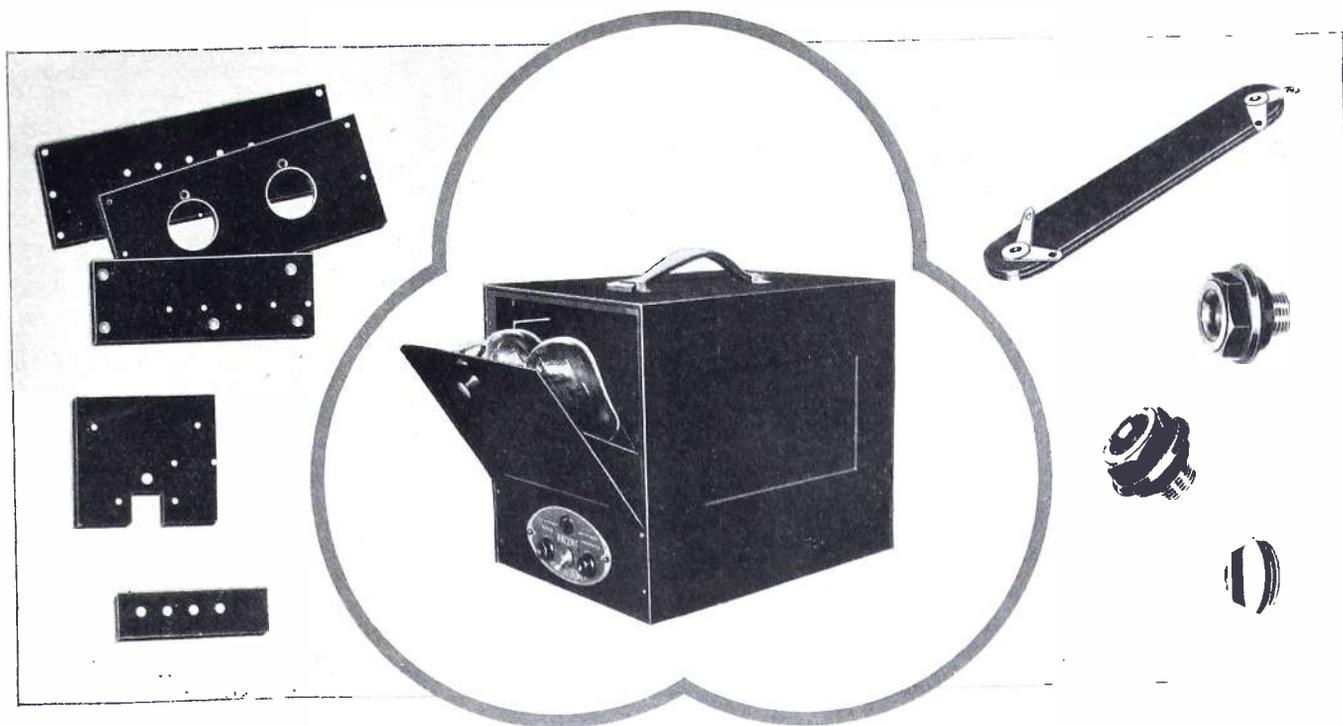
It is possible, by this method, to compare the results obtained from each form by the simple throw of a switch, which is conveniently mounted on the front panel. Further, the output of a three stage resistance coupled amplifier can be fed into a fourth stage. However, the impedance coupling feature is primarily intended to operate after the first stage of a transformer coupled receiver.

For the utmost flexibility of control and adaptability, three variable output voltage taps are provided, which assure regulated voltages of 45, 90, and 135, regardless of the number of tubes used. A fixed resistor is used to cut down the maximum output somewhat, so that it can be applied safely to the plate of the 171 power tube. The high negative bias which this tube requires is obtained by the drop through a fixed resistance in series with the center tap of the filament supply winding on the power transformer.

In order to make the apparatus absolutely free, from the necessity for care or constant changing of the AC connections, one of the new automatic power switches has been built into the assembly. This switch incorporates a sensitive relay, which is placed in series with the lead from the positive terminal of the A battery to set. When the filament current to the receiver is switched on, the B eliminator and power amplifier is connected to the AC line; when the filaments of the receiving tubes are switched off, the eliminator and power amplifier is disconnected, and the battery charger is turned on. This arrangement is a decided convenience, and affords what practically amounts to automatic operation for sets using parallel filament wiring.

A tone filter, which consists of a choke coil and condenser, is used between the output of the power tube

* Complete construction article in January, 1927, *Radio Mechanics*.



Three forms of Bakelite in the Pacent Powerformer

Because of its mechanical strength and high insulation value, Bakelite Laminated is used for the panels and insulating strips.

Because of its electrical properties and its permanently lustrous finish and color, Bakelite Molded is used for the jack nipples.

Because it is transparent, but not brittle, red Bakelite clear material is used for the "ruby" that glows when the power is on.

These various applications of Bakelite in the Pacent Powerformer are indicative of the part that Bakelite is playing in the development of fine radio sets, accessories and parts. Manufacturers and designers will always find our engineers and research laboratories ready to render helpful cooperation.

Write for Booklet 38.

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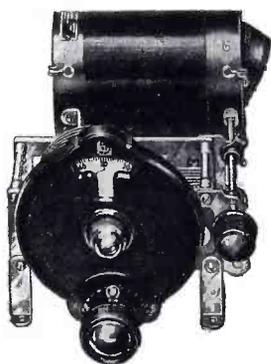
U. S. PAT. OFF

THE MATERIAL OF A THOUSAND USES

"The registered Trade Mark and Symbol shown above may be used only on products made from materials manufactured by Bakelite Corporation. Under the capital "B" is the numerical sign for infinity, or unlimited quantity. It symbolizes the infinite number of present and future uses of Bakelite Corporation's products."

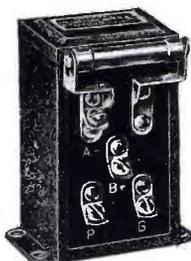
NATIONAL

POWER AMPLIFIER



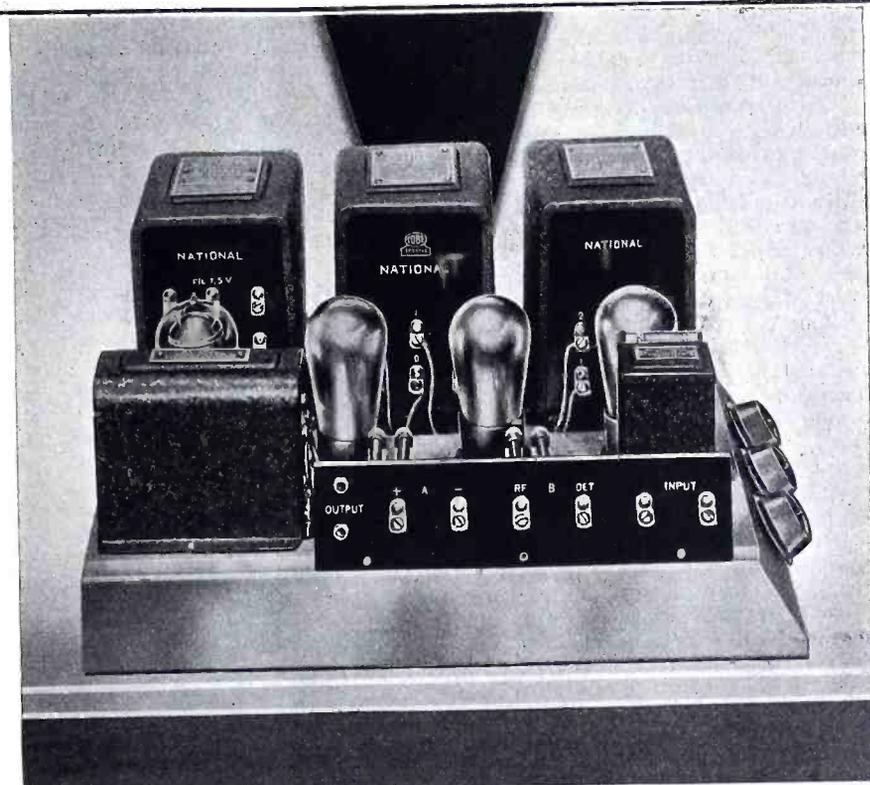
NATIONAL TUNING UNITS—

comprise the wonderful BROWNING-DRAKE R. F. Coils and Transformers with their SLOTWOUND primary and SPACEWOUND secondaries, EQUICYCLE wide-spacing condensers and Velvet VERNIER DIALS. They make good Radio sets.



NATIONAL IMPEDANCE-FORMER—Type B—includes in one case audio choke coil 0.1 Mfd. TOBE Condenser, mounted Lynch Resistor,—for modern audio amplification.

Price—\$5.50 each



MAKES your present Radio Set the last word in Fidelity of Reproduction,—and supplies all B and C current from the lamp socket. Designed on sound engineering principles in collaboration with Arthur H. Lynch and James Millen. It combines a B-power-supply and complete audio amplifier of the highest type. It is made to use either the Raytheon BH or Rectron Rectifying Tube. Each unit is newly designed for heavy and continuous duty, built to established NATIONAL standards.

The NATIONAL Power Amplifier is designed to plug directly into the detector output of any Radio set and has one stage of NATIONAL Impedance-former and two stages of resistance coupling with Lynch Resistors. Output from the UX-171 semi-power tube is through a NATIONAL Tone Filter, protecting the loud speaker and still further improving quality. All of the parts mount on a drilled and cored metal base.

Sold in complete kit form, including Raytheon BH Tube and every accessory and piece of wire required (except audio tube). Easily assembled in an evening. Price—\$85. Price of kit as above but completely assembled, ready to run \$95.

The units are also sold separately.

For home and professional set-builders—for dealers' custom trade.

The NATIONAL POWER AMPLIFIER

NATIONAL products are built to engineering standards of excellence. Anyone who has ever built a set using NATIONAL BROWNING-DRAKE Coils and Transformers knows what that means. Send for Bulletin 116RE.



National Company, Inc., Engineers and Manufacturers.—W. A. Ready, Pres., Cambridge, Mass.

Makers of NATIONAL BROWNING-DRAKE Coils and R.F. Transformers, Impedance-formers, Condensers, Power Transformers, etc., for Radio.

Reports from the R. M. A.

Detailed recommendations and findings of the Power Equipment Committee

THE Power Equipment Committee of the Radio Manufacturers' Association invited representatives of the Fire Underwriters to be present at their first meeting, for a discussion of suitable standards that would be acceptable to all concerned. After quite a lengthy discussion, it was decided that suggested requirements be outlined, and sent to the membership of the organizations interested.

The Underwriters at present have not adopted any definite standards, but they would like to have some passed as quickly as possible. In April, 1926, the Underwriters mailed suggested laboratory requirements for power equipment, in connection with radio apparatus designed to be operated from alternating current. The Power Equipment Committee held another meeting, and investigated thoroughly the suggested requirements. A few places were found where wording and definitions were recommended for change, and these suggested changes will be mailed to the membership for their opinions.

In order to avoid a multiplicity of references to power devices, a name covering the entire category of these devices, and apparently covering the subject very well, is recommended by the Association, as follows: a socket power unit is any apparatus supplying A, B, or C battery voltage to a radio set from the house lighting supply. The letters A, B, or C, should be prefixed to the name to indicate the class.

The Power Equipment Committee feels that it would be very beneficial to have all output terminals of socket power devices standardized as to markings. The present numerical marking of output terminals is not very satisfactory, and the recommendation is made that the Standardization Committee take up with the set manufacturers the standardization of cable markings. By the adoption of this method, all of the socket power devices could be marked in one way.

As paper condensers enter largely into most of the socket power devices, the Committee feels that it would be a great economy and convenience to manufacturers, and also to the suppliers of materials entering into the manufacture of condensers, if standard sizes could be adopted by the condenser manufacturers. Three of the large manufacturers of condensers have been approached on this subject, and all expressed a desire for such standardization, as have also the manufacturers of foil and paper. Mr. E. F. Potter was asked to furnish the Committee with definite recommendation on this subject after conferring with other manufacturers.

There is also apparently no satisfactory standard method of testing condensers, this being a highly specialized subject and one of vital importance to the manufacturer of A. C. power devices. It is recommended that the condenser manufacturers hold a conference and advise the Association regarding the best methods of testing for general practice.

It is also recommended that the R. M. A. have on hand sizes of the different socket power devices, and that set manufacturers and cabinet manufacturers take into consideration the space necessary for incorporation of these devices, when building their cabinets, with the idea that, eventually, a definite size space allowance can be made covering the majority of these products.

It was also unanimously decided that a six foot primary cord equipped with standard attachment plugs be used as standard on all socket power devices.

Where the cord is equipped with a feed through switch, it is recommended that the general standardization Committee put a standard on the location of this switch on the cord. This would be of advantage to the cabinet and set manufacturers in design, so that the switch could be in the most convenient place.

The committee requests the privilege of including in its report the Underwriter's laboratory requirements referred to, together with the recommended changes.

Underwriter's Laboratories' Laboratory Requirements

Note:—The following requirements have been prepared for the guidance of the Laboratories' engineers in investigating devices of this class. They comprise a summary of the Laboratories' rulings on such appliances as submitted for examination and test. They are not intended as a standard, and are subject to revision as may be necessary on account of further development and standardization.

2. These requirements cover radio appliances for non-commercial use, designed to be operated from lighting or power circuits.

3. Under this classification are included battery substitutes or power supply devices; battery chargers with or without batteries; battery units with switches and connections, designed particularly for radio use; and radio receiving devices incorporating any of the above-mentioned appliances.

4. Battery chargers, either portable or for permanent installation and not intended for use with radio appliances,

are classed as rectifiers and are not covered by these requirements.

5. The following specifications apply to devices designed to be operated from alternating current circuits.

6. Features not covered by these requirements, and to which none of the Laboratories' Standards may be directly applied, or new developments which may subsequently be made in Radio Appliances, shall be made the subject of special investigation and shall be judged accordingly.

General Design and Construction

7. The device throughout shall employ materials which are suitable for their particular use, and shall be made and finished with the degree of uniformity and grade of workmanship practicable in well equipped factories, fabricating materials and devices similar to those employed in this product.

Enclosure

8. The enclosing case of the cabinet shall enclose all current-carrying parts of the device except primary leads and secondary terminals. The device may be so designed that tubes may be replaced without opening the case; but the current-carrying part of the sockets for such tubes shall be enclosed.

9. The enclosing case shall be of substantial construction and provide the necessary mechanical strength to protect the various parts from physical injury. The case, if of cast-iron, shall be not less than $\frac{1}{8}$ in. in thickness; and if of sheet-metal, shall be sufficiently rigid and of material not less than No. 22 U. S. gauge (No. 22 gauge sheet-metal will probably be found not rigid enough in areas over 25 sq. in. unless ribbed or reinforced).

10. Wooden cabinets are acceptable for power supply devices or radio sets; but in such appliances individual units such as transformers, inductances and condensers, which are conductively connected to a light or power circuit, shall be separately enclosed in metal.

11. Metal enclosures shall be enameled or otherwise suitably protected against corrosion.

12. The cabinet or enclosing case may be ventilated, in which case holes shall be either not larger than $\frac{1}{4}$ in. in diameter, or so located or protected that the average small tool or the operator's hand cannot be inserted and come in contact with current-carrying parts of the secondary circuit involving potentials exceeding 200 volts maximum.

Supply Circuit

13. Component parts of the device such as flexible cord, attachment plug, snap switch, lamp holder, attachment plug receptacle, or cutout base, shall be standard appliances.

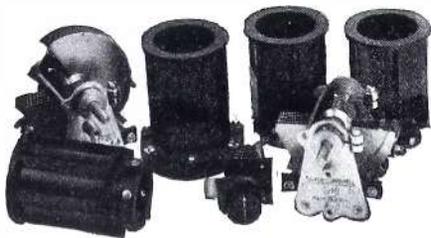
14. Where a flexible cord passes into the enclosing case, it shall be protected by an insulating bushing with smoothly rounded edges. Suitable strain relief shall be provided in the flexible cord.

15. The type of portable cord re-

SM

635

SHORT WAVE KIT



If you were going into the South American Jungles for months and months, you'd take the very best of everything with you—equipment tested, tried, and true. You'd be mighty careful about your safety, and you'd want to KNOW you could keep in touch with the World.

Commander Dyott, taking his expedition to the unknown River of Doubt, away back in Brazil, asked RADIO BROADCAST for radio equipment—and RADIO BROADCAST gave him a receiver that could be depended upon.

It was built around an S-M 635 Short Wave Kit. You, too, can build one just like it, exactly as the October RADIO MECHANICS shows you how. Then you can listen to Commander Dyott's expedition, and other explorers. And maybe even more interesting, when the static's bad and your regular set won't turn out in its regular style, your little short-wave set will pull in the important rebroadcasts in a way that will amaze you—day in and day out.

The S-M 635 kit consists of four coils, a coil socket, two short wave condensers, and an antenna condenser. The price is \$23.00. Or you can buy the four plug-in coils alone, covering the 18 to 150 meter range with any Standard .00014 condensers, for \$11.00 if you just ask your dealer for a No. 117 short wave coil set.

220 & 221 Audio Transformers

Do you know that the unofficial report of the largest telephone manufacturing company in the world set S-M 220s up as the very finest they had ever tested? Do you know that a large manufacturer, building reproducing equipment for new theatres, standardized on 220s and 221s after going over the entire market? Do you know that the maker of the finest electrically cut phonograph records stopped looking for reproducing equipment when his laboratory reported on the 220s and 221s? Do you know that every important magazine has recommended them?

S-M type 220 audio transformer is designed for all stage use in ordinary or power amplifiers, with all standard tubes. S-M 221 is an output transformer, to be used between your power tube and loud speaker. It's guaranteed to improve quality and handling power—unconditionally, with any set or speaker. Both types are priced at \$6.00.

Do you know the secret of quality reproduction?

Have you your copy of "The Secret of Quality?" It tells you simply and concisely how to get the most out of your audio amplifier—how to get real quality.

It contains laboratory data never before available even to many manufacturers. It is the only authoritative treatise on all types of audio amplification, written in non-technical language, ever published.

It's free! Ask your dealer for a copy.

Prices 10% higher west of the Rockies.



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quired shall depend upon the nature of the device with which it is supplied.

16. The conductors of the supply cord shall preferably be soldered directly to the primary windings; but one pair of screw terminals may be considered acceptable, when such terminals are provided with upturned lugs or the equivalent, and protected by suitable strain relief in the cord.

Transformers

18. Transformers connected to the lighting or power circuit shall have the primary insulated from the core and case and secondary winding.

19. All materials entering into the construction of transformers, except insulation, shall be non-combustible. The amount of combustible material employed for insulation shall be as small as consistent with the design of a device having high insulation.

20. Transformers shall be of thoroughly substantial design. The coils shall be wound in a workmanlike manner and impregnated or otherwise enclosed to exclude moisture.

21. Taps may be put on the primary windings for factory adjustment, but shall not be arranged to facilitate the user varying the number of primary turns. If a primary control or multi-point switch is employed to change the number of turns on the primary winding, the complete device shall be capable of successfully withstanding the prescribed tests with the switch in any position, including the most severe condition possible in actual operation.

Condensers

22. Condensers shall employ such materials and shall be so constructed that they will not constitute an undue fire hazard. They shall not be injuriously affected by the temperature attained by the device under the most severe conditions of normal use. Paper condensers shall be impregnated or otherwise suitably enclosed to exclude moisture.

Interior Wiring

27. All wires which are accessible when alive shall be insulated, and the insulation shall be suitable for the voltages involved and the temperatures attained under any conditions of actual use. Wires of special type (i. e., other than standard, listed, insulated wire), shall be made the subject of a special investigation with respect to their intended use and shall be judged accordingly.

24. No terminals or other live parts shall come in contact with a wooden cabinet or enclosing case.

Voltage Limitations in Secondary Circuits

25. No special protection against accidental contact need be provided for live parts in secondary or output circuits involving potentials not exceeding 200 volts.

26. Live parts in circuits involving potentials in excess of 200 volts shall be wholly inaccessible or the opening of the enclosing case shall cut off this high

voltage. The device or arrangement whereby this result is obtained shall be positive in action and such as not to nullify its purpose.

Spacings

27. A spacing of not less than $\frac{1}{2}$ in. over surface or through air shall be maintained between primary input terminals and between exposed live metal parts of the primary or supply circuit and the case.

Secondary Terminals

28. Outside (exposed) secondary terminals shall be provided with insulated nuts.

29. The maximum open circuit voltage between any two outside (exposed) terminals, shall not exceed 200 volts.

30. If permanent secondary leads are supplied, outside (exposed) terminals shall be eliminated. In such case a suitable strain relief shall be provided and the cord or cords shall be properly bushed where they pass through the wall of the cabinet or enclosing case.

Fuses

31. A device including a storage battery shall be protected by a fuse or circuit breaker in the battery leads. Such fuse or circuit breaker shall be rated at not more than 15 amperes.

32. Fuses, if used in primary circuits, shall not be readily accessible.

33. Fuses wherever used shall be standard, and suitable for the voltage involved.

Markings

34. Secondary terminals shall be properly identified.

35. The device shall be plainly marked where it can be seen readily. Secondary output ratings shall be clearly indicated on the device or in the accompanying instructions.

36. A connection diagram or instructions shall accompany the device, if the connections and method of operation are such that there may be any question regarding same.

TESTS

Current Consumption

37. Each device shall be tested to determine the current consumption on a supply circuit, the voltage of the primary which corresponds to the primary rating of the device.

38. The current consumption test shall be made (1) with no load on the secondary output, (2) with full load on the secondary output.

Temperature

39. Temperature tests shall be made at full load, with the device connected to a supply circuit whose voltage corresponds to the primary rating of the device, and such tests shall be continued until constant temperatures are reached.

40. When the cabinet or enclosing case is of metal, temperatures shall be noted at various points on the exterior surface of the device. When the cabinet or enclosing case is of

wood, temperatures shall be noted at various points within the cabinet.

41. In this test, temperatures obtained on the exterior surfaces of metal cabinets or enclosing cases, or temperatures on the interior surfaces of wooden cabinets, shall not exceed 90 degrees C. (194 degrees F.). Temperatures attained at any point on or within the device shall not be sufficiently high so as to injuriously affect any material used in the construction of the device

Voltages

2. Each device shall be tested to determine the terminal output voltage and the highest obtainable secondary voltage. Limits of these potentials have already been given in paragraphs 25 and 26.

DIELECTRIC STRENGTH

General

43. The insulation and spacing of the device shall be capable of withstanding the applied potentials, specified below, for a period of one minute without breakdown.

44. With the device still hot after the full load temperature test, a potential of 900 volts AC shall be applied between current-carrying parts of the primary circuit and the core of the transformer, between current-carrying parts of the primary circuit and the enclosing case, and between the current-carrying parts of the primary and secondary circuits.

45. With the device still hot after the full load temperature test, a potential of twice the highest (primary or secondary, open circuit voltage plus 1000 volts AC shall be applied between the primary and secondary windings, with the transformer disconnected.

46. The insulation of all current-carrying parts of the secondary circuit operating at a difference of potential from the transformer core, case, or any other part, shall be subjected to a potential test of twice the highest peak voltage to which the parts are subjected under any condition of actual use.

Condensers

47. Condensers shall be tested for breakdown by the application of a DC potential equal to twice the highest peak of voltage to which they are subjected under any conditions of actual use. This requirement does not apply to electrolytic condensers.

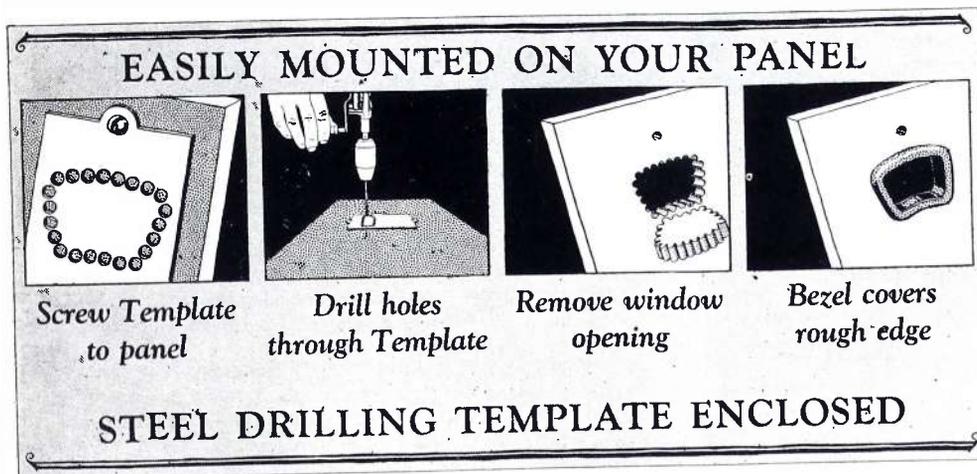
Maximum Input Test

48. During this test there shall be no emission of flame or of molten metal from (a) the metal case enclosing a device as a whole or (b) the separate units within an enclosing case or cabinet of wood or other inflammable material.

49. Devices having secondary output terminals, shall be tested with the input leads connected to a circuit of rated voltage and frequency, and with the secondary output terminals connected to give maximum primary

Fans want them

to add the "professional touch"
the note of style to home built sets!



This new label—printed in striking blue and yellow—now comes pasted on every MAR-CO control carton. It pictures the 4 simple steps in panel drilling, for mounting the control. To show these pictures to a fan... is to remove his last resistance to buying the one tuning control that returns you the most profit!

Easy to install and to sell

At the New York, Boston, and Chicago radio shows—the MAR-CO control display was a big center of interest. Qualified observers reported "more interest among set-builders in the MAR-CO control than in any other instrument exhibited".

Its illuminated back-panel scale is the one thing fans everywhere want. It makes a home-built set look "professional".

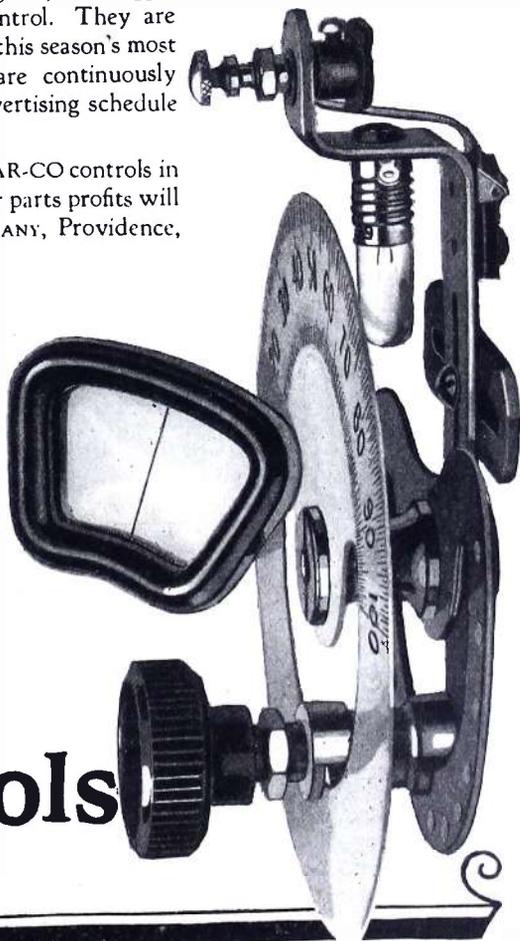
But, because of this, it also looks difficult to mount—which is NOT the case. For the template supplied makes panel drilling so easy—you simply CAN'T go wrong. And in order to SHOW just how easy the mounting is—MAR-CO is now pasting the label shown above on every carton... and reproducing the pictures in color page advertisements in ten radio magazines.

Now, therefore, the wise parts dealer will

feature MAR-CO controls. They give you a bigger profit than any other tuning control. They are specified equipment in a score of this season's most important circuits. And they are continuously featured by the most powerful advertising schedule in the parts field.

The sooner you put a display of MAR-CO controls in your window... the sooner your parts profits will grow. MARTIN-COPELAND COMPANY, Providence, R. I. Branch Offices and Representatives in principal cities.

MAR-CO illuminated controls list at \$3.50, including Bezel, Template and MAZDA lamp. Replacement lamps, 20c. Scales read either 0 to 100, or 100 to 0. Lamp runs off "A" battery, draining only .1 ampere. Controls fit all standard condensers, including double and triple models.



MAR-CO

Illuminated Controls

input, and shall be operated until constant temperature is reached or until burnout occurs.

50. When the enclosing case or cabinet is of metal, the temperatures reached in this test shall be such that cheese cloth, placed in contact with the outside of the case, will not be ignited. When the enclosing case or cabinet is of wood or other inflammable material, the temperatures reached shall be such that no charring of the case occurs.

Suggested Changes in Underwriters' Laboratory Requirements

Paragraph 3—Suggested that the words "or without" be omitted, so as not to include chargers already on the market, to be used for other purposes than radio.

Paragraph 8—Suggested that the following be added after the words "secondary terminals"—"except where the potential is less than twenty-five volts, and the primary input does not exceed two hundred and fifty watts when such secondary terminals are short-circuited."

Paragraph 10—Suggested that the word "combustible" be substituted for the word "wooden," and that the word, "non-combustible" be substituted for the word "metal." This suggestion is made so that cabinets could be made of some other heat-resisting insulating material than metal.

Paragraph 24—Suggested that the following be added—"unless the case is made of a suitable insulating material."

Paragraph 25—Recommended that the limit of two hundred volts be increased, and that inasmuch as the commercial sockets, which present a much greater shock hazard than secondary circuits of radio devices, it should be allowable to build the apparatus to at least as high voltage, namely, the peak voltage encountered in a two hundred and fifty volt A C circuit. This would maintain throughout the specifications where reference is made to two hundred volts.

Paragraph 28—Suggested that the following be added—"except where the potential is less than twenty-five volts and the primary input does not exceed 250 watts when such secondary terminals are short circuited."

Paragraphs 34 and 35—Suggested that in the case of a complete power unit and radio set where a cable is attached directly and becomes a part of the radio set, the other end being equipped with a keyed multi-conductor plug, that it would not be necessary to mark the secondary terminals of either the socket power supply device or the plug.

Paragraph 37—Suggested that paragraph read as follows—"each device shall be tested to determine the current consumption on a supply circuit, the voltage and frequency of which corresponds to the primary rating of the device."

Barawik First to Recognize Short Wave Possibilities

THE Barawik Company, Chicago, Ill., announces the installation of a new department devoted entirely to the interests of short wave enthusiasts. The interest in short wave transmission and reception is continually growing because of the ease with which tremendous distances can be covered. The Barawik Company has inaugurated this new department for the sole purpose of making it easier to enter and follow this most fascinating of all radio arts, and to meet the demand for something new in radio activity.

Mr. F. J. Marco, consulting engineer for several radio manufacturers in the broadcast and amateur fields, and owner of the special experimental short wave station 9ZA, has been retained to direct this special department. Mr. Marco is one of the best known radio men in the country, and will be recognized as the designer of Aero and Bremer-Tully Short Wave Coils, several successful makes of broadcast receivers, and a host of radio accessories. He has been in constant touch with all the parts of the amateur and broadcast experimental departments for nearly ten years. For the past several years he has been devoting his attention particularly towards the short wave branch of the radio industry, and is thoroughly familiar with both the amateur operators and broadcast listeners' angle on the short wave situation.

In the direction of this new department, Mr. Marco will endeavor to establish a center of short wave information and engineering service for the U. S. as well as internationally. The Barawik Company will be in a position to give technical information and supply all equipment pertaining to this field in a manner never before accomplished by any business organization. In the design of the new equipment and the correction of difficulties with existing apparatus, the Barawik Company will constantly issue catalogs and bulletins. This department is primarily for the every-day person, whether he be a licensed amateur, a broadcast listener, a layman just breaking into the code game, or merely a would-be listener to experimental broadcasting.

Twenty-four hours a day, every day in the year, the world over, much code and special experimental transmission work is being done on wave lengths between 15 and 100 meters. The very recent discovery of the real merit of these high frequencies in covering tremendous distances with exceedingly low powered transmitters and simple receivers, has induced thousands of

radio fans, both expert and tyro, to take up this fascinating art. A simple two or three-tube regenerative set brings in readable voice and music from England to Australia. United States Experimental Broadcasting Station 2XAF (WGY Experimental) on 32.79 meters, or KDKA on 74 meters, are heard in all parts of the country every afternoon and night, with volume equalling a local station.

Transmitting amateurs from all six continents of the globe using code are sending out at slow speeds, signals that can be picked up anywhere in the country under ordinary weather conditions, every day of the year, either day or night.

With a transmitter of simple construction, using a receiving tube and a B battery, two-way conversation can be carried on with most foreign countries. A 199 tube with 90 volts on the plate has actually talked with Australia, from Columbus, Ohio!

Thousands of enthusiasts experience this thrill every night in the year, and since almost everyone uses English as a common tongue, many new friendships are formed over a ten-thousand mile gap.

Daven Buys Port Co.

Mr. W. H. Frasse, the President of the Daven Radio Corporation has just announced that at the last Board of Directors meeting the Directors voted the purchase of controlling interest of the stock of the Port Manufacturing Company, manufacturers of the Daven Bass Note Circuit.

The purchase price was not divulged by Mr. Frasse.

Mr. Frasse stated to a representative of this paper that the reason for buying was that the Daven Radio Corporation realized soon after granting the license to the Port Manufacturing Company that they had made a mistake. The business of the Port Company far exceeded anyone's expectations, due to the popularity of the Bass Note Set. The only way to get control of the license again was to buy the controlling stock of the Port Company which has just been accomplished.

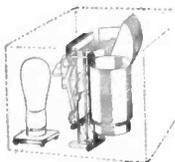
The business will be conducted as in the past by the Port Manufacturing Company but will be under constant and strict supervision of the parent company.

This is a very interesting piece of news because it definitely puts the Daven Radio Corporation, who for the past five years have been identified as Resistor Specialists, into the Radio Set Field, manufacturing the Daven Bass Note Circuit.

YOU CAN BUILD THE NEW SHIELDED HI-Q*



The Hammarlund-Roberts Board of Engineers
The Hammarlund-Roberts Hi-Q Receiver is the joint creation of ten of America's leading engineers.



Automatic Variable Coupling
A wonderful new feature which gives maximum and equal amplification and selectivity over entire tuning range.



"How to Build It" Book

Simple A B C language. Every detail described, numbered and diagrammed so that you can easily understand it. 25c.



The Hi-Q Foundation Set

Includes drilled and engraved panel and sub panel and all the essentials required to start building. Price \$10.50.

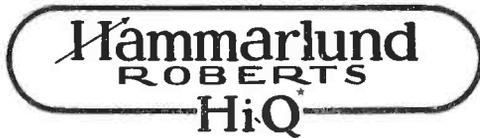


6⁰⁵

*Over 57,000 Built at Home
You Can Do It Too*

IF you want radio's greatest value look into this New Shielded Hi-Q Receiver—designed by ten leading American engineers. Even a greater instrument than the famous Hammarlund-Roberts which has been built by over 57,000 novices. Incorporates every modern feature. Highest quality parts are PERFECTLY MATCHED. Five tubes equal eight. A new feature eliminates distortion and produces the selectivity of expensive many-tubed "Supers." And on all stations, one has that velvet-smooth, crystal-clear quality you have always hoped for.

Ask your dealer for the "How to Build" book and learn how you can build one of the world's finest radios—at a saving of \$50 to \$100 over sets of anything like similar efficiency.



*High ratio of reactance to resistance.
High ratio—Great Selectivity—Loud Signals.

HAMMARLUND-ROBERTS, Inc.

1182-G Broadway New York

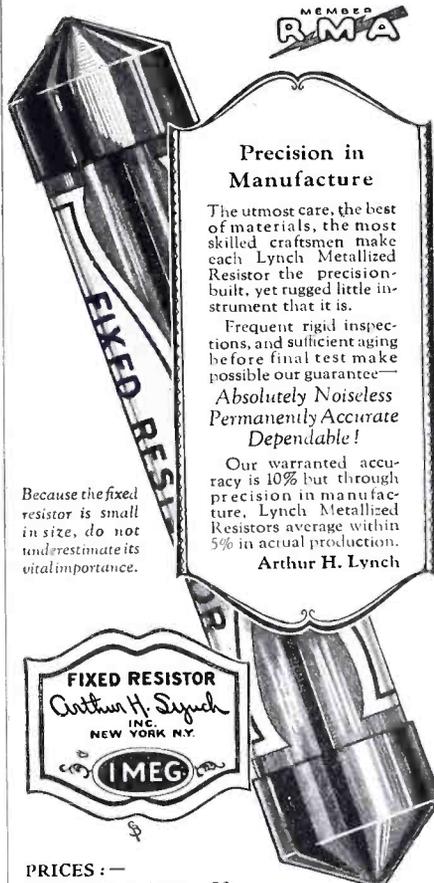
Chosen by EXPERTS

GLENN H. BROWNING, Laurence M. Cockaday, Gerald M. Best and many other eminent radio designers use the Lynch Metallized Resistor in their experimental circuits and receivers. These men know radio; they have laboratory and testing equipment with which quickly to make accurate comparisons. There could be no better proof of the true merit of the Lynch Metallized Resistor than the endorsement of these experts.

Comprising a concentrated metallized deposit one-thousandth of an inch thick upon a rigid core, sealed forever within a glass tube, the Lynch Metallized Resistor gives *conductive, non-arcing* resistance that remains silent, accurate!

Dealers—Write us!

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Precision in Manufacture

The utmost care, the best of materials, the most skilled craftsmen make each Lynch Metallized Resistor the precision-built, yet rugged little instrument that it is.

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Our warranted accuracy is 10% but through precision in manufacture, Lynch Metallized Resistors average within 5% in actual production.

Arthur H. Lynch

Because the fixed resistor is small in size, do not underestimate its vital importance.



PRICES :—

.25 to 10 Megohms	.50	Single Mounting	.35
above .01 to .24 "	.75	Double "	.50
.001 to .01 "	\$1.00		

Lynch Metallized Resistors cost no more than the ordinary kind. If your dealer cannot supply you it will be well worth your while to wait for the mail—we ship post-paid, at once.

LYNCH METALLIZED

FIXED RESISTORS

In Radio Engineering, January

Review of December I. R. E. Papers, Inspection Tests for Eliminators, New Methods for Shield Design, Selective A. C. Filter System And Other Important Articles for Radio Engineers and Designers.

With The Manufacturers

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

Willard

The Willard Storage Battery Company, Cleveland, Ohio, has a full line of A and B power units. The A power unit incorporates several features. This piece of apparatus contains, in one case, a 40-ampere hour storage battery, and a charger which provides two charging rates for this battery. The charger also charges storage B batteries. On the front of the unit is an indicator, which shows at all times the condition of the A battery. Three switches are provided, and four binding posts. One switch turns the charger from the A to the B batteries; one changes the charging rate from one half to two amperes, and the third switches the unit from the set to the charger.



The Willard A Power Unit

The B power unit, made by the same company, is of the electrolytic type. Two variable output voltages are provided, and a fixed tap for the power tube. Upon the front of the unit is mounted, in addition to the variable voltage controls, four binding posts, and a switch which turns the unit on and off.



The Willard B Power Unit

Grigsby-Grunow-Hinds

The Grigsby-Grunow-Hinds Company, 4540 Armitage Avenue, Chicago, is making three models of the Majestic B eliminator, all of which are designed for use with the Raytheon tube.

The Majestic Standard-B is rated 45 milliamperes output at 135 volts, and retails at \$32.50, including Raytheon tube. This model is intended for sets using up to six 201-A type tubes, and one 112 tube.



The Majestic Super-B Power Unit

The Majestic Super-B is rated 45 milliamperes output at 150 volts, and therefore is capable of furnishing B power to sets using up to 12 tubes. The retail price is \$35, including Raytheon tube.

The Majestic Master-B is rated 60 milliamperes output at 150 volts, and is specially designed for sets having a very heavy current drain. In addition, this outfit has three variable output voltages, which fact permits of its adaptation to any receiver. The retail price, including Raytheon tube, is \$42.50.



The Majestic Master-B Power Unit

Yaxley

The Yaxley Manufacturing Company, 9 S. Clinton St., Chicago, has just released a new automatic power control. This device is connected to

the light socket, and contains receptacles into which the trickle charger and B eliminator are plugged. Two terminals are provided, through which the A plus lead from the battery to the set is connected. When the filament



The Yaxley Automatic Power Control, which operates B eliminator, Power Amplifier and Charger from the filament switch on the receiver

switch on the receiver is turned on, this device automatically shuts off the trickle charger and turns on the B eliminator and power amplifier; when the filament switch is turned off, the power control switches the AC from the eliminator, and power amplifier if used, to the trickle charger.

American Radigon Laboratories

The American Radigon Laboratories, 569-561 W. Monroe St., Chicago, are making a Radigon B power supply unit. This apparatus provides two variable voltage controls; the detector



The Radigon B Power Supply Unit

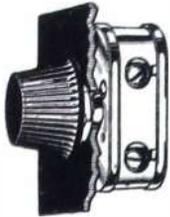
tap is variable from 12 to 110 volts, and the intermediate tap is variable from 20 to 135 volts. In addition, a high voltage tap is provided for the power tube, and delivers up to 200 volts. The retail price, including rectifying tube, is \$19.95.

Cornish

The Cornish Wire Company, 30 Church St., New York City, is making a flexible stranded and insulated wire, sold under the trade name of Corwico Flexibus. This wire is made with in-

Bradleystat

PERFECT FILAMENT CONTROL



The Bradleystat provides perfect filament control for all tubes

Provides complete noiseless filament control for all radio tubes without change of connections. Metal parts are nickel plated. One hole mounting. Self-contained switch opens battery circuit when desired.

Allen-Bradley Co.

Electric Controlling Apparatus

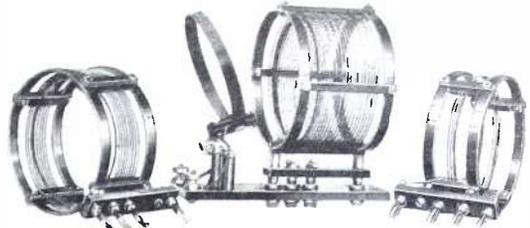
288 Greenfield Avenue Milwaukee, Wis.

Radio Engineering

INVITES contributions from the technical men, designers, engineers, and production managers on all subjects concerning laboratory tests and developments, materials, manufacturing methods, servicing, and factory equipment.

THESE articles will be paid for upon publication. They should be accompanied by good photographs. Drawings may be in the form of pencil sketches.

CONTRIBUTIONS should be addressed to the Editor, Radio Engineering Magazine, Radio Hill, Poughkeepsie, N. Y.



Short Wave Kit—15 to 133 Meters

\$12.50 Complete

AERO COILS

Give Best Results-Always!



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



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235-550 Meters
Price \$4.00

Sheer merit and sparkling dependable performance are the principal reasons why Aero Coils have been featured in so many sets designed by Radio Engineering.

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

If you are building a new receiver or want to improve your present one, be sure to obtain Aero Coils from your dealer or direct from us.

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X-L VARIO DENSER

RESULTS in easier tuning, more distance, volume and clarity—greater stability. Indorsed by leading authorities. Model "N" a slight turn obtains correct tube oscillation on all tuned radio frequency circuits. Neutrodyne, Roberts two tube, Browning-Drake, McMurdo Silver's Knockout, etc., capacity range 1.8 to 20 micro-microfarads. Price \$1.00

Model "G" with grid clips obtains the proper grid capacity on Cockaday circuits, filter and intermediate frequency tuning in heterodyne and positive grid bias in all sets. Capacity range Model G-1 .0002 to .0001 M F D. Model G-5 .0001 to .0005 M F D. Model G-10 .0003 to .001 M F D. Details on request. Price \$1.50
X-L Push Post. Push it down with your thumb, insert wire, remove pressure and wire is firmly held. Releases instantly. Price 15c.
Seven Push Post Panel permanently marked in white on black insulating panel. In box including soldering lugs, raising bushings and screws for mounting, etc. Price \$1.50



X-L RADIO LABORATORIES 2423 Lincoln Ave., CHICAGO, ILL.

D. K. BULLENS CO.

Stock Magnets for Loud Speakers

Permanent Magnets to Blue Print

Pottstown, Pennsylvania

sulation of various colors, and is designed for sub panel and point to point wiring.



Corwico Flexibus is made in various colors for circuit distinction

Ford Radio and Mica

The Ford Radio and Mica Corporation, 111 Bleeker St., New York City, is making apparatus known as the Tran-Choke Unit. This consists of a power transformer and chokes, com-



The Ford Tran-Choke Unit Simplifies B Eliminator Assembly

bined in one case, and designed for use as the foundation unit for B eliminators. The same company is licensed, under Hiler patents, to manufacture the new double impedance units for audio amplifiers.

Webster

The Webster Company, 3510 W. Lake St., Chicago, is making a complete line of B and B & C eliminators. The "Little Giant B-C" power supply unit, made by this company, delivers up to 85 milliamperes at 180



This Webster Power Unit supplies both B and C voltages

volts. The detector voltage is variable from 5 to 75 volts, the intermediate tap from 20 to 135 volts, and the power tube tap from 135 to 180 volts. The intermediate C supply is variable from 0 to 25 volts, and the power tube C voltage from 0 to 41 volts. The retail price, complete with Raytheon tube, is \$50.00.

Niles

The Niles Manufacturing Company, Ypsilanti, Michigan, is making a model known as the Console charger, which charges a 6-volt battery at a 2-ampere rate. This charger is very compact, and is designed to be placed inside of the cabinet or console. The retail price is \$10.00.



The small size of the Niles Console Charger permits of its enclosure in the cabinet or console

General Radio

The General Radio Company, Cambridge, Mass., has announced a new audio transformer with a high impedance primary, specially designed



The General Radio 285-D Audio Transformer is specially designed for a 200-A Type Detector

to match the impedance of the 200-A type of special detector tube. The turns ratio of this transformer is 3 to 1, and the retail price is \$6.00.

Polymet

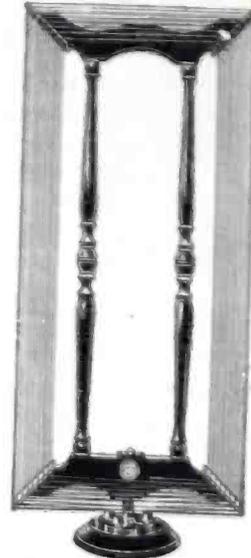
The Polymet Manufacturing Corporation, 599 Broadway, New York City, is making a full line of filter condensers, in addition to the small fixed and by-pass type. B blocks are made for the Raytheon circuit, and a special unit is also provided for the two buffer condensers. This company specializes in furnishing condensers to set manufacturers.



The Polymet By-Pass Condenser

Bodine

The Bodine Electric Company, 2266 West Ohio St., Chicago, is making a new Bodine De Luxe Loop, in addition



By the use of a special base, the Bodine loop can be turned without twisting the connecting wires

to the former line of basket weave folding loops. This loop is different in design to the usual apparatus of this type, particularly as to the method by which the wires are supported.

Chaslyn

The Chaslyn Company, 4611 Ravenswood Avenue, Chicago, is making a special hydrometer for testing storage



The Chaslyn Hydrometer

batteries. This hydrometer uses three colored balls for the indicators, instead of the floating scale ordinarily employed for this purpose.

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



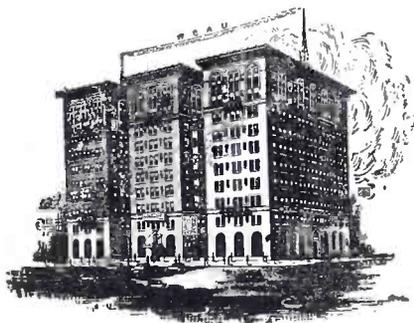
The "SELF-ADJUSTING" Rheostat

PHILADELPHIA

Chestnut and 39th Street

Hotel Pennsylvania

Fireproof—Unrestricted Parking—Garage



OSCAR W. RICHARDS, Manager

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Rooms with running water from \$2.50 per day
Rooms with private bath and shower from \$3.50 per day

Food and Service the Best

Near West Philadelphia Station Pennsylvania Railroad
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"used
in the
LC-27"



AEROVOX

"Built Better"

FIXED CONDENSERS

are Specified in

LC-27	by L. M. Cockaday
Diamond of the Air	" Herman Bernard
To be announced soon(?)	" John Rider
Raytheon "B" Eliminator	" Kaytheon Mfg. Co.
Ultradyn	" R. E. Lacault
To be announced soon(?)	" R. E. Lacault

AEROVOX fixed condensers have been approved by M. I. T. and Yale Universities.

AEROVOX WIRELESS CORP.
489-491-493 Broome Street
New York

Belden

The Belden Manufacturing Company, 2302-A South Western Ave., Chicago, is making a special wire which is suitable for hooking up B eliminators. This wire is covered with rubber insulation of various colors, and is marketed under the trade name of "Colorubber."



Belden "Colorubber" Wire

Freed-Eisemann

The Freed-Eisemann Radio Corporation, Manhattan Bridge, Plaza, Brooklyn, N. Y., is making a B and C eliminator, which is especially designed for use with Freed-Eisemann receivers.



The Freed-Eisemann B and C Power Unit



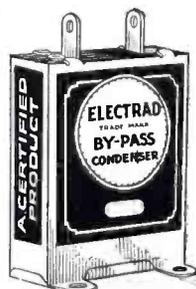
The Utah Book Speaker

Utah

The Utah Radio Products Company, 1421 S. Michigan Avenue, Chicago, is making a new speaker of unique design. This speaker is built in the form of a book, as illustrated, and is adaptable to harmonize with the home furnishings.

Electrad

Electrad, Incorporated, 428 Broadway, New York City, is making a full line of filter and by-pass condensers. These condensers are made in various capacities and types, each of which is rated to operate under certain voltages.



Electrad By-Pass Condenser

Rathbun

The Rathbun Manufacturing Company, Jamestown, N. Y., is making a new vernier dial. This dial operates on the friction principle, and is num-

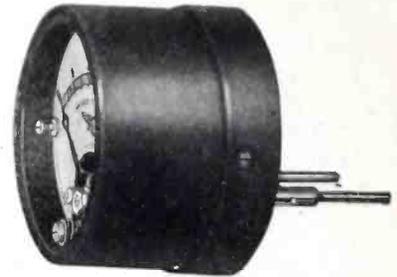


The New Rathbun Vernier Dial

bered from right to left, and from left to right. Space is provided where the call letters of a station, received at a certain number, can be written down.

Jewell

The Jewell Electrical Instrument Company, 1650 Walnut St., Chicago, is making a pin jack type voltmeter. This meter is designed for use with sets which provide pin jacks for this purpose, or these small jacks can be applied easily to existing receivers, without the necessity for drilling large holes in the panel.



Jewell Pin Jack Voltmeter

The same company makes a full line of milliammeters, as well as voltmeters designed for flush panel mounting.



All-American Constant-B

All-American

The All-American Radio Corporation, 4201 Belmont Avenue, Chicago, is making a B power unit known as the Constant B. This outfit has binding posts for 45, 67½, and 90 volts, and a high-low switch for the power tube tap. Variable controls are provided for the detector and intermediate voltages. The Raytheon type B tube is used for the rectifier, and the unit is made for 25, 40, and 60 cycle lines. Retail prices range from \$37.50 to \$42.50, according to model.



Kellogg B Power Unit

Kellogg

The Kellogg Switchboard and Supply Company, 1066 West Adams St., Chicago, is making a B supply unit, which is designed to operate either with two half wave rectifying tubes, or one full wave tube. Three adjustable voltages are provided; one regulates the detector voltage, one the intermediate tap, and one the high voltage for the power tube.

Heavy-Duty RADIOHM

with **5**

New advantages



Designed to control the output current of "B" Battery Eliminators, Centralab Heavy-Duty Radiohms are fully approved by the Raytheon Laboratories. Full resistance variation with a single turn of knob, allowing panel marking for proper setting to provide various voltages. Resistance remains as adjusted. (No carbon particles or discs.) Bushing and shaft insulated to withstand 1500 volts. Will remain smooth and noiseless for the life of the eliminator. Write for full information, prices and discounts.

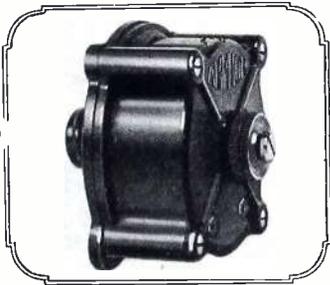
CENTRAL RADIO LABORATORIES

25 Keefe Ave.

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Makers of a full line of variable resistances for 69 manufacturers of leading standard sets.

Centralab



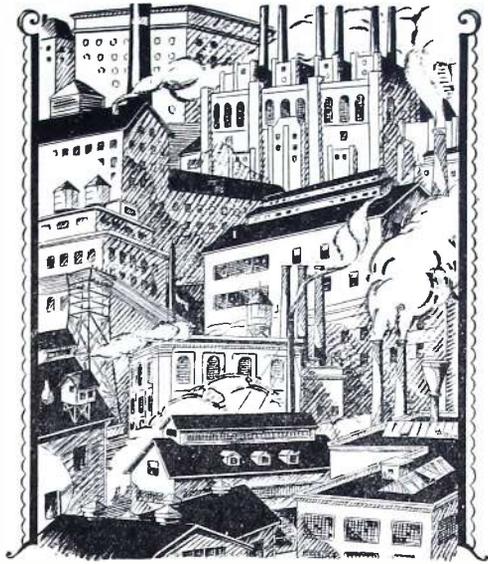
Manufacturers Emphatically Indorse Amplion Matched Impedance Principle

---with the gratifying result that our plants at New York and Muskegon are working to full capacity to fill orders!

The Amplion Engineering Staff is at the command of manufacturers for consultation on impedance and all other special inbuilt-speaker problems.

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AMPLION



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Freed Eisemann
Stewart-Warner
Mohawk
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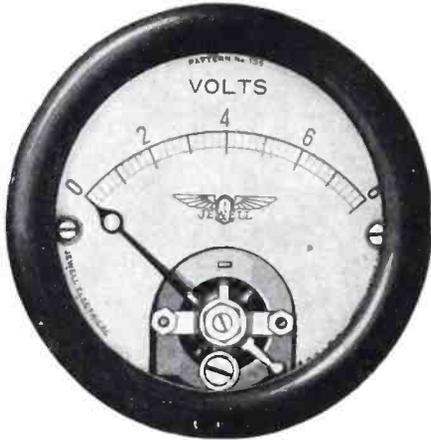
Freshman
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NO matter what sets or power units you sell, it is practically certain that you will find one or more Polymet Products incorporated therein. With few exceptions, leaders of the industry have adopted Polymet Products as standard equipment. And, just as Polymet Products have won the unqualified endorsement of the manufacturers, so have they found a ready market among radio enthusiasts everywhere.

Polymet Products stay sold, and, through giving complete satisfaction, create additional customers and profitable repeat business. YOU can handle Polymet Products with profit to yourself. Write TODAY for information and name of nearest distributor.

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"World's Largest Manufacturers of Radio Essentials"

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Pattern No. 135. Panel-mounting voltmeter for tube filament control.

QUALITY
Radio
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Pattern No. 135-C. Portable Radio Voltmeter "De Luxe"

QUALITY—
—instruments for Radio.

Jewell experience and standing in the electrical industry enables them to produce radio instruments of recognized merit. We have an instrument for every radio use.

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Sheet Copper for Shielding

Shielding

Prevents aerial radiation and feedback.

Insulates against interference from adjoining circuits.

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**Dependable
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Endorsed and used by
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Audio Frequency Transformer
Highly efficient—optimal selection—fully shielded in an ornamental metal case.
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Variable High Resistance
Controls oscillation and regulates quality and volume—highly shielded bakelite base—shell with moulded bakelite knob.
Range 0 to 200,000 Ohms
Stock No. 2140..... \$1.25 list
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Interference and Static Eliminator
Moulded bakelite case with insulated adjusting screw.
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Variable Condensers
Moulded bakelite case—000003 to 200000 p.f.
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Fixed Condensers
Highly polished metal and glass with adjustable catheter legs. Bakelite shell—also die castion—brass electrodes—gives maximum results.
Used by leading set builders.
All metal dimensions 30 x 85 list.

Knife Throw Switches

Moulded bakelite base—Spring brass contacts—Moulded insulating shell.

Single Pole, Double Throw
Base 2 1/4" x 3 1/4"
Stock No. 2020..... 70c list

Double Pole, Double Throw
Base 2 1/4" x 3 1/4"
Stock No. 2020..... \$1.00 list

Triple Pole, Double Throw
Base 2 1/4" x 2"
Stock No. 2030..... \$1.50 list

Five Pole, Double Throw
Base 2 1/4" x 3 1/4"
Stock No. 2050..... \$2.50 list

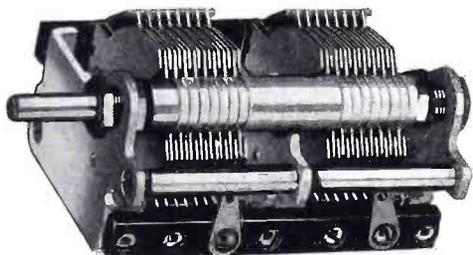
Antenna Plug
Black moulded bakelite, 2 1/4" lead.
Stock No. 2600..... 60c list

Resistance Amplifiers
Completely wired ready for installation. Individually packed, with instructions.
Stock No. 1410 (2 stack)..... \$4.00 list
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Standard Complete Aerial Kit
Contains all necessary parts to erect. Antennae in divided sections.
Stock No. 210..... \$3.50 list



Universal Compact TYPE UX CONDENSERS



The new Universal Compact Type UX Condenser is ideal for the shielded set because it is the smallest, lightest, most rigid condenser ever manufactured. It separates the wavebands to conform to present day broadcasting conditions.

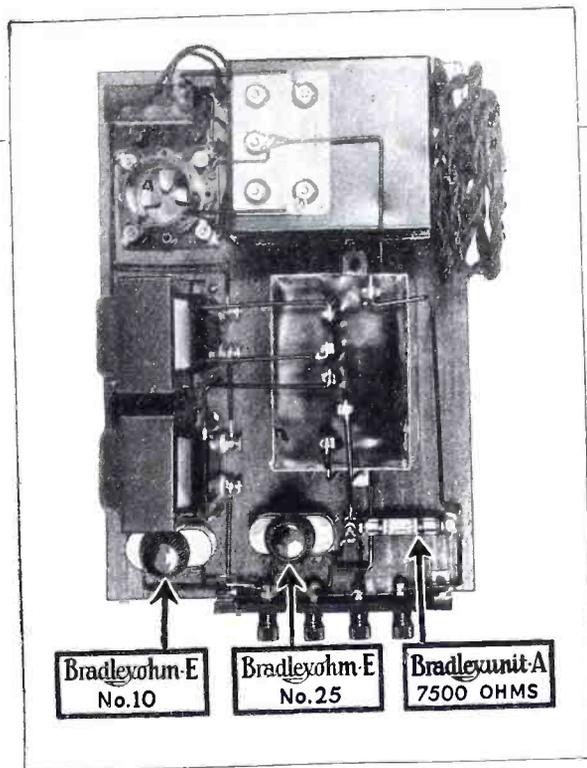
Every set manufacturer and builder knows that the old-fashioned "straight-line - capacity," "straight - line - frequency," and "straight - line - wavelength" condensers were never entirely satisfactory. After much research and experimental labor, the United Scientific engineers combined the desirable features of the old condensers and eliminated their disadvantages. The result is the new Universal Compact Type UX Condenser—the most perfect condenser ever made.

All parts in the new Universal Compact are made of aluminum and brass with all segments highly nicked. The insulation is radion and is placed to prevent warping and misalignment. These condensers are made in single, dual and triple models and can be had in both .00035 and .0005 capacities. Prices are lowest on the market.

There will be a great demand for the new Universal Compact, type UX Condenser. Send for Price Sheet and characteristic curve TODAY.

United Scientific Labs., Inc.,
80 Fourth Avenue, New York

BRANCH OFFICES
CHICAGO BOSTON
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What a whale of a difference a few Bradleyohms make —in a B-Eliminator!

THE leading manufacturers of B-eliminators all use Bradleyohm-E for plate voltage control as standard equipment in their B-Eliminators. Leading



*Bradleyohm-E perfect
variable resistor*

radio authorities specify the use of Bradleyohm-E and Bradleyunit-A in B-Eliminator kits. There is no better evidence that these two units are outstanding successes for B-eliminator service. When you build a B-eliminator, be sure that your kit contains Bradleyohm-E for plate voltage control

and Bradleyunit-A for fixed resistors. You then will be assured of perfect plate voltage control which is so essential for radio sets operated with B-eliminators.



*Bradleyunit-A perfect
fixed resistor*

ALLEN-BRADLEY COMPANY
288 Greenfield Ave. Milwaukee, Wis.

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This is a new line of TOBE High-Voltage Condensers, for 400 volts continuous operating voltage. The advent of the Raytheon BH Tube has made necessary condensers for higher working voltages than those formerly employed, in cases where the B-Eliminator Transformers deliver voltages in excess of 300 volts. The TOBE 400-volt Condenser is of the *short-path* type, is cased in a substantial metal container with heavy lugs, for attachment to baseboard or sub-panel and is equipped with new and unique base terminals, for shortness of wiring and safety. These terminals are not found on any other make of condenser.



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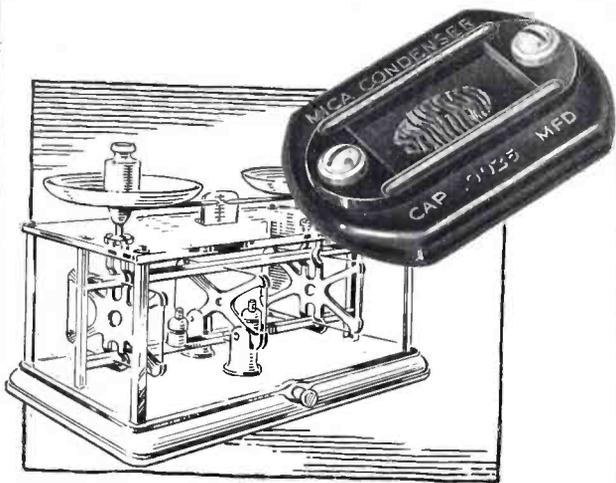
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A. C. L.

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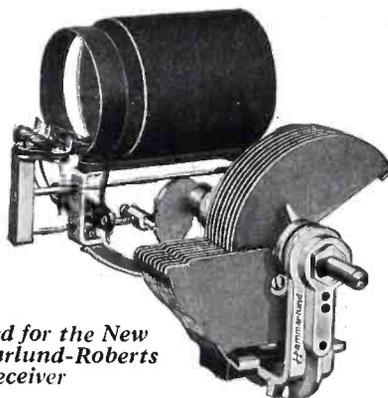
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A SCIENTIFICALLY correct arrangement of Space-Wound Coil, "Midline" Condenser and Aluminum Shield, which encloses the complete assembly with accompanying tube and its socket.

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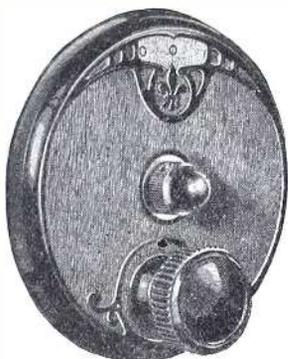
As a testimonial to Hammarlund quality, Hammarlund products are officially specified in a large number of this season's kits among which are: Cockaday's "LC27"; Lacault's "LR4"; St. James Super; Sargent's "Infra-dyne"; the New Harkness; "Henry-Lyford"; Morrison's "Varion"; Victoreen Superheterodyne; Loftin & White; Patent "Ultimax"; Browning-Drake; Popular Science Monthly "Powerful"; Hammarlund-Roberts "Hi-Q".

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For Better Radio
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PRECISION
PRODUCTS



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A complete metallic shield forms the back of the Eby Dial and minimizes the effect of body capacity. Removing hand does not detune receiver.

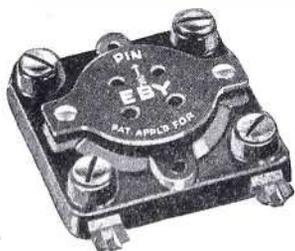
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The Eby Socket assures a positive three-point wiping contact at all times. When the tube moves, the patented construction actually makes the contact tighter and checks the jar.

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A Brief Study of Audio Amplification

In the design of any amplifying device for use at audio frequencies, it should be kept in mind that the curve of voltage amplification against frequency should approximate as closely as possible a horizontal line, if true tone quality is to be preserved in the process of intensifying the audible notes.

Since the purpose of amplification is to effect a considerable increase in volume, the curve representing the character of amplification should be as high as possible as well as a straight line running in a horizontal direction.

While it is a comparatively simple task to design a transformer to have a high and even amplification curve over any narrow frequency band, it is considerably more difficult to maintain the same degree of amplification at very low and very high frequencies as in the middle of the range.

In order that a transformer may function efficiently at low frequencies, its input impedance must be high—several times the plate impedance of the tube at 100 cycles. This is accomplished in the General Radio Type 285 transformers by means of a core of large cross-section of high permeability steel and a primary coil of many turns. Proper coil design, avoiding excessive coil capacity and magnetic leakage prevents loss of notes above the middle register.

Careful laboratory measurements of all General Radio Type 285 Audio Transformers show a high and comparatively flat curve over practically the entire section of the audio range covered by the human voice and musical instruments.

It will be remembered by radio experimenters whose interest in the science dates back to the early days of broadcasting, that in 1917 the General Radio Company brought out the first closed core transformer to be sold commercially. This instrument was the type 166. It established a new and higher standard of audio frequency transformer design. Since that time the subject of amplification has been exhaustively studied in the laboratories of the General Radio Company with the result that transformer design has been constantly improved and today the General Radio Company is universally recognized as an outstanding manufacturer of quality transformers.

The General Radio Type 285 Audio Amplifying Transformers

Under average conditions, two stages of audio amplification are necessary to produce the desired loudspeaker volume.

Usually a combination of 1 to 2.7 and 1 to 6 ratio transformers proves most satisfactory with its high ratio preferably in the last stage.

The new General Radio Type 285D transformer has a ratio of 1 to 2.7 and has been designed specifically for use in the first stage of audio amplification following the new type 200A detector tube, but may be used with excellent results in either the first or second stage with any type of tube.

Type 285	Ratio 1 to 6	Price \$6.00
Type 285D	Ratio 1 to 2.7	Price \$6.00
Type 285L	Ratio 1 to 2.7	Price \$6.00

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Complete protection of all circuits is a prime consideration in radio operation. The electric impulses must pass through the circuit without the possibility of leaks.

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Ace Crackle Surface Panels resemble Rich Spanish Leather. They have attracted wide attention. They add materially to the sales possibilities of a set.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF RADIO ENGINEERING.

Published monthly at New York, N. Y., for October 1, 1926.

State of New York } ss.
County of New York }

Before me, a Notary in and for the State and county aforesaid, personally appeared M. B. Sleeper, who, having been duly sworn according to law, deposes and says that he is the Business Manager of RADIO ENGINEERING, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24th, 1912, embodied in section 443, Postal Laws and Regulations, to wit: 1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, M. B. Sleeper, Inc., 32 Vanderbilt Avenue, New York; Editor, M. B. Sleeper, Poughkeepsie, N. Y.; Managing Editor, M. B. Sleeper, Poughkeepsie, N. Y.; Business Manager, M. B. Sleeper, Poughkeepsie, N. Y. 2. That the owner is M. B. Sleeper, Inc., whose stockholders are: Anne P. Sleeper, Poughkeepsie, N. Y.; Milton B. Sleeper, Poughkeepsie, N. Y. 3. That the known bondholders, mortgagees, and other security holders owning or holding 1% or more of the total amount of bonds, mortgages, or other securities are: None. 4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of this company but also, in cases where a stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiants full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) M. B. SLEEPER, President.

Sworn to and subscribed before me this 1st day of October, 1926.
Westchester County,
New York Co. Clerk's No. 852-A.
New York Co. Register's No. 6031.
Commission expires March 30th, 1927.

(Seal) F. N. BUNGER, Notary Public

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Cardwell Condensers



The Cardwell "BALANCET"

Type 609-A
Cap.—.000033
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Specified for the Best Receivers

THE Sixth Christmas of the Cardwell Condenser finds its popularity undimmed, and during these years it is the only condenser whose basic design has not been radically changed.

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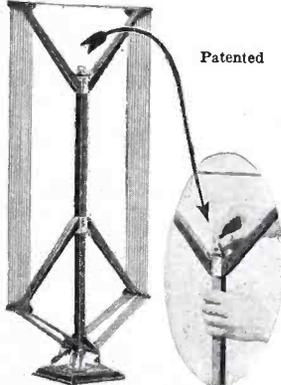
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Give clearer reception with greater signal strength. No carbon, paper, varnish or fiber. The metallic resistance element is fused to the inside of a glass tube. Noiseless, accurate, non-inductive, non-hydroscopic. Uniform in all weathers and working conditions. Capped with the exclusive Electrad ferrule. Impregnated under high vacuum. Great current-carrying capacity without overheating or change of resistance. List, 60c—in Canada 85c.

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



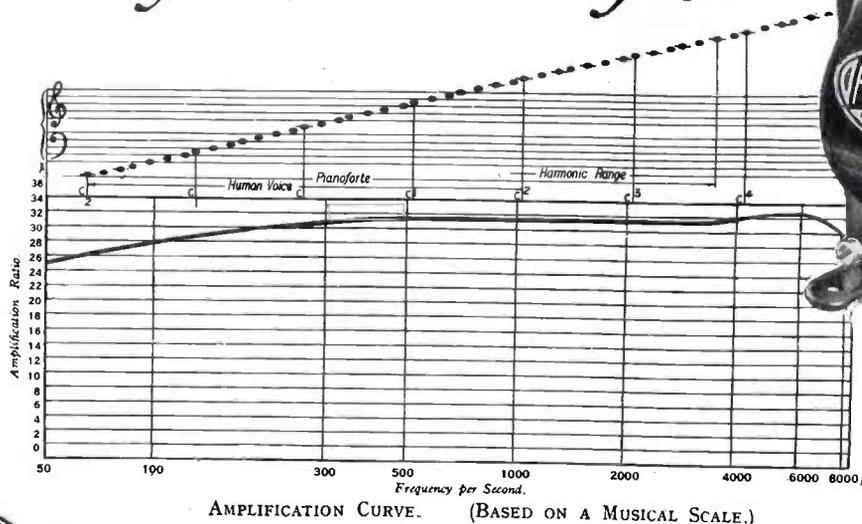
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*supreme
- yes, but why?*



Audio Frequency
Transformer
A. F. 3 \$12

This graph is drawn on the musical scale — the only accurate way of showing the full value of each tone which your set receives. Note that the evenness and fullness of amplification extends throughout the range of the organ, the cello, and the human voice. The unattainably perfect curve would be a straight line. Note how much nearer than any other transformer the Ferranti approaches this characteristic of perfection. That is why it is called "nearly perfect."

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Ferranti Transformers are the result of research conducted to produce a transformer of low self-capacity and high amplification ratio with flat curve over a frequency range of 50 to 8000 cycles.

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Ten tests are made on each transformer after assembly to establish its condition.

The amplification ratio of each transformer is tested with a tube. All transformers which do not come within five per cent of the accepted standard are rejected.

All transformers are tested at 1000 volts between primary and secondary and between primary and secondary and ground.

Ferranti Transformers, even under the extreme climatic conditions of the Tropics, have been found to stand up to the most severe conditions of service.

Use the Ferranti after the new detector tubes, and before new amplifier tubes, and you will have efficiency that cannot be approached by the old-time transformers and tubes.

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We are trading through bona fide wholesalers with a minimum quantity shipment of 12 transformers. We are preparing to supply two transformers and two only to any retailer who sends cash with order and the name of his jobber. If you should be a dealer or jobber and are interested in handling Ferranti Transformers, please write immediately and we shall supply you with information in regard to discounts and general company policy.

No Better Transformer Is Available At Any Price

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New York, N. Y.

THE NEARLY PERFECT TRANSFORMER



*A Business Devoted to the Requirements of
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Audio, Eliminator and Power Amplifier Transformers

—all of the very latest design and produced in quantities for leading manufacturers. Fifteen years experience in the manufacture of transformers, unlimited resources and facilities in research and engineering development and a long established policy of satisfying the radio manufacturer has won preeminence for Dongan as parts suppliers.

A new catalog just published describes new Eliminator and Power Amplifier construction. Manufacturers are invited to make use of the data developed in our engineering department. Transformers for Raytheon, R C A and Cunningham Units available from production—special designs upon request.

No. 147, Transformer designed for use in connection with the output circuit avoids the loss of B voltage due to the high resistance of the loud speaker and eliminates all risk of damage to the speaker. List.....\$4.50.

A Conspicuously Successful B-Eliminator incorporates Dongan Radio-Power Unit No. 1582 for use with the Raytheon Tube

Thousands of these B-Eliminators have been built and are giving 100 per cent satisfaction. Dongan No. 1582 consists of 1 Transformer and 2 Chokes, designed in conjunction with Raytheon engineers. The Radio-Power supply is quiet, smooth and consistent all the time.

Built into handsome black metal case—very durable. Complete instructions for building. Send check or money order at once.



No. 1582
\$11 List

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Made in 2 Types
\$10.00 Each

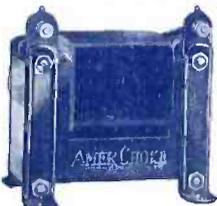
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The Amertran
Power Transformer
Type PF-52

Type PF-52 is intended for use in the better type of power supply developments. It will convert the standard 110-volt, 60-cycle alternating house-lighting current to a higher voltage for the plate, and lower voltage for filament supply.

Price \$18.00 Each



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This 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 loud speaker it is both efficient and economical.

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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 are made in two types—AF-7 (ratio 3½:1)—AF-6 (ratio 5:1).
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These men know by test and comparison that the Amertran De Luxe makes a transformer coupled amplifier excelling all other forms of amplifiers. They know, too, how well the Amertran De Luxe performs in Power Supply Developments. Used with other Amertran Products, it will make a power unit capable of dependable, satisfactory service.

Every Amertran De Luxe is manufactured to maintain a high laboratory standard. Its improved performance recommends it especially to those seeking "better than the average" radio reception.

Write for free booklet "Improving the Audio Amplifier." It contains valuable technical data.

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"Transformer Builders for over Twenty-six Years."