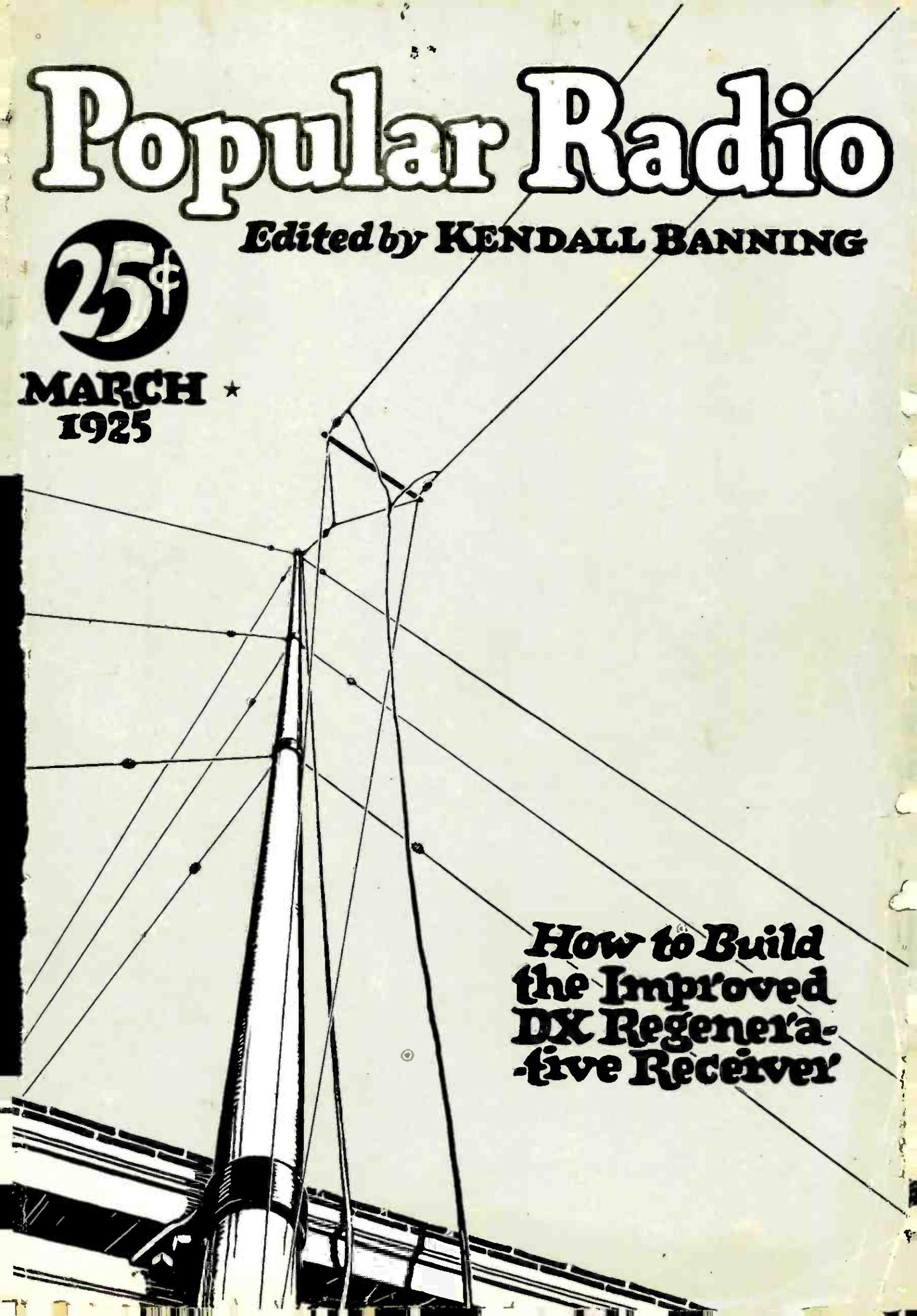


Popular Radio

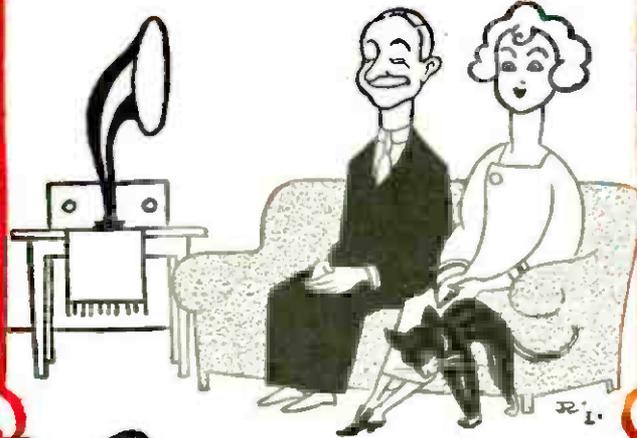
Edited by **KENDALL BANNING**

25¢

MARCH ★
1925



*How to Build
the Improved
DX Regenera-
-tive Receiver*



No set is better than its Loudspeaker

The one big thing in radio is *tone*. If you are listening to music, you want the tone so exact that it carries over the very personality of the artist. If you are listening to speech, you want the human voice—not a “radio voice.” If you haven’t heard a Radiola Loudspeaker, you may not know how clear it can be.

Try a Radiola Loudspeaker on your set and you will get the finest tone the set can produce—as clear as on a fine pair of headphones, but thrown out into the room in full volume for the whole family to enjoy.

Radiola

REG. U. S. PAT. OFF.

LOUDSPEAKER



This symbol
of quality is
your protec-
tion.

RADIO CORPORATION
OF AMERICA

Sales Offices:

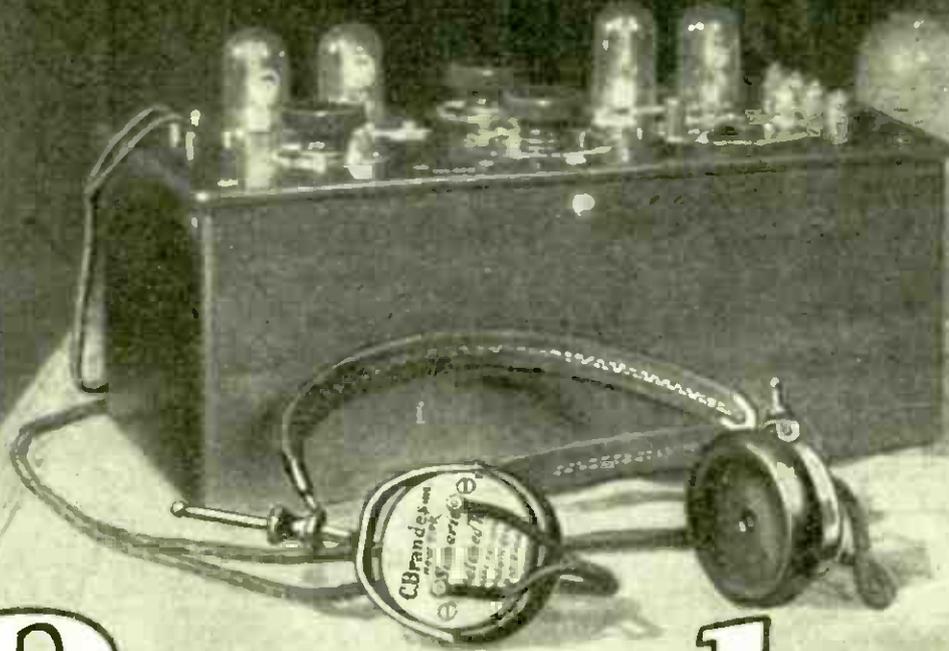
233 Broadway, New York
10 So. La Salle St., Chicago, Ill.
28 Geary St., San Francisco, Cal.

You need a headset

- to tune-in with
- to get distant stations — both domestic and foreign
- to listen-in without disturbing others
- to shut out the noise in the room — and get all the radio fun
- to get the truest and clearest reception — always

No one realizes these facts more forcibly than the makers of the famous Radiola IIIA. They include Brandes as standard equipment.

Be sure your set is Brandes equipped



Brandes

The name to know in Radio

POPULAR RADIO

EDITED by KENDALL BANNING



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(Cover design by Frank B. Masters)

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VOLUME VII

MARCH, 1925

NUMBER 3

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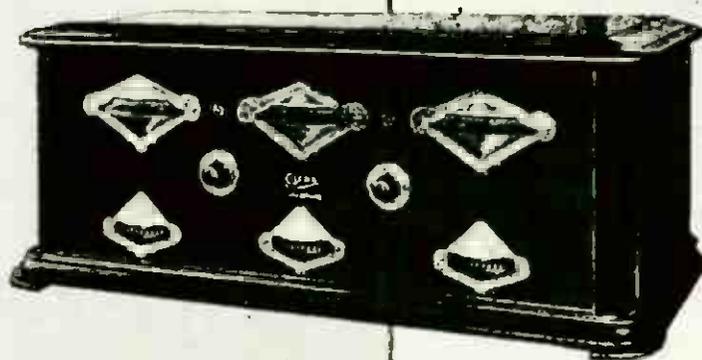
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IT IS WRITTEN:

"Over-loud words from an orator jar the ears; music too faint to dance by strains them." The secret of pleasing volume is in the Synchronphase.

Doctor W.



The GREBE SYNCHROPHASE

TRADE MARK

WHEN, from so many good radio instruments on the market, one may choose with the same wisdom and deliberation exerted in the selection of a motor car or timepiece, it is not surprising that you will find an ever-increasing number of Synchronphase enthusiasts. A man who has once operated a Synchronphase is content with no other type of receiver.

Binocular coils—unaffected by local interference—arranged in two stages of balanced tuned radio frequency, give greater selectivity and sensitivity. On the S-L-F (straight line frequency) condensers all stations are spaced at equal intervals around the dials. No crowding of stations at the lower end of the dials in the Synchronphase.

The surpassing beauty of the Synchronphase is emphasized by comparison with other radio receivers. Close inspection reveals that every detail was designed and built in the Grebe factory, while in other receivers is found merely a variety of assembled parts.

Write for literature

A. H. GREBE & CO., INC.

Van Wyck Blvd., Richmond Hill, N. Y.

Western Branch: 443 So. San Pedro St., Los Angeles, Cal.

THIS COMPANY OWNS AND OPERATES STATION WAHG

All Grebe apparatus is covered by patents granted and pending



Synchronphase Secrets No. 3. Volume Control

In the Synchronphase an entirely new control for audio amplification is provided.

This volume control, with six gradual variations, enables you to obtain just the right intensity for a vocal selection, a lecture or a dance.



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

PAGES WITH THE EDITOR

ONE of the most conclusive proofs of the standing of a publication is the regard in which it is held by the educational authorities. And when a magazine is officially adopted as a text-book in schools and colleges, one may safely conclude that it ranks foremost in its field.

WITH particular satisfaction, therefore, we record the extending use of POPULAR RADIO in both public and private institutions of learning. The latest school to select this magazine as a text-book in radio is the Brunswick School in Greenwich, Conn. The faculty notifies the Editor of its decision as follows:

"THE enclosed order for fifteen copies of POPULAR RADIO each month is the result of the decision of our Science Department to use your magazine as a text-book during the rest of this school year. We plan to use everything—from editorials to advertisements—in some way in our work."

WHILE from far-away Wellington, New Zealand, Mr. C. Billings reports: "Your publication has become a standard text-book in New Zealand and we follow your articles with the greatest interest."

If you see it in POPULAR RADIO it's so!

FEW articles in POPULAR RADIO have stirred so many readers to write their opinions to the Editor as "Religion's Raid on Radio" in the January number. And all of these opinions—with just two exceptions—have strongly endorsed the views expressed by the author, Mr. Armstrong Perry.

"MR. ARMSTRONG PERRY surely started something when he wrote 'Religion's Raid on Radio,'



THE INSPIRATION FOR THE CURRENT COVER OF POPULAR RADIO

Do you notice any similarity between this little amateur photograph and the cover design on this issue of POPULAR RADIO? The picture was sent to the Editor by a reader, Mr. F. K. Leslie of Detroit, as a suggestion for a cover—and our artist used it!

writes F. A. Gates of Albany, N. Y. "But whether he started a much-needed reform or merely overturned a beehive will have to be decided by public opinion."

As if in answer to Mr. Gates, the very next letter that the Editor opened was from Mr. H. H. McFellen of Washington, D. C., who wrote: "The article 'Religion's Raid on Radio' is such that I wish to express my appreciation—as well as thank an editor big enough to print it!"

FROM a Chicago reader, Mr. G. W. Rabnett, comes an opinion that is representative of the more scientifically-minded readers:

"I SHOULD like to compliment you upon the article 'Religion's Raid on Radio.' I feel very sure that early steps toward some method of restriction of religious propagandists will avoid much later trouble. It is a shame that the religionists, who ridicule science, should try to grab off the findings of science and put them to use for their own personal aggrandizement. Keep up the fight!"

"I WANT to express my approval of Mr. Armstrong Perry's article in POPULAR RADIO for January," writes Henriette E. Staeger of Mattoon, Wis. "We hope the time will never come when we shall be forced to listen to anything or listen to nothing. You do well to put the public on guard."

"THE article in POPULAR RADIO for January, 'Religion's Raid on Radio' by Armstrong Perry, is a good one. He states things clearly and straight. I believe as he does. A mighty good article," writes Lowell L. Ellis of Warren, Mass.

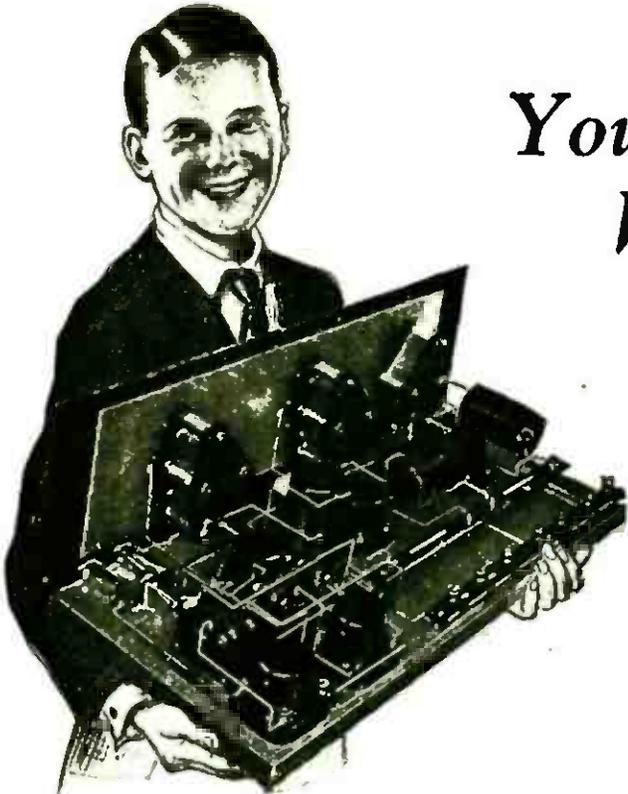
ONE of the two letters that object to the article comes from a man who is an avowed religionist; he states that "it is highly regrettable that such material should pass through a censor's hands."

FORTUNATELY there are no official censors in this country to throttle the expression of religious opinion yet. The press is still a free press, and POPULAR RADIO is not subjected to the blue pencil of either the religious fanatic or the professional reformer.

AND POPULAR RADIO believes that a protest against the intrusion of religious propaganda—or any other form of propaganda—on the ether is not only justified but that it is an expression of the opinion of the vast army of radio fans.

IN the meantime new broadcasting stations are springing into existence under the sponsorship of religious bodies; within the past few

(Continued on page 6)



You Like it Better When You Build it Yourself

THE 5-TUBE THOMPSON NEUTRODYNE

KNOCK-DOWN SET

LICENSED TYPE K-40

THE American boy is a natural-born builder. His imagination—his inherited constructive spirit—craves a worthy objective.

There is nothing that so satisfies the natural creative ability of American boys— young and old—as the building of a radio set; for when a radio is finished it brings to the boy the world's best entertainment and education from far and near.

Many of the achievements in modern radio reception have been made by young men who a few years ago built radio sets, listened to code messages, and were the first to listen in when speech and music were first broadcast.

Building a radio receiver is a happy event in *any* boy's life.

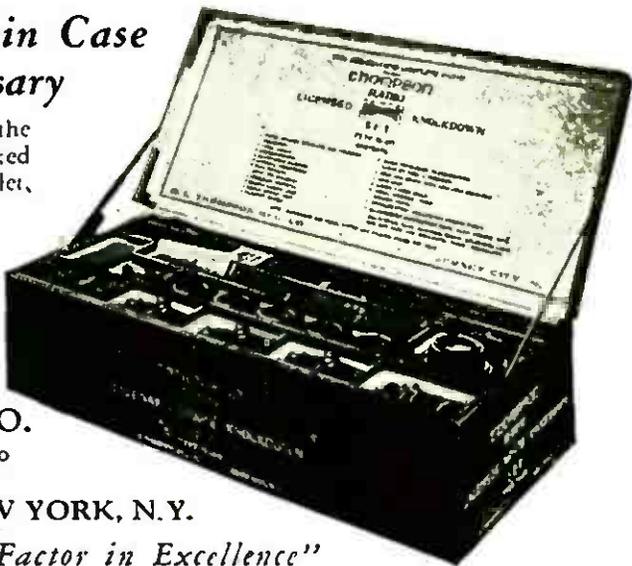
The Thompson Knockdown Licensed Neutrodyne Set contains parts that have been developed by famous radio engineers of many years experience. The perfectly designed and perfectly matched Thompson parts are in no way similar to ordinary parts. Thompson neutroformers and audio transformers, that have made the Thompson quality of tone reproduction famous, cannot be bought separately.

The Neutrodyne circuit, which was designed since present-day broadcasting was perfected, plus Thompson experience of many years in radio, make the results from Thompson Knockdown Set superior to any Knockdown Set on the market. It is easy to assemble.

All Parts included in Case No drilling necessary

All parts, (except batteries and tubes) needed to assemble the Thompson 5-tube Neutrodyne Knockdown Set are packed in a case with the Thompson 16 page instruction booklet.

This booklet contains easily understood building directions together with photographs, diagrams and actual size blueprints—everything to make building a Thompson Knockdown Set about the easiest thing you have ever tried. The Thompson Knockdown Set is only \$72 at good radio stores.



**R. E. THOMPSON
MANUFACTURING CO.**

Maker of Thompson Neutrodyne Radio
Receivers and the Thompson Speaker.

30 CHURCH ST., NEW YORK, N. Y.

"Experience is the Vital Factor in Excellence"

PAGES WITH THE EDITOR

(Continued from page 4)

weeks alone the following have been licensed; KFRP, Redlands, Calif., (Trinity Episcopal Church); WOQ, Kansas City, Mo., (Unity School of Christianity); KPPC, Pasadena, Calif., (Pasadena Presbyterian Church); KFBG, Tacoma, Wash., (First Presbyterian Church); KFRW, Olympia, Wash., (United Churches of Olympia); and WGBC, Memphis, Tenn., (First Baptist Church).

* * *

AND the Paulist Fathers (Roman Catholic) are now announcing station WPL in New York, as the first of a chain of broadcasting stations that are established frankly "for the purpose of acquainting the public with the Catholic viewpoint on current affairs."

* * *

"OUR station," announces the Very Reverend Joseph MacSorley, the Superior General, "will be the official mouthpiece of everything Catholic. We want especially to reach isolated communities where there is no Catholic church. We want owners of radio sets all over the country to be in a position to understand Catholicism and the Catholic viewpoint."

* * *

ON the heels of this announcement from the Roman Catholics, the National Lutheran Council announced that the Lutheran Church will also "broadcast direct gospel messages," employing station WFUS at St. Louis for the purpose. This station "will be used to bring the Lutheran viewpoint to the radio audience," is the gist of their own frank statement.

* * *

How long will the radio fan submit to this rising flood of religious propaganda?

* * *

"JUST about a year ago I picked up the first copy of POPULAR RADIO that I ever saw," writes Byron Jones of Sag Harbor, N. Y. "Since then I have never missed a copy and have also sent for several back numbers."

* * *

"As the idea of your magazine seems to be simplicity and clearness you might use the following as a sort of slogan:

"POPULAR RADIO—by the scientist, with the amateur, and for the people."

* * *

To the "hams"—the radio amateurs who transmit and who can read the code—the rhythm and technique of the expert on the key is something akin to music. And once in a while a broadcast listener rises to doff his hat to the brass-pounding artist.

* * *

"OFTEN, when broadcasting is uninteresting," writes Ward Dorrell of Toledo, Ohio, "I get an undeniable thrill when I tune in on some of the boys on '600.' The most pleasurable of all comes from the fist of the night operator at WSC at Tuckerton. He is, of

course, unaware of my enjoyment of his skill—and I'd like to let him know of it through POPULAR RADIO. The commercial stations come in for so much criticism from the BCL's that I want to give a kind word when it is deserved."

* * *

THE Editor is glad to broadcast this tribute—which is the first of its kind that he has received.

* * *

ON page 274 of this issue of POPULAR RADIO appears the first of a series of monthly commentaries on broadcast programs—a series that the Editor believes will prove widely popular with all classes of readers. This feature is contributed by Mr. Raymond Francis Yates who, under the pseudonym of "Pioneer," made a national reputation as the first radio program critic of *The New York Tribune*.

* * *

THE series of "Simple How-to-Build" articles that POPULAR RADIO is running for the particular benefit of beginners is proving widely popular. Apparently the simply-constructed receivers that are described in the brief but pointed directions given by our Technical Editor are being built in large numbers by our readers—and with marked success, too.

* * *

"I WANT to thank Laurence M. Cockaday for his article on the Reinartz set," writes Harold J. Kittsley of Cedarburg, Wis. (to select a typical experience). "I am using an inside aerial. I get Texas every night, have had KOA, but I can't get static!"

* * *

IF you are thinking of building a simple radio receiver, just turn to page 258 and see for yourself how easy it is to follow Mr. Cockaday's instructions—in this case for the building of a combination three-stage amplifier.

* * *

IN this number two of our regular departments—"What's New in Radio Apparatus" and "Trouble Shooting"—have been so extended in length, in order to include new and timely information of value to readers, that the "What Readers Ask" department has been crowded out entirely—but out of this number only. Many of the questions that would have been answered in the held-over department will be found in the departments that have encroached upon it.

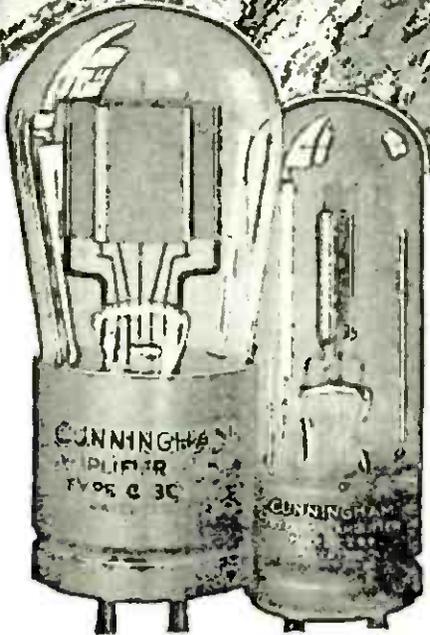
Kendall Banning
Editor, POPULAR RADIO



*Selections
from
Carmen*

says the broadcasting announcer, and in a moment you are transported to old romantic Spain, to enticing, sunny Seville. That is but one of the endless joys of radio owning. For the full enjoyment of modern life, radio has become a necessity. For full enjoyment of radio, you will find Cunningham Tubes essential.

Since 1915—Standard for all sets
Types C-301A C-299 C-300 C-11 C-12
In the orange and blue carton



Cunningham
RADIO TUBES

C. J. Cunningham Inc.

HOME OFFICE:
Chicago 182 Second Street, San Francisco New York

PATENT NOTICE: Cunningham tubes are covered by patents dated 2-18-08, 2-18-12, 12-30-13, 10-23-17, 10-23-17, and others issued and pending.
Cunningham 40-page data book fully explaining care and operation of Radio Tubes now available by sending 10c in stamps to San Francisco Office.



This button identifies Ozarka representative—your assurance of radio satisfaction.

Here's the right way to investigate a radio instrument

It's one thing to hear a radio instrument give an impressive performance in a dealer's store or someone else's home, but entirely different to get thoroughly satisfactory results in your own home with your own operation.

Thousands of folks have spent their good money for radio outfits that are not delivering the results they had hoped and expected to receive.

Ozarka Radio Instruments are sold on the results they actually show you in your own home. The Ozarka representative brings the instrument to your home and sets it up, supplying the batteries, the aerial and all equipment for the demonstration—from that point on the instrument is yours for the evening.

Tune in yourself—let the wife and children tune in
Test for Tone, Volume and Distance
and then—decide if it gives the radio results you want.

If you invest in an Ozarka Instrument, our representative installs the equipment and leaves it in perfect working order, and is always near at hand if some little problem comes up that you can't figure out for yourself.

Through the Ozarka Plan of demonstration in the home, people are finding that Ozarka gives the radio results they want—at far less expense than they thought possible.

4 Tube Set as Low as \$39.50

We predict you will be greatly pleased with the easy-tuning Ozarka—it gives wonderful satisfaction as a radio instrument for the whole family—but you will be the sole judge as to whether you want it or not after you hear it, after you swing the dial yourself and know exactly what Ozarka will do in your own home.

Let us know you are interested in hearing Ozarka in your home, and we will make the arrangements. Send for large illustrated book No. 200 and don't fail to mention your county when you write.

OZARKA, INC.,

806 Washington
Boulevard

Chicago

Here's What One 6 Year Old Child Did

Ottawa, Ill., Oct. 13, 1924

Ozarka, Inc., Chicago, Ill.

Dear Sirs—On October 7th, at 6:45 P. M., I had completely set up my Ozarka No. 201 and began tuning in, hurriedly, on account of a meeting which I had at 7:00 o'clock sharp.

My son, six years of age, watched me while I was tuning in, and after I left he was able to tune in seven (7) stations very plainly and entertained his mother until his bedtime at 8 P. M.

Since that time he has been able to manipulate the instrument very satisfactorily.

Yours very truly, E. T. EBERSOL.

We Need a Few More Men in counties where we have no Ozarka factory representative

Get in your mind these details: (1) A remarkably efficient radio instrument, (2) well advertised to the public, (3) sold at an exceedingly low price—and you get some idea of the opportunity that exists in the sale of Ozarka Radio Instruments. It differs greatly from the ordinary

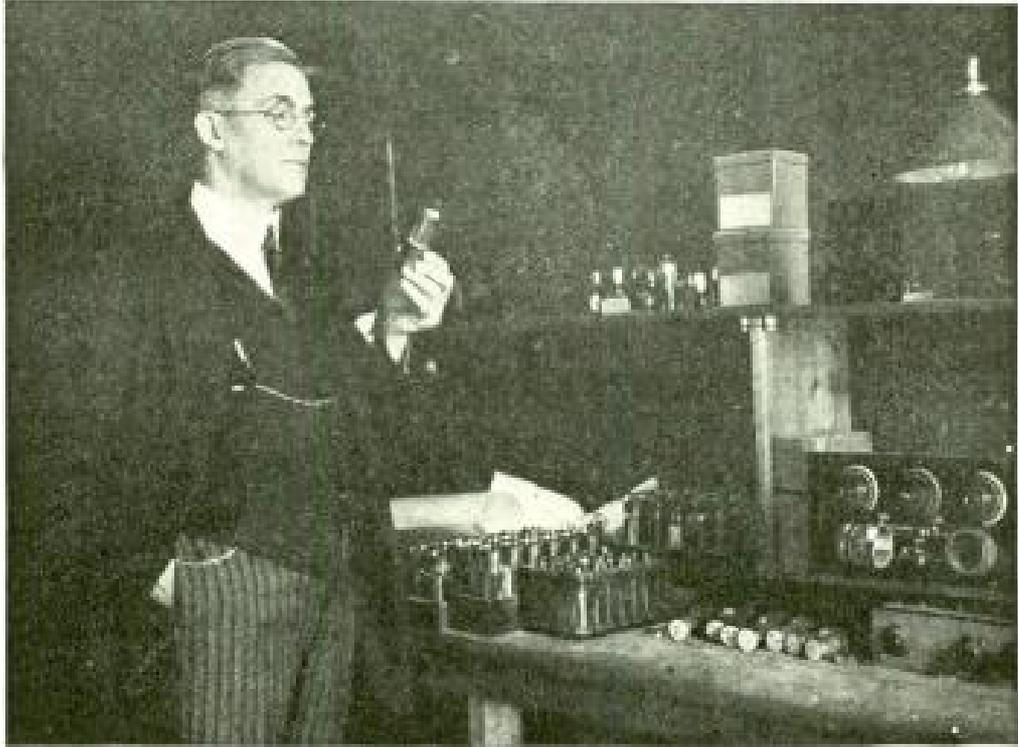


job of selling. The Ozarka man arranges the demonstration but the instrument "does the talking" and its performance is what makes an easy sale.

We have trained 3100 Ozarka factory representatives in their own homes, made them thoroughly capable, in a short time, of assembling Ozarka instruments, installing the complete equipment, and qualified to wear the Ozarka button.

The right man soon becomes the sole Ozarka representative in his territory and makes an excellent income, because so large a percentage of his demonstrations lead to sales. A small investment is necessary. Experience in selling is valuable but a willingness to learn is necessary. A clean record and a good reputation locally are essential.

If you are interested in the possibilities as outlined, write and tell us about yourself, who you have worked under during the past five years, and be sure to give the name of your county. We will send our Ozarka Plan Book No. 100. It may prove to be the most important thing you ever read in your life.

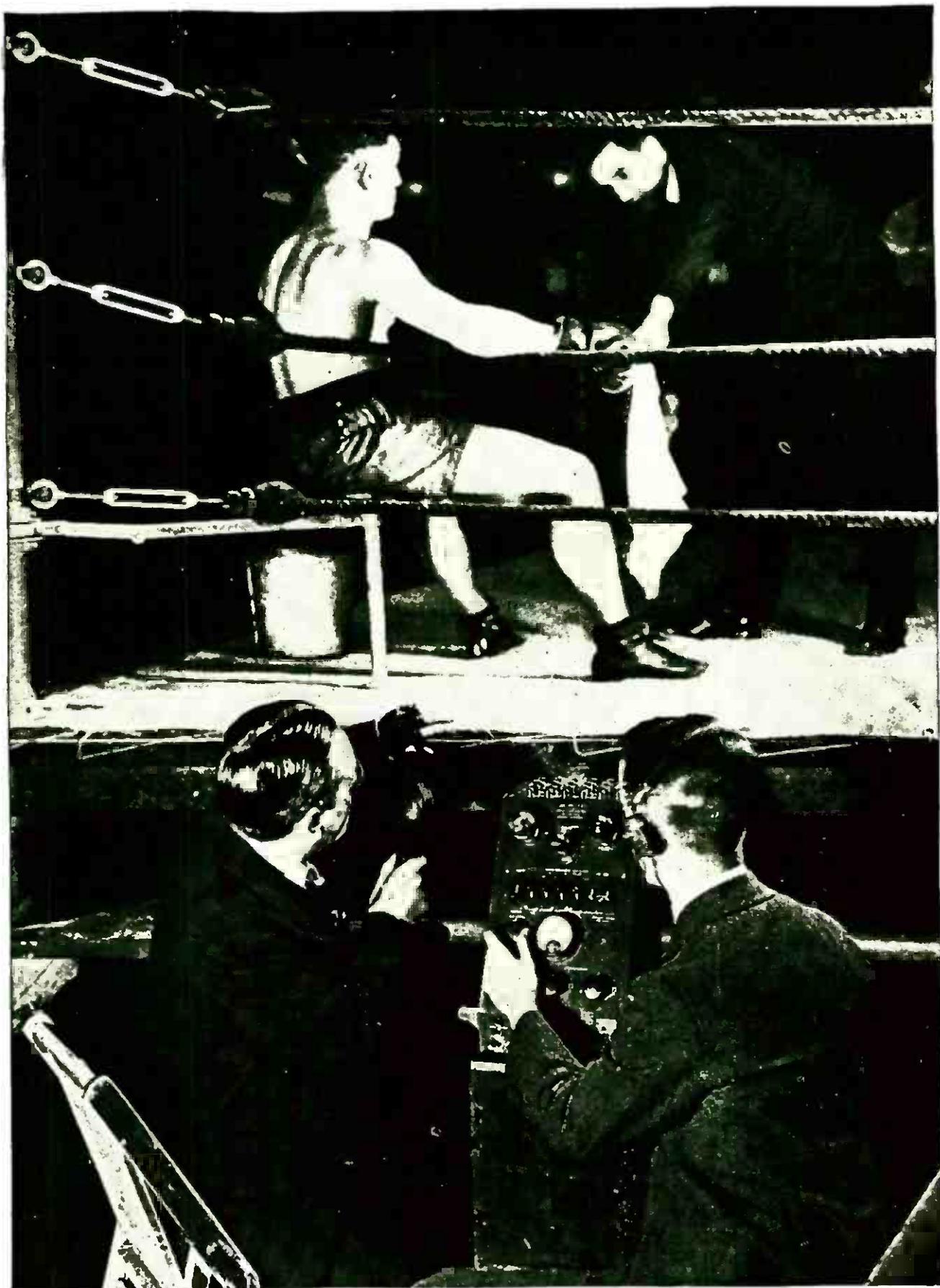


From a photograph made for POPULAR RADIO

“The Foremost Magazine in the Field of Radio”

“To my knowledge there is no periodical that covers the field of radio with the combination of sound, authoritative scientific information and human interest that characterizes POPULAR RADIO. It has been a powerful factor in popularizing radio by its insistent adherence to only the highest standards of radio practice and equipment—and of editorial ethics as well.”

—BYRON ELDRED, D.Sc.,
SCIENTIST AND INVENTOR



International

The broadcast listener can hear not only the reporter's ringside descriptions, but the actual sounds of the boxers' blows

The outstanding "radio reporter" of pugilistic events is J. Andrew White, whose running comment during the contests ranges from introductions to notable figures among the spectators to detailed accounts of each movement of the contestants.

Popular Radio

VOLUME VII

MARCH, 1925

NUMBER 3



WHAT RADIO IS DOING TO THE WORLD OF SPORT

How the introduction of reports of athletic contests, broadcast from the side lines, is not only affecting the public's attitude toward sporting events—but affecting the sports themselves. Told by one of the world's foremost sport writers—

LAWRENCE PERRY

A BOXING promoter recently took steps to end the broadcasting of important bouts by refusing admission to the radio reporter to arenas, indoor and out, where his fights are held.

At the same time the intercollegiate athletic authorities, who have hardly known where to turn in the face of ever-growing demands for tickets by alumni and their friends, are welcoming the broadcasters with every manifestation of pleasure.

Apparently the appearance of the radio reporter is having an effect on attendance at sporting events. It has not, however, affected the sale of sporting news; publishers state that they have noticed no appreciable effects upon the sale of sporting extras and Sunday editions because of previous publicity of outstanding sporting events via the ether route.

Radio broadcasting is new to sport as to other phases of entertainment, of busi-

ness and the like, and there is no telling what the ultimate effect may be. Certain it is that the attitude of writers for the press toward broadcasters was at first characterized by an inimical bearing, as of men who saw in the radio reporters a menace to their calling. This state of mind has changed to a rather grudging acceptance of the new order of things, but it is easy to see that the newspaper writers are looking ahead to the future and wondering just what changes are in store. What will happen, for instance, when the radio companies begin to engage special experts in the various sports which are now being covered on an ever-widening scale? A large Eastern broadcasting station (WBZ) has already placed a sports writer in the job of announcer.

This spring, as an example, the broadcasters are reporting the opening games of the baseball season. One game at the beginning of the season and a complete

detailed narrative of every game of the World's Series at the end of the season do not constitute a very great menace to the baseball reporter, or to those sections of the daily newspapers devoted to chronicles of the great national game. But this is merely a beginning; when descriptions of every game in the various leagues are broadcast every evening, as will probably be done before long, what will be the effect upon newspaper circulation? And what will become of the sport writer? Will he have to change his method of reporting, as well as his point of view, in order to give his public the sporting news instantaneously?

Just to illustrate what these changes really are in the reporting of sporting events, let us watch a radio reporter in action.

One of the big football games of the autumn season is about to begin. It is a great day in the chronology of inter-collegiate sport. It is also a rainy day. Throughout the year, in sooth, there have been no rainy days like it. The sporting scribes of the daily press, seated high on the very rim of the vast concrete bowl, lean forward to shield their sheets of paper from the torrential downpour as they record the inclement conditions and then give vent to metaphor and downright statement of fact as the telegraph operators attempt vainly to transmit, over washed-out telegraphic mechanism, what has been written.

Above the press seats, approximately in the middle of the field, rises a small booth, canvas-covered. (The press seats are not covered.) Comparatively, everything seems quite snug and cosy in that booth, which contains three chairs and a section of pine planking serving as a desk. Directly in the center of this piece of deal stands a telephone transmitter with an arrangement on either side which enables the speaker to talk directly into the microphone, with his mouth always in the same position. It is through this instrument, of course, that the radio public is to receive its report of this aqueous

football contest while it sits dry at home.

A young man is working over the microphone, adjusting it, insuring proper connection with the nearest long-distance station, which in this case happens to be located in New Haven, a bit more than two miles away.

The crowd gathers—it takes more than sheeted rain to keep a football throng at home. The bowl becomes a huge duotone of gleaming umbrellas and yellow slickers. Below, the gridiron has developed into a pond. The newspaper men glance upward at the canvas-covered radio stand and huddle in their coats with venomous scowls.

In five more minutes the teams will be upon the field. Down the press aisle hurries a keen-faced young man with felt hat and raincoat of capacity and texture it would seem to defy the heaviest precipitation that ever drowned the gorse of a Scottish moor.

He looks upward to the booth.

"Everything set?"

His voice has a full, pleasing cadence, a resonant baritone quality which these days is as familiar to a public incalculably immense as are the mellifluous voices of Jeritza and Chaliapin to frequenters of the Metropolitan Opera House.

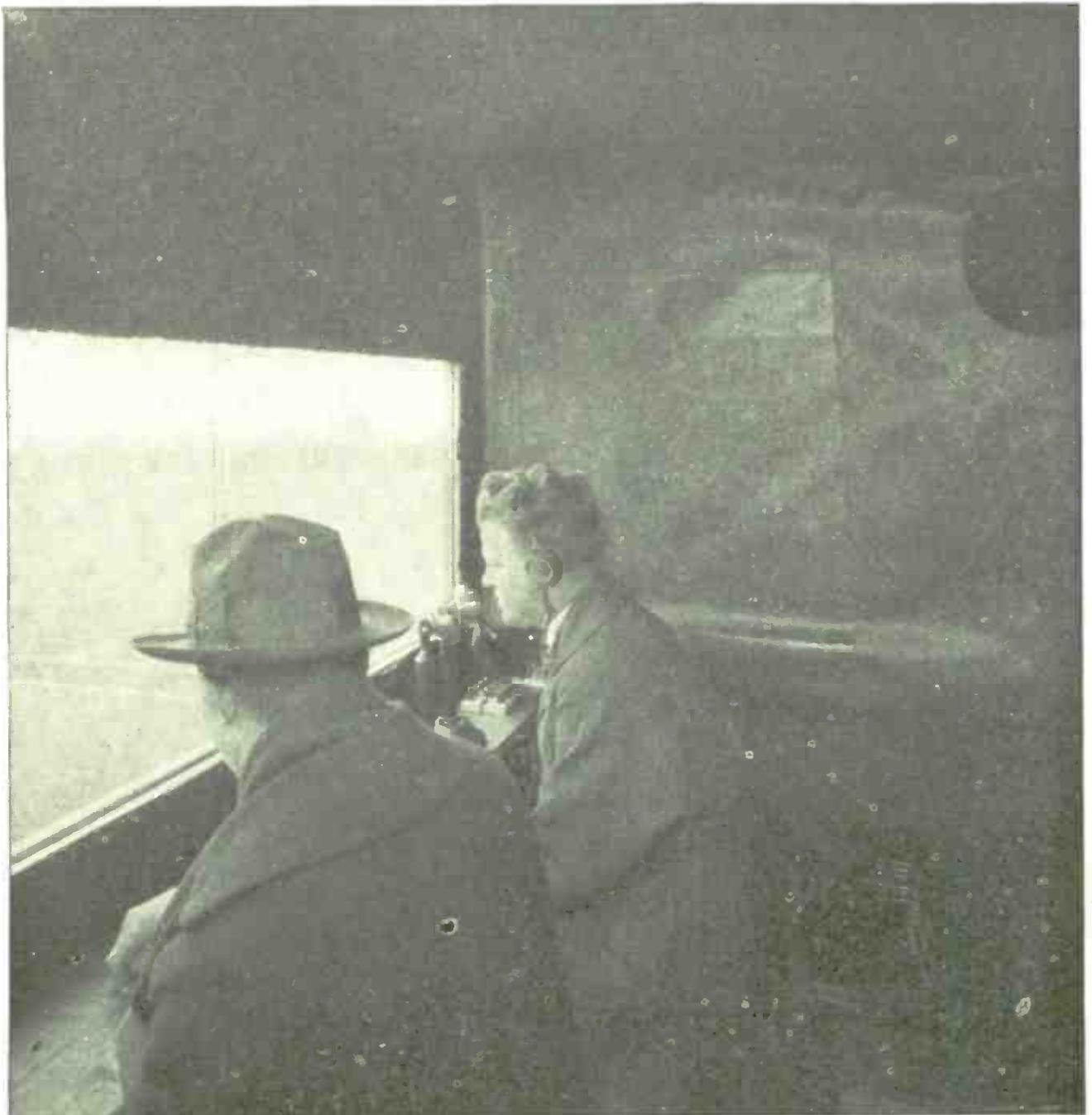
"Everything all right," comes the reply from the booth.

"Good!"

The newcomer scales a concrete tier and ducks under a flap into the booth. He leans forward to the transmitter with that expression of assurance such as one marks upon the countenance of any protagonist of stage or platform who is absolutely sure of himself and of his audience.

He knows that hundreds of thousands, perchance millions, are waiting in cities and towns and hamlets in expectancy to hear his voice.

He is a new adjunct to sport, this broadcaster, and already he is invested with a personality that is unique. No feature writer for the newspapers has a tenth of his audience. He leans forward to the microphone.



George H. Davis, Jr.

WHERE THE BROADCAST LISTENER SITS AT A BIG FOOTBALL GAME

From this vantage point at the athletic stadium at Harvard the new kind of reporter not only tells his audience what is happening—while it is happening—but, by a system of supplementary microphones, enables listeners to get "close-ups" of the college songs, the cheering and occasionally the comments of distinguished spectators.

"Good afternoon, ladies and gentlemen!"

Then in matter of fact tone he proceeds to cull from the alphabet a mouthful of capital letters by which the waiting public may know—as if they already did not—the identity of the corporations to whom they are to be indebted for their afternoon of sport.

A gust of wind carries a pailful of rain into the booth. It strikes the broadcaster

squarely in the neck. It penetrates beneath his raincoat and trickles down his chest and back. None the less he smiles. It gives him something to talk about aside from the football game. And if your announcer loves anything it is the opportunity for humorous asides by which he may enhance the quality of the entertainment and more deeply establish an impression of his personality upon his hearers.

"Some rain up here," he says. "They may call this a gridiron down below, but from the water it contains I should call it a tea kettle. The boy who makes a touchdown to-day will be one fine swimmer."

"Hi! There goes my hat!"

Now, no one can be an acceptable broadcaster who cannot visualize his audience as clearly as the actor actually sees his audience in front of the footlights.

For example, when the remark about the watery gridiron was made the broadcaster had imagination sufficient to see the smiles that went the rounds of groups seated in the comfortable warmth of their homes throughout hundreds and hundreds of square miles of territory.

Graham McNamee tells the writer it would be impossible for him to get any-

where in broadcasting were it not for the fact that he is visualizing, or, rather—as he puts it—*feeling* his vast army of listeners-in every minute he is talking.

One wonders if the radio audience, those comfortably sequestered within doors, or—since the voice of the radio is so far-reaching—in milder climes where the sun was shining, could in their turn visualize the rain-soaked announcer at his post, trying to protect his transmitter from washout by the intervention of his own body to the end that the game might be reported to its very end? There is evidence that many do.

The Yale-Princeton game at Princeton, for example. It was not raining that day; but, my, how cold it was! There was a high wind and it had teeth. Down in the stadium there was protection, but



Underwood & Underwood

THE FIRST "RADIO REPORTER" TO COVER A YACHT RACE

When the Royal St. Lawrence Yacht Club held a contest four years ago, an ingenious sport writer rigged up a radio transmitting apparatus on a small launch and sent out "side line" reports of the race by means of electric power derived from a hand-driven generator.



International

THE BEST-KNOWN BROADCASTER OF SPORTING EVENTS IN THE WORLD

Every radio fan in the East knows Graham McNamee—whose absorbing side line reports of the World Series baseball games and the most important of the football games have made him a unique figure in the world of sport.

the radio announcers were high in the air with nothing but the horizon at their backs.

"Gee! This is cold!" So asserted Graham McNamee to the wide world. "I've got a fur coat on, but the wind is cutting through the small of my back like a buzz-saw. B-r-r-r!"

This is almost precisely what he said, for the writer sat directly in front of him that frigid day and heard him "report" the game.

Well, so much for that. Next Monday McNamee received a letter by special delivery. Here is what it said:

"I felt for you last Saturday at Princeton as I was quite comfortable at home and enjoying what you said about the game immensely. I cannot bear to think of your being cold at these games and therefore I beg you to consider the following offer: 1, a silver, very flat, quart flask

which is guaranteed to contain the most warming fluid; 2, a suit of very heavy flannel underwear; 3, two bottles of Scotch which I have had in my cellar for ten years. Make your choice and please advise me."

He selected the article first named. And he got it!

And that was not all he received from other sources. All sorts of gifts that make for warmth, sweaters and the like, came in. In fact, for some curious reason a broadcaster of sporting events receives more gifts by far than any other person in public life. It is a way the public has of showing its appreciation.

How many of those who sit at home and listen to sporting events—as, for example, a great football game—realize the detail which must be observed to the end that the event be broadcast?

In the first place, of course, there is

the setting of the microphones. In addition to the "mike" used by the announcer there is one at each end of the stadium, designed to catch the cheering and band music and thus give those who take the game through the air a complete impression of what is going on.

These supplementary microphones, naturally, must be placed with due regard to the direction of the wind, lest the sounds which it is desired to transmit be



Thos. C. Knight

"EPINARD IS RUNNING SECOND!"

Everyone who is familiar with the thrill that is evoked in the theater by an actor's excited comment about an imaginary horse race run "off stage" can realize the possibilities of a real report of a real race! Here is Mr. J. Andrew White reporting the international horse races at Belmont Park.

swept in an entirely different direction and thus escape the instruments. They are under the control of the announcer, and when he calls into his "mike":

"Now I'll let you hear the cheering over that great run." Or, "Now I'll switch you on to the Yale band," he performs this service simply by throwing in one or the other of the supplementary transmitters.

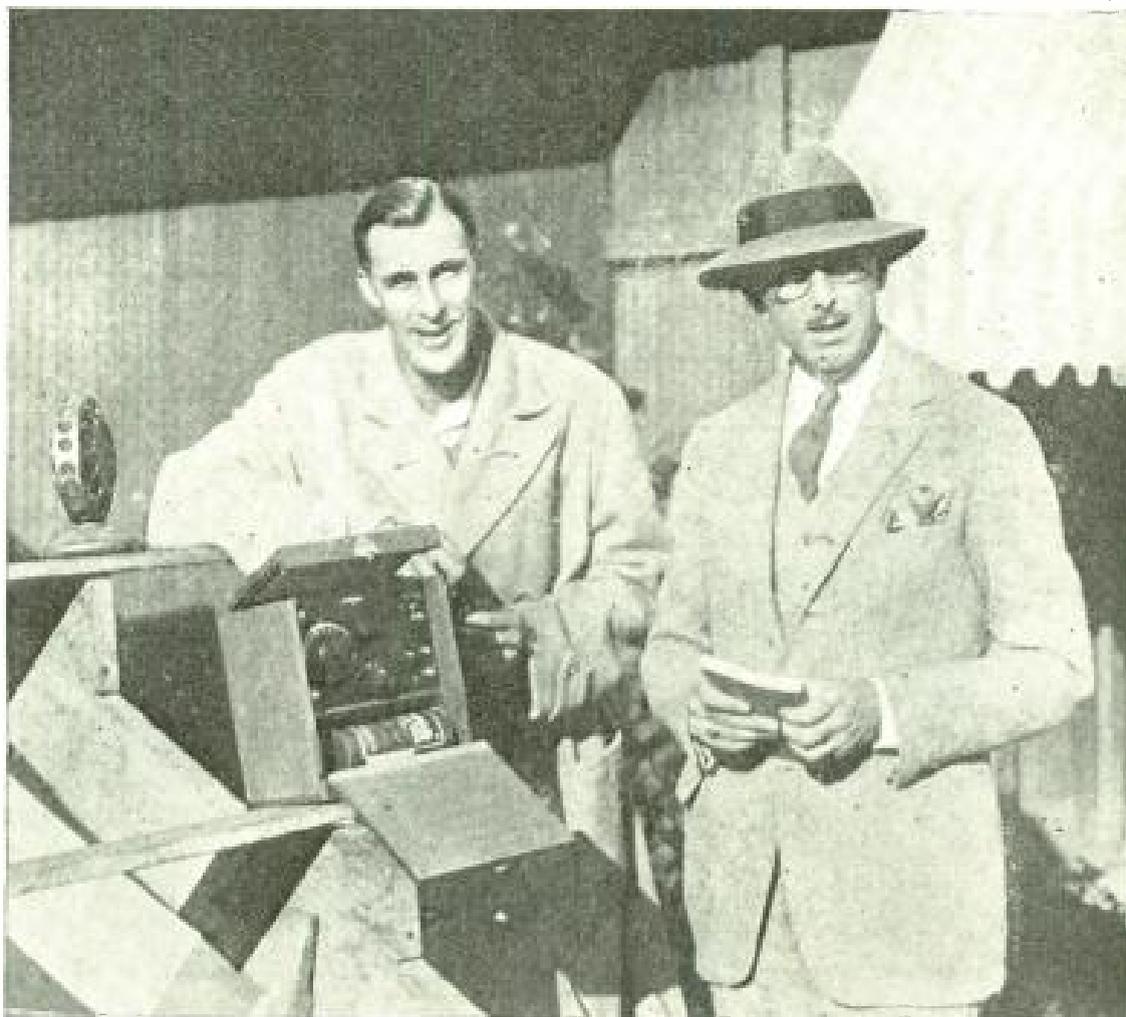
At the announcer's side is an assistant—a man whose duty it is to distinguish the various players. Usually he is some man who has played football and has a gift for penetrating the welter of writhing bodies and singling out the man who carried the ball as well as the man who tackled him.

Whereas the newspaper men can say, "Dartmouth carried the ball ten yards through left tackle," or "Harvard made first down on Princeton's twenty-yard line," it is a fetich on the part of the broadcast announcer to name the individual in every instance. That is the reason why often you will hear a correction made in a name when in the surge of the excitement with which you are following the narration of the contest it matters little to you who did which or what. But announcers, above all things, desire to be exact.

The assistant who, through his glasses, picks out the players speaks through a telephone transmitter, the receiver of which is hooded to the ear of the broadcast announcer, even though the two men may be touching elbows. This is a precaution taken against the voice of the assistant carrying into the microphone thus to be transmitted to the radio fans. In addition to the assistant there is the amplifier operator who sits next to the announcer, or at least near him.

The voice of the broadcaster goes into this amplifier and there gets an increased impulse.

Thus enhanced in volume and carrying power the announcer's voice goes over a local line to the nearest long distance office. In the case of the Yale



Kadel & Herbert

THE CONTESTANTS THEMSELVES TALK TO THE RADIO AUDIENCE

The radio fan may not only follow the game play by play and hear the applause of the spectators, but may even listen to the players' own comments. Here, for instance, is William Tilden, the world's champion tennis player, about to talk into the microphone at the tennis courts.

game, this long-distance office was in New Haven. Here it was again amplified and then shot *via* wire to an intermediate long-distance station at New Rochelle. Caught here, the voice received further amplification. In this connection it should be understood that a voice loses power in transmission just as water through friction loses force in traveling through a line of hose. That is the reason the sound goes through the amplifying process at each station.

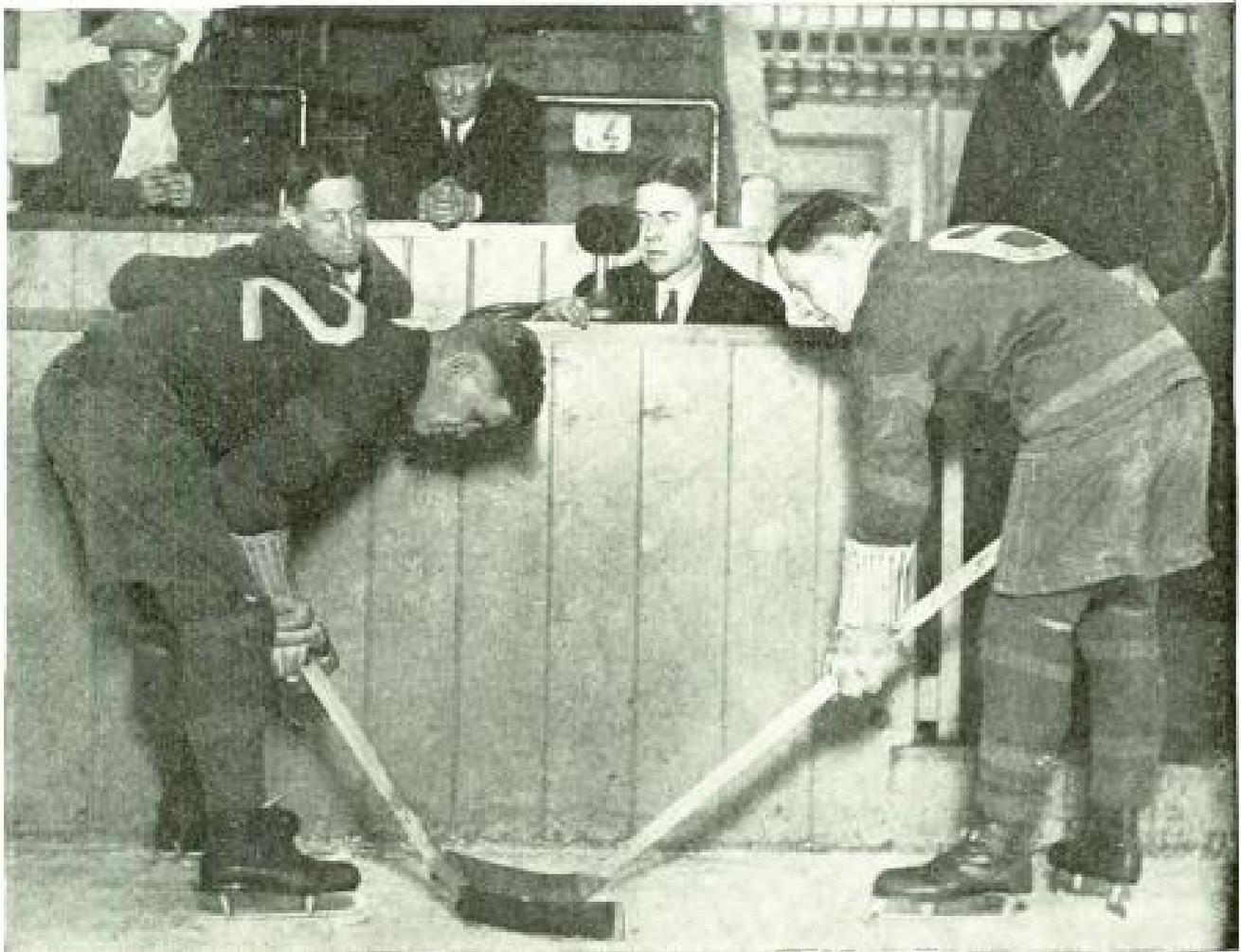
From New Rochelle the voice went, still *via* wire, to the building at 24 Walker street, the long-distance terminal in New York City. Here it was once more amplified and sent into the WEA F headquarters, where it was kicked out over another line to the Western Electric

Building on West street, New York, where it was "put on the ether."

Pretty difficult to realize that the voice you hear from some football arena or prize fight ring is going through all the manhandling as above described, isn't it? Yet the voice, through all the processes, is the same voice speaking into the microphone at the scene of activities.

And, in addition, the voice thus being transmitted from the field to the final station is also being sent over long-distance wires to various other stations that are involved in the broadcasting of the game—as, for instance, WNAC in Boston and WCAP in Washington.

Finally, besides the three men at the field the broadcasting involves the services of interior men at the various stations



Kadel & Herbert.

THE FIRST HOCKEY GAME TO BE BROADCAST

The contest between the Boston Bruins and the Ottawa teams, held in Boston in December, 1924, is said to be the first hockey game to be reported by radio. The sideline reporter is Mr. Frank Ryan of station WBZ.

such as those who operate the transmitters at the West Street station and the men who monitor the amplifiers at WEAJ.

By the term, "monitoring" the amplifiers, is meant the regulation of the volume of sound so that there will be no blurring or other defects.

Of all the new order of sporting broadcasters the two best known are Graham McNamee and J. Andrew White. McNamee was a concert singer before he went into broadcasting; in fact, he still holds down choir-singing positions. Hence his style of broadcasting differs materially from that of his colleague who has been, and still is, in the commercial side of the new industry. McNamee has a lot of temperament and throws into his broadcasting a great deal of the dramatic

spirit of a contest; whereas Mr. White is more judicial in his methods.

Radio fans tell me that they thoroughly enjoy McNamee at a football game, but that Major White impresses them as being a bit more of a critic at an important boxing match than does the other, who is pretty much inclined to be in the ring himself, ducking and walloping and blocking as the fight rises to crescendo.

What effect does the radio-reporting of sporting events have upon attendance?

Figures are not yet available for reply. But it may be safely assumed that the publicity that is accorded sports by broadcasting is and must be a powerful factor in arousing public interest in them. Boxing bouts that involve the world's champions naturally draw out the boxing fans in throngs; at the same time they interest

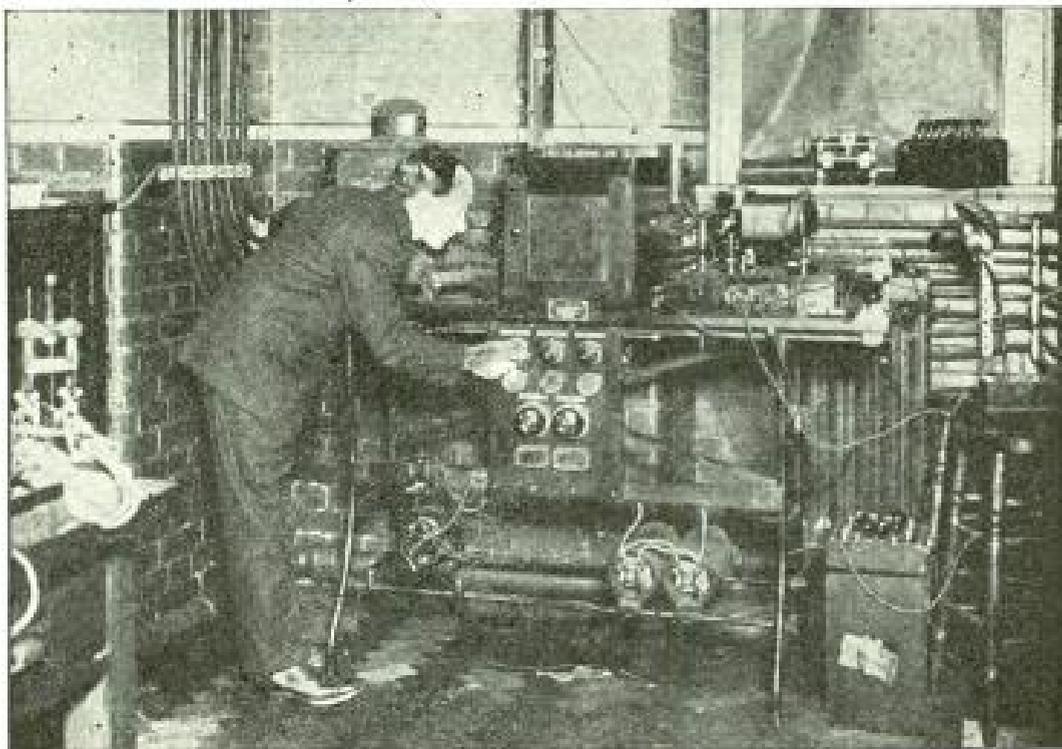
many who prefer to stay at home and listen to an absorbing narrative of a bout as it actually takes place. These are the radio fans who have never attended bouts in the past but who are initiated into the sporting world as the result of the stirring ringside reports that reach their ears.

On the other hand, some of those who have been accustomed to attend sporting events now prefer to remain at home and hear the games over the radio if only because they are able to follow the contest so much more closely in all its details than if they were present. The broadcaster occupies a post of vantage in the very center of things and finds every sort of information demanded right to hand. One easily may imagine, therefore, that the person who is taking the game out of the air has more accurate and intimate information as to what is actually happening, or at least why and how it is happening, than the occupants of a majority of seats in the vast stadiums. This is particularly the case when it comes to

penalties in football games, for example, and other incidents the exact nature of which most of those present at the field have no means of knowing.

This coming spring and summer radio will give even more than usual attention to national and international sport. The announcers who have become familiar to radio audiences through their activities in football, boxing and polo, will be at the microphones to report boat races, horse races, field games and tennis. The time may conceivably come when William Tilden, the singles champion and other star players, whose writings on the game are now featured in the daily prints, will be taken over by the broadcasting interests.

And the time may not be far distant, too, when radio pictures of sporting events will be flung through the ether, even as sound now is. In such event, it is not difficult to imagine two prize fighters or two baseball or football elevens staging their struggles before a mere handful of witnesses with the rest of the world listening and looking in!



From a photograph made for POPULAR RADIO

WILL THE VAST ENERGY IN THE ATOM BE RELEASED?

Dr. T. F. Wall of London thinks that it may be, and has been making experiments that are attracting world-wide interest. Just what they are he will tell in a coming issue of POPULAR RADIO.



A PICTURE THAT CROSSED THE ATLANTIC IN 20 MINUTES

This is one of the photographs (of a street scene in London) that was sent from England in the radio photographic tests. These experiments prophesy the publication of pictures of important European events in the daily press of America as soon as in the newspapers abroad.

THE NEW PHOTORADIOGRAMS

The recent inauguration of the radio-transmitted picture on a commercial basis opens up new and startling possibilities in the realms of industry and commerce. Contracts and other documents may be signed within a few moments, between parties on opposite sides of the globe, and the world's business thereby speeded up immeasurably; news photographs may be sent to newspapers throughout the world; portraits of missing persons and crooks may be broadcast to police departments everywhere. In this article the inventor of this latest apparatus tells the readers of POPULAR RADIO how these pictures are sent and received on the Ranger apparatus.

By RICHARD H. RANGER

BEHIND any development or invention there must be first the desire for its particular accomplishment. This desire has long been behind the transmission of pictures by radio and it has finally culminated in the demonstration of last month when picture after picture

was successfully transmitted from the City of London to downtown New York by the Radio Corporation of America's high-powered transatlantic system.

Set up in the laboratories were loudspeakers amplifying the signals coming in from England; but instead of the radio

code signals with which most broadcast listeners are familiar, this picture talk seemed to be an incongruous collection of buzzing noises—not particularly rapid in succession and with more or less of a halting characteristic. Nevertheless, they were the shorthand indications which were accomplishing the registration in New York City of the photographic impulses that originated from Radio House, London.

Mr. Donald G. Ward, an engineer, had gone across to London only three weeks before to set up a "board" about 3 feet by 4 feet in size, on which was mounted a fair-sized motor which is used to rotate a glass cylinder. This motor revolves at

an exact speed determined by a vibrating tuning fork which sees to it that, in spite of load or electric current variations, the motor will keep rigorously geared to time.

The glass cylinder supports the photographic film to be transmitted. The film may be either a positive or negative, but from an operational point of view it is usually found convenient to use a positive print so that the operator can judge better of the values which should be brought out as the solid black and the pure white of the picture. Inside the glass cylinder is a powerful, although small, electric light which, with its appropriate lenses, sends a beam of light through the film at one point at a time as the drum



A RADIO CAMERA WITH A 3,000 MILE FOCUS

The inventor is here comparing an original photograph with its transmitted duplicate.



rotates into a light proof box inside of which is a photoelectric cell.

This cell is the "photoradiographic eye." The electrical resistance of this cell changes in accordance with the amount of light which falls upon it and in this way takes care of the shading of the picture in transmission.

The photo-electric cell functions practically without any lost motion. That is, the instant the slightest change in the amount of light reaches the cell, a corresponding change in the output current of the cell takes place. In this way the "eye" of the transmitter is able to "see" even the tiniest light variations; in fact the "eye" sees and records electrically millions of different current impulses as the films sweep by the light beam from inside the cylinder.

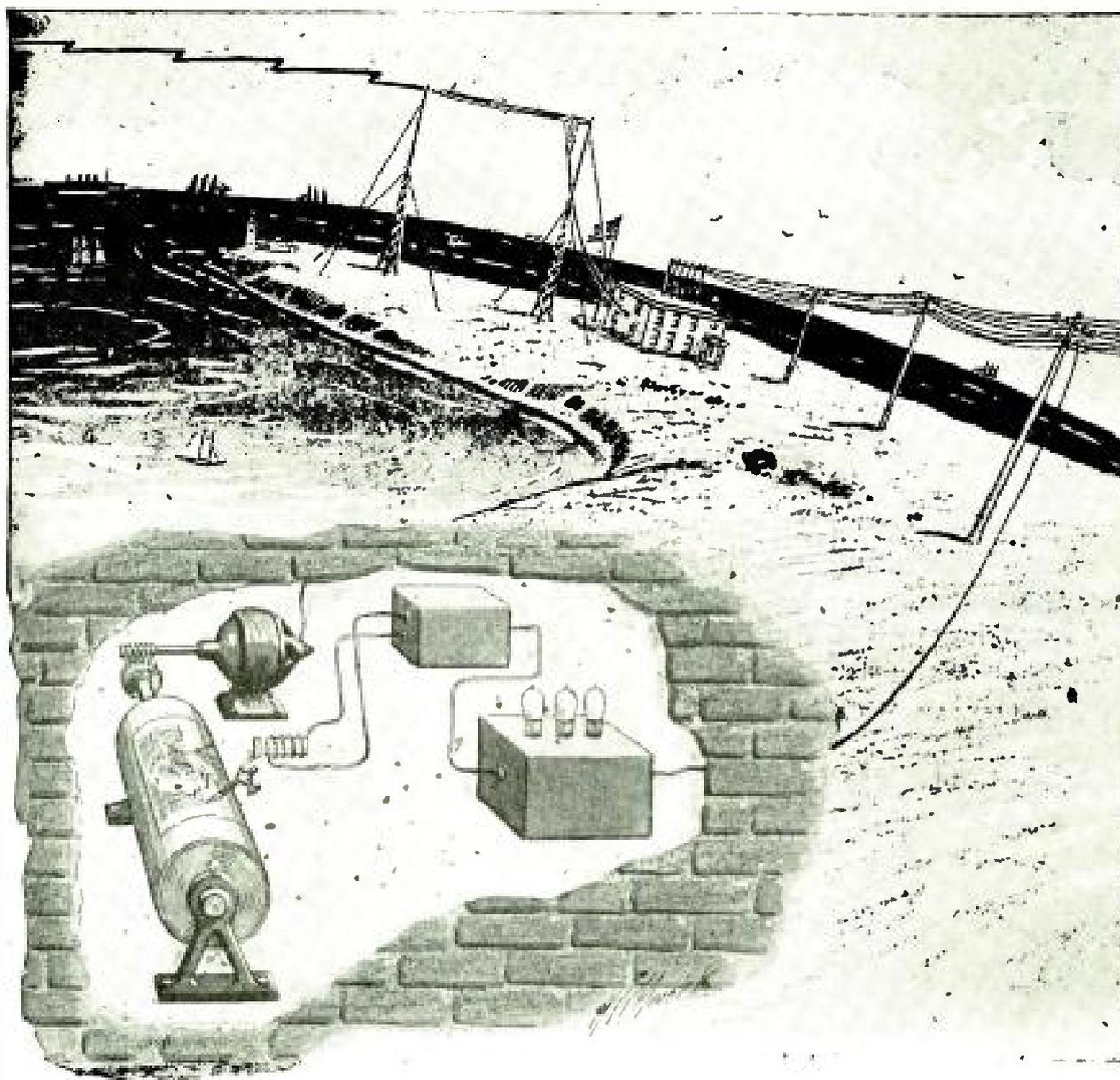
The photo-electric cell is, therefore, responsible for reproducing an infinite number of different electric current values which correspond with the light or dark areas of the pictures that are being transmitted.

In order to cover all of the original film, the glass cylinder is rotated back and forth; in this way the entire surface is eventually exposed to the piercing light beam. The film rotates through an angle equal to the width of the picture, and the electric camera itself advances down the length of the picture one notch at a time.

Thus, line upon line, the whole picture is covered.

After the signal impulses or electric waves from the photo-electric cell pass through a series of vacuum-tube amplifiers, they are fed into a modulating device ready for transmission. The electrical interpretation of the picture is then transmitted over land wires from the London laboratory to the high-powered transmitting station of the Marconi Wireless Telegraph Company, Ltd., at Carnarvon, Wales. Here the electric impulses on the land wire operate small relays which turn on and off the high value currents that flow from the 200-kilowatt generator to the antenna system. This high power electrical energy leaving the antenna in interrupted impulses, similar to dots and dashes of the telegraph code, creates the ether waves which carry the photograph 3,000 miles through space to the receiving station on this side of the Atlantic, located at Riverhead, Long Island.

The development of the photoradiogram transmitter has purposely been carried on in connection with the established radio-transmitting stations, now engaged in sending radiograms daily between Europe and America. Thus the new device does not require the preparation of any special radio circuits for efficient operation.



HOW THE PICTURES SPAN THE ATLANTIC

The photographs and printed documents are sent from London by wire to a radio station as shown on the page opposite. They are received by an American station as indicated on this page. From the radio station the electric impulses are relayed to New York and are recorded, as shown, on the cylinder by the special pen.

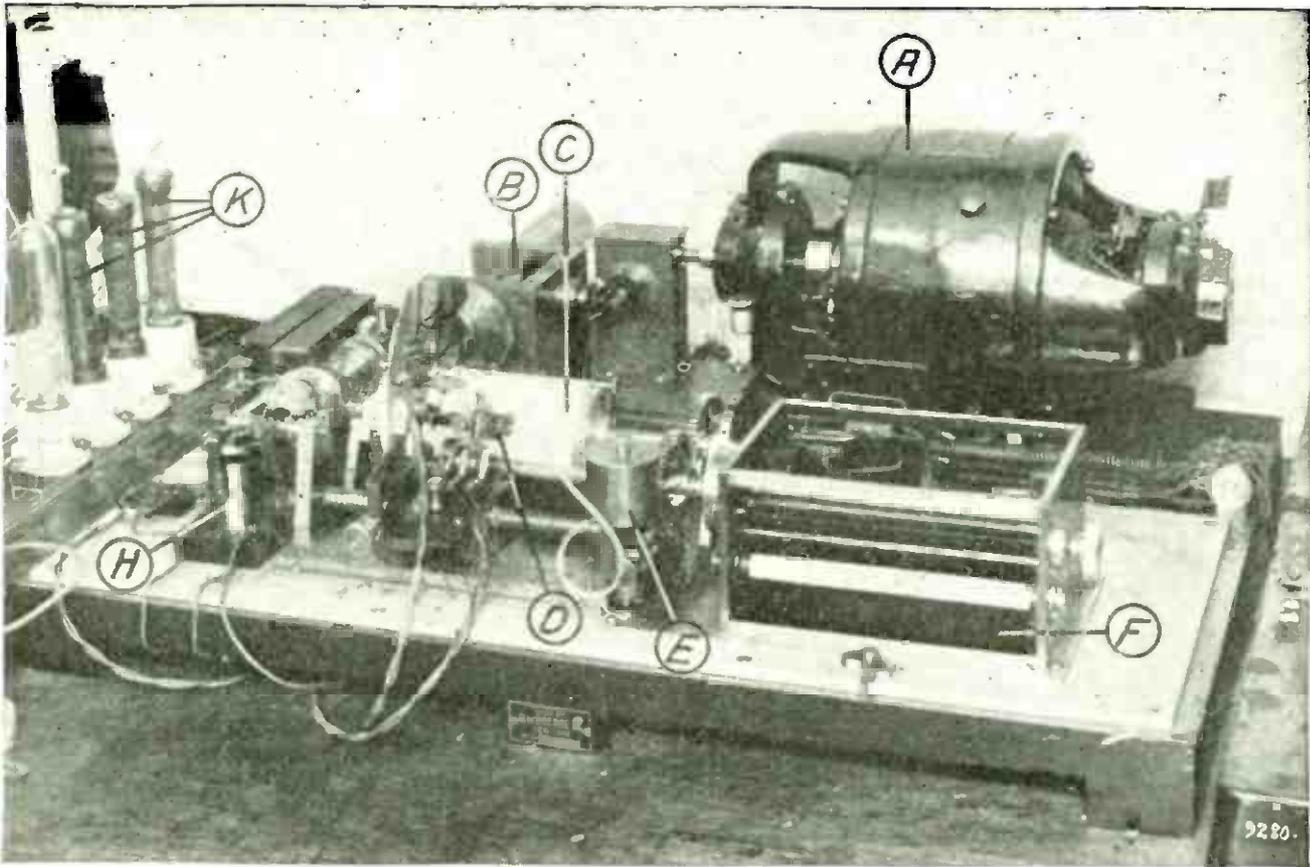
At Riverhead, Long Island, in the Radio Corporation's central receiving station, the operator tunes in to the Carnation station. He receives the picture just as he would receive a radiogram, but instead of dots and dashes which he can read he receives an undecipherable series of electrical impulses. These impulses pass through a bank of vacuum-tube amplifiers and are then sent by land wire to the laboratory of the corporation, located in the building in Broad Street, New York.

Here this unintelligible code, carrying

the photograph, is translated back into black and white, recording the original picture much in the style of a stippled engraving.

An "unscrambling" device in the laboratory then decodes the complex photo message and gives each individual electrical pulse of energy a definite task to perform in reassembling the picture.

The picture is reproduced in duplicate at the receiver, both on a paper record and on a photographic film. The paper upon which the record is made is wrapped about a rotating cylinder, which, in size



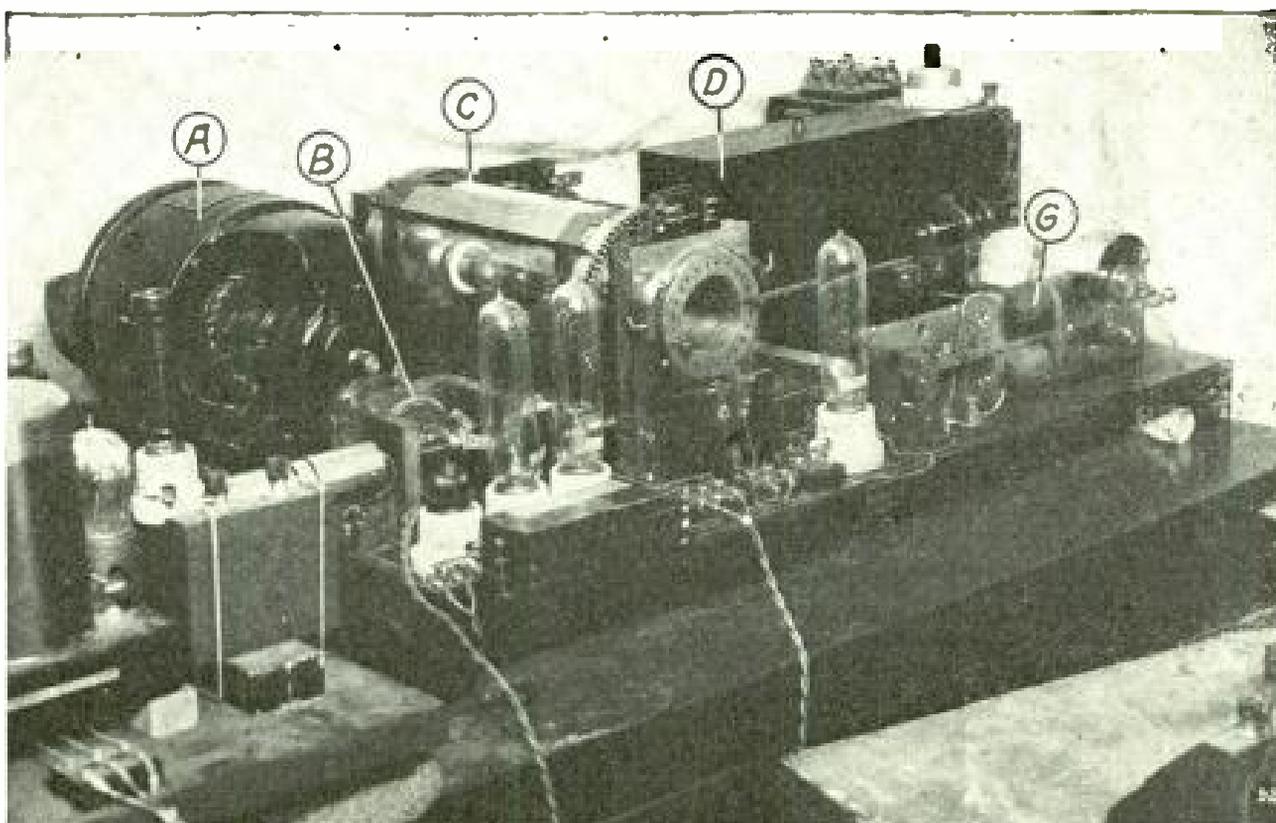
THE RECEIVING AND RECORDING APPARATUS

A in the picture above is the driving motor that runs exactly at the same speed as a similar motor at the sending end. *B* is the gear that runs the cylinder *C* on which the picture is recorded by the special pen *D*. At *H* is a magnet that shifts the pen like a typewriter carriage. *K* are resistances. *E* is an ink reservoir for the pen. While the pen makes a picture, a ray from an electric light makes a duplicate within the camera box *F*.


One Picture is Worth
10,000 Words
[Old Chinese Proverb]

HOW PRINTED DOCUMENTS ARE RECEIVED BY RADIO

At a public demonstration of the Ranger apparatus a full-page advertisement, complete with reading matter and pictures, was transmitted from London within a few minutes, ready for reproduction in a New York newspaper.



THE RADIO PHOTOGRAPHIC TRANSMITTER

A is the synchronous motor and B is a gear that connects it with the cylinder C on which the photograph to be sent is fastened. D is the camera box that is shifted by the magnets G while the varying lights and shades of the photograph are being converted into electric impulses.

and appearance much resembles the early type wax phonograph record. A specially constructed fountain pen bears against this just as the needle of the phonograph does on a record. The pen is attached to an electrically-controlled lever in such a way that every pulse of electrical current which passes through the magnet coils of the relay lever draws the pen to the surface of the paper, making a fine ink mark. A changing current fed through the magnet coils causes the pen to wiggle in step with the current impulses, thus giving the artistic stippling effect in the reproduced picture.

One of the outstanding requirements in sending pictures by radio or wire is absolute synchronism of the sending apparatus with the receiving device; otherwise distortion will occur. If the receiving apparatus should lag the slightest particle of time behind the transmitting set, the received picture would be blurred and unrecognizable.

This necessary synchronism is maintained by the use of special driving motors, one geared to the transmitting cylinder and the other geared to the receiving cylinder. These motors although separated by 3,000 miles maintain the same speed. This is accomplished by the aid of the tuning forks already mentioned.

Chief of the features of this photoradiographic system may be mentioned the fact that the entire operation at transmitter and receiver is in broad daylight. This immediately removes the process from the laboratory stage, which necessitated dark rooms and many other special provisions and brings it into a category of usual commercial equipment.

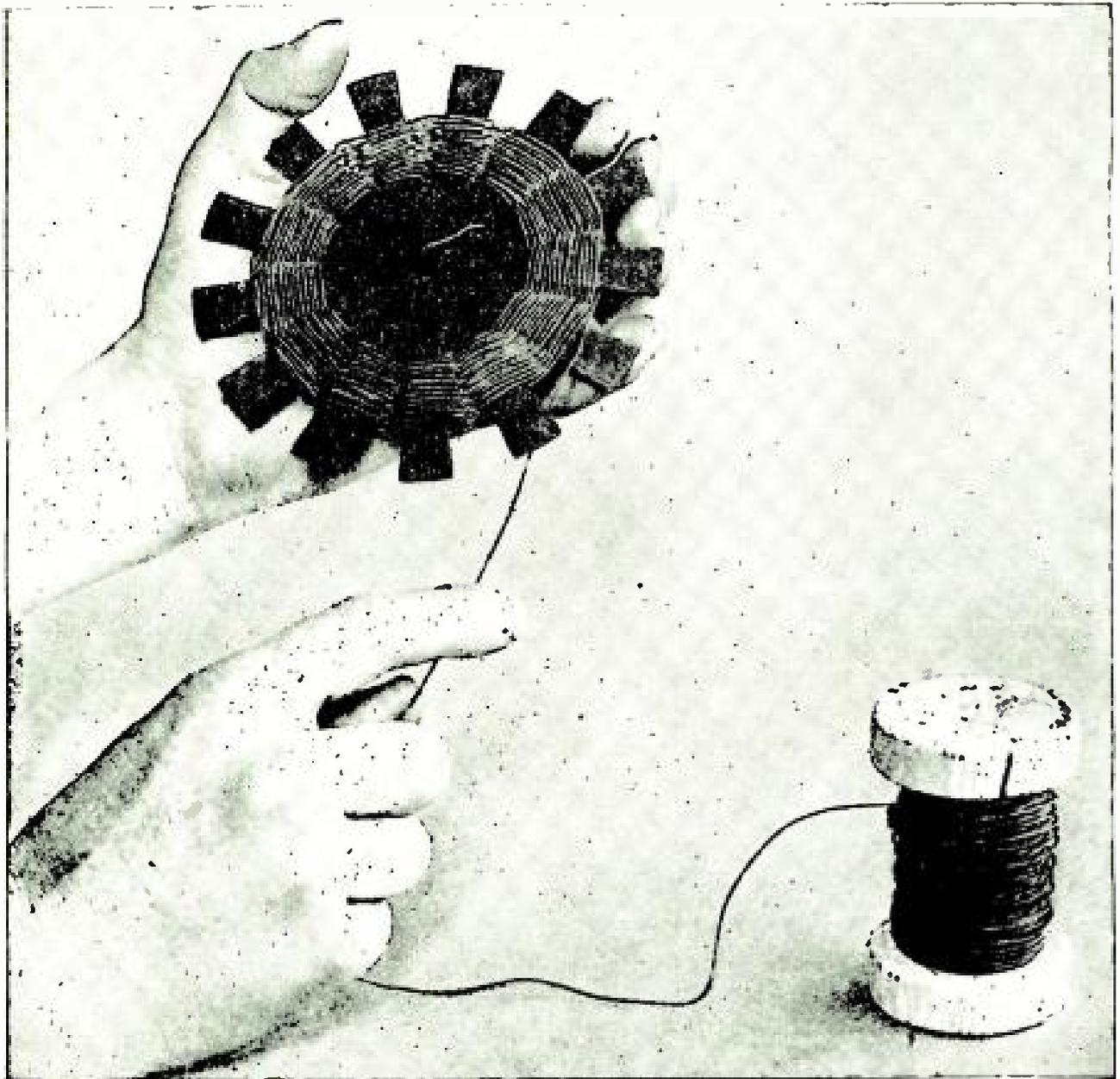
The building up of the received picture is a fascinating sight, even to those who have watched it as it became more perfect day by day. This is particularly true when it is realized that it is originating more than 3,000 miles away, and that those particular dots are being formed

nowhere else but right on the receiving cylinder in New York City. No human hand could hope to imitate the precision of the small special fountain pen which puts down, here and there, dots or dashes, then leaves an open space which gives the pleasing effects of the finished picture.

If the same picture is transmitted twice, the dots do not occur in exactly the same spots on each picture; in other words, each and every transmission is individualistic, although the resultant pictures

when held at a little distance are absolutely identical. In other words, the dots come in seemingly, hit or miss, but it all depends upon the chance way in which the picture first starts, so that the succeeding dots will take up their proper places with mathematical exactness to give true tonal value to the picture.

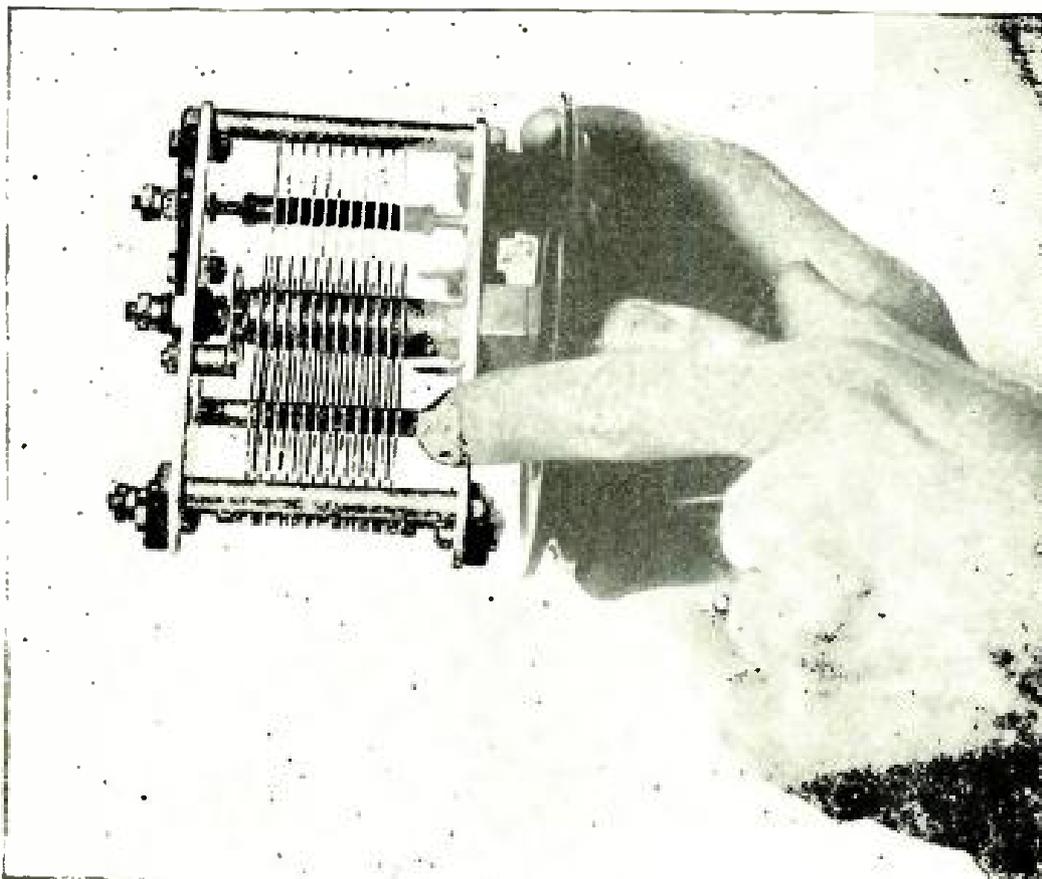
So it seems that this photoradiographic art will soon come to have a real place in communication; particularly as facilitated by the rapidity of radio waves.



Kadel & Herbert

HOW TO WIND A LOW-LOSS SPIDER-WEB COIL

On a hard rubber or bakelite form as shown above, start winding the wire from the center in an over-and-under fashion around the spokes of the frame. Continue alternating the wire in this manner until you have wound on the frame the number of turns required for the particular coil.



From a photograph made for POPULAR RADIO

A TYPICAL RECEIVING CONDENSER

FIGURE 1: *The ordinary receiving condenser has air insulation and the plates are spaced as close as mechanical considerations permit. This is a satisfactory procedure since the potential between the plates is low, and the close spacing gives relatively high capacity. If the air was replaced by another insulating material, the capacity of the condenser would be increased.*

FACTORS THAT GOVERN THE CAPACITIES OF CONDENSERS

Article No. 12

Condenser capacity is determined by the insulating substance between the condenser plates, as well as by the mechanical dimensions of the condenser. High-grade materials that will not absorb moisture and that are not greatly affected by changes in temperature should be employed. In this article a condenser capacity formula, embodying these variables, has been developed.

By SIR OLIVER LODGE, F.R.S., D.Sc., LL.D.

WHEN a conductor is charged with electricity, its potential rises. And, if the quantity of electricity supplied to it, is doubled, the potential is doubled too. The ratio of the charge to the potential is called the "capacity" of the body.

There is the same sort of thing in heat. The more heat is supplied to a body, the higher grows the temperature.

And the ratio of the amount of heat supplied, to the consequent rise of temperature, is called its "thermal capacity."

The thermal capacity of a body naturally depends on its size or rather its weight; but it also depends on its material. That part of the capacity is called "specific," which means the capacity of each pound or each gram.

The specific capacity of lead is one thing, of iron another, and of water is greater than either.

In this respect, thermal capacity differs from electric capacity. Electric capacity does not depend on the material of the conductor, but, as Faraday showed, on the nature of the material surrounding the conductor. A conductor in air has one capacity; but if plunged into a vessel of oil, or melted resin or pitch, or some other insulator, it has another and greater capacity. Hence there is a specific inductive capacity for each insulating material, which can be ascertained by experiment.

In addition to that, however, the capacity of a body changes, not only by reason of the insulator surrounding it, but also by reason of conductors in its neighborhood. If it is brought near the earth, for instance, or near a wall, its capacity increases. And this increase of capacity is calculable from the geometrical conditions, that is, when the shape and distance of bodies is known.

In some respects, therefore, electrical capacity is less simple than thermal capacity; since the latter has wholly to do with properties of materials, whereas the former is dependent on geometrical conditions besides.

Take the simplest case—an isolated sphere: the moon, for instance, or a brass ball far away from anything else. A charge on it is measured by the repulsive force it can exert on a similar equal force at a given distance, in accordance with what is called Coulomb's Law. The electrical force varies inversely with the square of the distance, just as gravitation does. But force is always equal to gradient or slope of potential. From this it follows, though not quite obviously, that the electric potential at any point near a charged body is equal to the charge divided by the distance, *i.e.*, the simple distance of that point from the charge.

Assuming this, and applying it to the case of an isolated sphere, let us ask:

What is the potential of its center?

The charge resides wholly on the surface; hence the center is at a distance from that charge equal to the radius of the sphere. Consequently the potential is $\frac{Q}{r}$.

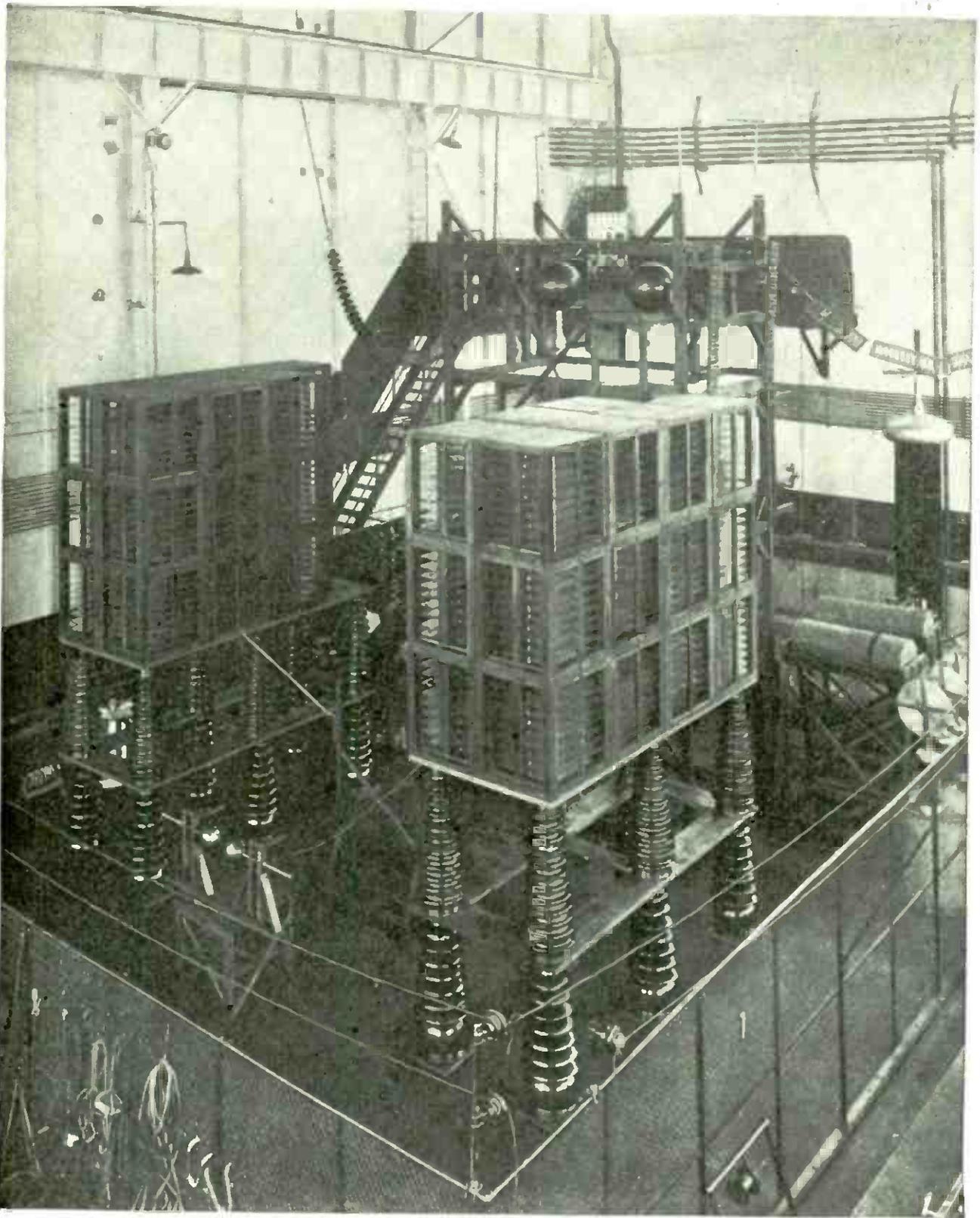
And since the body is a conductor, and the electricity is at rest upon it, its potential is uniform, or the same throughout. This $\frac{Q}{r}$ therefore gives the potential of the conductor. And, if you want to know its capacity, you simply divide the quantity by the potential; and you get r .

That is, the capacity of an isolated sphere is equal to its radius, and can be expressed in centimeters, meters, miles, or any other units of length.

It may be asked: How can a capacity be a length?

The capacity depends, not on the body itself, except as regards its size and shape. It depends essentially on the properties of the material surrounding it. The material surrounding the moon is the ether of space. The material surrounding a brass ball is the ordinary atmosphere. The two surroundings do not differ appreciably in this respect. They both have practically the same specific inductive capacity. But unfortunately its value is unknown. It is accordingly called K . And when we speak accurately, we ought to say that the capacity of an isolated sphere is Kr .

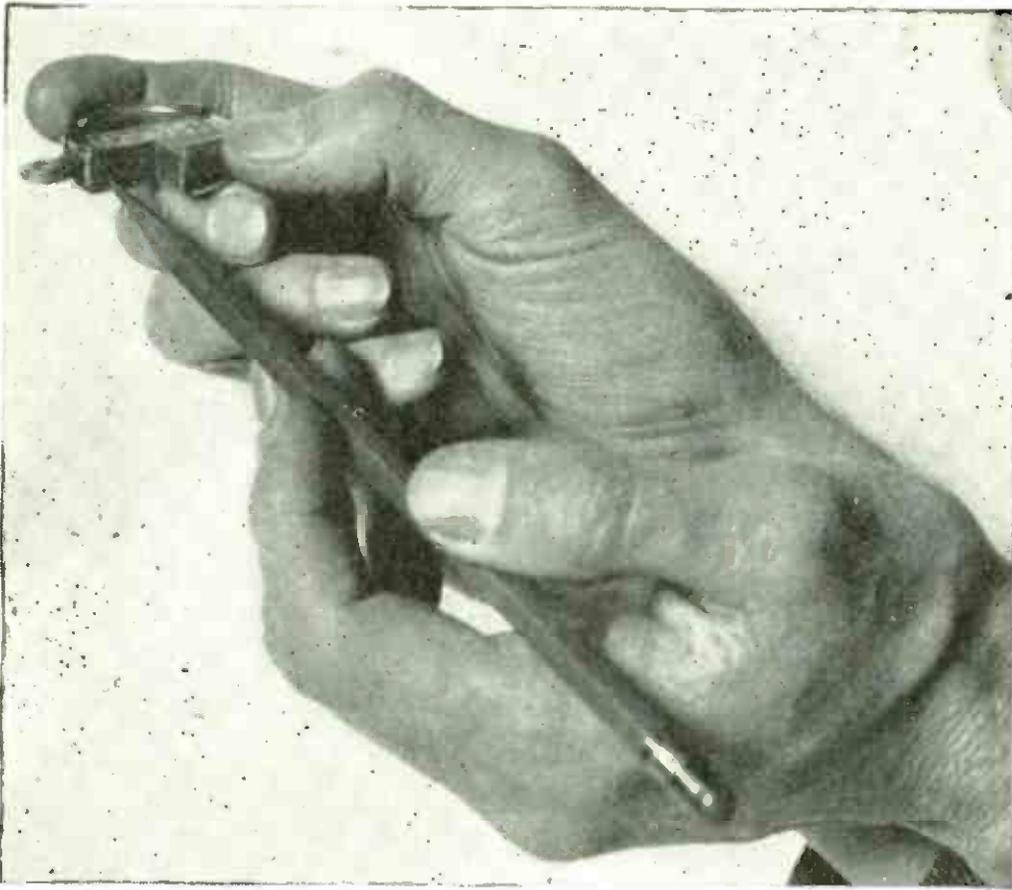
But for practical purposes, we cannot deal with an unknown quantity. The simplest plan is to assume it to be 1, and proceed with the memory of that perfectly gratuitous and arbitrary assumption at the back of our minds. This is the basis of the electrostatic system of measurement. When a thing is expressed in electrostatic units, the meaning is that the unknown quantity K has been arbitrarily called 1. The worst of it is that we get so used to doing this that we are likely to forget the assumption altogether. The convenience of the assumption is that it enables us to specify our measurements



General Electric Co.

A COLOSSAL 2,000,000 VOLT CONDENSER

FIGURE 2: In the case of this high-tension condenser, used in producing a 2,000,000 volt lightning flash, high insulation is of the utmost importance. Thick glass insulation separates the condenser plates of each unit and many units are connected in series so that the voltage across each one is much reduced. With all these insulating precautions the condenser naturally attains a huge bulk.



From a photograph made for POPULAR RADIO.

A COMPACT TYPE OF CONDENSER

FIGURE 3: This tiny condenser has about ten times the capacity of the one shown in Figure 1 because it is constructed with mica insulation and the plates are spaced only a few thousandths of an inch apart. Part of the condenser is cut away to show the interior construction.

in a very much more simplified manner.

Now put an outer hollow globe round the brass square. It can be done, and actually used to be done, by applying to it two brass hemispheres bigger than itself, and suspending it symmetrically in the hollow. It can be charged through the suspending wire. If the outer shell is earthed, the inner globe will now be found to have a much greater capacity than before. The charge on it has, so to speak, pulled up from the earth an equal quantity of opposite electricity; and the two charges face each other across the insulating space.

If we now reckon the potential of the center of the sphere, it will be $\frac{Q}{r}$ due to the one charge, and $-\frac{Q}{r'}$ due to the other. The potential will then be:

$$Q \left(\frac{1}{r} - \frac{1}{r'} \right) = Q \frac{r' - r}{r r'}$$

and hence the capacity (Quantity ÷ Potential) of the globe, now that it is surrounded by an outer shell of radius r' , is

$$C = \frac{r r'}{r' - r}$$

Now, we see that $r' - r$ is the thickness of the insulating space or dielectric separating the two conductors, which we may call Z ; and if this space is very thin, that is if the spheres nearly fit, $r r'$ may be called r^2 . So the capacity of such an arrangement as this, which is familiar to electricians as a condenser, is $\frac{r^2}{Z}$. Now the area of a sphere is $4 \times r^2$.

Hence we may specify the capacity of the spherical condenser as,

$$\frac{A}{4 \pi Z}$$

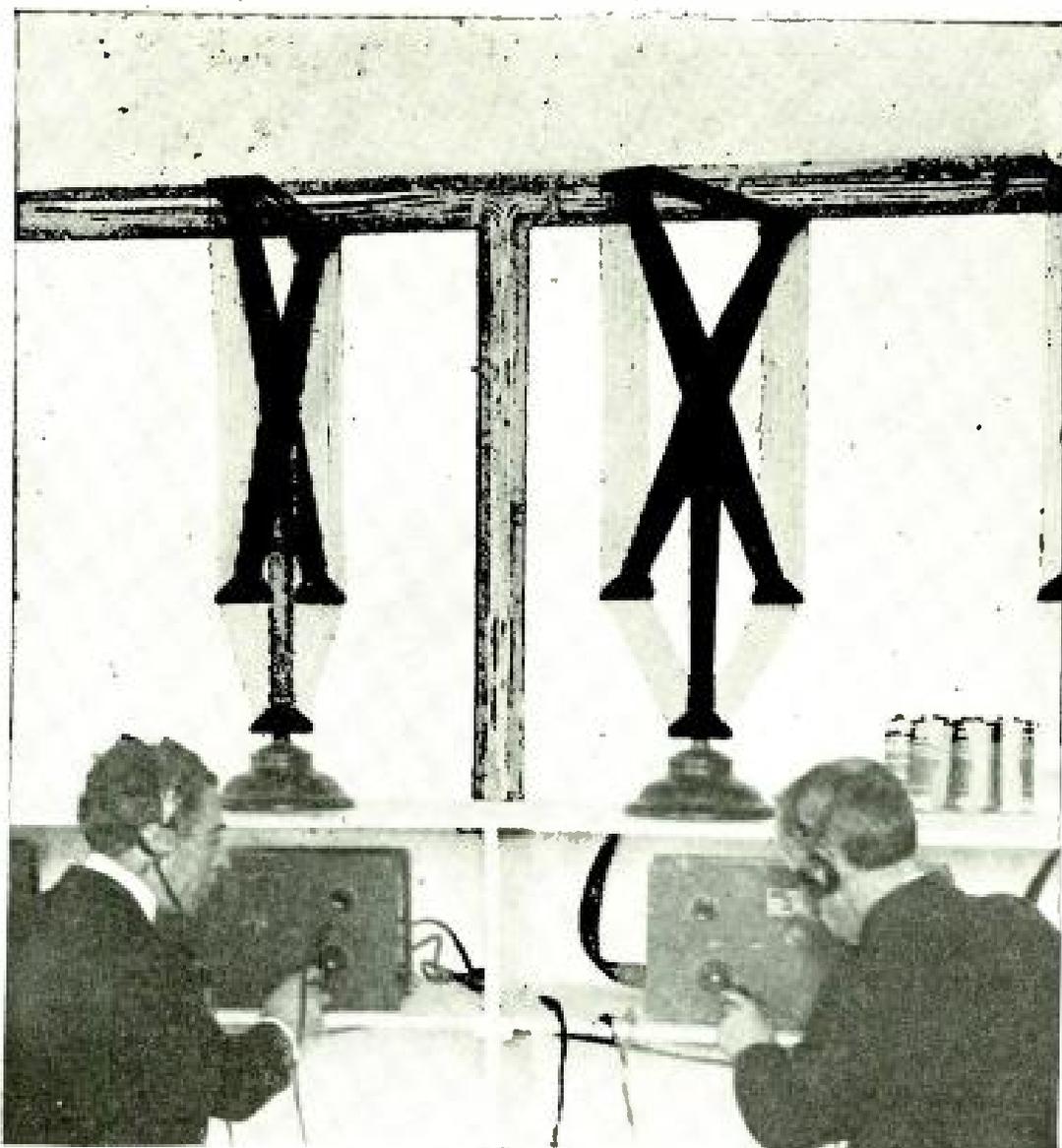
This result is general; for it does not really matter whether the condenser is

spherical or not, provided the dielectric thickness is uniform. It will do equally well for a pair of flat plates, one earthed, the other insulated, each plate of area A . So the capacity of a condenser in general is,

$$\frac{A}{4 \pi Z}$$

provided only air or ether is between the plates. If, however, some other

substance is used as the insulator or dielectric, such as glass or mica or paraffin or oil, we must multiply this value by the specific inductive capacity of the material relative to air, as determined by Faraday; and may thus get four or five times the air-value. This numerical ratio has to be determined by experiment for different materials, and is usually recorded among the data characteristic of different substances.



United

THE RADIO EQUIPMENT IN AN APARTMENT HOUSE WHERE RADIO GOES WITH THE RENT

In a new apartment house in New York, each tenant can plug in on any of four programs in his own rooms. All the tenant needs is a loudspeaker. Four radio receivers, which are operated on the top floor, pick up the programs. Besides, through the use of four loudspeakers, the dweller in this house may have four programs in four separate rooms.

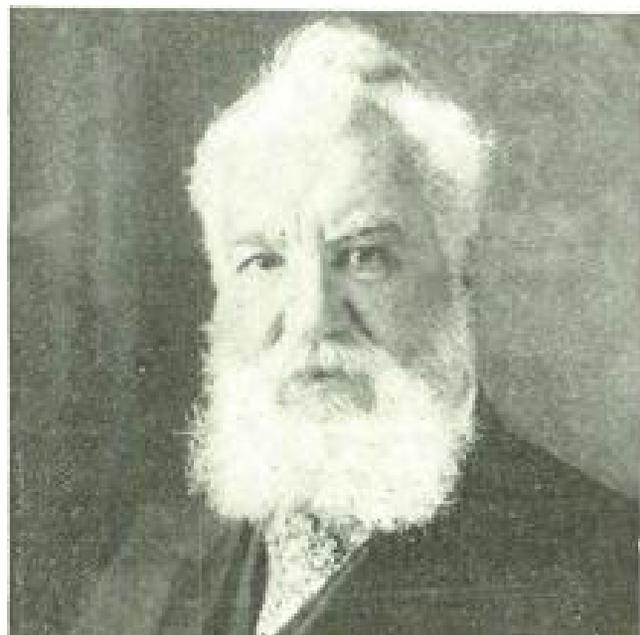


The MEN WHO

4th Installment

THE BUILDER OF THE FIRST PRACTICAL ARC TRANSMITTER

BEFORE 1902 the electric arc had been experimentally used for radio transmission, but it was not until VALDEMAR POULSEN, a Dane, in 1902 developed an arc transmitter that efficiently produced radio-frequency waves. His invention embodied the principles of William Duddell and Elihu Thomson.



A. T. and T. Co.

THE MAN WHO LAID THE FOUNDATION FOR THE "BEAM SYSTEM"

IN 1878 ALEXANDER GRAHAM BELL, known the world over as the inventor of the telephone system which bears his name, spoke along a beam of light. In his experiment a flexible mirror acted like the diaphragm of a telephone receiver that vibrates with the sound waves produced by the voice. This mirror sent a ray of light to the receiving station where it moved about the face of a selenium cell in unison with the vibrations of the voice at the transmitting station. The consequent varying current of the cell actuated a telephone receiver which reproduced the transmitted voice.



Elliott and Frey, London

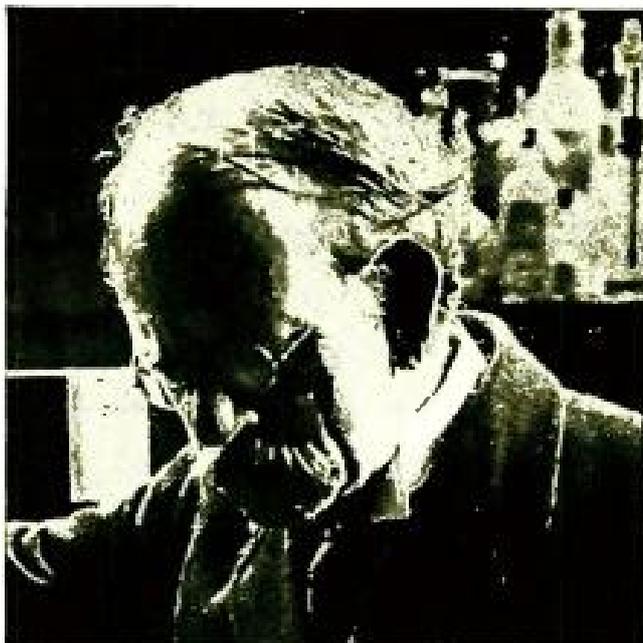
ONE OF THE FIRST TO SIGNAL AT A DISTANCE WITHOUT WIRES

WITH two loop circuits one quarter of a mile apart, SIR WILLIAM PREECE in 1885 transmitted speech between two points on the Bristol Channel in England. The method used by Preece united conductive and inductive effects in making one circuit influence the other. Little is known about the apparatus he employed. In 1896 he was associated with Marconi in his early experiments.

MADE RADIO

THE FIRST TO EXPLAIN THE BEHAVIOR OF ELECTRONS

SIR JOSEPH J. THOMSON, an Englishman, was the first person to isolate the electron. Following this discovery, he expounded the electron theory, which provided the true explanation of the operation of the vacuum tube. His other work that is directly related to this same field were experiments with the discharges of electricity through gases and with the conductivity of gases that led up to his electron investigations.



Special Press, London

THE FIRST NAVAL SIGNALLER

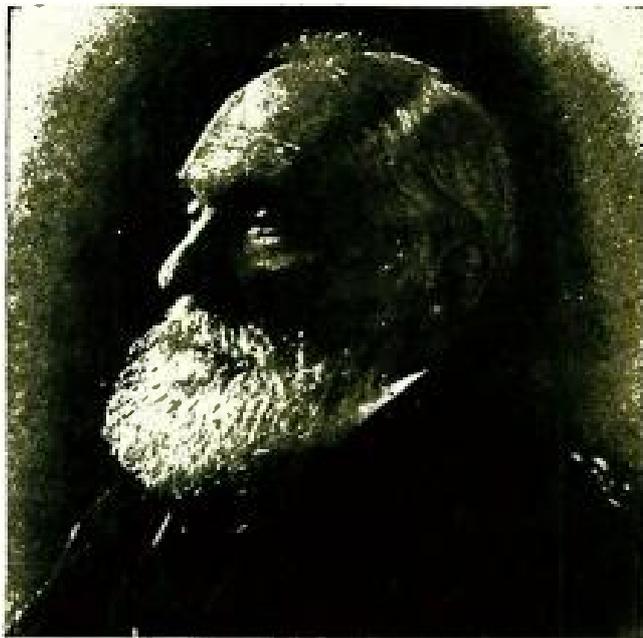
IN 1895 ADMIRAL JACKSON of the British Navy used vertical antennas and tuned sending and receiving stations to telegraph at a short distance between ships employing most of the principles expounded by Marconi. His experiments were conducted for the British Navy for which he did a large work in organizing its radio service. Later Admiral Jackson was associated with Marconi in other experimental transmitting tests.



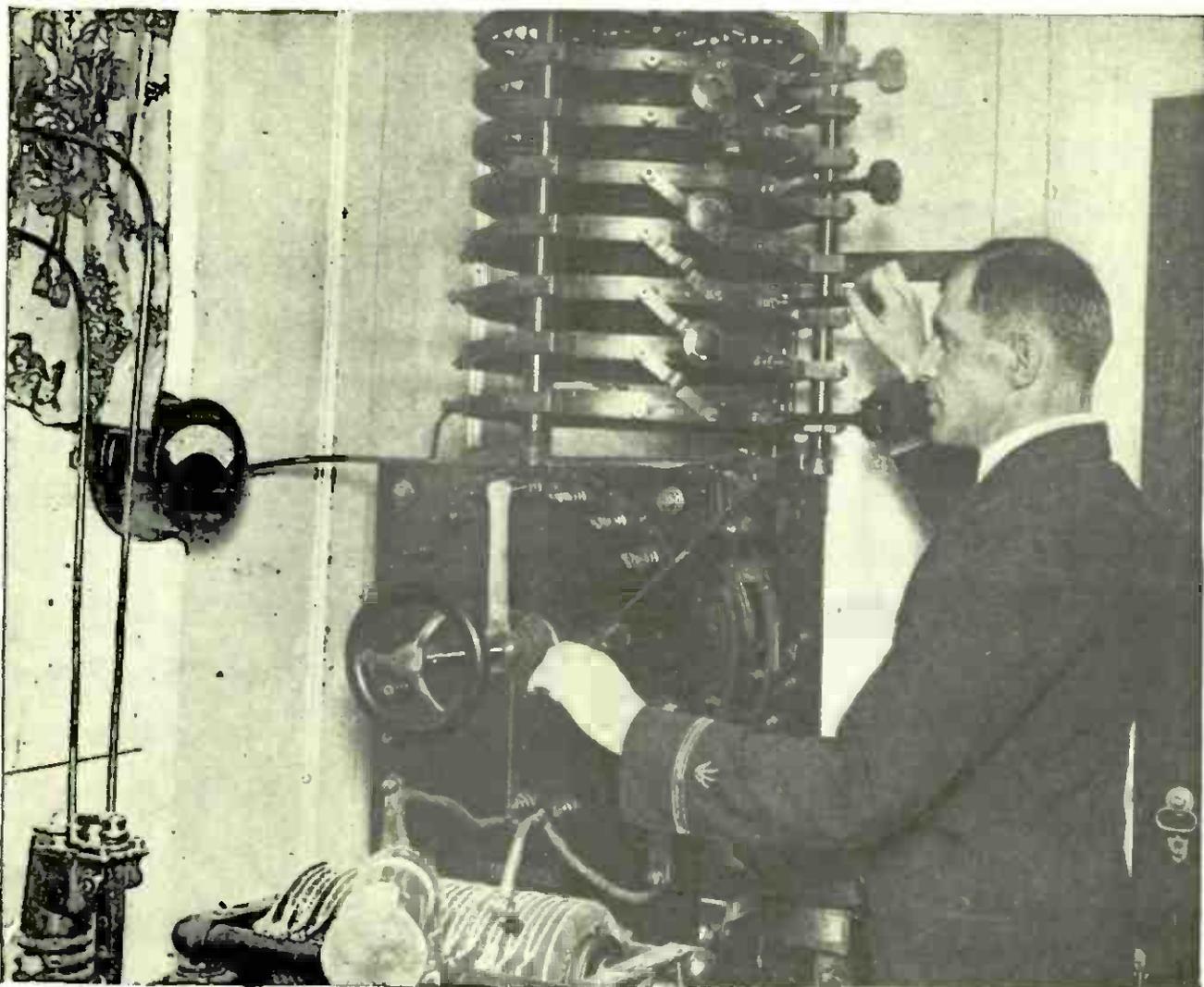
Barratt's Photo Press, London

THE FIRST RADIO MATHEMATICIAN

THE first man to provide mathematical explanations for some of the electrical phenomena associated with radio was LORD KELVIN (William Thompson). His paper "On Transient Electrical Currents," written in 1853, has become classical as a mathematical unfolding of the character of the discharge of a Leyden jar. Similar investigations in the same field that have contributed to radio science were his mathematical studies in electro-dynamics.



Brown Bros.



Kadel & Herbert

ADJUSTING INDUCTANCE ON A SHIP'S RADIO TRANSMITTER

The radio operator adjusts the coupling with the left hand and changes the inductance of the loading coil with the right hand. These changes have to be made carefully in order to get the greatest possible radiation and a sharp wave in the case of the spark sets.

What "Inductance" Means to Your Set

In the ordinary radio circuit are found three electrical properties: *resistance*, *inductance* and *capacity*. In POPULAR RADIO for July the author told how resistance affects the constants of a radio circuit; in this article he tells what *inductance* is

By JULIAN K. HENNEY

THE year 1831 was a memorable one in the history of electricity, for that year marked the date of the discovery of electromagnetic induction by

Michael Faraday, Professor in the Royal Institution in London. Were it not for this phenomenon, whereby a change of current in one circuit sets up currents in

another circuit, not metallicly connected, there would be no motors, no dynamos and no radio.

Electricity would exist in the form produced by chemical action, such as modern dry cells, and by rubbing the cat's back. It would be useful in producing light and heat in limited quantities, but the many other applications to which this natural energy has been placed would be non-existent.

Faraday's experiment is now part of the stock and trade of any high school course in physics. Two coils of wire, a dry cell E, and an indicating instrument G, such as a galvanometer, and a switch S are all the instruments that are needed.

The arrangement of such an experimental set-up is shown in Figure 1. The two coils L1 and L2 are placed near each other, and the current made and broken in the first circuit, known as the "primary." As the current is turned on or off, a slight movement of the pointer shows that a minute current has been "induced" in the secondary winding. As long as the current flows steadily in the primary, no deflection is noted. It is only at the *make* or the *break*.

The two principles underlying the phenomenon of induction are stated simply as follows:

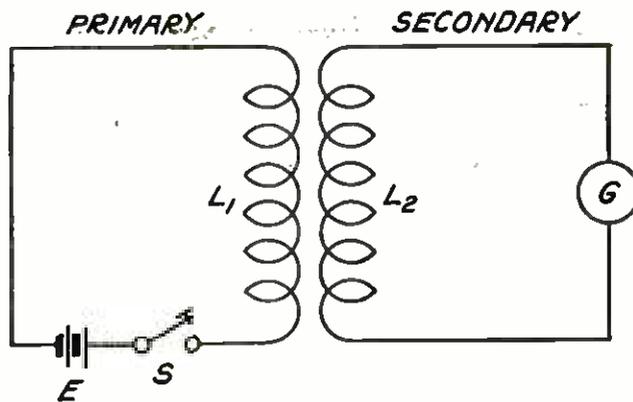
1. Any coil of wire in which a current is flowing will have a north and south pole and the coils will be surrounded by magnetic lines of force like a horseshoe magnet.

When the current is turned on or off these lines of force *move out from the coil or fall back upon it*.

2. Any other coil, placed so that these lines of force move through it, will have an electric current induced in it.

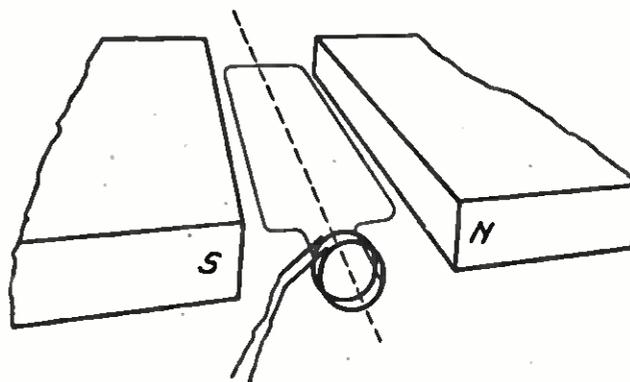
From these two principles, which are practically the converse of each other, have come the motor and the dynamo. The coil of wire carrying a current will tend to orient itself with respect to a magnet just like any other magnetized material. If the magnet moves, the coil will tend to follow, and a motor results.

Conversely, a coil of wire rotated in a magnetic field will have a current set up in it. In Figure 2 is shown an elemen-



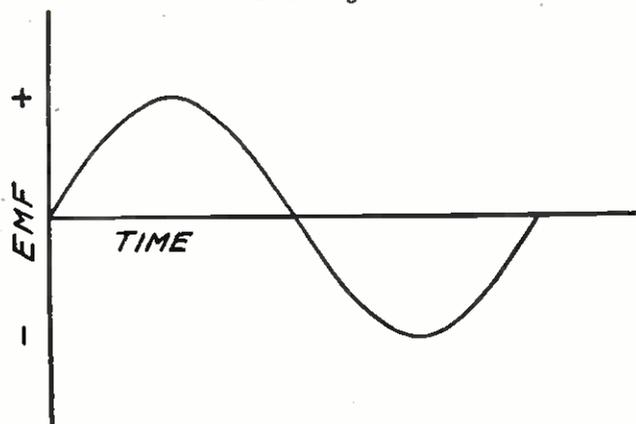
A TEST FOR INDUCTION

FIGURE 1: When key S is opened or closed, galvanometer G flickers, thus showing that the building up or collapsing of the lines of magnetic force about coil L1 have induced a current in coil L2.



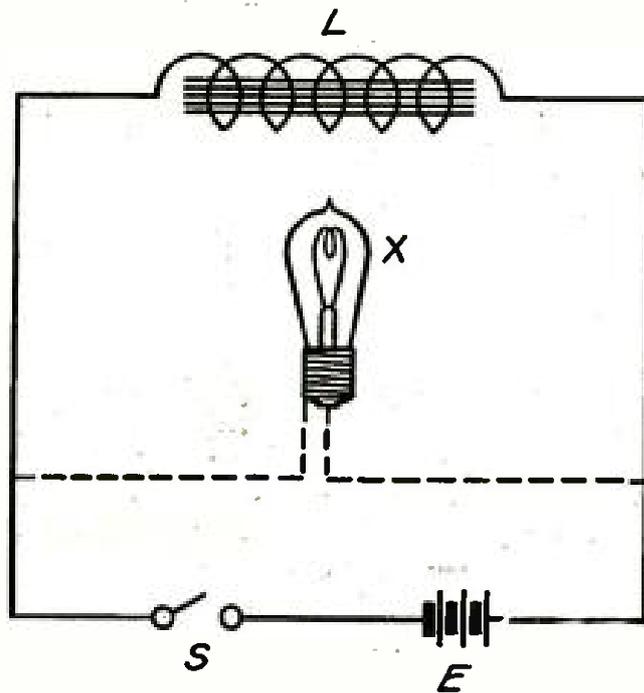
HOW THE GENERATOR WORKS

FIGURE 2: As the wire of the armature rotates between the magnetic poles pieces, it cuts the magnetic lines of force that lie between them, and a current is induced in the wire which is carried from the armature by the brushes that press against the rings. As the direction in which the wire cuts the lines of force reverses on each half revolution, the current is an alternating one.



HOW ALTERNATING CURRENT LOOKS

FIGURE 3: If the change in the voltage of alternating current is plotted graphically, it will produce a curve as shown above. Each wire that carries the current becomes alternately positive and negative.



INDUCTION WILL LIGHT THE LAMP
FIGURE 4: When key *S* is opened, the collapsing lines of magnetic force about the core of magnet *L* cut the wire of the magnet and induce a current that flashes the lamp.

tary alternating-current dynamo. When the coil passes the two magnets, the lines of force are cut most rapidly by the windings and the greatest amount of current is induced. When the coil moves parallel to the lines of force, no current is induced. The net result of one revolution is shown on the curve in Figure 3, representing one complete "cycle" of alternating current.

There are two kinds of induction, "mutual," illustrated by Faraday's experiment, and "self-induction" which is pictured in Figure 4. Here the lines of force from any one turn cut adjacent turns of the same coil, so that a current is set up in them—even though they are part of the original winding.

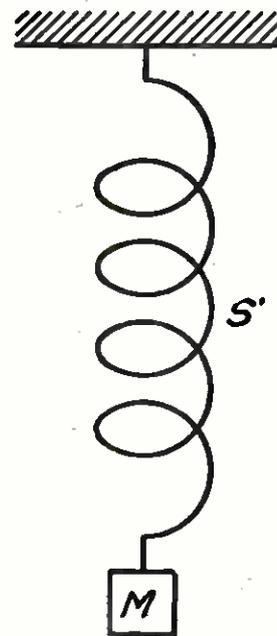
Consideration of the law of the conservation of energy makes it necessary for this induced current to be in an opposite direction to the exciting current, for otherwise the resultant energy would build up and no one could tell where such a process would stop. Lenz's Law states this principle.

In any circuit the induced electromotive force and the induced current depend

chiefly upon the "amount of cutting" of lines of force. This in turn is controlled by the number of turns of wire and the current flowing in the primary coil. The "amount of cutting" is termed the inductance of a coil, and the unit is named after the American mathematician and physicist, Joseph Henry.

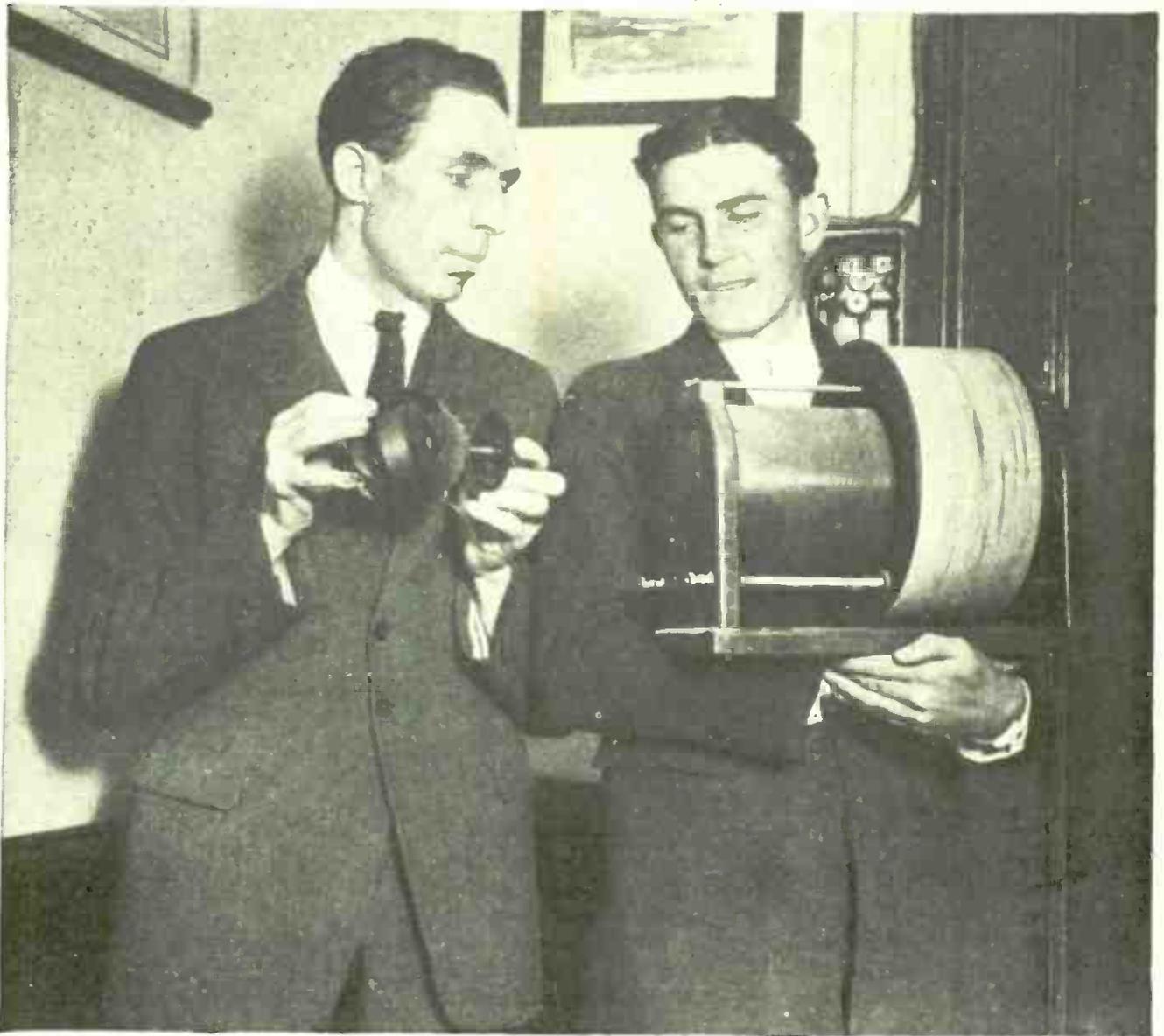
When the induced electromotive force amounts to one volt and is caused by a current changing at the rate of one ampere-per-second, the unit of inductance is said to be one henry. The henry is a very large unit, and radio-frequency coils for the ordinary range of wavelengths seldom have an inductance above a few milli-henries (thousandths of a henry).

To illustrate the effect of induction we may connect a large electromagnet *L*, a battery *E*, a key *S*, and a small lamp *X*, as shown in Figure 4. When the key *S* is closed, current flows in the winding *L*, lines of force cut the many turns of wire, and a current, due to self-induction, is set up. According to Lenz's Law the direction of this induced current must be opposite to that of the exciting current.



HOW RESONANCE WORKS

FIGURE 5: If the weight *M* is pulled down and then released, it will move up and down in regular time, depending on the strength of the spring and the weight. Similarly, a coil of wire has an electrical resonance which depends on the number of turns of wire, the spacing and other physical dimensions.



Kadel & Herbert

MODERN INDUCTANCE COILS ARE SMALLER THAN THEY WERE
At the right is a loose coupler which was in use twelve years ago. At the left is a modern variocoupler which performs the same electrical function as the bulky, old-style instrument.

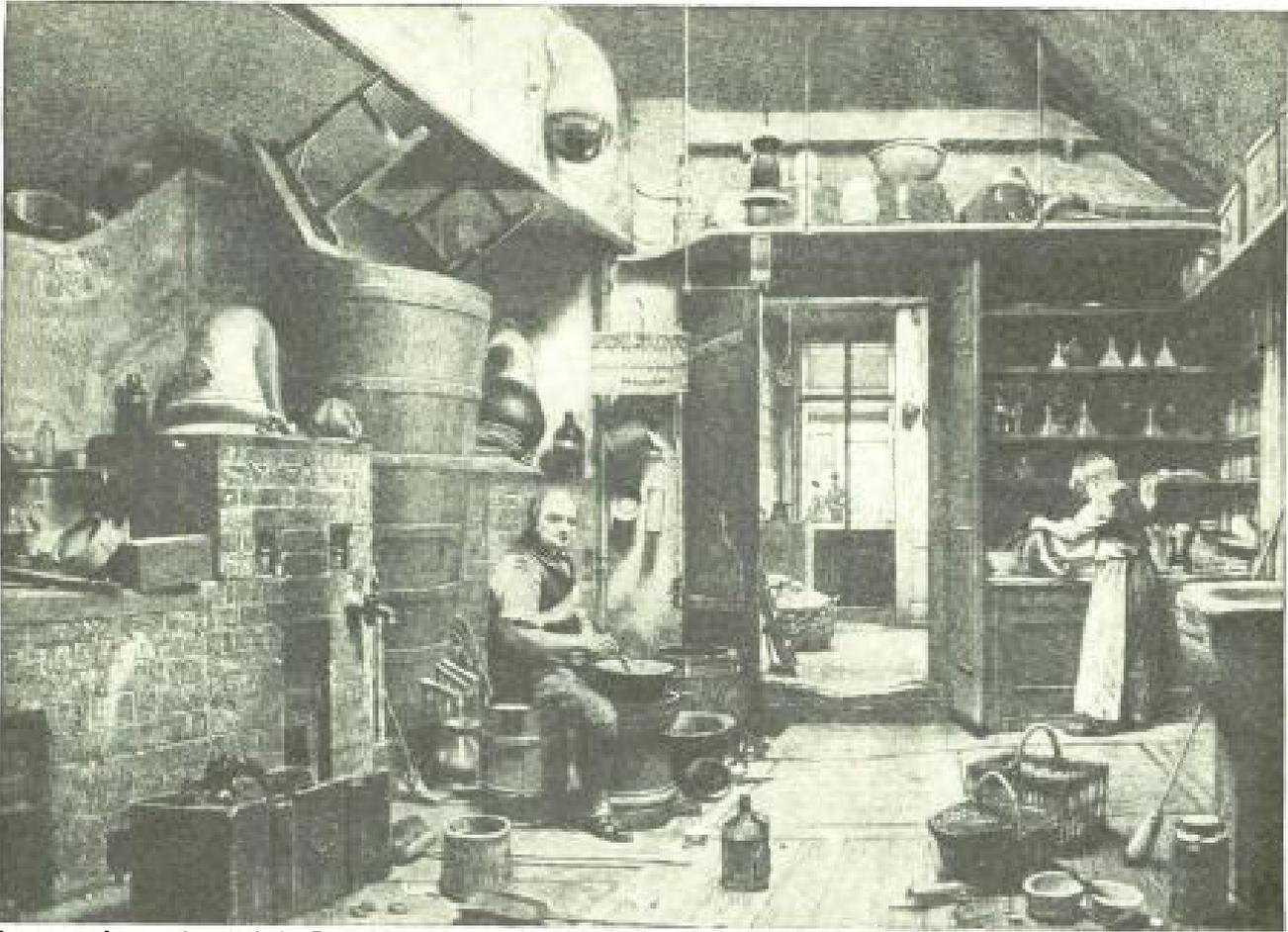
For this reason several seconds may elapse before the magnetic field is built up, and the maximum flow of current is reached.

When the key S is opened, the lines of force collapse back upon the coil L, a current is induced in such a direction as to keep the exciting current *flowing*, and a rush of energy takes place across the gap at the key. This is made evident by the spark that occurs between the points of the key.

A lamp X of higher resistance than the magnet windings L (placed as shown in the dotted lines) will flash up when

the key is closed and the current is hindered in its journey through the coil. After the lines of force through the magnet are established and no more energy is required to move them, the current divides, and the lamp dies down. When the key is opened, the rush of current takes place through the lamp instead of the gap at the key.

A severe shock may be felt if both wires are touched at the time of breaking the contact, for not only does the experimenter get the effect of the normal current but the added induced current as well. This "make and break" system is

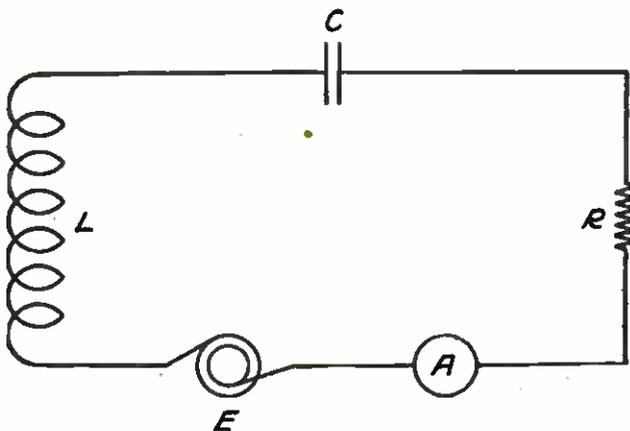


From a steel engraving made by J. G. Murray, 1842, owned by the Chemists' Club, N. Y.

THE FIRST LABORATORY OF THE DISCOVERER OF THE LAWS OF INDUCTION

Michael Faraday, the scientist who later discovered the laws of electromagnetic induction, started his career as a dishwasher and pupil of the great chemist, Sir Humphrey Davy, in the famous laboratory of the Royal Institute in London.

often used for lighting gas jets, or cigar lighters, or for the ignition on motor boat and stationary engines. A coil with an iron core, a battery, and a timer which



HOW RESONANCE IS TESTED

FIGURE 6: In an electrical circuit, the frequency of oscillation depends on the inductance and the capacity. When generator *E* is run at varying speeds, some one speed will produce a frequency that will give the highest reading in ammeter *A*.

opens and closes the circuit at the proper intervals comprise this form of ignition.

A comparison of inductance with resistance has a mechanical analogue in the comparison of inertia with friction. Resistance opposes any flow of current; inductance opposes a change in direction or magnitude of current. Friction opposes any motion; inertia opposes a change in direction or magnitude of motion. Thus, in the realm of direct current electricity, inductance plays a relatively unimportant role. In alternating current circuits, however, the effect of inductance may be many times that of resistance. This is particularly true of high-frequency, alternating current with which radio has to deal.

Another mechanical illustration will show the effect of inductance upon a high-frequency circuit.

The spring shown in Figure 5 will vibrate at a certain frequency if disturbed from a position of rest. This frequency—be it five vibrations per second, or a hundred—is determined by the stiffness of the springs, and the inertia of the mass *M*. Energy applied to this system must overcome these two forces as well as the resistance of the air.

If the spring is disturbed at a certain rate, known as the natural frequency, the greatest amount of vibration will result. In an imperfect way this represents what in electrical terminology is known as resonance.

An alternating current flowing in a circuit as shown in Figure 6 will give a certain response in the ammeter. It will be found that at some particular frequency the current will be at a maximum. This is known as the natural frequency of the system, and is determined by the inductance of the coil, and the capacity of the condenser—a property of electrical circuits which will be discussed in the *third* of these articles.

The process of tuning consists in varying either the inductance or capacity of a circuit in order to get maximum current flow.

The application to radio receiving is illustrated by Figure 7. Here is an antenna *A* in which current of definite frequency is flowing. The "secondary" of the receiving circuit is tuned by means of a condenser *C* or a change in the inductance of the coil until maximum response is heard.

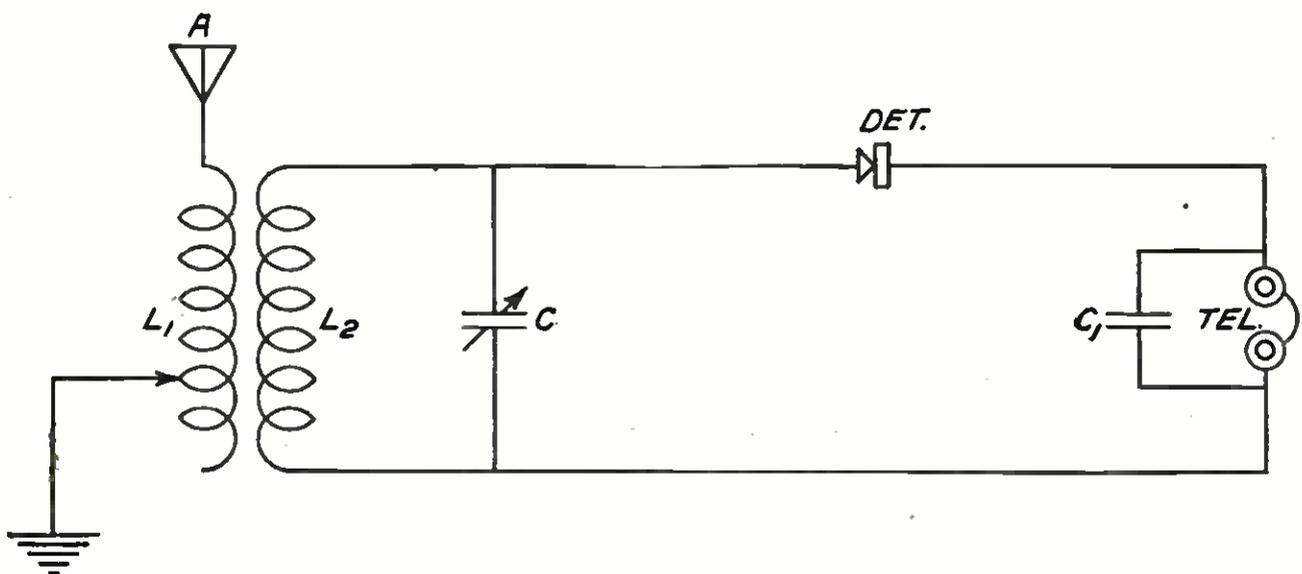
The relation between wavelength and its components is

$$\text{Wave length} = 1884 \sqrt{\text{inductance} \times \text{capacity}}$$

$$\text{Wave length} = 1884 \sqrt{LC}$$

Where *L* is inductance in microhenries, *C* is the capacity in microfarads.

For instance, if a broadcasting station operating on 360 meters is to be received, the product of *L* and *C* must be .03648. If we own a "twenty-three-plate variable" whose maximum capacity is about .0005 microfarad, our coil should have an inductance of about 200 microhenries. Charts have been given in POPULAR RADIO for the winding of coils of any desired inductance, and in various publications may be found tables of the product of *L* and *C*. By varying the condenser mentioned above, with an inductance, signals from a range of about 170 to 600 meters can be received.

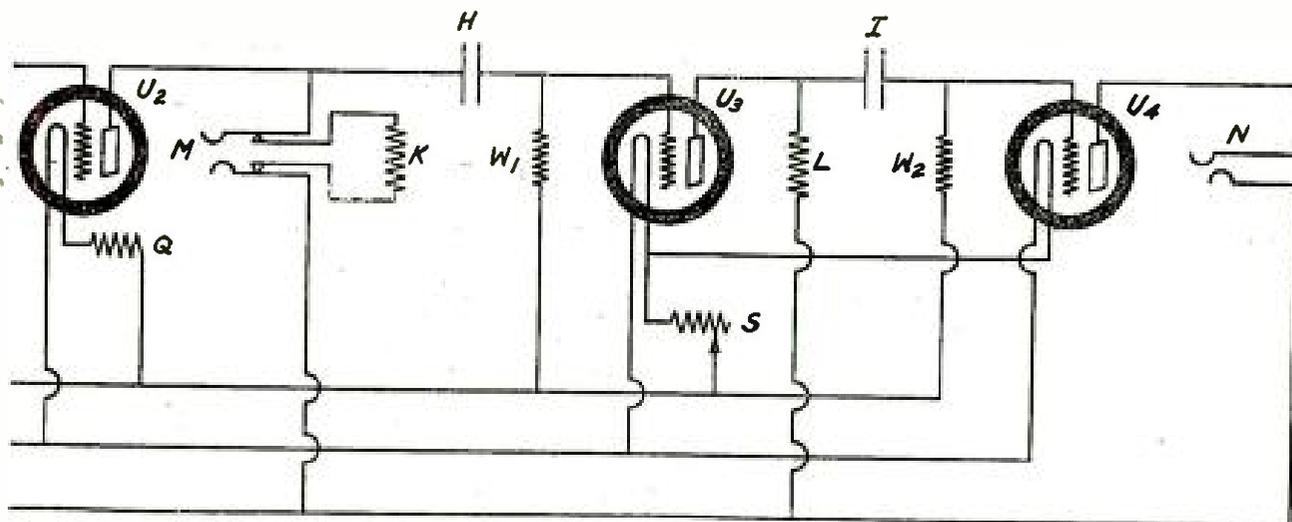


HOW RESONANCE WORKS IN RADIO

FIGURE 7: Compare this diagram with Figure 6 and see how the inductance, capacity and resistance are duplicated (the resistance of the radio receiver is in the wire, etc.). Radio currents flowing in *L1* induce currents in *L2* and maximum response is secured when variable condenser *C* is adjusted to resonance.

THE COMPLETE CIRCUIT DIAGRAM

FIGURE 1: This is the hook-up for the improved regenerative receiver. All the symbols for the instruments bear designating letters which reappear in the list of parts on the opposite page and throughout the text and the illustrations.



X—sub-base;
Y1—antenna connection block;

Y2—battery connection block;
Y3—brass brackets;
Z—cabinet.

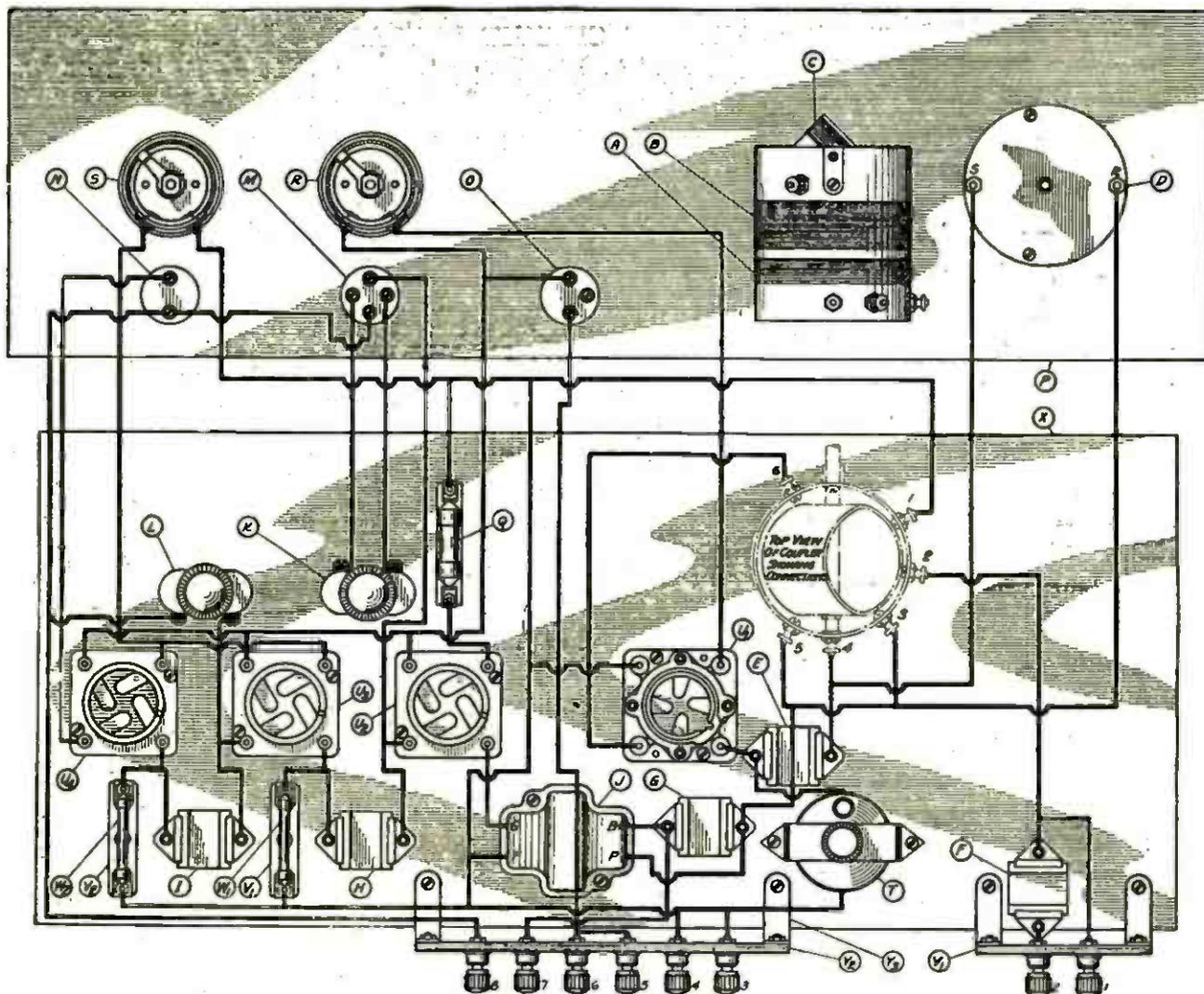
SO many radio enthusiasts are using the "Real DX Regenerative Receiver" which was described in the January, 1923, issue of POPULAR RADIO, and so many requests are received for information about improvements for this set, that the POPULAR RADIO Laboratory has worked out a new embodiment of this design which incorporates all the good features and eliminates many of the troubles experienced with the former set.

In this new and improved set only a single variable condenser is used and the plate variometer has been reduced to a simple form of tickler coil. Otherwise, the tuning circuit remains substantially the same except that the frequency range has been broadened to take in the whole broadcasting range from 200 meters to 536 meters. In addition to this the same type of amplification that was used in the last Four-circuit Tuner has been incorporated in the set described in this article.

The whole set has been arranged with a view to obtaining the following features:

- (1) Maximum amplification as obtainable from a regenerator:
- (2) Sufficient selectivity to allow tuning in distant stations through the local stations:
- (3) A receiver that can be used on an outdoor, or on an indoor antenna:
- (4) Truthful reproduction:
- (5) Ample volume for distance reception on a loudspeaker:
- (6) Low cost of construction:
- (7) Simplicity of operation.

The set contains the modified DX Coupler with an aperiodic primary and a secondary coil shunted by a variable condenser. The general scheme of hook-up for the tube circuit is the familiar ultra-audion scheme of DeForest with the addition of a novel tickler connection. One stage of transformer-coupled audio-frequency amplification is used next to the vacuum-tube detector and two additional stages of resistance-coupled amplification are used after this stage.



THE WORKING PLAN FOR CONNECTING UP THE INSTRUMENTS

FIGURE 2: The upper rectangle represents the panel and on it the instruments are drawn just as they appear. The lower rectangle represents the baseboard; the instruments are drawn in about their relative positions. The heavy black lines show the way to wire up the mounted instruments.

This combination gives results superior to any other form of audio-frequency amplification that has been tried out in the laboratory.

All of the apparatus is mounted on a standard 7 by 24-inch panel and sub-base, with a standard cabinet of the same dimensions as used for the five-tube Four-circuit Tuner. The schematic wiring diagram for this receiver is shown in Figure 1. The picture wiring diagram which shows the instruments as they appear and the connecting wires as they actually go in the set, is shown in Figure 2.

Parts Used in Building the Set

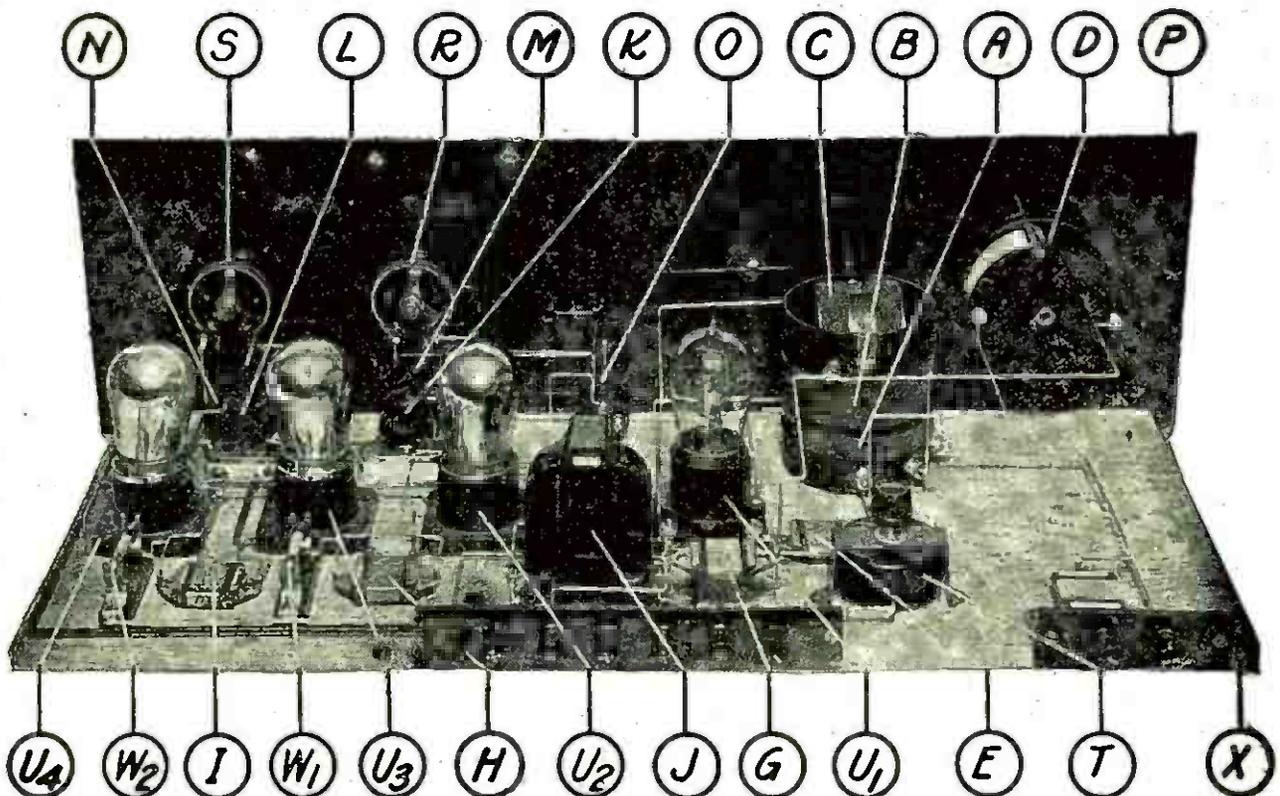
In all the diagrams in this article each part bears a designating letter; in this way, the

prospective builder of a set may easily determine how to mount the instruments in the correct places and connect them properly in the electric circuit.

The same designating letters are used in the text and in the list of parts at the beginning of the article.

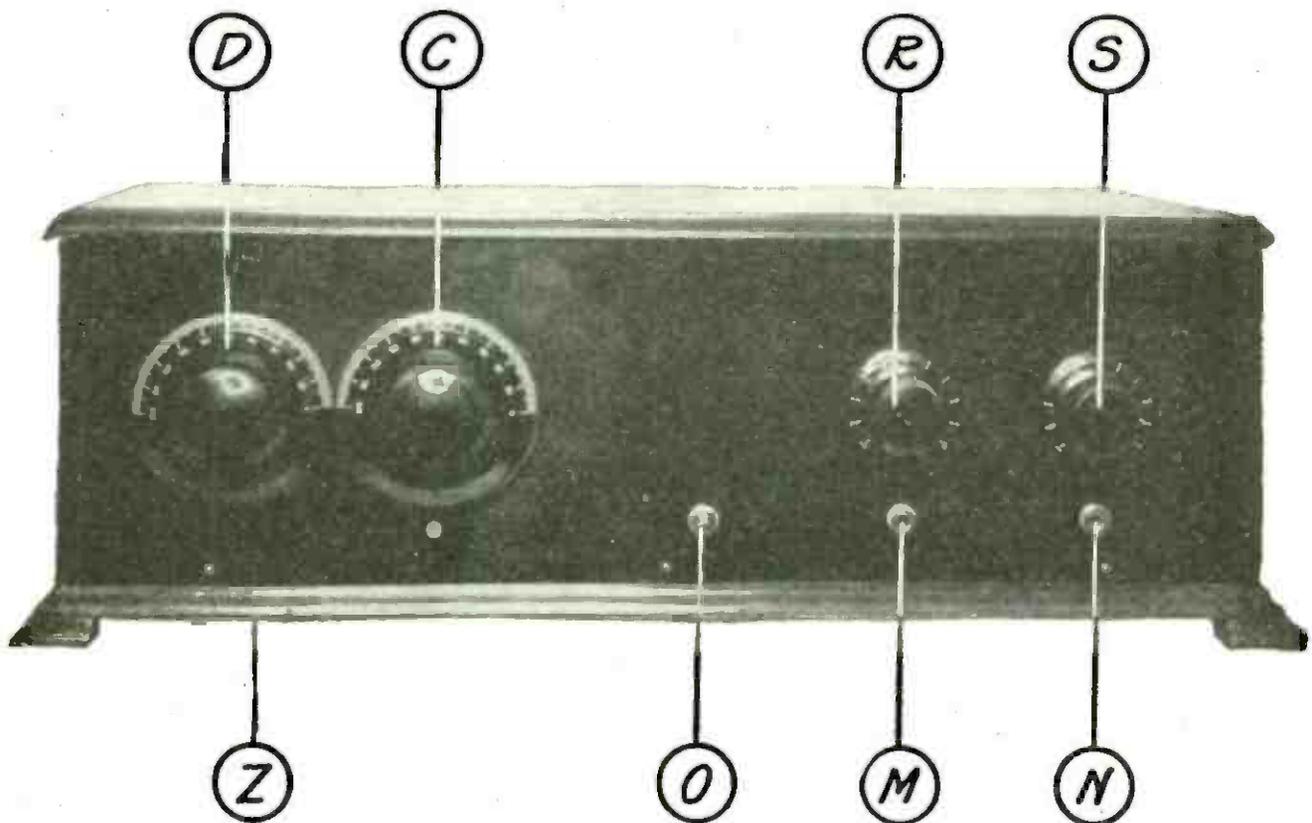
The list of parts there given includes the exact instruments used in the set from which these specifications were made up. The experienced amateur, however, will be able to pick out other reliable makes of instruments which may be used with equally good results. But, we recommend that the novice follow the list. For the diagrams in this article will tell him exactly where to bore the holes and exactly where to place the connections.

If instruments other than the ones listed are used, the only change that will be necessary will be the use of different spacings for the holes that are to be drilled in the panel for mounting the instruments.



VIEW OF THE SET FROM THE REAR

FIGURE 3: This picture shows the general arrangement of all the instruments fastened to the panel or base. The exact locations for the instruments are shown in Figure 5.



THE PANEL VIEW OF THE RECEIVER

FIGURE 4: This gives an idea of how the set looks from the front and as the dials and knobs are marked with letters which correspond to the instruments to which they are attached, the prospective operator will have no trouble in locating the various tuning controls as they are explained in the instructions for tuning.

How to Construct the Set

After procuring all the instruments and materials for building the set, the amateur should prepare the panel P. (Shown in Figures 3, 4, 5, 6, 7 and 8.)

First of all, cut the panel to the correct size, 7 by 24 inches.

Then square up the edges smoothly with a file. The centers for boring the holes (which are necessary for mounting the instruments) should be laid out on the panel as shown in Figure 8. A convenient method of doing this is to lay out all center holes on a piece of paper the same size as the panel; then the piece of paper should be fastened on the panel and the centers marked directly on the panel by punching through the paper with a sharp, pointed instrument.

If all the holes to be drilled are first started with a small drill, one-sixteenth inch in diameter or less, they can be more nearly centered.

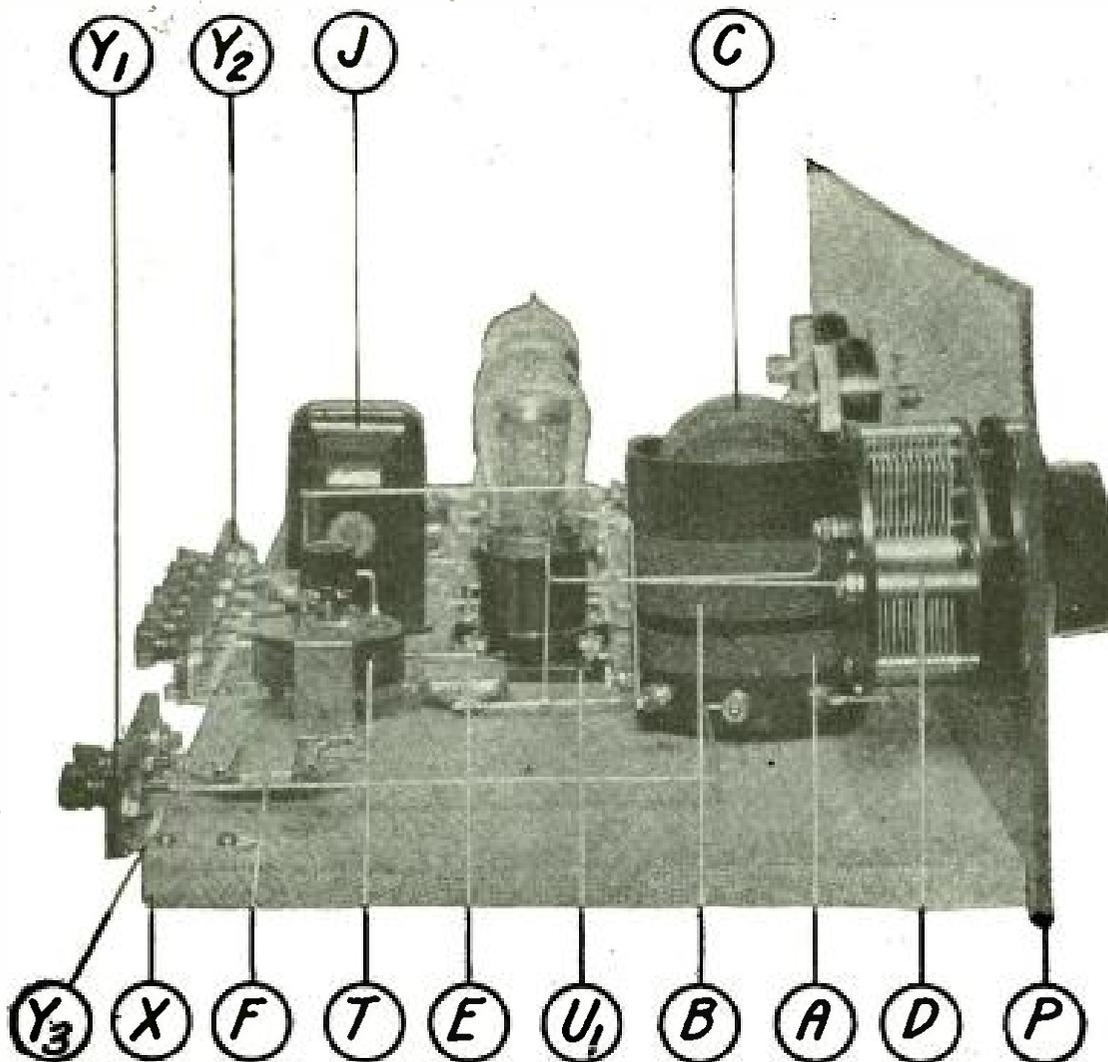
The holes outlined with a double circle

should be countersunk, so that the flat-head machine screws used for fastening the instruments will be flush with the panel. All the rest of the holes in the panel are straight-drill holes. Sizes for the diameter of these holes have not been given, but the builder will readily decide what size hole is necessary by measuring the size of the screws and shafts of instruments that must go through the holes.

When the panel is drilled, the builder may give it a dull finish by rubbing the face of the panel lengthwise with fine sandpaper until it is smooth. This process should be repeated, except that light machine oil should be applied during the second rubbing. Then rub the panel dry with a piece of cheesecloth. A dull permanent finish will be the result. Or, the panel may be left with its original shiny-black finish, if care has been exercised, so that it has not been scratched during the drilling.

After the panel has been prepared you are now ready to mount the instruments on it.

First fasten on the variable condenser D by means of the large nut that comes with the



VIEW OF THE SET AS SEEN FROM THE LEFT

FIGURE 6: This illustration shows the general manner of mounting the DX coupler, condenser and variable grid-leak.

instrument and then attach the dial to the shaft of the instrument.

Next mount the DX Coupler by means of two screws fastened through the panel P and attach the dial to this instrument. (See Figures 2, 3, 4, 5 and 6.)

Next fasten on the switch O and the two jacks M and N, in their respective places as shown in Figure 5. Then mount the two rheostats R and S by means of two screws to each rheostat and attach the knobs and dials. See Figures 4 and 5. This finishes the mounting work on the panel and it can be set aside for the time being.

Now prepare the baseboard. It should be cut from one-half inch hard wood to the size shown in Figure 5. Be sure that it is squared up properly when it will be ready for the mounting of the instruments.

First mount the four sockets U1, U2, U3 and U4 in their respective places as shown in Figures 3 and 5. These are fastened to the baseboard X by means of two wood screws to each instrument.

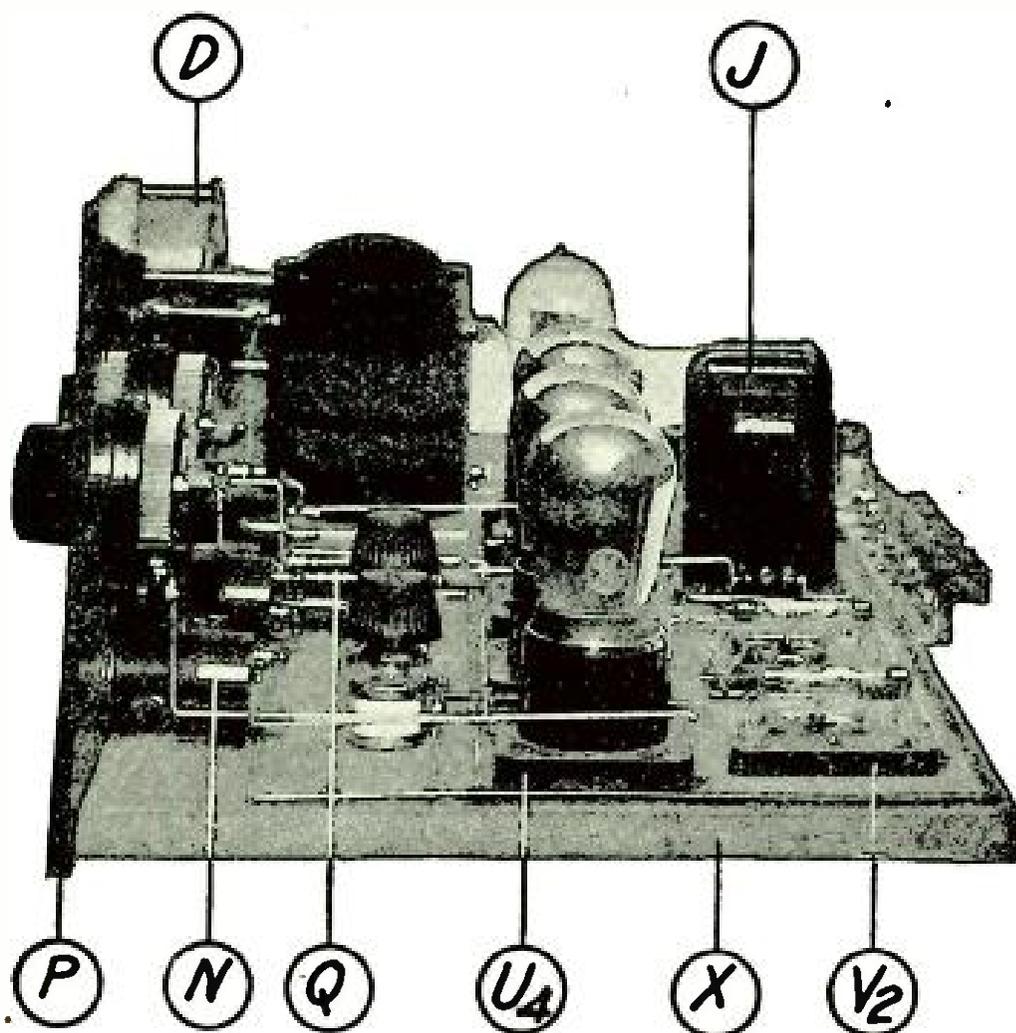
Then mount the two Bradleyohms K and L

with two thin wood screws fastened through the two holes in the instrument and into the wood of the base X. The amperite Q should then be fastened in its place by a single short wood screw as shown in Figure 5.

Next mount the transformer J and the grid-leak T as also shown in Figure 5. The grid-leak should be mounted with the small peep-hole turned around toward the front of the set. This instrument should be mounted by means of the brass bracket that will be found in the box in which the instrument is packed. This bracket should be fastened to the instrument by means of the thumb nut which is usually used to mount the instrument on a panel. Be careful that you have the transformer mounted with the terminals turned into the same position as indicated in Figure 2.

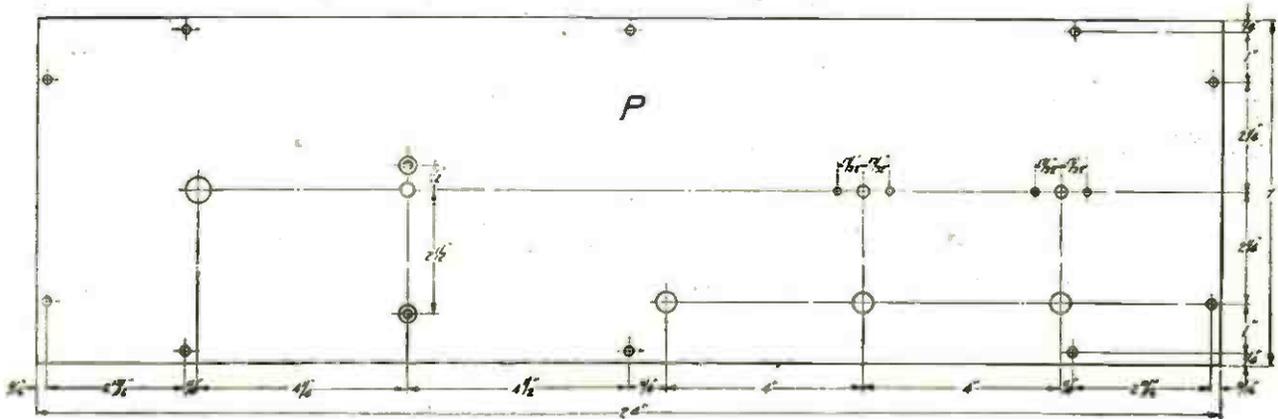
Then fasten the two Daven mountings V1 and V2 in their proper positions as indicated in Figures 5 and 7. These instruments require only a single wood screw to hold them to the base.

All of the mica fixed condensers are supported by the wiring and these should be left



VIEW OF THE SET AS SEEN FROM THE RIGHT

FIGURE 7: This end view indicates the manner of mounting the sockets, grid-leaks, Bradleyohms, rheostats and the jacks.



THE DRILLING PLAN FOR THE PANEL

FIGURE 8: This drawing shows where to drill the holes for mounting the instruments. The correct spacings are given for the holes. The holes outlined with a double circle should be countersunk. Always start drilling holes in the panel with a small drill—one-sixteenth is a desirable size.

to hook up after the connections are being made.

The last job on the sub-base is to prepare and mount the battery connection block Y2 and the antenna connection block Y1 by means of the brass brackets Y3; construction data on these three accessories appear in Figure 10. The connecting blocks should be mounted in the positions shown in Figure 5. The Eby binding posts Nos. 1-8 should then be fastened in the holes drilled for them in the two connection blocks Y1 and Y2.

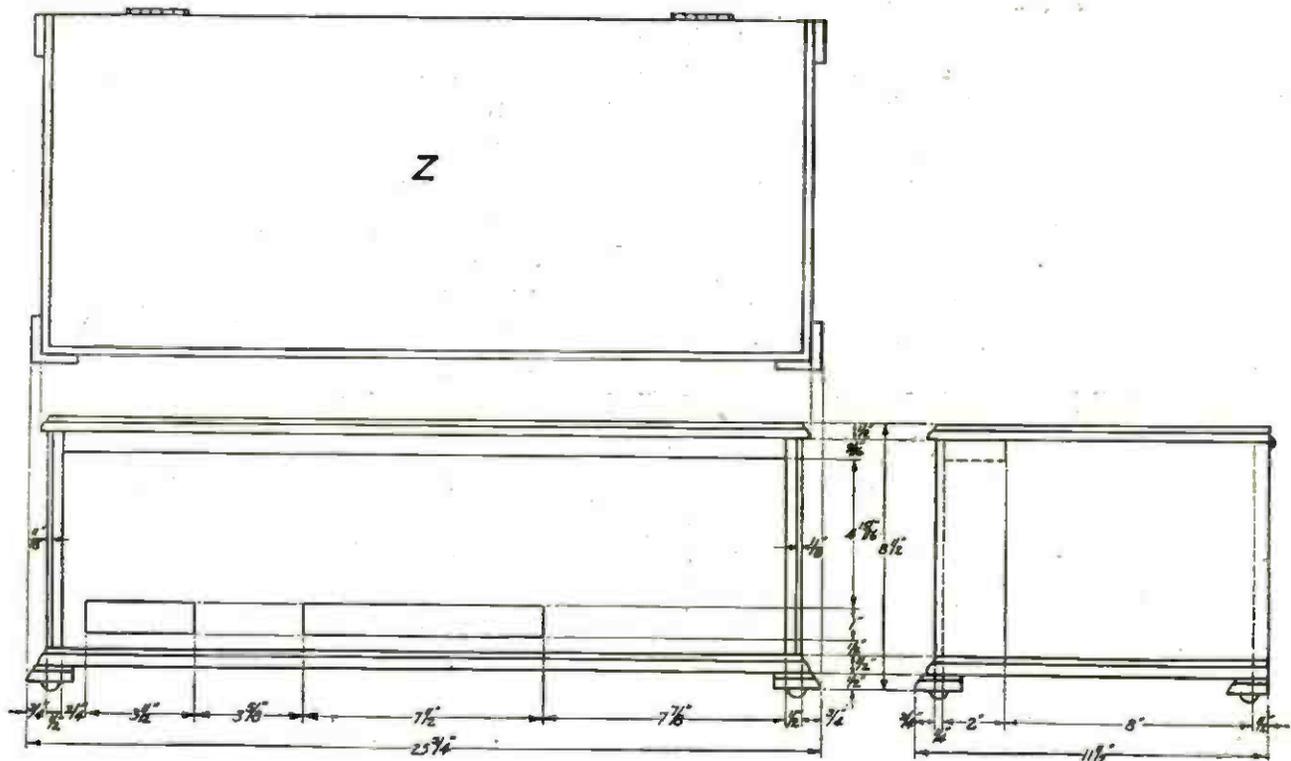
This completes the mounting of the instruments on the base which may be fastened at

right angles to the panel P by means of three wood screws inserted through the holes drilled for them in the panel and into the edge of the sub-base X.

When this has been done the set is ready to be wired up.

How to Wire the Set

The design of this set is such that the wiring of the grid circuit of each of the four tubes is made extremely short and is isolated from other parts of the circuit. In fact, this



THE DIMENSIONS FOR THE CABINET

FIGURE 9: This diagram (which contains the top, front, and side measurements for the walnut cabinet) may be turned over for construction to a competent cabinet maker who can build it from these directions exactly the right size for the panel.

idea has been employed throughout and the leads are so arranged that the shortest connections may be used. As this is the case, the set should be wired with bus-bars.

A tinned-copper, round bus wire is recommended. All connections should first be shaped so that they will fit and then soldered in place. Refer to the wiring diagram in Figure 1 and more specifically to the picture diagram in Figure 2 for the exact way in which to run the wires.

Start wiring up the primary circuit by running a wire from binding post No. 1 on the antenna connection block Y1 over to binding post No. 2 on the DX Coupler, which is comprised of the coils A, B, and C.

Next, solder one terminal of the mica fixed condenser F to binding post No. 2 on the antenna connection block Y1 and run a wire from the remaining terminal of this condenser to a junction with the first wire connection you have completed.

Next run a wire from the terminal marked (—) of tube socket U1 over to the right-hand terminal of rheostat R, looking from the rear of the set. Then run a wire from terminal marked (+) on the same socket over to the right-hand terminal of the rheostat S, looking from the rear. An extension of this last wire should be connected to the terminal nearest the panel of the amperite Q. Another extension should be run from this wire to the terminal No. 1 of the DX Coupler and this completes the wiring to the coil A of the DX Coupler.

Next remove the two screws fastening the grid-leak T to the base and fasten two one-inch pieces to the two terminals of this instrument.

Then connect the rear terminal of this instrument (the one to the rear of the set) to binding post No. 3 and from there to binding

post No. 4 and carry this wire to the left and connect it to the rear terminals of the grid-leak mountings V1 and V2.

Next run an extension from this wire to the terminal F of transformer J and then run another extension from this wire over to the terminal (+) of the tube socket U1.

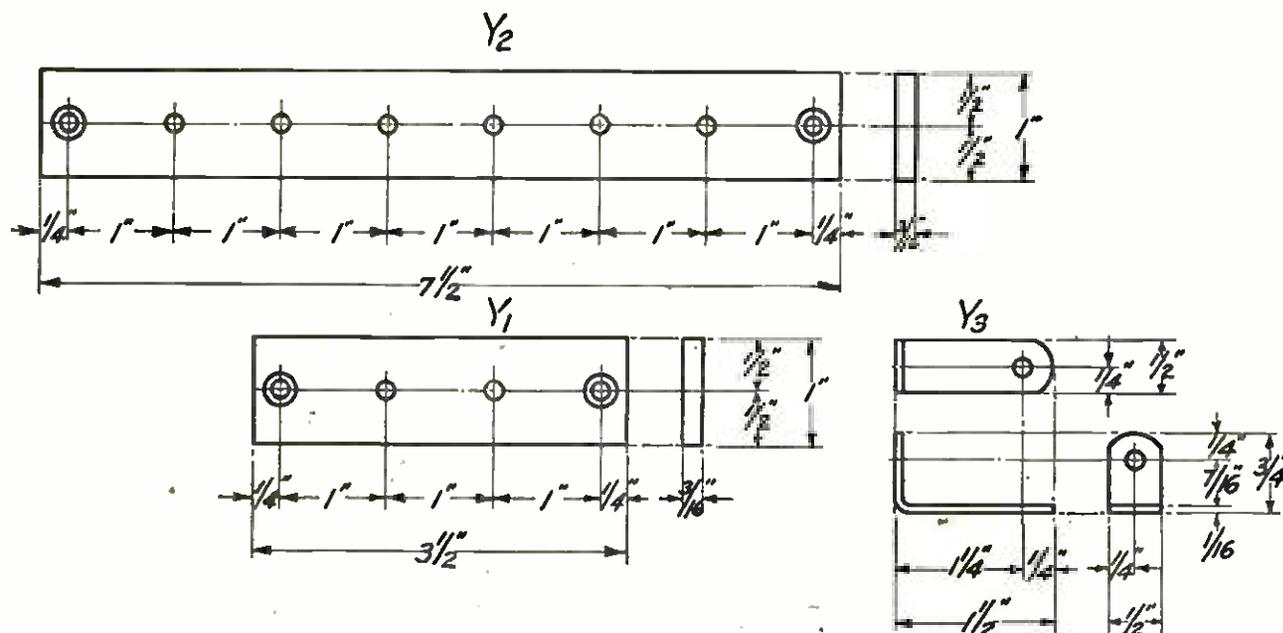
Next solder one terminal of the condenser E to the terminal G of the first tube socket U1 and run a wire from this point to the remaining terminal of the grid-leak T. The remaining terminal of the grid condenser E should be connected to post No. 4 on the coupler and an extension of this wire run over to the left-hand terminal of the condenser D. The right-hand terminal of the condenser D should be connected to post No. 3 of the DX Coupler and then run over to post No. 5 of the same coupler and then extended from here to the post P on the transformer J.

Next connect the two binding posts Nos. 5 and 6 on the block Y2 together with a wire and run a wire from here over to the bottom terminal of the switch O. The top terminal of the switch O should be connected to the left-hand terminal of the rheostat R by a wire and an extension run to the left-hand F terminal on the socket U2 and then to the same terminal on U3 and the same terminal on U4. The intermediate terminal on the switch O is left disconnected.

Then connect terminal No. 6 on the DX Coupler with the terminal marked P on the first tube socket U1.

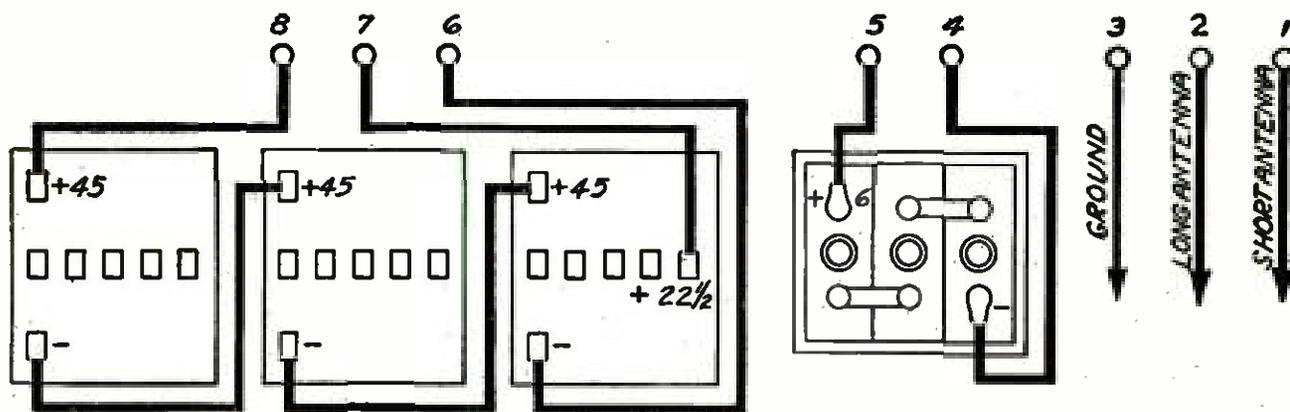
Be careful to follow the diagram in Figure 2 while you are doing this work.

Now, run a wire from binding post No. 7 on the block Y2 to the terminal marked B+ of transformer J and to this solder one terminal of the condenser G. The other terminal of the condenser G should be soldered to the



DETAILS OF THE CONNECTION BLOCKS AND THE SMALL BRASS BRACKETS

FIGURE 10: This drawing gives the necessary data for making the insulated blocks or strips on which the binding posts are to be mounted. It also gives the dimensions for the small brass brackets that are used to fasten the blocks to the baseboard.



HOW TO HOOK UP THE BATTERIES

FIGURE 11: This drawing prevents you from making mistakes in connecting the batteries to the terminals. If you follow these instructions the set will be hooked up correctly because the terminals shown in the wiring diagrams are marked with designations that correspond with the numbers given here.

wire running to terminal P on the transformer J.

Next run a short wire from the right-hand F terminal of the socket U2 and connect it with the remaining terminal of the amperite Q. Then with a wire connect the right-hand F terminals of the sockets U3 and U4 and run an extension of this wire over to the left-hand terminal of the rheostat S. Next connect the two bottom terminals of the jacks M and N together with a wire and run an extension around the left-hand side of the set and over to the binding post No. 8 on the battery connection block Y2. A short extension of this wire should also be run to the left-hand terminal of the Bradleyohm L. The right-hand terminal of this instrument should be connected to the terminal marked P on the socket U3 and a wire continued from here to the right-hand terminal of the condenser I. The remaining terminal of this condenser should be connected to the terminal marked G of socket U4 and also to the remaining terminal (which is turned nearest the panel P) of the grid-leak mounting V2.

Next connect the two terminals of the Bradleyohm K to the two horizontally spaced terminals of the jack M.

Now run a wire from the top terminal of the jack M over to the terminal marked P on the socket U2 and continue this wire over to the right-hand terminal of the condenser H. The remaining terminal of this condenser

should be connected to the terminal marked G on the socket U3 and also to the remaining terminal (which is turned nearest the panel P) of the grid-leak mounting V1.

Then connect the top terminal of the jack N to the terminal marked P on the socket U4.

The terminal marked G on transformer J should be connected to the terminal marked G on the tube socket U2.

How to Install the Set

After the wiring has been completed the cabinet may be attached by means of wood screws (nickel plated) inserted through the panel into the woodwork of the cabinet.

The terminal binding posts Nos. 1 to 8 on the connection blocks Y1 and Y2 will now protrude through the two slots cut for them in the back of the cabinet.

To connect the set do the following: Attach the antenna lead-in wire to either binding post No. 1 or No. 2. (If you are using a regular, long outdoor antenna the lead-in wire should be connected to binding post No. 2. If, however, you are using a short outdoor antenna or an indoor antenna the lead-in wire should be connected to binding post No. 1.)

Connect the ground wire to binding post No. 3.

Connect the negative terminal of the 6-volt storage "A" battery to terminal No. 4.

Connect the positive terminal of this same battery to terminal No. 5.

Working Blueprints of This Receiver

IN order to accommodate readers who may desire actual-size diagrams of this Improved DX Regenerative Receiver, a set of three blueprints has been prepared, consisting of—

- One panel pattern (actual size);
- One instrument layout;
- One picture diagram of all parts, showing the wiring.

This set of three prints will be forwarded, postage prepaid, upon receipt of \$1.10

Connect the negative terminal of the 135-volt "B" battery to binding post No. 6.

Connect a 22½-volt tap on this same battery to binding post No. 7.

Connect the positive terminal of the 135-volt block of "B" battery to terminal No. 8.

Be sure that these connections are made as shown in Figure 11.

Next be certain that the small knob of the switch O is pushed in so that the batteries are turned off.

Then insert the UV-200 detector tube into the tube socket U1. Then insert three C-301-a tubes or three UV-201-a tubes in the sockets U2, U3 and U4. Pull out the switch knob O and adjust the rheostats R and S for the correct filament current of the tubes.

Insert the loudspeaker plug into the jack N and the set is then ready for use.

Operating Data

The approximate setting for both of the rheostats will be found to be about three-quarters of the way towards the "on" position.

Set the knob on the grid-leak T so that the Figure "5" shows in the small peep hole.

Next set the knob of the tickler control C at approximately zero on the dial. Then by

rotating the knob of the condenser D, the various stations may be picked up.

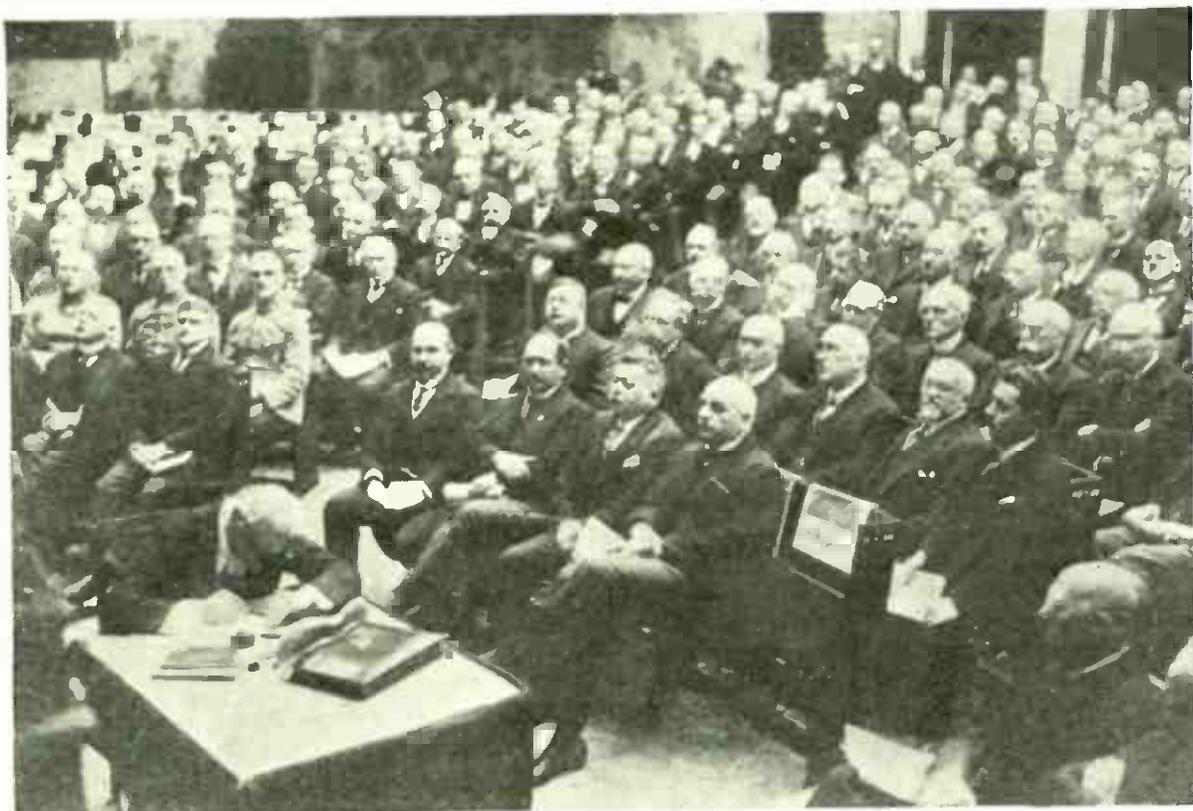
By careful rotation of the tickler coil C the strength of the signals received may be controlled so that the proper volume is obtained. (It may be necessary to reverse the setting of the coil C on the knob because the signals from stations should be of minimum loudness when the knob C is set at zero. This can be easily determined from experience.)

The proper way to determine the settings for the two Bradleyohms K and L is to screw them down rather tight and then, after a signal is tuned in, to turn the knobs in an anti-clockwise direction until there is a click and the signal fades out. The knobs should be set just about a half turn clockwise from this point.

For an antenna, a regular, outdoor wire of about one hundred feet may be used with the lead-in connection to post No. 2 as previously explained. For an indoor antenna, about forty to sixty feet of wire strung in back of the picture molding may be used with good results. The lead-in in this case should be connected to the binding post No. 1.

The volume, selectivity, and tone quality that will be obtained, if the set has been built exactly as specified, will amply repay the builder.

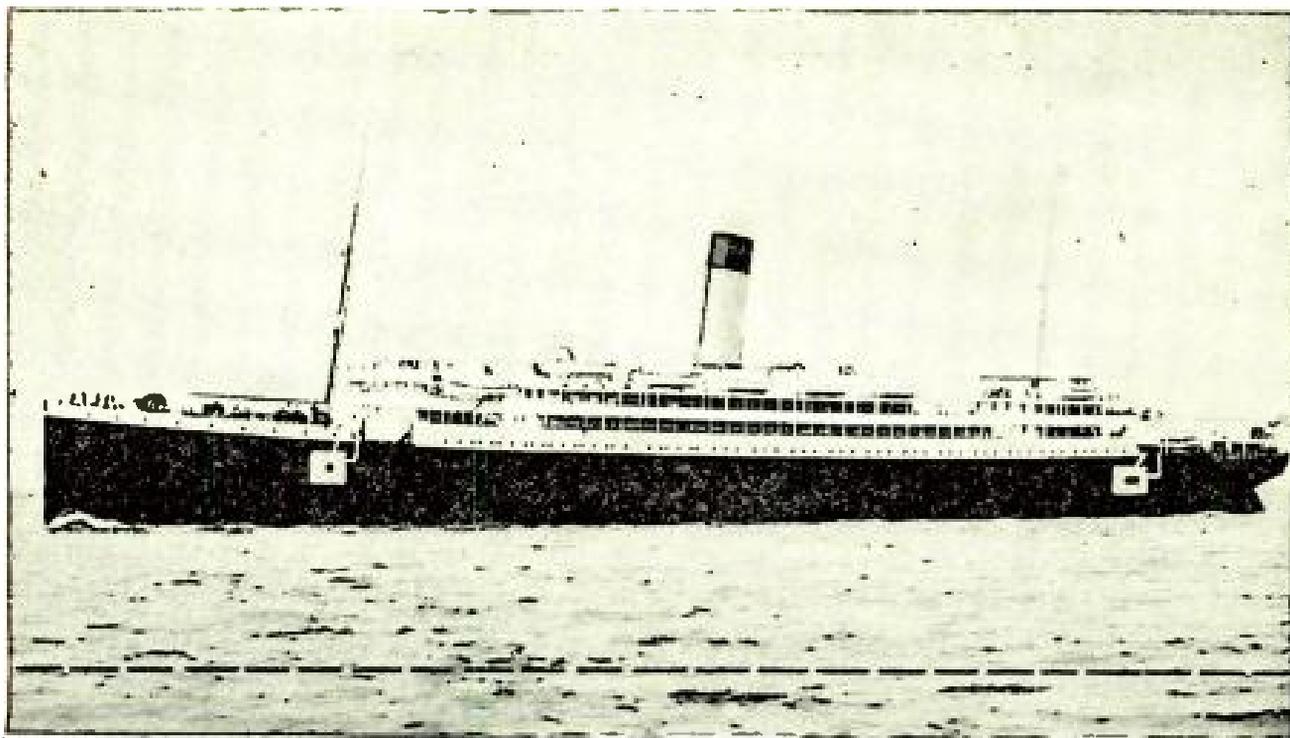
Attention is called to the fact that this article is protected under the provisions of Section 3 of the Copyright Law of the United States.



Gilliams Service

GERMANY DEDICATES A HALL TO RADIO

At the national radio exposition held recently in Berlin, a building that was completed last year for radio research was officially opened by German officials and scientists. This building is the first of its kind in Germany.



Gilliams Service

HOW THE "PHANTOM PILOT" WORKS

The white coils, forward and aft shown above on the side of the ship, pick up the inductive signals from the piloting cable, the position of which is indicated by the broken line at the bottom of the picture.

Piloting Ships by Radio

How the new piloting cable that is coming into use will save enormous sums of money to business by eliminating the delays of vessels which now wait outside fog-bound harbors—at a cost—ranging from \$500 to \$4,000 an hour.

By PHIL HARRIS

RADIO signals that emanate from piloting cables laid along channel beds will result in a saving of from \$500 to \$4,000 an hour for steamship companies. Only recently more than a dozen passenger ships were held up outside New York harbor for more than twenty-four hours by dense fogs. Had these ships been equipped to depend on "the phantom pilot," the radio piloting cable, they could have been brought to their berths on schedule.

The United States Navy laid a piloting cable in the Ambrose Channel at New York some time ago as an experiment. The narrowness, together with the two dangerous turns of this channel, have formed the most difficult problem

which the inventors of the new cable piloting system expect to encounter in any of the harbors of the world.

In the navy's experiments, the cable extended from Fort Wadsworth, on Staten Island, through the channel to the Ambrose Lightship, which is the polar star of the channel, fourteen miles away. The cable, lying at the bottom of the channel and directly in the center, acts as an antenna to transmit the word "NAVY" continuously. Coils on either side of the incoming ship, acting as receiving antennas, carry the impulses to a sensitive receiving set, telling which side of the ship is nearest the cable and when the ship is directly over the cable.

Although auditory signals have been found to be practical, a plan is being developed whereby sensitive galvanometers will show the exact location of the ship with respect to the cable and will be as simple to read as the common magnetic compass.

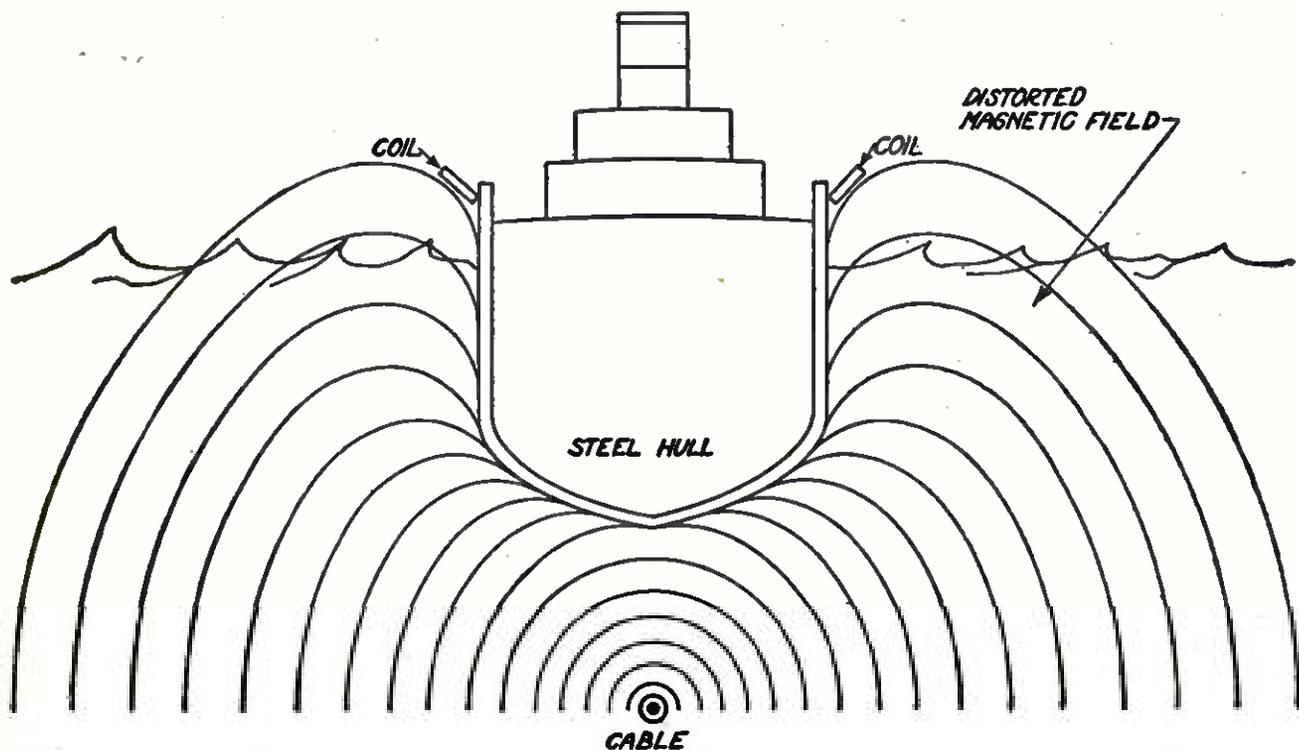
The use of a single receiving coil and a single telephone receiver first showed the principle to be practical. It indicated the proximity of the ship to the cable, but not the direction the ship should take. It was found necessary to place a coil on either side of the ship, so that by comparing the strength of the signals it was possible to tell which coil was nearest the cable.

Even the use of two coils had its faults and was successful only when the vessel started in the proper direction and kept moving. If the vessel stopped or in some other way managed to turn at right angles to the cable, the signals from both coils were the same, and there was no way to tell definitely in which direction the ship was pointing with regard to the channel.

It was therefore necessary to install four receiving coils, two forward and two aft. The job of listening to signals from four coils and comparing their signal strength was found to be a delicate task and was at once turned over to the sensitive milliammeter, which tells the true relations at a glance. When the four meters are arranged to correspond with the coils, it is a simple matter to tell which coils are nearest the cable and how the ship is heading.

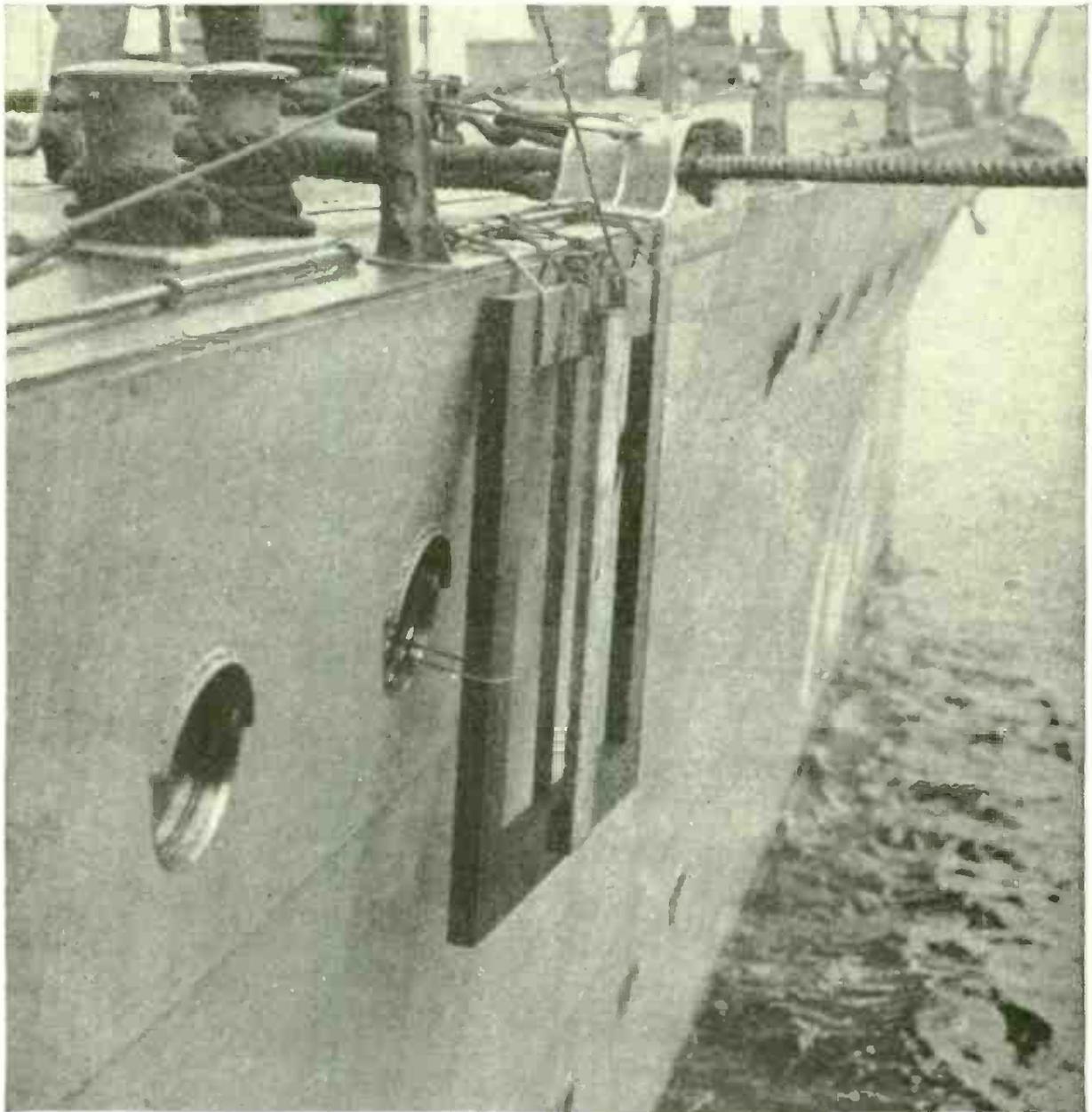
A combination meter is being developed in which two coils on opposite sides of the ship will set up opposing fields. In such an instrument, the pointer would rest at zero when the two fields were of equal strength, showing that the ship was directly over the cable. A slight shift to either side would swing the pointer correspondingly to one side or the other.

In the navy's experiments the wave was sent out by a 500-cycle generator at Fort Wadsworth, with about 350 volts potential and a current of 3.25 amperes. The cable was of the ordinary commer-



HOW THE MOUNTING POSITION OF THE COIL IS DETERMINED

This diagram shows how the electromagnetic field surrounding the cable is distorted by the steel hull of the ship. The coils, to operate to best advantage, must be parallel to these waves, as indicated above.



International

THE PILOTING CABLE COIL IN ACTION

The rectangular wooden frame shown in the illustration encases a coil of wire that is constructed like a loop antenna. When this coil is directly over the piloting cable, sensitive galvanometers indicate this position by maximum deflections of their needles.

cial variety, with seven strands of number 18 copper wire, insulated with a half inch of para rubber and jute, and armored with $\frac{1}{4}$ -inch steel cables. The impulse sent out through the cable was returned to the generator along its armored surface and the water which touched it, so that the cable in reality formed a loop antenna.

The signal word, "Navy," was transmitted by an omnigraph. The word was selected merely to distinguish the cable signal from the induction of a passing ship's generator or other noises which

might be ignored by a listening operator.

All the apparatus is still under the direct control of the navy and will probably be so controlled in the future—at least until it is perfected and protected with patents. The work was begun under the direction of Lieutenant Commander J. W. Reeves, Jr.

Harbors protected by mines have heretofore been unavailable to incoming ships during foggy weather. War vessels have been forced to wait outside where they were exposed to submarine attacks. The cable will guide a ship into

such a port where it is urgently needed to protect the port or to bring valuable supplies without delay.

Ship operators not only lose by having their cargo delayed but also by burning huge amounts of coal to keep steam up in case the fog should lift, by serving extra meals to passengers, by holding piers and harbor facilities in readiness, by general overhead expenses and possibly by being able to make fewer trips within a year.

The new device will not take the place of the pilot who now meets all vessels

according to federal laws, and steers them safely to port, but will aid him in his work. He will merely take the small amount of equipment necessary when he boards a ship. He will suspend his coils from the side of the vessel, take his meters to the bridge and perform his duty in all kinds of weather.

Not only has the United States Navy demonstrated the practicability of the "phantom pilot" but the British Government has used one experimentally in Portsmouth Harbor outside Southampton.



From a photograph made for POPULAR RADIO

HOW RADIO MAY DIRECT OUR TRAFFIC

A prophecy made in POPULAR RADIO may soon come true. The first step in this direction is shown by this electric timing apparatus which automatically directs all the street traffic in Los Angeles. This same system adapted to radio could be operated without the use of a network of wires as explained in "The Radio Traffic 'Cop'" in the November issue. Radio-controlled traffic signals are not at the mercy of the weather or wire trouble; and the construction cost is low.



Pacific & Atlantic

THE FIRST PRACTICAL DETECTOR

The Branly coherer (shown at the left), which its inventor, Edouard Branly, is adjusting, marked a tremendous step in radio progress in 1892. Before this a single loop of wire was the only electromagnetic wave detecting device; this, however, was too crude for practical use. Branly's coherer gave Marconi a basic piece of apparatus for his work.

WHERE RADIO BEGAN



Kadel & Herbert

EARLY MODELS OF SENDING AND RECEIVING INSTRUMENTS

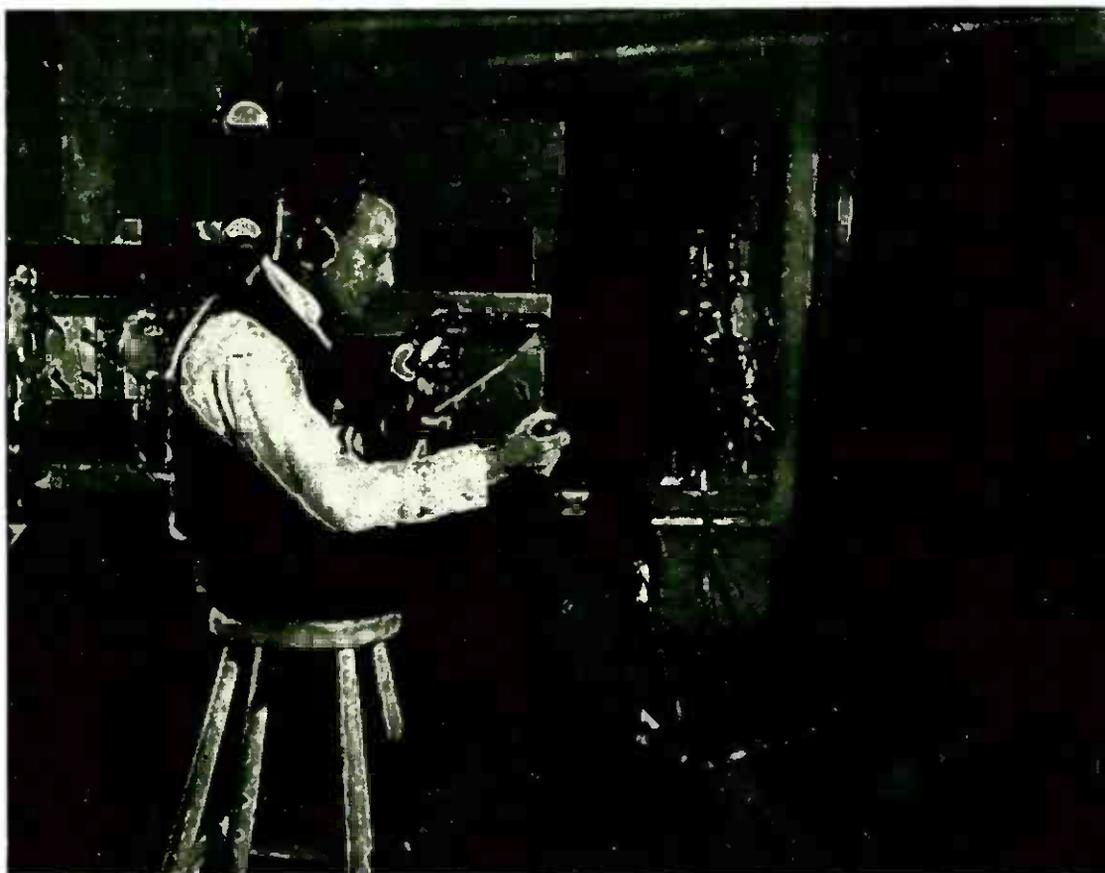
The old tuner (shown at the left in the picture above) was the type first used in radiotelegraph ship stations. It had three sliding contacts that permitted fairly close tuning through a conductively coupled hook-up. At the right of the picture is the old "pump-handle" key used in land stations as well as aboard ship. As it was used to break heavy currents, its contacts had to be large.



Harris & Ewing

THE FIRST TRANSMITTING TUBE

This vacuum tube is, in the U. S. National Museum at Washington. It was made in 1898 and is said to be the first tube to transmit radio waves. At a distance of a block, D. McFarlan Moore, its inventor, blew up a miniature of the battleship Maine.



International Newsreel

THE CRADLE OF THE FIRST BROADCASTING STATION

The pioneer broadcasting station, KDKA, was born in the unromantic atmosphere of a garage near Pittsburgh, Pa. Frank Conrad, the radio inventor, from his station, 8XK, broadcast the returns of the Harding election in 1920. The election figures were relayed from the office of J. C. McQuiston in East Pittsburgh to Mr. Conrad's home.



Kadel & Herbert

ONE OF THE EARLIEST RADIOTELEGRAPH TRANSMITTERS

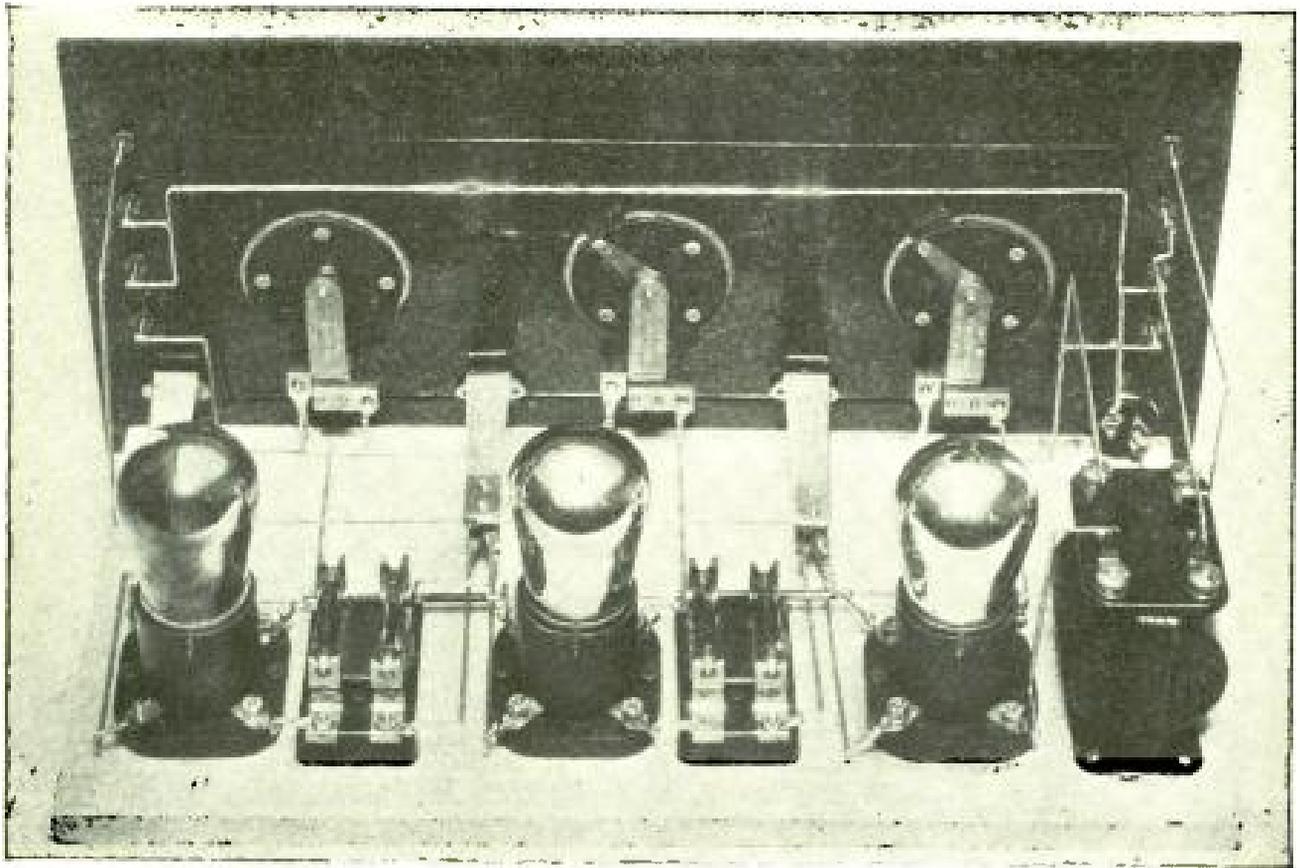
Before the transformer, operating on an alternating current, came into use for radio transmission, this induction coil was run on a direct current that also operated an interrupter. The secondary terminals of the coil were connected to a spark gap which was placed in series with the antenna.



Kadel & Herbert

THE PRIDE OF THE NAVY IN 1909, THE POULSEN ARC

The picture at the right shows the old arc transmitter which was used aboard the U. S. S. Connecticut in 1909 when the American fleet made its famous trip around the world. Some of the earliest radiotelephone experiments were made with these arcs in the Navy. The piping shown is for feeding gas to the arc to increase its steadiness.



VIEW OF THE AMPLIFIER FROM THE REAR

Compare this picture with the diagram on the next page when you mount the parts and when you connect up the instruments. The wiring is so simple that it can be done in a little less than an hour.

Simple "How-to-Build" Articles for Beginners No. 7

How to build a combination three-stage amplifier

By LAURENCE M. COCKADAY

COST OF PARTS: *Not more than \$25.00*

HERE ARE THE ITEMS YOU WILL NEED—

- | | |
|---|--|
| A—Samson audio-frequency transformer, Type HWA-2, ratio 3 to 1; | J, K, L and M—Daven resistances, $\frac{1}{4}$ meg.; |
| B, C and D—Kellogg rheostats, No. 502, 20-ohm; | N—Bradleyswitch; |
| E, F and G—Cutler-Hammer sockets; | O and P—Yaxley radio jack, double-circuit; |
| H and I—Daven resisto-coupler No. 41; | Q—Yaxley radio jack, single-circuit; |
| | R and S—N. Y. mica fixed condensers, .006 mfd. |

THE seventh instrument to be described in this series is a vacuum-tube, audio-frequency amplifier comprising one stage of transformer-coupled amplification and two stages of resistance-coupled amplification. This is the type of amplifier first used by the author in connection with the Four-circuit Tuner

described in the issue of October, 1924.

This unit was built in the POPULAR RADIO LABORATORY with the express purpose of submitting to the beginner an amplifier that will give him the best reception possible and at the same time teach him something about the principles involved in distortionless amplification.

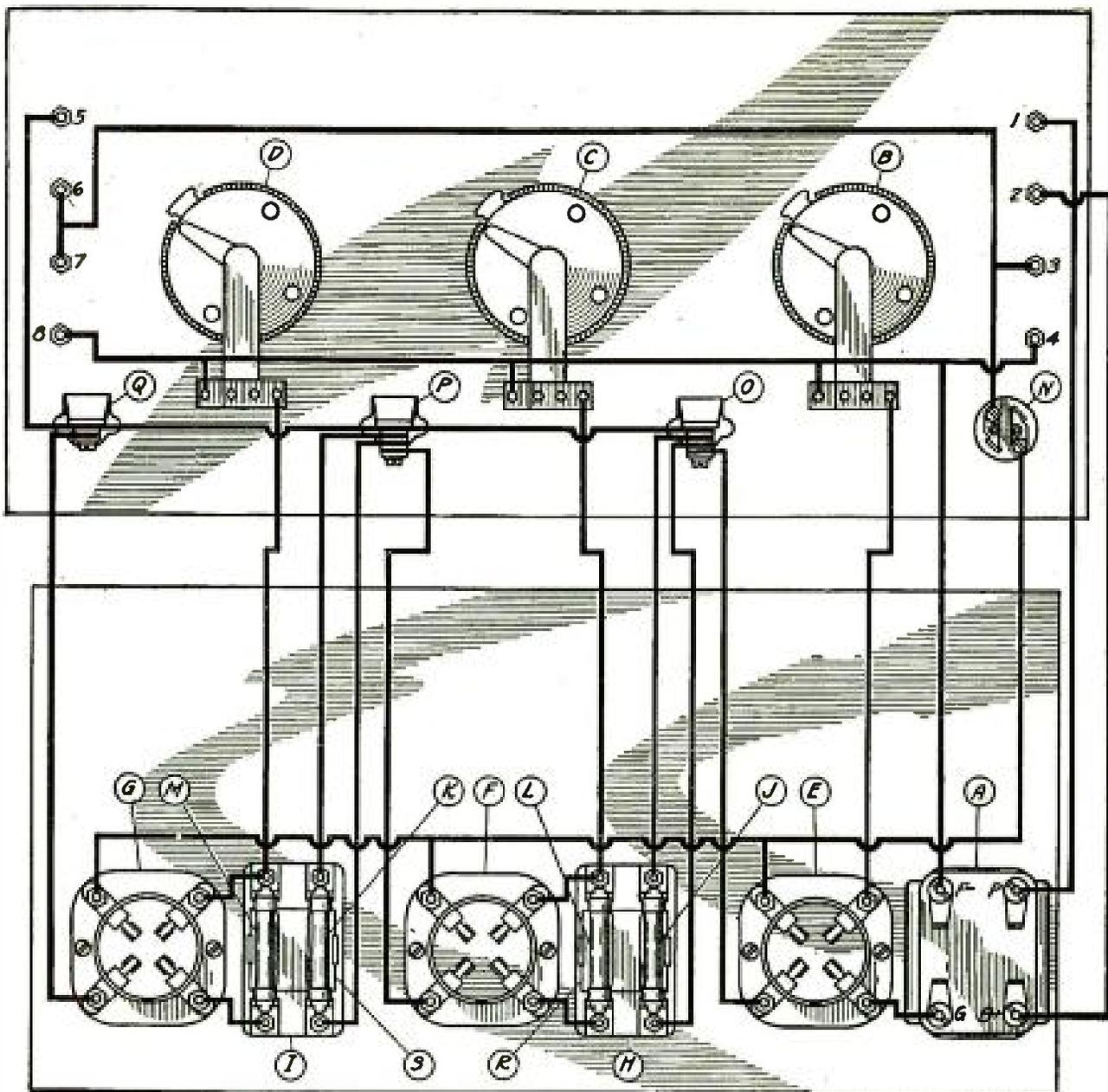
The unit is simple to construct and to operate as are all the other units described in this series.

This particular unit may be connected to any of the other single-tube or crystal receivers described in this series. It will enable you to obtain louder signals and still retain the same quality of reception on a loudspeaker as on headphones.

Take these pages to a radio dealer and ask him to supply you with the parts listed above. When you have your parts ready for mounting, use a kitchen-work

table for the job. Set them upon the panel and baseboard as shown in the picture diagram on the opposite page and also in the two photographs accompanying this article.

Next, wire up the instrument as indicated in the picture diagram. If you follow the series as shown there you cannot make a mistake. All the connections are clearly shown and the instruments are all marked with designating letters that re-appear in the list of parts and in the text.



THE "PICTURE DIAGRAM" OF THE HOOK-UP

This illustration shows the exact manner in which the instruments are placed on the panel and baseboard and how the wires run in relation to them. The upper rectangle shows the back of the panel, and the lower one shows the baseboard. All the parts are lettered to correspond with the designations in the text and in the list of parts.

Q The next article in this "Simple How-to-build" series will describe how to build "A SINGLE-TUBE FOUR-CIRCUIT TUNER." The editors consider this to be the best single-tube receiver that a beginner can make.

When you have finished wiring up, all you have to do is to connect the loudspeaker, the batteries and the detector unit and you are ready to "go."

To connect this unit do the following:

Connect the binding posts 1 and 2 in place of the phones in your detector unit. The binding posts 3 and 4 should be connected to the "A" battery terminals on the detector unit with the positive terminal connected to binding post 3 and the negative terminal connected to binding post 4.

Then connect the "A" battery that was originally used on the detector unit to binding posts 7 and 8 of this unit with the positive terminal connected to binding post 7 and the negative terminal to binding post 8. This means only the single "A" battery connected to the two units, as the binding posts 7 and 3 are bridged across as also are binding posts 8 and 4.

Next, connect a 90-volt "B" battery to terminals 5 and 6 on the amplifying unit with the positive terminal connected

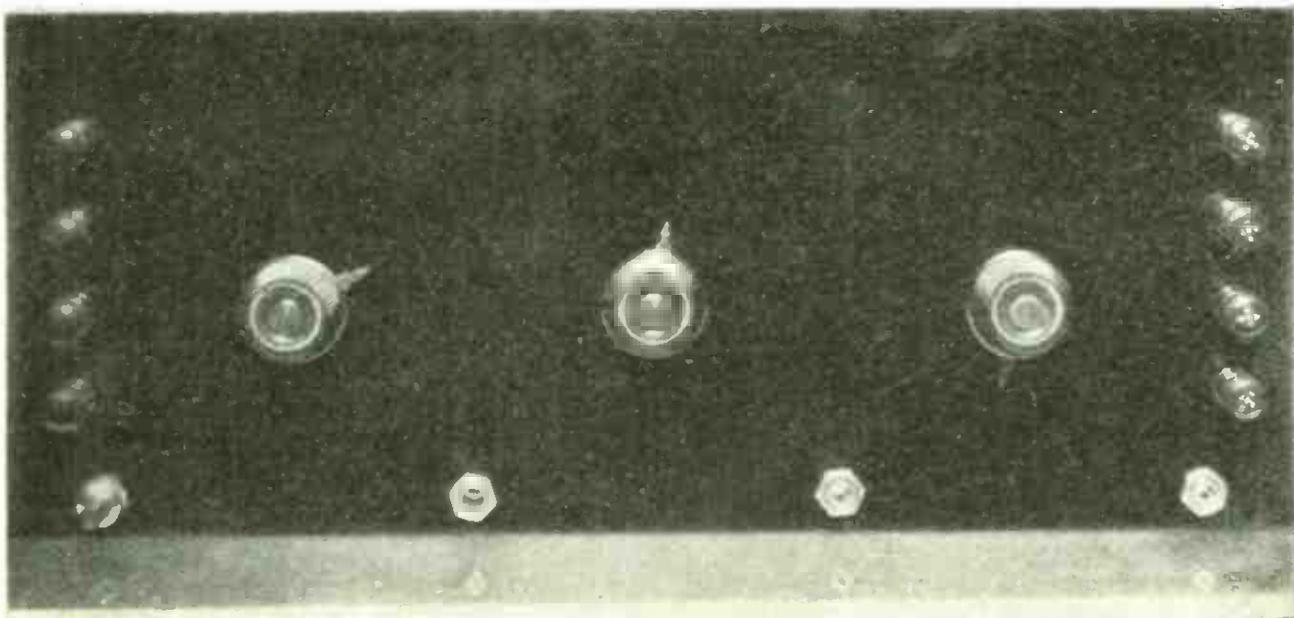
to binding post 5 and the negative terminal connected to binding post 6. Insert 3 UV-201-a tubes in the three sockets and turn up the three rheostats B, C and D approximately three-fourths of the way and place the loudspeaker plug in jack Q.

Then turn on a detector rheostat in the tuning unit and tune in a station after which the three rheostats may be adjusted for proper quality and volume.

You will find that you will obtain wonderful reproduction if a good loudspeaker is used with this type of an amplifier. You will also discover that distance reception will sound much clearer and stations will be easier to understand with a high-grade loudspeaker.

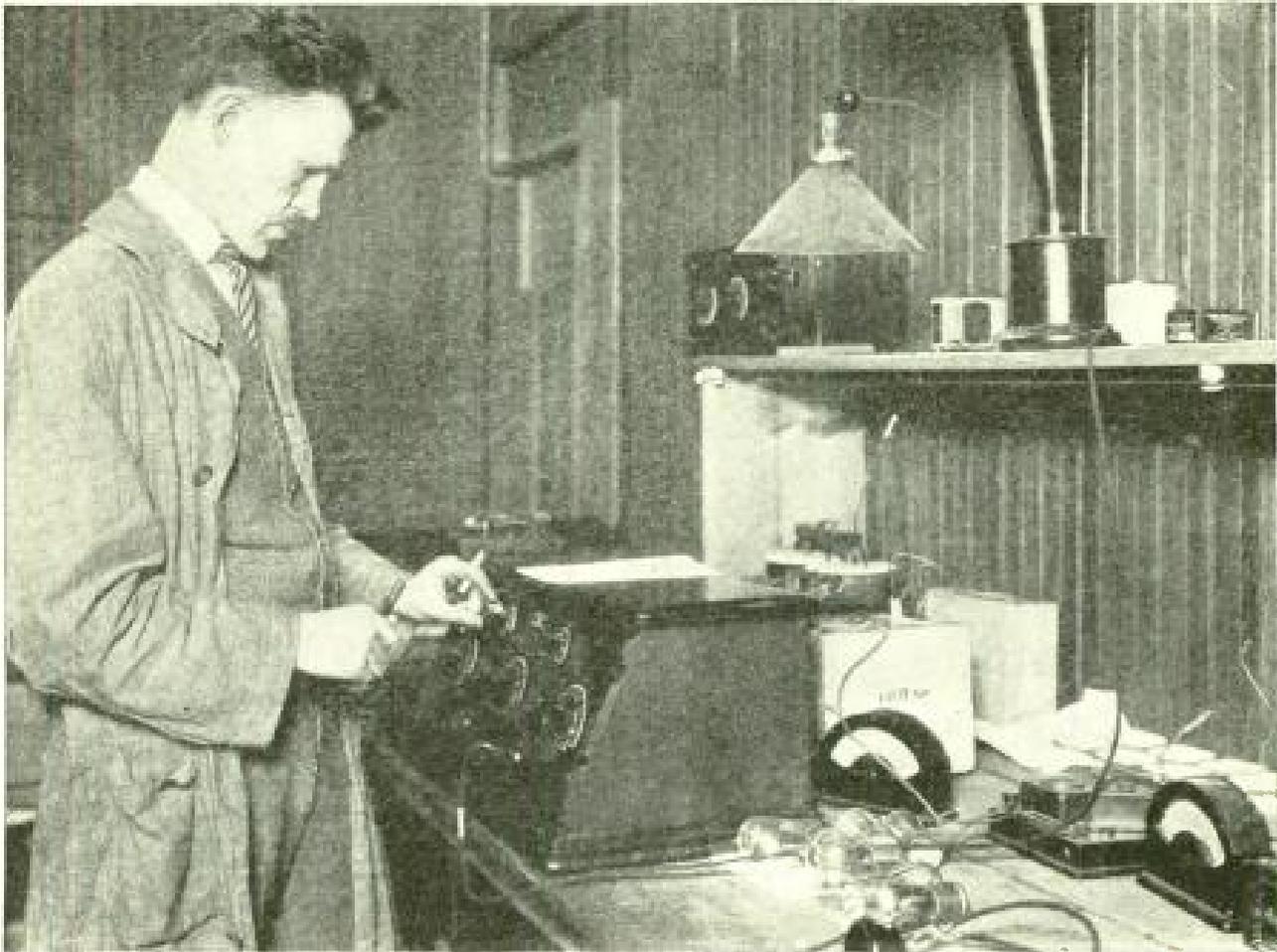
Do not turn the rheostat which controls the filament current any higher than is necessary to produce sufficient volume.

If dry-cell tubes are used, you will have to get suitable rheostats in place of the ones specified, and also, you will have to vary the "A" battery voltage to suit the tubes used.



THE FRONT VIEW OF THE PANEL

This view shows the arrangement of the three rheostat control knobs, the rows of binding posts, one at each side of the panel, and the three jacks for cutting in the various stages. The battery switch is located at the lower left-hand corner of the panel.



From a photograph made for POPULAR RADIO

MAKING THE ACQUAINTANCE OF THE RECEIVER

The author has made himself familiar with the tuning characteristics of the Melco receiver, and has begun to log broadcasting stations for future reference, as explained in this article.

HOW TO GET THE MOST OUT OF YOUR READY-MADE RECEIVER

No. 3: MELCO SUPREME RECEIVER

This series of articles explains the theory, operation, equipment and care of standard receiving sets

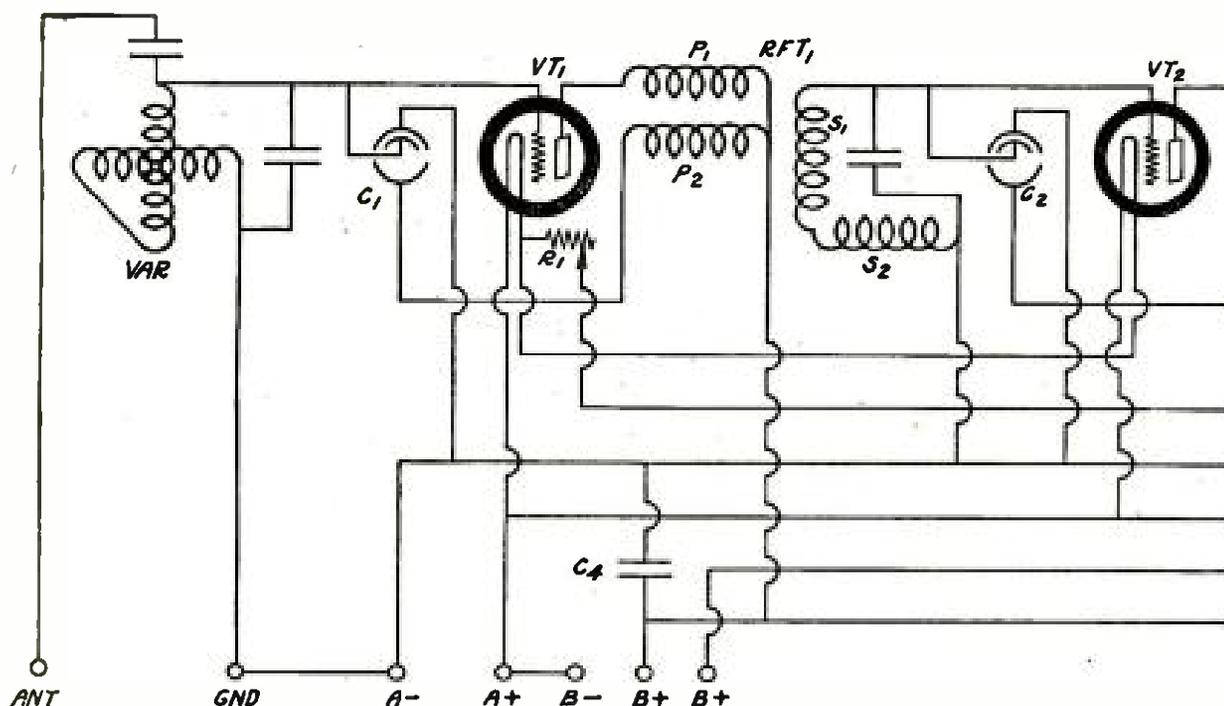
This series does not indorse the product of any manufacturer or make comparisons between receivers. The sets already described include: No. 1, the Eagle Neutrodyne and No. 2, the Radiola Superheterodyne.

By S. GORDON TAYLOR

THE use of tuned radio-frequency amplification in radio receivers has become increasingly popular. One reason is because this type of amplification brings in distant stations with sufficient volume to operate the loud-speaker. This type of set, besides, does

not require a long outdoor antenna and it usually gives better tone quality than the ordinary regenerative receiver used so extensively a year or two ago.

There are numerous types of radio-frequency amplification in common use. How to operate one type—the neutro-



WIRING DIAGRAM OF THE MELCO RECEIVER

FIGURE 1: All the designating letters in this hook-up are referred to and explained in the text. The parts are: VAR, variometer; RFT1 and RFT2, variotransformers each of which consists of four windings P1, P2, S1 and S2; AFT1 and AFT2, audio-frequency transformers; C1 and C2, compensating condensers; C3, .00025 mfd. grid condenser; C4, 5 mfd. fixed condenser; C5, .005 mfd. fixed condenser; GL, 2 megohm grid-leak; R1, 15 ohm rheostat; R2, R3, R4, 20 ohm rheostats; VT1, VT2, VT3, VT4, VT5, are UV-201-a or C-301-a vacuum tubes and sockets; J, filament-control jack; S, double-pole, double-throw jack switch.

dynes—was told in the first article of this series (December, 1924). How to operate another type, which makes use of a special kind of tuned radio-frequency transformers, is told in this article.

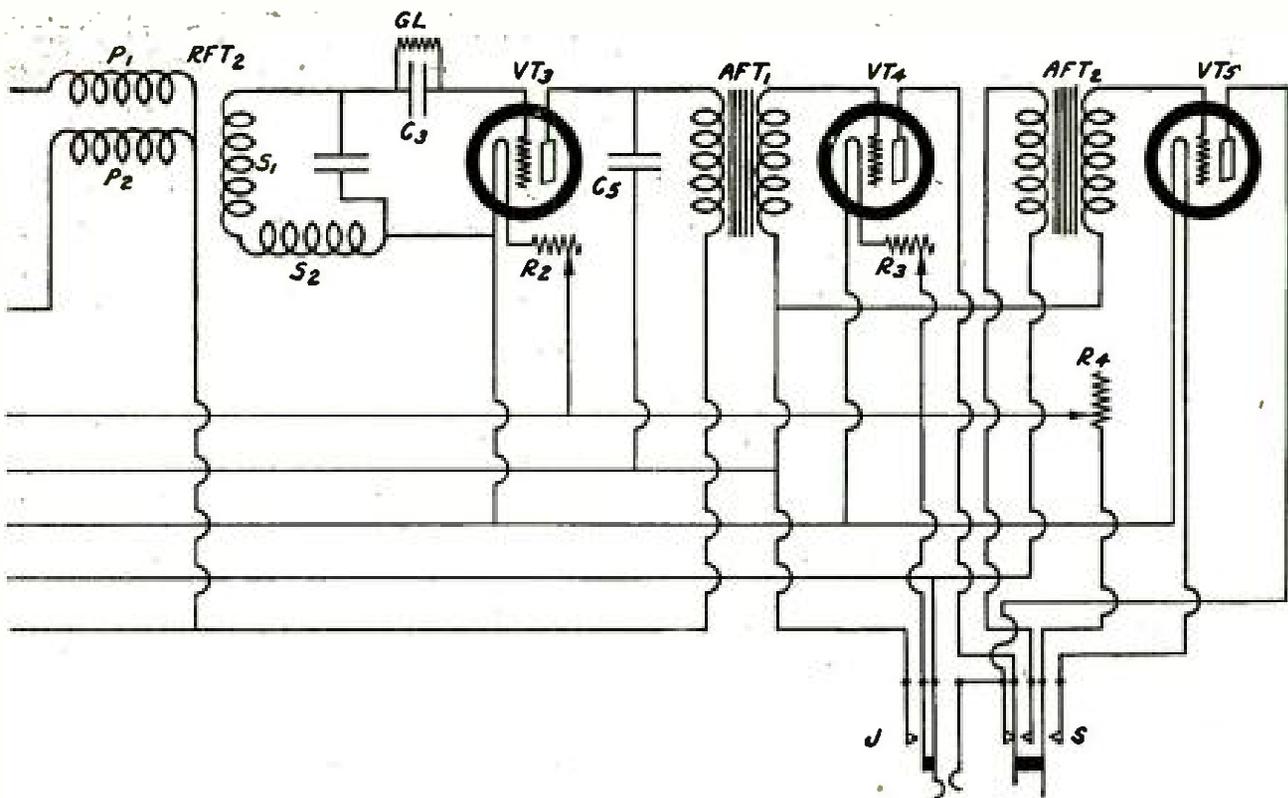
Feed-back should be at least partly eliminated in a radio receiver, otherwise the interaction between the plate and grid circuits of the vacuum tube creates oscillations that prevent reception, or produce distortion of signals. This condition becomes increasingly troublesome when radio-frequency amplification is used.

Feed-back may occur through the elements of the vacuum tube itself, or through the interaction between the coils in the various circuits. The coils, however, may be placed in such a way that their fields do not affect each other noticeably or they may be wound in a form which produces practically no external field. Thus the so-called "in-

ductive feed back" may be largely eliminated by the physical placement or form of the coils. There still remains the capacitive feed-back through the action of the capacity of the elements of the vacuum tube itself. This feed-back too may be eliminated through the agency of an external capacity and inductance that will neutralize or compensate the capacity of the tube.

In the Melco Supreme receiver a special form of winding is used in the radio-frequency transformers shown at RFT1 and RFT2 in Figure 1. This form of winding practically limits the electro-magnetic field of the coils in each transformer to the dimensions of the transformer, or variotransformer as it is called in this receiver. In addition to this, a small variable condenser is employed in conjunction with each variotransformer to compensate the tube capacity.

The variotransformer is designed to



provide the necessary coupling between the plate circuit of one tube and the grid circuit of the succeeding tube. This instrument also tunes the grid circuit to the resonance with the incoming signal by means of the variometer action of coils S1 and S2. The variotransformer includes a special winding (P2) in the plate circuit which induces a neutralizing voltage on the grid of the preceding tube and thus, in combination with the variable compensating condensers C1 and C2 prevents oscillation, but nevertheless permits the operation of the tube at the point of maximum practical efficiency.

The Construction of the Receiver

This receiver is designed to make use of external batteries, loudspeaker, antenna and ground, as shown in Figure 3. Binding posts are arranged at the back of the receiver for these various connections with the exception of those for the loudspeaker. This instrument is connected to the jack J by means of a standard loudspeaker plug which is inserted in the jack.

Five vacuum tubes are used as shown in Figure 1. VT1 and VT2 with their

accompanying equipment make up two stages of tuned radio-frequency amplification. VT3 is the detector. VT4 and VT5 with the equipment that goes with them, are used in two stages of audio-frequency amplification. The variometer T1 is used to tune the antenna circuit as well as the grid circuit of the first tube. This arrangement is in its effect a two-circuit, conductively-coupled tuner. RFT1 and RFT2 are the variotransformers which tune respectively the first and second stages of radio-frequency amplification. Regular audio-frequency transformers are used for coupling the last two stages of amplification. These transformers are shown at AFT1 and AFT2. The rheostats R1, R2, R3 and R4 control the current flow from the "A" battery, through the filaments of the vacuum tubes. R1 controls the filaments of VT1 and VT2, while R2, R3 and R4 control the filaments of VT3, VT4 and VT5, respectively. The switch S is for volume control. With it only four tubes may be thrown in setting the receiver for "Soft" reception, and five tubes when setting for "Loud," which are marked on the panel.

The Antenna and Ground.

This receiver may be used with any antenna from 20 to 75 feet in length. A longer outdoor antenna will provide greater volume on weak or distant signals, but it may broaden tuning. In locations close to powerful broadcasting stations, however, as in most large cities for instance, such an antenna is not advised because of the possibility of interference from the local stations.

Perhaps the best antenna for this receiver is an outdoor stretch of approximately 50 feet including the lead-in. The lead-in should be as short as possible and should be attached to the end of the antenna nearest the receiver. A convenient way to bring in an antenna lead is to attach it to an insulator fastened to a window frame. Care should be exercised so that the lead hangs free of the house and anything that may partly ground the antenna. Where the lead-in wire is brought through a window, it should be No. 18 rubber-covered wire or bare wire insulated by a glass or porcelain tube. The lead-in may be the same kind of wire as that used for the antenna. If the lead is a continuation of the antenna wire, it will eliminate all joints throughout the antenna circuit. Figure 4 shows one good method for accomplishing this.

When the use of an outdoor antenna is not practical, a short indoor antenna may be used with nearly as good re-

sults. The indoor antenna may consist of a wire from 20 to 30 feet long connected directly to the antenna binding post on the receiver. From this binding post the antenna lead may extend up to a picture moulding and follow it around the room. Where possible the lead should run in a straight line.

With an outdoor antenna a lightning arrestor should be connected to the antenna lead at a point just inside the window through which the lead-in comes. This device is, of course, unnecessary with an indoor antenna.

A ground connection may be made to the nearest cold water pipe, or to a radiator. In case these connections are not available, use an iron pipe driven six feet into the ground, preferably beneath the window through which the antenna lead is brought. The lead from this iron pipe can then run straight to the window above.

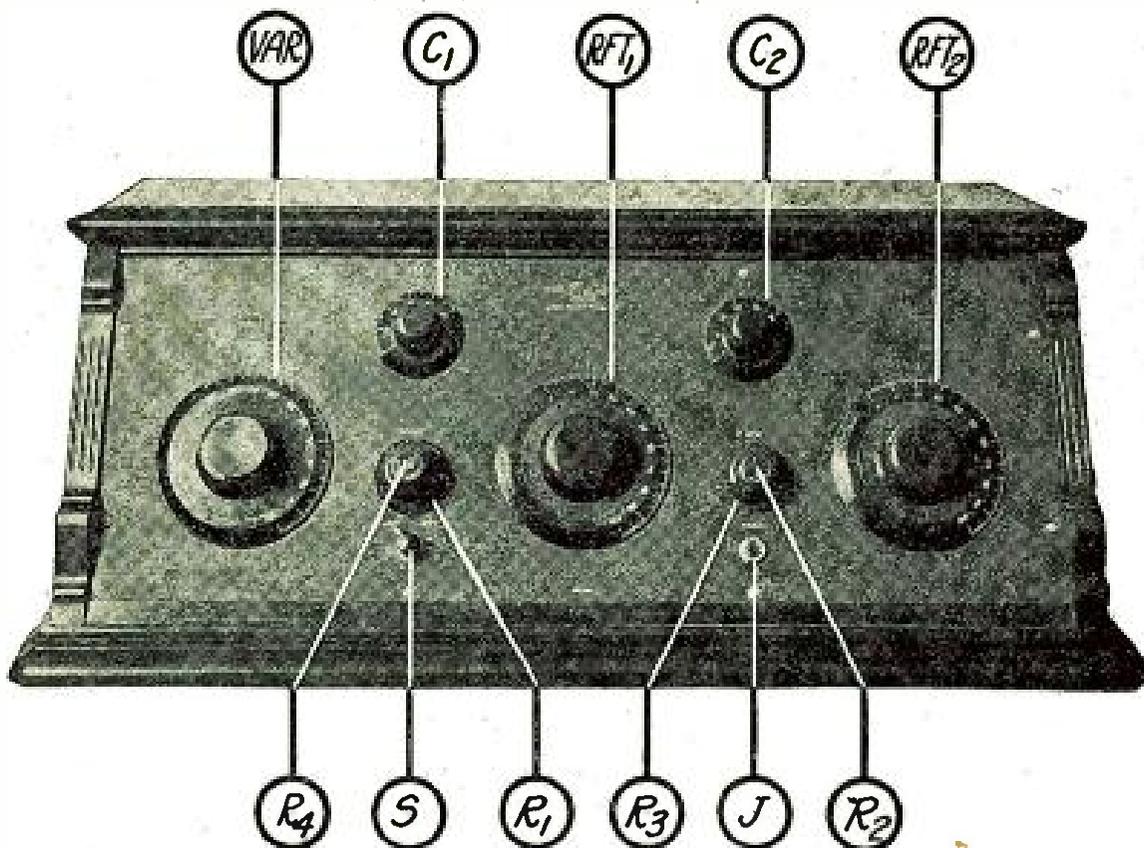
The Tubes that Are Used

This receiver is designed for the use of UV-201-a or C-301-a tubes throughout. Either of these types will give equally good results. Many receivers employ a UV-200 tube for the detector, but in the case of the Melco receiver this is neither necessary nor advisable. As a result there is a considerable saving of "A" battery current. Dry cell tubes are not recommended for this set.

When the receiver is first put into

Approximate Life of "B" Batteries When the Receiver is Used for an Average of Two Hours a Day

VOLTAGE CONNECTED TO POST NO. 6	VOLTAGE CONNECTED TO POST NO. 7	VOLUME SWITCH SET FOR "SOFT"	VOLUME SWITCH SET FOR "LOUD"
45	90	243 days	132 days
67½	67½	142 days	82 days
67½	90	112 days	72 days
90	90	65 days	47 days



PANEL VIEW OF THE RECEIVER

FIGURE 2: The three principal controls are VAR, variometer; RFT1 and RFT2, variotransformers; C1 and C2 are the compensating condensers; and R1, R2, R3 and R4 are the rheostat controls for the tubes. S is the jack switch and J is the filament control jack.

operation, the operator should shift his tubes around from socket to socket to discover which ones work best in particular holders. Some tubes, as many of us know, work better as radio-frequency amplifiers, or as audio-frequency amplifiers. Insist upon your dealer's having the tubes in the receiver which he uses to demonstrate the set for you. This policy will eliminate the possibility of getting a defective tube.

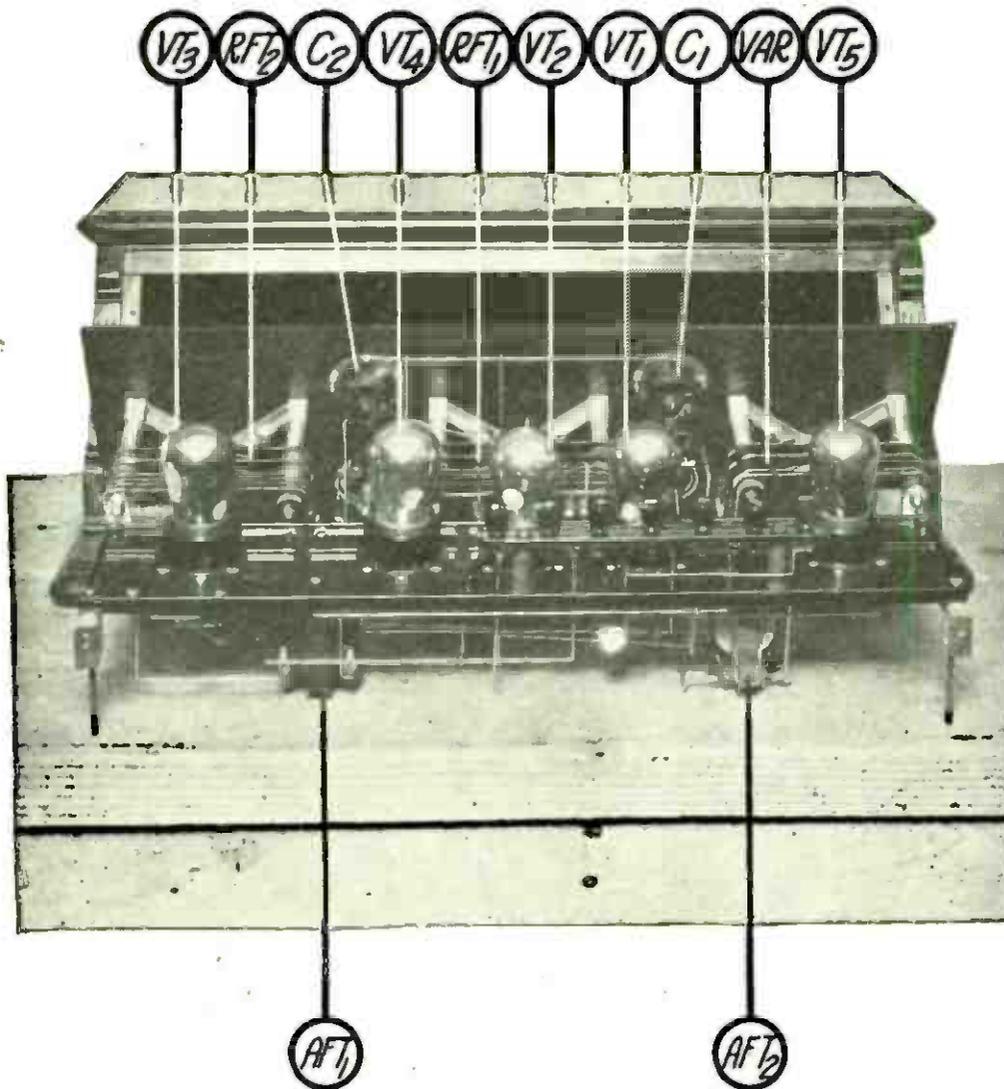
Types of Batteries Necessary

To light the filaments of the five tubes a 6-volt storage battery is required. The 100 ampere hour capacity type is preferable. Batteries of smaller capacity may be used but with less success. Dry batteries are not recommended, because they become nearly dead after a few hours of use with five UV-201-a tubes.

If you use storage batteries, it is worth your while to have a battery

charger that operates on ordinary lighting circuits. If your house current is alternating current (A.C.) the charger must be the rectifier type. If your lighting system is direct current (D.C.) then the charger required is the resistance type. Connections for the A.C. type of charger are shown in Figure 5. One method of charging from a D.C. line, using electric lights for the charging resistance, is shown in Figure 6. You should have a special storage battery hydrometer with which to watch the progress of charging the battery and to determine when you have a full charge.

Besides the storage "A" battery another set of batteries known as the "B" battery is needed. This battery is made up of blocks of 22½ or 45 volts. A total voltage of 90 is needed for this receiver. The "B" batteries may be of the dry-cell type as the current consumption is low. For those who



VIEW OF THE SET WHEN OPENED

FIGURE 3: The rear view of the set showing the parts and wiring. The designating letters refer to the parts that are listed in Figure 1 and explained in the text.

prefer them, the storage "B" batteries may be used, or some of the "B" battery substitutes now on the market. The latter are outfits which make it possible to use the house-lighting current to supply the high voltage to the receiver in place of the "B" batteries. Before purchasing one of these, however, it is advisable to demand a demonstration on the receiver with which it is to be used.

The five tubes of this set consume approximately $1\frac{1}{4}$ amperes an hour of "A" battery current. If, therefore, a 100-ampere-hour storage battery is used, a full charge will operate the receiver for something less than 80 hours. This means you can use your battery an hour

a day for about two months. If you have a battery charger, it is a good plan to charge the battery to keep it nearly at full charge. Never allow your battery to run down completely. Check often the amount of charge with a hydrometer. When this instrument registers 1,185, the battery should be recharged.

The "B" battery current consumption is much lower than that of the "A" battery, but the capacity of the "B" batteries is lower than that of the "A" battery. Inasmuch as the cost of replacing "B" batteries (if the dry-cell type is used) represents practically the entire upkeep cost of the receiver, it is naturally an important point for consideration. The amount of "B" battery

current consumed varies with the number of tubes in use and the "B" battery voltage. Using only four, for instance, the life of the "B" battery will be nearly 50 percent greater than with five tubes. It is therefore advisable to use the fifth tube only to provide great volume. Usually four tubes will give ample volume to operate the loudspeaker satisfactorily on local broadcasting stations even when an indoor antenna is used. Also, the use of 67½ volts instead of 90 volts reduces the current consumption considerably. If using only 67½ volts and 45 volts gives satisfactory results, the saving will be quite noticeable. Data demonstrating are given in the table on page 264.

How to Operate the Receiver

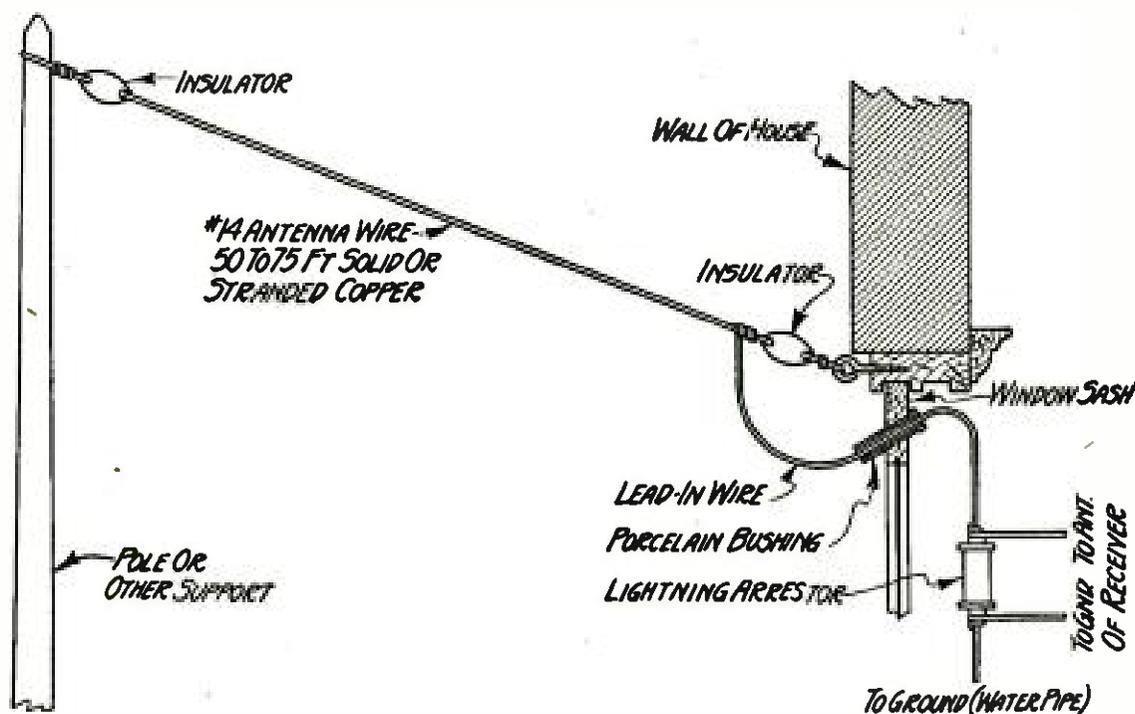
Assuming that the batteries, antenna and ground have been connected as shown in Figure 5, and that the tubes have been placed in the sockets, the loudspeaker plug should be inserted in the jack which is marked "output," and the volume switch S set with the pointer

toward "loud." Next, the four rheostat knobs R1, R2, R3 and R4 should each be turned approximately one-half a revolution in a clockwise direction, thus lighting the tube filaments preparatory to operation. It should be noted that the filaments will not light even when the rheostats are turned on unless the loudspeaker plug is in position in the jack as there is an automatic switch in connection with the jack which breaks the "A" battery circuit when the plug is removed from the jack. When one is through listening it is necessary merely to withdraw the plug to cut off the batteries. This eliminates the necessity for turning the rheostats on and off every time the receiver is used.

All is in readiness now to start the tuning operations.

First, the dials C1 and C2 which control the two compensating condensers should be set at about 30.

Then you begin the actual operation of tuning in the stations with only the three dials T1, T2 and T3. Start with



HOW TO BRING IN YOUR ANTENNA LEAD

FIGURE 4: This diagram shows how the lead-in is attached to the antenna and anchored near the window. From the insulator outside the house, the lead passes through a porcelain tube or bushing that is set in a hole bored through the window sash.

all three set at any given point, say 40. At this point it is likely that station WGY of Schenectady will be heard if it is within range and is on the air at the time. If nothing is heard, move each of these three main dials one degree higher. If there is still nothing audible, continue turning these dials one degree at a time, with the settings of the three dials always alike, until a station is heard.

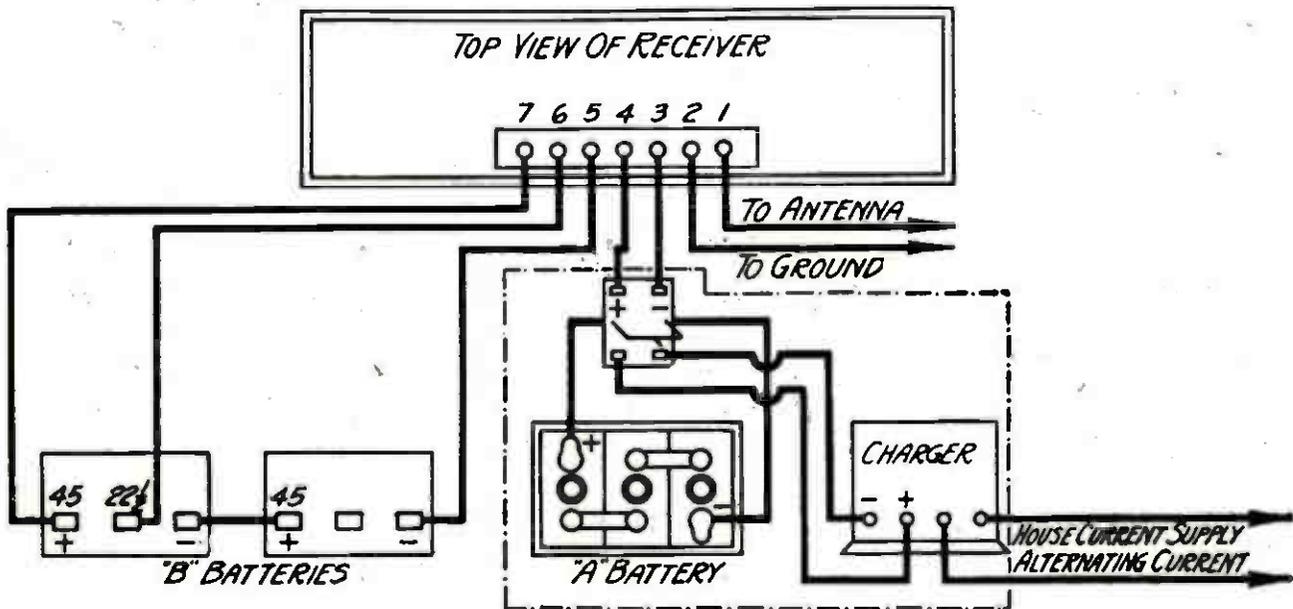
When the first station is heard readjust each of the three dials until the point is found on each where the volume is greatest. When this has been done it will probably be found that the dial readings of the three are not quite alike. In any event they will be very nearly alike. With a station tuned in, make the final adjustments to bring the receiver up to the point of greatest efficiency. Readjust the rheostats one at a time until the lowest point is found on each where best volume and quality of signals are obtained. By "low" is meant the least part of a revolution in a clockwise direction from the "off" position. The last operation is the readjustment of the dials C1 and C2.

These should be turned one at a time to a point where there is the best volume without distortion. Beyond this point the receiver will oscillate, the result will be a hissing or whistling sound in the loudspeaker. It is sometimes helpful to slightly readjust T2 while C1 is being adjusted; and T3 during the adjustment of C2.

After practice the operator will discover that C1 and C2 need not be adjusted for every station. A certain point will be found on each of these where they may be left permanently set, except when extremely distant stations are tuned in.

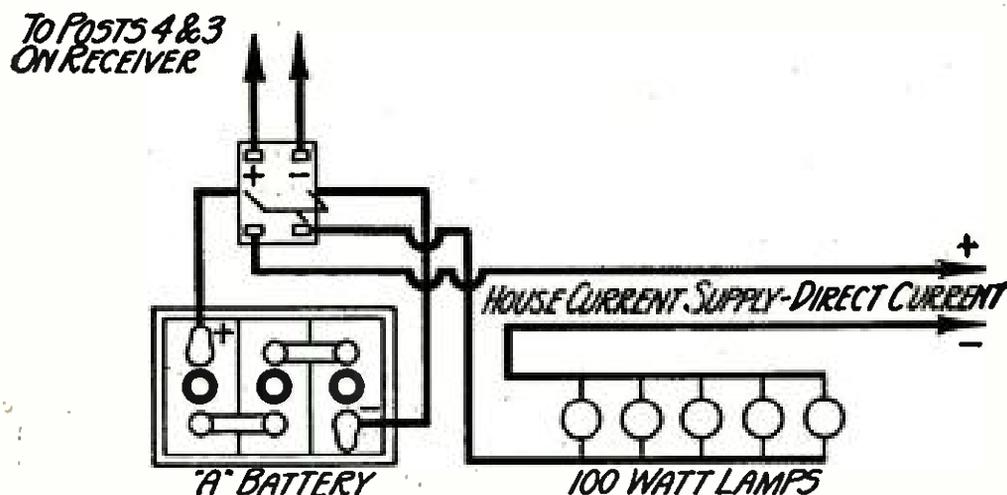
If the volume is too great on local stations the volume switch S may be turned to the "soft" position, thus cutting out the last stage of audio-amplification. Or if one wishes to use headphones when hunting around for DX (distant stations) this switch may be set for "soft" and the headphones plugged into the jack.

When you have fulfilled the foregoing instructions, it is well to change the connections from binding posts 6 and 7 at the back of the receiver to different



HOW TO CONNECT THE RECEIVER WITH THE BATTERY CHARGER

FIGURE 5: This is the hook-up for the charger that operates on an alternating lighting current. Refer to Figure 6 for the attachment of a direct current battery charger to the receiver.



HOOK-UP FOR THE DIRECT CURRENT CHARGER

FIGURE 6: When your house-lighting service is direct current, a different type of charger is needed, which is wired to the set as shown above. To determine the positive and negative terminals of your house current, dip leads from the supply line in a cup of salt water. Bubbles will form around the negative wire.

points on the "B" battery. Try connecting both to the 67½ volt tap, then No. 6 to the 45 volt tap, etc. Remember always that the lower the "B" battery voltage used the longer will be the life of the batteries.

Charting the Receiver

As each station is tuned in, a record should be made of the settings of the three large dials, similar to that shown in the tuning chart below. With the aid of such a "log" or chart, it is easy to pick up any station that has been tuned in previously by setting the dials at the readings shown on the chart for that particular station.

The dial settings of any receiver of this make and type will be approximately like those shown in the chart so far as the dials T2 and T3 are concerned. In the case of the readings shown for T1 there is more likelihood of deviation that results from the use of different types of antennas.

Make up a rough chart first, on which you list the stations with their wavelengths, call letters, location and dial settings in the order you tune them in. After a dozen or so have been recorded in this manner, begin your permanent record to correspond with that in the chart.

ACTUAL LOG OF A MELCO RECEIVER

Wave-length	Station	Location	T ₁	T ₂	T ₃
278	WNAC	Boston, Mass.	21	22½	22½
286	WTAS	Elgin, Ill.	22½	23	23
291	KFKX	Hastings, Neb.	23	24	24
303	WEEI	Boston, Mass.	24½	25	25
309	WSAI	Cincinnati, O.	25½	26½	29½
312	KGO	Oakland Cal.	26	27	27
326	KDKA	Pittsburgh, Pa.	27	28	28
330	WGBS	New York City	28	29	29
337	WBZ	Springfield, Mass.	32	33	33
360	WHN	New York City	36	37	37
370	WGN	Chicago, Ill.	39	40	40
380	WGY	Schenectady, N. Y.	41	42	42
390	WTAM	Cleveland, O.	43	44	44
395	WDAR	Philadelphia, Pa.	45	46	46
400	WHAS	Louisville, Ky.	46	47	47
405	WOR	Newark, N. J.	47	48	48
411	WDAF	Kansas City, Kan.	48	49	49
455	WJZ	New York City	59	61	61
461	WCAE	Pittsburgh, Pa.	61	62	62
469	KFI	Los Angeles, Cal.	62	63	63
476	WBAP	Fort Worth, Tex.	63	64	64
492	WEAF	New York City	70	71	71
500	WMC	Memphis, Tenn.	72	74	74
509	WIP	Philadelphia, Pa.	74	76	76
517	WWJ	Detroit, Mich.	76	78	78
535	KYW	Philadelphia, Pa.	86	88	88
545	KSD	St. Louis, Mo.	90	92	92

“THEY SAY—”

Onion Sauce on the Ether

“SWEET are the uses and abuses of radio. Especially sweet, however, to the numerous corporations which are quick to capitalize the air opportunities afforded by New York’s fourteen stations. Orchestras are named after hotels and eating places, and comedians for various soaps and pickle brands. The radio fans plug in night after night only to hear the jazz babies plug the same old songs. Rice and coffee recipes are freely thrown on the ether, while bedtime stories and sports talks, ostensibly given for entertainment purposes, turn out as propaganda for a new kind of onion sauce or face massage. . . . The perfect radio program will be reached only when it is shorn of its too evident commercialism.”

—THE NEWS (*New York*)

Unwanted Sermons

“THE more radios you get the more sermons you hear, and I won’t let any preachers come into my house uninvited.”

—CLARENCE DARROW

Pocket Radio Sets

“ONE’s head spins at the rapidity with which one radio feat piles on top of the other. . . . At the present rate it looks as though we were to be placed in complete audible and visual communication with the rest of the world. The pocket radio, apparently, is sure to come. If in addition to the ear-pieces it has a little hole we can look into and see ten thousand miles away, then away dull travel-talks and school courses on Asia. The world is ours, to do what we please with.”

—THE WORLD (*New York*)

Radio Now a “Public Necessity”

“It seems probable that broadcasting is permanently established as a public necessity and may be considered as indispensable in the average home as the telephone. The success achieved in this country has encouraged many other countries to utilize this important means of establishing direct contact with the public.”

—D. B. CARSON

United States Commissioner of Navigation

Why They Broadcast

“THE big broadcasters are of two classes—those who use radio to advertise and those who broadcast to promote the sale of receiving sets and apparatus.”

—WILLIAM E. HARKNESS

Assistant Vice President, American Telephone and Telegraph Co.

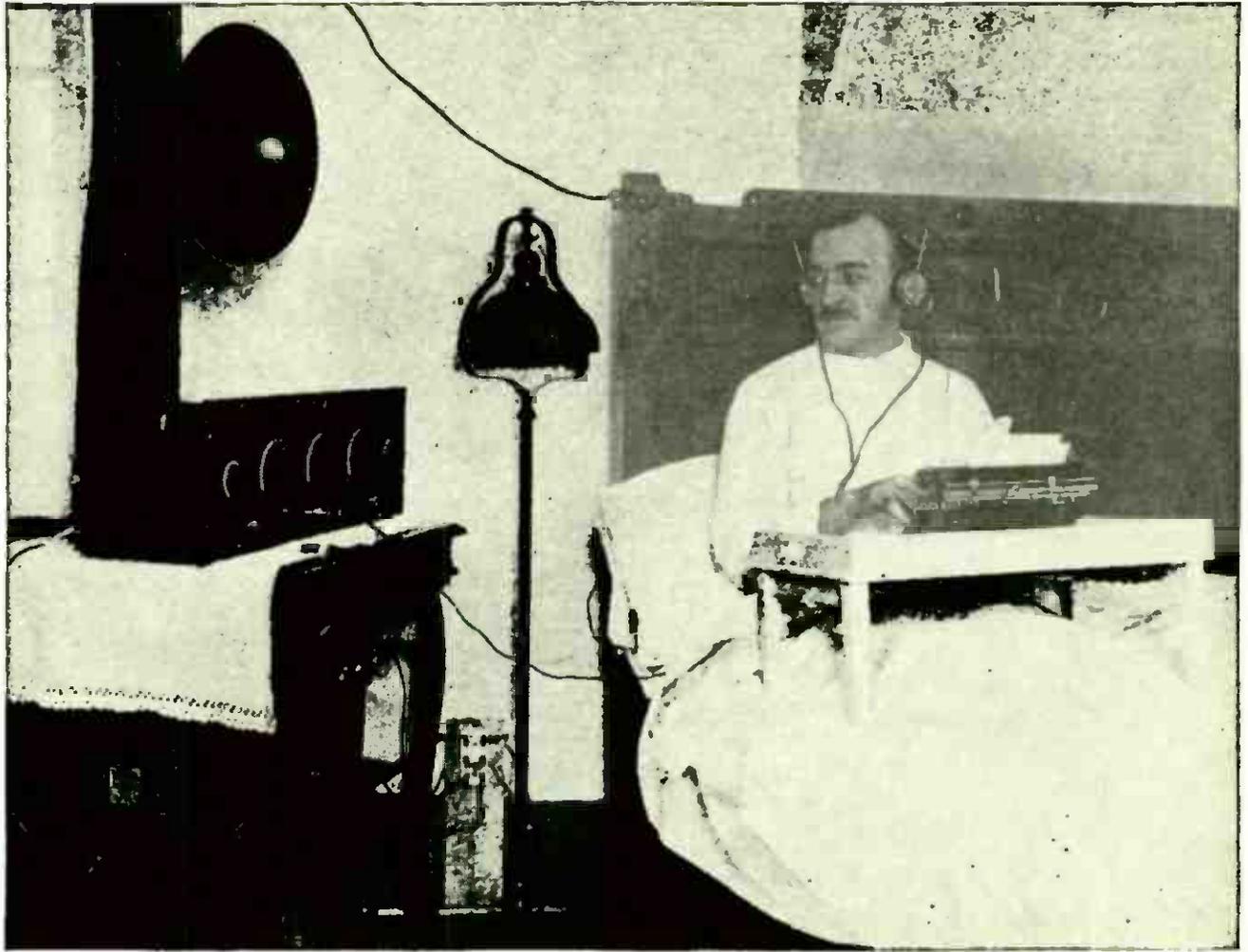
How Radio Helps American Drama

“THOSE who believe that the radio will sweep all other forms of entertainment away are in error. . . . The show which cannot more than hold its own with the present standard of broadcast entertainment must be a play of the feeblest sort. If the radio serves to kill off the inconsequential dramas and leave only the more sturdy ones, it will have performed a useful task for the betterment of the American theater.”

—HEYWOOD BROWN

—THE WORLD (*New York*)

¶ *Excerpts from the notebook of an isolated fan who keeps in touch with the world through personal cards of comment to broadcast artists*



Kadel & Herbert

CONFESSIONS OF AN APPLAUSE-CARD ADDICT

By HAROLD R. THOMPSON

ONE evening there was a fellow telling stories from a station out West. His stuff was so old I could not look my loudspeaker in the face without feeling sorry. He even pulled that old one about having a little dog at home and his name was Tax; he opened the door and Income Tax! And also the old one about a fellow's brother who was so strong that he could tear a pack of cards in two with one hand, and the other chap says:

"That's nothing; my brother only yesterday rushed out the front door and tore up the street."

Well, the broadcasting stations always ask us to send in our suggestions and criticisms, so I drew up a Cartoon-a-gram picturing a young girl laughing so hard that she was falling out of bed, and I wrote on the card:

"Applause, Mr. Story-teller; your program came over well. But when my grandmother was a girl she fell out of bed laughing at those jokes and broke her collar bone."

In a few days I received a letter saying:

"I am glad my part of the entertainment came in so good. Sorry grandma had an accident."

To a Cornet Player

THERE was a chap broadcasting a cornet solo the other night—and he was simply awful! He used the “hit and hunt” method of playing, although he didn’t hunt at all; he just blew. It really was so bad that I could not help sending this card:



SAY BROTHER THE NEXT TIME YOU FEEL LIKE PLAYING ON THAT HORN DON'T COME TO A BROADCASTING STATION TO DO IT.



APPLAUSE MISS LEHLBACH I ENJOYED YOUR SOLOS FROM STATION A.B.C. LAST NIGHT. I HOPE YOU WILL SOON BROADCAST AGAIN FROM THIS STATION.

And her answer was:

“Dear Sir:

“Thanks for your Cartoon-a-gram. Would you do me a favor, and draw me a cartoon just like this one, only have my brother’s face in it, because he never says anything nice about my singing, and this would be such a joke. He has light hair and brown eyes. And, oh, yes! his nose turns up just a bit.

“Sincerely, “_____”

After several days I received this.

“Too bad you use clever applause cards to such poor advantage. My advice to you is not to first blame the broadcasting artist—look for trouble with your receiving set.”

I guess he is right, at that!

To a Vocal Soloist

To a young lady singing at one of the western broadcasting stations, I sent an applause card like this:

To a Temperamental Soprano

BUT “that ain’t the half of it.” I sent one of these applause cards to a young lady who sings every week from Chicago. She answered with a personal letter: “I’ll say it was personal!” After thanking me for making her such a perfectly lovely personal card, and such a clever one too, she wondered why I did not write and tell her something of myself; she would

A Radio Fan Who Has Checked Up on 42 Stations an Evening

Up at Lake Placid, New York, lives a radio fan who has written—and illustrated with pen-and-ink sketches—so many and such amusing applause cards that his name is known to many hundreds of broadcast artists throughout the country. It is Harold R. Thompson.

Mr. Thompson’s cards are so unusual that they sometimes elicit unexpected replies. Some of these replies bring a smile—as the incidents told in this article indicate.

During Mr. Thompson’s health sojourn at Lake Placid he has become a diligent radio fan. He has logged as many as 42 stations a day. He claims that the mental stimulation resulting from this interest has been largely responsible for his improvement in health. “And I am getting well,” he adds, “because I have not forgotten how to laugh.”

just *love* to hear something of such a clever boy.

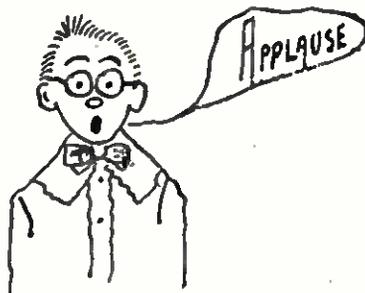
Well, I answered that one before the wife got down to breakfast. I didn't like to say "Soft pedal on that stuff, girly; the wife goes to the post office for the mail," so just as though I were telling her all about me I wrote:

"It may interest you to know how I started cartooning. When my three boys were young, they always wanted me to draw for them before they went to bed. . . ."

I have had no further requests for the rest of my autobiography.

To a Prize Fighter

ONE of the popular prize fighters broadcast from one of the New York stations. He told how he had succeeded by hard work. He said he would like to hear from his listeners, so I sent him this card, with the following message:



"Oh, Mr. —, are you really the man that

fights? My papa enjoyed your talk last night. Maybe you don't recognize my papa by name but he attended your last fight and you no doubt will remember him as the man with the brown derby in the third row."

This answer came in a few days.

"Your card received. Thanks. If your papa was the man that stood up every time I knocked my opponent down—yes, I remember the brown derby."

To a Telephone Girl

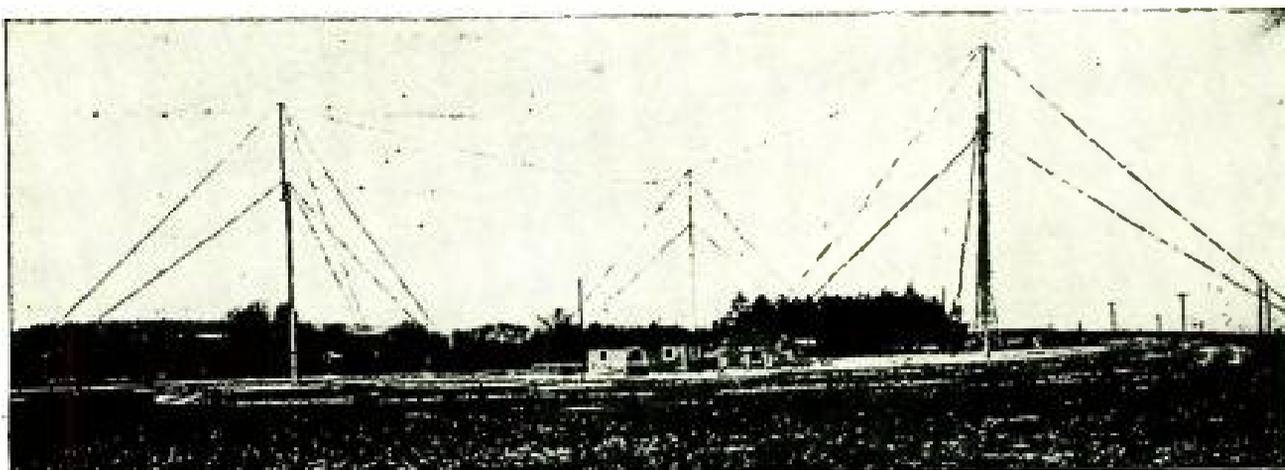
A TELEPHONE operator gave a most interesting talk, "How a Telephone Call Is Made," from one of the popular broadcasting stations. Having enjoyed it I sent the following applause card:



In a few days I received the following from friend telephone operator.

"Many rings you have wished me
But one is enough
I hope that you get me,
For I'm calling your bluff."

I have crossed telephone operators off my applause card list for good.



A FIFTY-THREE ACRE RADIO LABORATORY

To discover means of improving broadcast transmission, the General Electric Company has constructed near Schenectady, N. Y., one of the most extensive radio testing plants in the world. One of the experimental antennas is shown above.



The Bray Productions

The BROADCAST LISTENER

*Comments on radio programs, methods and technique
—from the point of view of the average fan*

By RAYMOND FRANCIS YATES

"Ear-fag" from Listening in on Dinners

IT seems that our hard-pressed *entrepreneurs* of the radio still believe that public and semi-public dinners with their rattling salad forks, incessant chattering reminiscent of the primate quarters at the zoölogical park, and the crusty puns of bored speechmakers, make good material for broadcasting.

If you are a hearty laughter and need but a small mental prick to provoke a sustained spell of guffawing, you probably get a great deal of pleasure out of these dinners. On the other hand, if your funny bone is properly shielded and insensitive to anything but double-distilled humor and witticism, you may feel with us

that the dinners of the United Association of Traffic Managers or the Society for the Appreciation of Mozart, wherein Mrs. Dingle, the fat lady president, reads a ten-thousand word eulogy filled with platitudes and lavender-scented phrases, should be kept off the air.

Either that or arrangements should be made to attach some sort of a gaget to the aerial of the studio so that the vaporous matter, instead of pouring over the country, would be stored in high-pressure steel cylinders. These in turn might be distributed to local garages for inflating automobile tires.

It seems to us that dinners fulfill their social mission when they bore their guests to the point of picking up and nibbling on cracker crumbs or balancing their butter knives on the edge of their soup plates. Why, in the name of

human decency, should this contagion be flung far and wide to bring to a state of itching boredom the thousands of innocent radio listeners who seek solace in the air?

Dinners make pretty inexpensive broadcasting in many ways. It is certain that they are about fourteen kilometers short of making good material for the esthetic nourishment of the radio audience.

Ear-fag, that's what they are; ear-fag!

Not a single thing can be recorded in their favor. Continuity, so necessary to the formula of good broadcasting, is about as conspicuous by its absence as anything can be. Long spaces of waiting, filled by the impromptu ranting of an announcer registering with negative interest is another sad but inevitable part of every dinner program. And then, to top all of this, the transmission, like the transmission from most out-of-studio events, is chronically bad.

So here is a great big vote against the broadcasting of public dinners in their entirety. Only excerpts in the form of orations from prominent folks are excusable.

* * *

Why Not a "Fade-out" in Radio?

HEAVEN knows that we are not a body to pile up more responsibilities on the already rounded shoulders of our studio managers, but we must be permitted to suggest new artistic touches to the programs when they occur to us. If these old bones are not mistaken, an acoustic fade-out for the radio, functioning in the manner of the optical fade-out in the movies, could be devised for a very few pennies.

A curtain roller spring with a slider on it bridged across the microphone might do the trick; variable resistance across the microphone—that is what we are driving at.

Imagine, if you will, an orchestra playing Victor Herbert's "Kiss Me Again." That should be very easy to remember if you listen much to the radio. The fade-out device is brought into action on the last two bars and during a short interim a second orchestra strikes up a fox-trot version of the same number. This is faded-in.

Here's a little dare for some studio to put this into practice.

* * *

Do Announcers Talk Too Much?

IT is difficult to define the correct formula for correct announcing. Yet this cannot be taken to mean that the mistakes of some announcers are any the less evident or that they can shock the artistic sensibilities of this department and get away with it.

If there is one thing in this wide, wide world that stirs these old bones to action it is a talky announcer possessed with the notion that he is about the wittiest thing on the air and that, were it not for his literary pie-throwing, his station would be about the saddest spectacle in airdom.

Short, easy, facile announcements in a well-modulated voice with an occasional salting of witticism, register strongly in this neck of the woods.

There is one announcer up at WGY that just tickles us all over.

Some of our worthies seem to think that the interim between features should be stretched out and filled up with a heavy brand of arid hokum designed to send the listeners into prolonged fits of laughter. There is a technique to being cheery and there is a technique to being humorous but there is no technique to the incessant unloading of parlor wisecracks.

Let us have more announcing and less talking!

* * *

A Distinguished Service Medal for Broadcasting

IT will be one of the aims of this department to toss out little bunches of smiling violets to worthy performers and studios. Let it be understood at the outset that our blue ribbons and our violets are very precious and that the recipients can feel justly proud at having penetrated a hide of substantial thickness.

WEAF must be the first to be called forth to the platform to receive the distinguished service medal.

No fair-minded listener to the radio could have heard the broadcasts of the Navy Orchestra coming through from WCAP Washington without feeling like going right out to the voting booths and voting it one of the grandest pieces of broadcasting that ever modulated a plate current.

To think that this music was exposed to all of the dangers of two hundred and thirty miles of land wire between Washington and New York without losing one iota of its brilliancy or life is to appreciate the marvel and perfection of the work.

We have a pretty long list of stations that should write in to WEAF for a little information on this subject.

* * *

The New Technique of the Radio Drama

FOR two years now we have been deserting the dinner table at the salad in order to be at the radio in time for WGY's dramas.

It must be admitted, even by the most intolerant observer, that WGY has once and for all time established the ear-play in broadcasting. This accomplishment in itself should be attended with some honor and glory and in the radio years to come perhaps the penetrating pen of some historian of the theater will give decent recognition to the effort.

This establishment of the ear-play, with its carefully worked out technique of sound illusions, has by no means come about through unintelligent leadership or unmindful application to the problem of creating the atmosphere of the theater in the voids of space. The performers, the principal equation, have been selected with care and patiently trained. Their work, all considered, has been admirable.

Unfortunately for WGY, the technique of the theater is strange to the technique of the

studio and we can never hope to take a play prepared to meet the needs of the legitimate stage and broadcast it without, in the majority of cases, confusing the listeners or losing their interest.

The chief obstacle to the success of the transfer from the stage to the studio is not caused entirely, as might be presumed, by the total lack of vision. A play with a sufficiently small cast may be presented from either source with a large degree of success.

The trouble with most stage plays adapted to the radio is that they have too many characters who, because they are not seen, cannot be readily recalled by the listener.

The listener, unlike the theatergoer, must mark and follow his characters by voice only and when a large group of players with voices differing only slightly in modulation appear, the radio listener divides his mental effort between following the plot and keeping tabs on the players. It is natural that he should lose much of the entertainment.

The only solution to this problem seems to lie in preparing plays especially for the air with a small cast of characters with voices varying in modulation to a marked degree. Four players or five at the utmost would seem to be about the limit.

The Art of Radio Program-making

SOME day we shall feel inspired (or bored?) to the point of writing a long and bitter critique on the art of program fabrication.

It has always seemed to us that our station programs are assembled with little regard for emotional or artistic effect. To an esthetic soul of our sensitivity, this is one of the unpardonable sins of the radio. Jazz band follows jazz band, sopranos follow sopranos and it seems, to one who listens with a critical ear, that proper balance and artistic arrangement are attained always by chance, and never by design. Some day program construction will be reduced to an art with a list of rules as rigid and definite as those that have been formulated for the theater. That may be a long way off, but it must come.

* * *

(EDITORIAL NOTE: This feature is dedicated to more intelligent program presentation and to better service from the studios. Its function as a forum will be facilitated if you will jot down your own thoughts about broadcasting features and send them to this department for comment.)

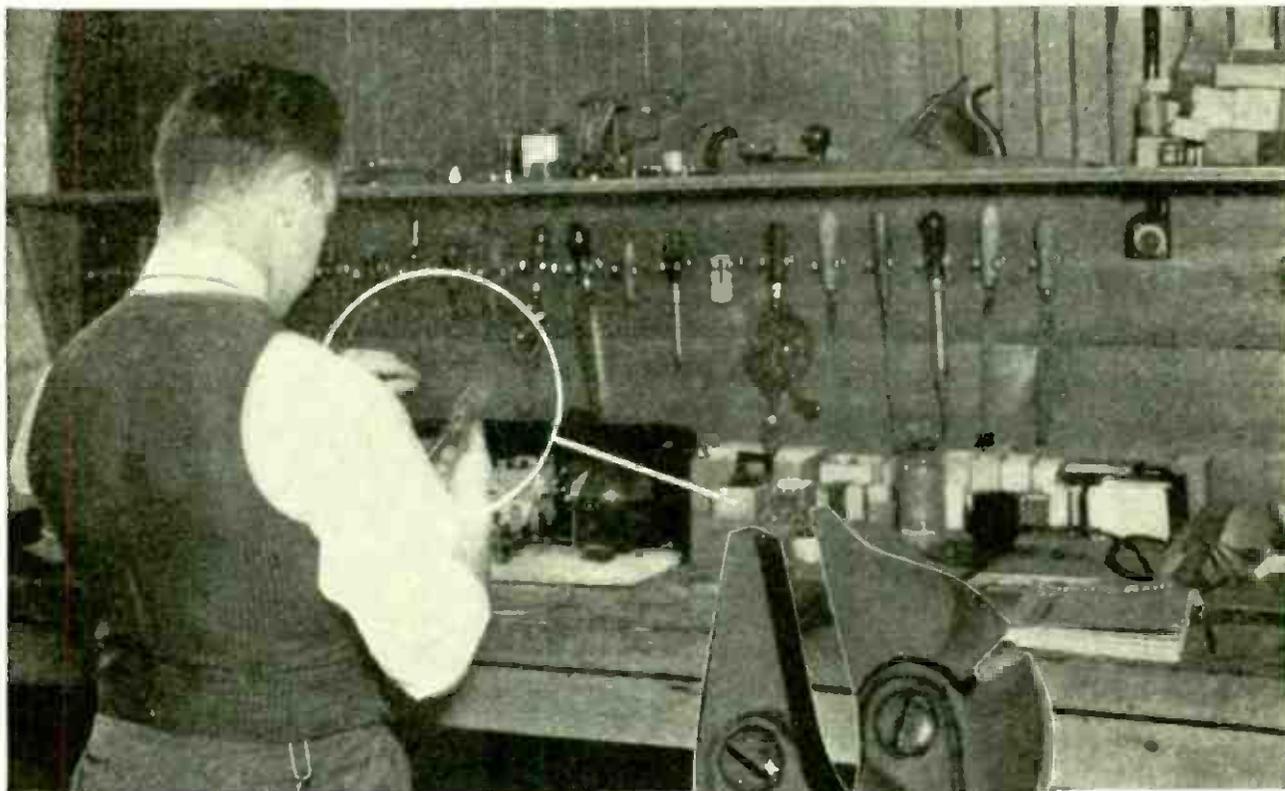


International Newsreel

HOW JOHN BULL CATCHES BANDITS BY RADIO

Constables aboard motor cars, equipped with radio transmitting and receiving apparatus, kept in communication with other police cars while they chased automobile bandits a short time ago in England. In the picture above the riggings on top of the automobiles are used to support antenna wires. They may be raised, with the aid of counterweights, when they are used for transmitting. Other European police forces are developing similar radio "flying squad" systems to combat crime in conjunction with the broadcasting of descriptions of criminals.

Handy Tools for Radio Fans: No. 1



From a photograph made for POPULAR RADIO

SIDE-CUTTING PLIERS

*An indispensable tool for any
radio set owner*

THE average radio fan's tool kit usually consists of a pair of pincers, a screwdriver and (if he is lucky) a small soldering iron. There are many jobs that he may like to do, but unless he has adequate tools he will be handicapped.

This series of workshop hints will indicate the tools that always come in handy for a set owner, whether he is interested in actually building a set, or merely in keeping it in repair. The first six items that will appear are necessary to every set owner, and the following implements will be of interest to the more intensive experimenter.

The first tool—here illustrated—is extremely useful for cutting and bending wire used in a radio set or for antenna or ground connections. It is probably the most used single tool in radio work.





Kadel & Herbert

A Five Meter Vacuum-Tube Transmitter and Receiver

The use of shorter and shorter wavelengths for both broadcasting and amateur transmission is slowly increasing. At one time a wavelength of 200 meters was considered as short as could be successfully employed. Now, however, we have had for some time regular broadcasting transmission and reception established on a successful basis below 100 meters by station KDKA. In the above picture is shown an experimental transmitter and receptor which operates from a VT-2 vacuum tube (with the base removed) and the connections made directly to the lead-in wires. This laboratory set-up was designed by William A. Bruno.



THIS department is conducted by POPULAR RADIO LABORATORY for the purpose of keeping the radio experimenter and the broadcast listener informed concerning the newest inventions and the approved developments in radio equipment. Only such apparatus as has been tested and endorsed by the Laboratory is noted in these columns.

LOOPS

Amplifex loop; Amplifex Radio Corp.
Bodine basket-weave loop aerial; Bodine Electric Co.
"Boone" Super Folding loop acrials; J. T. Boone Radio Corp.
Loop antenna and base; Calvert Specialty Co.

AMPLIFIERS

Adaunit amplifier; Auto Indicator Co.
Algo audio-frequency amplifier; Algonquin Elec. Mfg. Co.
Distortionless amplifier; Amplex Instrument Laboratories.
"Superheterodyne" amplifier; Amplex Instrument Laboratories.
"Atwater Kent" amplifying units; Atwater-Kent Mfg. Co.
"Bristol" one-stage power amplifier; The Bristol Co.

HEADPHONES

Bel-Canto headset; Bel-Canto Mfg. Co.
Berston headset; Berston Radio Products.
Bi-Metallic phones; Bi-Metallic Radio Parts Corp.
"Brandes" Navy type headset; C. Brandes, Inc.
"Brandes" Superior headset; C. Brandes, Inc.
"Callophone" headset; Callophone Co.
"Camco" Cannon-Ball headset; Cannon and Miller Co.
Headset; Connecticut Instrument Co.
"Coryphone" headsets; Chas. Cory and Son.

LOUDSPEAKERS

"Dodge" Tone Amplifier; Ackerman Bros. Co., Inc.
Burns loudspeaker; American Electric Co.

A USEFUL ACCESSORY

Name of instrument: An extension jack.

Description: A jack which may be used on a long cord for moving the loudspeaker away from the receiving set. It is equipped with a cover which may be attached after the connections have been made so that there are no live terminals.

Usage: As an accessory in connection with the lengthening of the loudspeaker cord.

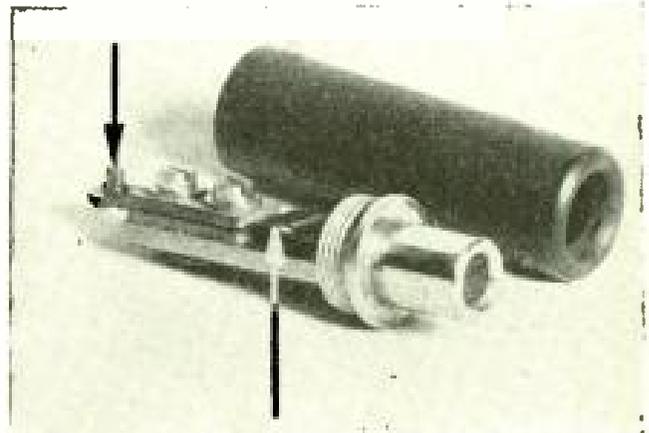
Outstanding features: Sturdy construction. Well insulated. Dustproof.

Maker: Yaxley Manufacturing Co.

"Radion" loudspeaker horn; American Hard Rubber Co.
"Amplion" loudspeaker; Amplion Corp. of America.
"Atwater Kent" loudspeaker; Atwater Kent Mfg. Co.
Bel-Canto loudspeaker; Bel-Canto Mfg. Co.
"Sonochorde" loudspeaker; Bondette Mfg. Co.
"Brandes" table talker; C. Brandes, Inc.
"Bristol" audiophone loudspeakers; The Bristol Co.
"Callophone" loudspeaker; Callophone Co.
Camco loudspeaker; Cannon and Miller Co.
Radiograph (crystal set loudspeaker); Central Radio Co.
"Madera" Clearspeakers; Compressed Wood Corp.
"C. I. C." loudspeaker; Connecticut Instrument Co.
"Coryphone" loudspeaker; Chas. Cory and Son.

CRYSTAL DETECTORS

All American Super-sensitive crystal; American Radio Mfg. Co.
Syn-tec radio crystal; Appliance Radio Co.
"Airader" detector; Bernards Radio Co.
B-Metal loud talking crystal; B-Metal Refining Co.
Celerumdum "de-lex-it" (fixed detector); Celerumdum Radio Products Co.
"Century" Radio Reflex crystal; Century Products Co.
"Century" Maxitone crystal; Century Products Co.



Equipped with phosphor bronze connection strip and screw terminal.

RADIO-FREQUENCY TRANSFORMERS

Acme "D" Coil Unit (Tuned R. F. Transformers with Condenser); Acme Apparatus Co.
 Radio-frequency transformers; Associated Sangamo Electric Companies.
 "Benson" Reflex transformer; Benson Engineering Co.
 "Ballantine" Variotransformer Units; Boonton Rubber Mfg. Co.
 "Branston" Radio-frequency Transformers; Chas. A. Branston, Inc.
 "Branston" Three Stage Long Wave R. F. Transformer; Chas. A. Branston, Inc.
 "Tri-Coil" Radio Frequency transformers; Brooklyn Metal Stamping Co.
 "Cardwell" radio transformer; Allen D. Cardwell Mfg. Corp.
 "Como" intermediate frequency transformer; Como Apparatus Corp.
 "Coto" radio frequency transformer; Coto Coil Co.

BATTERY CHARGERS AND RECTIFIERS

APCO "A" battery charger; Apco Mfg. Co.
 APCO "B" battery charger; Apco Mfg. Co.
 "Acme" silent battery charger; Acme Engineering Co.
 "Gold Seal" "Homcharger" Automatic Electrical Devices Co.
 No. 4 chemical rectifier; Cleveland Engineering Laboratories Co.
 Storad "B" battery charger; Cleveland Engineering Laboratories Co.

BATTERIES

Bosch Nobattery (takes place of "B" battery); American Bosch Magneto Corp.
 "Arrow" Storage batteries; Arrow Battery Co.
 Radio "B" batteries at "factory" prices; Ayres Battery Corp.
 Burgess Batteries (dry cell); Burgess Battery Co.
 Ace Radio "B" battery No. 15; The Carbon Products Co.
 Ace Radio "A" battery No. 61; The Carbon Products Co.
 Ace Radio "B" battery No. 1301; The Carbon Products Co.
 Flashlight battery No. 1-A; Champion Carbon Mfg. Co.
 Flashlight battery No. 1-B; Champion Carbon Mfg. Co.
 Storad "A," "B" and "C" batteries; Cleveland Engineering Laboratories Co.
 "Copper Giant" "A" battery; Copper Giant Battery Co.

RADIO CABINETS

Radio cabinets; A. Hall Berry.
 "Blandin" radio cabinet; Blandin Phonograph Co., Inc.
 "Corbett's" radio cabinet; Corbett Cabinet Mfg. Co.

PHONOGRAPH ATTACHMENTS

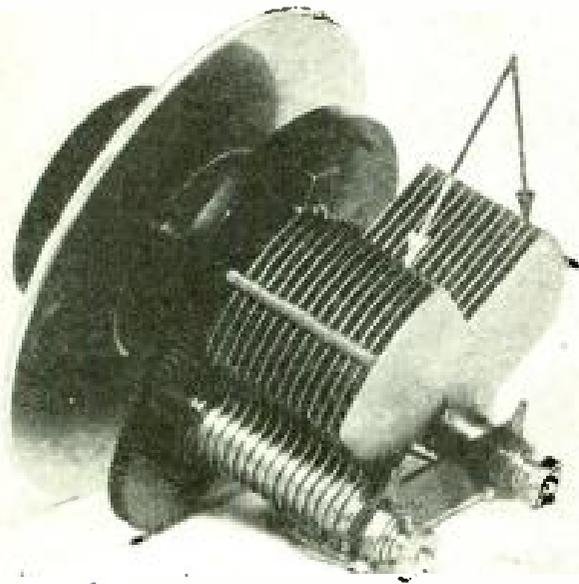
"Amplion" phonograph unit; Amplion Corp. of America.
 "C.I.C." Phonograph attachment; Connecticut Instrument Co.

VARIABLE CONDENSERS

"Acme" variable condenser; Acme Apparatus Co.
 "Bradleydancer"; Allen Bradley Co.
 "American Brand" Worm-drive vernier condenser; American Brand Corp.
 Kelford variable condenser; American Specialty Co.
 Amplex grid-condensers; Amplex Instrument Laboratories.
 "Amsco" Low Loss variable condenser; Amsco Products, Inc.
 "Fada" variable condenser; F. A. D. Andrea, Inc.
 Variable air condensers; Beacon Radio Mfg. Co.
 "Boone" Super Variable condensers; J. T. Boone Radio Corp.
 "Bremer-Tully" Lifetime condenser; Bremer-Tully Mfg. Co.
 "Bruno" 3 in 1 variable condensers; Bruno Radio Corp.
 "Flewelling" variable condensers; Buell Mfg. Co.
 "Cardwell" variable condensers; Allen D. Cardwell Mfg. Corp.
 "Chelsea" variable condensers; Chelsea Radio Co.
 Chelton "Special" condensers; Chelton Electric Co.
 "Connecticut" variable condenser; Connecticut Telephone and Elec. Co.
 "Coto" compact air condensers with vernier, types 35025 and 3505; Coto Coil Co.

SWITCHES

"Fil-fonc" control switch; The A-C Electrical Mfg. Co.
 "Ackerman" inductance switch; Ackerman Bros. Co., Inc.
 "Bradleyswitch" (battery switch); Allen-Bradley Co.
 "Regal" switches; American Specialty Co.
 "Amsco" switches; Amsco Products, Inc.
 Benjamin radio battery switch; Benjamin Elec. Mfg. Co.
 "Bruno" inductance switches (single and double); Bruno Radio Corp.
 "Centralab" battery switch No. 300; Central Radio Laboratories.
 Lock "A" battery switch; Connecticut Instrument Co.
 "Cico" battery switch; Consolidated Instrument Co. of America, Inc.
 C-H Radioloc; Cutler Hammer Mfg. Co.



Two sets of movable plates.

A NOVEL FORM OF VARIABLE CONDENSER

Name of instrument: Variable condenser.

Description: This instrument is unique in design because its rotary plates are made of hardened brass. These are mounted on two separate shafts which are geared together by means of three bakelite gears which also transmit the rotary motion from the knob and dial. Both of the plates are equipped with pigtail connections and the terminals are both brought out to binding posts with soldering lugs.

Usage: In any radio-frequency circuit for tuning.

Outstanding features: High efficiency. Compact. Simplicity of mounting on a panel.

Maker: Remler Radio Manufacturing Co.

AN EXCELLENT AUDIO-FREQUENCY TRANSFORMER

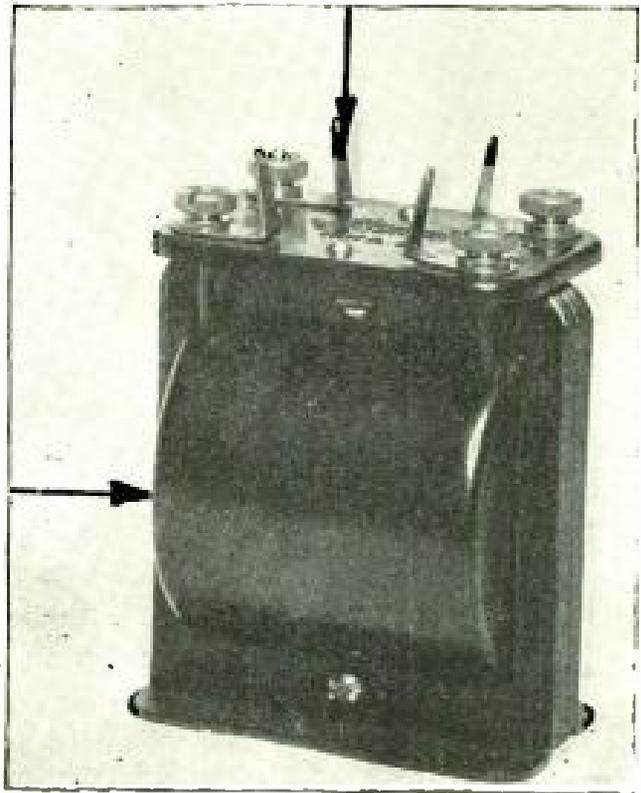
Name of instrument: Audio-frequency amplifying transformer.

Description: A transformer in which the core and the two sets of windings are totally enclosed in a metal shell. The windings themselves are composed of sets of helically-wound coils connected in series as against the ordinary layer-wound coil, which is generally used. This construction reduces the distributed capacity across the windings. The terminals are brought out to soldering lugs.

Usage: In an amplifying circuit of audio-frequency transformer.

Outstanding features: Coils entirely enclosed. Equipped with soldering lugs. Good volume. Clear amplification.

Maker: Samson Electric Co.



Coils encased in metal shell. Equipped with soldering lugs.

TUNING INDUCTANCE UNITS

"Copp" Vario Selector; A. C. Electrical Mfg. Co.
"Amrad" Basketball (inductance tuner); American Radio and Research Corp.

"Amsco" variometers; Amsco Products, Inc.
"Amsco" honeycomb coils and mountings; Amsco Products, Inc.

Oscillator Coil Unit; Associated Sangamo Electric Companies.

Honeycomb coils; Atwood Electric Co.
Bel-Tone Variometer; Bel-Tone Radio Co.

Bel-Tone Variocoupler; Bel-Tone Radio Co.
Coupler and plate coil for superdyne circuit; Bel-Tone Radio Co.

Bel-Tone Filter Tuner; Bel-Tone Radio Co.
"Branston" Oscillator Coupler; Chas. A. Branston, Inc.

"Branston" honeycomb coils; Chas. A. Branston, Inc.

Bremer-Tully Vernier tuning unit; Bremer-Tully Mfg. Co.

New type B-T Low loss tuner; Bremer-Tully Mfg. Co.

"Flewelling" Tuner; Buell Mfg. Co.

"Chelsea" antenna tuning unit; Chelsea Radio Co.

"Chelsea" radio-frequency tuner; Chelsea Radio Co.

"Voisometer" (combination variometer and coupler); Co-operative Sales Co.

"Coto" Compact moulded variocoupler; Coto Coil Co.

"Coto" Compact moulded variometer; Coto Coil Co.

"Coto" honeycomb coils; Coto Coil Co.

GRID-LEAKS AND RESISTANCES

"Bradleyleak" (grid-leak); Allen-Bradley Co.

"Bradleyohm" (resistor); Allen-Bradley Co.

Amplex Lavite resistances; Amplex Instrument Laboratories.

"Kant-Blo"; Apex Radio Co.

"Brady" grid-leak; A. C. Brady Co.

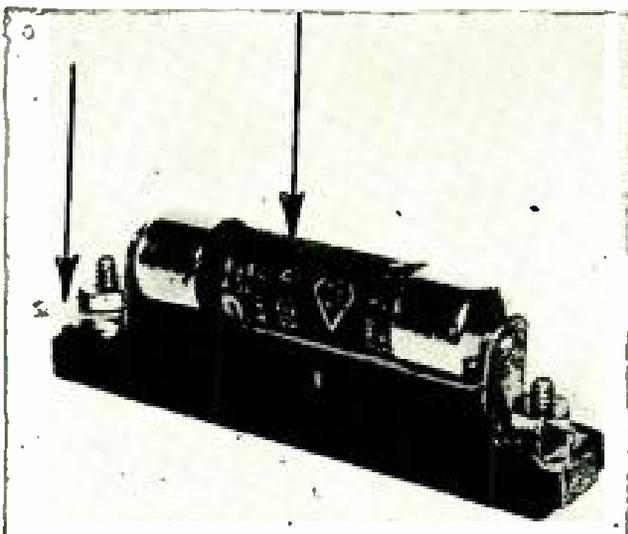
Volt-X Ball-bearing variable grid-leak; Burton and Rogers Mfg. Co.

"Centralab" Adjustable grid-leaks, No. 106 and 107; Central Radio Laboratories.

"Crescent Lavite resistances; Crescent Radio Supply Co.

"C-H" grid-leaks; Cutler-Hammer Co.

"C-H" resistances; Cutler-Hammer Mfg. Co.



Detachable unit. Equipped with soldering lugs.

A FILAMENT CURRENT CONTROL

Name of instrument: Automatic rheostat.

Description: A small vacuum tube which contains a filament of metal that has a high co-efficient of resistance. In other words, a metal filament which has a very low resistance at low temperature, but a high resistance at high temperature. This ability of the metal to vary its resistance with temperature makes it useful for controlling the filament current of vacuum tubes. The small tube that contains this resistance element is equipped with two metal ends which are used as terminals when it is inserted in the base that is supplied with the instrument.

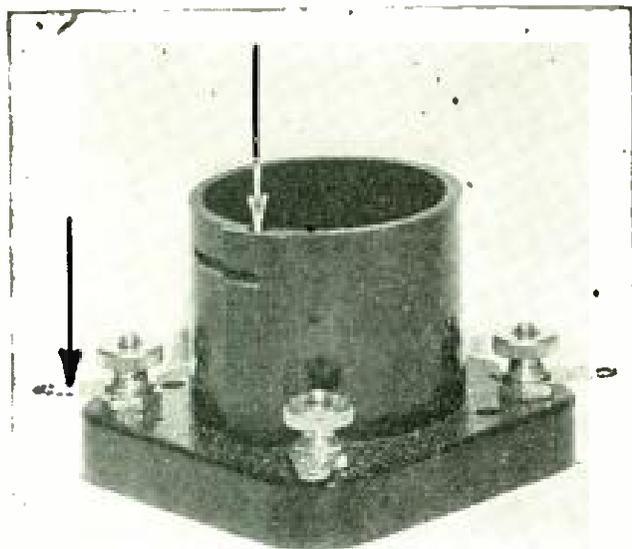
Usage: For controlling the filament current of vacuum tubes.

Outstanding features: Automatic in control. Needs no adjustment. Neat appearance.

Maker: Radiall Co.

MISCELLANEOUS ACCESSORIES

"Copp" vario selector; The A-C Electrical Mfg. Co.
 "Celatsite" (tinned copper wire); Acme Wire Co.
 "Acme" Spaghetti tubing; Acme wire Co.
 7/22 Enameled antenna wire; Acme Wire Co.
 Ribbon copper aerial; Acorn Radio Mfg. Co.
 Enameled ribbon aerial; Acorn Radio Mfg. Co.
 Window Lead-in; Acorn Radio Mfg. Co.
 Jack Wrench; Adams Radio Mfg. Co.
 Multi Radio Connector No. 18; Ajax Electric Specialty Co.
 BPB 5 Binding Post; Ajax Electric Specialty Co.
 Panel mounting; Alden Mfg. Co.
 Allen Special radio soldering paste; L. B. Allen Co., Inc.
 "Radion" Insulators; American Hard Rubber Co.
 "Radion" Loudspeaker phone cap; American Hard Rubber Co.
 "Amrad" S-tube rectifier; American Radio and Research Corp.
 Condenser plate cleaner; Atwood Electric Co.
 "Bakelite" products; Bakelite Corp.
 "Condensite" products; Bakelite Corp.
 "Redmanol" products; Bakelite Corp.
 Quarter hard copper; Baltimore Brass Co.
 Flat copper antenna ribbon; Baltimore Brass Co.
 Flat brass, bronze, gold and zinc; Baltimore Brass Co.
 No. 602-60 lightning arrester switch; The Berkeley Elec. Mfg. Co.
 No. 66 lightning arrester switch; The Berkeley Elec. Mfg. Co.
 "Bates" Ear Cushion for phones; Bates and Co.
 "Solderette" Senior Electric soldering iron; Beehler Steel Products Co.
 "Solderette" Junior Electric soldering iron; Beehler Steel Products Co.
 Belden loop wire; Belden Mfg. Co.
 Belden Litz wire; Belden Mfg. Co.
 Beldenamel aerial wire; Belden Mfg. Co.
 Magnet wire; Belden Mfg. Co.
 Bel-Tone mounted binding posts; Bel-Tone Radio Co.
 Spaghetti tubing; Bentley-Harris Mfg. Co.
 Perfection Hydrometer; Bernco Mfg. Co.
 Domino Lead-In; Bi Metallic Radio Parts Corp.
 Gold plated bus bar; Bi Metallic Radio Parts Corp.
 Gold plated aerial wire; Bi Metallic Radio Parts Corp.
 Blackburn Ground Clamp Type A1; Blackburn Spec. Co.
 Board's Bearings for radio tuning coils; Edward Board.
 "Junior" Bench Saw; W. B. and J. E. Boise.
 "Branston" Three Coil mounting; Chas. A. Branston, Inc.
 "Brilliantone" radio specials; Brilliantone Radio Products.
 Dutch Radio valves; Thos. Brown Co.
 Bruno engraving; Bruno Radio Corp.



Reinforced slot. Equipped with soldering lugs.

C & C "Reachit" Wrench Kaufman and Clough Co.
 Camco Grand; Cannon and Miller Co., Inc.
 Jack Name Plates; Carter Radio Co.
 S.O.S. Hydrometer; Chaslyn Co.
 "Gem" radio fuse base; Chicago Fuse Mfg. Co.
 Kester Rosin-core radio solder; Chicago Solder Co.
 "Church" automatic template; Clark and Tilson, Inc.
 Silver-tone antenna; Colonial Brass Co.
 Bus Wire, square and round; Edward N. Cook Plate Co.
 Tinned "Copperweld" antenna wire; Copperweld Steel Co.
 "Pyrex" insulators; Corning Glass Works.
 Telephone receiver cords; Crescent Braid Co., Inc.
 Premier 20-ft. extension cord with plug; Crescent Braid Co., Inc.
 Tufglass battery tray; R. B. Cressman.
 Cuno radio electric match; Cuno Engineering Corp.

PANELS

"Radion" panels; American Hard Rubber Co.
 "Bakelite-Dilecto" panels; Continental Fibre Co.

KITS

Reflex, Neutrodyne and Superheterodyne kits; American Radio Mfg. Co.
 Neutrodyne and Tobias kits; Amplex Instrument Laboratories.
 Superdyne kit; Amplex Instrument Laboratories.
 Kits for Improved Cockaday 4-Circuit Tuner; Amplex Instrument Laboratories.
 Kit for 4-Circuit Tuner with Resistance-Coupled Amplifier; Amplex Instrument Laboratories.
 "Melco" Supreme Kits; Amsco Products, Inc.
 Kit for 7-tube Superheterodyne; Apex Electric Mfg. Co.
 "Bel-Tone" Superdyne Kit; Bel-Tone Radio Co.
 Superheterodyne Transformer Kits; J. T. Boone Radio Corp.
 "Branston" Kit (for Superheterodyne); Chas. A. Branston, Inc.
 "Bremer-Tully" "Nameless" R. F. Circuit; Bremer-Tully Mfg. Co.

POTENTIOMETERS

"Acme" potentiometer; Acme Apparatus Co.
 "Bradleyometer"; Allen-Bradley Co.
 "Regal" potentiometer; American Specialty Co.
 "Fada" potentiometer; F. A. D. Andrea, Inc.
 "Amsco Dubl-Wundy" combination potentiometer-rheostat; Amsco Products, Inc.
 "Centralab" potentiometers No. 110 and No. 111; Central Radio Laboratories.
 "Cico" bakelite potentiometers; Consolidated Instrument Co. of America, Inc.
 "C-H" potentiometers; Cutler-Hammer Mfg. Co.

JACKS

Radio Jack; Adams Radio Mfg. Co.
 "Tri-Jack"; Brooklyn Metal Stamping Co.
 "Hold-Tite" Jack No. 104; Carter Radio Co.
 "Imp" Jack; Carter Radio Co.
 Receptacle Jack No. 202-A; Carter Radio Co.
 "Cico" Bakelite Jacks; Consolidated Instrument Co. of America, Inc.

A WELL-MADE VACUUM TUBE SOCKET

Name of instrument: Vacuum-tube socket.

Description: A socket for standard tubes completely constructed of bakelite with strong connection fingers of phosphor-bronze and terminals including both binding posts and soldering lugs. The portion of the socket which includes the slot for the vacuum tube pin is reinforced to prevent breakage.

Usage: For mounting standard makes of vacuum tubes.

Outstanding features: Neat appearance. Good contact. Compact.

Maker: Rauland Mfg. Co.

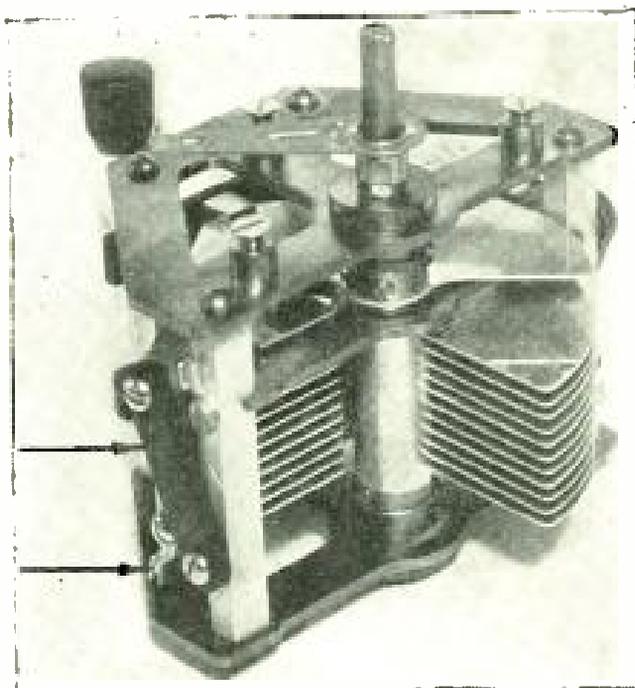
A STURDY VARIABLE CONDENSER

Name of instrument: Vernier variable condenser.

Description: A condenser in which great pains have been taken to make a rigid instrument. The rotary plates are forced into a solid piece of metal and three sets of metal end plates are used. Two are located on each side of the main-section plates and one on the end which contains the vernier plate. The machine work is well done and the insulated segments are so placed and shaped as to reduce the dielectric losses to a minimum.

Usage: In any radio-frequency circuit for tuning.

Maker: Duplex Engine Governor Co.



Long narrow insulation strips. Equipped with soldering lugs.

RECEIVING SETS

A-C Dayton receiver; The A-C Electrical Mfg. Co.
Polydyne receiver, type XL-5; The A-C Electrical Mfg. Co.

"Paragon" Receiver; Adams-Morgan Co.

"Air-Way" Receiver; Air-Way Electric Appliance Corp.

Ajax Crystal Receiving set; Ajax Electric Specialty Co.

Marv-O-Dyne radio receiver; Amber Sales Corp.

"Amrad" Receiver (3380); American Radio and Research Corp.

Electrola Receiver; American Specialty Co.

Melco Supreme Receiver; Amsco Products, Inc.

"Fada" Neutrodyne Receiver; F. A. D. Andrea, Inc.

Deresnadyne Broadcast Receiver; Andrews Radio Co.

Microdyne radio receiver; Apex Electric Mfg. Co.

"Atwater Kent" receiving set; Atwater Kent Mfg. Co.

Pocket radio receiver; Auto Indicator Co.

"Baby Grand" crystal receiver; Beaver Machine and Tool Co., Inc.

"Benson" Portable Superflex; Benson Engineering Co.

Biltmore Master Reflex receiver; Biltmore Radio Co.

Brandola Receiver; J. F. Brandeis Corp.

"Cardwell" Receiver; Allen D. Cardwell Mfg. Co.

"Chelsea" Receiver; Chelsea Radio Co.

Clear-O-Dyne receiver; Cleartone Radio Co.

"Goldcrest Cleartone" receiver; Cleartone Radio Co.

Crosley Receivers; Crosley Radio Corp.

"Teledyne" Receiver; Cutting and Washington Radio Corp.

"C & W" Receiver; Cutting and Washington Radio Corp.

"Town & Country" Receiver; Cutting and Washington Radio Corp.

PHONE PLUGS

Multi Radio Plug No. 18; Ajax Electric Specialty Co.

Series four-phone plug, No. 616; The Barkeley Electric Mfg. Co.

Multiple four-phone plug No. 614; The Barkeley Electric Mfg. Co.

Series four-phone post No. 618; The Barkeley Electric Mfg. Co.

Series four-phone post for binding post mounting No. 628; The Barkeley Electric Mfg. Co.

Series four-phone post for Radiala III No. 624; The Barkeley Electric Mfg. Co.

"Tu-way" Plug; Carter Radio Co.

"One-Way" Plug; Carter Radio Co.

"Imp" Plug; Carter Radio Co.

"Cico" 2-Way Plug; Consolidated Instrument Co. of America, Inc.

"Cico" automatic plug; Consolidated Instrument Co. of America, Inc.

DIALS

"No-ald" Dials; Alden Mfg. Co.

"Radion" Dials; American Hard Rubber Co.

"Regal" Dials; American Specialty Co.

"Amsco" Dials; Amsco Products, Inc.
"Apex" vernier dial; Apex Electric Mfg. Co.
"Bell" dials; Bell Mfg. Co.

SOCKETS AND ADAPTERS

"No-ald" sockets; Alden Mfg. Co.

Standard socket; Alden Mfg. Co.

"Radion" socket; American Hard Rubber Co.

"Amsco" socket; Amsco Products, Inc.

Sockets; Belden Mfg. Co.

"Bell" sockets; Bell Mfg. Co.

Benjamin Cle-Ra-Tone socket; Benjamin Electric Mfg. Co.

Cle-Ra-Tone Gang socket; Benjamin Electric Mfg. Co.

"Flewelling" sockets; Buell Mfg. Co.

"Coto" tube socket; Coto Coil Co.

"C-H" sockets; Cutler-Hammer Mfg. Co.

RHEOSTATS

"Acme" rheostat; Acme Apparatus Co.

"Bradleystat"; Allen-Bradley Co.

"Amsco" Dubl-Wundr" combination potentiometer-rheostat; Amsco Products, Inc.

"Fada" rheostat; F. A. D. Andrea, Inc.

"Autostat"; Automatic Electrical Devices Co.

"Centralab" rheostats No. 206 and No. 230; Central Radio Laboratories.

"Cico" rheostats; Consolidated Instrument Co. of America, Inc.

AUDIO-FREQUENCY TRANSFORMERS

"Acme" Audio-Frequency transformer; Acme Apparatus Co.

"Amertran" transformers; American Transformer Co.

Kelford audio transformer; American Specialty Co.

"Regal" audio transformer; American Specialty Co.

"Fada" audio transformer; F. A. D. Andrea, Inc.

Twin Audio-frequency transformer; Chas. A. Branston, Inc.

"Cardwell" audio transformer; Allen D. Cardwell Mfg. Co.

Chaslyn A-F transformer; The Chaslyn Co.

"Chelsea" amplifying transformer; Chelsea Radio Co.

"Como" Duplex transformer (push-pull); Como Apparatus Co.

"Coto" audio transformer; Coto Coil Co.

"Globe" audio frequency transformers; Coyne Radio Service.

"Crescent" push-pull transformers; Crescent Mfg. Co.

"Crescent" audio transformer; Cresoent Mfg. Co.

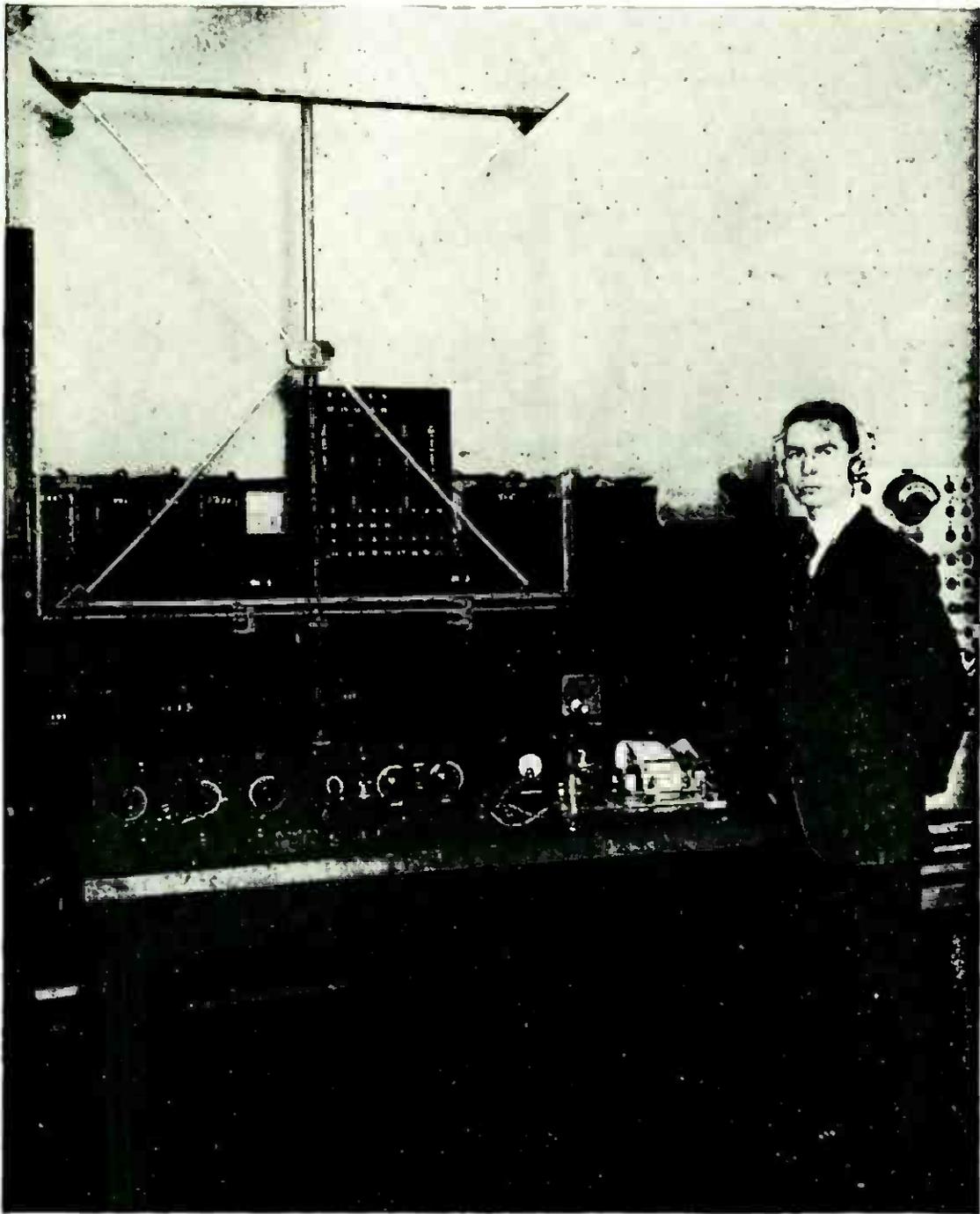
TUBES

Bluebird radio tubes; Bluebird Tube Co.
Vacuum tube; Brendonne Corp.
Brighton True Blue vacuum tube; Brighton Laboratories, Inc.
"Gem" radio fuse; Chicago Fuse Mfg. Co.

"Sodion" tubes; Connecticut Telephone and Elec. Co.
Magnetron, types DC-201A, DC-199 and DC-199 (Standard base); Conneway Electric Laboratories.
"Cunningham" tubes; E. T. Cunningham, Inc.

Q

This list of apparatus approved by the POPULAR RADIO LABORATORY will be continued as a part of the WHAT'S NEW IN RADIO APPARATUS department until all instruments, parts and complete sets have been included. The listing is alphabetical by manufacturer's name and the installment in this issue goes only to the end of letter C.



United

LISTENING-IN ON THE ECLIPSE

This radio receiver in the Bureau of Standards at Washington, D. C. was part of the chain of stations that made observations on January 24 to determine the effect of the eclipse on radio transmission. Signals were broadcast during the eclipse so that the check-up could be made.

Ready Reference Table of Ready-made Receivers

MANUFACTURER'S NAME	<i>Western Coil & Elec. Co.</i>	<i>The Crosley Radio Corp.</i>	<i>F. A. D. Andrea, Inc.</i>	<i>Mu-rad Labs., Inc.</i>
MODEL NUMBER OR NAME	<i>Radiodyne</i>	<i>Model 52</i>	<i>Neutrola Grand</i>	<i>MA-15</i>
NUMBER OF TUBES	6	3	5	6
TYPE OF TUNING	<i>Radio Frequency</i>	<i>Regenerative</i>	<i>Neutrodyne</i>	.....
TYPE OF DETECTOR	<i>Vacuum Tube</i>	<i>Vacuum Tube</i>	<i>Vacuum Tube</i>	<i>Vacuum Tube</i>
RANGE ON PHONES	.....	<i>2,000 miles</i>	<i>Unlimited</i>	.....
RANGE ON LOUDSPEAKER	.....	<i>1,500 miles</i>	<i>1,000 miles</i>	<i>3,000 miles</i>
COST COMPLETE	<i>\$200.00</i>	<i>\$45.75</i>	<i>\$360.00</i>	<i>\$182.50</i>
ANTENNA RECOMMENDED	<i>Outdoor or indoor</i>	<i>Outdoor</i>	<i>Outdoor</i>	<i>Indoor</i>
KIND OF TUBES FOR R. F.	<i>UV-201-a</i>	.....	<i>UV-201-a C-301-a</i>	<i>C-301-a</i>
DETECTOR TUBE	<i>UV-201-a</i>	<i>UV-200 C-300 WD-12 C-12 UV-199 or C-299</i>	<i>UV-201-a C-301-a</i>	<i>C-301-a</i>
AUDIO TUBES	<i>UV-201-a</i>	<i>UV-201-a C-301-a WD-12 C-12 UV-199 or C-299</i>	<i>UV-201-a C-301-a</i>	<i>C-301-a</i>
TYPE OF "A" BATTERY	<i>Wet or dry</i>	<i>To suit tubes</i>	<i>6 Storage</i>	<i>6 Storage</i>
TYPE OF "B" BATTERY	<i>Wet or dry</i>	<i>90 volts</i>	<i>90 volts dry or storage</i>	<i>Large size</i>
DETECTOR "B" VOLTAGE	<i>22 1/2 volts</i>	<i>22 1/2 volts</i>	<i>22 1/2 volts</i>	<i>36 volts</i>
WAVELENGTH RANGE	<i>220 to 560 meters</i>	<i>200 to 600 meters</i>	<i>200 to 600 meters</i>	<i>250 to 600 meters</i>
NUMBER OF TUNING CONTROLS	2	1	3	1
"A" BATTERY CURRENT USED	<i>1 1/4 amps.</i>	<i>Depends on tubes</i>	<i>1 1/4 amps.</i>	<i>1.25 amps.</i>
"B" BATTERY CURRENT USED	<i>9 to 12 mils.</i>	<i>Depends on tubes</i>	<i>20 mils.</i>	<i>27 mils.</i>
MANUFACTURER'S NAME	<i>Garod Corp.</i>	<i>Clearstone Radio Co.</i>	<i>The C. D. Tuska Co.</i>	<i>Radio Corp. of America</i>
MODEL NUMBER OR NAME	<i>Type V</i>	<i>Models 70, 71, 72</i>	<i>Type 4</i>	<i>Radiola Regenoflex</i>
NUMBER OF TUBES	5	4	4	4
TYPE OF TUNING	<i>Tuned Radio</i>	<i>Tuned Radio</i>	<i>1 R.F. with Regeneration</i>	<i>1 stage R.F. with Regeneration</i>
TYPE OF DETECTOR	<i>Vacuum Tube</i>	<i>Vacuum Tube</i>	<i>Vacuum Tube</i>	<i>Vacuum Tubes</i>
RANGE ON PHONES	<i>4,000 miles</i>	<i>3,000 miles</i>	<i>3,000 miles</i>	.....
RANGE ON LOUDSPEAKER	<i>2,500 miles</i>	<i>2,000 miles</i>	<i>3,500 miles</i>	.....
COST COMPLETE	<i>\$195.00</i>	<i>\$130.00</i>	<i>\$350.00</i>	<i>\$191.00</i>
ANTENNA RECOMMENDED	<i>Outdoor</i>	<i>Outdoor</i>	<i>Outdoor</i>	<i>Outdoor</i>
KIND OF TUBES FOR R. F.	<i>UV-201-a or C-301-a</i>	<i>UV-201-a or C-301-a</i>	<i>UV-201-a</i>	<i>WD-11</i>
DETECTOR TUBE	<i>UV-200</i>	<i>UV-200, C-300 UV-201-a C-301-a</i>	<i>UV-200</i>	<i>WD-11</i>
AUDIO TUBES	<i>UV-201-a or C-301-a</i>	<i>UV-201-a C-301-a</i>	<i>UV-201-a</i>	<i>WD-11</i>
TYPE OF "A" BATTERY	<i>Storage</i>	<i>Storage</i>	<i>6 storage</i>	<i>Dry cells, 1.5 volts</i>
TYPE OF "B" BATTERY	<i>Storage</i>	<i>Dry or storage</i>	<i>Any standard</i>	<i>90 volts</i>
DETECTOR "B" VOLTAGE	<i>90 to 200 volts</i>	<i>Depends on tubes</i>	<i>Any standard</i>	<i>20 to 45 volts</i>
WAVELENGTH RANGE	<i>200 to 600 meters</i>	<i>200 to 600 meters</i>	<i>Broadcast range</i>	<i>220 to 550 meters</i>
NUMBER OF TUNING CONTROLS	3	2	2	2
"A" BATTERY CURRENT USED	<i>1 1/4 to 2 amps.</i>	<i>1 to 1.75 amps.</i>	<i>1 1/4 amps.</i>	<i>1 amp.</i>
"B" BATTERY CURRENT USED	<i>15 to 35 mils.</i>	<i>.02 amps.</i>	<i>10 mils.</i>	<i>6-7 mils.</i>



IN THE WORLD'S LABORATORIES

CONDUCTED BY DR. E. E. FREE

No Lightning Danger from Radio Installations

ANOTHER recognized authority has gone on record to the effect that the installation of a radio antenna does not increase the danger that a house will be struck by lightning. This time it is the Bureau of Standards.* After stating that radio antennas are not likely to be a menace, the official statement of the Bureau continues: "They need not be considered as potential inviters of lightning strokes, being in a class with other metal objects normally found about buildings, such as metal gutters, downspouts and wire clothes lines."

But it is unwise, the Bureau explains, to count on a radio antenna for actual protection against lightning. While a grounded antenna wire may serve, to some degree, as a discharge point for a dangerous accumulation of ground charge, an actual stroke of lightning is likely to melt the antenna wire at once. Ground connectors for lightning rods, intended to supply real protection from lightning-damage, are much larger than the usual radio wire. Furthermore, an adequate lightning rod installation always has at least two separate ground connections instead of the single connection usual in radio.

Fortunately, the prejudice against radio on account of a supposed lightning hazard seems to be passing. But this cannot be said about the prejudice of landlords and insurance companies to interior radio installations of experimental character. For the landlord much can be said; it really is not so desirable to have holes cut in floors and acid spilled about in the fashion which thoroughgoing radio experimentation seems so often to require.

But why do the insurance companies continue so to oppose radio? Professor Morecroft cites an instance in his always-interesting Department, the March of Radio, in *Radio Broadcast*.† One recent policy requires, he reports, that "the source of energy shall be only from primary or storage batteries."

* "Radio Antennas Not Lightning Menace," a statement issued by the Department of Commerce, Washington, D. C., for release October 31, 1924.

† *Radio Broadcast* (Garden City, N. Y.), vol. 6, pages 255-256 (December, 1924).

It is quite true that devices for supplying radio receivers with current drawn from the ordinary house mains are not yet entirely perfect. Nevertheless, the Editor of this Department joins Professor Morecroft in a strong feeling of resentment against such a clause in any insurance policy, a clause which, the Professor remarks, "one could almost believe was written at the request of the battery manufacturers."

The supply of radio current from the ordinary power lines is undoubtedly the method of the future. There are a hundred ways in which the fire risk of such attachments may be eliminated. Neither the insurance companies nor anyone else should attempt to stand in the way of inventive progress.

New Measurement of the Speed of Ether Waves

PROFESSOR A. A. Michelson of the University of Chicago, one of the most distinguished of American physicists, has spent the last two summers on top of a mountain in California attempting to make a new and better measurement of the speed of light. At the recent centenary meeting of the Franklin Institute, in Philadelphia, he described the results obtained so far.*

This natural constant of the velocity of light is one of the most important figures in all of science. It underlies the theories of electricity and of the propagation of electric waves as closely as it does the phenomena of light itself. It is involved in the theory of relativity and in all our modern ideas of the relation between matter and energy. Its exact determination is a matter of altogether exceptional interest.

The trouble with many of the past determinations of this velocity has been that they were made over comparatively short distances. Small errors in measurement meant large er-

* "Preliminary Measurement of the Velocity of Light," by A. A. Michelson. *Journal of the Franklin Institute* (Philadelphia), vol. 198, pages 627-628 (November, 1924). The address was published also in *Science* (Lancaster, Pa.), vol. 60, pages 391-392 (October 31, 1924).

rors in the final value. Dr. Michelson has avoided this by using a path 44 miles long. The light-producing apparatus was set up on Mount Wilson, where the great Mount Wilson Observatory is located. On Mount San Antonio, 22 miles away, Dr. Michelson set up a carefully adjusted mirror. A beam of light was sent from Mount Wilson to Mount San Antonio and back again and the fraction of a second needed for the trip was measured with the greatest possible exactness.

The results give, as the mean value of eight independent measurements, a speed of 299,820 kilometers per second for the speed of light in a vacuum. This is somewhat more accurate than any previous measurement. Still more accurate determinations will be attempted with the same apparatus this year.

A New High-frequency Resistance Measurement

A NEW means of high-frequency resistance measurement has been devised by Professor E. Mallett.* In his method the circuit to be measured is coupled magnetically with a coil, and the magnitude of the ratio of the resultant effective impedance to that of the coil alone is measured at various points as the resonance of the circuit is passed through by alternation of the frequency of the supply. The resulting ratios are plotted against the supply frequencies and the high-frequency resistance of the circuit is determined by a graphical solution.

* A paper read before the Institution of Electrical Engineers, London.



General Electric Co.

HAS BALL LIGHTNING BEEN DUPLICATED IN THE LABORATORY?

In this vacuum tube that contains a very small quantity of vaporized tungsten, Dr. C. G. Found has produced a "streamer discharge" that is said to be similar to the rare "ball lightning" that is observed in nature. An electric current acting upon the tungsten creates the atomic behavior that produces this phenomenon.

A Radio Detector Suggested for Earthquakes

IN this Department of POPULAR RADIO two months ago mention was made of the growing use of radio apparatus in all kinds of laboratory measurements, for example, in the measurement of very small motions and distances.* Now comes Mr. J. E. Anderson with the suggestion that these effects can be used for the recording of slight earthquakes, possibly of those very minute earth tremors that the present mechanical seismographs do not record satisfactorily.†

The suggestion is to attach one plate of a condenser to a pier fixed firmly in the earth; the other plate of the condenser to a heavy weight so suspended that its inertia will prevent its responding to all the tiny tremors of the earth. The two plates of this condenser are part of the circuit of a vacuum-tube oscil-

* "The Vacuum Tube as an 'Electrical Microscope,'" POPULAR RADIO for November, 1924, page 507.

† "Vacuum-tube Oscillators Record Distant Earthquakes," by J. E. Anderson. *Radio News* (New York), vol. 6, pages 660-662, 831-832 (November, 1924).

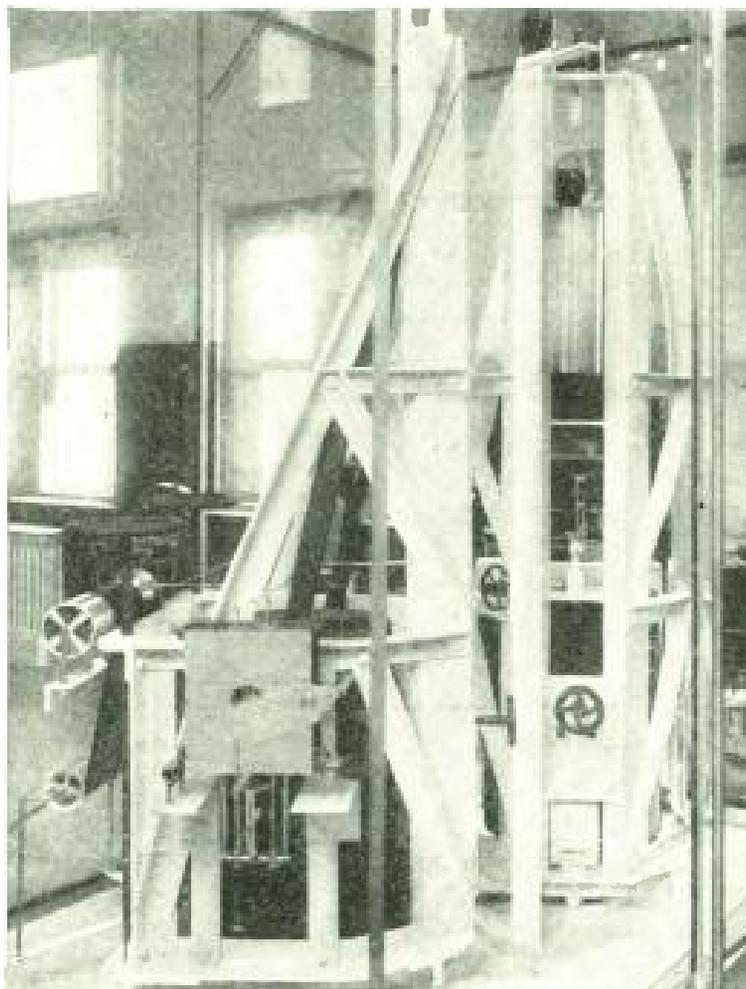
lator. Another oscillator is set up near the first one, but is not attached to the condenser plates. These two oscillators are slightly different in frequency, so that they give an audio-frequency beat note.

If, now, the earth quivers at all, the condenser plate attached to the pier will quiver also. This will alter the capacity of the condenser, the frequency of the first oscillator and the beat note between the two oscillator circuits. This alteration can be measured and recorded in some one of the standard ways.

Where the Static Comes From

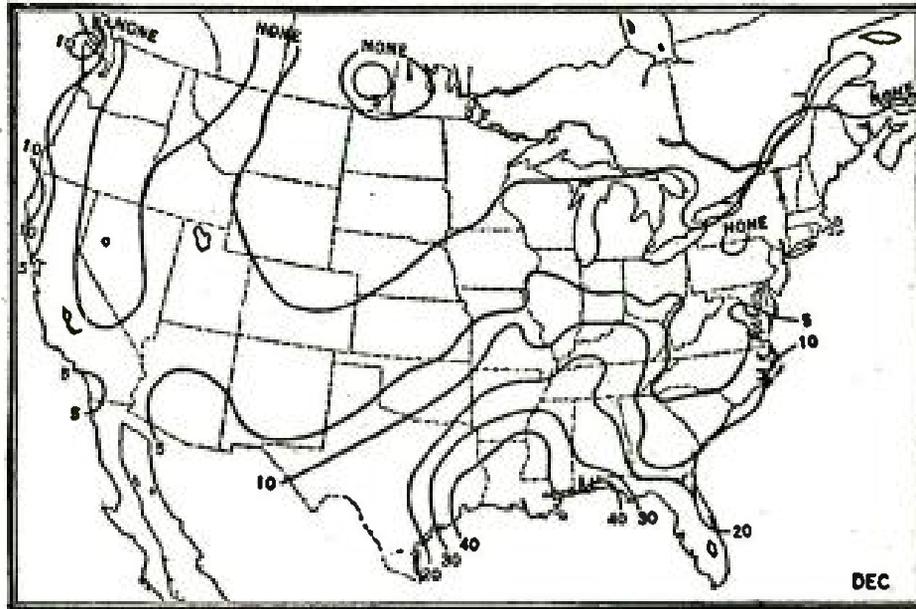
THE relation of static, at least in part, to areas of thunderstorms is now so well established* that data concerning the places where thunderstorms are most likely to occur has the greatest possible interest for the radio public. Records of thunderstorms are kept regularly by the observers of the United States Weather Bureau and a map showing the average number of storms in different parts of the United

* See "Tracing Static to its Lair," by Professor Earle M. Terry, POPULAR RADIO for October, 1924, pages 342-349.



WILL A RADIO DEVICE SUPERSEDE THIS EARTHQUAKE RECORDER?

This is a typical, recording seismograph that is installed in the Smithsonian Institution in Washington; it may be made more sensitive by the application to it of radio detecting principles.



WHERE THUNDERSTORMS OCCUR IN WINTER

This map indicates the number of thunderstorms that strike different areas in the United States as proved by December storm records for the years 1904-1923.

States was compiled and published by the Bureau in 1915.† Data for ten additional years has now been added to this map and the results of this revision, together with the data used and with individual thunderstorm maps for each month of the year, have been published in the official journal of the Bureau.‡

The new map showing the average location of thunderstorms for the entire year is little changed from the earlier map based on a ten-year period and which has already been reproduced in POPULAR RADIO. Radio fans will be more interested in the maps for the individual months. During the winter months the center of thunderstorms activity is in the Gulf of Mexico and in the southeastern states; Louisiana, Alabama and Mississippi. This is clear from the map for December, reproduced herewith.

As the winter goes on, the center of activity moves slowly northward and westward. In February it is about over the northeastern corner of Louisiana. In March and April the total number of storms increases and the center of greatest number moves slightly westward, invading the northeastern corner of Texas. By May there are two centers of storminess; one over northern Florida, the other (slightly less intense) over Oklahoma.

With June we enter the summer thunderstorm season. Many more storms occur. As in the spring, there are two centers of prevalence. One remains stationary over northwestern Florida and the Gulf. The other center moves westward until it hovers over Arizona, New Mexico and southern Utah. This

is the typical summer condition, as is indicated by the July map.

In August conditions begin a slow return to the winter distribution. The western storm center moves slowly back toward the east. By October it has nearly coalesced with the other center over the Gulf. In November the conditions are again almost the same as indicated by the December map.

For the radio fan there are two conclusions. *First*, the amount of static is much greater in summer than in winter—which is something that we already knew well enough from listening in.

Second, the summer static comes from *two* centers of dispersal, one over the Gulf of Mexico, the other over the southwestern deserts.

The winter static, on the other hand, comes mainly from the single eastern center, over the Gulf and the states adjacent to it. These, of course, are average conditions. Local storms may occur anywhere and almost any time.

When Electric Circuits Show No Loss At All

Most things move more sluggishly as they get colder, but electrons are an exception.

If you cool down a piece of wire until its temperature comes close to the so-called absolute zero (which is about 450 degrees below zero, Fahrenheit), the wire will have practically no electrical resistance at all.

Such extremely low temperatures as this do not exist naturally on the part of the earth which is accessible to us although they may possibly exist in the space outside the earth's atmosphere. Whether they do or not, we cannot take metals out there to cool them. It has proved possible, however, to devise laboratory methods, using liquid hydrogen and liquid

† This map was reproduced in connection with Professor Terry's article just cited; POPULAR RADIO for October, 1924, page 342.

‡ "The Distribution of Thunderstorms in the United States," by William H. Alexander. *Monthly Weather Review* (Washington, D. C.), vol. 2, pages 337-343 (July, 1924, issued September 27, 1924).

helium as cooling materials, which will cool wires down to within less than two degrees of the supposed zero below which it is believed to be impossible to go.

Most of this work on the effect of extremely low temperatures on metals has been done by Professor Kamerlingh Onnes of the University of Leyden, in Holland, and some of his more recent and remarkable results are summarized in a paper by Dr. Karl K. Darrow, one of a series on contemporary advances in physics which has been appearing in the *Bell System Technical Journal*.*

"When with the aid of liquefied helium," Mr. Darrow writes, "Kamerlingh Onnes penetrated to within five degrees of the absolute zero, something astonishing took place." Previous experiments with fine wires of platinum had showed some uncertainties. Accordingly Professor Kamerlingh Onnes was working with a thin thread of repeatedly-distilled mercury, contained in a narrow glass tube so that it formed a tiny filament like a wire.

"When he lowered this filament of mercury to the temperature of frozen helium," Mr. Darrow continues, "at a certain point the resistance suddenly vanished. Literally it vanished; the word is justified, for the value to which it had dropped was, if not truly zero, at all events not so much as one five-billionth of its value at room temperature, and not so much as one ten-millionth of its value just before . . . it suddenly disappeared. The mercury had altogether lost what had always seemed to be as inseparable a quality of matter as its inertia or its weight."

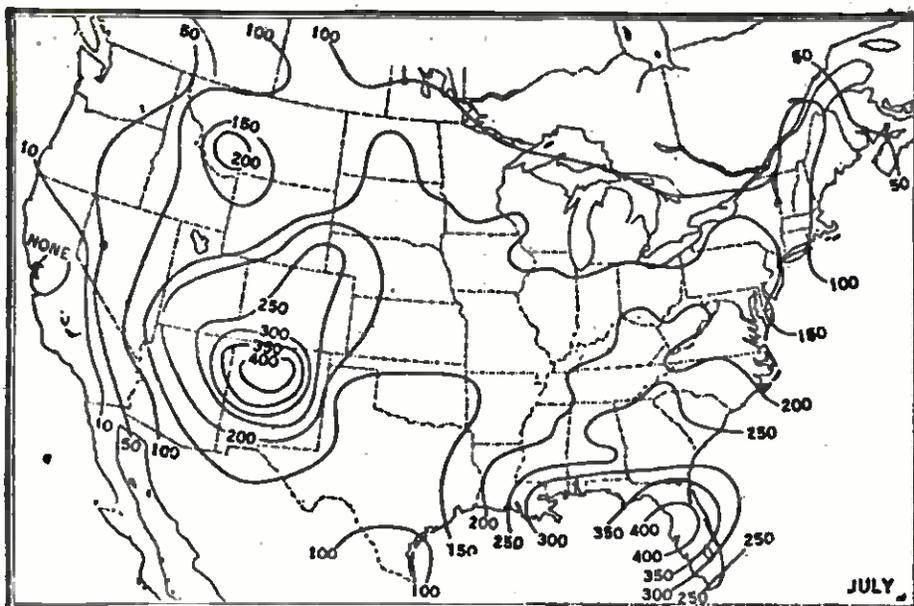
This remarkable loss of electrical resistance

* "Some Contemporary Advances in Physics—V. Electricity in Solids," by Karl K. Darrow. *The Bell System Technical Journal* (New York), vol. 3, pages 621-650 (October, 1924).

happens, in the case of mercury, at about 4.1 degrees, Absolute, which means 4.1 Centigrade degrees above the hypothetical—but unreached—Absolute Zero. Three other metals show similar behavior. Tin loses its electric resistance completely at about 3.8 degrees Absolute, lead at about 7.2 degrees, thallium at about 2.3 degrees. Gold, copper, iron, platinum and cadmium do not lose their resistance altogether at any temperature so far attained in the laboratory.

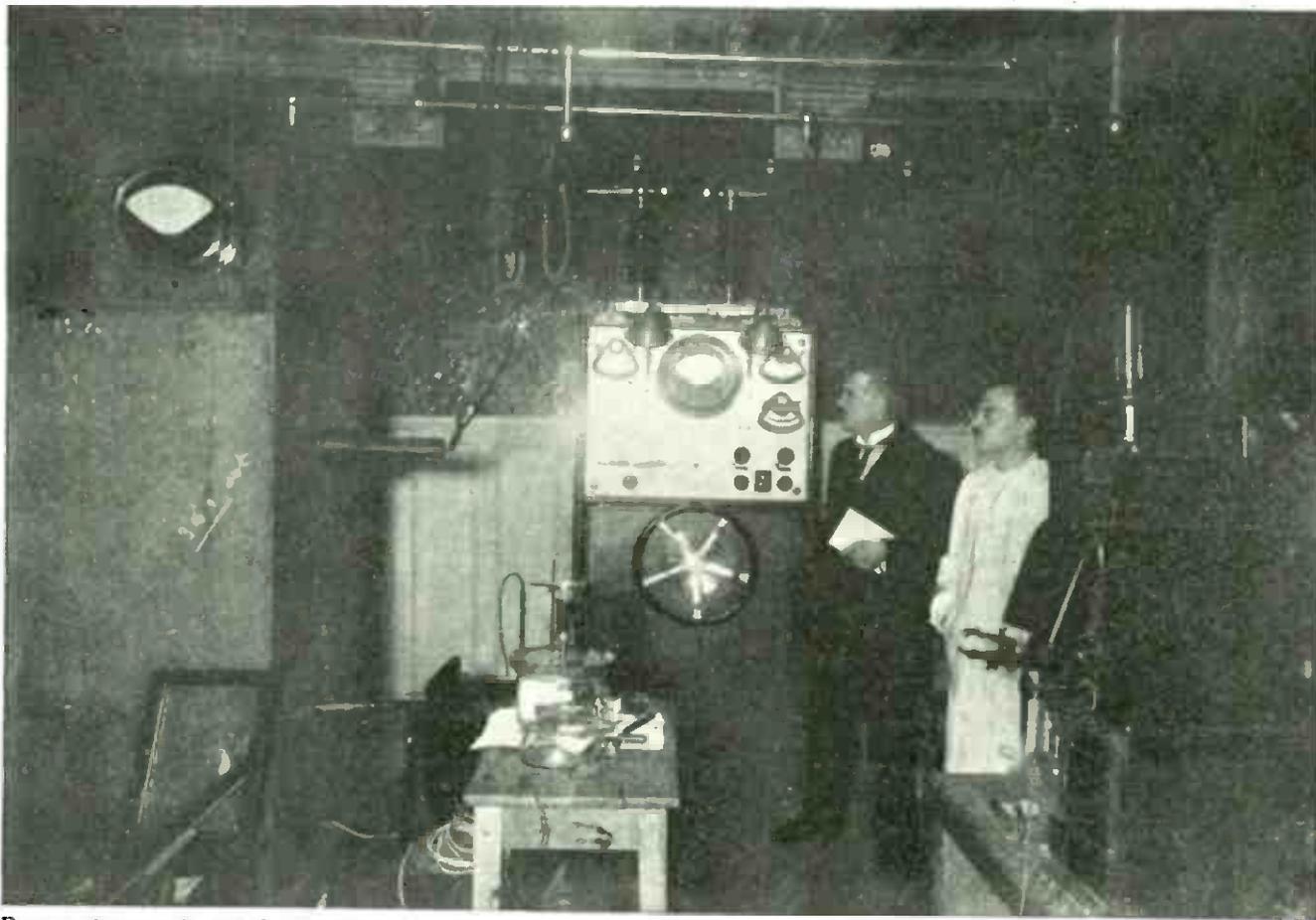
"A number of fantastic things could happen," says Mr. Darrow, "in a world from which electrical resistance had vanished, and one of them was actually realized by Kamerlingh Onnes within the compass of his helium-cooled chamber, when a current of 320 amperes flowed for half an hour around and around a leaden ring with no applied electromotive force whatever to maintain it, and did not lose so much as one one-hundredth of its initial strength. In another experiment a current of 49 amperes flowed for an hour around a coil of lead wire of a thousand turns, wound upon a brass tube, and did not lose quite one percent of the intensity with which it had been started by removing a magnet of which the field had interlaced the coil."

This is certainly the last word in "low-loss" coils, but we fear that few radio fans will be willing to keep their receivers in frozen helium in order to operate under these conditions. In fact, the liquefied and frozen helium upon which these experiments depend is available, at present, only in two laboratories, that of Professor Kamerlingh Onnes and that of the University of Toronto. Temperatures almost as low as these have been attained in the helium laboratory of the United States Bureau of Mines but the records remain with Kamerlingh Onnes and his workers at Leyden.



WHY JULY IS THE GREAT "STATIC" MONTH

This map shows another 20-year record of electric storms during July. In one area we note that there were 400 thunderstorm days out of a possible 620. California is comparatively free from these disturbances, as the storm lines show. The Gulf region and the Southwest are the worst "static" areas.



From a photograph made for POPULAR RADIO

FAMOUS STUDENT OF ETHER WAVES

Louis, the Duke of Broglie, French nobleman and distinguished scientist, is one of the world's foremost students of the Quantum theory—the theory of ether-wave squirts. The Duke (in dark clothes) is here shown in his private laboratory near Paris.

Ether Waves That Move in "Squirts"

THE new quantum theory of light and of other kinds of radiation has already been described in this Department.* This theory abandons the familiar idea that light is a spreading wave in the ether, a wave moving outward from the source in the shape of a continually enlarging sphere. On the contrary, the quantum theory conceives light as consisting of small individual bits or particles, what Sir Oliver Lodge called so vividly small "squirts" of light.

Each of these moves in a straight line in the direction in which it started. It is as though the source of light was a tremendously powerful and quick-acting gun from which billions of bullets were being shot out in every direction all at once.

This idea has come to be accepted by the majority of physicists for the rays of light and now it has been applied successfully to another kind of ether waves, the X rays. In

* "Are Ether Waves Composed of Minute Particles," POPULAR RADIO for February, 1924, pages 207-209; "Is There a New Universe Still Smaller Than the Electrons?" POPULAR RADIO for July, 1924, pages 82-83.

a recent talk before the American Association for the Advancement of Science, Professor Arthur H. Compton of the University of Chicago summarized his recent researches in this field.†

These researches have dealt mainly with the phenomenon that is called "scattering." When a beam of sunlight passes through a dark room the beam becomes visible because it illuminates the hundreds of tiny dust motes in its path. Even with very much tinier particles than these dust motes a certain amount of light is "scattered" in this fashion so that it goes out sideways from the path of a beam. An effect of this sort is supposed to be responsible for the blue color of the sea.

The theory of this scattering of light has been worked out by numerous scientists, as has also the theory of the similar scattering of X rays by small particles, although in this instance the "particles" are as small as possible, being, in fact, the atoms and electrons of matter. When a beam of X rays is allowed to pass through almost any kind of matter a part of the X rays are scattered off sideways, just as light is in fog or dust.

† "The Scattering of X Rays," by Arthur H. Compton. *Journal of the Franklin Institute* (Philadelphia), vol. 198, pages 57-72 (July, 1924).

In studying this phenomenon Professor Compton found that the usual theory for it would not fit the facts. This usual theory had been worked out by Sir Joseph J. Thomson a number of years ago and was based on the ordinary spreading-wave theory of all ether waves, including the X rays. Finding that this theory did not fit, Professor Compton tried the new quantum theory. He endeavored to develop a theory based on the idea that X rays, as well as light, consist of discrete *quanta*—the “squirts” of Sir Oliver Lodge.

This new theory was worked out. It does fit the facts. No other theory will fit them unless we abandon the time-honored principles that energy cannot be destroyed and that action and reaction are equal. Here is Professor Compton's conclusion:

“If this work on the scattering of X rays is correct, we must, therefore, choose between the familiar hypothesis that electromagnetic radiation consists of spreading waves, on the one hand, and the principles of conservation of energy and momentum on the other. We cannot retain both.

“It seems to me that the very fact that the energy and momentum principles may be applied to the problem of the scattering of radiation with results in accord with experiment constitutes a test of their validity for phenomena of this type. For this reason I am inclined toward the choice of these principles even at the great cost of losing the spreading-wave theory of radiation.

“I am by this choice confined to the view that radiation consists of directed quanta.”

The “directed quanta” are Sir Oliver's “squirts”; each squirt going out in a given direction which it thereafter maintains unless deflected. This is a complete reversal of all our familiar ideas about ether waves. Even the ether itself becomes unnecessary.

Just what these quanta are we do not know. Most scientists seem to incline to the idea that they may be “darts” that still maintain something of wave character; a kind of snake-like object that goes ahead in a straight line but consists, somehow, of a succession of humps and hollows as a moving snake does. This idea was suggested two years ago by Silberstein.* Even if these snake-like darts are what make up the supposed “waves” of light and of the X rays nobody knows whether they or some other variety of quanta compose the longer “waves” that we use in radio.

The science of ether radiation is now in the state of having had one theory shot from under it and not being able to find another. There is little doubt that the spreading-wave theory is wrong or incomplete. It is reasonably certain, too, that the squirt-like quanta represent some kind of reality which we do not yet see in detail. The next two or three years are likely to bring important progress in all these problems, progress which can hardly fail to have significant effects on all our theories of radio.

* *Philosophical Magazine*, vol. 44, pages 257, 956 (1922). An excellent summary of all the modern theories of radiation is the article by Dr. Wheeler P. Davey entitled “Radiation,” in the *Journal of the Franklin Institute* (Philadelphia), vol. 197, pages 439-478 and 629-666 (April and May, 1924).



Gilliams Service

THE OFFICIAL RADIO EAR OF GERMANY

Part of the extensive receiving apparatus in the famous, high-powered radio station at Nauen near Berlin in Germany. This station, now owned by the German Republic, was a great factor in communicating with the outside world during the war; it ranks with the American station at Arlington, Va., and the Eiffel Tower station as one of the most powerful in the world.

A Perambulating Receiver for Radio Detectives

FOR the discovery of concealed transmitting stations or for the locating of careless operators who annoy their neighbors with mushy transmitters or with howling regenerative sets it has been customary for some time to employ a portable loop receiver mounted on an automobile, so that directional bearings can be taken at a number of places and the point of origin of the disturbance thus tracked down. A new form of apparatus for this purpose, the entire receiver being so constructed as to be carried around by a single man, has now been suggested by Mr. Robert H. Marriott.*

The receiver, which may be of any light-weight type, is mounted in front of the operator on braces connected with an Indian packboard of a type quite familiar to campers. On the side of the operator, also connected to the braces of the packboard, is the compass loop. The entire equipment, as made up, weighed only about twenty-five pounds. This weight could be reduced, Mr. Marriott states, to ten pounds or even, in extreme cases, to five pounds.

Mysterious Errors in Radio Time

ONE of the chief developments of radio during the past five years has been the sending of extremely accurate time signals from a large number of stations all over the world. At a limited number of these stations—Greenwich, England; Paris; Berlin; Arlington, and others—the radio time signals are controlled more or less directly by independent determinations of the exact time made by watching the stars. The larger stations are powerful enough, furthermore, so that the time signals from any one of the fundamental stations can be picked up at the others. Thus it has proved possible to compare exactly the time signals from, for example, Paris, with those from Arlington or from Berlin (Nauen) or elsewhere.

Surprisingly enough, it has been found that the signals do not agree. There may be an error of as much as two or three tenths of a second.

When this error was first discovered it was attributed to some fault of the apparatus or to some error in the obtaining of the exact time from the stars. Further investigation has failed, however, to confirm this idea. For example, the United States Naval Observatory, which is responsible for the time observations and signals in the United States, has just reported the results of a two-year series of comparisons between duplicate sets of instruments for the determination of the time.* No errors of any magnitude were found in the instruments. Similar tests in other countries have been equally negative. It seems probable that

* "A Kit for the Radio Detective," by Robert H. Marriott. *Radio Broadcast* (New York), vol. 6, pages 463-469 (January, 1925).

* "Some Recent Results of Time Determinations at the United States Naval Observatory," by J. C. Hammond. Paper before the American Association for the Advancement of Science, Washington, D. C., December 31, 1924.



Radio Broadcast

THE RADIO SHERLOCK HOLMES

With the portable radio-receiving outfit shown strapped to the man in the picture, concealed transmitting stations can be located, radio "hogs" discovered and tests can be made for comparing reception in different localities.

there exists some unsuspected factor which is affecting the speed of radio transmission so that a variable lag may occur between the time of sending a time signal from Paris or Nauen and the receipt of this same signal at Washington.

What may be the cause of this radio variation is unknown. In reporting the Naval Observatory results before the American Association for the Advancement of Science, Mr. Hammond suggested the possibility that the atmosphere over Washington might vary in some way, as, for example, by a variable smoke content and consequent variable ionization, and that this might be responsible for the variations in the time of receipt of the foreign time signals at the American station.



CONDUCTED BY S. GORDON TAYLOR

EVERY radio receiver requires a careful balancing of all of its parts if the best results are to be obtained. Two receivers made from exactly the same design may give widely different results, owing to variations in the parts used, the skill of the experimenters and the locations of the receiver. This department is conducted for the special benefit of readers who have built the radio receivers described in POPULAR RADIO and who want to profit from the experience of others in operating them—to learn the little kinks that get the maximum results.

The Non-radiating Seven-tube Superheterodyne Receiver

(This set was described in POPULAR RADIO for December, 1924)

THE hints given below for the use of an antenna with the eight-tube Reflex Superheterodyne receiver also apply to this receiver, as do the suggestions regarding the matching of tubes. The data given for the home-made loop is also correct for both receivers.

How to Neutralize the Set

Evidently some readers do not understand the method of neutralizing the seven-tube superheterodyne, as explained in the descriptive article in the December issue. This is done by connecting headphones in series with the 45-volt tap of the "B" battery.

In Figure 2 is shown a duplicate of the battery connection diagram given in the December issue except that the headphones are shown properly connected for the neutralizing process. The loop must, of course, be connected to the receiver while it is being neutralized, and the tubes lighted just as they would be when the receiver is in operation.

With connections made as shown in Figure 2, the two tuning dials are rotated until a check is heard. Or the first dial from the left may be set at any desired point, preferably about 20, and the second dial rotated. When this has been done and the click is heard, move the neutralizing condenser rotor plates slightly and again rotate the second dial until a click is heard. Continue this until a point on the neutralizing condenser is found

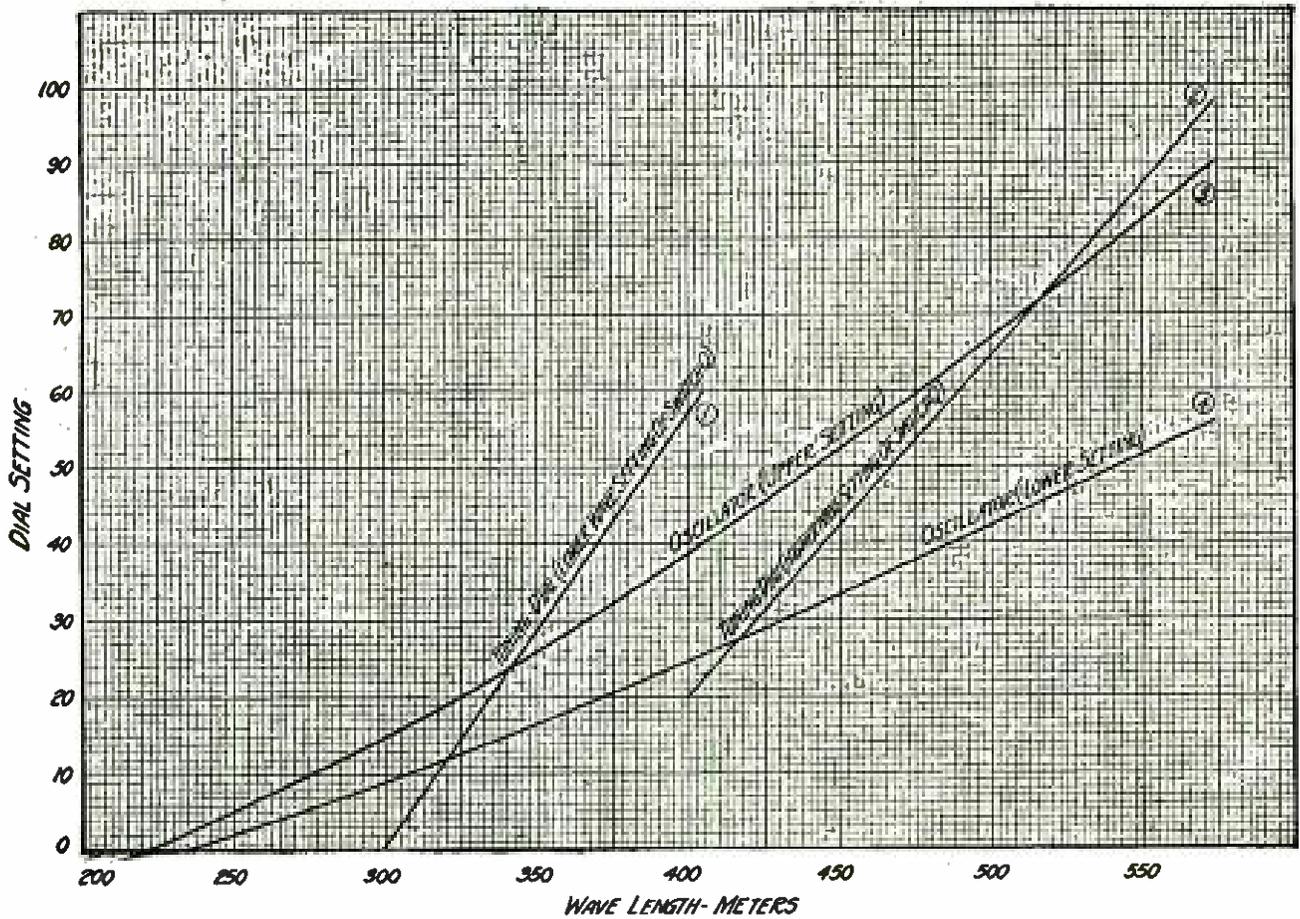
where no click can be obtained by rotating the second dial—or at most a very soft click. This will be the proper point of neutralization and the neutralizing condenser should be left permanently at this setting.

Charting the Receiver

The dial settings of this receiver are always the same for the same wavelength; therefore it is entirely practical to make up a tuning chart as shown in Figure 1.

The chart shown here was made up in a few minutes, using one of these receivers and a home-made loop, tapped approximately in the center. Line 1 represents the setting of the first dial when the wavelength switch Q was set for the lower wavelengths. Line 2 shows settings of this dial with switch Q set for the higher wavelengths. Line 3 shows the upper settings of the oscillator dial while line 4 represents the lower settings of the second or oscillator dial.

Any superheterodyne receiver stations can be picked up at two points on the oscillator dial. The lower of the two points is the one at which the oscillator frequency is equal to the sum of the frequency of the incoming wave plus the frequency of the intermediate transformer windings. The upper setting occurs when the oscillator condenser is set so that the oscillator frequency is equal to the frequency of the incoming wave less the frequency of the intermediate transformer windings. This action was explained more in detail in the description of the Radiola Super-



TUNING CHART FOR THE SEVEN-TUBE SUPERHETERODYNE RECEIVER

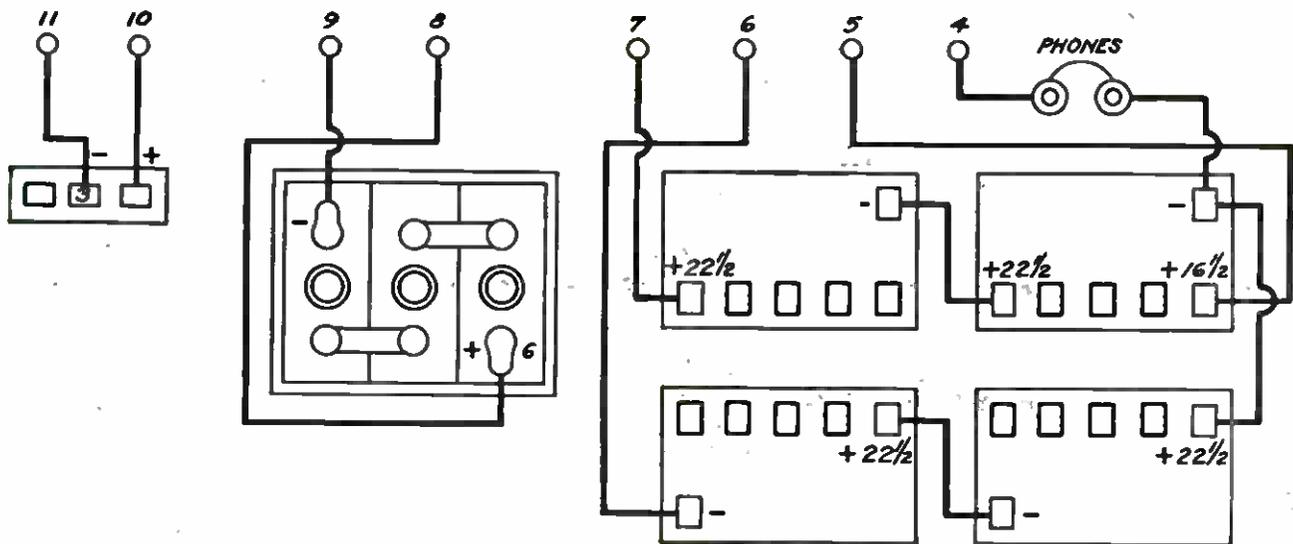
FIGURE 1: Curves 3 and 4 will be practically the same for any receiver of the same type, but curves 1 and 2 will vary with the kind of loop antenna employed.

heterodyne in the February, 1925, issue of POPULAR RADIO. It may be mentioned here that it is usually best to use the upper setting of the oscillator condenser dial when tuning in stations.

To make up a chart of this kind, tune in any broadcasting station, the wavelength of

which is known, in the usual manner, and, when it is tuned in best, mark the settings of the two dials with dots on a piece of cross section paper laid out as shown, with wavelengths and dial calibration marked at the bottom and left as in Figure 1.

Next rotate the oscillator condenser dial un-



CORRECTED BATTERY HOOK-UP FOR THE SEVEN-TUBE SET

FIGURE 2: The headphones are shown properly connected for the neutralizing process.

til the other setting for the same station is found and show this with a dot on the chart. Repeat this process with other stations until several have been registered with the switch Q set for high wavelengths and several with the switch set for low wavelengths. When this has been done join together with a line all the dots representing the lower oscillator settings for the various stations. Then draw another line through the dots which represent the upper oscillator settings. Do the same with the first dial settings with the switch set for low-wave stations. Finally connect the dots which represent the setting of the first condenser when switch Q is set for high wavelengths.

Assuming that the above directions have been followed and a chart similar to that in Figure 1 has been made, it becomes a simple matter to tune in any station without knowing the

dial settings, providing the wavelength of the station is known. If you want to tune the receiver to 380 meters (the wavelength of WGY at Schenectady, for instance), simply follow the vertical line at 380 meters up to the point where it intersects curve 1, then follow the horizontal line from this intersecting point over to the left-hand edge where the setting for the first condenser will be found (provided the switch Q is set for low wavelength). Then, going back to the 380 meter vertical line, follow it to the point of intersection with curve 3, and from this point move horizontally to the left where the proper setting for the oscillator dial will be found. With these two dials thus set, station WGY should be heard. If you cannot hear it and you know that it is broadcasting, a slight movement of the oscillator dial should tune the receiver to its wavelength.

New Data About the Eight-tube Reflexed Superheterodyne

(This set was described in POPULAR RADIO for January, 1925)

MANY readers are surprised when they read that a single rheostat is used to control the filament current of the eight tubes in this receiver. To those who have operated other types of superheterodyne receivers, this control method seems highly impractical because most superheterodynes will not operate properly unless the oscillator and detector tubes are controlled by individual rheostats, the adjustment of which must be just right. This makes the several rheostat adjustments among the most critical that are required in tuning these receivers. However, in the design of the Eight-tube Reflexed Superheterodyne the critical adjustment of the filament current has been eliminated to such a degree that a single rheostat proved just as satisfactory as individual rheostats.

Equally important is the fact that the adjustment of this single rheostat is far from critical. In tests made in this connection it was found that results were practically equal with the rheostat set at any point between 45 and 65 on its dial. Absolutely no difference was noted at any setting between 45 and 55. This means that this rheostat can be permanently set at a point such as 50, for instance, and no further adjustment is necessary at any time.

Matching the Tubes

It should be noted that only tubes in good condition should be used in this receiver. When vacuum tubes of the UV-201-a type have been used for a long period of time, until they are almost worn out, they will require more current than ordinarily for best results. They may even not function at all at the current for which they are rated. It is therefore obvious that a tube in such a condition as this will not function satisfactorily in a receiver in which several tubes are controlled by a single rheostat for the reason that, if a normal current sufficient to operate the good tubes is

passed through the rheostat, this current will not be sufficient to operate the worn-out tube.

On the other hand, if the rheostat is turned sufficiently high to pass enough current to operate the poor tube, the current will be too high for best results from the good tubes.

As in any receiver, the tubes should be changed around until each is in the socket where it gives best results. There is a certain amount of variation in UV-201-a and other tubes of this type. Some oscillate more freely than others while some are better detectors or better amplifiers. It is most important that sockets H, I1 and I2 be equipped with tubes which function best in these positions. Therefore all eight tubes should be tried in these three positions, by shifting them around one at a time. Having an extra tube on hand will facilitate this try-out process.

The Use of an Outdoor Antenna

When the superheterodyne receiver will cover such remarkable distances using a loop antenna, many wonder why even greater distances cannot be covered when an outdoor antenna is used. Logical as this question may seem, it is nevertheless a fact that the most satisfactory results are obtained with the loop. The reason for this is that the extreme sensitiveness of this receiver, when combined with an outdoor antenna, is such that too many disturbing noises are picked up along with the desired signals. The farther a receiver is able to reach, the more interfering noises will be heard. This is especially true where an outdoor antenna is used. If the transmitting station to which one desires to listen is too far away these interfering noises will be louder than the sought for signals.

For those who wish to experiment with the use of an outdoor antenna, however, the most simple plan is to add a two-turn coil around the loop. This coil is connected to the antenna and ground in the same way that the primary of a coupler is usually connected; thus making a two-turn aperiodic (untuned) pri-



From a picture made for POPULAR RADIO

HOW DATA FOR THE "TROUBLE SHOOTING" DEPARTMENT IS OBTAINED

The author of the "Trouble Shooting" department, Mr. Taylor, constructs the models of the receivers from which the "How to Build" articles are made up. He is shown above at work on the Cockaday Eight-tube Reflex Superheterodyne receiver described in the January issue.

mary. The loop connections are not changed in any way as the loop merely serves as the secondary of this giant coupler.

The Use of Dry-cell Tubes

The use of dry-cell tubes is not recommended in this receiver.

First of all, dry-cell tubes are not as efficient as the larger tubes. More important, however, is the fact that this circuit has been designed and balanced (if a somewhat over-used, but nevertheless understandable term may be applied) for use with 201-a tubes. Much time and patience were spent in this process until everything in the receiver was just right for best results. It does not seem logical that a receiver thus carefully worked out for one type of tube would prove as satisfactory with another type, and it is not believed that the results obtainable with dry-cell tubes would be sufficient to warrant going through the balancing process again.

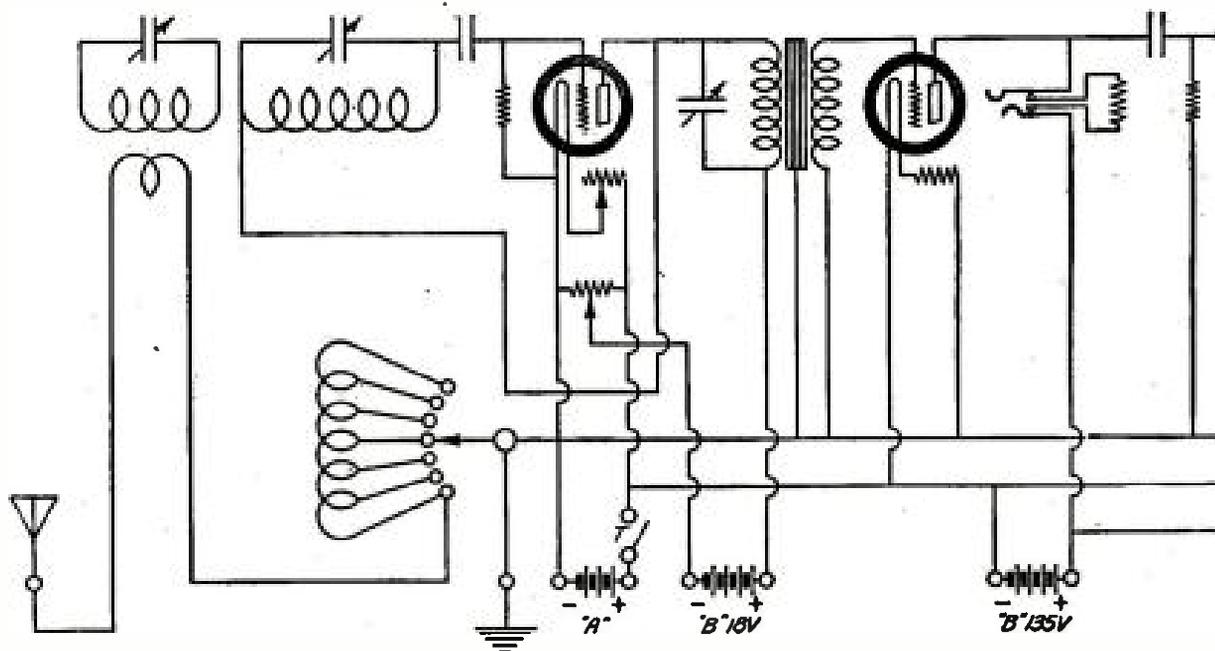
A-Suitable Home-made-Loop

A loop for this receiver may be of the flat, square type with two wooden crosspieces for the form. Each crosspiece is slotted at intervals of $\frac{3}{8}$ of an inch to hold the windings.

Fifteen turns of stranded loop wire or ordinary stranded insulated electric light wire are wound on this form, the outer turn being 18 inches square and the turns spaced $\frac{3}{8}$ of an inch apart. The loop should be tapped at the eighth turn for the lower wavelengths.

Change in Connections of the Audio Transformer

The manufacturer of the audio-frequency transformer specified for this receiver in the January issue has recently changed the location of the connections. The connections on the new type are properly indicated on the transformers themselves but this point is brought up to avoid any possible confusion in the minds of readers. The marking on the transformer should be followed in connecting it into the circuit. Referring to the blueprints of this receiver published by POPULAR RADIO, and also to the picture wiring diagram on pages 38 and 39 of the January issue, the P and B connections should be reversed if one has the new type transformer. Also F- and G should be reversed. Attention is called to a typographical error which appeared on page 40 of the January issue. The total "B" battery current consumption as given there should be 35. milliamperes instead of 15.



More Data on the Four-circuit Receiver with Resistance-coupled Amplification

FREQUENTLY only the last two or three switch points are used for tuning in stations, even the low-wave stations. This is decidedly wrong, and is caused by an antenna that is too short. The coil D, to which these switch points are connected, is simply an antenna loading coil, which makes it possible to tune the antenna circuit approximately to the wavelength of the incoming signals. However, if the antenna is too small, so that a good deal of the load coil must be used to tune to a given wavelength, tuning will be broadened and there will be decreased selectivity.

In the ordinary receiver the selectivity is inversely proportional to the size of the antenna, so that increasing the antenna size decreases selectivity. The action is just the reverse in the Four-circuit Receiver. An antenna which has been found to give wonderful results with this receiver consists of four parallel wires, spaced three feet apart and each 100 feet long. This type is not practical for the average fan, especially for those who are located in congested districts.

However, many other types of antennas will give excellent results. A single wire 150 feet long, exclusive of lead-in is satisfactory. Two wires, each of this length, will be still better. If the length must be limited to 100 feet the use of two parallel wires spaced three feet apart is recommended. If space limitations require the use of a shorter antenna than this it is best to make it as long as possible and use three or four parallel wires two or three feet apart. Incidentally, the lead-in should always be taken off the end of the antenna and not from the middle. It should be borne in mind that *the length of an antenna is measured from the point where the lead-in is taken off to the farthest end.*

Thus an antenna 100 feet long which has

the lead-in taken off the middle is considered a 50-foot antenna. Also, an antenna that has two parallel wires, each 100 feet long, is not a 200-foot antenna. It is the overall length that is counted, not the number of feet of wire.

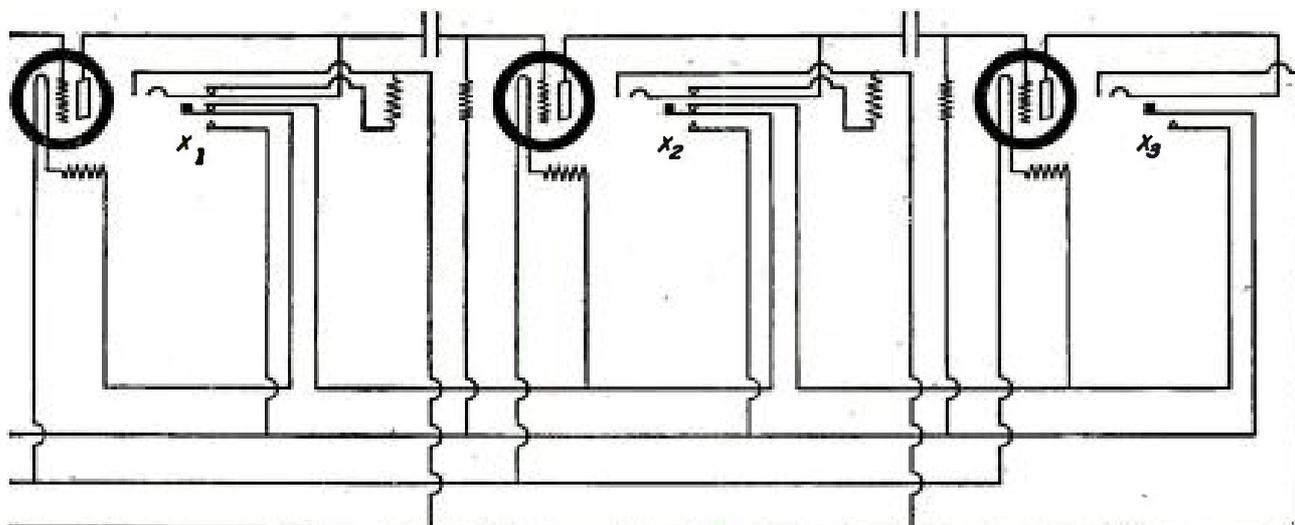
Selectivity Depends on Bypass Condenser

In some cases the condenser H across the primary of the transformer cannot be adjusted for sufficiently low capacity to permit proper selectivity.

Experiment has shown that while .00025 mfd. capacity (which is the minimum capacity of the grid-denser specified), is usually correct, better selectivity is obtainable in other cases by the use of lower capacity. When difficulty is experienced in obtaining perfect selectivity, therefore, it would be well to replace this instrument with a fixed condenser of .0001 mfd. capacity. Or results may be still better if two such condensers are connected in series and then connected across the transformer primary. This will provide a capacity of .00005 mfd., which should prove sufficiently low for any receiver of this type.

Poor Coil Connections

Attention should be called to poor connections at the binding posts on the coils. A number of Four-circuit Receivers have been found recently in which trouble has been traced to this source. In some cases soldering flux has been allowed to get into the connections while in others the heat of the soldering iron has caused the radion tube to shrink, thus leaving the binding posts loose, with attendant loose connections between the ends of windings and the lugs. This is usually the cause



WIRING DIAGRAM OF THE RESISTANCE-COUPLED, FOUR-CIRCUIT RECEIVER WITH AUTOMATIC FILAMENT-CONTROL JACKS

FIGURE 3: In the hook-up X_1 and X_2 are "Radio Improvement" double filament-control jacks. X_3 is a single filament-control jack of the same make. These jacks may be substituted for those specified in the October, 1924, issue without changing the panel holes or layout.

when it is found that the stabilizer coil seems to have no effect on tuning regardless of how the stabilizer condenser is set.

A Set That Is Practically Fool-proof

Fundamentally, the resistance-coupled type of amplification is as nearly "fool-proof" as an amplifier can well be. However, even in this there are possibilities for trouble.

The adjustment of the Bradleyohms in the amplifier is not critical. They will not function at all until turned about halfway in, and from this halfway point to the all-in position results will be practically uniform. Usually results are slightly better with the knobs turned part of a turn clockwise beyond this halfway point. Once they have been adjusted they need never be touched.

Perhaps the most common trouble is a high-pitched whistle when all four stages are put into use by plugging the loudspeaker into the last jack; also a body capacity is noticeable in the receiver when using this last jack.

This trouble is due to audio-frequency feedback and usually results from having the loudspeaker or its cord too close to the receiver, or to the body of the operator. The antenna lead and loudspeaker cord should be led directly away from the receiver and the loudspeaker should be several feet away from the receiver and operator if this is possible.

Another plan usually helpful in alleviating this trouble is the substitution of a $\frac{1}{4}$ or $\frac{1}{10}$ megohm grid-leak in place of the $\frac{1}{2}$ megohm in the last stage.

Another source of trouble is a short-circuit in the condenser banks. This results perhaps from applying the soldering iron directly to the condensers in making connections. Condensers may be tested by connecting them in series with headphones and a dry cell. If there is a click in the phones as the connection is

made and broken it is an indication that the condensers have "gone west" or are damaged:

Contacts in the jacks may be poor. In the double-circuit jacks each inner arm should make contact with an outer arm when the plug is not in the jack. Sometimes through wrong adjustment of the springs the arms do not quite make contact, thus leaving an open circuit, in which case the amplification will be poor or may be entirely inoperative. Poor contacts in one of the tube sockets may also cause this trouble.

Several cases have been found when dealers, through oversight—or worse, have supplied resistances of 50,000 ohms for the grid-leaks P1, P2 and P3; instead of 500,000 ohm ($\frac{1}{2}$ megohm) as specified.

These resistances will produce only weak signals.

In other cases $\frac{1}{2}$ megohm may be too high for the leak in the last stage with a resulting lack of good tone quality. This fault can be determined by bridging the thumb and forefinger across the leak mounting terminals. If results are improved by doing this, it is an indication that a lower resistance of $\frac{1}{4}$ or $\frac{1}{10}$ megohm is needed.

The only instruments left that may give trouble are the Bradleyohms. If none of the foregoing suggestions remedy the trouble it is well to remove the Bradleyohm from the stage that is not working properly and try it in a stage that is operating perfectly. If the good stage then refuses to function, it is evidence that the Bradleyohm is defective in some way and should be replaced.

If no click is heard when the loudspeaker plug is inserted in the various jacks, the trouble will be found in defective tubes in the stages where no click can be produced, or in an open connection in the plate circuit of the tube. This open connection may be due to improper connections of the plus side of the

"B" battery circuit, poor contact between the spring contact and the plate prong of the tube base, poor contact between jack and plug, to a defective plug, a broken wire in the loudspeaker cord, or a defective loudspeaker. The method for correcting these troubles is too obvious to need detailed explanation.

It is always well to try reversing the connections of the loudspeaker. Most of them operate best when the power flows through them in one direction.

The Use of the Filament-control Jacks

Some readers have requested a hook-up of the receiver described in the October issue but with filament control jacks added.

In the arrangement shown in Figure 3, turning on the battery switch "T" lights the filaments of the first two tubes only; that is, the detector and first amplifier tube. The filaments of the other three amplifier tubes are individually controlled by the automatic filament-control jacks. Plugging the loudspeaker into the second jack lights the filament of the third tube and permits reception when using the first three tubes but leaving the last two tubes unlighted. Removing the loudspeaker plug from the second jack and inserting it in the third jack, automatically lights the filaments of the third and fourth tubes; and inserting the same plug in the last jack lights the filaments of the last three tubes. This arrangement dispenses with a filament switch.

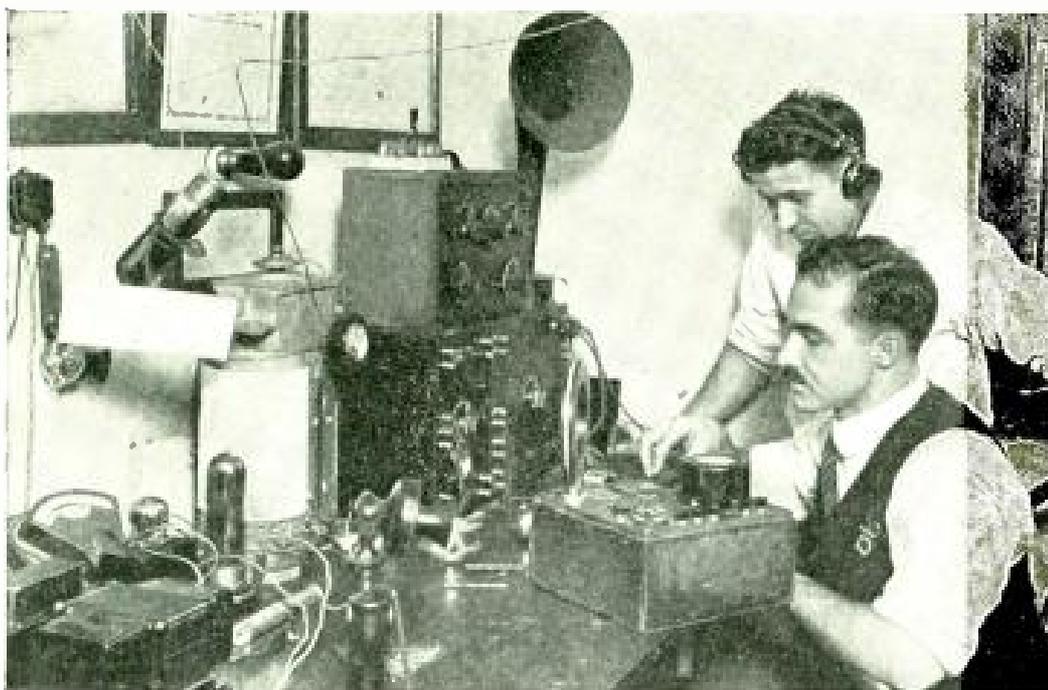
Wavelength Data for the Low-loss Tuner

(This set was described in POPULAR RADIO for November, 1924)

THE coil set used in this receiver is made in two different types. The first is designed to cover a waveband of approximately from 250 to 550 meters, or the usual broadcast wavelengths. The second is for the short wavelengths, from 60 to 275 meters. This latter band includes the wavelengths used by several of the larger broadcasting stations which operate around 100 meters or lower. This low-wave band also covers the wavelengths used by amateurs—wavelengths which will interest the fan who wants to pick up amateur code and telephonic communication as well as broadcasting.

This explains why some receivers cover only the low-wave stations and do not tune up to the stations that operate around 400 meters. In such cases it is evident that the correspondents have installed short-wave coil sets instead of the long-wave receivers.

Some readers have had trouble because of the lack of a by-pass condenser across the primary of the audio-frequency transformer. Such a condenser is especially important on the short-wave receiver and is frequently helpful in the long-wave receiver. The condenser may be of the usual "postage stamp" variety, preferably with lugs for transformer mounting. It is well to try different capacities between .00025 and .001 mfd. until the capacity is found that gives the best results in any particular receiver.



Kadel & Herbert

THE RADIO "COP" PATROLS THE ETHER

When broadcasters—amateur or professional—violate the transmitting regulations, a radio traffic cop camps on the trail of the offenders. Here is a Federal radio inspector, Emery H. Lee, checking up on them. The inspectors are kept busy besides with complaints—some of them from "cranks" with obsessions about radio waves.



BROADCASTS

CONDUCTED BY DAVID LAY

ITEMS of general interest that you ought to know; bits of useful information that every radio fan ought to know.

Hospitals Install Radio Sets

Nor only for entertainment but for the therapeutic effect upon nervous sufferers, London hospitals are installing radio apparatus. The results at one hospital where broadcast musical programs were tried out on nervous patients have been so satisfactory that two eminent British physicians, Sir Henry Hadow and Sir Bruce Bruce-Porter generally recommend the use of radio sets in hospitals. It was proved some years ago that certain kinds of music had a decided calming effect upon even a normal nervous system.

* * *

Theatrical Producers Fear Competition of Radio

THE fear on the part of certain theatrical producers that radio is competing successfully with the drama and must, therefore, be regarded as a rival, has stirred Sam H. Harris, one of the prominent producers of New York, to institute a movement to insert a clause in contracts with actors to prevent them from appearing before the microphone. In the meantime, other impresarios are seeking opportunities for their stars to appear on broadcast programs in the belief that such publicity creates a demand to see and hear them in person.

* * *

Will Union Labor Run Radio Programs?

THE first strike to occur in a broadcasting station was recently staged in Chicago at station KYW. Union musicians acting upon orders from the Chicago Federation of Musicians, refused to play in the same studio with two non-union pianists. This action brings up a point of discussion when noted but non-union artists are engaged to give instrumental performances in broadcast studios where union musicians are employed.

An American Radio Club in Paris

A GROUP of English and American radio amateurs residing in France has organized the "Radio - Club Anglo - Franco - American," the object of which is to promote radio relations of all kinds between amateurs and listeners in England, the United States and France. The President of the Club is Mr. Reginald Gouraud, a young American who has been active in French radio circles.

* * *

"Listening In" Seats for Fans

STATION WHB in Kansas City is attempting to solve the problem of who will pay the broadcasting bill by selling seats to its invisible audience. "Seats" run from a dollar for general admission to the cost of "box seats." The audience is supplied with programs as in a regular theater. The plan was based on the belief that the fans would be ready to support a favorite station, which WHB believes it has become with a large number of Missourians.

* * *

Radio Helps Drug Addicts

RADIO is proving so beneficial to the narcotic addict inmates of the Municipal Farm on Rikers' Island, New York, that similar installations may be made in other "dope farms." According to a recent report of the State Commission of Prisons, the radio entertainment has had a "distinct effect upon the discipline of the institution."

* * *

The "Unco Guid" Can't Go to Church by Radio

SCOTLAND is now in the throes of a religious rumpus over radio. The Glasgow Presbyterian Council prohibits the broadcasting of full religious services on the grounds that there is no "real presence" in any service except that held in a consecrated church, and that many persons would abstain from attending church if services were broadcast.

A Sales Tax to Pay Broadcasting Artists

IN THE belief that "the radio industry can't live on an endless diet of jazz," Secretary Hoover recommends a two percent tax levy on radio sales. He maintains that a licensing tax upon radio listeners would not be tolerated in this country; and besides, as one large radio manufacturer alone has reported sales running above \$22,000,000 for 1923, Secretary Hoover sees in such an amount a revenue that would pay for daily programs of the best talent in the country.

Radio Breaks the Isolation of the Jungle

DR. ALEXANDER H. RICE, a New York surgeon and explorer, who is 1,200 miles up the Amazon River in the Brazilian jungles where he is studying tropical diseases, is in touch with his city every night. He communicates with his family through the 50-watt short-wave transmitter owned by Ellison Thompson. In this way he sends requests for scientific supplies.



Pacific & Atlantic

WILL BROADCASTING HELP OR HURT THE SALES OF PHONOGRAPH RECORDS?

To determine their merchandising value for the sale of phonograph records, a manufacturer recently put opera stars (Lucrezia Bori and John McCormack) on the air in co-operation with a group of broadcasting stations. The sales of radio sets and phonograph records are reported to have increased appreciably since several of these concerts have been broadcast.

German University Lectures by Radio

A SUMMARY of topics studied by students at the University of Berlin is being broadcast from one of the Berlin radio stations two evenings a week. These programs are intended primarily for students, but they are also presented for the purpose of interesting the general public in educational courses.

Bootleggers Seek Broadcast Help

THE Department of Commerce finds that rum runners are seeking the aid of commercial and amateur radio stations. A couple of instances have occurred when operators have unknowingly relayed messages that related to the illegal shipment of liquor. One station on the Great Lakes broadcasts regular programs which the Federal authorities believe contain code instructions to the rum runners on the Canadian side of the lakes.

Radio "Subscribers" Increase Rapidly in Germany

SINCE the German Government lowered the radio broadcasting service fee, subscribers have increased from 7,500 to 500,000 within half a year. Concert managers are protesting against the condition that has resulted from this low cost of broadcasting and predict that German singers will be ruined.

Brazilians Demand Broadcast Stations

BRAZIL still prohibits radio transmitting stations except in a few cases. In Bahia communication with the outside world is so slow and unreliable that a group of citizens has organized a radio society in the hope of having the radio prohibition removed so that broadcasting stations may be built. There is a radiotelegraph station in the city, but it is used by the government for the transmission of federal code messages only.

5,000 Monthly Radio Complaints

THERE are about 5,000 complaints filed each month with the Department of Commerce regarding some phase of radio. These protests come by phone and are made by personal calls as well as by mail. The majority of the complaints are concerned with radiating receiving sets. Last November the Chicago district led with 756 complaints; San Francisco was second; and New York was third.

One Set for Every 15 Persons

ONE district of New York City, the Borough of Queens, with a population of a little more than 500,000, reports 34,994 receiving sets within its boundaries. This means there is one radio set for every 15 persons in that area. Since Christmas the borough president believes the number of sets has passed the 40,000 mark.



Kadel & Herbert

MAKING PHONOGRAPH RECORDS OF BROADCAST PROGRAMS

A device for making a permanent record of important broadcast programs has been made by R. C. Borden and A. C. Busee of New York University. Here they are shown using their apparatus to test the "radio" voice of the singer who sits before the horn. Records are made on wax cylinders.

A "Radio Newspaper" in Esperanto

A NEW radio periodical is being published in Switzerland in the "international" language, Esperanto. The new publication comprises four pages and is called *Radio-Servo*. It is of newspaper size and devoted in part to propaganda for making Esperanto the world-wide language through its use in radio broadcasting.

Receiving Sets and Loops As Storm Direction Finders

By using a loop antenna and an ordinary receiving set, weather observers at the naval air station at Cocosolo, Panama Canal Zone, have detected the approach of thunderstorms and other atmospheric disturbances. The operators have been able to ascertain not only the direction from which the storms are coming, but also the approximate hour of arrival. Nearby storms have been anticipated through static on board naval ships for several years, but the question of the past of the storm areas, of greatest importance to aircraft operations, remained to be solved by the use of the loop antenna as it is employed at Cocosolo.

"Radio Lifeboats" Now Compulsory

HEREAFTER all British passenger liners must be fitted with at least one lifeboat equipped with radio-transmitting apparatus, according to a recent rule of the London Board of Trade. These sets will be able to send up to fifty miles and the receiving sets used in conjunction with them will receive signals at least a thousand miles, according to the power of the sending station. A picture of one of these radio-equipped lifeboats appeared in *POPULAR RADIO* for January, 1925.

Radio Fills an Emergency Rôle in Grand Opera

WHILE listening in at his home, a Boston singer heard the manager of the opera house announce that the tenor singing the leading rôle in "Il Trovatore" would be unable to continue after the second act and that a substitute would be sent for. The substitute was the listener, and before the messenger had come from the opera house, the understudy had arrived backstage.

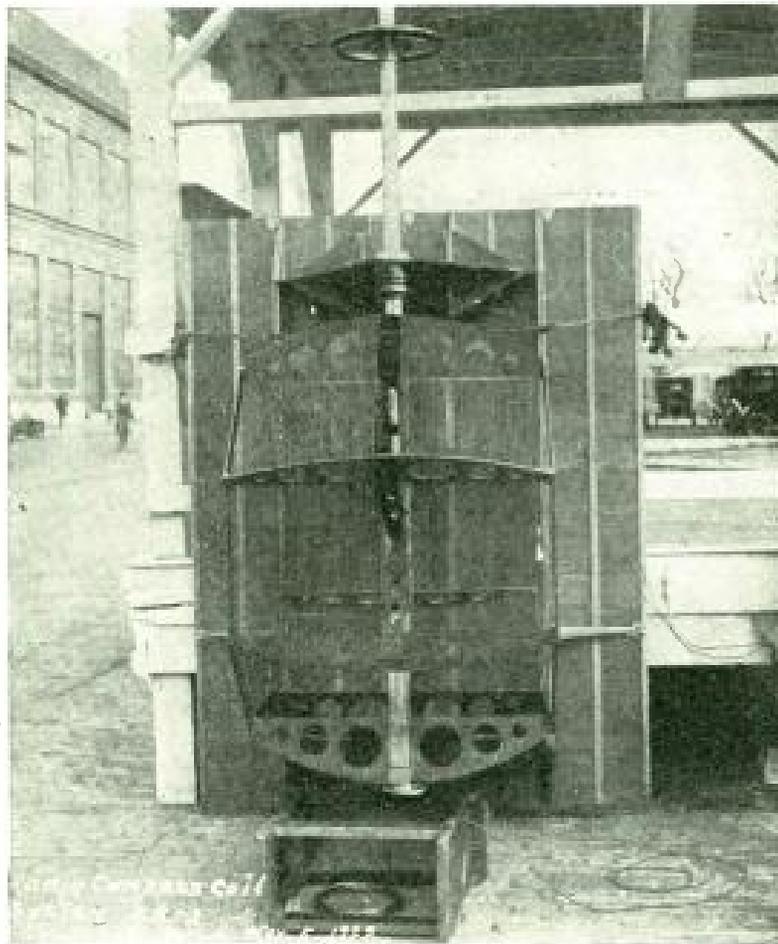
New List of Broadcasting Stations

CALIFORNIA has the largest number of broadcasting stations of all types, while New York has the largest number of Class B stations, records at the Radio Bureau disclose. Second to California in the total number of stations is Pennsylvania, with Texas third. According to the records, every state has one or more Class A stations, while only nineteen states and one territory have Class B stations.

The following table gives the total number and type of broadcasting stations in each state:

State	Class			Total
	A	B	C	
Alabama	3	..	..	3
Alaska	3	..	..	3
Arizona	2	..	1	3
Arkansas	7	..	..	7
California	31	6	6	43
Colorado	11	..	..	11
Connecticut	2	..	..	2
Delaware	1	..	..	1
District of Columbia	3	2	..	5
Florida	6	..	..	6
Georgia	4	1	..	5
Hawaii	1	..	1	2
Idaho	3	..	1	4
Illinois	24	8	..	32
Indiana	11	..	..	11
Iowa	18	3	1	22
Kansas	6	1	..	7

Kentucky	1	1	..	2
Louisiana	14	..	1	15
Maine	3	..	..	3
Maryland	5	..	..	5
Massachusetts	12	2	3	17
Michigan	14	3	..	17
Minnesota	11	1	1	13
Mississippi	4	..	..	4
Missouri	15	5	..	20
Montana	6	..	..	6
Nebraska	17	2	..	19
Nevada	1	..	..	1
New Hampshire	3	..	..	3
New Jersey	13	1	1	15
New Mexico	2	..	1	3
New York	18	9	2	29
North Carolina	1	..	1	2
North Dakota	5	..	..	5
Ohio	22	7	1	30
Oklahoma	7	..	3	10
Oregon	6	1	2	9
Pennsylvania	29	6	2	37
Porto Rico	..	..	1	1
Rhode Island	4	..	2	6
South Carolina	2	..	1	3
South Dakota	4	..	..	4
Tennessee	8	1	1	10
Texas	22	5	7	34
Utah	3	..	2	5
Vermont	1	..	1	2
Virginia	5	..	..	5
Washington	17	2	5	24
West Virginia	2	..	..	2
Wisconsin	13	..	..	13
Wyoming	1	..	..	1
Totals	427	67	48	542



U. S. Navy

THE APPARATUS THAT GIVES SHIPS THEIR LOCATIONS

Here is a close-up picture of a radio compass coil, ready to be installed. It is mounted upon a long vertical shaft fitted to bearings attached to a square wall bracket. When the compass coil is finally mounted it is usually placed in a reversed position to that shown above.

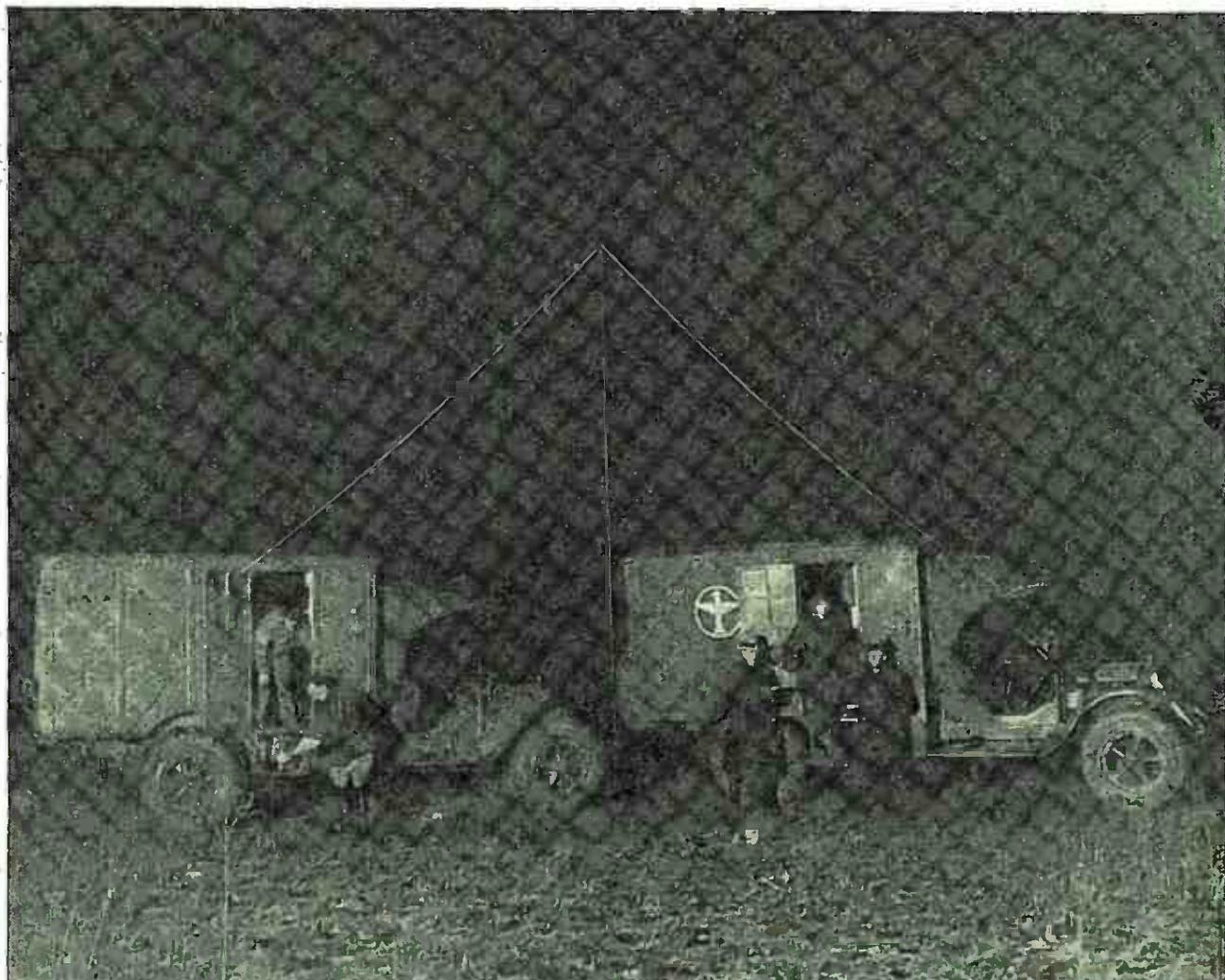


Foto Topics

UNCLE SAM'S SOLDIERS LISTEN IN ON EUROPE

To discover how far the American air force could receive messages in the event of an emergency, this portable transmitting and receiving unit was tried out on Mitchell Field, near New York, during the recent transatlantic broadcast tests. This radio motor equipment is used for communicating orders to air squadrons and scout planes.

Racing News by Radio

BEFORE even a small part of the crowd that gathered recently at Epsom Downs in England to witness the Derby, the biggest horse racing event in Great Britain, knew the name of the winning horse, thousands of radio listeners as far off as India, South Africa and even South America had heard the news over the air. No provision was made to announce the news at the race course, so that distance in this instance had its advantage through the miracle of radio.

* * *

A Broadcast Bugle Call Musters a Regiment

Two hours after a mobilization call was broadcast from the 131st Infantry armory in Chicago, the entire regiment mustered at its headquarters. Only a few commissioned officers knew that the test was to be made on Armistice Day, yet seven minutes after the order was broadcast, the first man responded to the call.

A New Austrian Loop Wound On Pegs

A NEW type of loop antenna that has appeared recently in Vienna consists of a round wooden hoop, like a barrel hoop, with a number of pegs of insulating material inserted in the edge of the hoop so that they project on one side of it. The loop is then wound on these pegs. The advantages are said to be a firm support by the hoop, and the small amount of dielectric material in contact with the wires of the loop or inside them.

* * *

Radio-Sets To Be Taxed in Vienna

THE Viennese, who have been cherishing the idea that in radio they had at last found a tax-free amusement, are now incensed over the proposal of Herr Breitner, the financial advisor of the municipality of Vienna, that all owners of radio sets be taxed, in order to maintain the costs of broadcasting. The "radio craze" in Austria is now reported at its height.

A Death Message by Radio

"If there is anyone listening in Kansas City, please notify the Union Station officials, and the Chief of Police to search for R. C. and J. R. C. Moseley, brothers, at the Union Station; their parents have been killed in a motor car accident," was the startling announcement made on January 6 at station WBAP in Kansas City. The Union Station telephone switchboard immediately was flooded with calls from persons who had heard the appeal. All trains were paged and the Moseley brothers were found just before time for departure of the train on which they were to have gone to Chicago.

New Officers of the Institute of Radio Engineers

At the annual election of officers for the year 1925, Institute of Radio Engineers, the following were elected: John M. Dellinger, president; Donald McNicol, vice-president;



Felix J. Koch

A NOVEL DEVICE FOR AVOIDING WAITS IN BROADCAST PROGRAMS

A novel attachment to a microphone stand has been developed by station WLW in Cincinnati. It consists of a cylinder (shown above) in which one of two words "PREPARE" or "BROADCAST" is illumined as instructions to the artist from the director. The device has helped to eliminate the "one moment please" waits that usually interrupt the broadcast programs.

members of the Board of Managers, Melville Eastham and A. E. Reoch. At the first meeting of the new Board three appointive managers were added to the Board, J. H. Morecroft, Lloyd Espenschied, and John V. L. Hogan. Alfred N. Goldsmith was reappointed secretary and editor of the *Proceedings*, and W. F. Hubley, treasurer. Managers whose terms have not yet expired and who continued to hold office throughout 1925 are: Edward Bennett, L. A. Hazletine, H. W. Nichols and A. H. Grebe.

Ban on Radio Lifted in Azores

IN the Azores the use of radio transmission apparatus is prohibited, but the ban on receiving sets was lifted recently. Now, the Portuguese islands boast of nine receivers. Most of them are long-range sets, as the nearest land is 750 miles away. Two of these sets are American eight-tube hook-ups. An effort is being made to persuade the Portuguese Government to install up-to-date radio transmission and receiving equipment on the islands so that regular communication can be maintained with the European continent. The daily newspapers on the islands use receiving sets to keep in touch with the events of the world.

Melodious Time Signals

INSTEAD of broadcasting the noon time signals with the customary ticks that are used almost universally by government weather bureaus, a Swedish broadcasting station has begun to broadcast the noon-hour chimes from the Stockholm City Hall. This is considered an exceptional treat for Swedish listeners because the chimes are one of the finest in the world, and were recently installed at a cost of \$4,000,000.

Daily Chats by Radio

THE practical use of the radiotelephone for private conversation between two individuals has been demonstrated by Donald H. Johnson of Cleveland, Ohio. For two years he has employed his radiophone for a daily chat with his father, Dr. William H. Johnson, who lives about seventy miles from his son. These conversations are carried on in the daytime with the same reliability as that of a private telephone and, of course, they necessitate no toll charges. Both father and son are, naturally, licensed amateurs. Their calls are respectively 8BEI and 8DGS.

Radio Unites Another Family

"OUR next number will be a song by George Dion," was a recent simple announcement from a broadcasting station. But it brought Edna Dion and her father in touch for the first time in fourteen years. When Mr. Dion went on the stage in 1910, he lost track of his wife and daughter. A short time ago the daughter, at her home in Whitinsville, R. I., picked up the message from Providence which was the means of Mrs. Dion's tracing her husband who was appearing in vaudeville.



HINTS FOR

AMATEURS

CONDUCTED BY ALBERT G. CRAIG

How to Mount the Sub-panel

A GOOD way to support the panel of a receiving set on the wooden base or to fasten a sub-panel to the front panel is by the use of special jacks which are made with tapped holes in the frame so that the sub-panel or wooden baseboard can be bolted directly to them. It is a simple matter, if your dealer can not supply you with jacks already drilled and tapped, to drill the necessary holes and tap them yourself. This construction method eliminates a number of unsightly screw heads on the front panel. Incidentally, it means a rigid mounting of the base.

Keep the Wire Clean

ANYONE who has wound special coils knows how hard it is to prevent the wire from becoming soiled by the hands. Besides, the perspiration on most people's hands is slightly acid and if any appreciable amount soaks into the insulation, the losses in the coil will be much greater than if the wire were kept clean and dry. Wind your coils with gloves on your hands. This may be a bit awkward but the results will warrant the annoyance.

Coil Angles Are Important

IN building a receiver which includes two stages of tuned radio-frequency, it is desirable to mount the tuning induc-

tances so that the angle of the coils with relation to each other can be varied slightly. Often a small change in the angles of the coils will eliminate troublesome oscillations.

The Dials Should Run True

A DIAL that wobbles as it rotates does not affect the working qualities of a radio receiver but it certainly does spoil its appearance. When you buy dials, have the dealer spin them on the shaft of a condenser and make sure that they run true before you make your purchase. It is often possible to true-up a dial on a shaft by fitting a bit of paper or shim brass in the shaft hole or by polishing the shaft on one side or the other with emery paper.

An Extension Cord for Your Loudspeaker

OFTEN we desire to operate the loudspeaker in another room from that in which the radio receiver is installed. The simplest way to do this is to buy a sufficient length of ordinary electric light drop cord, an open circuit jack and an extra plug. Solder the jack to the two wires at one end of the drop cord and fit the plug to the other end.

Select Your Cabinet First

IF you intend to fit your radio receiver into a cabinet, it is much easier and

may save you a lot of trouble to buy the cabinet when you purchase the other parts and then fit the panel and base together and into the cabinet before you start the rest of the work. Otherwise you may find, when you have your set completed, that it will not fit into any standard cabinet without changing the position of some of the instruments or re-wiring part of the circuit.

Clean Your Rheostat Contacts

GRATING and sizzling noises heard in the loudspeaker or phones are sometimes due to a defective rheostat contact. Remember that there are two sliding contacts in every wire wound rheostat. There is one between the contact finger and the resistance wire; and the other is between the rotating shaft and the spring which is connected to the terminal. It is easy enough to test the pressure of the contact on the resistance wire, but the other sliding contact may have become weak or dirty. The remedy for this condition in most forms of rheostats is to take them apart and increase the tension of the spring after cleaning the contact surfaces with emery cloth.

Round-nose Pliers Are of Wide Utility

ONE of the most useful tools for the radio constructor is a pair of small, round-nose pliers. With pliers of this type you can bend bus wires into any shape desired and form perfect loops on their ends to clamp under the binding posts of instruments that are not supplied with soldering lugs.

Watch Out for Your Rugs

FREQUENTLY it is necessary, in order to have a short ground connection, to run the ground wire across a room under a rug or carpet. After a few months you will notice that there is a streak across the floor covering caused by the extra wear on the portion which is raised slightly by the wire. To overcome this, substitute thin brass ribbon for the heavy, round ground wire.

Keep Your Soldering Iron Hot

Most of the poor soldered joints that bother the amateur radio constructor are due to working with an iron that is not hot enough. It must be remembered that the solder on the point of the iron should be hot enough so that the surface of the wire or soldering lug which it touches will be heated to a temperature which will permit the solder to flow onto the surface of the metal and not simply stick to it in a pasty mass.

When to Add Water to an "A" Battery

If water is added to the storage "A" battery when it is nearly discharged, it is likely to run out of the vents in the filler caps when the battery reaches full charge. This is due to the quantity of small gas bubbles which form in the solution and greatly increase its bulk. In most batteries, the separators between the plates extend up above the level of the top edge of the plates so that it is only necessary to keep the acid solution just above the separators. Water can be added after the battery is fully charged.

Will the Energy of the Atom Be Released?

Recent experiments indicate that the long dream of the scientists may soon become a reality and unlimited power be placed at man's disposal. In POPULAR RADIO next month Dr. T. F. Wall of London will describe his own experiments that have attracted world-wide attention.



“Compare It—
You’ll Buy”

The HORN with the “WHY”

When you first hear Radio through the Jewett Superspeaker, you marvel at the amazing accuracy and volume of the reproduction.

Yet there is no mystery in Superspeaker performance; it is based on laws you yourself can easily understand.

One could never jam the massed harmony of a full brass band through the eye of a needle. So the Superspeaker horn is ample in size for the work it must do.

Also sound, as you know, moves in a direct line. The Superspeaker throat is therefore straight as an organ pipe, avoiding the bugling effect due to the crooks or curves. And its inner surface is smooth and glossy, never tripping or confusing the waves of music or voice.

Just listen to The Superspeaker! Compare its performance with that of any other loud speaker in the world! The difference will amaze you.

No extra batteries—Exclusive air-gap adjustment to modify results from nearby stations, and increase strength of those from far away—A true musical instrument, built and guaranteed by the million-dollar company whose name it bears. Sweep the ether with a Superspeaker!

JEWETT RADIO & PHONOGRAPH COMPANY
5668 TWELFTH ST., DETROIT, MICH.

The
Superspeaker
trademark
Registered

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY

ATWATER KENT RECEIVING SETS

CONFIDENCE characterizes the attitude of all ATWATER KENT owners—Dependable performance, day in and day out, has brought to them a new realization of radio efficiency; a new meaning of the words Selectivity, Sensitiveness, Distance and Volume.

With an ATWATER KENT, everyone in the family can easily obtain perfect results. It gives instant command of any program on the air—

it is a library, a concert stage, a theatre and a newspaper all in one.

The knowledge of over a quarter century's experience is built into ATWATER KENT Radio. It is designed by skilled engineers and made by master workmen from the finest materials that money can buy.

Any ATWATER KENT dealer will prove to you through a demonstration that here are the instruments that will meet all your expectations.

Interesting literature on request

ATWATER KENT MANUFACTURING COMPANY
4712 Wissahickon Ave., Philadelphia, Pa.

Pacific Coast
Prices slightly
higher



Model 10-'85



Model 9-'85



Model 12-'105



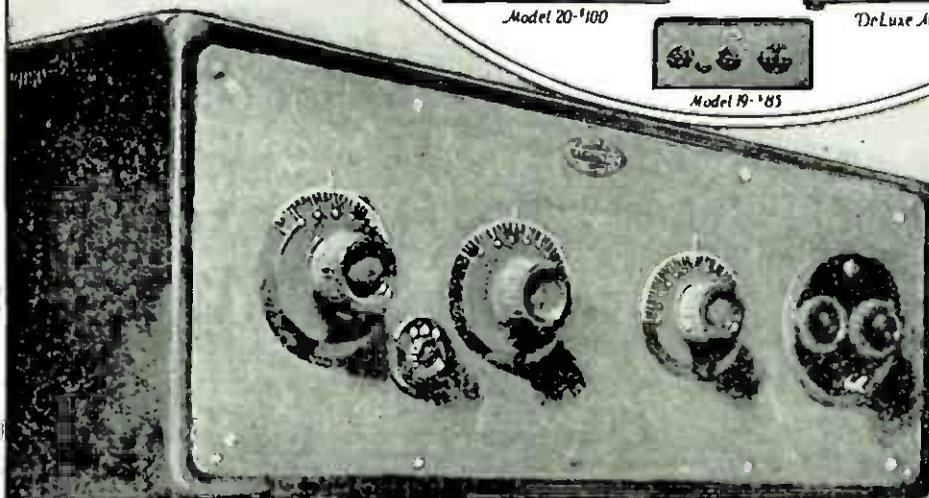
Model 20-'100



Dr. Luxe Model-'120



Model 19-'85



THINK WHAT IS BACK OF IT

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY

ATWATER KENT LOUD SPEAKERS

THE ATWATER KENT Loud Speaker brings out the best from any set.

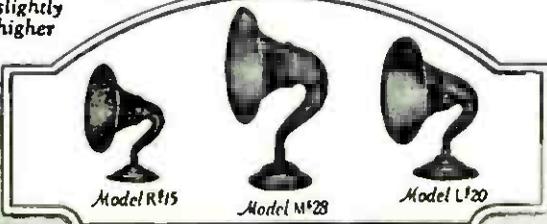
No matter how perfectly your receiver may bring in the wonderful programs that are in the air, unless your reproducer faithfully re-creates them you cannot get the true spirit and beauty of the broadcasts.

The ATWATER KENT Loud Speaker is the final touch to radio enjoyment. Through it, programs from far and near will fill your home in all their living beauty. It re-creates voice and music so natural in tone, so mellow and generous in volume that it seems not like a reproduction, but the original—just as the broadcasting artists produced it.

Interesting literature on request

ATWATER KENT MANUFACTURING COMPANY
4712 Wissahickon Ave., Philadelphia, Pa.

*Pacific Coast Prices
slightly
higher*

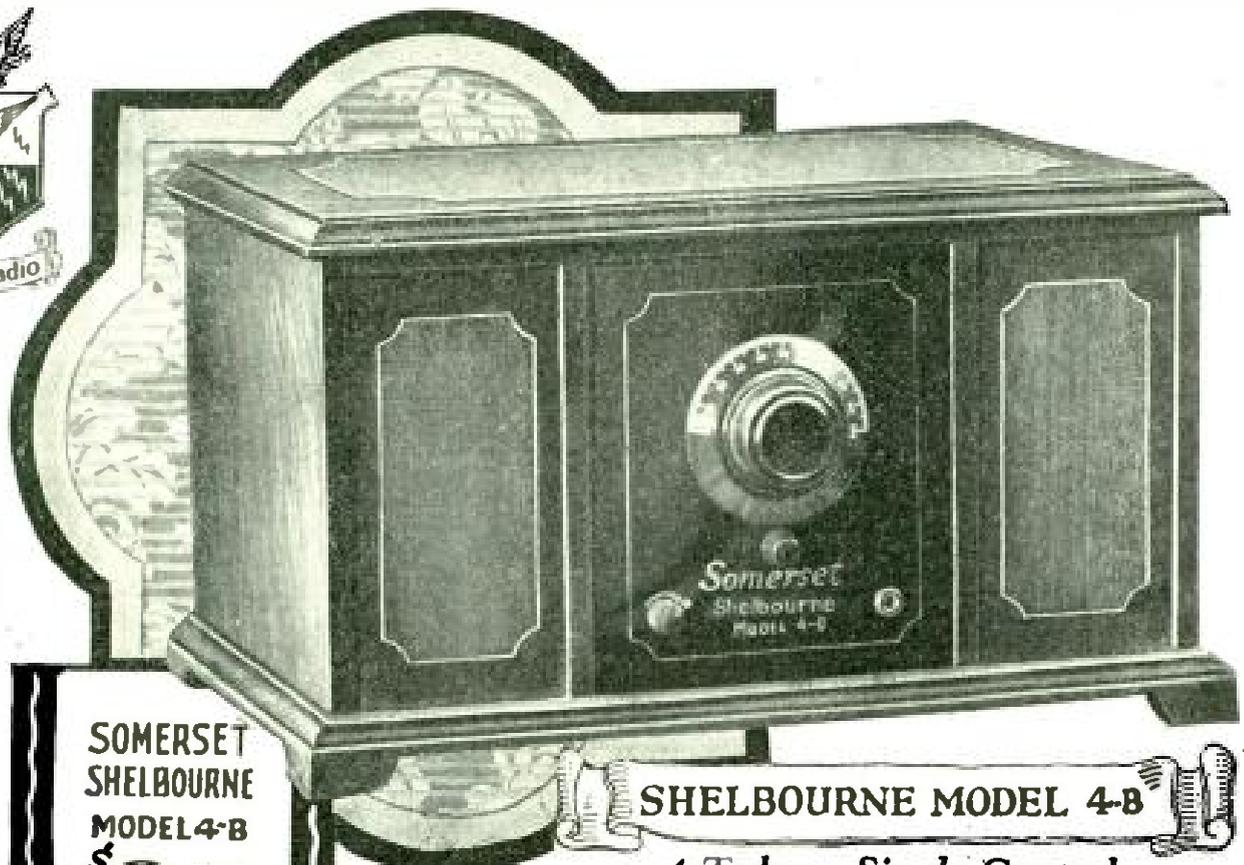


BRING OUT THE BEST FROM ANY SET

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY



© 1925
NATIONAL
AIRPHONE
CORP.



SOMERSET
SHELBOURNE
MODEL 4-B

\$85

SHELBOURNE MODEL 4-B

4 Tubes—Single Control

SOMERSET SHELBOURNE Model 4B 4 Tubes—Single Dial Control. Our perfected tuned radio frequency circuit with single dial synchronized control. Simple to operate and highly selective, with clear tones and volume that are found only in the higher priced receivers.

Storage battery or dry cell operation, automatic filament control, the finest "low loss" condensers, and the famous **SOMERSET** Calibrated Transformers. Compartments for large sized storage "A" and dry cell "B" batteries. Mahogany finish cabinet hand-rubbed two-tone effect. **List \$85**
Size 26" x 14" x 21"

Somerset

A style and price to suit every radio receiver demand!

DEDICATED to the ideal of radio as an integral part of the modern home, each Somerset Receiver is a substantial and decorative piece of furniture. All cabinets have an exquisite two-toned panel effect with hand-rubbed finish, and are fully up to the standard of the finest phonographs. Each has compartments to hold and conceal the unsightly "A" and "B" batteries with their necessary wiring. The Somerset Models are as *beautiful* in appearance as they are efficient in performance, fully worthy of the finest homes. Every set is guaranteed to give com-

plete satisfaction or money cheerfully refunded. The makers of these sets challenge comparison with all others as to correctness of engineering design, beauty of appearance, careful workmanship, high quality and suitability of parts and materials used, clarity of reception and faithfulness and purity of tone. These are values which can't be matched.

THE Somerset line consists of four models—Stratford Model 4A, 4 tube set, 2 dials, \$65. Mars Model 5A, 5 tube set, 3 dials, \$75. Shelbourne Model 4B, 4 tube set, 1 dial, synchronized control, \$85. Standish Model 4C, 4 tube set, 1 dial, synchronized control, and built-in loud speaker, \$150. *All sets are tuned radio frequency.*

TRUTH in RADIO

TRUTH in radio from now on will be the firm foundation on which the public will build its confidence.

Confused and disappointed by extravagant and misleading claims, by high sounding names and mysterious terms, the radio buyer has eagerly sought for an assurance of full value for his money and a definite idea of what he can expect for a definite expenditure.

The Somerset line has been developed to meet this unfilled want. It has been planned on the basis of providing a full dollar's worth of radio for the consumer's dollar, of highest quality for the least money, of conscientious workmanship and best materials, backed by finest engineering skill that money can command.

But extravagant claims and misleading descriptions will have no part in the sale of any Somerset Radio Receiver. This we pledge at the outset.



THE SINGLE DIAL CONTROL

THE Shelbourne and Standish models employ the latest development in simplification—the single control. By means of gears, the condensers are connected and operated by a single tuning knob. Of course this is made possible only by the most careful selection and matching of condensers and coils but the finished product is a revelation in easy tuning. There is also a midget condenser for fine adjustment if necessary, but it is not essential to the complete enjoyment of the set by even a most inexperienced person.

Radio

The Famous Somerset Guarantee — Satisfaction — or Money Back

YOU must be satisfied with this receiver or we do not want you to keep it. If for any reason you feel that it is not exactly as represented or that it is not the quality and value which you have a right to expect, we want you to return it for exchange or for refund, whichever you prefer. We will cheerfully and promptly make good any Somerset product which does not fully measure up to your expectations.

FILL OUT AND MAIL TODAY

National Airphone Corporation
16-22 Hudson Street, New York City
Send me full information on the Somerset line and the Somerset Primer.

Name

Address

City

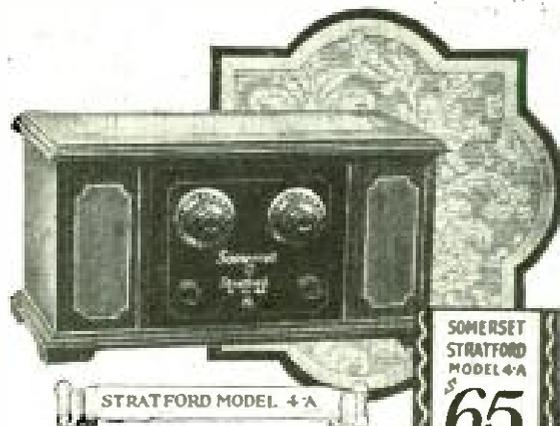
Prices subject to change without notice. Prices West of the Mississippi—add 10%

NATIONAL AIRPHONE CORP.

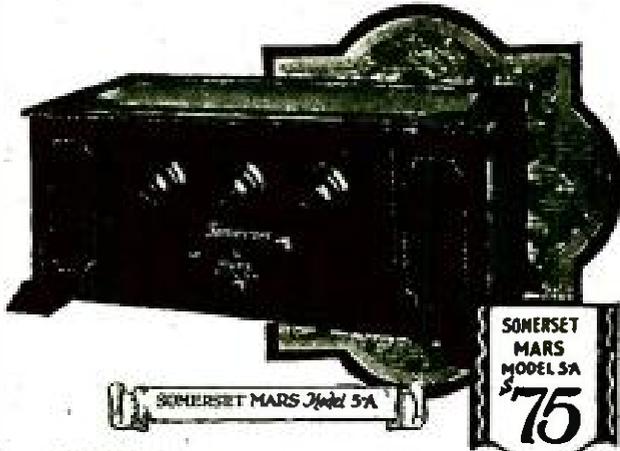
Manufacturers of Somerset Radio Receivers

16-22 Hudson Street, New York City

Here are the other Somerset Models!



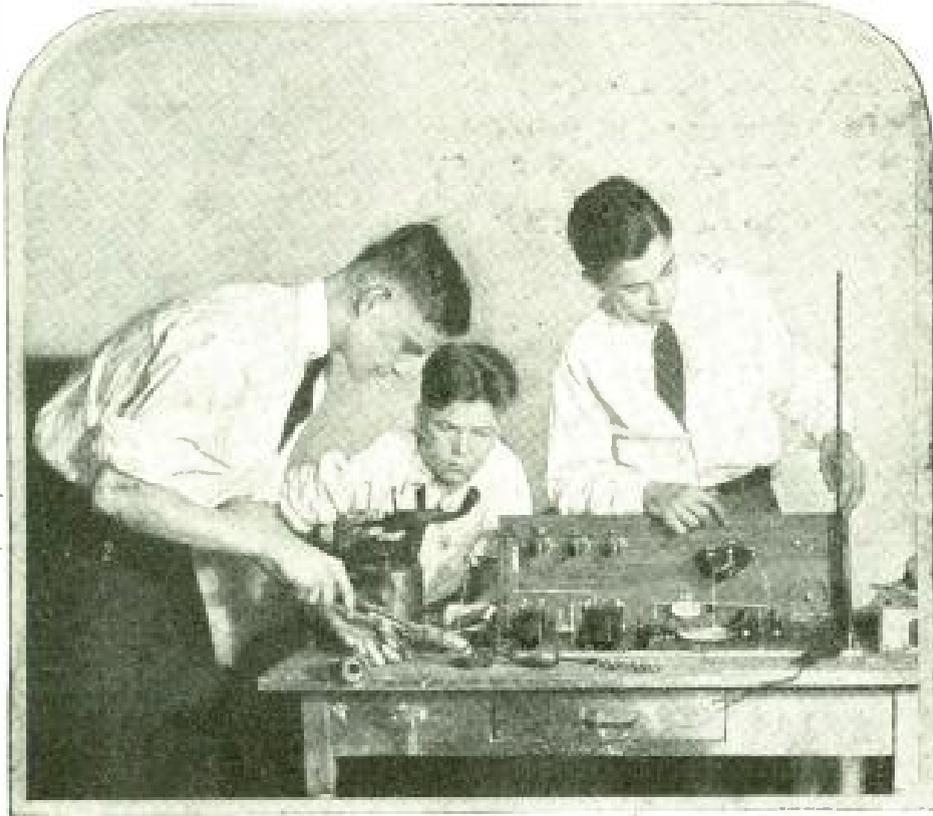
SOMERSET STRATFORD Model 4A 4 Tubes—Dual Control. A superior four tube, tuned radio frequency receiver—two dial control—operates on storage battery or dry cells. Automatic filament control insures long life of tubes. The finest "low loss" condensers and the famous SOMERSET Calibrated Transformers are features. "A" and "B" battery space is provided in the handsome two-tone mahogany finish cabinet. List \$65
Size 21" x 15" x 11"..... List \$65



SOMERSET MARS Model 5A 5 Tubes—Three Dial Control. Two stages tuned radio frequency, detector, and two stages audio frequency. Storage battery or dry cell operation, automatic filament control, highest quality "low loss" condensers and the famous SOMERSET Calibrated Transformers. Artistic cabinet hand-rubbed mahogany finish providing space for storage "A" and dry cell "B" batteries. Size 29" x 14" x 11" List \$75



SOMERSET STANDISH Model 4C 4 Tubes—Single Dial Control with built-in loud speaker. Combining a built-in loud speaker of the highest type and the four tube tuned radio frequency circuit with single dial synchronized control—all the latest and best in radio. Storage battery or dry cell operation, automatic filament control, highest quality "low loss" condensers, and the famous SOMERSET Calibrated Transformers. Ample space is reserved in this cabinet for standard size high ampere hour storage "A" batteries and dry "B" batteries. Exquisite cabinet, antique mahogany finish. Size 29" x 13" x 14"..... List \$150



Youth is the creative age in radio

Boys are the builders of radio. In them flames a creative urge that impels them to constant experiment—constant improvement. The fine, high-powered set that satisfies a man, is to the boy but the starting point for further testing and searching.

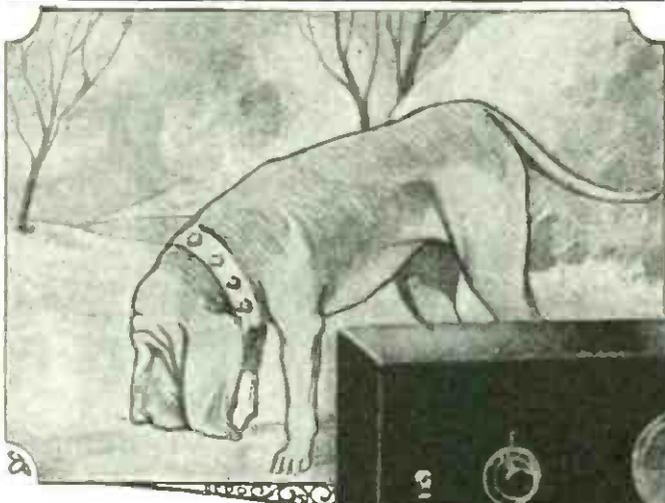
While older men marveled at the first primitive sets, youths still in their teens, like Armstrong, Cockaday, Reinartz and Tuska were developing the inventions that have made possible such unbelievable advances in this new science. Today millions of boys, actuated by the same irrepressible urge, are building their own sets, designing new-hook-ups, changing, revising, improving. And that's why the bulk of radio sales are made to boys, or to parents buying for boys.

THE AMERICAN BOY is the radio guide of 500,000 up-to-the-minute boys, averaging 15½ to 16 years old. Radio takes a big part in its stories. Its articles deal with the latest developments in radio—written by radio authorities. And this great section of boydom naturally turns to its advertising columns for information on all that's newest and best in radio equipment.

Tell these boys about your product. They're the very cream of your market. Win their confidence in your goods, and their preference for them, by advertising in **THE AMERICAN BOY**.

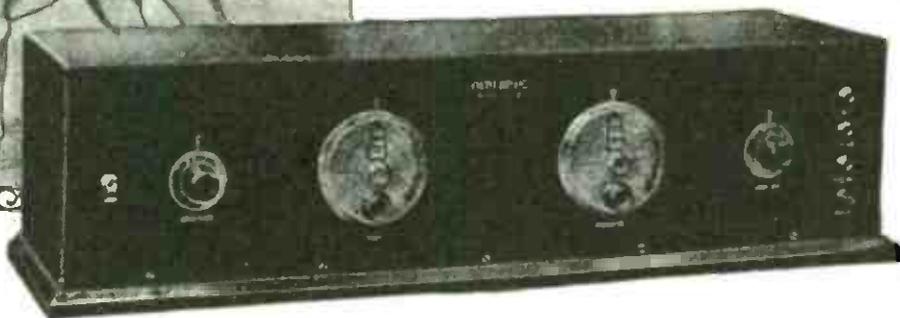
Copy reaching us by March 10th will appear in May.

The **American Boy**
The Biggest, Brightest, Best Magazine for Boys in All the World
 Detroit Michigan



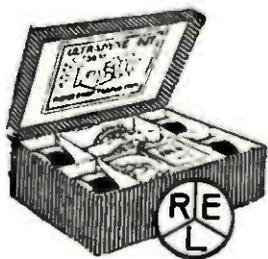
Sensitivity

The bloodhound, remarkable for the acuteness of its smell, can pick up a scent and follow a trail when all else fails.



-never before thought possible!

With the extreme acuteness of the bloodhound's scent, the Model L-2 Ultradyne detects the faintest broadcast signals—signals that are "dead" to other receivers—regenerates and makes them audible on the loud speaker.



THE ULTRADYNE KIT
 Consists of 1 Low Loss Tuning Coil, 1 Special Low Loss Coupler, 1 Type "A" Ultraformer, 3 Type "B" Ultraformers, 4 Matched Fixed Condensers.
 To protect the public, Mr. Lacault's personal monogram seal (R. E. L.) is placed on all genuine Ultraformers. **\$30.00**
 All Ultraformers are guaranteed so long as this seal remains unbroken.

It's here, where the development of other super-radio receivers has halted; the Ultradyne forges ahead.

The unusual sensitivity of the Model L-2 Ultradyne is due to the successful application of regeneration, to the famous Modulation System of radio reception, recently perfected by R. E. Lacault, E.E., A.M.I.R.E., Chief Engineer of this Company and formerly Radio Research Engineer with the French Signal Corps Research Laboratories.

It's this development, an exclusive feature of the Model L-2 Ultradyne, that makes it possible to receive great distance on the loud speaker.

Everything that the Model L-2 Ultradyne means in actual results and genuine satisfaction, you will appreciate the first evening you operate it.

Write for descriptive folder



32 page illustrated book giving the latest authentic information on drilling, wiring, assembling and tuning the Model L-2 Ultradyne Receiver **50c**

ULTRADYNE

MODEL L-2

PHENIX RADIO CORPORATION, 7-9 Beekman Street, New York

Formica Maintained its Leadership

FORMICA again during the past season maintained the leadership it has held for several years as an insulating material for radio uses.

With few exceptions every important radio manufacturer in the country used Formica—more than 125 in all.

They find it pays. For Formica is thoroughly dependable as insulation and provides a strikingly handsome panel for the front of a radio set. Formica has set a standard of good appearance—and permanent and lasting good appearance—which creates sales resistance of considerable proportions for the manufacturer who uses cheaper material.

Of course, wise amateur set builders are moved by the same motives that determine the choice of the set manufacturer. They, too, want good looks and lasting beauty; perfect insulation, strength, and freedom from sagging, warping, softening and discoloring.

Formica is one of the most permanent materials available in the world today. In any climate, under any conditions, it remains almost forever—just as you see it when it is new.

Write for booklet, "What Formica Is."

**THE FORMICA
INSULATION
COMPANY**
4641 Spring
Grove Ave.,
Cinn., O.

SALES OFFICES

50 Church Street.... New York, N. Y.
9 South Clinton St.... Chicago, Ill.
516 Caxton Bldg.... Cleveland, Ohio
1142 Granite Bldg.... Rochester, N. Y.
422 First Avenue.... Pittsburg, Pa.
6 Beacon Street.... Boston, Mass.
55 Calle Obispo.... Habana, Cuba
289 Victoria St.... Toronto Ontario, Canada
1026 Second Avenue.... Minneapolis, Minn.
1210 Arch Street.... Philadelphia, Pa.
708 Title Building.... Baltimore, Md.
585 Mission Street.... San Francisco, Cal.
419 Ohio Building.... Toledo, Ohio
309 Plymouth Bldg.... New Haven Conn.
Whitney Central Bldg.... New Orleans, La.

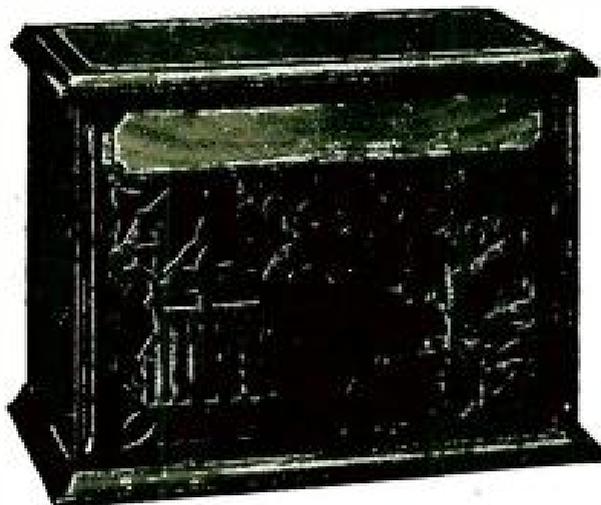
Write for Booklet "What Formica Is"

- 1 Formica is used by 125 leading makers—and has for years been used by more makers than all other materials.
- 2 Formica will last forever.
- 3 Formica, in appearance, is the finest of all panel materials and always remains so.
- 4 Formica's electrical qualities of every kind far exceed any possible requirement.
- 5 Formica has high mechanical strength and will not break in use.
- 6 Formica will not sag from heat or cold flow under pressure. It retains its dimensions. Everything you fasten to it stays tight and precisely where you put it.
- 7 Formica panels are sold in neat craft paper envelopes which assure you that you are getting the genuine.
- 8 Formica is one of the most widely approved materials in radio.

FORMICA
Made from Anhydrous Bakelite Resins
SHEETS TUBES RODS

Hear the Formica band every Wednesday evening from 9 to 10 Central Standard Time over WLW.

Make this test yourself



ASK your dealer to let you hear an Adler-Royal Radio Speaker side by side with any speaker in his store. Operate its magic modulator yourself and see how it adapts its tones to your mood. Notice how free it is from the noises you have formerly associated with loud speaker reception. Whether it is the strident measures of a jazz band or the plaintive notes of a world renowned violinist, put yourself under the spell of Adler-Royal tone quality.

Then Make the Hardest Test of All

TUNE in on a station that is broadcasting piano music, and observe how the Adler-Royal actually reproduces music that really sounds like a piano. The remarkable purity of tone in Adler-Royal is accomplished in two ways. The horn preserves pure tonal qualities. This coupled with the tone modulator, easily accessible, gives you perfect control over tone volume and quality.

Two Exclusive Features

YOU tune in your radio set for maximum amplification so that every delicate overtone is caught and amplified and then by this modulator, you blend and soften this tone to your own mood.

The cabinet design of Adler-Royal Radio Speakers provides a setting that will grace the finest living room.

Our experience of 25 years in producing fine pianos, organs and phonographs enables us to offer this speaker at the extremely reasonable price of \$30.00. In two finishes, either duo-tone walnut or mahogany.



The Secret of Adler-Royal natural tone

ADLER MANUFACTURING COMPANY

New York

Louisville

Adler-Royal Radio Speaker

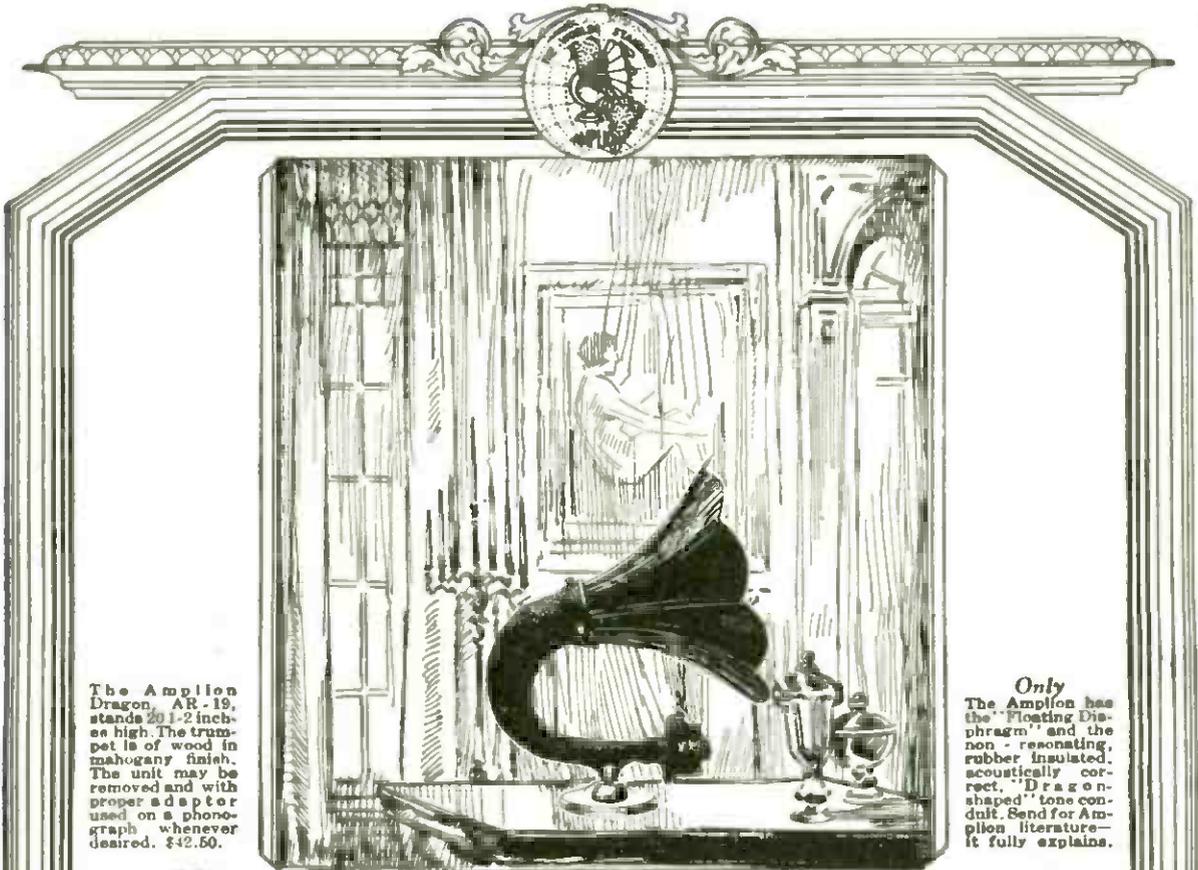
ADLER MANUFACTURING COMPANY,
Dept. B3, 881 Broadway, N. Y.

I should like to know the name of a dealer near me where I can compare an Adler-Royal Radio Speaker. Also please send me The Adler-Royal Catalog and Log.

Name

Address

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY



The Amplion Dragon, AR-19, stands 20 1/2 inches high. The trumpet is of wood in mahogany finish. The unit may be removed and with proper adapter used on a phonograph whenever desired. \$42.50.

Only The Amplion has the "Floating Diaphragm" and the non-resonating, rubber insulated, acoustically correct, "Dragon-shaped" tone conduit. Send for Amplion literature—it fully explains.

Hear it in comparison!

Learn Why it is Outselling Any Other Loud Speaker

Hear the favorite of music lovers in all quarters of the globe! The creation of the originators and world's oldest makers of loud speakers.* The Amplion!—which a third of a century of loud speaker experience has brought to radio.

Hear it in comparison! We assure you that never has such supreme sensitivity, clarity and natural tone, such volume without distortion, been known before. Your ears will tell you why the Amplion internationally outsells any other loud speaker. The supremacy of Amplion performance will win you as no words can. Enjoy this treat at once. Gain an entirely new conception of what loud speaker reception can be. There is an Amplion dealer in your vicinity. Write to us for literature and his name.



The Amplion Junior Deluxe, AR-114, \$27.50



The Amplion Junior, Model AR-111, \$24.00



Amplion Phonograph Units, \$19 and \$25



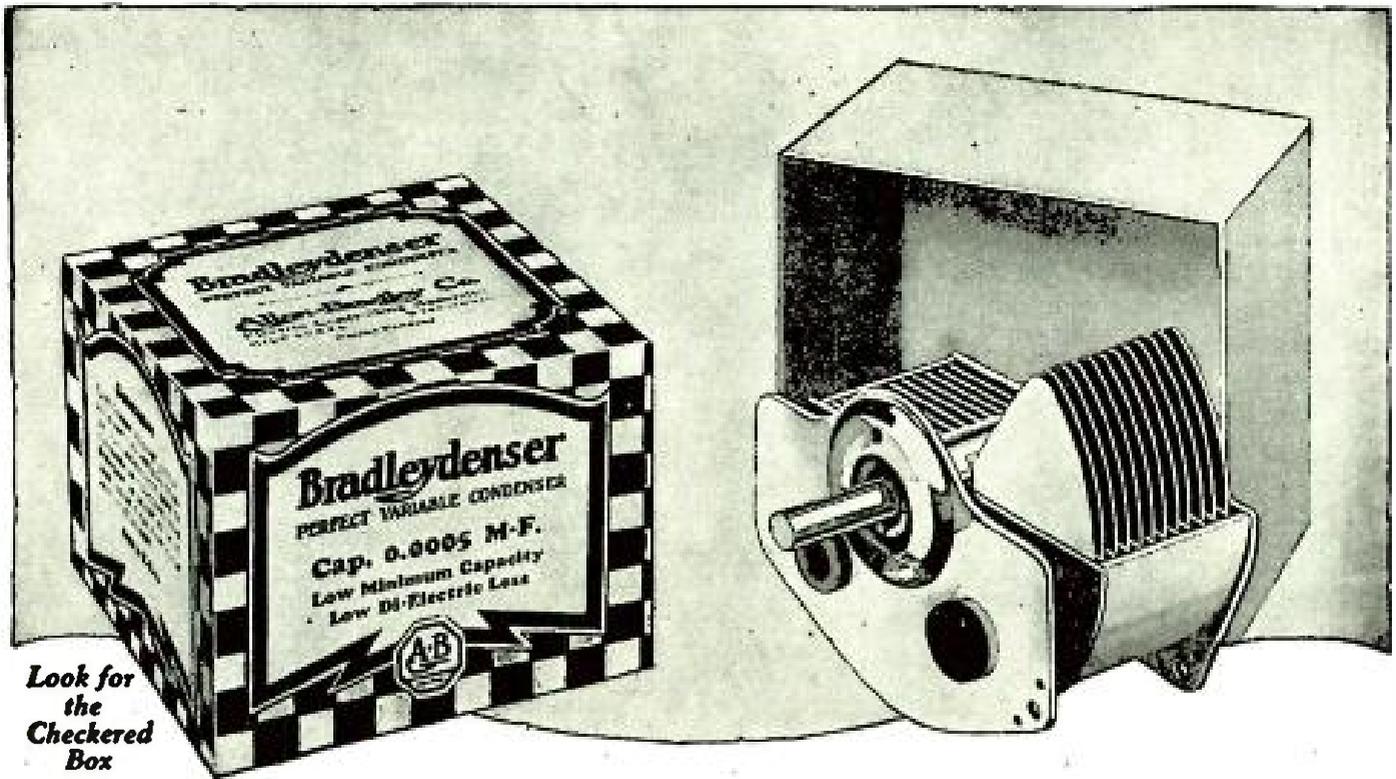
Amplion Dragon, Model AR-102, \$13.50

Slightly higher in far west

Slightly higher in far west

THE AMPLION CORPORATION OF AMERICA
 Executive Offices: Suite X, 280 Madison Avenue, New York
 Canadian Distributors: Burndept of Canada, Ltd., 172 King St. W., Toronto
 *Alfred Graham & Co., London, England, patentees





Look for
the
Checkered
Box

Brass Plates — Soldered Joints — Grounded Rotor Are Standard Features of the Bradleydensen

The Bradleydensen is a low-loss condenser with many distinctive features that insure long life and high efficiency. For instance, the brass stator and rotor plates are soldered at all joints. The plates cannot become loose, corrode at the joints or work out of alignment. The rotor is mounted on a long sleeve bearing that supports the rotor plates without the use of an outer end-plate. Therefore, the di-electric material is reduced to two small buttons. This means low loss and sharp tuning.

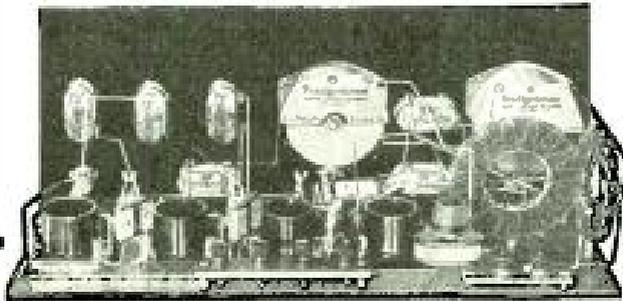
The stator plates are protected with a dust cap that can be detached without tools. The minimum capacity is extremely low, and body capacity effects are greatly reduced. The entire design makes for the highest efficiency in radio receivers.

*Build for
Efficiency*

Allen-Bradley Co.
Electric Controlling Apparatus
276 Greenfield Ave. Milwaukee, Wis.

*Use the
Bradleydensen*

This filter tuner with resistance-coupled audio amplifier is equipped with Bradleydensens. The tuning is very sharp and selective.



Send for the latest information on the Bradleydensen. It will pay you to know about this remarkable low-loss condenser before planning your next radio set.

McCormack—More Clearly on the **FRESHMAN MASTERPIECE**

WHEREVER you are in this country you can easily tune in John McCormack, Bori, Alda and the host of other Metropolitan Opera artists, now broadcasting every other Thursday evening, from W E A F and other stations.

The Freshman Masterpiece assures true to life reproduction with real loud speaker volume. Brings out every single note distinctly, with matchless tonal qualities.

*The easiest of all
sets to operate.*

A five tube tuned radio frequency receiver made of the finest low loss materials and in a beautiful genuine solid mahogany cabinet, that is attractive enough for the most pretentious room, and at sixty dollars, economical enough for the most modest. Combining all points essential to the perfect receiver, it is the greatest value ever offered in a radio receiving set.

Chas. Freshman Co. Inc.
Radio Receivers and Parts
FRESHMAN BUILDING
240-248 WEST 40TH ST.—NEW YORK, N.Y.



These artists broadcasting through courtesy of Victor Talking Machine Co.

Every genuine Freshman Masterpiece has the serial number and trade mark riveted on the sub-panel. Sets are not guaranteed if number has been removed or tampered with. Beware of imitations. Insist upon the genuine.

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY



A MICADON —it's the condenser

*There is a Micadon for every
possible requirement, price
35 to 75 cents.*

The Micadon is the standard fixed condenser of radio! Extremely accurate because only the very best materials are used and because Dubilier condenser craftsmen assemble and inspect them. Simple to install because equipped with extension tabs for soldering and eyelets for set-screw assembly. Different capacities for different requirements. More than 90% of all sets made—by manufacturers and amateurs—use Dubilier Micadons.

The preference of all these fans and experts has made Dubilier Micadons the standard.

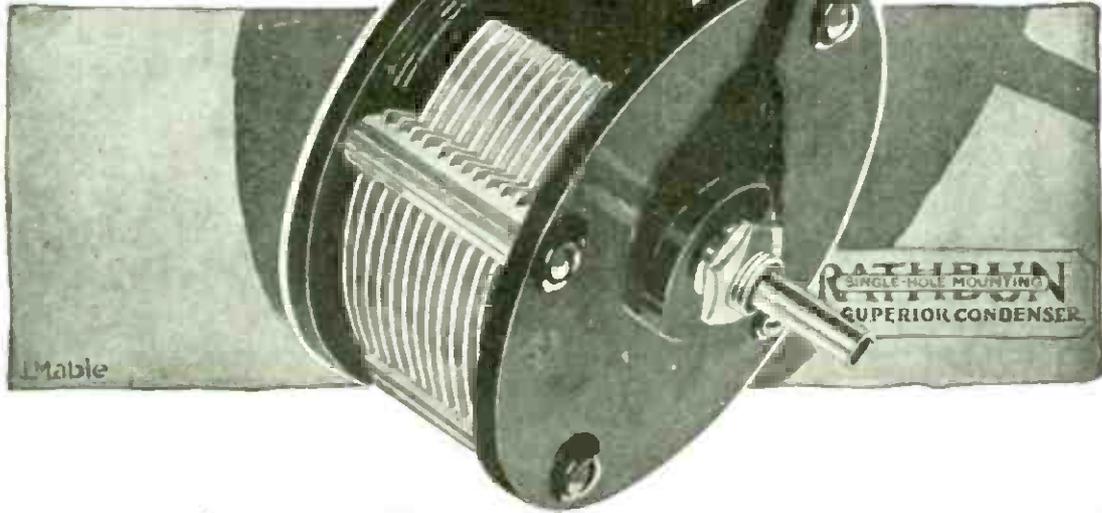
Sold by all good Dealers

Dubilier

CONDENSER AND RADIO CORPORATION

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY

RATHBUN



Don't be Fooled by "Low-Loss" Bunk!

RATHBUN CONDENSERS—with genuine Bakelite moulded end plates—will give results fully equal to any variable condenser on the market. None are more honestly made or more reasonably priced.

We are proud of our condenser—proud of the materials, the workmanship and the care put into it. It would be easy for us to make metal end plate condensers of the so-called "low-loss" type, but we are firmly convinced that our present methods of construction are right and that the radio public has been grossly misled as to the supposed advantages of the "low-loss" metal end plate types.

In order to prove our sincerity, and to justify our product—honestly made—in the face of much exaggeration and misleading propaganda, every Rathbun Condenser is sold with the following guarantee:

Rathbun Condensers are guaranteed satisfactory in electrical and mechanical construction—any proving otherwise will be replaced free of charge, or the purchase price refunded. If you can get longer distance, sharper tuning, better quality, or more volume with any other condenser on the market today—return ours and your money will be immediately refunded.

That's An Honest Guarantee For An Honest Product—And We Mean Every Word Of It!

We have prepared a little booklet giving in detail the story of so called "low-loss" condensers, including a tabulation of the losses, accurately measured, in over fifty standard condensers. You will find it interesting and instructive and it's free for the asking.

An Entirely New System of Radio Reception

Rathbun Single Hole Mounting Superior Condensers have been specified for use in the *Hoyt System of Signal Augmentation*, by the inventor *Francis R. Hoyt*. We have a limited number of Blue Printed copies of Mr. Hoyt's original laboratory notes on this new system of radio reception, together with nine circuit sketches, which will be sent free to you upon receipt of this coupon and 4 cents for postage.

NAME _____

ADDRESS _____

RATHBUN MANUFACTURING COMPANY, INC.
JAMESTOWN, NEW YORK

Honest CONDENSERS

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY

A Special Offer!

An opportunity for radio fans to save money in buying Celoron Panels and Vulcawood Cabinets

WE are making this special introductory offer to make new friends for our products and for the dealers who sell them. Celoron is the standard insulating material among leading radio manufacturers and it is the choice of nearly a million radio fans. It is made by the oldest and largest manufacturer of vulcanized fibre and laminated technical materials in the world. In spite of these facts there are many fans who never have had an opportunity to see and use this popular insulating material.

For a limited time, we offer you the privilege of buying a Celoron panel and a Vulcawood cabinet direct from our factory—at special introductory prices. Orders will be accepted subject to the conditions outlined below.

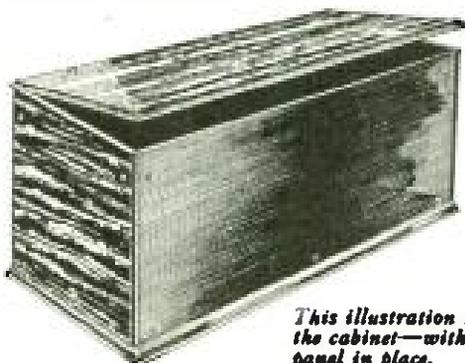
This offer expires on April 30, 1925.

Your money back if not satisfied

If your dealer does not stock these parts, you may select a cabinet, and the panel to fit it, at the special introductory prices quoted.

In return for this privilege we ask you to send us your dealer's name and the names of three of your friends who are radio fans.

We shall refund your money without a whimper if you are not entirely satisfied with the goods when received. No red tape—no delay—no questions asked.



This illustration shows the cabinet—with the panel in place.

NEW VULCAWOOD CABINET

The only bakelite cabinet made

This new bakelite cabinet insulates your entire set. It protects your delicate instruments from dust and dirt.

The Vulcawood Cabinet is grained and colored to match beautiful hand rubbed mahogany. It comes packed flat and is easy to set up.

Vulcawood Cabinet Prices		
Sizes	List Prices	Special Prices
(1) 7 x 7 x 10	\$7.95	\$4.50
(2) 7 x 7 x 12	8.10	4.50
(3) 7 x 7 x 14	8.10	4.50
(4) 7 x 7 x 18	9.40	4.50
(5) 7 x 7 x 21	10.40	6.50
(6) 7 x 7 x 24	10.40	6.50
(7) 7 x 7 x 26	10.55	6.50
(8) 7 x 7 x 30	11.15	6.50

DIAMOND STATE FIBRE COMPANY
Bridgeport, Pa., and Chicago, Ill.

Branches in Principal Cities Toronto, Can.—London, Eng.



CELORON RADIO PANELS

universally endorsed by radio experts

Celoron will help you get better results from your radio hook-up. It will help you get greater distance, greater volume.

A Celoron Panel will not soften with heat or deteriorate with age as do rubber and composition panels. It retains its beauty and its insulating properties indefinitely.

Celoron Panel Prices

Sizes	List Prices	Special Prices
(1) 7 x 10 x 1/8	\$1.09	\$1.00
(2) 7 x 12 x 1/8	1.31	1.00
(3) 7 x 14 x 1/8	1.53	1.00
(4) 7 x 18 x 1/8	2.95	1.00
(5) 7 x 21 x 1/8	3.45	2.00
(6) 7 x 24 x 1/8	3.94	2.00
(7) 7 x 26 x 1/8	4.25	2.00
(8) 7 x 30 x 1/8	4.92	2.00

If your dealer does not carry Celoron, order by mail

In ordering please follow these simple directions:

1. Indicate on the coupon the size of the panel and the size of the cabinet you want.
2. Print in your name and address carefully.
3. Clip out the coupon and attach it to a plain sheet of white paper.
4. Mark on the white sheet the name and address of your dealer and the names and addresses of three friends who are radio fans.
5. Attach your check or money order to the white sheet.
6. Mail all papers to the Diamond State Fibre Co., Bridgeport, Penn.

DIAMOND STATE FIBRE COMPANY
Dept. 102, Bridgeport, Pennsylvania

Please send me prepaid the following items:

Celoron Panel Size No. Price \$.....

Vulcawood Cabinet (without panel)
Size No. Price \$.....

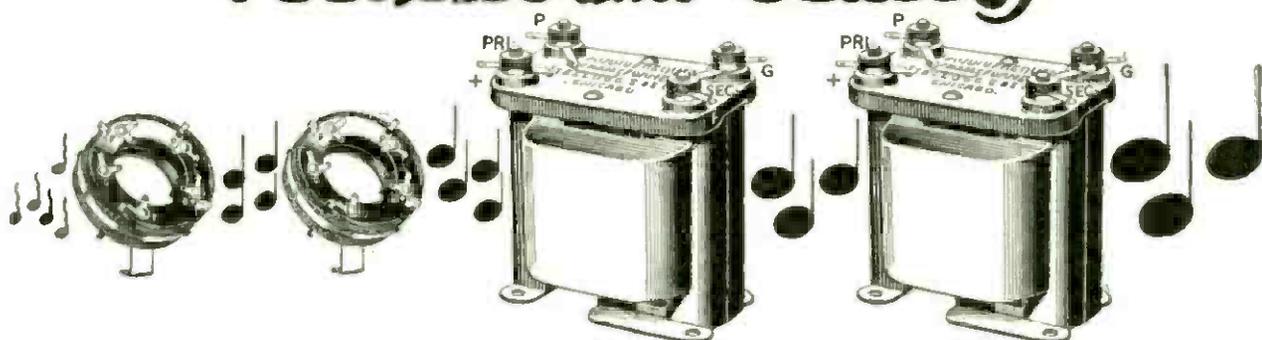
Check attached \$..... Total \$.....

Name

Street

City State

Volume and Clarity



with Kellogg Transformers



Radio
Frequency
Transformer

A Radio Frequency Transformer of the aperiodic type suitable for all sets with which tuned radio frequency is desired. Also used for one stage of radio frequency amplification ahead of regenerative sets to prevent re-radiation.

Consider these points of superiority:

No dope to hold windings in place.

Soldered connections.

Mounting bracket holds coil at correct angle.

Minimum rubber used in form.

Lowest possible loss, with greatest transfer of energy.

Works with any .0005 condenser.

Secondary arranged with suitable taps for biasing features.

This transformer makes the construction of a radio frequency set an easy matter, assuring best possible reception with widely varying types of circuits, including reflex.

Built and guaranteed by Kellogg Switchboard and Supply Co.

No. 602 Radio Frequency Transformer
at your dealers for \$2.35 each.

Kellogg Audio Frequency Transformers are the "stepping stones" of modern amplification.

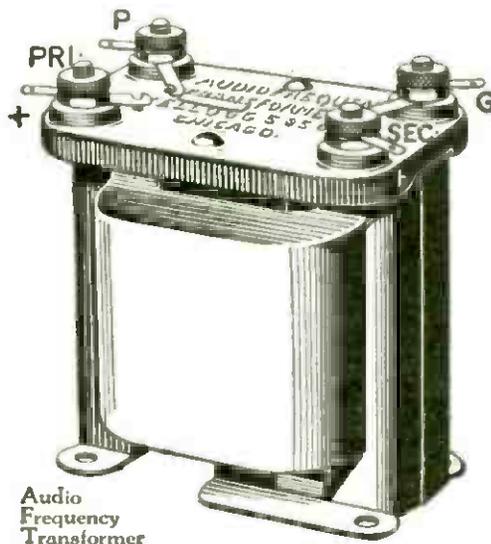
Clear, accurate reproduction assured over the entire range of the musical scale.

Plainly marked, accessible terminals.

It is acclaimed by test to be the best.

No. 501 Audio Frequency Transformer
Ratio $4\frac{1}{2}$ to 1—

No. 502 Audio Frequency Transformer
Ratio 3 to 1—
\$4.50 each

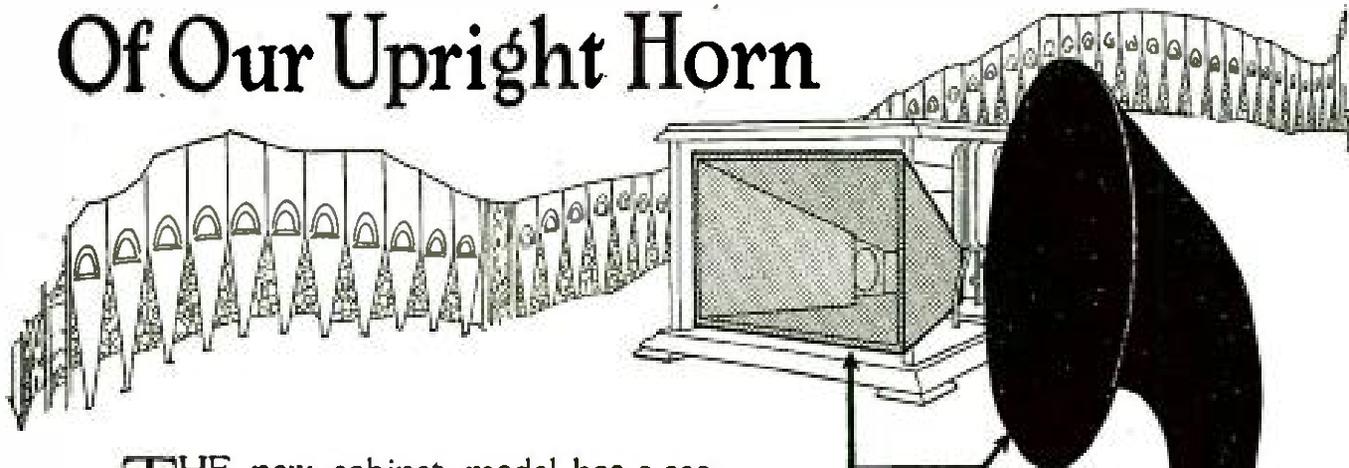


Audio
Frequency
Transformer

KELLOGG SWITCHBOARD & SUPPLY CO.

1066 WEST ADAMS STREET, CHICAGO

It Has The Full Sweet Resonance Of Our Upright Horn



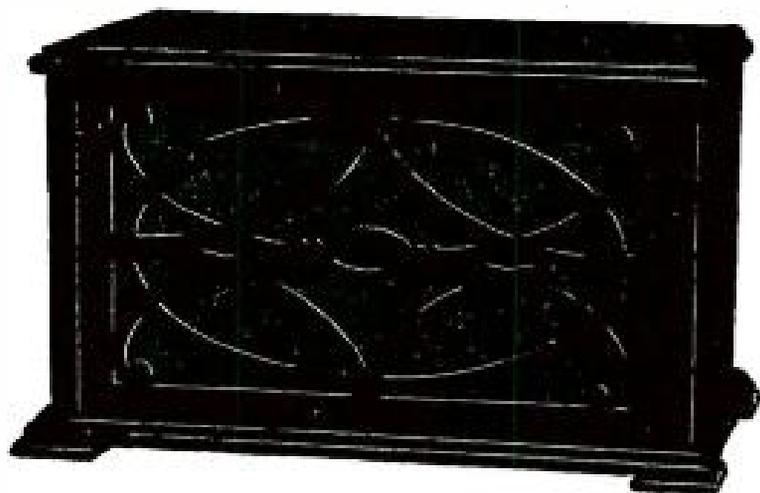
THE new cabinet model has a seasoned wood horn which is "full floating"—the outer end, or bell, does not touch the cabinet. This, together with a long expansion chamber, gives it that same freedom of vibration which goes to make the Bristol horn type Loud Speaker such a resonant, sweet-toned instrument. It also has the same high-grade electromagnetic sound mechanism. It is not only a handsome piece of furniture, but a speaker worthy of the best radio set that money can buy.

Both Horns are Free to Vibrate Like the Open Diapason of the Organ.



Model S Audiophone \$25.00

Rubber horn 14 3/4" in diameter. Cast metal throat. Velvet mat finish of mottled bronze and gold.



Cabinet model \$30.00

Beautifully finished mahogany. Full floating wooden horn and cast metal throat. Musically, a companion to the finest set ever built; size 17 x 10 x 10 1/4"

There are five Bristol Loud Speakers, priced from \$12.50 to \$30.00. If not at your dealer's, write for Bulletin No. 3020-L.

Bristol TRADE MARK AUDIOPHONE REGISTERED Loud Speaker

The Bristol Company Waterbury, Connecticut



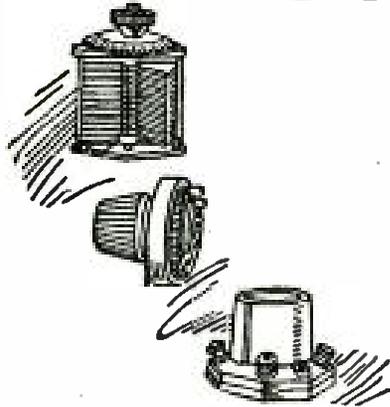


Radio Headquarters

Why not buy your set or parts at Radio Headquarters? Only tested and approved radio equipment is sold. Every set sold by us is guaranteed to give satisfactory results.



Ward's Radio Catalogue



The best Radio Experts made this catalogue—men who devote their entire time to Radio—who are up to the minute with everything new, who tell you the best hook-ups, who have selected for you the best tested parts, who have chosen the best sets—so simple that you yourself can easily install them—so reliable that we guarantee them to give satisfaction.

Write for your copy of this Catalogue. See for yourself the

low prices. Buy your radio at Radio Headquarters.

Our 53 Year Old Guarantee
Ward's has dealt with the American people for 53 years under a definite guarantee of "Money back if you are not satisfied." All our Radio sets are guaranteed to give satisfactory results and back of this guarantee is a proven reliability that for 53 years has not been questioned. Address our house nearest you. Dept. 38-R.

ESTABLISHED 1872
Montgomery Ward & Co.

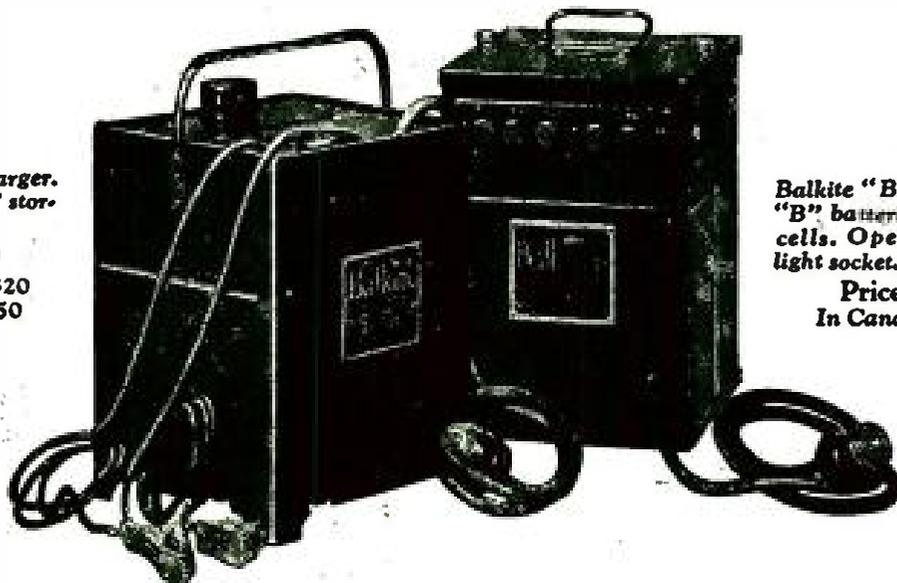
The Oldest Mail Order House is Today the Most Progressive!

Chicago Kansas City St. Paul Portland, Ore. Oakland, Calif. Fort Worth

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY

Balkite Battery Charger.
Charges 6 volt "A" storage batteries.

Price \$19.50
West of Rockies \$20
In Canada \$27.50



Balkite "B"—replaces
"B" batteries and dry
cells. Operates from
light socket.

Price \$55
In Canada \$75

A uniform, constant power supply for both "A" and "B" circuits

Here at last is a convenient and unfailing power supply for your radio set. Balkite Radio Power Units furnish constant uniform voltage to both circuits, and will give your radio set greater clarity, power and range. The Balkite Battery Charger keeps your "A" storage battery charged. Balkite "B" replaces "B" batteries entirely and supplies plate current from the light socket.

Based on the same principle, both the Balkite Battery Charger and Balkite "B" are entirely noiseless. They have no bulbs or moving parts, and nothing to break, adjust or get out of order. They have a very low current consumption, are simple and efficient in operation, and can be put in use at any time by merely connecting to a light socket. Both are guaranteed to give satisfaction.

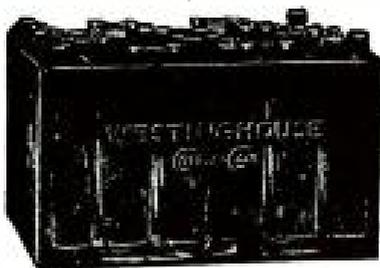
Sold by leading radio dealers everywhere

FANSTEEL
Balkite *Radio*
Power Units

BALKITE BATTERY CHARGER — BALKITE "B" PLATE CURRENT SUPPLY

Manufactured by FANSTEEL PRODUCTS COMPANY, Inc., North Chicago, Illinois

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY



Type 24-RG2
 $7\frac{1}{8}'' \times 5\frac{1}{8}'' \times 4\frac{1}{4}''$
 3500 Milliampere hours

A Super B Battery

Designed for multi-tube sets, compact in size, large in capacity, this new "B" Battery offers you the following distinctive advantages:

A one-piece crystal glass container affords you at all times a view of the interior.

Easily recharged at slight expense.

No leakage from cell to cell.

Will not pump acid.

Bird cage plates insure long life and steady, reliable service.

Large acid space requires less attention.

THE WESTINGHOUSE UNION BATTERY CO.
 SWISSVALE, PENNA.

Distributor for Canada:
THE CANADIAN WESTINGHOUSE CO., LTD.
 Offices in all principal Canadian Cities

Distributor for South America, Mexico and Cuba:
THE WESTINGHOUSE ELECTRIC INTERNATIONAL CO.
 Mexico City, Buenos Aires and Havana

WESTINGHOUSE
RADIO
 "A," "B" and "C"
BATTERIES



The Trans-Atlantic CUP WINNER

Mrs. Edna M. Smith, of Springfield Gardens, Long Island, is the winner of the handsome silver cup, awarded for being the first to report reception of European broadcasts on a FREED-EISEMANN RECEIVER during the recent trans-Atlantic tests.

The winner was selected by "Radio Broadcast" Magazine, which was in charge of the arrangements, and verified the reports of reception.

Scores of other participants in the tests heard the following European stations on FREED-EISEMANN RECEIVERS:—

Paris, Petit Parisienne	Glasgow	5SC
Madrid . . . PTT	Aberdeen	2BD
London . . . 2LO	Brussels	SBR
Bournemouth 6BM	Liverpool	6LV
Newcastle . . 5NO	Birmingham	5IT

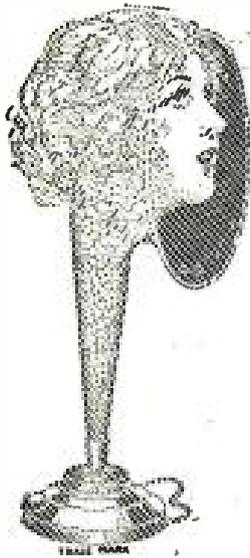
For full sworn statement and
fac-simile letters, write —

Freed-Eisemann Radio Corporation
MANHATTAN BRIDGE PLAZA, BROOKLYN, N. Y.



FREED-EISEMANN

RADIO RECEIVERS



Atlas

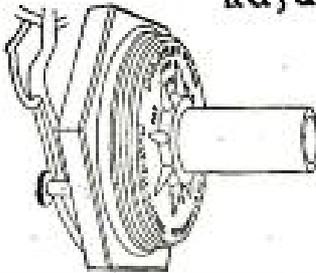
TRADE MARK

RADIO REPRODUCTION speaker

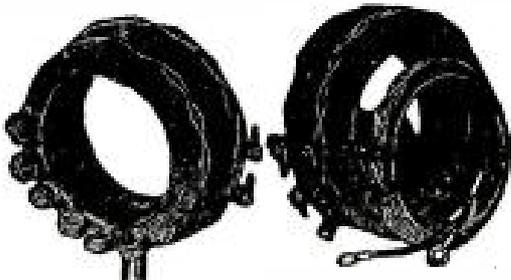
The ATLAS Unit with adjustment and compound diaphragm —the heart of the ATLAS Speaker. "It gives the best that's in your set."



MULTIPLE ELECTRIC PRODUCTS CO., Inc.
365 Ogden St., Newark, N. J.
(Dept. B.)
New York Philadelphia
Boston Baltimore Detroit
Pittsburgh Chicago
St. Louis San Francisco
Marconi Wireless Telegraph Co.
of Canada, Ltd.
Sole Canadian Distributors



ATLAS Products are guaranteed



Coils for Roberts Circuit, No. 18
Price \$8.00 a Set

An entirely new system of Radio Reception

Sickles Diamond-Weave Coils have been specified for use in the Hoyt System of Signal Augmentation, by the inventor, Francis R. Hoyt. We have a limited number of blue printed copies of Mr. Hoyt's original laboratory notes on this new system of radio reception, together with nine circuit sketches, which will be sent free to you upon receipt of this coupon and four cents for postage.

The F. W. Sickles Co.
Springfield, Mass.

Please send information of Hoyt System

Name

Address

SICKLES

DIAMOND-WEAVE COILS

Patented Aug. 21, 1923

For Craig, Roberts and Hoyt Circuits

Sickles Coils were chosen by Albert G. Craig in designing his remarkable new Reflex Receiver using the new Sodion detector, and are specified by him, for this circuit in the February issue of POPULAR RADIO. This coil set, No. 20, is priced at \$4.50.

For the very popular Roberts Circuit the Sickles Coil Set No. 18 (\$8.00) is standard equipment. Unit No. 1 has primary and secondary coils. Unit No. 2 has primary, secondary, neutralizing coil and tickler. Broad variation in coupling adjustments is provided for. Tickler is provided with 180 degree dial control.

Coils for the Hoyt Circuit at \$8.50 a set, for the Knockout Reflex Circuit at \$4.00 a pair, and the Tuned Radio Frequency coil at \$2.00 are among the standard Sickles coils. We manufacture special coils also for manufacturers' requirements.

Send for descriptive catalog

The F. W. Sickles Co.

339 Worthington Street
SPRINGFIELD, MASS.



The Amber MARV-O-DYNE

The Spring Model Is Here!

MARV-O-DYNE—the set with the Filameter—has been improved. Many refinements have been added. The new spring model surpasses in performance even the records made by the original MARV-O-DYNE.

The Filameter, that exclusive device that saves both tubes and batteries, has been retained with its Weston meter. Haig and Haig Straitline condensers have been added, making tuning easier than ever. Coto-Coil's famous transformers are now used. And a Cutler-Hammer Lock Switch insures the set against tampering.

This MARV-O-DYNE Tuned Radio Frequency five tube receiver is exceptionally handsome and efficient. It is built into a genuine solid mahogany cabinet, by the way. Go to your dealer and have him show you a MARV-O-DYNE today!

Write for descriptive folder

Manufactured by

AMBER MANUFACTURING CORP.

115 West Broadway, New York, N. Y.

Don't fail to see the MARV-O-DYNE exhibit at the Amateur Radio Show, Pennsylvania Hotel, New York City, Week of March 2-7. Booth 36



The Centralab RADIOHM

—a new non-inductive variable resistance

The Centralab Radiohm is an entirely new non-inductive variable resistance. It may be used wherever a high-resistance is used in a radio circuit, as for resistance-coupled amplification. Its most frequent use is as a resistance in the plate circuit to control the oscillation of radio frequency tubes. The Super-Zenith and Andrews Deresnadyne are two well-known sets which use it for this purpose.

The construction of the Centralab Radiohm is similar to that of the well-known Centralab Non-Inductive Potentiometer, except that the ohmic value is different and that it has only two binding posts. Bakelite base and knob. One hole mounting.

No. 2M . . . 0 to 2,000 ohms	Price \$2
No. 50M . . 0 to 50,000 ohms	
No. 100M 0 to 100,000 ohms	
No. 200M 0 to 200,000 ohms	

Adjustable Grid Leak	Rheostat	Non-Inductive Potentiometer	Battery Switch
No. 106, \$1.25.	No. 206, 6 ohms, \$1.25.	No. 110, 400 ohms, \$1.50.	No. 300, 50c
No. 107, with .00025 Condenser, \$1.60.	No. 230, 30 ohms, \$1.25.	No. 111, 2000 ohms, \$1.75.	

Centralab

CENTRAL RADIO LABORATORIES
305 Sixteenth St. • MILWAUKEE, WIS.

NOKORODE FOR EASY SOLDERING

- 1st—Clean with file or emery cloth all four pointed sides of soldering iron.
- 2nd—Heat soldering iron. Avoid pointed end of iron coming in contact with flame as illustrated.
- 3rd—Apply some NOKORODE and some solder to sloping points of iron.
- 4th—While iron is still hot rub with cloth quickly on all four sides until iron is bright like new tin.
- 5th—Apply a little NOKORODE with stick, brush, or end of solder to both parts to be soldered.
- 6th—When ever possible hold hot soldering iron underneath parts to be soldered, applying solder above parts.

When the solder is running freely take away soldering iron and let soldered parts get cool. Do not waste your NOKORODE. NOKORODE is so thoroughly efficient that only a little is required for perfect results.

M. W. DUNTON CO.
Providence, R. I.
U. S. A.

Perfectly soldered joints in the building of radio sets is a prime essential for best results. Perfect soldering the easy way has been achieved by amateur builders everywhere who have used NOKORODE the Soldering Flux which is recommended by leading electricians and radio technicians throughout the world. Insure that your dealer sell you NOKORODE. The man who takes pride in building his set cannot afford substitution.

ATTENTION DEALERS

SEND FOR OUR 152 PAGE CATALOG

The finest and largest exclusive Radio Catalog in the United States.

SCHNEITTER RADIO COMPANY
DEPT. G. ST. JOSEPH, MISSOURI

DX "mushy"?

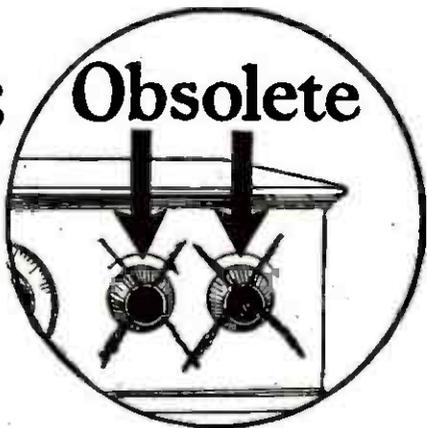
FREE

BOOKLET

On "Tube Control" tells how to bring in distant stations clear and loud. Just drop a post card to

UNITY MFG. CO.
226 North Halsted Street
CHICAGO, U. S. A.

8 improvements
at **ONE** stroke



The Self-Adjusting Rheostat

Price \$1.10 Everywhere

Write for
FREE
Hook-Ups

1. Eliminates hand rheostats—simplifying control and giving compactness.
2. Simplifies wiring.
3. Prolongs life of tubes from 2 to 3 times.
4. No moving parts—therefore no grinding noises.
5. Permits use of any type of tubes or combination of tubes.
6. No filament meters necessary.
7. Brings the most out of each individual tube—automatically—no guessing.
8. Makes perfect tube operation absolutely fool proof.

AMPERITE takes the place of a good hand rheostat, a delicate meter and an expert operator. Operates on the thermo-electric principle. Automatically changes in resistance as the "A" battery voltage changes. Mounts conveniently inside the set. No knobs to turn. Nothing to get out of order. Approved by every prominent laboratory. Standard equipment in such sets as Somerset, Ultradyne, Marshall, Pfanstiel, Kilbourne & Clark, Heteroplex, Cockaday and numerous others. Fully guaranteed.

RADIALL COMPANY

Dept. P. R.-6

50 Franklin St., New York

AMPERITE

REG. U.S. PAT. OFF.

"means right amperes"



The Utmost in Performance

5 Tubes—\$120.00

S U P E R

CLEAR-O-DYNE

THIS tuned radio frequency set will give the average broadcast listener greater satisfaction than any other he can buy. It will bring in stations from coast to coast in good radio weather. Stations a thousand miles away come like local on the loud speaker.

It will tune out several local stations and bring in distance. Solid mahogany cabinets and gold finished front panels make it an unusually beautiful piece of furniture.

Clear-O-Dyne is going big. Quick deliveries on dealer orders.

- | | | | |
|--------------------------------|---------|-------------------------------|----------|
| Clear-O-Dyne Model 70..... | \$75.00 | Clear-O-Dyne Model 80..... | \$120.00 |
| Clear-O-Dyne Model 71..... | 90.00 | Clear-O-Dyne Model 82 Console | 190.00 |
| Clear-O-Dyne Model 72 Console. | 135.00 | Other Sets from \$60.00 up. | |



The Super Clear-O-Dyne in a console cabinet, \$190.00

THE CLEAR-TONE RADIO COMPANY, 462 E. McMILLAN STREET, CINCINNATI, OHIO



\$10

Complete with Cord

ROSE-MARIE

When your favorite radio orchestra is playing "Rose-Marie," tune it in on the Needlephone and your phonograph. You'll be surprised at the wonderfully sweet reproduction—the clear tender strains—and the full rich notes.

MAGNIFIED REPRODUCTION

No other type of loudspeaker can possibly give equal reproduction because no other type of speaker takes advantage of the principle of "magnified reproduction" and the perfection of the entire phonograph reproducer.

The Needlephone picks up the delicate impulses that come in over your radio and transmits them through by vibrations of a flexible reed (more sensitive than a metal diaphragm) to the point of the phonograph needle. These small vibrations at the point are then transmitted through the pivoted needle to the mica diaphragm where they are enlarged and transformed into sound. As a result, the most delicate variations of tone are enlarged and given fuller value. It is adapted for use on any phonograph including the Edison with Victor reproducer.

SEND NO MONEY TAKE NO RISK

Send the coupon today, pay on delivery, and try the Needlephone on your own phonograph and radio. Try it with a soft needle on local broadcasting and see what pleasures await you. Try it with a loud needle and see what volume you get without distortion or metallic noises. Then if you are not entirely satisfied—if you do not think it is the best loudspeaker for the money you ever heard—if you cannot say you get better reproduction, sweeter, clearer music—Rhamstine* does not want you to keep it. Return it and he will gladly refund your money in full.

Rhamstine*

NEEDLEPHONE

A complete unit, plugged in like a loud speaker, that transforms the electrical impulses into vibrations which are enlarged and transformed into sound at the diaphragm of the phonograph reproducer.

Mail this coupon today

J. THOS. RHAMSTINE*

J. Thos. Rhamstine* (3)
 Woodbridge at Beaubien, Detroit, Michigan.
 Send me the Needlephone. I'll pay the postman \$10 upon its arrival. It is strictly understood I may return it if I desire, within 5 days and receive a refund in full.
 Name.....
 Address.....

PRECISE

Laboratory Instruments at Commercial Prices



ALL PRECISE instruments are manufactured in strict accordance with the specifications of our research engineer, J. L. McLaughlin. Thousands every week are discovering that for range, volume, and perfect reproduction of tone quality the PRECISE line has no equal.

1 PRECISE SUPER-MULTIFORMER 1700. 1 instrument that does the work of 4. The only great advancement that has been made in Superheterodyne design. Replaces all long wave transformers. PRICE \$20.00.

2 PRECISE POWER AMPLIFYING TRANSFORMERS for "Push-Pull" circuits. "Push-Pull" success is absolutely dependent upon critically balanced transformers. These PRECISE instruments yield results never before obtained. PRICE \$11.00 per pair.

3 PRECISE FILTOFORMER No. 1900. The latest PRECISE development—a combination radio frequency choke and by-pass condenser. PRICE \$4.50.

4 PRECISE AUDIO TRANSFORMER No. 285. The most remarkable and the smallest high grade transformer on the market today. Selected by the leading radio engineers of America for its amazing volume, and distortionless reproduction. No other transformer has ever met with such overwhelming success. PRICE \$5.00.

SEND \$1.00 FOR CONSTRUCTIONAL BOOK ON ONE-CONTROL SUPERHETERODYNE

Sold by the better dealers

Precise Manufacturing Corporation, Rochester, New York

BRANCHES

53 W. Jackson Blvd., Chicago 821 Market St., San Francisco

Eastern Sales Office—Niagara Sales Corp., 3-5 Waverly Place, New York City

Southern Representatives—Saal Products Sales, Inc., 35 Warren Street, New York City

CANADIAN DISTRIBUTORS

Perkins Electric, Ltd. • Toronto • Montreal • Winnipeg

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY

BURGESS

RADIO BATTERIES



Radio Engineer Extraordinary!

Old folks can take a tip from the family radio expert, for he and his gang constitute the last word in the choice of receiving set parts.

And when boys get together and talk Radio "A," "B" and "C" batteries there's only one brand that they're strong for—BURGESS—because Burgess Batteries are quiet, serve longer, and they do everything a battery should do—better.

"Ask YOUR Boy"

BURGESS BATTERY COMPANY
Engineers DRY BATTERIES Manufacturers
Flashlight - Radio - Ignition - Telephone
General Sales Office: Harris Trust Bldg., Chicago
Laboratories and Works: Madison, Wisc.
In Canada: Niagara Falls and Winnipeg

RUBICON—

The Super you can afford

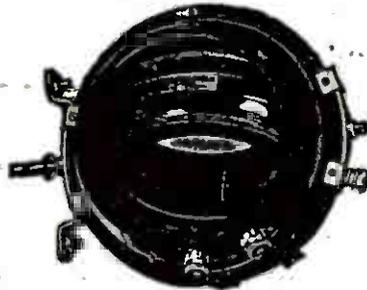
Save by using your present variable condenser, sockets, audio transformers, etc. Buy only the Super parts needed. These come in RUBICON Kits priced from \$33.75 to \$138.50.

Postcard brings descriptive folder. Gives lists of parts needed. Check off what you have. Get a RUBICON Kit—and on the average save 60%.



RUBICON COMPANY
918 Victory Bldg.
Philadelphia

Patent Applied for



L+K
**Clarifying
Selector**
Greatly Improves
Any
Standard
Hook-Up

Whether your set is an Erla or any other reflex, an Ultradyn, a R. F. or a Regenerator, you can easily give it that high selectivity and perfect control so necessary where stations interfere.

Just replace variocoupler, fixed coupler, tapped coil, or aerial variometer with an L+K Clarifying Selector and a .0005 variable condenser.

This improvement clears up muffled signals—gives minute selectivity—permits complete control of antenna coupling over entire B. C. wave band—cuts down antenna losses and strengthens reception, and does away with tapped coils and high-loss aerial tuners. Price, \$7.00.

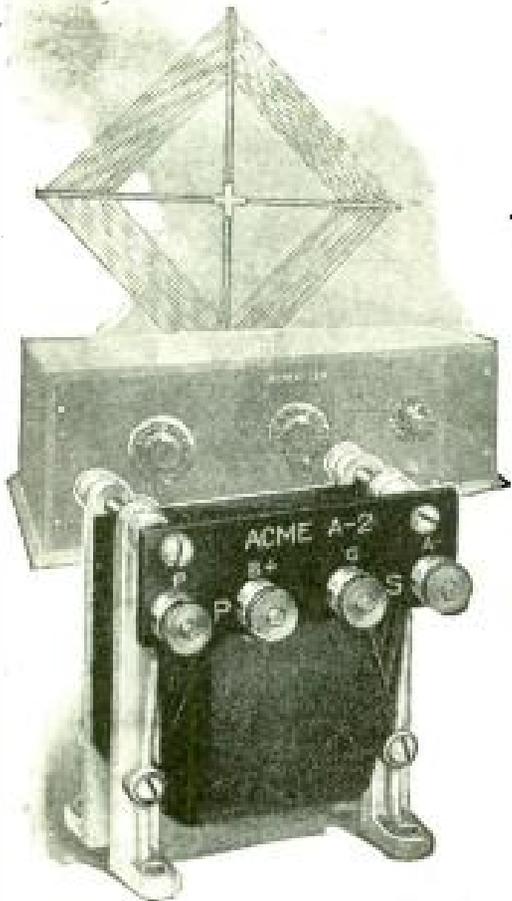
Send for Free Diagram Spread

showing complete L+K line, Greene Concert Selector hook-up, and other effective circuits. (Jobbers, Dealers—write.)

Dept. P. 511 Chapel Street New Haven, Conn.

LANGBEIN+KAUFMAN **L+K**
High Grade "Low Loss" Tuning Devices A Guide to TECHNICAL ACCURACY

Be sure ~ that your transformers are giving you Amplification without Distortion



Acme Transformers give maximum volume of sound, clearly and distinctly

WHEN you put a lot of time and money into a radio set you want to be sure that it will give the best results. You want to know that your set will bring in the stations so that you can enjoy listening and be proud to call in your friends. You want Amplification but above all you want Amplification without Distortion. Be sure to use amplifying transformers that increase the sound without spoiling the quality.

The Acme A-2 Audio Amplifying Transformer is the result of 5 years of research and experimenting. It gives amplification without distortion to any set. Whether you have a neutrodyne, superheterodyne, regenerative or reflex the addition of the Acme A-2 will make it better.

If you are not getting loud clear radio try Acme Transformers and note the difference.

Each transformer is tested and carries a guarantee tag. If you want Amplification without Distortion use Acme Transformers in the set you build and insist on them in the set you buy. (That's one of the big reasons why the Acmeflex Kit-set gives such good results—it uses Acme Transformers). Send for our 40-page booklet which explains how to get the best results by proper amplification and also contains a number of valuable wiring diagrams. It will help you build a set. Mail the coupon with 10 cents.

For Amplification without distortion use ACME transformers in the set you build. Insist on them in the set you buy and enjoy all the year round Radio

The Amplifying Transformer is the Magnifying Glass of Radio

ACME APPARATUS COMPANY
Transformer and Radio Engineers and Manufacturers
Dept. C2, Cambridge, Mass.

Have the fun of making your own radio set

ACME

~ for amplification

ACME APPARATUS COMPANY,
Dept. C2, Cambridge, Mass.
Gentlemen: I am enclosing 10 cents (U. S. stamps or coin) for a copy of your book, "Amplification without Distortion."
Name.....
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The Carborundum Crystal Detector

\$1.50

From your dealer or
post-paid direct

MONTHS of exhaustive re-
search brings this remark-
able Carborundum Crystal De-
tector Unit to the radio world.
A specially made, carefully
selected Carborundum Crystal,
set in a protective cartridge.

Permanently fixed to retain
its sensitivity indefinitely—it
will not burn out.

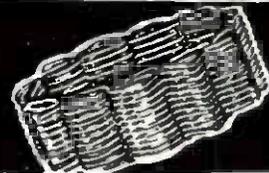
Sharpens the tuning—in-
creases the selectivity of any
crystal or reflex set—and no
booster battery is needed.

It gives results never before
attained by any other crystal
detector.

Every Carborundum Crystal
Detector Unit is laboratory
tested and is guaranteed for any
properly designed circuit.

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A SUPERIOR COIL SERVICE FOR RADIO SET MANUFACTURERS

Coils developed to suit require-
ments. Deliveries as per agree-
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make our service profitable to
you regardless of your own
facilities. We specialize in coils
only—that is why we can help
you. Write us.

ACME PRODUCTS CO

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CARTER

NEW VERNIER CONTROL POTENTIOMETER
Smooth—Positive—Noiseless



Clock spring pigtail connections
Vernier control all the way with but
one knob
One hole mounting
Binding post terminals
Complete with combination knob
and pointer

Any dealer can supply

200 ohms \$2 In Canada—Carter Radio Co.,
400 ohms Limited, Toronto

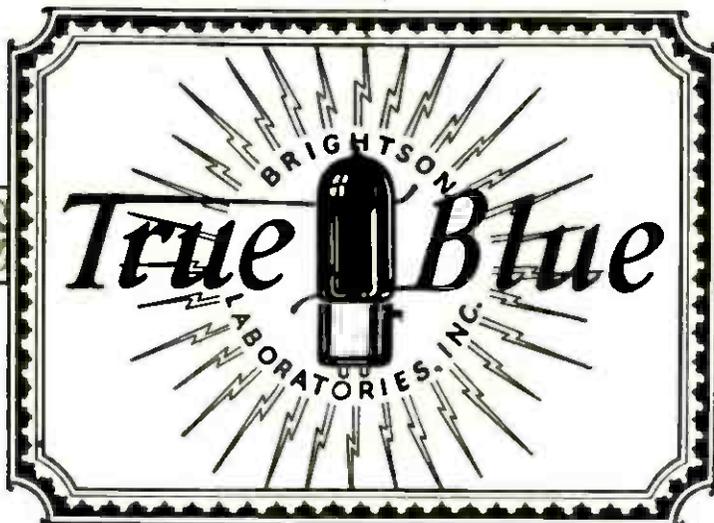
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1807 REPUBLIC BUILDING
CHICAGO

FAHNESTOCK CLIPS



the Perfect Radio Connect-
ors—are used by Manu-
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Wet Batteries and exclusive on
Eveready Dry Batteries. Their
Sure Patented Grip is Recog-
nized Universally by Enthusias-
tic Users.

FAHNESTOCK ELECTRIC CO., - L. I. CITY



Any Standard Socket is the Right One for any True Blue Radio Tube

Put five TRUE BLUE Radio Tubes in the finest Neutrodyne Radio Receiver, or put eight of these tubes in the costliest Super-Hetrodyne. Then switch the tubes and try them in different sockets—detector, radio, or audio.

The reception will be equally perfect, regardless of position of tubes—crystal clear tone, full and undistorted. Any standard socket is the *right* socket for *any* TRUE BLUE Tube.

TRUE BLUE Radio Tubes are not an imitation of any other radio tube. TRUE BLUE Radio Tubes have features

that make them vastly superior to any radio tube heretofore made. One of these is a filament that makes TRUE BLUE Tubes last two or three times as long as any other tube. Therefore the price of TRUE BLUE Tubes—\$6—is an economy, to say nothing of the new joy they bring.

TRUE BLUE Radio Tubes are backed by the finest and most modern radio tube laboratory in America and each tube has with it a certificate which is a *GUARANTEE in writing* of perfect service.

STOP SWITCHING. Your dealer can get TRUE BLUES

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BRIGHTSON LABORATORIES, Inc.

GEORGE E. BRIGHTSON, President (Founder of Sonora Phonograph Co.)

Northwest corner Waldorf-Astoria Hotel, 16 West 34th St., New York, N. Y.

Some Jobber Territory Still Open.



All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY



Grand \$4.75

TRUST YOUR EYES AND EARS TO LEARN THE MERITS OF A HEADSET.

Then you'll appreciate the appearance and craftsmanship, and the clear, rich, mellow tone of the popular priced Camco Headsets. You should know what real enjoyment either one will bring you. Ask any user, your dealer or write for folder

"RADIO AS YOU LIKE IT"

Camco Grand: Cases, highly polished aluminum; Magnets, chrome magnet steel; Cores, special alloy; Core Heads, Formica; Diaphragms, silicon steel; Wire, copper enamel insulation; Terminals, inside; Caps, brown Bakelite; Resistance, about 2,200 ohms D.C.; Turns, 5,000 per coil, 20,000 per set; Impedance, about 23,000 ohms at 1,000 cycles; Cords, black mercerized cotton, 5 feet long; Headbands, adjustable type, wire covered with brown Kid leather; Weight, complete with headband and cord, 10½ ounces.

Compare Camco Grand and Camco Cannon-Ball Headsets. Then choose the one you like best. Both are sold on a MONEY-BACK GUARANTEE.



Cannon-Ball \$3.50

DEALERS: Ask your jobber about Camco products or write for complete details.

CANNON & MILLER CO., Inc.
SPRINGWATER, N. Y.



DONGAN

AUDIO TRANSFORMERS

Choice of

28 Set Manufacturers

Ratio 3 1-2 to 1 and 6 to 1. Fits all hook-ups.

For consistently smooth performance use Dongan Audio Transformers. At all good dealers or supplied direct from factory. Special proposition to manufacturers, mounted or unmounted type.

Greatly increased manufacturing facilities insure prompt deliveries to manufacturers and jobbers.

Dongan Electric Manufacturing Co.

2988 Franklin St.

Detroit, Mich.

Transformers of Merit for 15 Years

The LARGEST RADIO STORES in AMERICA



Hook-ups!

All the latest and best Kits in our new

RADIO CATALOG

FREE

NO other Radio Catalog includes such a complete assortment of the best and latest Knock-Down Kits, Parts and Accessories. You need this book — Write for your FREE copy today!

We Save You Money!

Our business is to buy up manufacturers' and government surplus stocks, jobber and dealer bankrupt stocks—but only brand-new, fully guaranteed, nationally advertised apparatus. Our enormous buying power permits us to pay spot cash and get rock-bottom prices—even way below manufacturer's costs. That's why our catalog is crammed with thousands of wonderful Radio Bargains.



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EVEREADY HOUR
 EVERY TUESDAY AT 9 P. M., E. S. T.
 For real radio enjoyment, tune in the
 "Eveready Group." Broadcast through
 stations

WEAF	New York	WFI	Philadelphia
WJAR	Providence	WCAE	Pittsburgh
WEEL	Boston	WGR	Buffalo

*Dry "B" Batteries
 are an economical,
 dependable and
 convenient source
 of plate
 current!*

There's more life in Eveready Batteries

Buy Eveready "B" Batteries and you get electricity in its surest, safest and most compact form. They reduce your operating expense. New developments in the Union Carbide and Carbon Research Laboratories, Inc., have been converted into new manufacturing processes in the Eveready factories. Good as they always have been, Eveready "B" Batteries are much better today.

The Eveready achievement of giving you more hours of "B" Battery service for less money has cut the cost of running receivers in half, and in some cases to a third.

There is an Eveready Radio Battery for every radio use.

Manufactured and guaranteed by
NATIONAL CARBON COMPANY, Inc.
 Headquarters for Radio Battery Information
 New York San Francisco
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EVEREADY Radio Batteries -they last longer



No. 7111.
 1 1/2-volt
 Dry Cell
 "A"
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No. 772.
 45-volt
 Large
 Vertical
 Price
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No. 770.
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No. 771.
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 Battery
 improves
 quality,
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 Batteries
 Price 60c

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY

Surprising!... the improvement this discovery can make in your radio set

IN THE electrical laboratory of a leading engineering university, a test has just been made which reveals some striking facts about sockets.

Out of 13 different makes of sockets, 12 showed losses higher than a good low loss condenser. Of these 13, only one—Na-Ald Sockets—showed losses lower than a good low loss condenser.

This means that many sockets are of such poor dielectric or insulating material that they nullify the efficiency of a good condenser. Na-Ald Sockets (of genuine Bakelite Alden-processed) have the qualities that enable a condenser to function efficiently.

The laboratory test also showed that Na-Ald Sockets have the lowest capacity of any socket. This is particularly important for short wave length reception.

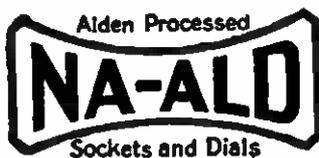
Also most important is the "Clean-easy" feature of Na-Ald DeLuxe Sockets. You simply turn the tubes several times and the tube terminals become bright and clean. The side-scraping contact (not merely side pressure) removes the film of corrosion that hinders the delicate minute current; this corrosion so often is the cause of disturbing noises in your set.

Use Na-Ald Sockets not only in the set you build but also install them in the set you buy, if not already adopted by the manufacturer. Sockets for all tubes. DeLuxe 75c; others 35c, 50c, 75c.

Send for free booklet and story of laboratory test.

MAIL coupon for full particulars of the laboratory test; also free booklet "What to Build," giving tested, selected circuits.

ALDEN MANUFACTURING COMPANY
Also manufacturer of the famous Na-Ald Dials
Dept. C4, Willow St., Springfield, Mass.

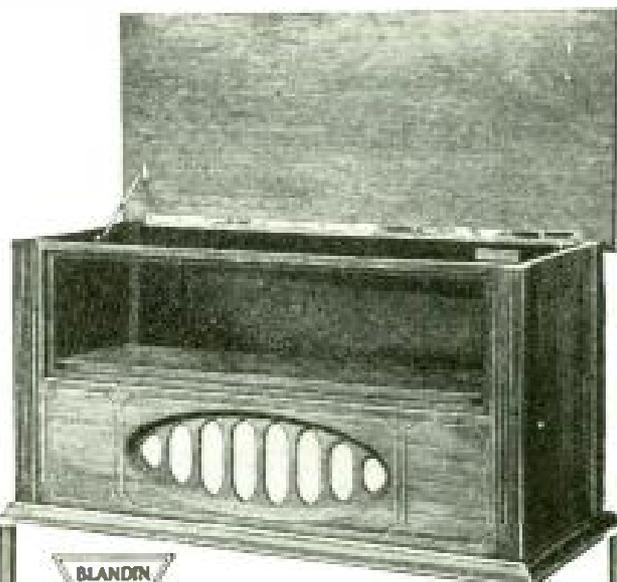


ALDEN MANUFACTURING CO.
Dept. C4, Willow St., Springfield, Mass.

Please send me free booklet, "What to Build" and details of laboratory test.

Name.....

Address.....



The New "35-D" Super Radio Cabinet

Panel at top 7 x 26—10 1/2" deep, back of panel. Built-in spruce horn. Compartments for complete dry cell set. Door in back. Built of mahogany—piano finish. Same quality and equipment as

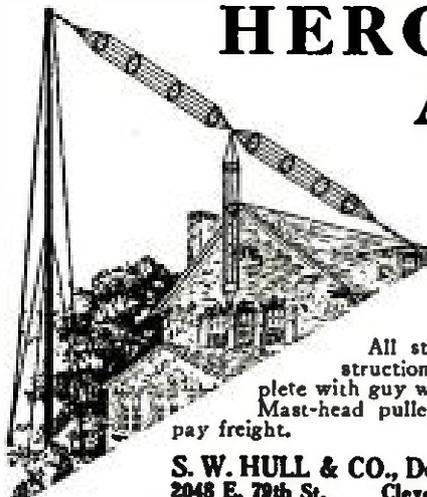
Blandin Triple "A" De Luxe Series

Also new De Luxe sizes, 7 x 18-7"; 7 x 24-7 1/2"; 7 x 26-7 1/2"; 7 x 30-8"; 8 x 36-8" and 8 x 40-8". Write for illustrated price list.

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BLANDIN PHONOGRAPH COMPANY, INC.
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HERCULES Aerial Mast



20 Ft. Mast \$10
40 Ft. Mast \$25
60 Ft. Mast \$45

All steel construction. Complete with guy wires and Mast-head pulley. We pay freight.

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Use **A Jewell**

for testing your "B" Batteries.

Ask your dealer or write for our 15-A radio instrument catalog.

Order from Dealer

No. 84
\$2.75

Jewell Electrical Instrument Co.

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PLIODYNE-6

TRADE MARK REG.

"The Perfect Broadcast Receiver"

A New Superior Broadcast Receiver

Simple—Long Range—Highest Quality
Non-Radiating — Non Regenerative

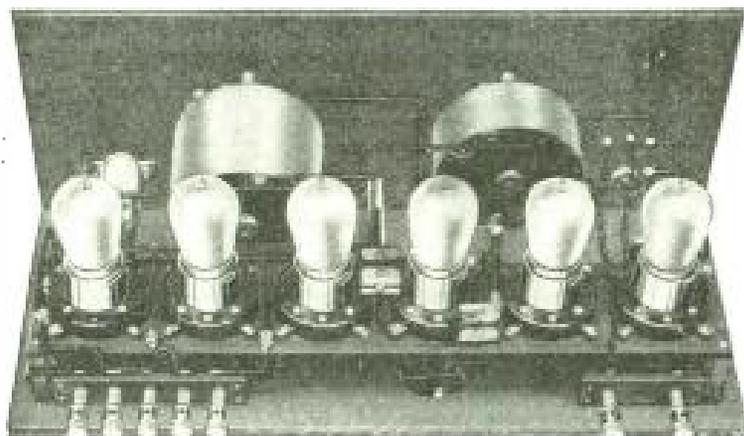
\$ 60⁰⁰

*Two Stages Tuned Radio Frequency-Detector
and Three Stages of Audio
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**COMPLETELY
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Without Accessories**



PLIODYNE 6
Front View Showing Simplicity
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PLIODYNE 6
Interior View Showing Compact
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**Sold Direct
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OUR GUARANTEE

We guarantee every Golden-Leutz "Pliodyne 6" to be the finest broadcast receiver that can be manufactured using 6 tubes or less and to be satisfactory to you in every way and to reach you in perfect condition.

You take no risk whatever in sending us your order for unless you are completely satisfied with the receiver and with your saving you may return the receiver to us and we will refund your money.

GOLDEN-LEUTZ, Inc.

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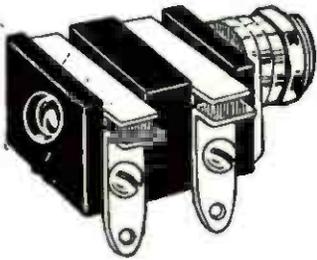
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RADJO LOW LOSS PRODUCTS!

RADJO Low Loss Tuner



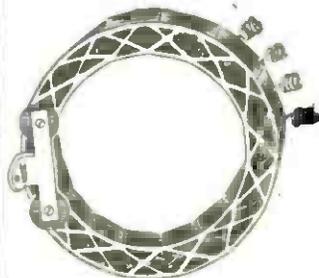
Install a Radjo Low Loss Tuner in your old tube set and you will increase its EFFICIENCY and SELECTIVITY to a surprising degree. Wound by the Lorenz type of winding. Single, Double or Three Circuit Tuner. PRICE \$5.00



RADJO Anti-Capacity Jacks & Switches

Minimum of electrical capacity, wiping contact rugged and compact. The Radjo is one-third the size of other jacks and fits any standard plug. It assures minimum resistance. 70c to 90c

RADJO Low Loss Radio Frequency Transformer



No dielectric absorption losses. Minimum distributed capacity gives increased clarity, volume and selectivity. For use in Tuned Radio Frequency, Neutrodyne and Reflex circuits. \$1.50

FREE! You owe it to yourself and your set to learn about Radjo Low Loss Products. Send today for interesting literature. It's free.

Dealers and Distributors Wanted—Write for Proposition

ELECTRIC CITY NOVELTY & MFG. COMPANY

Licensed Manufacturers Schenectady, N. Y.

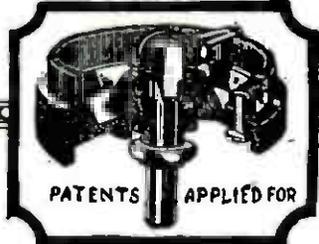


DeJUR ONE HOLE MOUNT RHEOSTATS

- 1—Easiest to mount.
- 2—No back panel fussing.
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- 4—Genuine bakelite throughout.
- 5—Contact slider and shaft made in one piece.

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Large and most complete stock of Quality Radio merchandise at standard prices. Complete sets and standard parts of reliable makes. There's sixty-five years of uninterrupted service back of the "House that Satisfies." Reliable Radio merchandise is the only kind that's worth while. You can be certain of reliable, complete satisfaction and prompt delivery if it comes from Andrae.

Send for catalog

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127 Michigan St. Milwaukee, Wis.

ANDRAE *In Business Since 1860*

VACUUM TUBES REPAIRED

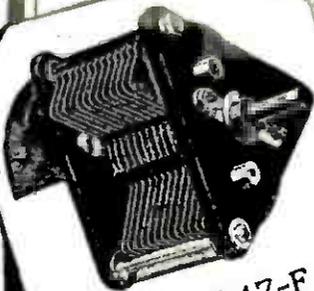
WD-11, WD-12, UV-201A, UV-199, And others for **\$2.00**

Quick service. All tubes repaired by us guaranteed to work as good as new. Send your dead tubes. All you pay is \$2.00 plus Postage to Postman.

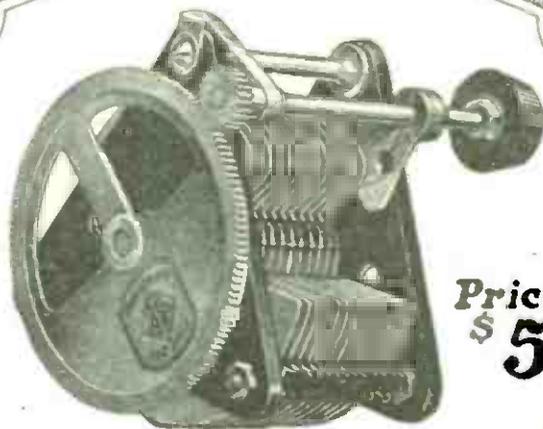
THOMAS BROWN CO.

511-519 Orange St., Newark, N. J.

GENERAL RADIO Condensers



Type 247-F



Type 247-H

Price
\$5



Type 247-G

The Standards of Excellence Since 1915

THE original low loss condenser was introduced in 1915 by the General Radio Company.

This instrument heralded an era of rapid advancement in the science of radio.

Today the design and performance of the General Radio Type 247 Condensers merit their distinction as the standards of excellence.

Eight different models are now available for various radio requirements. All of these models incorporate the following features, which contribute to lower losses and greater efficiency:

Low resistance losses, because of soldered plates.

Straight line plates, which give a uniform wave-length variation.

Plates always in perfect alignment, being individually straightened before assembly in a jig, and firmly soldered while in position.

Rotor plates counterbalanced to permit greater precision of adjustment.

Mechanically rugged design, which insures faithful performance over long periods of use.

Tight and smooth running spring bearings, adjusted to compensate for wear.

Popular prices, made possible by large-scale production and efficient methods.

Ask your dealer or write for instructive folder "Quality Condensers," containing complete information on all 8 models of General Radio Condensers.

The red cartons with the General Radio label are your unfailing assurance of satisfaction.

GENERAL RADIO CO.
Cambridge, Mass.





A \$150.00 Receiver Selling For Only \$68.00

Here is as fine a five-tube receiver as was ever made. Fine in appearance, workmanship, materials and results.

The circuit is the Biltmore improved Radio frequency type. All materials are the finest which it is possible to obtain. The variable condensers and R. F. Transformers are low loss especially designed.

The cabinet is heavy mahogany hand rubbed. The panel is mahogany and all metal parts are highly nickel plated.

The results match the appearance of the Receiver. Its extreme sensitiveness, matchless selectivity and perfect tone have made for the Biltmore a host of highly enthusiastic owners. "Absolutely the best Receiver which can be had at any price" is an example of the hundreds of testimonial letters in our files.

Model T 5 Price.....\$68.00

FOR SALE BY ALL THE BETTER RADIO DEALERS

Write for descriptive literature Dept. B

The Biltmore Radio Company.

BOSTON 30 MASS.

New Long Distance Crystal Gives Remarkable Results

A recent invention in crystals is amazing Reflex and Crystal Set owners everywhere. It is stated that this marvelous Crystal Detector gets distant stations loud and clear and there is no disagreeable "hunting" for spots because the entire surface is sensitive. Many are finding it far superior for Reflex work and claim it the last word in mounted synthetic crystals.

A Trial Costs You Nothing

In order to introduce his invention, the owner, Mr. Hick, offers you two \$1.00 Crystal Detectors for the price of one. Sell one, and put the other on your own set without cost to you. Just send name and address to Chas. M. Hick, Dept. 10, 1018 So. Wabash Ave., Chicago. Pay Postman \$1.00 (plus postage). Unless you are absolutely satisfied write Mr. Hick and money will be cheerfully refunded.

AMBASSADOR Low Loss Products



Master Tuning Coil
Perfectly Balanced Head Phone
Low Loss Condenser

High grade, standard radio products that will increase the efficiency of any set and add to the satisfaction of the user. Ambassador Low Loss Products have long been the choice of particular fans. See them—compare them, and you will choose them too.

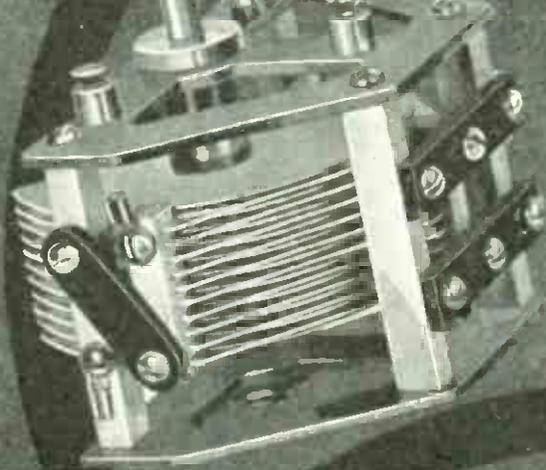
At all good dealers.

Write for FREE diagrams of circuits in which Ambassador Products can be used.

AMBASSADOR SALES COMPANY
108 Greenwich St., New York
326 W. Madison St., Chicago



DUPLEX CONDENSERS



DUPLEX
STANDARD

The Accepted Standard

DUPLEX Standard Condensers (Series FR) have attained a generally recognized supremacy. They are especially designed to conform to Bureau of Standards specifications for lowest losses and best electrical characteristics. Bearings are brass on bronze, with automatic take-up at both ends. Four heavy metal posts further insure perfect alignment. Plain and vernier models both are unconditionally guaranteed to give absolute satisfaction.

A DUPLEX KIT of Matched Condensers Affords Uniform Dial Settings



The discriminating parts buyer will appreciate this latest DUPLEX innovation! *Matched Condensers*—packed three in a kit—specially tested and guaranteed! Uniform dial readings and simplified logging are possible only with DUPLEX Matched Condensers in tuned Radio frequency, Neutrodyne, and similar circuits. Don't just buy three condensers—insist on DUPLEX Matched Kits! Instructive literature sent on request.

Duplex Condenser & Radio Corp., 50 Flatbush Avenue Extension, Brooklyn, N.Y.

Best At The Price

DUPLEX Junior Condensers (Series DR) will give you the same satisfactory service that you get from other, higher-priced condensers. True, they are not quite so fine an instrument as is the DUPLEX Standard—but they are better than any other condensers at the same price. *DUPLEX Junior Condensers*, plain or vernier models, are particularly suitable for use in portable sets as they are extremely small and are light in weight.

DUPLEX





Tune by Sight



Designed by R. E. Lacault, E. E., A.M.I.R.E., inventor of the famous Ultradyne circuit. This monogram seal (R. E. L.) is your assurance of Lacault design.

Tune your favorite stations once, mark them on the Ultra-Vernier, then forget wavelengths. Tedious tuning, blind fumbling and guessing are over for all time.

Now it's possible to pick your entertainment from the radio program and turn the dial instantly, accurately, to your station and know your receiver is tuned with infinite precision.

\$2.50

Made by the Hammarlund Mfg. Co., your assurance of quality and dependability — produced solely for the Phenix Radio Corp. At your dealer; otherwise send purchase price and you will be supplied post-paid.

The silvered Ultra-Vernier dial mounts fast to panel. Single control 20-1 ratio operates vernier for hair-splitting adjustment and governs station indicator. Replace your old dials with Ultra-Verniers. You've never known such tuning ease.

Write for descriptive folder

ULTRA-VERNIER TUNING CONTROL

PHENIX RADIO CORPORATION
7-9 BEEKMAN STREET
NEW YORK CITY



KORACH

Tuned Loop

Tuning Feature
Directional
Can Be Logged
Collapsible

Patent
Applied
For

APPROVED!

Recommended and used on the famous COCKADAY 8-Tube SUPERHETERODYNE REFLEX

Laurence M. Cockaday, in the January issue of POPULAR RADIO, recommends the famous KORACH TUNED LOOP on his "Cockaday 8-Tube Superheterodyne Reflex." Mr. Cockaday and his associates are loud in their praises of this marvelous instrument. You too, will find it far superior to anything yet offered. Operates successfully on all sets designed for loop reception.

Brings in London, Paris, Madrid During Transcontinental Tests

The Editorial on page four of Feb. POPULAR RADIO tells how Cockaday, using the Korach Loop, logged the following Foreign Stations: 2BD, Aderdeen, Scotland; 5NO, Newcastle, Eng.; 2PY, Plymouth, Eng.; ESP, Paris, France; 2LO, London, Eng.; PTT, Madrid, Spain; WKA2, Porto Rico and CYC, Mexico City.

Positively the last word in loop construction. Exclusive features give you selectivity and distance unheard of before with loop aeriels. Also used with remarkable results on the Pressley Superheterodyne. If your dealer cannot supply you, order direct from us. Price \$16.50. Send \$2.00 as good faith deposit with your order, balance C.O.D. Parcel Post. Satisfaction guaranteed.

KORACH RADIO COMPANY
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Full Particulars on Request

Dealers and Jobbers: Write at once for attractive discounts.

The Traffic Cop of the Air

FERBEND Wave Trap



Add a Ferbend Wave Trap to your Radio Set and "Police" your reception. Regulate traffic. Guaranteed to tune out any interfering station. Widely imitated but never equalled. The original and only successful WAVE TRAP. Now in its third year. Sent Postpaid upon receipt of \$8.50 or C. O. D. plus postage. Send for Free Booklet.

FERBEND ELECTRIC CO.
21 E. So. Water St. Chicago

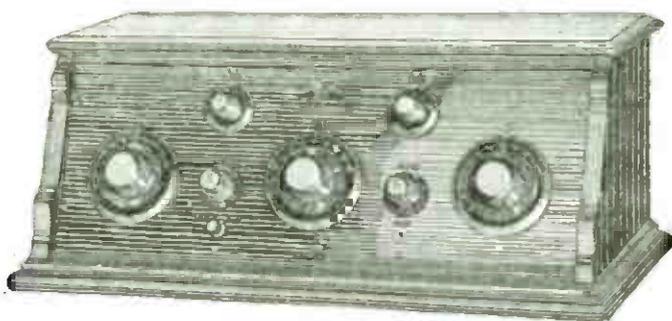
Always look for this Trade Mark. It is your protection against misleading imitations and those who infringe on the registered name "Wave Trap" and its reputation. If it isn't a FERBEND, it isn't a WAVE TRAP.



MELCO SUPREME



"THE MAGIC CARPET"



YOU tour the world in a night with your MELCO Supreme---a five tube tuned radio frequency Receiver with a unique low-loss Amsco chassis.

Tuned by inductance---not capacitance---it is without parallel for purity and precision of reception. Write for literature.



AMSCO PRODUCTS INC. BROOME & LAFAYETTE STREETS. N.Y.

ECHO LOUD SPEAKER



The Voice that Thrills!

When You Hear It Then You Will Be Convinced

POSITIVELY THE LAST WORD IN SPEAKER CONSTRUCTION

All metallic sounds, wooden sounds, vibrating horn sounds have been eliminated in the Echo Speaker. One of the features that make for clear reception and volume is the distance from the unit to the out-let of the Speaker. The Echo Speaker has a distance of 21 inches from the unit to the out-let and still is only 12 $\frac{3}{4}$ inches in height. It is molded from compositions which after long experimentation have proven best for Radio reception. Our unit which was designed especially for the Echo Speaker is made to stand any set and needs no extra batteries.

We Welcome Your Comparison for Tone Qualities With Any Speaker Regardless of Price
GUARANTEED TRIAL OFFER

We will send this speaker on 10 days' trial. Simply send \$2.00 as a good faith deposit with your order. Balance \$15.50 to be paid when Speaker arrives. Try it for 10 days. If you are not perfectly satisfied, return and we will refund your \$17.50. Our offer is guaranteed. We stand back of it.

Handsomely finished in Brown Mahogany or Polychrome. State which you desire.
 Price, \$17.50. West of Rockies, \$18.50.

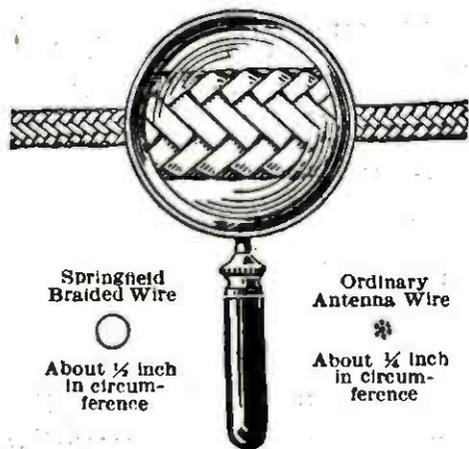
Dealers and jobbers who are rated, sample will be sent on memo invoice for inspection.
 Full particulars and circulars on request.

ECHO RADIO COMPANY

2512-14 IRVING PARK BLVD.

Dept. 7

CHICAGO, ILL.



Increase your Range

From 15 to 100 per cent

You can, with your present equipment, by using **SPRINGFIELD 16-STRAND BRAIDED ANTENNA**. Most wonderful wire for indoor loops. Its extra large surface—twice that of ordinary wire—enables you to get greater distance and clearness. 125 feet in your attic, in strands 3 feet apart, gives better results than 150 feet of ordinary wire outdoors. Write for free booklet. At dealers—or send us \$2.50 for 100 feet. Dealers and Jobbers—write for prices and terms.

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Springfield, Mass.

New York Office: 51 E. 42nd Street

Tel. Vanderbilt 5090

Springfield 16 Strand Braided Antenna

PERSIL RADIO SERVICE

2114 MAPES AVE.
NEW YORK CITY

COCKADAY'S LATEST! 8-TUBE SUPERHETERODYNE REFLEX

1 G. I. .0005 Condenser (Isolantite).....	\$5.50	1 Amsco Rheostat—2 Ohms.....	\$1.35
1 G. I. .001 Condenser (Isolantite).....	6.00	1 Amsco Potentiometer—400 Ohms.....	1.50
1 Set Haynes-Griffin Transformers.....	20.00	2 Daven Resisto-Coupler Mountings.....	2.50
1 Precision Autodyne Coupler.....	3.50	1 Daven Grid Leak Mounting.....	.35
1 Karas Harmonik A. F. Trans.....	7.00	6 Daven Resistors—5 Megohms, 5 Megohms, .005 Meg., and .25 Meg.....	3.50
1 Amplex Grid-Denser .0005.....	1.25	7 N. Y. Mica Condensers: .0001 Mfd., .006 Mfd., .00025 with clips.....	4.15
1 Benjamin Cle-ra-tone Socket.....	1.00	1 Duratran R. F. Transformer.....	4.00
7 Federal Sockets No. 16 (\$1.20 each).....	8.40	1 Walbert "A" Battery Switch.....	.50
1 Patent D. C. Jack; 1 Patent S. C. Jack.....	1.10	7 Eby Binding Posts.....	1.40
2 Na-ald 4-Inch Dials.....	1.50	1 Sub-panel, bakelite 1' x 9", bus bar, brackets.....	.45

KIT OF ALL ABOVE PARTS. (Blue Prints, Baseboard, Engraved Panel, \$4.35 Extra) \$74.95

WIRED IN BEAUTIFUL MAHOGANY HAND FINISHED CABINET \$99.00

5-TUBE COCKADAY, 4-CIRCUIT TUNER

The Wonder Set

KIT Parts, exactly as specified by Mr. Cockaday, including Bus Bar, Baseboard, Blue Prints, Drilled and engraved panel, **\$67.00**

WIRED IN GENUINE MAHOGANY OR WALNUT CABINET, ONLY \$85.00

In February's Popular Radio

Craig 4-Tube Reflex Kit—PARTS

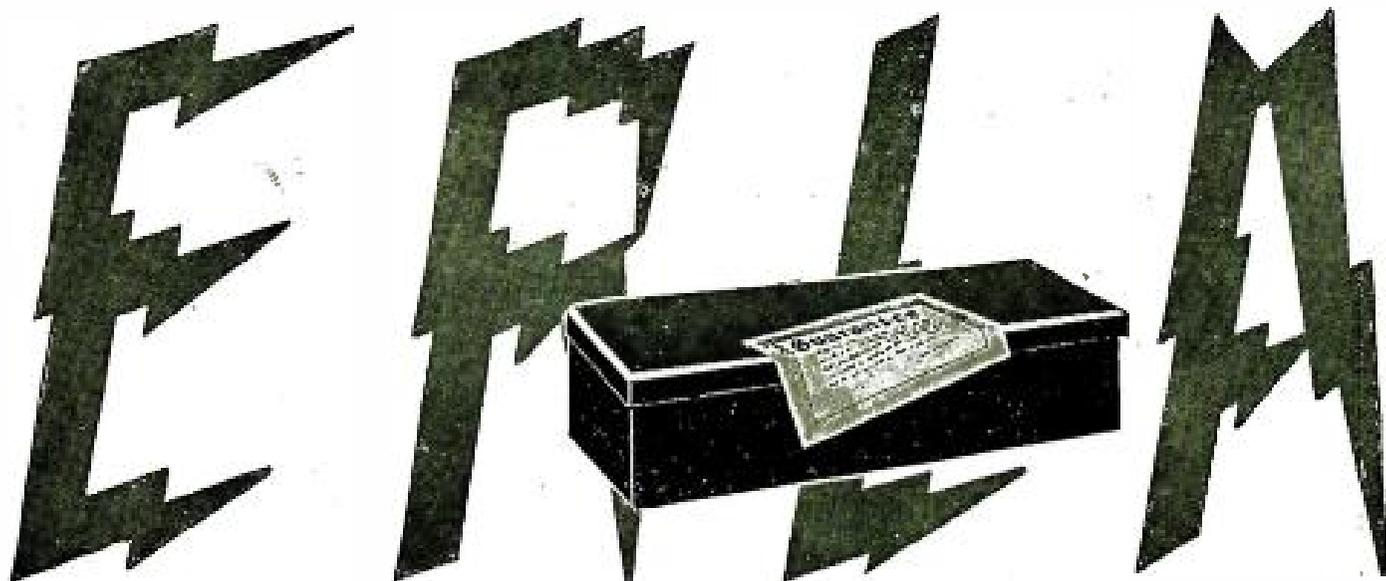
as mentioned in magazine, including Blue-prints, panel, bus bar, and baseboard, only **\$47.50**

WIRED IN MAHOGANY CABINET, HIGHLY FINISHED AND RUBBED \$74.50

Delivered free in U. S. Canada add 5% to order. One-third must accompany all orders. Insured if you wish.

Shoot your questions and troubles to us. No charge for advice. Our radio experts are at your service. Catalogue?

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY



Supereflex Means MORE POWER PER TUBE

Erla Supereflex makes tubes do triple duty. One tube actually does the work of three that would be needed otherwise. Three tubes do the work of five, unquestionably! That is why simple, compact, inexpensive Erla Supereflex receivers equal or surpass the performance of costliest, temperamental multi-stage radio sets.

More power, tube for tube, is basic in Erla Supereflex. Nothing else can "make up for it." Greater power in Erla Supereflex just simply means finer radio, which you can afford.

For you yourself can confidently build these matchless Erla circuits with Erla Supereflex *CIR-KIT*.

CIR-KIT is a complete array of Erla Scientific Precision Apparatus, especially created to make Supereflex possible. *CIR-KIT* provides clear, simple instructions for perfect assembly. Blueprints are full size. The panel is pre-drilled for you. The baseboard is marked to locate every unit accurately. The famous Erla Solderless Connectors do away with soldering entirely.

With screwdriver, pliers and *CIR-KIT* you are sure of a set that will make you proud, both for appearance and performance. The cost is very moderate. Yet the range, volume, selectivity AND TONE PURITY are rarely equaled at any price, because Supereflex does give you more power, tube for tube.

Electrical Research Laboratories
Department R 2500 Cottage Grove Avenue, Chicago

CIR KIT

MAGNAVOX Radio



**ONE hand on ONE dial
for Tuning in!**



WITH a Magnavox Set, you are free to give your whole attention to the *variety* of the available programs and the exquisite *tone* in which they can be heard.

TRF-50—[As illustrated] is a 5-tube tuned radio frequency circuit in carved mahogany cabinet with built-in Magnavox Reproducer \$150.

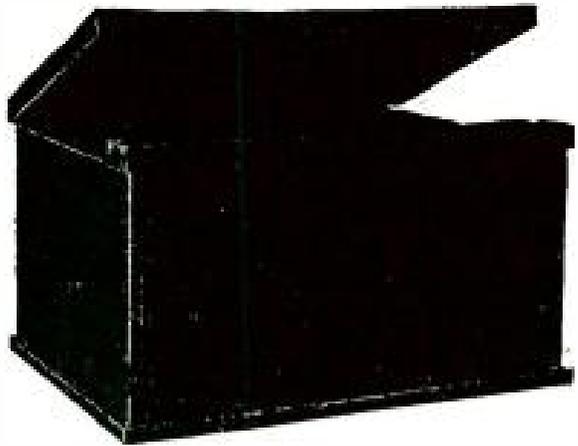
TRF-5—in smaller cabinet, including M4 Reproducer. \$125.

Magnavox Products, Sets, Reproducers and Tubes, are carried in stock by Registered Magnavox Dealers. Booklet on request.

THE MAGNAVOX COMPANY

OAKLAND, CALIFORNIA

NEW YORK: 350 W. 31st. St. CHICAGO: 162 N. State St.
Canadian Distributors: Perkins Electric Limited, Montreal



RADIO CABINETS Strong and Rigid.

Remember that we pay mail and express charges—it makes quite a difference when comparing prices.

Specifications

Hardwood, rubbed mahogany finish. Top hinged, ends of top splined to prevent warping.

Panel size	Depth	Price
7 x 14	10	\$3.00
7 x 18	10	3.25
7 x 21	10	3.50
7 x 24	10	3.75
7 x 26	10	4.50
7 x 27	9	5.00
7 x 28	10	6.00

Mail and express prepaid East of the Mississippi River.

We also make Radio Desks and Tables. Send for free catalogue.

THE SOUTHERN TOY COMPANY, Inc.
Dept. P. Hickory, N. C.

EBY

BINDING POSTS

*Twenty-five They Don't
Different Lose
Engraved Tops Their Heads*



H. H. EBY MFG. CO.
Philadelphia

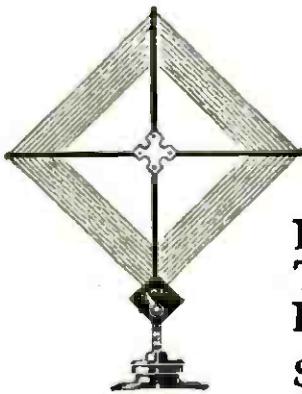


Haynes-Griffin

RADIO SERVICE, Inc. 41 West 43rd St., N. Y. City
 250 W. 49th St., New York MAIL ORDER DEPARTMENTS 111 So. Clark St., Chicago

Complete Parts for the New Cockaday Super-Heterodyne Reflex

New and Special Apparatus Specified by Mr. Cockaday



Korach Tuned Loop
\$16.50

Essential for best results with the new Cockaday "Super". The Korach Loop is uni-directional, assuring the highest degree of selectivity. Tapped to permit variations in selectivity and tuning.

Haynes-Griffin sells the identical parts used and specified by Mr. Cockaday for his remarkable new Super-Heterodyne in January "Popular Radio." There will be no changes or substitutions of any kind.

Haynes-Griffin Mail Order Service will give you immediate delivery on any of the items specified by Mr. Cockaday for his new set. Order what you need from the list below.

Parts Specified by Mr. Cockaday

1 General Instrument .001 Isolantite Condenser.....\$6.00	1 Dubilier Duratran.....4.00
1 General Instrument .0005 Isolantite Condenser..... 5.50	1 Karas Audio Transformer ...7.00
1 Precision Autodyne Coupler 3.50	2 Daven Resistance Couplers..... ea. 1.50
1 Set of 4 Matched Haynes-Griffin Intermediate Transformers.....20.00	1 Daven Single Mount ..... .40
2 Daven .25 Resistance.....ea. .50	2 Naald 4 inch Dials ea. .75
1 .005 Daven Resistance.....ea. .50	7 Federal No. 16 Sockets...ea. 1.20
2 .5 meg Daven Resistance..... .50	1 Amsco 400 ohm Potentiometer.....1.50
4 .006 N.Y. Coil Condenser...ea. .75	1 Amsco 2 ohm Rheostat.....1.35
1 .00025G N.Y. Coil Condenser.. .45	1 Bakelite Panel 7 x 24 in. drilled and engraved.....6.00
2 .0001 N.Y. Coil Condenser...ea. .35	1 Special Cabinet 7 x 24 .....10.00
1 Benjamin Standard Socket...1.00	1 9 1/2 x 22 3/4 in. baseboard ..... .75
1 Amplex .0005 Gridenser .....1.25	7 Eby Engraved binding posts.....ea. .20
1 Pacent Double Circuit Jack... .60	Set of Popular Radio Blueprints.....1.10
1 Pacent Single Circuit Jack.... .50	1 x 9 in. Hard Rubber strip drilled..... .20
1 Walbert Filament Switch..... .50	

All of the above parts supplied for \$93.10

MATCHED!



Sold only in matched sets of four

Haynes-Griffin Matched Intermediate Transformers

One In-input Transformer and three Intermediate Transformers (New Type) exactly as specified by Mr. Cockaday. Every set tested and matched for resonant frequency.

Designed by A. J. Haynes and manufactured by Haynes-Griffin Radio Service, Inc.

\$20.00 set of four

DEALERS: For name of distributor nearest you write to Tested Radio Products, Inc., 244 W. 49th St., New York City

HAYNES-GRIFFIN RADIO SERVICE, Inc.

250 West 49th St., New York City 111 So. Clark St., Chicago

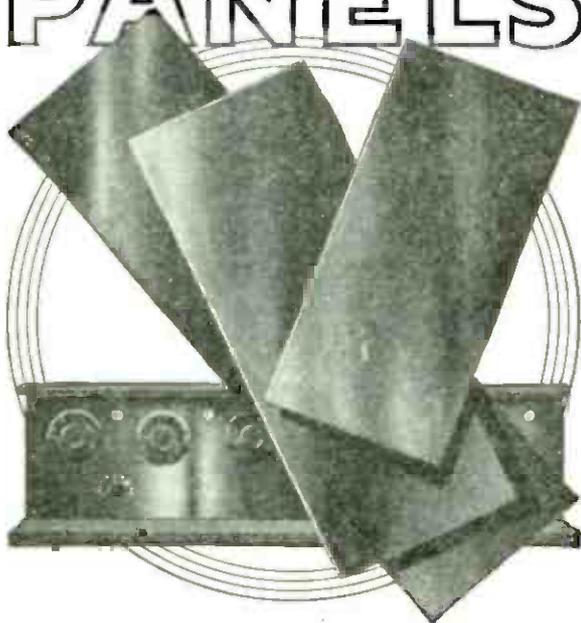
The Panels That Produce Results

A superior panel will increase the efficiency of your reception through reducing surface leakage. You can be certain of this if your set is built with

ELECTRASOTE

TRADE MARK

PANELS



These beautifully finished panels will neither warp nor change color. They are scientifically constructed to reduce surface leakage to a minimum, hence assure increased efficiency of the set.

One of the famous "sote" products introduced by The Pantasote Company, Inc., Electrasote Radio Panels are sold strictly on their merits—yet are

Lower Priced
than other standard panels

Make your Set an "Electrasote Panel Set"—and get results!

On sale at good Radio Dealers

M. M. FLERON & SON, Inc.

Sole Sales Agents

Trenton, New Jersey



\$1.50
now
for the Ideal
Radio Rheostat

The old-story of big demand and quantity production making for price reduction has worked out for the Marshall-stat, the ideal radio rheostat. Its new price is \$1.50 now.

For your money you get the smoothest accurate adjustment rheostat on the market. It gives vernier precision throughout its entire range from 100 to 0.2 ohms. Yet there is only one adjustment to make—only one dial to turn.

In addition, it is compact (illustration above full size), requires only one hole in panel, and can be used with any tube or combination of tubes.

You can't go wrong with the Marshall-stat.

MARSHALL ELECTRIC CO.,
3237 Locust Boul. St. Louis, Mo.

Get the Marshall-stat at radio dealers everywhere. Write us for descriptive literature.



KEYSTONE RADIO LIGHTNING ARRESTERS

Get the Keystone Low Loss Lightning Arrester installed now before the Spring thunder and lightning storms get severe. Your set and your home must be protected to comply with fire laws. Get the greatest protection and satisfaction—use the genuine Bakelite Keystone. Approved by Fire Underwriters. E 1835. The Keystone is the only Low Loss Arrester and forms perfect insulation between aerial and ground. Get one today. Sold by all dealers.



\$1.50
Complete

\$2.00
In Canada

ELECTRIC SERVICE
SUPPLIES CO.

PHILADELPHIA
17th and Cambria Sts.
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CHICAGO
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DE FOREST

Leads again

Another jump ahead!

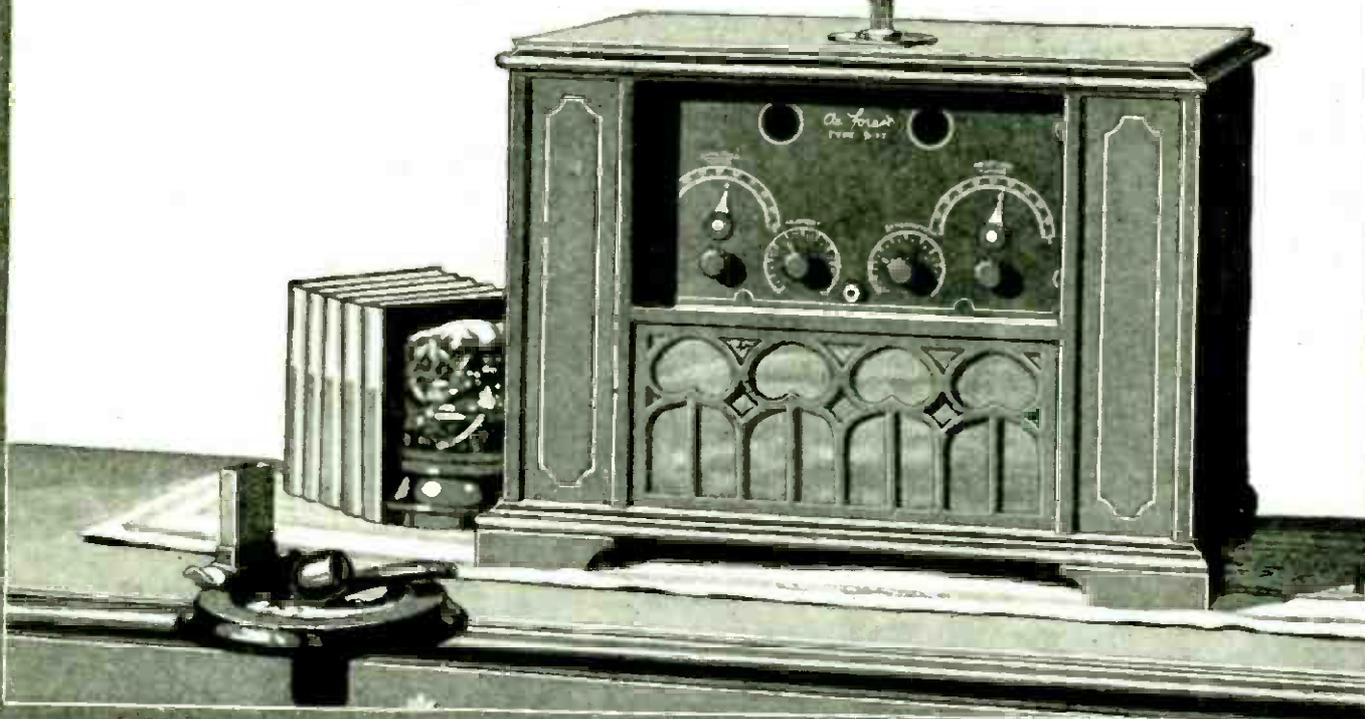
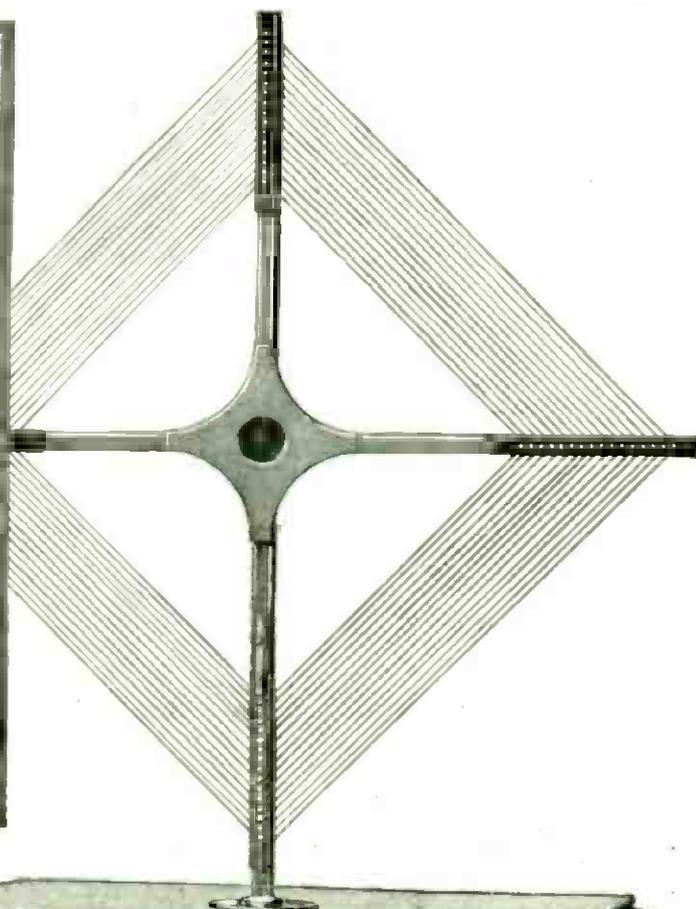
Just out — First in 1925

DE FOREST'S greatest triumph. A truly remarkable advance in ease of operation — beauty of tone — selectivity — distance range. It uses tube detector instead of crystal.

You should see and test this instrument before you buy any set. Its refinements and improvements are too many to tell here.

Ask your nearest De Forest dealer to bring it to your home and show you how simply and perfectly it operates. It will be hard for you to let him take it away.

Price range, \$125 to \$200



THE NEW

DE FOREST D-17

REG. U.S. PAT. OFF.

De Forest Radio Company, Jersey City, N. J.

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY

*Gee!
I've got 'em*



*Loud and Clear
with the*
Howe Radio Receiver

\$1.75

DO you know that you can listen to every radio broadcasting station in and around your city with a Howe Radio Receiver costing only \$1.75? Thousands of folks—young and old—all over the country are having many hours of solid enjoyment listening to the wonderful and varied programs—music, talks, sport and church services.

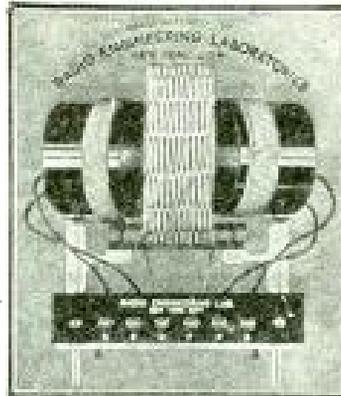
The Howe Radio Receiver is not a toy but a very sensitive, practical, radio set made of the best materials and furnished in a strong, steel case finished in a beautiful dark olive antique verde. It is fool and trouble proof. **No Batteries to Buy.** Guaranteed you can hear any broadcasting stations within 25 miles. One or more persons can "listen in" at the same time.

For perfect local reception use a Howe Radio Receiver crystal set.

For Sale by All Dealers

Howe Auto Products Co.
Radio Division
Chicago, Illinois

Minnesota Man Claims 2-Tube Reception Record with Lopez Low-Loss Tuner



"Edward C. Connelly of Breckenridge, Minn., claims the greatest reception record in the Northwest during International Radio week with a two-tube set. His reception record is as follows: Madrid, Aberdeen, Birmingham, Lyons, Newcastle, Rome and stations in Porto Rico and Mexico City. Mr. Connelly assembled the set himself."

(Reprint from Minneapolis Tribune.)

As he used dry cell tubes, which give about 75% of the signal strength secured with 6 volt tubes, he attributes his record to the

LOPEZ LOW-LOSS TUNER

Exceptionally well made
Rigid Inspection
Minimum insulation

No short-circuited turns
Rugged
Super Selectivity

Broadcast Type, 200 to 600 meters
Regular Amateur, 40 to 205 meters

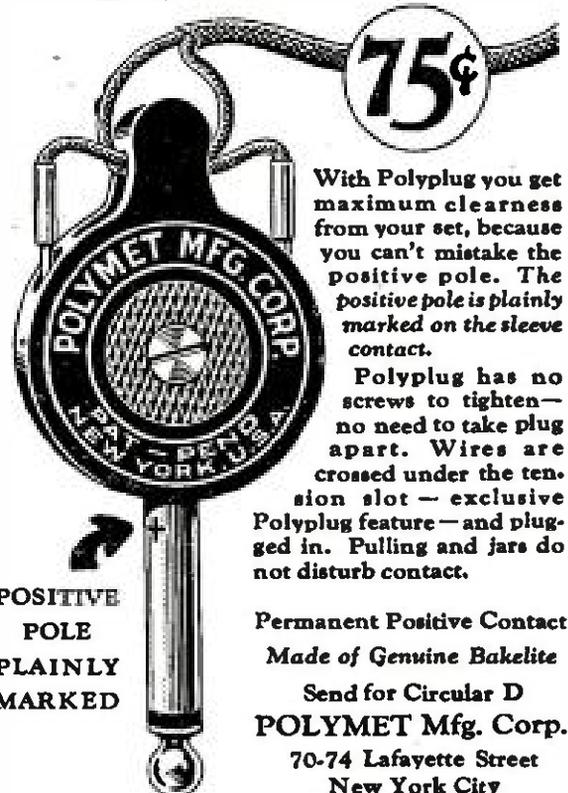
Circuit diagram, panel drilling template and instructions with each tuner

PRICE \$10 each (At your dealers or sent direct, postpaid)

A. C. LOPEZ & CO.

334 Fifth Avenue Dept. P-3 New York City

POLY PLUG



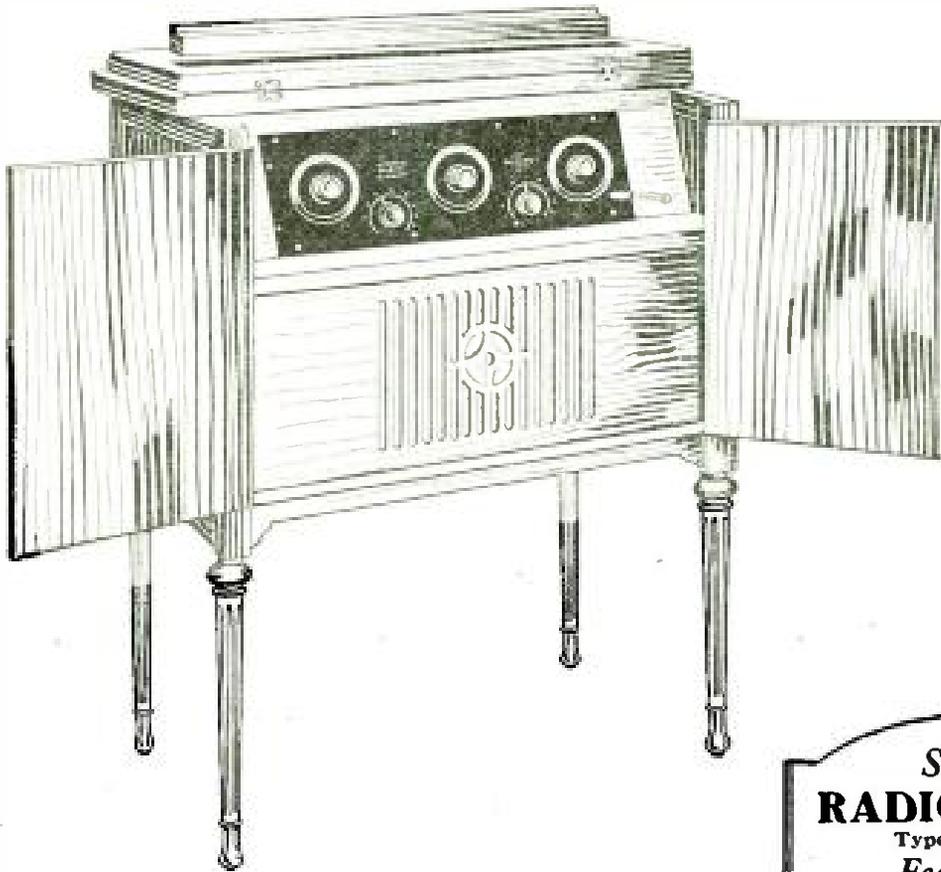
With Polyplug you get maximum clearness from your set, because you can't mistake the positive pole. The positive pole is plainly marked on the sleeve contact.

Polyplug has no screws to tighten—no need to take plug apart. Wires are crossed under the tension slot—exclusive Polyplug feature—and plugged in. Pulling and jars do not disturb contact.

POSITIVE
POLE
PLAINLY
MARKED

Permanent Positive Contact
Made of Genuine Bakelite

Send for Circular D
POLYMET Mfg. Corp.
70-74 Lafayette Street
New York City



"I have proof of bringing in San Juan, Honolulu, Havana, a station in every state in the U. S., and several stations in Canada and Mexico. One night my Radiodyne picked up Berlin, Germany and Paris, France. A few nights previous I distinctly heard London, England. I have over 200 stations logged."

E. B. HORNE, Arkadelphia, Ark.

*If you can get it with any set
you can get it better with the*

Some
RADIODYNE

Type WC-12

Features

Has an Amazing Degree of Selectivity

Uses 6 Dry Cell Tubes
Receives from Great Distances

Has Wonderful Volume
Exceptional Clarity
Self Enclosed in Beautiful
Two-Tone Mahogany Cabinet

Models Range in Price
from \$65.00 to \$250.

Write for Our Free Booklet

**WESTERN COIL &
ELECTRICAL CO.**

308 Fifth Street
Racine, Wisconsin

Radiodyne

The Voice of the Nation

AMPL-TONE

GUARANTEED



Radio Headsets

Price \$5.00

For three years these headsets have been tried, tested and proven their value. There are thousands in use today and are still giving perfect satisfaction. Ask your friends. They know. They are unexcelled for crystal sets and capable of great distance reception with tube sets. Buy one pair and you will immediately order more. We can't make all the phones used so we make the best. Write us for phones or circulars, if your dealer fails you.

Make Your Own Loud Speaker! Our Excellent Unit, Including Blue Print For Making Horn, Price \$3.00.

Our Phonograph Attachment—More Volume, Clearer Tone, Less Battery Required. \$3.00.

Dealers: Quick turnover is our motto.

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The Union Fabric Co.
Derby, Conn.

FREE



To Each Purchaser of a World Battery

A 24-Volt "B" Storage Battery positively given FREE with each purchase of a WORLD "A" Storage Battery. The WORLD Battery is famous for its guaranteed quality and service. Backed by years of Successful Manufacture and Thousands of Enthusiastic Users. You save 50%.

Prices That Save and Satisfy	
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6-Volt, 11 Plate \$12.25	6-Volt, 100 Amps. 12.50
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Shipment Express C. O. D. subject to examination. 5 per cent discount for cash in full with order.

2-Yr. Guarantee Bond In Writing With Each World Storage Battery

proves satisfactory World performance. Mail this ad with your name and address — we will ship battery day order is received; and give you your choice of "B" Storage Batteries or a handsome nickel finish Auto Spotlite, FREE. Write TODAY.

WORLD BATTERY COMPANY
1219 So. Wabash Ave. Dept. 3 CHICAGO, ILL.

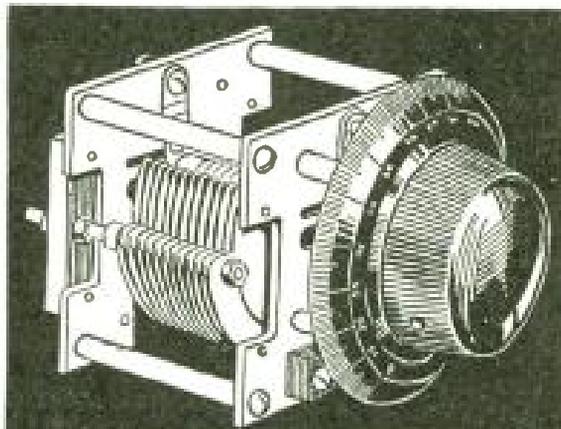
This FREE "B" Storage Battery takes the place of any cell "B" batteries. Can be recharged and will last indefinitely. To be sold retail for \$4.00. It is the only battery of its kind equipped with acid rubber case and insurance against acid and leakage. Take advantage of this remarkable introductory offer NOW. (To those who prefer it, we will send FREE a handsome nickel finish Auto Spotlite, instead of the "B" battery. Be sure to specify which is wanted.)

GIVEN
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To introduce this new and superior World "B" Storage Battery to the Public

A "National" Radio Product

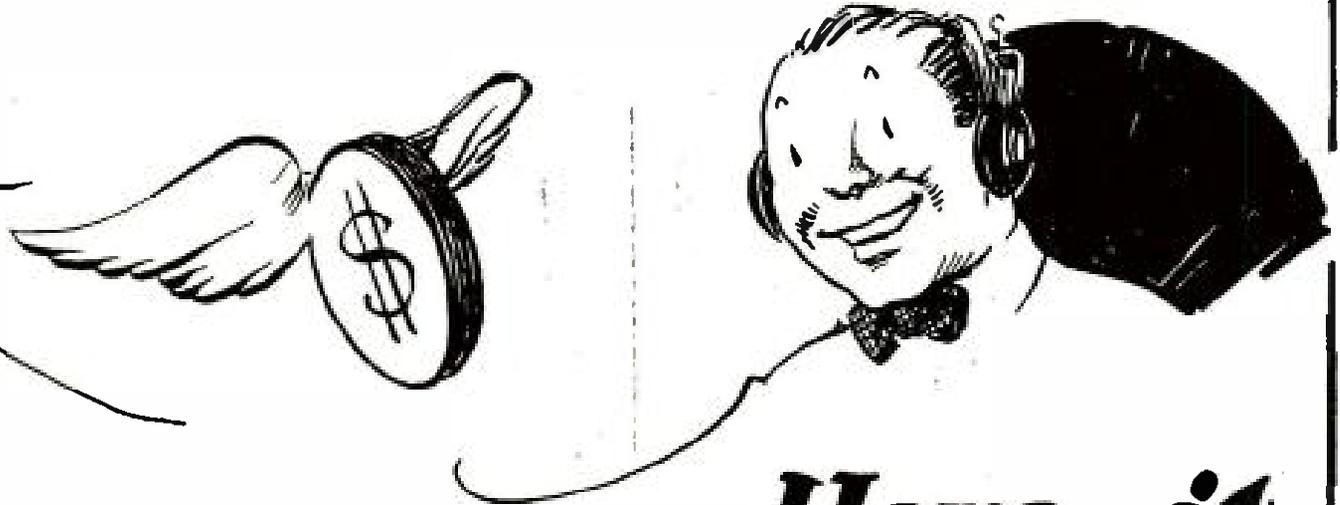


A Revelation to Radio Fans!

Get a NATIONAL CONDENSER and DIAL for your set. You'll say, "Never had such perfect reception."

Send for Bulletin 104 P. R.

NATIONAL COMPANY, Inc.
Engineers and Manufacturers
110 Brookline St. Cambridge, Mass.



Here it is! listen!

Hommel Broadcasting:

“Business static hurts your cash register as much as weather static hurts reception.”

Now, listen in carefully.

The **HOMMEL** Dealer Service Department was developed for the one particular purpose to help alleviate business “static.” That Department is vitally concerned in furthering your interests—as a Hommel Dealer.

We work shoulder to shoulder with our dealers—not in competition with them. We wholesale only and carry only the most reputable radio equipment. All user inquiries and orders resulting from our national advertising are forwarded *promptly* to our local dealer.

In our new six-story building we carry larger stock and have better facilities for serving you than ever before.

listen!

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We can't help you unless you ask us to. Write today for Hommel's Encyclopedia of Radio Apparatus 266-P. It's free and will help you.

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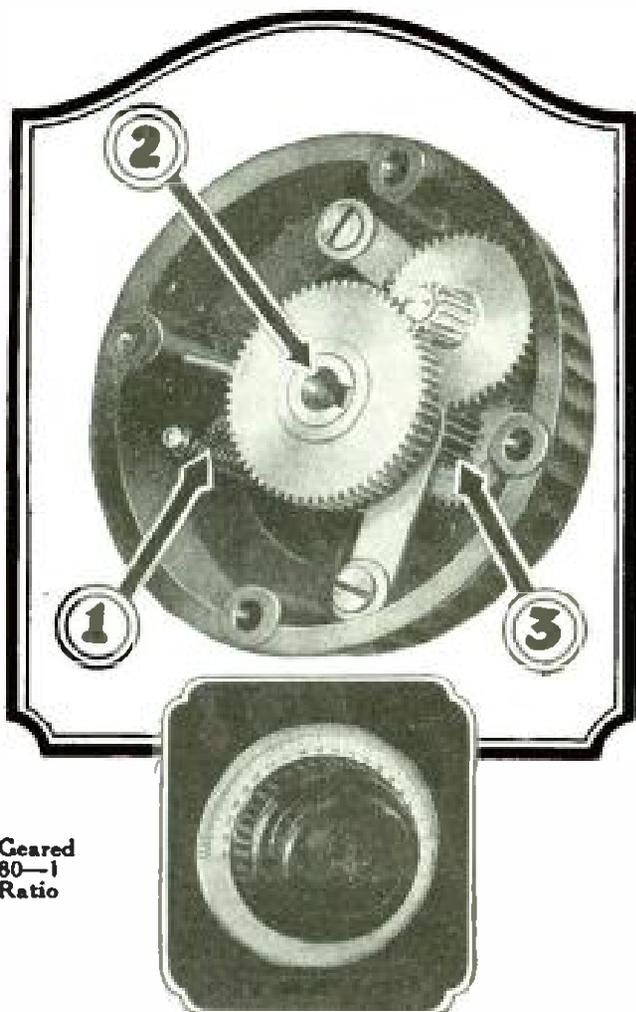
EXCLUSIVELY

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PITTSBURGH, PA.



Geared
80—1
Ratio

Dominating Accuratune Features

- 1.—No Back Lash—A new principle takes up all lost motion and back lash and produces a very smooth operating instrument.
- 2.—Long center bushing eliminates all dial wobble and takes all standard condenser shafts. Permits dial mounting flush with panel. No cutting of condenser shafts.
- 3.—Gear mesh and alignment perfected to the same degree of accuracy as the mechanism of a watch. Ratio 80—1. You can change from ordinary dials to Accuratune Micrometer Controls in an instant, no set alterations necessary—a revelation in fine tuning.

Write for descriptive folder

MYDAR RADIO COMPANY
9-B Campbell Street Newark, N. J.
Canadian Representative: Radio, Ltd., Montreal



Send for FREE Bulletin 94

Whether you plan to build or to buy a receiving set, it will pay you to know something about the "insides" of radio. This booklet gives you the "inside dope" on some of the recent inventions embodying the latest ideas of radio engineers. In this bulletin is full information about the

Premier "HEGEHOG" Audio Transformer

Ratios 1 to 3, 1 to 4
and 1 to 5, \$3.50
Ratio 1 to 10, \$4.50



This light weight audio transformer has earned a place in the very front rank for its remarkable volume, and pure, natural tone. It is 100% self-shielded against foreign noises.

Its small size is a surprise to everyone. It cuts the space requirements for audio transformers in two. This is a big advantage in portables and makes it ideal for neat and compact wiring.

FREE HOOK-UP DIAGRAMS also sent on request. All popular types. Address

Premier Electric Company

3807 RAVENSWOOD AVE., CHICAGO

PREMIER Quality Radio Parts

Praised by Experts!



Enjoyable volume and marvelous clarity are ensured with Airtron Tubes.

Every tube is a product of scientific skill and accuracy, and fully guaranteed. Bases are of Bakelite, which ensures highest efficiency. Tested and approved by Radio authorities.

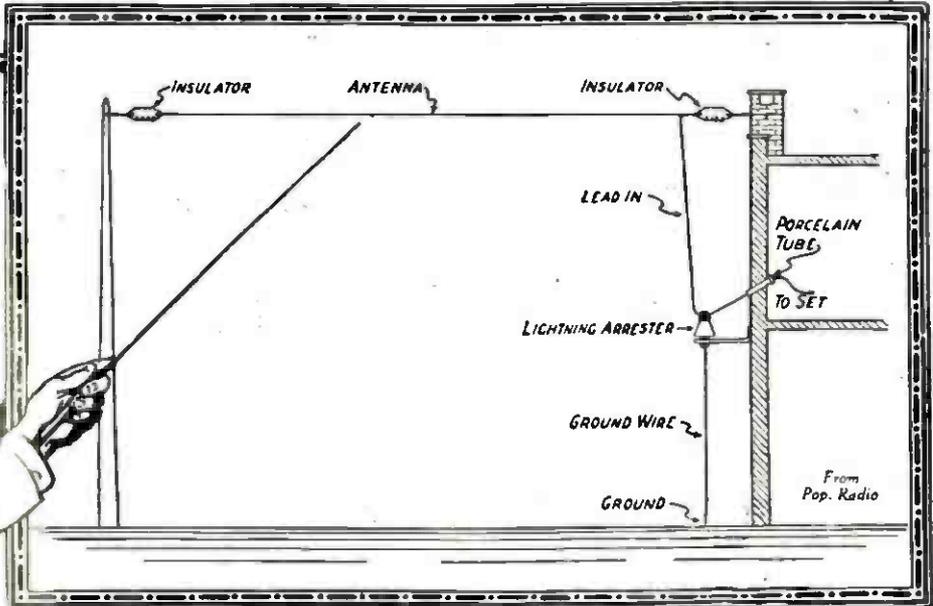
Ask your favorite dealer for Airtron Tubes. All standard types \$4.00.

Dealers write for discounts

We repair all types of tubes \$2.50.

H. & H. RADIO CO.
Dept. 102, 514 Clinton Ave., Newark, N. J.

AIRTRON RADIO TUBES



The Secret of a Good Aerial Is the Protective Enamel Coating

RADIO AUTHORITIES agree that ordinary bare aerial wire deteriorates rapidly when exposed to atmospheric fumes and moisture. High-frequency currents in the aerial always flow along the surface of the wire, and when this surface becomes corroded, the aerial current encounters great difficulty in reaching the radio set. This means considerable loss of range and volume.

Beldenamel Stranded Aerial Wire is made of bright, clean copper strands, each covered with a protective, baked-enamel coating. Atmospheric exposure, even for years, has no effect on Beldenamel and corrosion cannot take place to reduce signal strength. Follow the advice of acknowledged radio authorities, and replace your aerial with Beldenamel Aerial Wire. Do it now, and hear the difference.

For Best Results

the aerial and lead-in should be a continuous length of Beldenamel Aerial Wire. Use a 150-foot length furnished in standard Belden carton and avoid all joints.

Free Booklet



Belden Manufacturing Company
2316A S. Western Ave., Chicago

I want a *real* aerial for my set. Please send me your booklet describing Beldenamel Aerial Wire and other Belden Radio Products.

Name.....

Address.....

Results will be better anyway. Power lines in close proximity to an antenna cause a shadowing effect or an absorption effect and sometimes both.

Corroded Antenna Wire Causes Weak Signals

If your antenna has been up for a year or more the chances are that the surface of the antenna wire has become corroded due to the action of the weather. Radio frequency currents travel on the surface of the wire and often the weakening signals carried by them is due to this corrosion. This trouble is particularly prevalent in large cities where the atmosphere is contaminated with sulphur fumes and other chemicals from manufacturing plants.

Enamelled wire is excellent for antennas as the enamel protects the surface of the copper from the gases and other corrosive elements in the atmosphere.

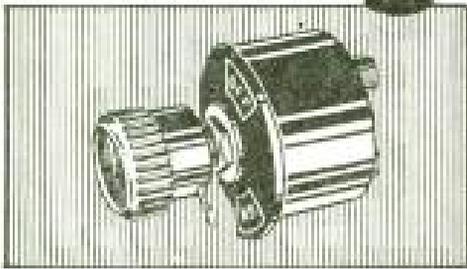
Clipping from Popular Radio



Belden

Manufacturing Company
2316A S. Western Avenue • Chicago

When
the phone
rings



Snap ~
AND ALL IS SILENT
Snap again ~
AND THE PROGRAM
CONTINUES ~
without retuning

No modern set lacks the convenience of a MAR-CO filament battery throw switch. Its definite on and off positions make it far superior to any pull switch. Saves tubes and batteries—you don't forget to turn them off! Saves annoying interruptions when you only want to stop reception for a minute!

Make your set
convenient with a
MAR-CO

ON AND OFF
BATTERY
SWITCH **\$1.00**

—and when you need a variable condenser, get one you *know* will cut down leaks—a MAR-CO! Handsomely finished, individual tension adjustment, a precision instrument throughout!



Murdock Phones

are backed by 20 years of successful experience. There are over 1,000,000 in use today. Murdocks are famous for distinct reproduction and for their light weight. With the Murdock Multiple Plug you can use from one to four phones at the same time.

WM. J. MURDOCK CO.
508 Washington Ave. Chelsea, Mass.

Free Booklet

Write for our free booklet "The Ears of Radio." It contains important data on headphones.



MURDOCK RADIO PHONES

Standard since 1904

VOLT-X VARIABLE GRID LEAK

NEW!

A BALL-BEARING
Grid Leak That Stays Put
Screw adjustment, expansion
contact and resistance unit
that cannot wear or tear.

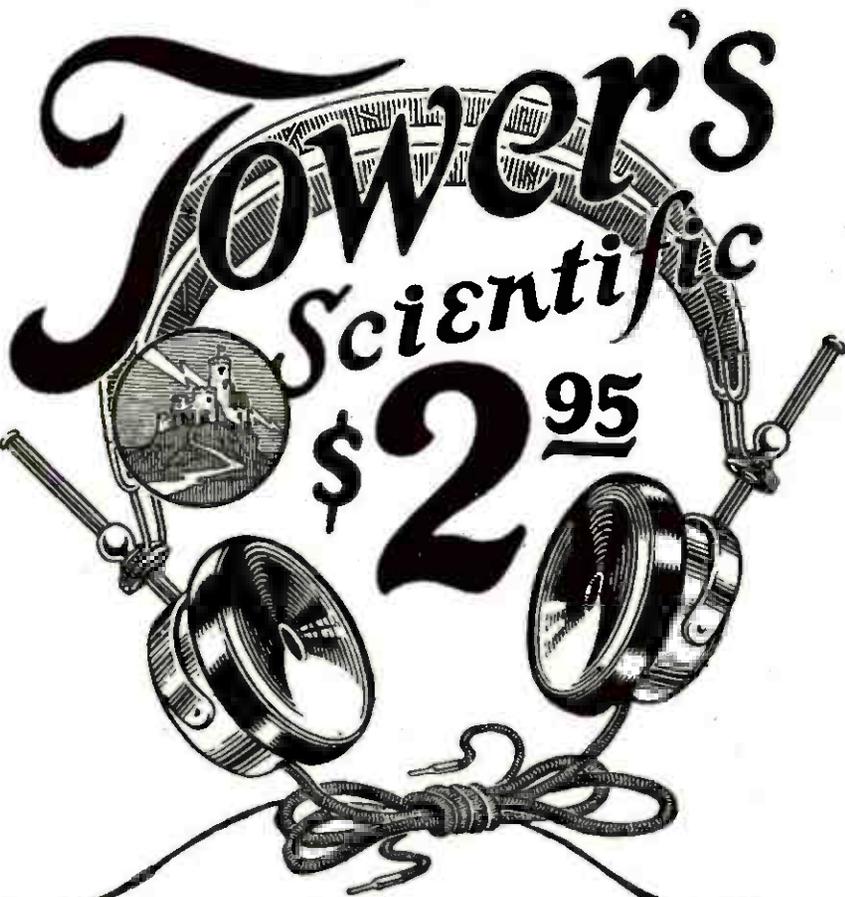
VOLT-X GRID LEAKS
are positive and smooth in
action with an accurate range
of from one-half to fifteen
megohms. Balancing Resistances
for Super-Heterodyne and other
circuits 30,000-150,000 ohms.

They fit any standard leak mount-
ing, and get the absolute maxi-
mum from your tubes. They do
not wear out.

Grid Leak \$1.00
Grid Leak Mounting .30



BURTON & ROGERS
MFG. CO.
755 BOYLSTON ST. BOSTON MASS.



Two Towers

As the Eiffel Tower stands as a monument to skilled engineering construction so TOWER'S Scientific phones stand as a monument to supreme radio achievement. ¶ Each phone is carefully tested and approved before it leaves the factory by a Government Licensed Radio Operator thus guaranteeing perfection in tone quality with a positive uniformity of volume.

TOWER'S Scientific Headsets are guaranteed to be made of the best materials money can buy—highest test enamel, insulated magnet wire, best grade five-foot tinsel cord, unbreakable caps, polished aluminum cases—using the famous scientific headband constructed for maximum comfort.

If your dealer cannot supply you, order direct, we will ship immediately Parcel Post C. O. D.

THE TOWER MFG. CORPORATION
98 BROOKLINE AVE. Dept. J BOSTON, MASS.



One of the seven wonders of the world.—The Eiffel Tower built in 1887-89 on the Champ-de-Mars contains 3 stories. Reached by a series of elevators, the platform at the top being 985 feet above the ground. In the top story is located the powerful Broadcasting Station FL.

The World's Greatest Headset Value

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY



Our King

Utility cabinets are all made of carefully selected lumber. They are beautifully finished and hand rubbed. The workmanship is of as high grade as in the best furniture.

By ordering direct from us you obtain factory to consumer prices and save jobber and dealer profits. If not entirely satisfied with the cabinets received, money will be refunded without question.



Our Monarch

DOES YOUR SET LOOK AS WELL AS IT WORKS?

Your set performs well but does it look well in your home? You owe it to your home and to your set to use a good looking cabinet. Utility cabinets will look well in the best surroundings, and are worthy of the highest grade sets.

Our King type of black walnut (illustrated above) is the best we make and as good a cabinet as is made. Our King is also made in birch.

Our Monarch (illustrated below) is made of walnut also. It differs from Our King chiefly in that it has a split top—a type preferred by some.

Our DeLuxe is of the same general type as our Monarch, but is built of thinner lumber and consequently is cheaper.

For Panel	Deep	Birch No Base	DeLuxe Black Walnut	Monarch Black Walnut	King Black Walnut	King Birch
6 x 7	7"	\$1.75	\$3.75	\$4.40	...	...
6 x 10 1/2	7"	2.25	4.65	5.35	\$5.35	\$3.35
6 x 14	7"	2.75	5.45	6.20	6.20	3.85
6 x 21	7"	3.25	5.90	6.80	6.80	4.60
7 x 12	7"	2.80	5.50	6.50	6.50	4.00
7 x 14	7"	3.00	5.80	6.70	6.70	4.20
7 x 18	7"	3.25	6.00	6.80	6.80	4.35
7 x 21	7"	3.60	6.50	7.40	7.40	4.90
7 x 24	7"	4.10	7.25	8.00	8.00	5.35
7 x 26	7"	4.75	7.80	8.50	8.50	5.80
7 x 27	7"	5.00	8.50	9.00	9.00	6.20
7 x 28	7"	5.25	9.50	10.00	10.00	6.60
7 x 30	7"	6.00	10.00	11.00	11.00	7.00
7 x 24	10"	5.60	9.25	10.00	10.00	6.70
7 x 26	10"	6.25	9.80	10.50	10.50	7.25
7 x 27	10"	6.50	10.75	11.50	11.50	7.70
7 x 28	10"	6.75	11.50	12.00	12.00	8.00
7 x 30	10"	7.00	12.00	12.50	12.50	8.20
8 x 36	8"	...	...	...	12.00	8.75
8 x 40	8"	6.00	11.50	12.50	12.50	9.25
9 x 14	10"	3.95	6.40	7.00	7.00	5.25
9 x 21	10"	5.00	7.70	9.25	9.25	7.50
9 x 24	10"	6.00	9.50	10.50	10.50	8.50
12 x 14	10"	4.25	7.00	8.00	8.00	5.50
12 x 21	10"	4.75	9.50	10.50	10.50	7.25

Order Direct From

UTILITY CABINET COMPANY
439-443 27th Street, MILWAUKEE, WIS.

HIGH QUALITY — LOW PRICE

The CLARITRON TUBE

\$2.30 BY MAIL

NOT CHEAP TUBES, BUT GOOD TUBES, WHICH WE SELL CHEAPLY

You cannot get a better tube at any price—and you pay more! Our Price is low because we sell direct and are content with a fair profit.

We guarantee that CLARITRON TUBES measure up to the highest standards. The well known New York Testing Laboratories declared CLARITRON to be better than standard tubes selling for \$4.00.

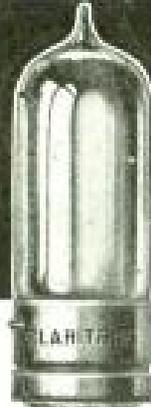
We make all types of tubes including—

Our No. 501A—for same use as 201A
Our No. 112—for same use as WD12

Our No. 499—for same use as 199
\$2.30 for any type

We ship all orders as soon as received. Shipments made by Parcel Post, C. O. D., or Pre-paid on Receipt of Express or Postal Money Order.

SUPERIOR RADIO COMPANY, Dept. 200
176 Shephard Ave. Newark, N. J.



OUR TYPE 499
Detector and Amplifier



OUR TYPE 501A
Tipless Detector and Amplifier

ATTENTION DEALERS

SEND FOR OUR 152 PAGE CATALOG



The finest and largest exclusive Radio Catalog in the United States

SCHNEITTER RADIO COMPANY
DEPT. G. ST. JOSEPH, MISSOURI

DeForest License



BRANSTON

Honeycomb Coils

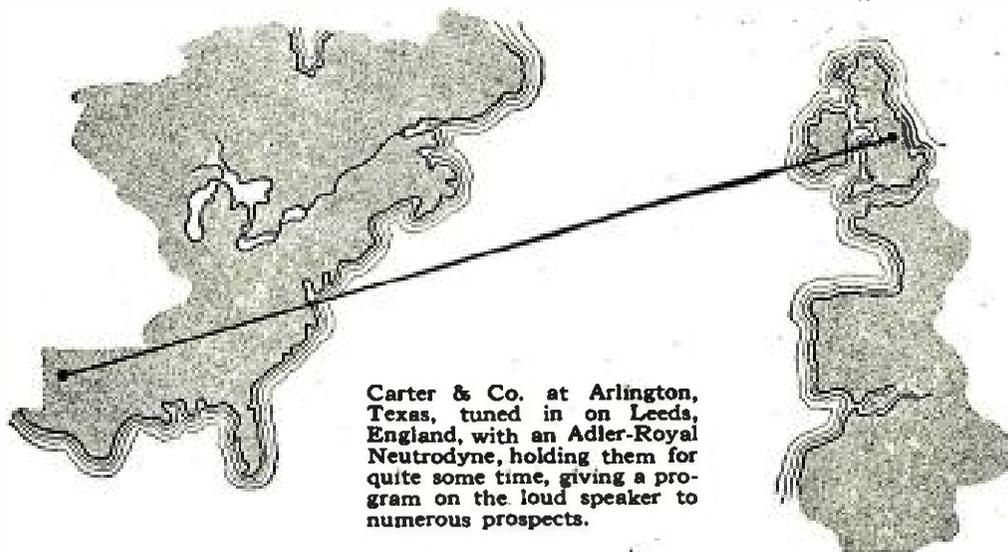
Back and Front Panel Mountings Plain or Geared—Genuine Bakelite

The Universal all-wave inductance—accepted as standard in regard to superior construction and electrical units of measurement. Ask Your "Old Timer" radio friend why sets using honeycomb coils are better; they give closer tuning, greater selectivity and range. No dead end losses, easy to operate. 16 sizes, mounted and unmounted. Interchangeable with all mountings. Be sure the set you buy or build has them.

Send 25c. for Super Heterodyne, Radio Frequency and Honeycomb Coil Circuits and Complete Catalog

CHAS. A. BRANSTON, Inc.
Dept. 2, 815 Main St. Buffalo, N. Y.
In Canada—CHAS. A. BRANSTON, Ltd., Toronto

Two Big Radio Thrills



Carter & Co. at Arlington, Texas, tuned in on Leeds, England, with an Adler-Royal Neutrodyne, holding them for quite some time, giving a program on the loud speaker to numerous prospects.

YOUR first thrill with an Adler-Royal neutrodyne will be the magic spell of D.X. as station after station comes in clear as a bell with the slightest change in dial settings. No matter how much you know about radio, the performance of Adler-Royal will be a remarkable radio experience for you.

The selectivity you had hoped for has really been accomplished.

Then, as your own log grows, you will be more discriminating about the quality of what you hear. You will begin to appreciate what Adler-Royal

really is and this will be your biggest thrill. Your daily paper will be your program. You will learn to depend on Adler-Royal absolutely.

The Neutrodyne principle is so far perfected in Adler-Royal that even in the hands of a novice its selectivity and pure tone qualities are almost automatic. Its operation is as simple as setting a clock. There are no squeaks, squeals or howls to ruin radio enjoyment. Adler-Royal has conquered the mysteries of the air.

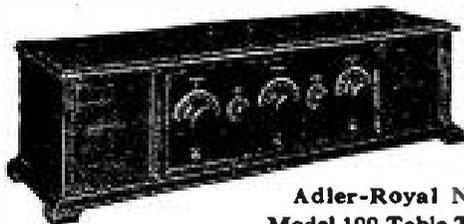
Seek a Service Dealer

THE dealer from whom you buy a radio set is quite as important as the set you buy. On his service to you, much of your enjoyment of a radio set will depend. It will pay you to turn the corner into Main Street to find the Adler-Royal dealer. He is appointed by us on his pledge to give purchasers the best of every service. On Adler-Royal, you get the guarantee of a high-class dealer to back up ours.

ADLER MANUFACTURING COMPANY, INC.
 General Sales Offices: Dept. B3, 881 Broadway, New York City
 Factories: Louisville, Ky.

ADLER-ROYAL

Phonograph and Radio



Adler-Royal Neutrodyne Model 199 Table Type used with dry cells. Batteries concealed in cabinet. 5 tubes (199) Cabinets walnut and mahogany. Price \$165.



Send this coupon today for your free copy of Adler-Royal Book and Log.

ADLER-MANUFACTURING CO.,
 Dept. B3, 881 Broadway, N. Y.

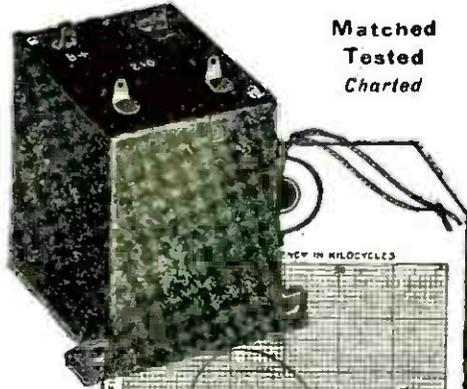
Please send me my copy of the Adler-Royal Book and Log.

Name.....

Address.....

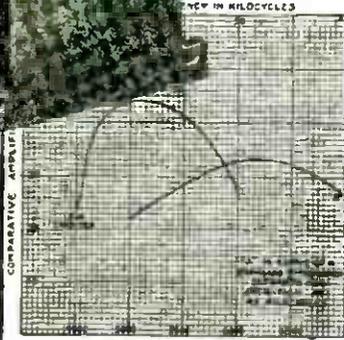
Years Ahead

With
A
Big
Idea



Matched
Tested
Charted

The curve of each TWO-TEN and TWO-ELEVEN Long-wave transformer is plotted in our laboratory—recorded on a tag, and tied to the transformer. It shows the peak—side-bands passed—amplification expected in any circuit. The curve applies to one transformer only. Price of TWO-TEN (interstage) or TWO-ELEVEN (filter) each.....\$8.00 Both peak at 6,000 meters.



**TWO-TEN
OR
TWO-ELEVEN**
LONG WAVE TRANSFORMER

Manufactured under the supervision of
McMurdo Silver, Assoc. I. R. E. by

SILVER-MARSHALL, Inc.
105 S. Wabash Ave. CHICAGO

Send for circulars

INDIVIDUAL CURVES

It remained for SILVER-MARSHALL to produce Long-wave Transformers so uniform that individual amplification curves could be supplied with each instrument. The idea is revolutionary. It establishes a standard of excellence that every progressive manufacturer will be forced to adopt. It demonstrates once again the fact the S-M engineering methods are always a year ahead of the industry. Now, you can build your super, as an engineer builds a bridge—after a definite plan.

Send for the "Why of Silver Supers"



THE FOUR-TUBE KNOCKOUT

The FOUR-TUBE KNOCKOUT was designed by McMurdo Silver, Assoc. I. R. E., to give super-heterodyne results—for the man who wants a simpler set. The March issue of *Radio Broadcast* will contain an account of this amazing circuit. Mr. Silver's book on the Knockout set will be mailed on receipt of twenty-five cents.

Silver-Marshall, Inc.

110 So. Wabash Ave. CHICAGO
Dept. A

New and Improved

\$5⁵⁰



Authorized Cockaday Coil!

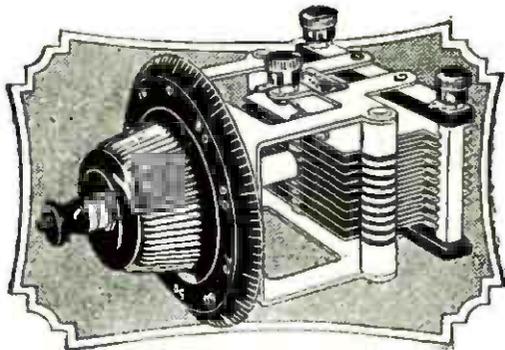
No more loose winding—special new feature holds coil windings fast. Built throughout of moulded hard rubber, not affected by atmospheric conditions. Wound with No. 18 D. S. C. copper wire.

The only coil specified by L. M. Cockaday in his New Four Circuit Tuner with Resistance Coupled Amplification because it meets all his specifications. Described in October *POPULAR RADIO* as Cockaday Precision Coil. Hundreds have substituted this quality coil for those of inferior make and are amazed at the improved reception, selectivity and general D-X results.

At your dealers, otherwise send purchase price and you will be supplied postpaid
In Canada \$7.75. Canadian Distributor, Perkins, Ltd. Montreal.

PRECISION COIL CO., Inc.
209-B Centre St., New York

The Only True Micrometer Type VARIABLE CONDENSER



A real micrometer permits fine mechanics to measure and make readable adjustments of 1/1000th of an inch or less.

The BARRETT & PADEN is the only condenser made that makes use of this principle and divides the adjustment of the movable plates into 1/1000 readable positions.

Think what this means in tuning distant stations.

Dealers write for name of nearest jobber.

.0005 } \$6⁰⁰
.00035 }
.00025 }

BARRETT & PADEN

1314 SEDGWICK ST. CHICAGO, ILL.

Prest-O-Lite

RADIO CHART

Voltage of Tubes	No. of Tubes	Type of Tubes (see foot-note)	Total Rated Ampere Drain	Recommended Prest-O-Lite "A" Batteries	
				Order by following Types	Days Between Chargeings
5-Volt Tubes C-300 and UV-200 are interchangeable C-301A, DV-2 and UV-201A are interchangeable For sets using current at a rate higher than 2 amperes.	1	UV-200	1	69 WHR or 67 WHR	22 16
	2	UV-201A	1/2	67 WHR	33
	2	1 UV-200 1 UV-201A	1 1/4	611 WHR or 69 WHR	22 17
	3	UV-201A	3/4	69 WHR or 67 WHR	29 22
	3	1 UV-200 2 UV-201A	1 1/2	611 RHR or 69 WHR	21 14
	4	UV-201A	1	69 WHR or 67 WHR	22 16
	4	1 UV-200 3 UV-201A	1 3/4	613 RHR or 611 WHR	22 15
	5	UV-201A	1 1/4	611 WHR or 69 WHR	22 17
	5	1 UV-200 4 UV-201A	2	613 RHR or 611 WHR	19 13
	6	UV-201A	1 1/2	611 RHR or 69 WHR	21 14
	8	UV-201A	2	69 KPR	21
				67 KPR	15
				69 KRL or 67 KPR	22 13
	2 1/2	2 1/2	69 KRL or 69 KPR	19 16	



What size batteries will work best in your set?

THE Prest-O-Lite Radio Chart makes it easy for you to select the right storage battery for best reception, and also arrange the time between chargeings to suit your convenience. Illustrated above is a section of the master chart showing Prest-O-Lite "A" Batteries for 5-volt tube sets. If your set has these tubes, you will find, in this chart, the Prest-O-Lite "A" Battery that fits it exactly. Two sizes are recommended, but the larger capacity battery will be found more desirable unless facilities for frequent and easy charging are provided. (The days between chargeings are based on an average use

of your set of three hours a day.) Thousands of radio dealers have the complete chart, showing you also how to select "B" Batteries, as well as "A" Batteries for peanut tube sets. You'll prefer Prest-O-Lite Batteries because of their special features designed for better radio reception. Improved separators and plates insure steady, unvarying current and years of life. They're easy to recharge and priced to offer you remarkable savings at from \$4.75 up.

See the Prest-O-Lite Chart at your dealer's—or write for booklet, "How to fit a storage battery to your set—and how to charge it."

THE PREST-O-LITE CO., INC., INDIANAPOLIS, IND.

New York

San Francisco

In Canada: Prest-O-Lite Company of Canada, Ltd., Toronto, Ont.





For any Circuit

Prompt shipment can be made on tested, standard apparatus of the following manufacture:

- E. I. S., Inc.
- General Radio
- Ultradync
- Sangamo Electric
- Benjamin Electric
- Allen Cardwell
- Dubilier
- Weston
- Jewell
- Western Electric
- Radio Corporation
- Music Master
- Cutler Hammer
- Federal
- Willard
- Formica
- Magnavox
- Amer Tram
- Acme
- Frost
- Kallogg

Pressley Circuit

as described in Popular Radio. We furnish parts as specified.

Pliodyne

6 tubes—two stages tuned radio frequency detector and three stages audio frequency amplification, the famous Golden Leutz model—Completely constructed.

Price, without accessories . . . \$60

Super-Heterodyne C-7

Model C-7, the Long Distance Concert Receiver
With a Telephone Range of 3,000 Miles

FEW of the so-called new "circuits" or modifications of standards approach the C-7 in efficiency—for long range, for high audibility, for selectivity. Experimenters' Information Service design. *Seven tubes give the result of ten* because this model allows signals to be regenerated and heterodyned through radio frequency amplifier.

E. I. S. Model . . . All material we furnish is endorsed and recommended by the designers.

Using the finest apparatus and building to Naval standards, Model C-7 has a telephone range of 3,000 miles.

Norden-Hauck Price List Saves You Money

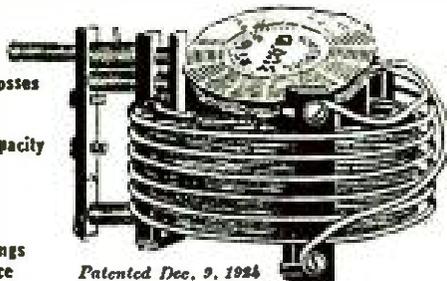
Free Information—Write for descriptive matter and price list. Our service is as near as your mail box. Full Stock on Hand—We carry complete stocks of laboratory tested apparatus for immediate shipment.

NORDEN, HAUCK, INC. Engineers . Office and Laboratories
1617 Chestnut St., Philadelphia

Globe LOW-LOSS TUNERS

Loses Nothing
Tunes every radio
impulse the aerial
receives

- No Metal
- No Eddy Current Losses
- Little Insulation
- Low Distributed Capacity
- Large Wire
- Self Supporting
- Anti-Capacity Windings
- Low R. F. Resistance



Patented Dec. 9, 1924

GET ORIGINAL GLOBE COILS

- Standard Tuner (Broadcast Range) \$7.00
- Short Wave (35-135 Meters) \$7.00
- For Superdyne Circuit \$8.50
- R. F. Transformer \$6.00

Circular on Request. Dealers and Jobbers Write.

Globe Radio Equipment Co.
217 WEST 125th ST., N. Y. C.

"The Knobs can't come off"

"Read 'Em" BINDING POSTS

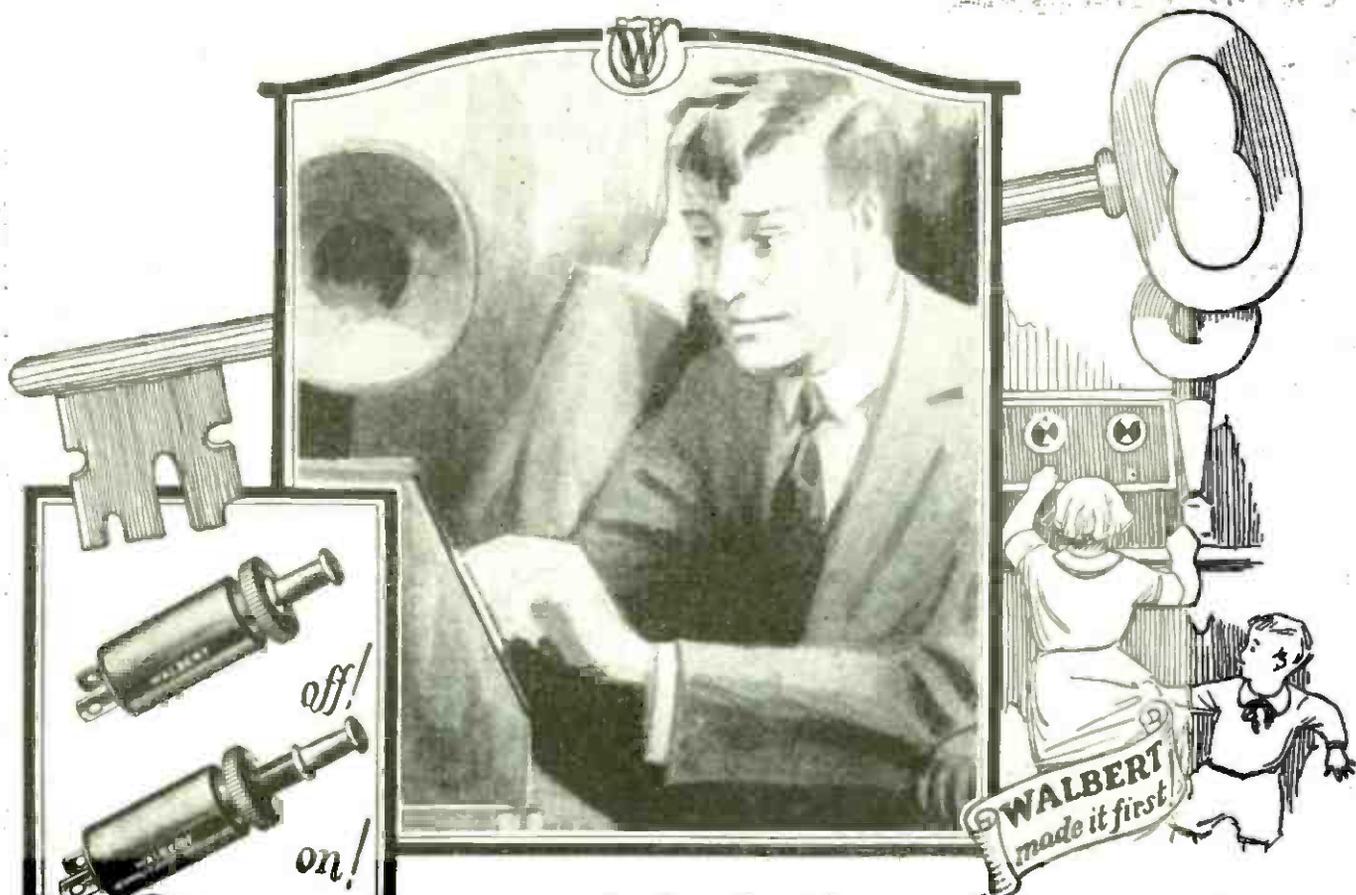
18
Styles
Engraved
Ready for
Immediate
Delivery in
Any Quantity



Made by
the Originators
of High Grade
Engraved
Terminals
Fully Protect-
ed by Patents

The Utmost in Quality and Appearance
at the Lowest Price—15c

THE MARSHALL-GERKEN CO.
TOLEDO, OHIO



And then he

LOCKED

his set!



Locked!

A Battery Switch Plus!

1. Easily Installed—One-hole mounting.
2. Compact—Requires less room behind panel than any other switch.
3. Sturdy, Simple—Can't get out of order.
4. Noiseless—Positive wiping contact; can't wear out.
5. Shockproof—Shell mounting and key-handle insulated.
6. Inexpensive—Costs less than a good plain battery switch.

SILENT night. A chance to get some real DX stations—and there somebody had left his set on all day!!! Not enough "A" Battery power to bring in the locals.

That's what happened to H. M. D.—and why he replaced his old Battery Switch with a Walbert LOCK-SWITCH, the original locking Battery Switch!

There's no chance for any one meddling with your set when the key to the Walbert LOCK-SWITCH is in your pocket. *Your set is locked and off!*

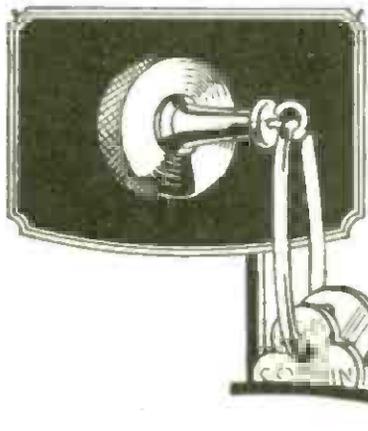
Play safe! Put a Walbert LOCK-SWITCH on your set tonight. It will give you silent and efficient filament control and absolute protection to your tubes and batteries. At your dealer or sent postpaid on receipt of purchase price.

Walbert LOCK-SWITCH	50c	Gold Plated	65c
Nickel Plated		Extra key with key ring attachment	20c

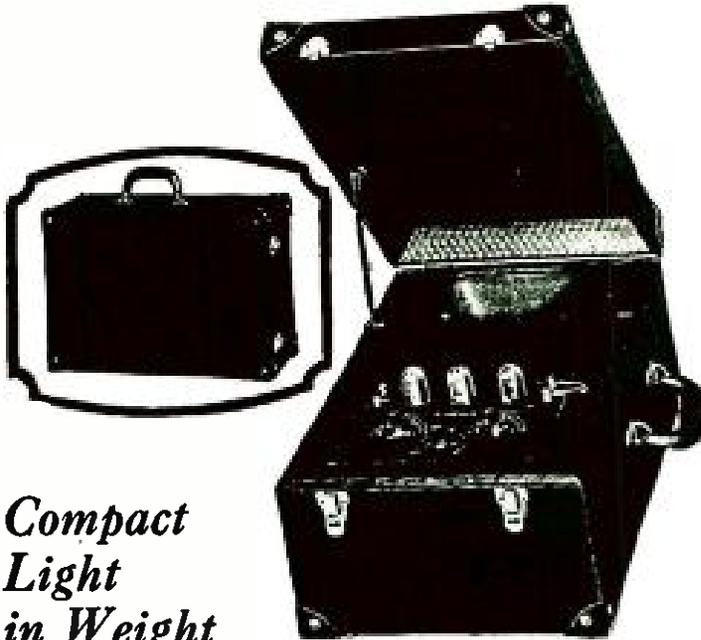
Jobbers and Dealers: Write for Discounts

WALBERT MANUFACTURING CO.
933 Wrightwood Ave., CHICAGO, U. S. A.

WALBERT
LOCK SWITCH



Introducing the ECHOPHONE Portable



**Compact
Light
in Weight
Yet No Sacrifice
In Volume \$75.00**

Without Tubes or Batteries

ECHOPHONE "3"
An exceptionally powerful 3 tube set. Uses dry batteries. Two dial tuning. Range 1800 to 2000 miles. Without tubes and batteries \$50.

ECHOPHONE "4"
A long distance 4-tube receiver of unusual selectivity. Non-radiating—clear toned—easy tuning. Operates on dry batteries. Without tubes or batteries, \$75.

An ideal portable receiving set—weighs only 30 lbs. completely equipped—size 9" x 12½" x 18". Uses a standard 60-foot aerial which automatically winds on a spring reel fitted into a special compartment of the case. This feature permits the convenience of portability without any sacrifice in efficiency. The built-in loud speaker unit reproduces all sounds with an unusual clarity and mellow tone.

Handsomely finished in Du Pont Leather—sturdy construction for severe vacation service. With Echophone "3" receiving unit \$75.00, with Echophone "4" unit \$98.00. Those who already have either of the Echophone cabinet receivers may secure the case complete for \$30.00.

Ask your dealer to show you this set. In the meantime write for descriptive folder.

ECHOPHONE RADIO, Inc.
1120 N. Ashland Ave., Chicago, Ill.

ECHOPHONE RADIO SHOP
Long Beach, Cal.

ECHOPHONE SALES CO.
156 2nd St., San Francisco, Cal.

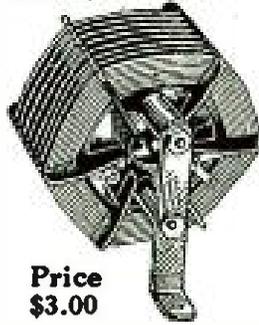


ECHOPHONE

Storage Battery Results at Dry Cell Cost

The Andrews Paddlewheel-Coil

Pats. Pend.



**Price
\$3.00**

A new low-loss coil of ideal characteristics for use with many different types of circuits. No dope used on windings. Moisture proof and unaffected by climatic changes. Has exceptionally high ratio of inductance to resistance.

Your results will be greatly improved by using this superior coil. Its exclusive construction assures maximum amplification, minimum distortion and much greater selectivity.

This coil which is the type employed in the Andrews Deroanadyne Receiver is manufactured under license from the Andrews Radio Company.

Write for full information regarding this wonderful new coil, its characteristics and its uses

DUO-SPIRAL FOLDING LOOP

A special model for every circuit. Easily portable. Rotates on base which has silvered dial graduated for calibration. Handle permits adjustment without body capacity effect. Handsomely finished in silver and mahogany. Write direct, if your dealer cannot supply you.



**Price
\$8.50**

Pats.
Pend.

Radio Units Inc.

1301 First Avenue

Maywood, Ill.

Perkins Electric, Ltd., Montreal

ARROW BATTERY SLASHES Prices

Prices Smashed!
Quality Not Sacrificed **TO CONSUMERS**

Here is real battery quality, guaranteed to you, at prices that will astound the entire battery-buying public. Order direct from factory. Put the Dealer's Profit in your own pocket. You actually save much more than half, and so that you can be convinced of true quality and performance, we give a **Written Two-Year Guarantee**

Here is your protection! No need to take a chance. Our battery is right—and the price is the lowest ever made. Convince yourself. Read the prices!
Special 2-Volt Radio Storage Battery, \$3.75
Special 4-Volt Radio Storage Battery, 6.00
6-Volt, 60 Amp. Radio Storage Battery, 7.00
6-Volt, 80 Amp. Radio Storage Battery, 8.00
6-Volt, 100 Amp. Radio Storage Battery, 9.50
6-Volt, 120 Amp. Radio Storage Battery, 11.50
6-Volt, 140 Amp. Radio Storage Battery, 13.00

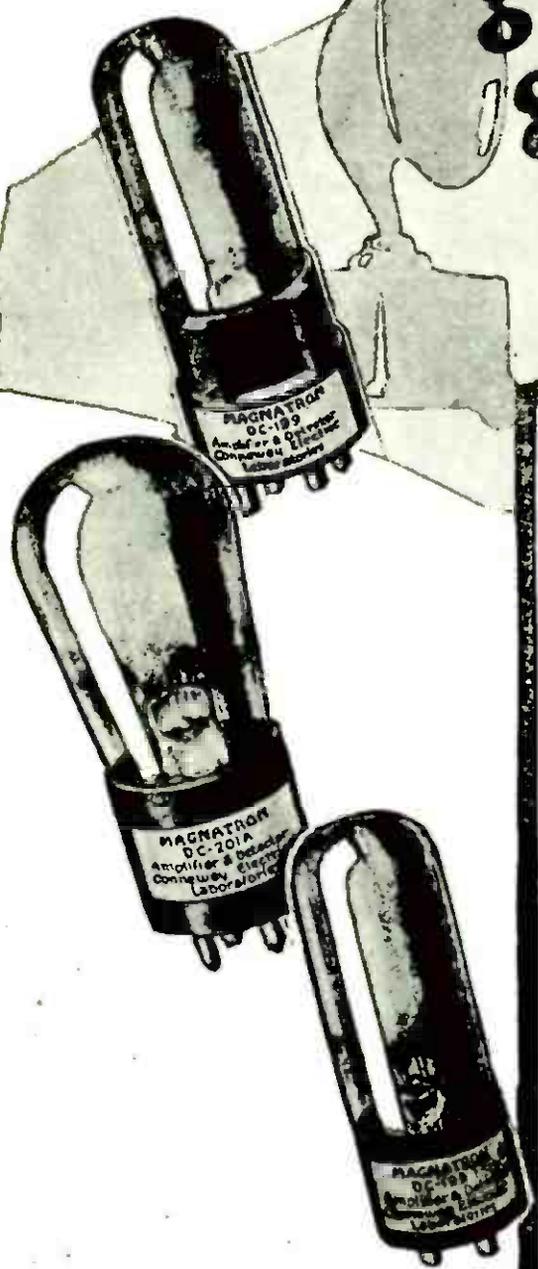
We ask for no deposit. Simply send name and address and style wanted. Battery will be shipped the day we receive your order Express C. O. D., subject to your examination on arrival. Our guarantee accompanies each battery. We allow 5% discount for cash in full with order. You cannot lose! Act quick. Send your order today—NOW.

Arrow Battery Co.
1215 South Wabash Ave.

Dept. 7 Chicago, Ill.



good tubes
for a
good set



MAGNATRONS have reached that degree of excellence where the mere name is synonymous with the very best in vacuum tubes. You have but to use MAGNATRONS to form the same opinion.

MAGNATRONS have received the unqualified approval of radio fans and radio engineers alike. And small wonder—when you realize that the design and manufacture of MAGNATRONS is carried on by an organization of men who have devoted a decade and more to vacuum tube problems.

MAGNATRONS are made in three types: the DC-201A, the DC-199 with large base, and the DC-199 with miniature base. They all list at \$3.00. Your dealer will gladly recommend all of them to you.

Magnatrons are manufactured and guaranteed by the Conneway Electric Laboratories New York City.

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MORE THAN MATCHED!



A Precision of
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VICTOREEN SUPER KIT

**The Master
of Super
Heterodyne Receivers**

has a sharper tuning curve. No interstage oscillation.
No matching of tubes.

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All transformers are adjusted and matched to a guaranteed precision of $\frac{1}{4}$ of 1%. That is why we say: "An achievement in radio yet to be equalled." (Pat. Pend.)

Sold under a money back guarantee. **\$37.00**

(In wooden box as illustrated, \$38.50)

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Write for one of our hookup diagrams and list of parts for an eight tube Super Heterodyne set

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RADION

The Supreme Insulation

Built-in Horn

MOULDDED of Radion, without metal. Insures remarkable clarity and purity of tone. Brings forth enough sound to fill any room yet is small enough to build into most cabinet sets. Cap to fit your own phone unit. \$3.00 with cap.

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Radion V-T Socket



Radion Dial

FORE'S MASTER FORE BATTERY CHARGER



Charges Radio A-6 Volt and 48 Volt B Battery in Series or 2-48 Volt B Batteries in Multiple Any Charging Rate.

Charges 6-Volt Automobile Batteries. The Fore Battery Charger will make anyone proud of his radio set.

Call at your jobber or dealer for them or write either address below for advice as to where they can be obtained.

Manufactured by
Fore Electrical Mfg. Co.
5255 N. Market Street
St. Louis, Missouri

Sales Department
The Zinke Company
1323 S. Michigan Blvd.
Chicago, Illinois

SUPERIOR



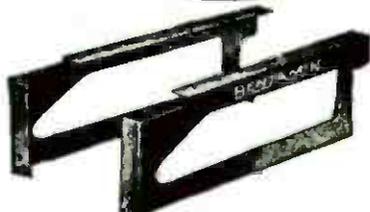
Cle-Ra-Tone Socket

RADIO



Battery Switch

PARTS



Radio Brackets

FOR



Grid Leak Panel

BETTER



Cle-Ra-Tone Gang Socket and Mounting Shelf

RADIO SETS



Cle-Ra-Tone Sockets

Shock Absorbing — Spring Suspended

Tube holding element "floats" on perfectly balanced springs. Spring supports are not affected by stiff bus wiring. Molded parts of genuine Bakelite. Keeps your tubes sensitive only to the radio waves. Keeps microphonic disturbances, due to jars and vibration, out of the receiving set. The Cle-Ra-Tone Socket marked so great an advance in the mechanics of radio reception that it is the choice of the leading manufacturers of high-class sets, and is recommended by the foremost engineers for their most popular hook-ups.

8645 For Standard Base Vacuum Tubes, \$1
8646 For UV-199, etc., Tubes 1

Radio Battery Switch

Lightest and neatest switch made. Mounts in single 1/4 inch panel hole. No spacer washers required. Push-pull single contact features give positive contact. When it's in it's off, avoiding accidental cutting in of battery.

No. 8640, \$0.30

Radio Bracket

Gets the wiring out of sight. Adaptable for standard cabinet mounting. No. 8629, per pair, \$0.70

Grid Leak Panel

With the bracket, provides a safe, secure mounting for this important element.

No. 8632, each, \$0.15

Cle-Ra-Tone Gang Socket and Mounting Shelf

Simplifies construction of the larger receiving sets, and may be used with most of the latest hook-ups. Consists of Cle-Ra-Tone Shock-Absorbing Sockets attached to Bakelite mounting shelf with set of binding posts and markers. There is adequate space for mounting of accessory equipment.

Standard VT Sockets	or UV-199, etc. Sockets	Dimensions of Shelf	No. of Sockets	
8613	8603	7 7/8" x 4 1/2" x 1/4"	3	\$5.50
8615	8605	17 1/4" x 4 1/2" x 1/4"	5	10.50
8626	8606	17 1/4" x 4 1/2" x 1/4"	6	11.25
8627	8607	17 1/4" x 4 1/2" x 1/4"	7	12.00

Ask for Benjamin Radio Products at your dealer's or write us

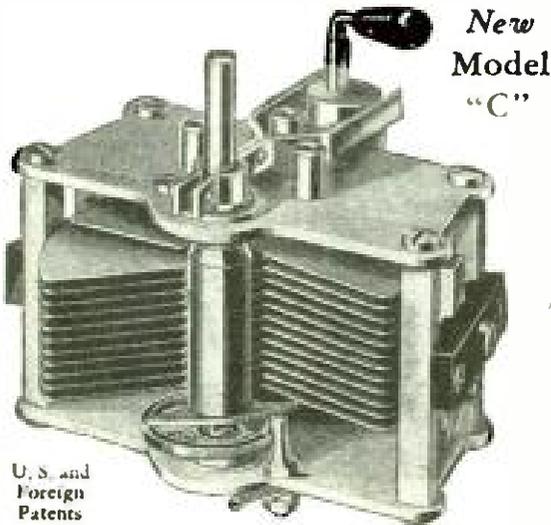
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For Better Radio
Hammarlund
 PRECISION
CONDENSER



U. S. and Foreign Patents

THE more you know about the technical requirements of radio, the more you appreciate the technical refinements of the Hammarlund New Model "C" Condenser.

It is an instrument of laboratory precision sold at a popular price by the better radio dealers. All capacities; plain and vernier.

HAMMARLUND MANUFACTURING CO.
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9 points of superiority

- 1—Soldered brass plates, chemically treated against corrosion; perfect alignment.
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- 3—Adjustable ball-bearing rotor shaft, grounded through metal end-plates.
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- 6—Rugged, compact construction; cannot warp.
- 7—Micrometer cam-vernier moves all plates; knob or lever control; no backlash.
- 8—Takes any size dial.
- 9—The product of 14 years' experience, making precision instruments.



5 TUBE RADIO SET \$38.50
 COMPLETELY ASSEMBLED



10 DAYS FREE TRIAL Coast to Coast
 Direct from factory to you at less than Dealer's Cost. Marvelous 5 tube radio set.

Latest and most efficient TUNED RADIO FREQUENCY circuit. Approved by America's Leading Radio Engineers and the Institute of Standards. Easy to operate. Dials can be logged. Tune in your favorite stations instantly, on the same dial numbers every time. No guessing. Mr. Howard of Chicago said, "While 5 Chicago Broadcasting Stations were on the air, I tuned in 17 out-of-town stations from 40 to 1,000 miles away, on my loud speaker, very loud and clear as though they were all in Chicago."

Description: 5 tube set. Comes completely assembled in beautiful mahogany cabinet, size 25 x 7½ x 7½. Has 2 stages Tuned Radio Frequency, Detector and 2 stages Audio Frequency. Equipped with the highest quality, approved standard low-loss parts. Genuine Bakelite Panel, Bakelite dials. Use any standard tubes and batteries.

10 DAYS' FREE TRIAL

Don't miss this wonderful opportunity to obtain the marvelous METRODYNE SUPER FIVE direct from the factory. **REGULAR VALUE \$100.** Our factory price **ONLY \$38.50**, assembled in a beautiful mahogany cabinet that will add to the appearance of the room. Our liberal **FREE TRIAL OFFER** gives you an opportunity to try the set in your home for ten days before deciding to keep it.

Metro Electric Co.
 400 N. Michigan Ave., Dept. 78, Chicago, Ill.
 Send me further details of your Metrodyne Super-Five Radio Set and Free Trial Offer.

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D-201 A., D-200, D-199, D-12, in standard sizes to fit any socket. The internationally famous

DUTCH RADIO VALVE will be mailed for \$2.25 plus postage

Three sent for \$6.50 plus postage (any type).

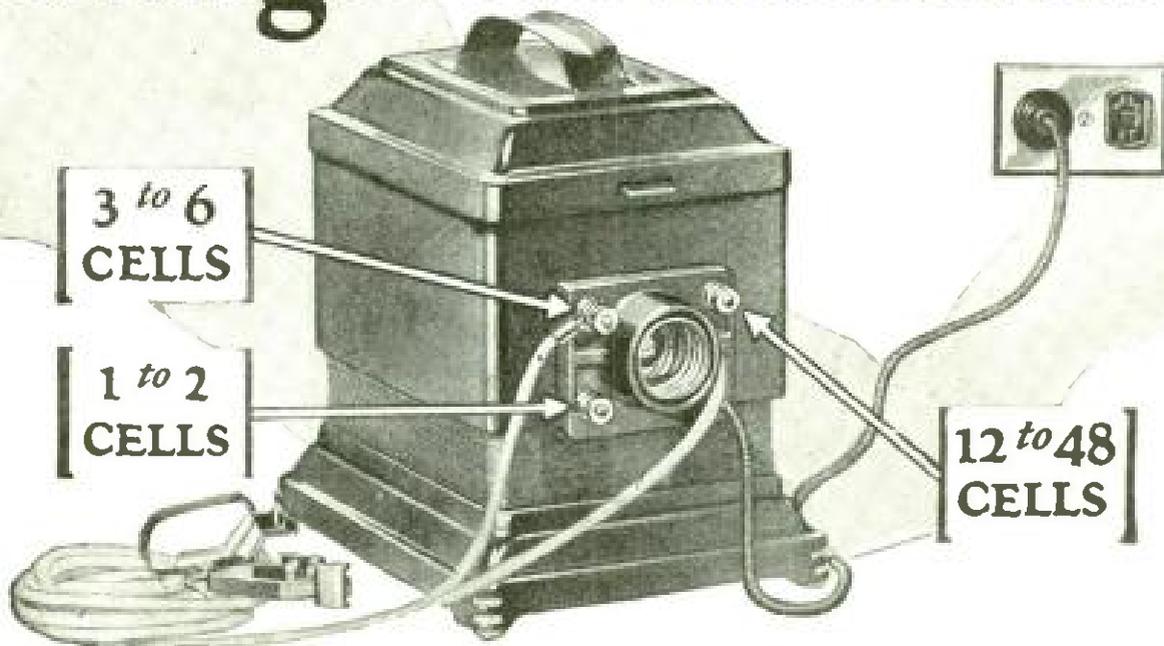
Approved by Popular Radio Laboratories.

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 D. R. V. IMPORTING CO.
 515 Orange St. Newark, N. J.

FOR ANY CIRCUIT IN ANY SET "YOU CAN'T BEAT THE DUTCH"

New Model Tungar charges all batteries



On the back of the Tungar, there are three terminals. Slip the wire into one and charge your radio "A" battery, 2 or 4 volt size. Use the second to charge your radio "B" battery, 24 to 96 volt size. Or the third will charge a 6 volt "A" battery or 6 to 12 volt auto battery.

Just clip on the Tungar, and plug it into any electric outlet in the house or garage. Then leave it overnight to charge while you sleep. Very simple.



The Tungar is a G-E product, developed in the great Research Laboratories of General Electric.

The New Model Tungar charges radio A and B storage batteries, and auto batteries. Two ampere size (East of the Rockies) \$18.00

The Tungar is also available in five ampere size (East of the Rockies) . . \$28.00

60 cycles—110 volts

Tungar

Reg. U. S. PAT. OFF.

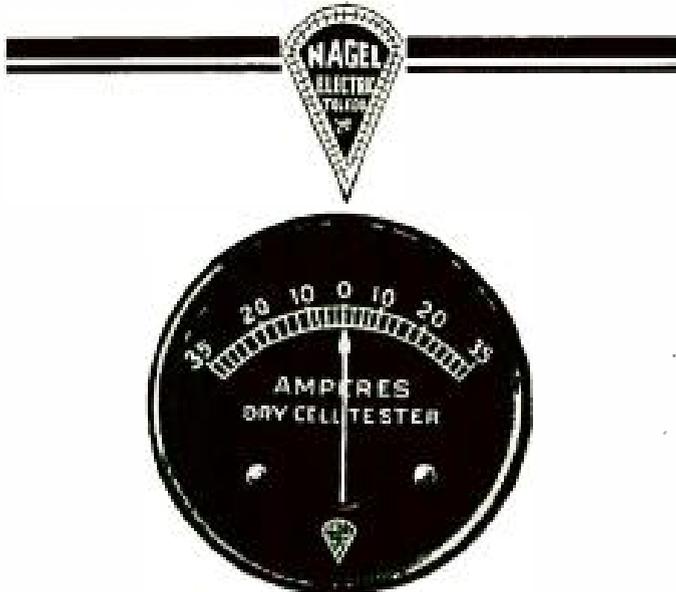
BATTERY CHARGER

Tungar—a registered trademark—is found only on the genuine. Look for it on the name plate.

Merchandise Department
General Electric Company
Bridgeport, Conn.

GENERAL ELECTRIC

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY



No. 41—About 3/4 actual size

How strong are your dry cells?

You can't tell by looking at them. But this Nagel Ammeter will give you the amperage in a second!

A new "A" dry cell should deliver about 35 amperes on short circuit. It will continue to give satisfactory service until the reading drops to about 15 amperes. Below this point the operation of any radio set will be seriously impaired.

Buy a Nagel Ammeter—not a new venture for this firm which has been manufacturing measuring instruments for years. Over 6,000,000 are in daily use on automobiles of every make.

See your dealer or write

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HIGH-RESISTANCE VOLTMETERS
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HOT MOULDED INSULATIONS

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The Loudspeaker Unit
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POSITIVE control of volume by turning the knob on the back of the Royalfone Unit. You can adjust the tone of any program to your own satisfaction without touching the dials of your set. Transfer your phonograph into an A1 loudspeaker with this remarkable unit; your dealer will give you a demonstration.

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The Royalfone Headset

The Royalfone Headset is designed especially for DX reception. Bell like tone. List Price

\$4.50

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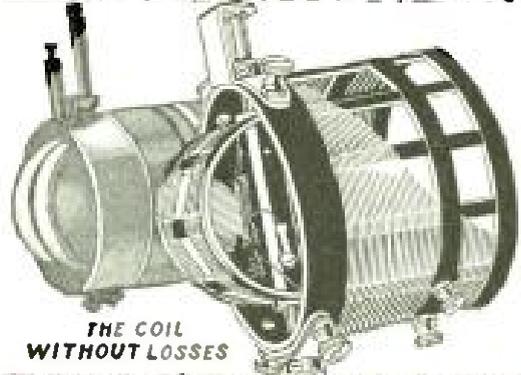
ROYAL ELECTRICAL LABORATORIES

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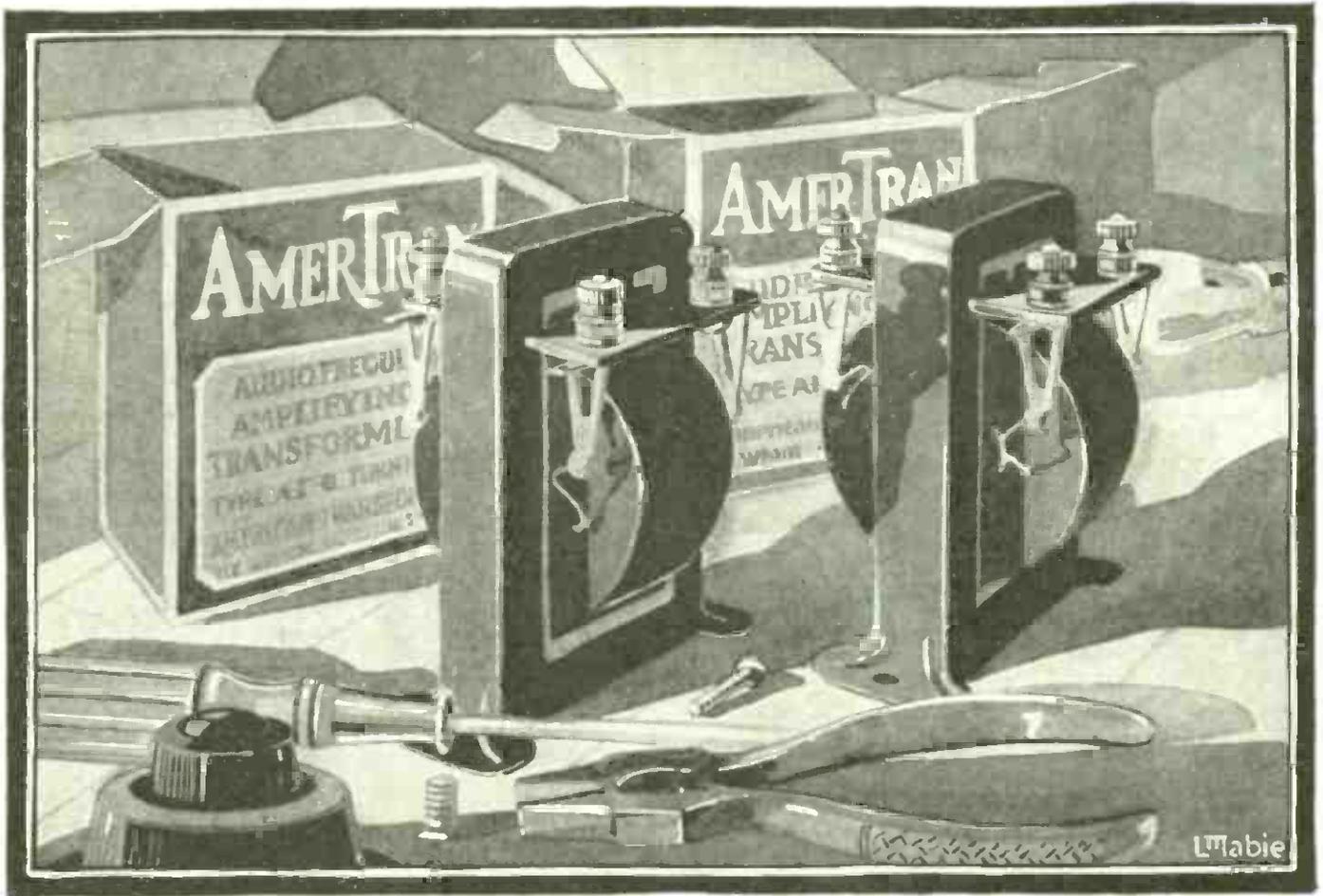


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Replace your old Uncle Sam with a new type and you will increase your volume from 50% to 180%, also improve selectivity. If a five days' trial does not prove this, your dealer will refund your money.

FREE Ask your dealer or send us four cents in stamps for wiring diagrams of circuits in which this remarkable coil can be used.

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IMPROVE YOUR SET!

The sure way to do it is to rebuild the audio side and use a pair of AmerTrans. Do this, and the utmost in volume, clarity and tone quality will result.

AmerTran is the product of over twenty-four years' specialized experience in transformer building.

Increasing appreciation of its quality comes with continued use.

AmerTran is made in two types, one quality—
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Send for leaflet
giving useful
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Why it is Better

"MASTER of Every Note in the Orchestral Range" is the *proven* claim of the Federal No. 65 Audio Frequency Transformer!—Volume without distortion is the basis for the beauty of Federal Tone

From its oversize locking nuts to its heavy brass mounting feet the Federal No. 65 Transformer incorporates the same engineering skill that has made Federal the recognized leader in electrical communication apparatus since 1890.

Insist upon Federal parts for your "pet" hook-up. There are over 130 standard parts bearing the Federal iron-clad performance guarantee.

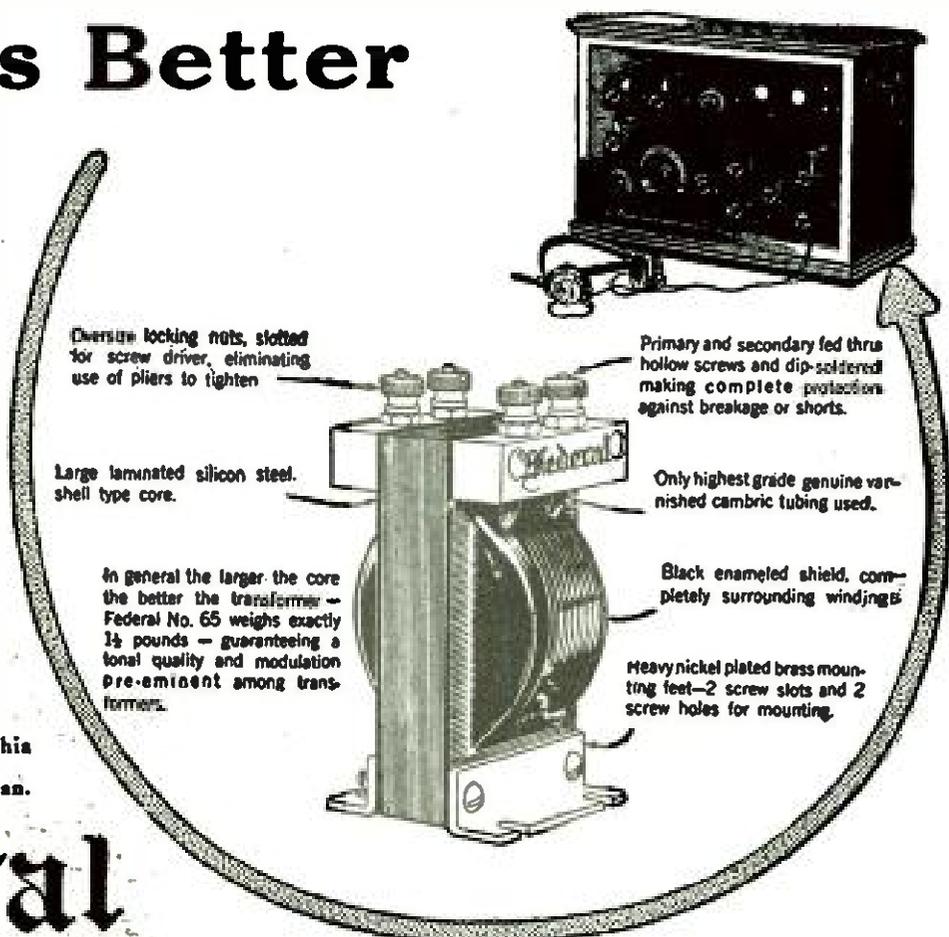
FEDERAL TELEPHONE MANUFACTURING CORP.

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Federal
Standard RADIO Products



Oversize locking nuts, slotted for screw driver, eliminating use of pliers to tighten

Primary and secondary fed thru hollow screws and dip-soldered making complete protection against breakage or shorts.

Large laminated silicon steel shell type core.

Only highest grade genuine varnished cambric tubing used.

In general the larger the core the better the transformer—Federal No. 65 weighs exactly 1½ pounds—guaranteeing a tonal quality and modulation pre-eminent among transformers.

Black enameled shield, completely surrounding windings.

Heavy nickel plated brass mounting feet—2 screw slots and 2 screw holes for mounting.



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Loud Speaker

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Natural Tones With Volume

A Reproducer that Satisfies
Aluminum Sound Column. 14 inch
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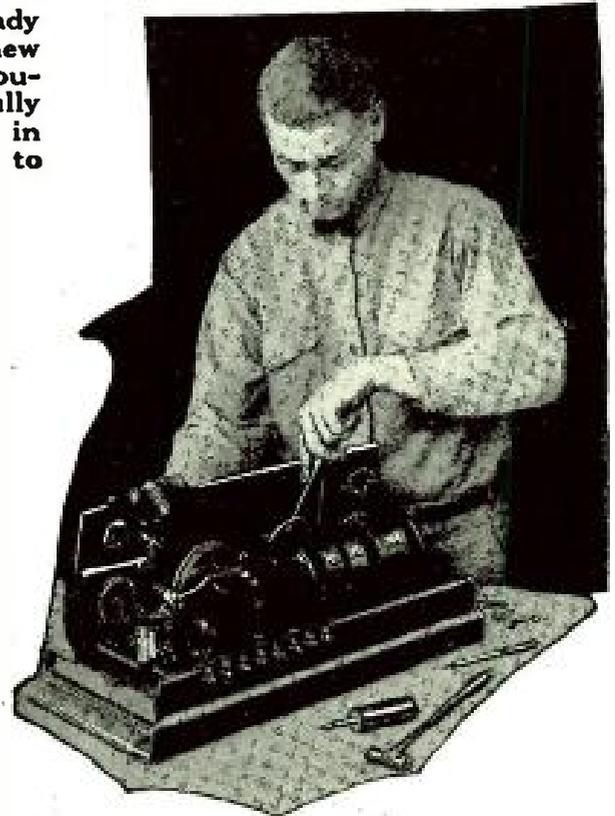
THE astounding growth of Radio has created thousands of big money opportunities. Millions of dollars were spent during the past year on Radio, and thousands of young men are needed right now to meet the ever increasing demand of work.

Men are needed to build, sell and install Radio sets—to design, test, repair—as Radio engineers and executives—as operators at land stations and on ships traveling the world over—as operators at the hundreds of broadcasting stations. And these are just a few of the wonderful opportunities.

Easy to Learn Radio at Home in Spare Time

No matter if you know *nothing* about Radio now, you can quickly become a radio expert, by our marvelous new method of practical instruction—instruction which includes all the material for building the latest up-to-date Radio apparatus.

Scores of young men who have taken our course are already earning from \$75 to \$200 a week. Merle Wetzel of Chicago Heights, Ill., advanced from lineman to Radio Engineer, increasing his salary 100% *even while taking our course!* Emmett Welch, right after finishing his training started earning \$300 a month and expenses. Another graduate is now an operator of a broadcasting station PWX of Havana, Cuba, and earns \$250 a month. Still another graduate, only 16 years is averaging \$70 a week in a Radio store.



The National Radio Institute is America's Pioneer Radio Home Study School—established in 1914. Our course is the absolutely complete one now being offered which qualifies for a government first class commercial license. It gets you the bigger paying jobs in Radio.

PAY INCREASES OVER \$100 A MONTH



(Signed) A. N. LONG,
Greensburg, Pa.

I am averaging any where from \$75 to \$150 a month more than I was making before enrolling with you. I would not consider \$10,000 too much for the course.

DOUBLES SALARY

I can very easily make double the amount of money now than before I enrolled with you. Your course has benefited me approximately \$3000 over and above what I would have earned had I not taken it.



T. WINDER,
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Wonderful Opportunities

Hardly a week goes by without our receiving urgent calls for our graduates. "We need the services of a competent Radio Engineer" — "We want men with executive ability in addition to Radio knowledge to become our local managers"—"We require the services of several resident demonstrators"—these are just a few small indications of the great variety of opportunities open to our graduates.

Take advantage of our practical training and the unusual conditions in Radio to step into a big paying position in this wonderful new field. Radio offers you more money than you probably ever dreamed possible—fascinating easy work—a chance to travel and see the world if you care to or to take any one of the many radio positions all around you at home. And Radio offers you a glorious future!

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Learn more about this tremendous new field and its remarkable opportunities. Learn how you can quickly become a Radio expert and make big money in Radio.

We have just prepared a new 32-page booklet which gives a thorough outline of the field of Radio—and describes our amazing practical training in detail. This Free Book, "Rich Rewards in Radio," will be sent to you without the slightest obligation. Mail coupon for it *now!*

For a short time we are offering a reduced rate to those who enroll at once. Act promptly and save money. National Radio Institute, Dept. 32EB, Washington, D. C.



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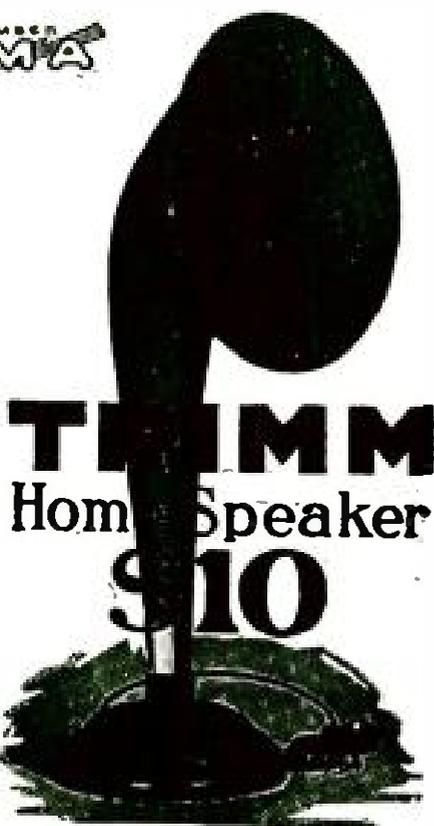
Please send me without the slightest obligation your Free Book, "Rich Rewards in Radio," and full details of your special Free Employment Service. Please write plainly.

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Address.....

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

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TRIMM Home Speaker out-talks other speakers costing twice as much. Beautiful tone, volume and clearness combine with the low price of \$10 to give the biggest value in radio. Factory regulated diaphragm assures maximum volume and perfect tone.

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RADIO Storage "B" Battery
 12 Cells 24 Volts
Lasts Indefinitely—Pays for Itself
 Economy and performance unheard of before. Recharged at a negligible cost. Approved and listed as Standard by leading Radio Authorities, including Pop. Radio Laboratories, Pop. Sci. Inst. Standards, Radio News Lab., Lofax, Inc. and other important institutions. Equipped with Solid Rubber Case, an insurance against acid and leakage. Extra heavy glass jars. Heavy zinc plates. *Order yours today!*
SEND NO MONEY Just state number of batteries wanted and we will ship day order is received. Extra Offer: 4 batteries in series (96 volts), \$12. Pay expressman after examining batteries. 5 per cent discount for cash with order. Mail your order now!
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 All equipped with Solid Rubber Base.

World FOR RADIO
 STORAGE BATTERIES
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BOSCH NOBATTERY
 "B" Current from the electric light socket. The Bosch No-Battery is a device which enables anyone to obtain from an electric light socket perfect and ample plate voltage for radio vacuum tubes. It takes the place of all "B" batteries and is decidedly more efficient, reliable, convenient and economical.
 Type BAN for AC current \$49.50
 Type BDN for DC current \$30.00
American Bosch Magneto Corporation
 Main Office and Works: Springfield, Mass.

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY

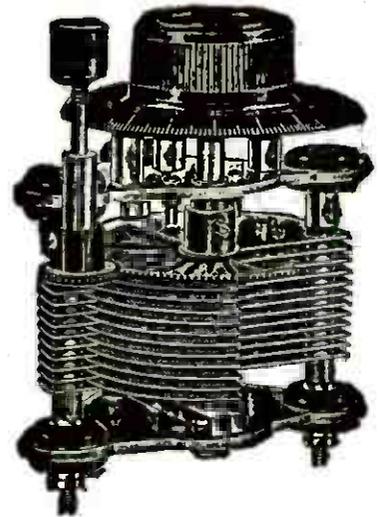
HEATH RADIANT

Non-Dielectric Condensers

*Contributing to the Popularity
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*Grounded
Metal End-Plates*



H EATH Condensers play an important part in the accuracy, easy tuning and range of this remarkable **Splitdorf Receiver**. The choice, by such an eminent manufacturer, of **Heath Condensers** is convincing evidence of thoroughgoing quality of both materials and workmanship and also of superior design. This sort of evidence is your best guide in the choice of condensers.

Permanently Flat Plates

Stamped under huge presses to absolute flatness, tempered to prevent warping.

Micrometer Geared Vernier

Ordinary tuning reduced by separate geared adjustment to hairbreadth distinction. We guarantee the Heath Vernier Condenser to be more highly selective than any condenser employing a vernier which actuates ALL of the plates.

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No. 24AV	24 Plate.....	5.50	4.85
No. 44AV	44 Plate.....	6.50	5.85

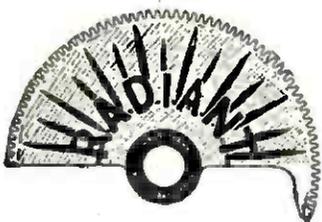
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Heath Sockets with the Exclusive Shock Absorber Feature, Price 75c.

Heath Genuine Bakelite Dials in 2, 3 and 4 Inch Sizes.

See the Heath Condenser at your dealer's

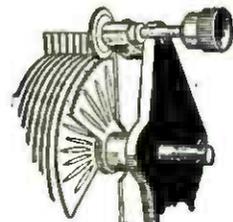
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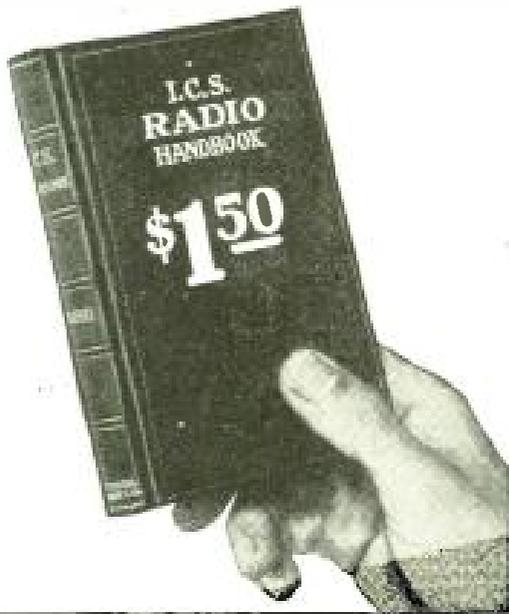


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Canadian Distributors: Marconi Wireless Telegraph Co. of Canada, Ltd.,
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Every Question ANSWERED for only \$1.50

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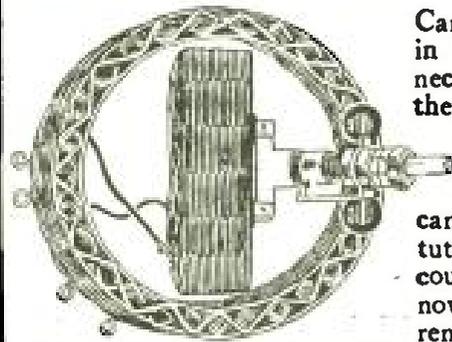
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Address.....

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"Radjo" Low Loss Tuner



Can be mounted in any position necessary to meet the wiring requirements of your present circuit and it can be substituted for any coupler you are now using. Lorenz system base-

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The three circuit tuner with a 180 degree movement of the rotor.

The single or double circuit tuner has the primary with eight taps as the stationary coil, with a 180 degree movement of the rotor.

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A new departure in radio apparatus. Designed for radio circuits exclusively with advantageous features possessed by no other jack on the market.

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- 12 months and "How to Build Your Radio Receiver" for \$3.00.
- 12 months and Set of "Simplified Blueprints" No. ... for \$3.00.
- 24 months for \$5.00.

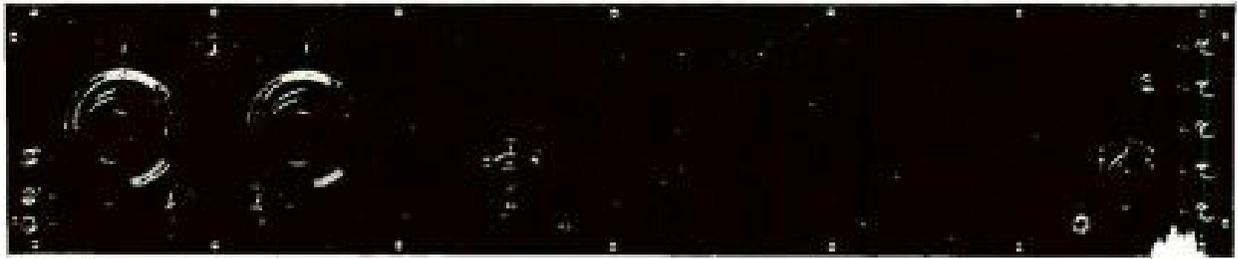
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THE NEW MODEL C-7

"The Rolls-Royce of Reception"



MODEL C-7 SUPER-HETERODYNE

Wave-length Range, 200 to 575 meters. Dimensions, 40 in. x 8 in. x 8 in.
 Tube Arrangement: Regenerative Detector, Oscillator, 2 Stages Radio, Detector, 2 Stages Audio

Important Today

THE EXPERIMENTERS INFORMATION SERVICE, Inc., has been recommending the Super-Heterodyne method of reception since the early part of 1922. In February, 1923, a Super-Heterodyne of our design was installed on the S.S. *Western World*, pier 1, Hoboken, N. J., in the cabin of Dr. Horatio Belt. On the voyage to Rio de Janeiro, Brazil, at a distance of 3,000 miles, southeast of New York, the entire Greb-Gardner fight was received from WJZ, with sufficient audibility for the entire cabin full of passengers to hear the bout, blow by blow, plainly. At 3,300 miles southeast of New York, an entire evening church service was received from Pittsburgh. At that time there was not another single firm advertising or advocating the Super-Heterodyne. Since then Mr. A. Ancieux, Engineer, Trarivia Elec de Arequipa, Arequipa, Peru, has reported consistent reception from KDKA, WDAP, WEA, WGY and others, a distance of over 5,000 miles, using a Model "C" Super-Heterodyne. The Pratt & Brake Corp., of New York City, sent a Model C to Rio de Janeiro which received American broadcast station at a distance of over 7,000 miles.

Practically all concerns now featuring Super-Heterodyne have copied our original Model C design, and to prove again that we are far in advance of competition, we present this Improved Model C-7 Super-Heterodyne as the *Most Sensitive, Most Selective*, and finest reproducing Broadcast Receiver that can be built.

7 Tubes Give the Results of 10

The Reason:—When regeneration is added to a one tube non-regenerative receiver the increased amplification is about equal to adding two stages of tuned radio frequency amplification. Heretofore it has been impossible to add regeneration in the 1st Detector of a Super-Heterodyne and accordingly this has been a big loss.

The new Model C-7 Super-Heterodyne has a special 1st Detector circuit with a split antenna inductance so arranged that normally the detector would oscillate continually. However, in addition, a neutralizing condenser is inserted in the circuit which gives absolute control of the oscillations to such an extent that the circuit can be adjusted to just below the oscillating point, as this adjustment gives the maximum regenerative amplification. The new circuit has a bias potential on the 1st Detector grid, in place of the usual grid leak and condenser, and this allows infinitely weak signals to be regenerated and heterodyned through the radio frequency amplifier, which an ordinary grid leak and condenser would block. On a weak signal the difference in sensitivity is very noticeable. Using a 22-foot indoor antenna in the suburbs of New York loud speaker reception has been obtained from KGO, Oakland, California. A normal range of 2,000 miles is easily obtained on an average small antenna at night under average conditions.

Blueprints giving all construction data \$1.00

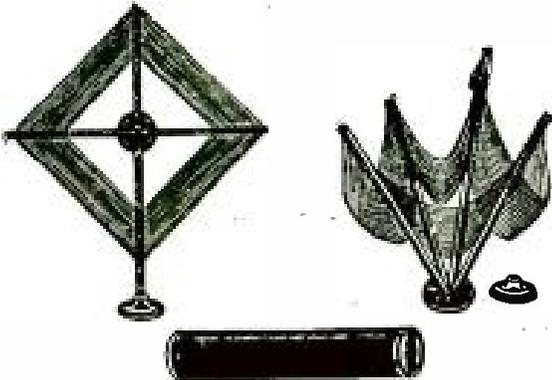
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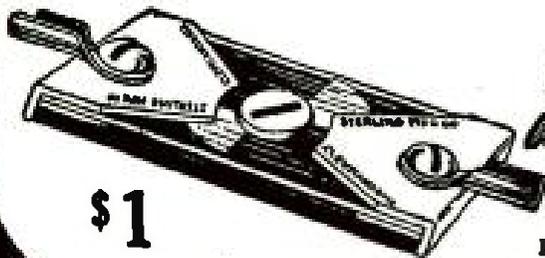
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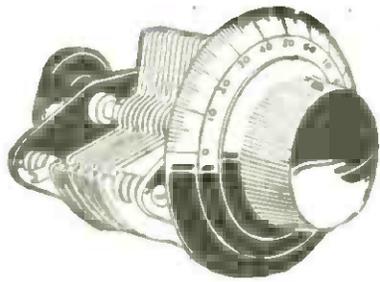
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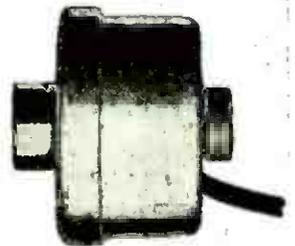
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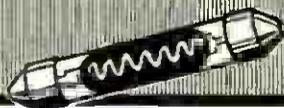
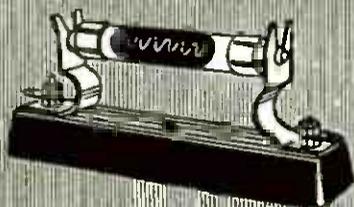
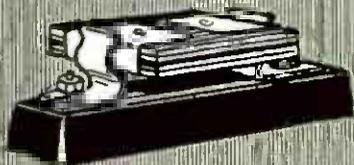
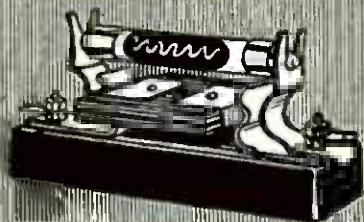
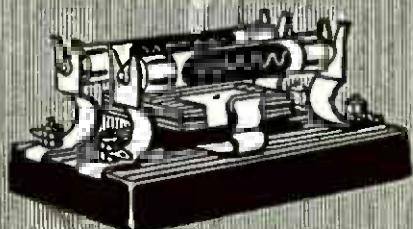
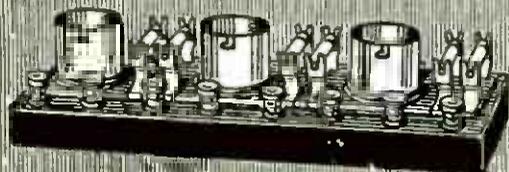
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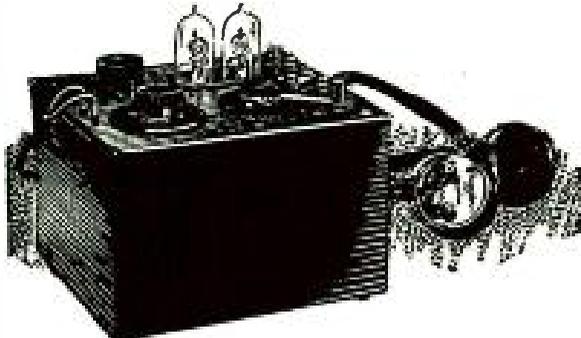
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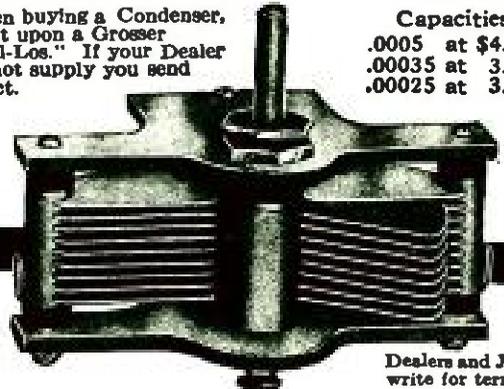
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7x21-8	5.00	6.25	7x36-8	8.00	10.00	7x24-10	6.45	8.00
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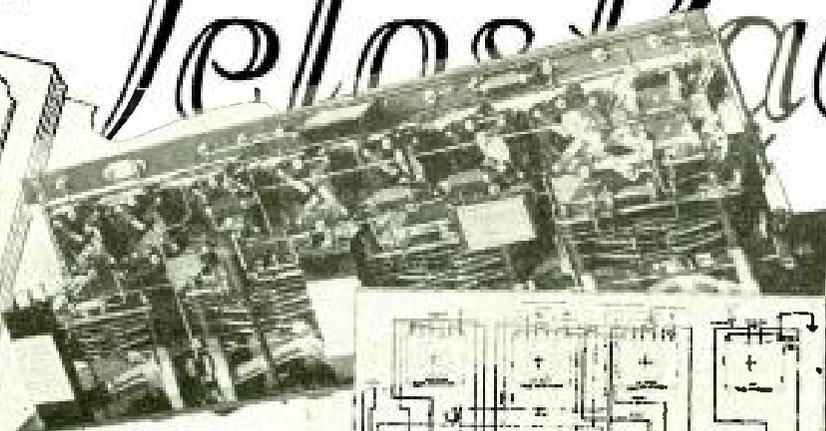
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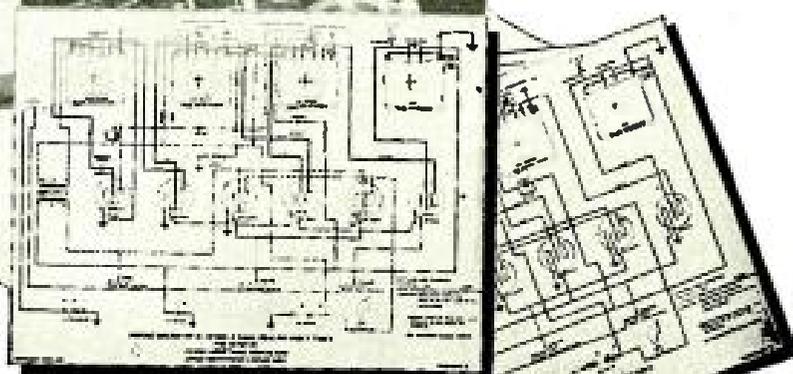
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Interior wiring of a typical Telos Set. Every step is clearly explained in the instruction book and diagrams.



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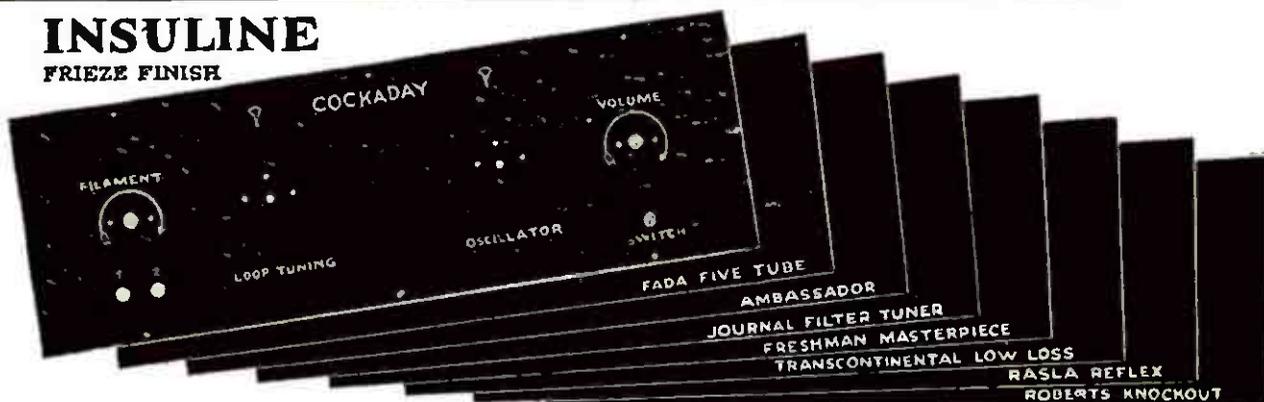
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(Continued from last month)

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Royal amplifies with Thordarsons!

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THEY SAY OF THE MICHIGAN:

12 "Gives any degree of volume desired—without distortion. Exceptionally mellow tone quality—a tone charm that eliminates harsh or mechanical notes."

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THORDARSON
Super
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Standard on the majority of quality sets

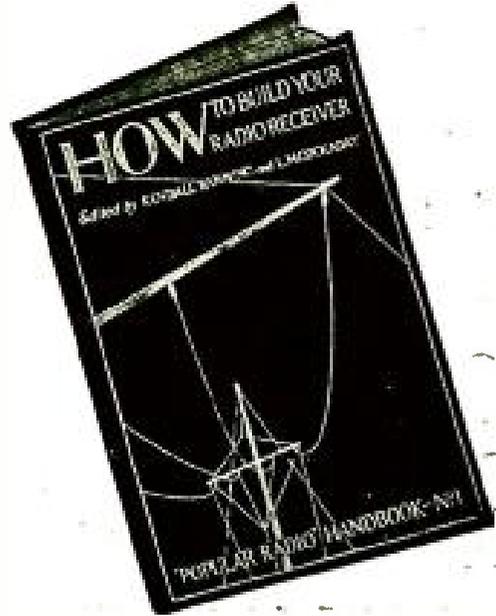
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The simplest up-to-date set for local broadcast reception. Approximate range, 15 miles, though distances up to 400 miles are not extraordinary. Gives clear signals on headset without distortion. No operating cost whatever.

THE HAYNES SINGLE TUBE RECEIVER

An efficient set that may be made by a novice at an approximate cost of only \$15 for parts. Simple to tune, selective, good audibility. Long distance range up to 1,000 miles on earphones. Six-volt storage battery and 2 1/2-volt "B" battery required, or may be adapted for dry cell and dry cell tubes.

A TWO-STAGE AUDIO-FREQUENCY AMPLIFIER

This instrument may be added to any set, crystal or tube, to strengthen the received signals, so that they will operate a loud-speaker. It is easy to construct, efficient and inexpensive, costing only \$15 for parts. Operates on the same "A" battery that is used on the vacuum-tube detector unit.

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A 3-tube set, famous for its high selectivity and beautiful tone. So neat and compact that it may be kept in a bureau drawer. Cost of parts about \$40. Receiving range approximately 1,500 miles on a loud-speaker. Operates on a 6-volt storage battery and two 45-volt "B" batteries, or may be adapted to dry cells and dry cell tubes.

A 5-TUBE TUNED RADIO-FREQUENCY RECEIVER

Two stages of tuned radio-frequency amplification, detector, and two stages of audio-frequency amplification are here employed so that the possibility of "oscillation and re-radiation" is eliminated. The set can be operated on a loop antenna and may be built at a cost of only \$90 for parts. Six-volt storage battery and two 45-volt "B" batteries required. Range about 1,000 miles on loop or indoor antenna and 2,500 to 3,000 miles on an outdoor antenna.

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Probably the most important contribution yet made to the equipment of the radio fan. A compact 5-tube set with a receiving range of over 3,000 miles. Cost of parts about \$95. Wave length range from 150 to 675 meters. Automatic tuning and power amplification. Maximum volume of sound, excellent reproduction and no interference. Requires a 6-volt "A" battery, three 45-volt "B" batteries, one 2 1/2-volt "B" battery and a 9-volt "C" battery.

THE REGENERATIVE SUPER-HETERODYNE RECEIVER

More sensitive, more selective and more simple to tune than any other 6-tube receiver yet developed. A three-section 6-tube set employing the Haynes Single Tube Receiver as tuner. May be further extended to a four-section, 8-tube set by the addition of the two-stage audio-frequency amplifier. The cost of parts approximates \$100. Range of 3,000 to 4,000 miles on a loud-speaker. Has been called the "Rolls-Royce" of radio receivers.

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627 West 43d Street, New York City

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New York City.

Offer expires
Mar. 20, 1925

Enclosed remittance of \$3.00 is payment in full for a 12 months' subscription for POPULAR RADIO and copy of "How to Build Your Radio Receiver" FREE.

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Check here and remit \$2.00 if you prefer POPULAR RADIO for 7 months only in combination with "How to Build Your Radio Receiver."

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BAKELITE combines properties which make it unique among insulating materials. It has high insulation value and great strength, resists both heat and cold, and is immune to moisture, oil and fumes. Bakelite is unaffected by time and use, and its color and finish are permanent.



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Radio has banished isolation. It has brought the music of opera and orchestra, the voices of statesmen and teachers into the cabin of the woodsman, the home of the farmer and to people everywhere.

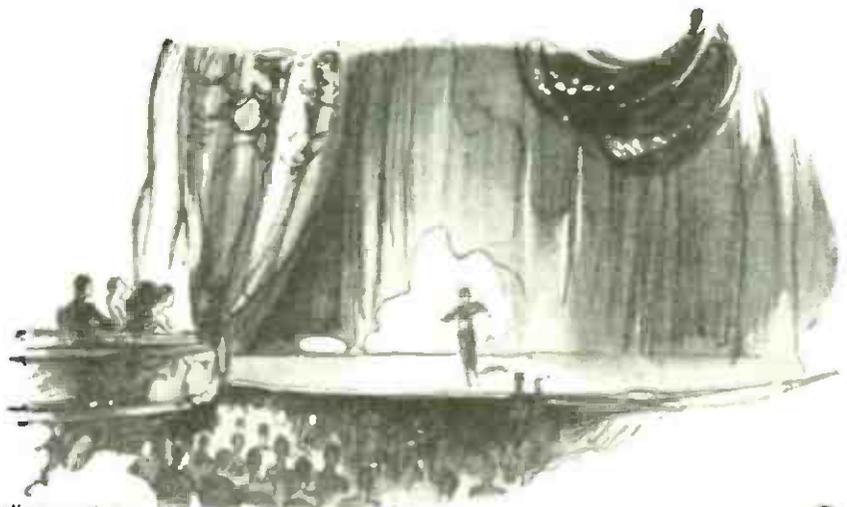
Bakelite is playing a vital part in this universal radio reception. It is used by over ninety-five per cent of the manufacturers of radio sets and parts, for they know that Bakelite insulation can always be depended upon to give superior results in service, in any climate and at any time of year.

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AUDIO TRANSFORMER

When your set is equipped with Supertran audio transformers you are assured faithfulness in reproduction, clarity, and freedom from all distortion together with great volume. The Supertran being shielded, is protected against damage to the coil while mounting.

\$6 At All Good Dealers
Write for Interesting Literature

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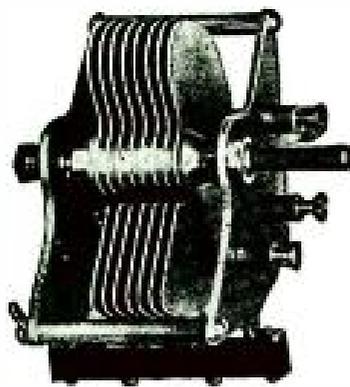
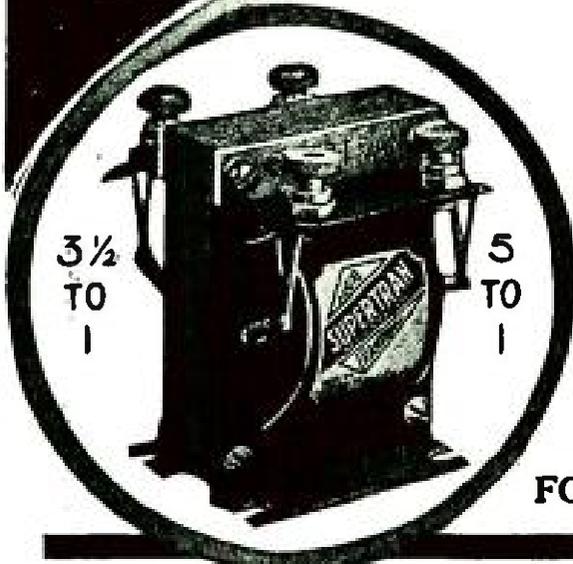
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**CONDENSERS
ARE UNSURPASSED**

100% low loss; grounded rotor; swedged in plates of logarithmic curved type; cone bearings front, ball bearings rear; special wipe contact rotor connections. Performance perfect. Type 3 star, \$4.00; Type 4 star, \$4.50; Type 5 star, \$5.50.

*Expert panel engraving for manufacturers.
Write for prices.*

HAIG & HAIG MFG. CO., INC.
Pioneer Condenser Builders Rochester, N. Y.



Type B. M. \$4.50

N EAT and simple to install, the Jones Multi-Plug affords a plug-in connection between set and batteries, antenna, and ground. The seven contacts take care of all input connections, two A Battery and three B Battery leads in cable and antenna and ground which are separate leads. The 8' cable not only affords a neat wiring arrangement but permits placing batteries in basement or other convenient place.

**Jones
MULTI-PLUG**

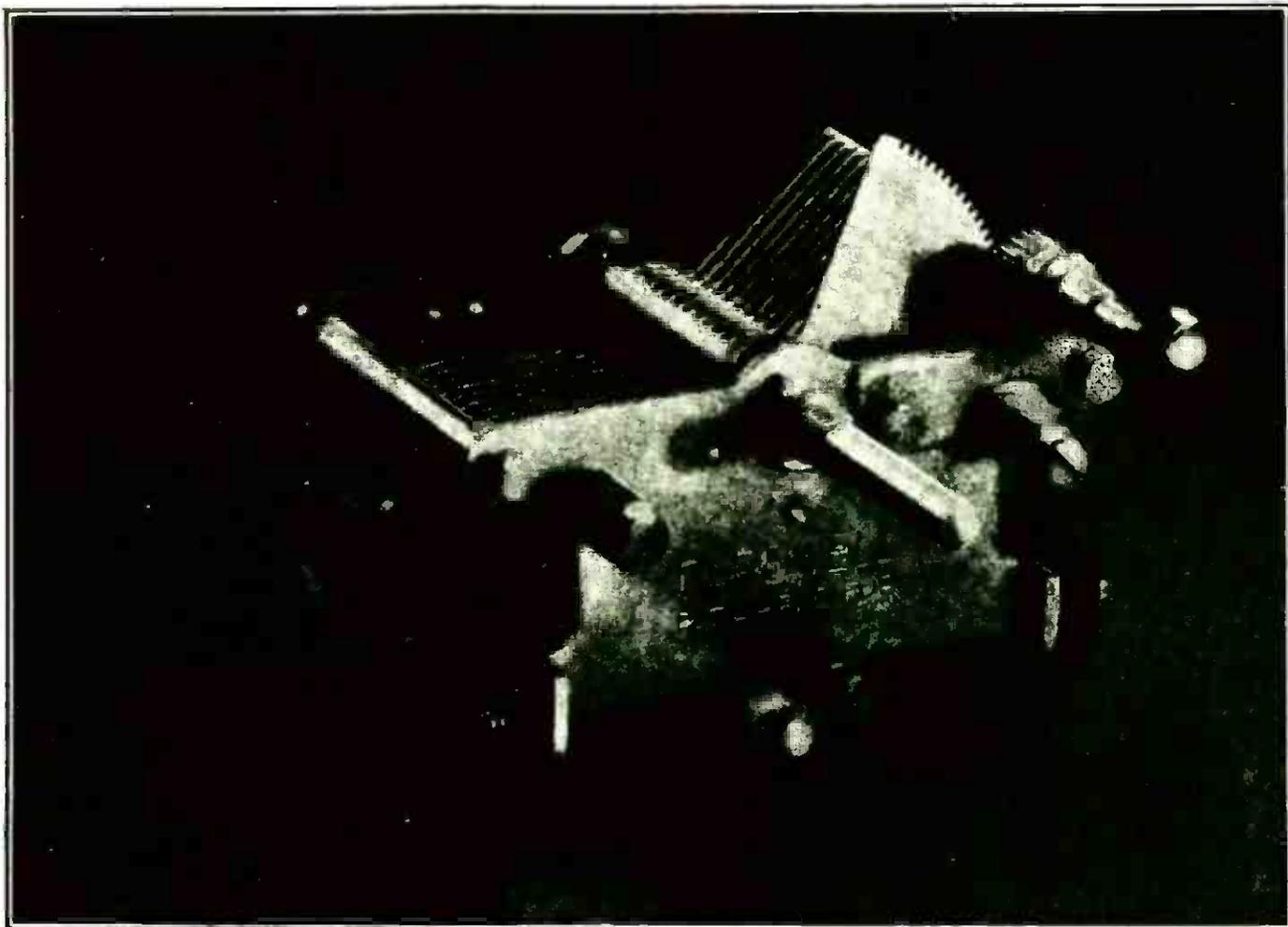
THE STANDARD SET CONNECTOR

Used by Leading Set Manufacturers Including

Howard-Workrite-Zenith-Mu-Rad

*Write for illustrated folder of
Panel Mounting and Binding
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HOWARD B. JONES
618 S. Canal St. Chicago



“No fancy gewgaws to attract the eye and cause trouble in the end”

SO writes Mr. Henry M. Neely, Editor of RADIO-IN-THE-HOME. Mr. Neely adds:

“The present-day low-loss condenser approaches more nearly to a perfect instrument, the more nearly it approaches the design and workmanship of the Cardwell.”

Simplicity is a distinctive characteristic of the Cardwell. There is no excessive bulk or weight—no intricate parts or complicated assembly.

Other points of merit have been praised by many different experts. In fact, Cardwell condensers have received the universal approval of radio editors and engineers everywhere.

Cardwell condensers are rugged, free

from play, noiseless and remarkably smooth in action. And there is nothing to work loose or get out of adjustment.

Cardwell invented the first “low-loss” condensers—a name originally applied only to Cardwells to distinguish them from ordinary varieties. Cardwell now makes seventy-six different types—a condenser for every requirement. Ask your dealer to show you his assortment.

A postcard brings you an education on condensers. Write today for the new Cardwell Condenser booklet.

The Allen D. Cardwell
Manufacturing Corporation
81 Prospect Street, Brooklyn, N. Y.

CARDWELL
(RADIO UNITS)



UNITRADS
(OF MERIT)

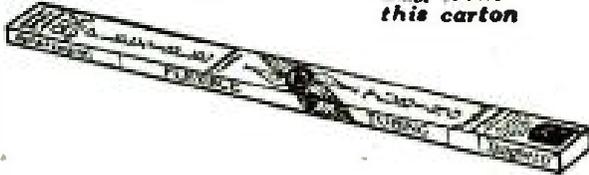
CONDENSERS — INDUCTANCES — TRANSFORMERS

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY

Look for this trademark



Buy from this carton



Be Sure—

In buying radio tubing (spaghetti) that you are getting perfect insulation.

You know your insulation is the best when you buy B-H Brand Radio Tubing, because it is—

- Made of special woven cambric.
- Has six coats of varnish.
- Proof against water, oil and acid.
- Extremely flexible.
- Guaranteed not to crack.

The different colors make it easy to trace your leads.

All our tubing is *hand dipped* and *naturally dried*, thereby making it flexible, non-peeling and non-cracking.

Your satisfaction is our aim—our trade-mark is your protection. Ask for it by name.

If your dealer cannot supply you, order direct from us.

Also Manufacturers of High Grade Optical Tubing and Magneto Tubing of High Dielectric Strength.

Bentley-Harris Mfg. Co.

Elm and Ash Streets
Conshohocken, Pa.

Low-Loss "Supercoils" Fully Adjustable For All Circuits

"Radio Broadcast's 'Knockout'"

Walter Van B. Roberts' Circuit—

Combining Radio Frequency,

Regeneration and Reflex.

Endorsed by Mr. Arthur H. Lynch, Editor

"Radio Broadcast"



\$8.00

Write for information regarding sets of Supercoils for Neutrodyne, Superdyne, Superheterodyne, and Harkness circuits.

At your dealer's, or direct, plus p. p.

PERFECTION RADIO MFG. Co.

Office 316-1523 Chestnut Street

Philadelphia, Pa.

Send 3-2c stamps for Low-Loss Bulletins and Hook-Ups

—the Panel SUPERFINE

NO other material known possesses the many combined advantages for radio paneling as does Dilecto. It has every endorsement of dealer and manufacturer, because it is practically indestructible.

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Factory: Newark, Delaware

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Look
for the
Red
Stripe

Offices and Agents
throughout the world.

Dilecto

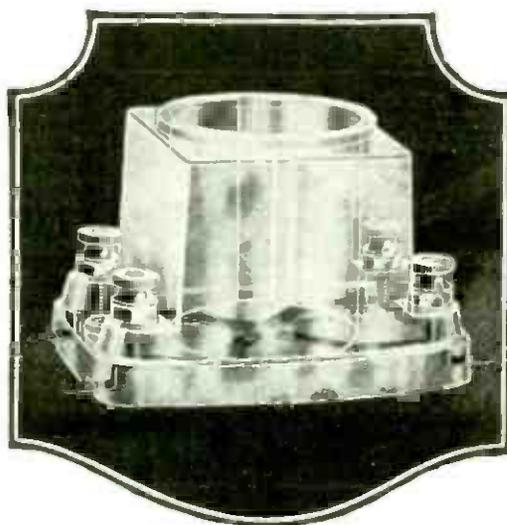
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The First All-Glass Socket

Countless tests have proven glass to be the most effective insulation available to radio. After exhaustive research, our engineers have developed a new-idea socket made entirely of VIRALON—a special glass processed for 100% electrical efficiency.

VIRALON Glass is absolutely heat and moisture proof, and unaffected by those influences that commonly make rubber, rubber derivatives, porcelain and vitreous products so inefficient.

Duray All-Glass Sockets eliminate



most of the so-called "tube noises"—cut down power losses—prevent short circuits—and eliminate radio frequency leakage.

DURAY RADIO CORPORATION

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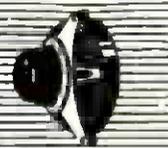
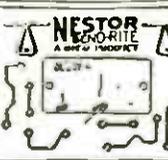
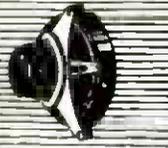
DURAY
ALL-GLASS
VIRALON
SOCKET

You'll like all the exclusive Duray features—the all-glass construction—the one-piece contact strips—the knurled contact spots (corrosion-proof)—the handy soldering terminals.

Price \$1.25 (standard size)
Packed in attractive carton.

Until all dealers have been stocked, you can be supplied direct from the factory at the retail price, plus 10c for packing and postage.

CICO

 CICO BATTERY SWITCH	 NESTOR BEND-RITE \$1	 CICO AUTOMATIC PLUG 75c.
 CICO BAKELITE JACKS	CICO BAKELITE RHEOSTATS Plain, \$1.00 Vernier, \$1.25 2 Ohm, \$1.25	 NESTOR BEND-RITE A NEW PROPERTY
 CICO BAKELITE POTENTIOMETERS \$1.15	Definite angles, perfect eyes, and straight wire from point to point does make a difference in radio reception. The NESTOR BEND-RITE gives satisfactory results.	 CICO 2-WAY PLUG 40c

JACK PRICES
 Single open No. 33-80
 Single closed No. 31-85
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SWITCH PRICES
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LIBERTY Sealed Five Last Month



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WE SHIP EVERYWHERE TO EVERYONE

BIG SAVINGS

ON GUARANTEED RADIO

This Big 1925 Radio Catalog Free

LATEST EDITION

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 Our Catalogue in your home is as good as a Standard link in your town

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STANDARD RADIO CO.

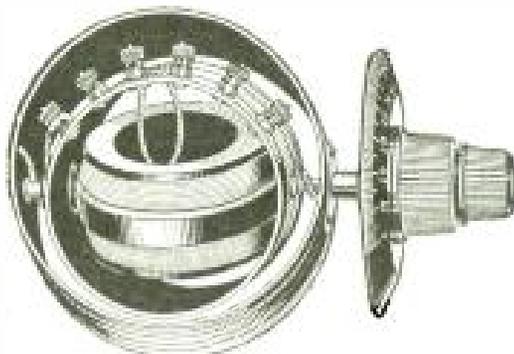
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Philadelphia, Pa.

COAST COIL

**Distance with local stations going strong
Maximum Volume without distortion
Coast to coast reception**

You will get all these to your best satisfaction if you use a Coast Coil—the only coil with a double rotor and built on the correct scientific low loss principle.

The Coast Coil is the one 3 circuit tuner that tunes your aerial to your set. The unfixed (variable) primary afford the correct coupling for receiving various wave lengths. With a Coast Coil you get the stations you want when you want them.



The records of Coast Coil reception are unapproached. Fans report as high as fifty stations received clear and loud in one night's tuning. Three foreign stations—Paris, Brussels, Mexico City—have been heard by one fan in one night. Isn't that what you have been looking for in radio?

Go to your dealer and ask for a free Coast Coil hookup. Notice how easy a Coast Coil set is built. If your dealer hasn't a Coast Coil, order direct from us giving dealer's name and address.

Variotector



\$1.50
Complete

The best detector for reflex sets. Can't short circuit or leak. Fixed or fixable. Mounts right on panel. Give more distance, greater volume and clarity. Ask your dealer for free Variotector hookup. If your dealer doesn't carry the Variotector, order direct, giving dealer's name and address.

Foote Crystals



8 Mounts—35c to \$1.00

Each crystal triple tested for triple power, triple life and triple size. Sensitive all over. Made to fit the stand and crystal cup. Get more pleasure—use Foote Crystals. Ask your dealer for free Foote Crystal hookup. If your dealer doesn't sell Foote Crystals, order direct, giving dealer's name and address.

FOOTE RADIO CORP.

123 North 19th Street, Philadelphia, Pa.

"MODERN RADIO RECEPTION"

A New Book

By
Charles R. Leutz

325 PAGES
200 ILLUSTRATIONS
FULLY BOUND

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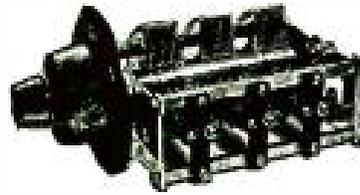
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Model C7 Super-Heterodyne
Long Distance Reception
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Model L Super-Heterodyne
and
Everything of importance relating
to Broadcast Reception

*This supersedes Mr. Leutz's earlier book
entitled "Super-Heterodyne Receivers"*

Price **\$3.00** Postpaid

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476 Broadway New York, N. Y.



*Latest
Development
in Radio*

The Lombardi Multi-Unit Condenser

The public is demanding simplified tuning in receiving sets. To fill this demand, the Multi-Unit Condenser makes possible the use of a

Single Dial Control

which can be used on any radio frequency receiver of one stage or more. Made in double and triple units—two capacity ranges, .00035 mfd. and .0005 mfd. Noted for rigid design, low-loss and perfect vernier.

Set manufacturers are including the Multi-Unit condenser in their new models. Sold also to the exacting radio experimenter and amateur constructor.

Licensed under Hogan Single Control Patent #1,014,002

*Literature Sent on Request
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The Lombardi Radio Mfg. Co.
67-71 Minerva Street Derby, Conn.



Made in Hoosick Falls, N. Y.

by the

TIMBRE-TONE MFG. CO.

KESTER *Radio* SOLDER

(Rosin Core)



Oh boy but it wins Approval

POPULAR SCIENCE



POPULAR RADIO



★ RADIO BROADCAST

Jack Binns knows, and here's what he says in Colliers:

"Never use any of the messy soldering pastes. This is quite important, because it causes a lot of noise in your reception. The only material to use, is rosin. Suitable strip solder can be obtained with a rosin core which makes the task of soldering a simple one."

Not only has Kester Radio Solder won the approval of the leading radio engineers, and laboratories, but it has also won the approval of thousands of users. Listen to what one of these fans says about it:

"I find Kester Radio Solder so good that I refuse to use any other make. I wired an 8 tube Super-Het. with your solder and it worked perfectly. I am now using my third can, and have recommended it to several of my friends who have been using inefficient and harmful soldering pastes and fluids of various kinds. They report much pleasure and satisfaction by changing to Kester Radio Solder."

Kester Radio Solder has a pure rosin flux inside of itself which makes: absolutely non-corrosive joints and prevents dielectric losses. It requires only heat. By using a good hot iron and having it touch the parts to be soldered, a neat, clean job quickly and permanently safe is the result.

Insure safely soldered joints in your set by purchasing a can from your dealer today, or sending this coupon to us.

CHICAGO SOLDER COMPANY

4235 Wrightwood Avenue

Chicago, U. S. A.



RADIO BROADCAST

25¢

for full size Can

CHICAGO SOLDER COMPANY, 4235 Wrightwood Avenue, Chicago

Gentlemen: Please send me one can of KESTER RADIO SOLDER for which I enclose 25 cents in stamps. (Postpaid in U. S. A.)

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Address.....

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

Dealer.....

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY

This KIC-O equipment has been approved by Popular Radio Laboratory

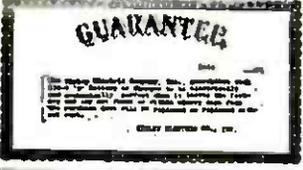


New KIC-O "B" Battery and Double Potential Charger

PRICES
PZ indicates panel type with switches.
CZ is plain type without switches.

Vol- tage	M.A.H.	Type PZ	Type CZ
130	2500	\$36.00	\$33.00
100	2500	27.50	24.50
70	2500	21.50	18.50
45	2500	16.00	14.50
22½	2500	.....	7.50

KIC-O CHARGERS
Type K-1 Single un-mounted.....\$1.50
Type K-2 Single mounted..... 3.50
Type K-3 Multi-Polar mounted... 5.00
K I C - O Special Charger Chemicals (one cell)..... .50



Let KIC-O Batteries help you to get those far-away stations

The real thrill for a true radio fan comes when he tunes in on a new station further away than any he has ever heard before. That is one of the reasons why we are continually receiving hundreds of letters of high praise for KIC-O Storage "B" Batteries. Each letter proves more conclusively the unrivaled superiority of the KIC-O for better, clearer, truer, radio reception.

Nickel-zinc construction of KIC-O elements preserved by a special alkaline solution give KIC-O Batteries practically unlimited life. They give an even, dependable discharge over long periods of service and are not harmed by idleness or overcharging.

And with the KIC-O single or double potential charger which charges the battery from any 110 volt A. C. lighting line you will have a real permanent power plant which will last for years.

All KIC-O products are backed by a satisfaction or money back guarantee. Write for full description which will tell why KIC-O units are better than dry cells, "B" eliminators and acid "B" batteries.

See your dealer or clip the coupon

Kimley Electric Co., Inc.,
2667 Main St., Buffalo, N. Y.
Gentlemen: Please send items checked below to undersigned address:
KIC-O "B" Battery type
Voltage Price
KIC-O Charger (specify which).....
Full information regarding KIC-O equipment.
Send C.O.D. subject to guarantee of satisfaction or money back to

KIMLEY ELECTRIC COMPANY, INC.
2667 Main St. Buffalo, N. Y.



Dulce-Tone and your Talking Machine —the BEST Loud Speaker

WITHIN your talking machine is the finest radio amplifying unit that money can buy—link it to your radio with a Dulce-Tone. Radio will be reproduced with the same clear, undistorted precision you get in playing a record. No substitute will give equal results.

Hear Dulce-Tone today at your favorite radio or music store. If they have not Dulce-Tone in stock, order direct.

THE TEAGLE COMPANY, 1125 Oregon Ave., Cleveland, Ohio
Canadian Representative: The Otto Higel Co., Ltd., Toronto

Dulce-Tone



Retail price complete, \$10
(In Canada \$14)

Dear Jim:

Here's something more important than has come out of your loudspeaker for a long, long time.

The leading broadcasting stations use Willards.

When a station broadcasts, voice and music must be amplified many, many times before the program can be put on the air.

The amplifiers used are like the ones in your set — only larger.

Quiet operation of the batteries employed to furnish this amplification is as essential to the broadcasting stations as it is to you.

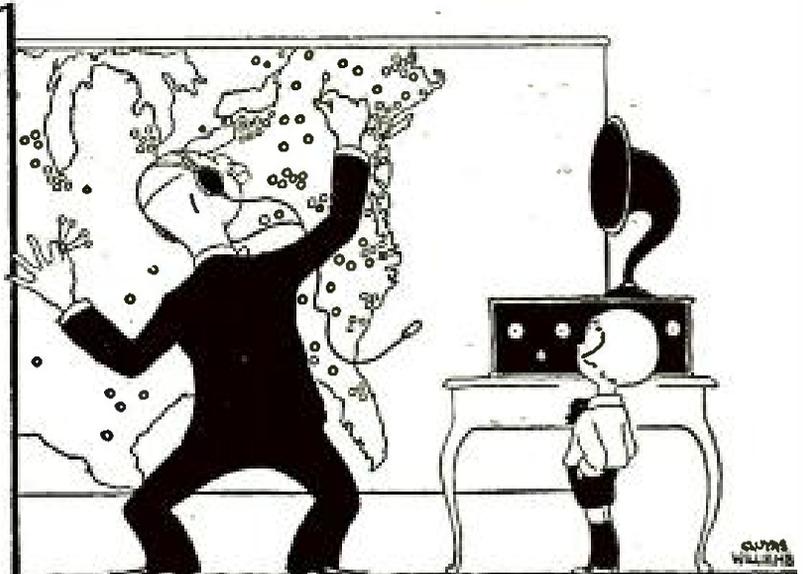
You see, their requirements for a good sending job are the same as your requirements for a good receiving job.

And believe me, Jim, Willards have what it takes to do it.

Signing off,

Sam.

P. S. I have been looking at the map and there are 178 stations using Willards. That will tell you something, I guess.



178 BROADCASTING STATIONS USE WILLARDS

WILLARD RADIO BATTERIES

FOR SALE AT WILLARD SERVICE STATIONS AND RADIO DEALERS

These unusual batteries were developed by WTAM—the broadcasting Station and Radio Research Laboratory of Willard Storage Battery Company, Cleveland, Ohio.

Write to **WTAM** for this booklet
(The Voice of the Storage Battery)

Read how you can get greater distance, and added clearness from your set—how to get the longest life and greatest value from your batteries. It's all in the little booklet. Sent to you with our compliments. Just mail the coupon.



Mail me to WTAM. I'll bring you "Better Results."

.....
Name

.....
City and State

.....
Street Address

P. R. 7

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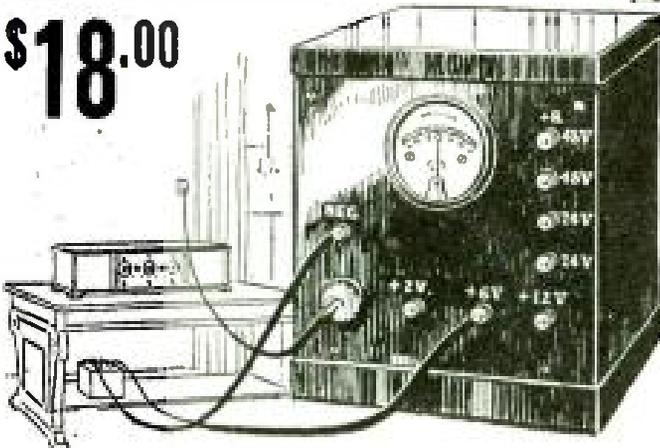
ULTRA HANDY CHARGER

Cannot overcharge your battery—
Even if allowed to run for several days
there is no danger of fire. For all bat-
teries "A" and "B" both 24 and 48
Volts. Charges quickly—5 to 7
amperes to a 6 Volt battery—"B"
batteries at recommended rate.

No bulbs nor liquid. No auxiliaries necessary.
No breakable glass. No frequent adjustments.
No fast wearing parts. No sticking contacts.

Absolutely Fireproof.

\$18.00



Simple to Connect

Very simple to connect and dis-
connect. Just connect carbon pure
silver contacts to battery and plug the
cord into a light socket—then turn on
current.

The Crystal Mahogany finish on the
Cabinet makes the Ultra Handy
Charger sufficiently attractive to stand
beside the most beautiful Radio Set.
It is not messy and will not dirty the
home or harm the furniture. There
are no acids to spill!

Ask your dealer today for a free
demonstration of this wonderful con-
venient radio necessity.

Illustrated literature on request.

INTERSTATE ELECTRIC Co.
4339 Duncan Ave., St. Louis, Mo.

For Better Results

You are always sure that the care and time you take in ar-
ranging or changing and wiring your set will not be mis-
spent when you use

YAXLEY

Approved Radio Products

Examine any Yaxley Product. Take it apart. You will see
many exclusive refinements in design and construction which
make for better results in your receiving.



Midget Battery Switch

Small and compact. One nut mounting in
single panel hole. Quick and positive
snap-break contact. Each..... **60c**

Other Yaxley Approved Radio Products:

**Jacks, Jack Switches, Rheostats,
Potentiometers, Plugs, Re-
sistance Units, etc.**

Fully Guaranteed and Protected by the Manufacturer

Ask your dealer or send his name with your order to

Yaxley Mfg. Co.

Dept. P, 217 North Desplaines Street
CHICAGO

"Good Parts Make a Good Set"



The Filter Tuner

The BEL-TONE Low-Loss Filter Tuner takes all the
guesswork out of building a Filter Tuner Set. This
unit has been built to the exact specifications laid
down by McGinnis and Maher of the N. Y. Journal.
It bears their signature of approval.

The BEL-TONE Filter Tuner is
made with bakelite tubes and green
silk wire. It is packed in a neat
box with complete instructions.

\$3⁷⁵

BEL-TONE RADIO CO.

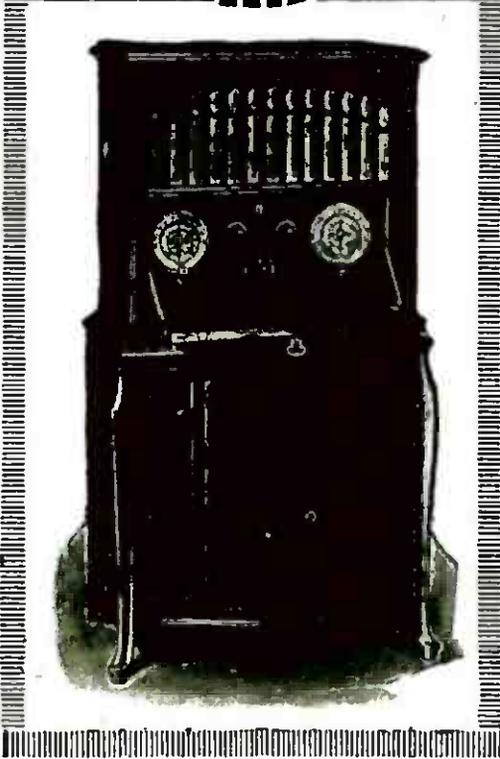
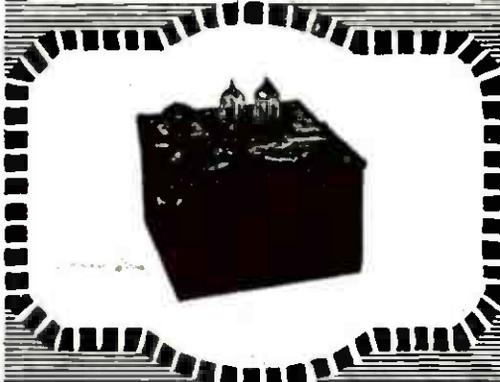
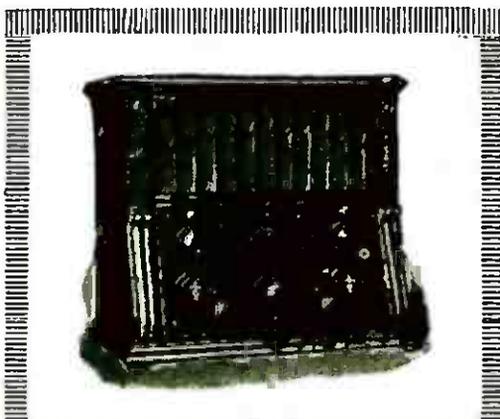
161-167 Jamaica Ave. Brooklyn, N. Y.

Other BEL-TONE Good Parts are: Bel-Tone Kit Type AC-
30, Bel-Tone Variometer, Bel-Tone Variocoupler, Bel-Tone
Mounted Binding Posts.

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Complete Line of Radiolas



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EXCLUSIVELY

LUDWIG HOMMEL & CO

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PITTSBURGH, PA.

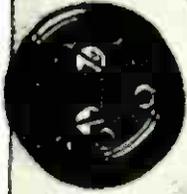
BARKELEY

Attachments for Radiola III and III-A

Antenna Selector Switch

The full range of antenna adjustments can be made by simply turning the two knobs and without loosening a nut. Remove the knurled nuts, slip the switch on the binding posts and replace the nuts. The antenna wire attaches to the one binding post on the rear.

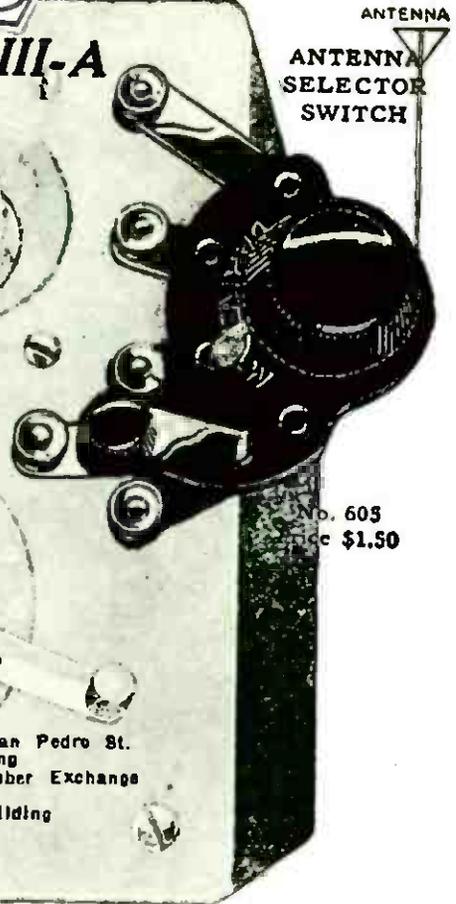
FOUR
PHONE
POST



No. 624
Price \$1.00

Four Phone Post

This post will take any number of head sets from one to four and all in series. It is equipped with prongs that push through the phone holes in the face of the panel.



No. 603
Price \$1.50

The Barkeley Electric Mfg. Co.

Middletown, Ohio, U. S. A.

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WASHINGTON, D. C., Millie Building
CHICAGO, 15 Carlton St. S
SAN FRANCISCO, 75 Fremont St.
SEATTLE, 1014 Sixth Ave., S.

LOS ANGELES, 443 S. San Pedro St.
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MINNEAPOLIS, 7017 Lumber Exchange
BOSTON, 31 Bedford St.
PITTSBURGH, Arrott Building

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With All the Equipment That Noted Experimenters Recommend

COCKADAY'S 8 TUBE SUPER-HETERODYNE REFLEX RECEIVER

1 General Instrument Low-Loss Condenser (isolantite insulation) .005 mfd.	\$5.50
1 General Instrument Low-Loss Condenser (isolantite insulation) .001 mfd.	6.00
1 Set of 4 Matched Haynes-Griffin Intermediate Transformers	20.00
1 Precision Autodyne Coupler	3.50
1 Karaa-Harmonic Audio-Frequency Transformer	7.00
1 Amplex Grid-denser .0005 mfd.	1.25
1 Benjamin Cle-ra-tone Socket	1.00
7 Federal Sockets No. 16, ea.	\$1.20
1 Patent Double Circuit Jack	.60
1 Patent Single Circuit Jack	.60
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2 Daven Resisto coupler mountings ea. \$1.25	2.50
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2 .0001 N. Y. Coil Mica Condensers ea. .35	.70
4 .006 N. Y. Coil Mica Condensers ea. .75	3.00
1 .00025 N. Y. Coil Mica Condenser with Grid-leak Mounting	.45
1 Duratran Radio-Frequency Transformer	4.00
1 Walcott A Battery Switch	.50
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1 Connection Block 1 x 9 x 3-1/8 ins.	.40
7 Eby Binding Posts, ea.	20
1 Material for making brackets	.25
1 Korach Tuned Loop	16.50
1 Mahogany Cabinet	12.50
	\$105.50

CRAIG 4 TUBE REFLEX RECEIVER

2 Duplex Series FR, 21-Plate Variable Condensers .000507 mfd.	ea. \$5.50	\$11.00
2 Na-aid 4 in. Dials for the above Condensers No. 3043-4	ea. .75	1.50
4 Na-aid Standard Sockets, Type 400	ea. .75	3.00
1 Cardwell 7 plate Variable Condenser .0001 mfd.		4.00
1 Dubilier Mica Fixed Condenser .00025 mfd. with Grid-leak Clips		.45
1 Dubilier Mica Fixed Condenser .0005 mfd.		.35
2 Daven Grid-leak 5 megohms	ea. .75	1.50
2 Daven Resisto Couplers No. 41	ea. \$1.25	2.50
2 Daven Resistors .25 megohm	ea. .75	1.50
2 Daven Resistors .1 megohm	ea. .50	1.00
1 Cutler-Hammer Rheostat 30 Ohms		1.00
1 Cutler-Hammer Rheostat 4 Ohms		1.00
1 Carter Closed Circuit Jack, Type 102-A		.80
1 Carter Filament Control Jack, Type 103		.90
1 Federal No. 65 Auto-Frequency Transformer		7.00
1 Bradley Switch		.60
1 Amaco Switch Lever, with points and stops		.40
9 Eby Binding Posts	ea. 20	1.80
1 Composition Radion Panel 7 in. x 25 in.		3.25
1 Sub-base 6 7/8 in. x 24 3/4 in.		.75
1 Cabinet, 7 in. deep		9.00
2 Sickles Counter Coils, No. 20		4.50
2 Sickles R-F Transformer Coils		4.50
		\$58.10

CAPTAIN PAUL S. EDWARD'S SUPERHETERODYNE

1 Sangamo Oscillator Coil Unit	
2 Sangamo Type AT-60 Intermediate Frequency Transformers	
2 Sangamo Type IF-60 Intermediate Frequency Transformers	
Complete set of above parts, care-fully matched	\$22.50
1 Cardwell Right-Hand Vernier Condenser (.0005 mfd) with 3 in. dial	7.00
1 Cardwell Left-Hand Vernier Condenser (.0005 mfd) with 3 in. dial	7.00
1 Cardwell Split Stator Balancing Condenser	4.00
2 Dubilier Mica Fixed Condensers (.00015 mfd) with Grid-leak Clips, ea. 45	.90
1 Dubilier Mica Fixed Condenser (.005 mfd)	.50
1 Dubilier By-Pass Condenser (.5 mfd)	.90
1 Daven 1-2 megohm Grid-leak	.50
1 Daven 2 megohm Grid-leak	.50
2 General Radio 30 Ohm Type 301 Rheostats, ea. \$1.25	2.50
2 Stromberg-Carlson Audio-Frequency Transformer, ea. \$4.50	9.00
1 Benjamin No. 8627 Seven-Socket Shelf with sockets and binding posts	12.00
1 Saturn Jack No. 1	.50
1 Saturn Jack No. 2	.55
1 Carter Jack Switch No. 3	1.15
1 Benjamin Battery Switch No. 8640	.30
1 Pr. Benjamin Shelf Brackets No. 8629	.70
1 Benjamin Bakelite Panel for Grid-condenser No. 8632	.15
1 Composition Radion Panel 7 in. x 18 in.	2.25
1 Portenna Loop	7.00
	\$80.00



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Try us on any radio parts you have been unable to secure.

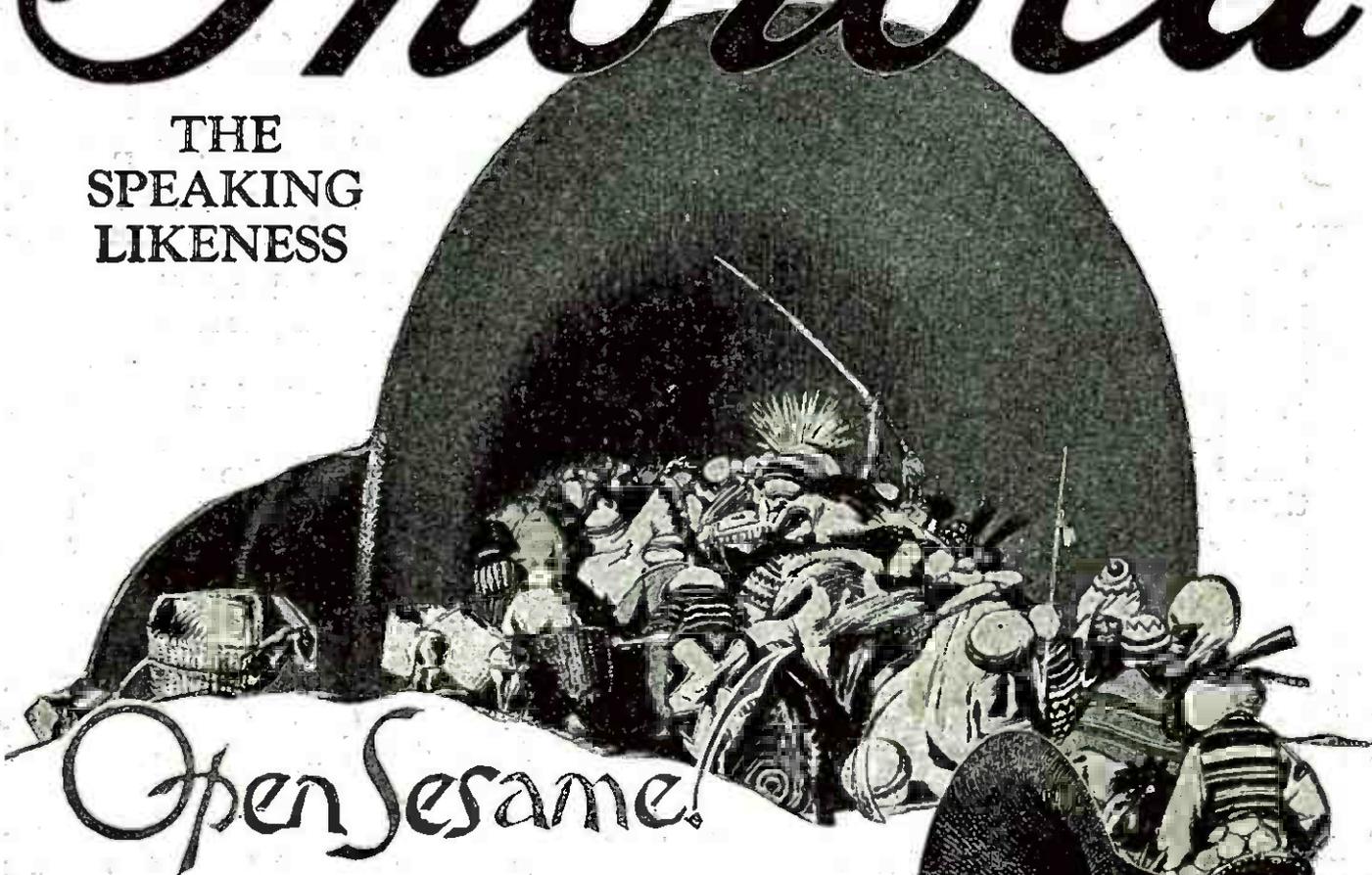
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Magic words opened the way to a mystic, fabulous treasure cave.

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Sift out every note, every word, every overtone, in all its original clearness, with beautiful Thorola Loud Speaker. Know radio now for its music, exquisite beyond anything heretofore.

Whatever your impressions have been, hear Thorola. With this loud speaker radio goes into finest music rooms to stay.

With this loud speaker new artistic possibilities are revealed in even the costliest radio receiver.

The difference is decisive, not only in tonal purity, but in volume. Thorola so far excels in amplifying efficiency that super-abundant volume remains when tuning for maximum clearness, even at extreme long distances.

Go to your Thorodealer. Examine all the specific, exclusive Thorola superiorities described below. Only Thorola construction permits surpassing Thorola music. Hearing is believing.



No external battery needed. Simply plug in. same as head phones.

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A toy piano cannot have the tone volume and purity of a concert grand. Compare the very size of Thorola Reproducer — much larger, permitting fine construction unduplicated in smaller reproducers.

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Easily establishes Thorola as THE musical instrument among loud speakers, another accomplishment made possible by Thorola veteran loud speaker experience and technical facilities.

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Indispensable for faithful preservation of the delicate note shadings and overtones

without which there cannot be true music, voice, tone—unblurred.

THE HORN OF THORITE

An exclusive laboratory compound, developed expressly to remove natural limitations. The value of Thorite superior acoustic accuracy cannot be overestimated.

THE THOROLA SYNCHRONIZER

The loud speaker, like every other circuit factor, must be in perfect balance for maximum results. Only Thorola can be harmonized with the exclusive Thorola Synchronizer, individually adapting your Thorola to your receiver, another reason even finest and most costly receivers do better with Thorola.

THOROLA 4 \$25

THOROLA 6 \$15
Phonograph Attachment

THOROLA 9 \$40
Cabinet Loud Speaker

THOROPHONE . . \$45
Power plus Speaker (Storage Battery)

The Thorola 10-day Refund Warranty is a guarantee to every user that Thorola will fulfill every claim.

REICHMANN COMPANY, 1725-39 W. 74th Street, CHICAGO

POPULAR RADIO Simplified Blueprints

Prepared in Sets Consisting of Three Actual Size Prints

UNDER the personal supervision of Laurence M. Cockaday, *Simplified Blueprints* have been prepared for eight of POPULAR RADIO's most popular circuits. Each set of three separate *actual size* Blueprints, contains a Panel Pattern, Instrument Layout and Picture Wiring Diagram. Simplified in the fullest sense of the word because—

The Panel Pattern can be laid on the panel and all holes drilled as indicated. No scaling to do and so accurate there is no danger of ruining the panel through faulty calculation.

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Popularly priced at \$1.10 per Set of three Prints

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Set No. 4—"Cockaday Four-Circuit Tuner with Resistance-Coupled Amplifier" (five tubes, distortionless, two dials, automatic vacuum tube control, as described in the October 1924 issue of POPULAR RADIO).

Set No. 5—"The 7-tube Non-radiating Super-heterodyne Receiver" (seven tubes, two dials, non-radiating, as described in the December 1924 issue of POPULAR RADIO).

Set No. 6—"The Cockaday 8-tube Super-heterodyne Reflex Receiver" (eight tubes, two tuning dials, loop, non-radiating, distortionless, as described in January 1924 issue of POPULAR RADIO).

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POPULAR RADIO, INC.

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Dept. 34

New York City

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Enclosed is my remittance of \$....., for which kindly send me Blueprint Set (s) consisting of Panel Pattern, Instrument Layout and Wiring Diagram as checked below:		
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\$60

Every Man's Receiver



Marwol Home Builder

outfit contains parts for the construction of a Marwol 5-tube tuned radio frequency receiver. Like the Marwol set, the Marwol home builder gives you the best value obtainable for the man who prefers to construct his own set. Retails for \$15.

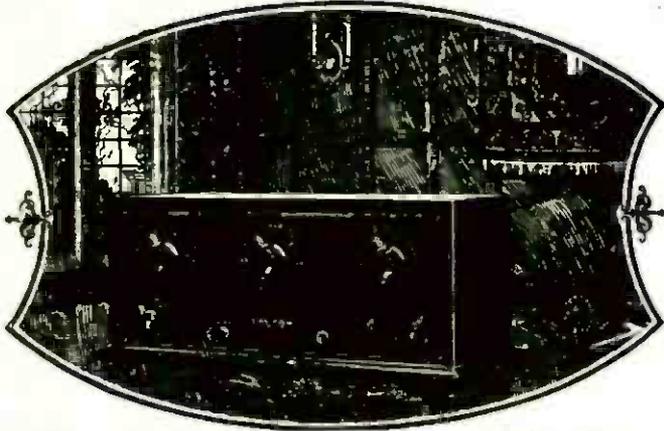
HERE'S a five-tube tuned radio frequency receiver that deserves the earnest consideration of the man who wants results in radio reception. Volume results! Range results! Satisfaction in every detail! At a price that makes the Marwol give more real radio value for your dollar than any other set on the market to-day. Before you purchase a set at any price, compare it with the Marwol point for point and part for part. You will then know the superiority of details that makes the Marwol to-day's best radio buy for the money.

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Day Fan

RADIO
A YEAR AHEAD



Amazing Simplicity The Set That Is Already Logged

CAN you imagine anything more simple—more practical—than a radio set with all the dial settings exactly identical for any station—regardless of where you live or what antenna you use?

The entire DAY-FAN line, comprising six models ranging in price from \$90 to \$285, is distinguished by this feature.

APPEARANCE. Every DAY-FAN set is a splendid example of the cabinet maker's art. Made of the finest materials, they have a finish and design which harmonize with the surroundings of the most tastefully furnished homes.

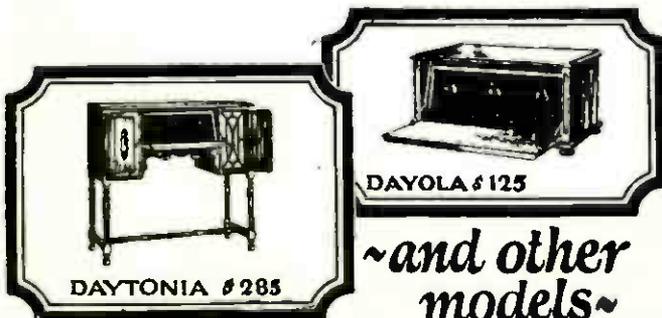
VALUE. In everything that you want—long range, selectivity, purity of tone, volume—there is no greater value.

PERFORMANCE. The age of technical discussion and experimenting in radio is past. Today a set must do certain definite things. You may want entertainment, business information, or an educational program. Whatever your desires, a DAY-FAN will get it for you, quickly and easily.

Sold by Leading Radio Dealers Almost Everywhere

The Dayton Fan & Motor Co.
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For 36 Years Manufacturers of High-Grade Electrical Apparatus.



~and other models~

You'll hear the duplicate of this loud speaker when Gabriel blows!!

The New
REMO
Trumpet
\$15.00

with heavy duty adjustable unit.

More volume and fine tone values and adjustable to meet any broadcasting conditions.

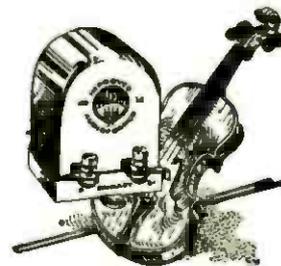
The Remo Trumpet nonadjustable
\$12.50



REMOLA
Solid mahogany cabinet type

\$25.00

THE REMO CORP., Meriden, Conn.



Fidelity

Just as the rare old violin expresses the finest instincts of its master, so does the Pacent Improved Audio-former bring out the best in any radio set.

It gives faithful, pure and undistorted reproduction over the entire band of sound frequencies, with an unusually high amplification factor *throughout the entire range* rather than at one high peak.

You will be more enthusiastic than ever about your set when you hear it with Pacent Improved Audio-formers. Order a pair today from your dealer.

Write for complete catalog of Pacent Radio Essentials.

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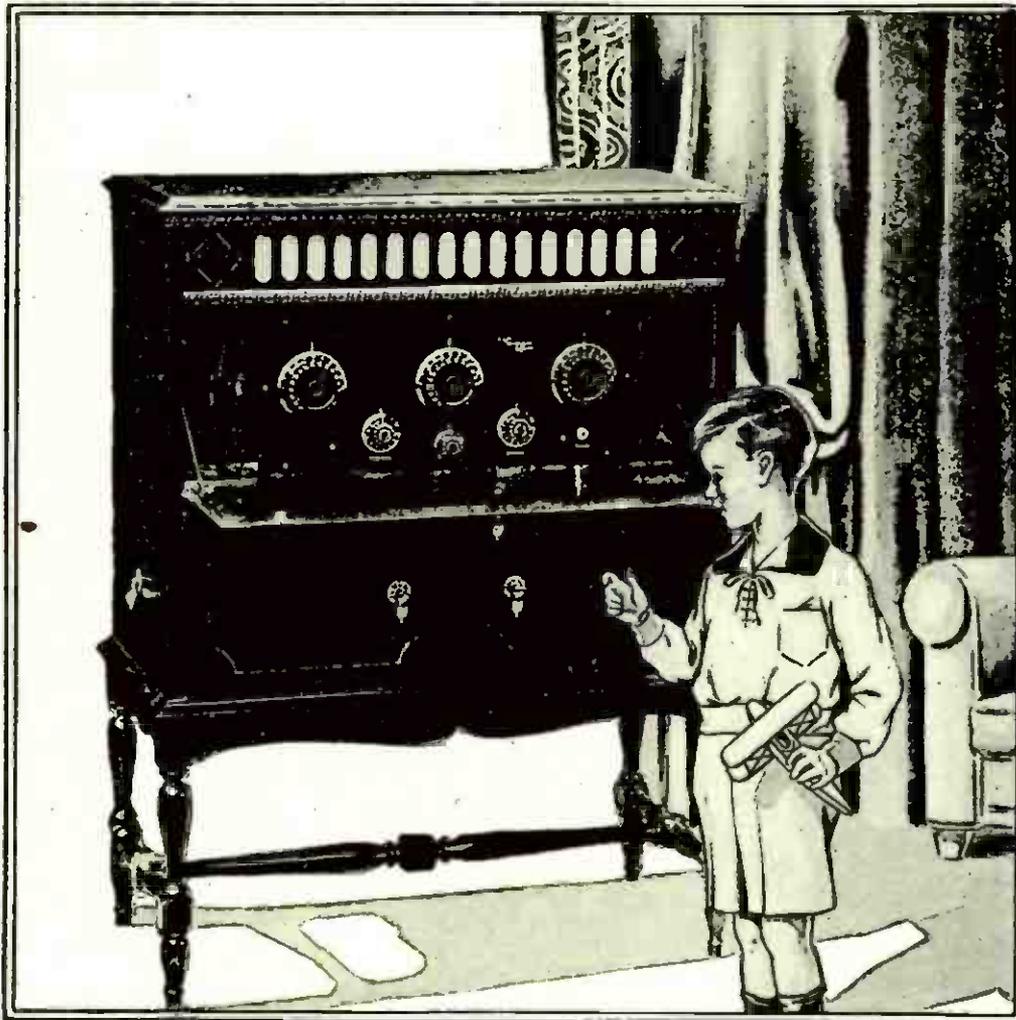
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- Improved Audioformer
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For Radio Beauty and Safety

TODAY'S Fashion says "Radio Console." And the most select environment bids gracious welcome to a distinctively panelled mahogany or walnut ADAPTO Radio Cabinet.

Encloses every radio accessory—*safely out of sight*, yet easily accessible when desired. A drawer on the side accommodates your battery, charger, distilled water and hydrometer. Batteries easy to inspect, easy to recharge. Simply throw a built-in switch which puts your charger in operation. Insert your own set—adapt it with the adapter frames. Horn inbuilt at top, needing only loud speaker unit. But read about it in detail.

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Don't Guess—It May Ruin a Good Battery!

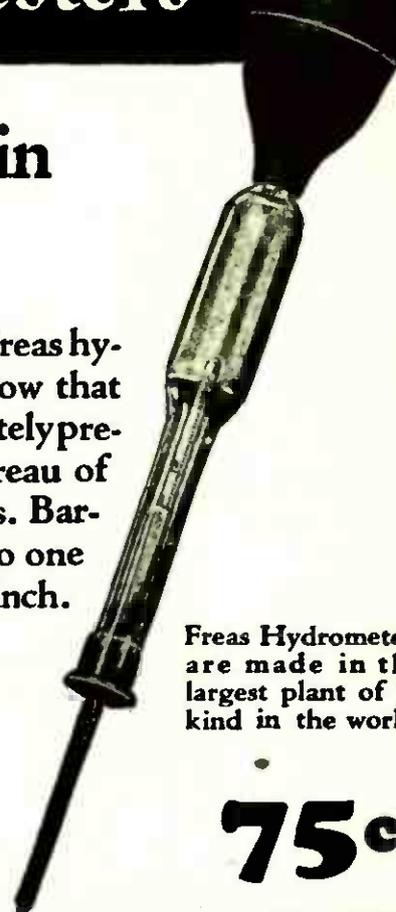
WHEN you're looking for battery trouble, be sure of the hydrometer you use. Be sure it gives you a reading you can depend on. The wrong indication may ruin a good battery.

WHEN you use a Freas hydrometer you know that the instrument is absolutely precise. Made to U.S. Bureau of Standards specifications. Barrels and floats gauged to one five-thousandth of an inch.

Weighted and tested four times before scale is permanently affixed.

FREE BOOKLET—Some valuable tips on how to get more out of your radio batteries by Major J.S.Hatcher, U.S.A. Send for a copy. It's free.

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Conshohocken - Pennsylvania



Freas Hydrometers are made in the largest plant of its kind in the world.

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Cockaday specifies!

Cockaday Super-Het Reflex

THESE parts take all the guesswork and all the labor out of building the Cockaday 8 tube Super-Het Reflex. Every part is exactly as Cockaday specified—and every part carries the AMPLEX guarantee in addition.

Think of the convenience these parts afford you. No shopping around, no uncertainty—every part you need for building this wonderful set is here for you.

No.	Item	Each	Total	No.	Item	Each	Total	No.	Item	Each	Total
1	General Instrument "Isolantite" Condenser .001	\$6.00	\$6.00	1	Benjamin Cle-ra-tone Socket	\$1.00	\$1.00	2	N. Y. Coil Condensers .0001	\$.35	\$3.70
1	General Instrument "Isolantite" Condenser .0005	5.50	5.50	7	Federal Sockets No. 16	1.20	8.40	4	N. Y. Coil Condensers .006	.75	3.00
1	Haynes-Griffin "Input" Transformer (new type)	20.00	20.00	1	Pacent Jack D.C.	.60	.60	1	N. Y. Coil Condenser .00025 G	.45	.45
3	Haynes-Griffin Intermediate Transformers (new type)	Matched	20.00	1	Pacent Jack S.C.	.50	.50	1	Duratran R. F. Transformer	4.00	4.00
1	Precision Autodyne Coupler	3.50	3.50	2	Naald Dials 4 in.	.75	1.50	1	Walbert Battery Switch	.50	.50
1	Karas Harmonic Transformer	7.00	7.00	1	Amesco Rheostat 2 ohms	1.35	1.35	1	Baseboard	1.00	1.00
1	Amplex Grid-Denser	1.25	1.25	1	Amesco Potentiometer 400 ohms	1.50	1.50	1	Connection Block 1 x 9 in.	.25	.25
				2	Daven Resisto-Couplers	1.25	2.50	7	Eby Binding Posts	.20	1.40
				1	Daven Leak Mounting	.40	.40	2	W Brass Brackets	.05	.10
				2	Daven Resistors .5 Meg	.50	1.00	1	Set POPULAR RADIO Blue Prints	1.10	1.10
				1	Daven Resistor 5 Meg	.50	.50		Bus Bar, etc.	.50	.50
				1	Daven Resistor .005 Meg	1.00	1.00				
				2	Daven Resistors .25 Meg	.50	1.00				

Official Total List Price. \$77.50

A beautiful mahogany finish cabinet. For \$3.75
A drilled and engraved genuine Bakelite panel. For \$3.00
At these prices only if the above list of parts is purchased complete

AMPLEX INSTRUMENT LABS.
88 W. Broadway Dept. PK. 3 N. Y. City

No radio set can possibly be better than its Audio Transformers

ANY RADIO SET WILL BE GREATLY IMPROVED BY THESE

KARAS Harmonik Transformers

Some Interesting Scientific

FACTS

About Audio Frequency Transformers

Why the greatest of radio engineers, after severe and exhaustive tests of the New, Scientifically Constructed Karas Harmonik Audio Frequency Amplifying Transformers, have pronounced them vastly superior and have placed them at the extreme top of highest quality radio apparatus.

Fact No. 1

Low Distributed Capacity

High distributed capacity in secondary windings acts as a multiplied shunt capacity across the primary which by-passes much of the high frequency audio current, causing drummy muffled reception.

Karas Harmoniks have extremely low capacity in the secondary, consequently they fully amplify all of the many vital high frequency harmonics and rich overtones.

Fact No. 2

Large Iron Core

The amount of magnetic force available for amplification is directly proportional to the cross section of the iron core and the number of turns on the primary. A small core causes distortion by dropping out both the very low and very high frequency sounds.

The extra large core of Karas Harmoniks permits full amplification on all frequencies by furnishing an easy path for the lines of magnetic flux.

Fact No. 3

High Inductance

It takes thousands of turns on the primary coil to furnish enough inductance to prevent loss of low frequency amplification gained in the tube and consequent distortion of sound.

The Primary coils of Karas Harmoniks have more than sufficient number of thousands of turns to develop an impedance that fully accommodates impedance of preceding tubes at all frequencies. Thus Karas Harmoniks DELIVER great amplification of even the lowest frequencies.

Fact No. 4

Low Hysteresis Loss

Hysteresis loss is the waste of energy consumed in overcoming the molecular resistance of inferior core laminations to the reversal of current at each frequency cycle. By reducing the amount of energy delivered to the secondary severe dropping off in amplification results.

The special formula iron from which the laminations of Karas Harmoniks are made, has molecular construction that reduces hysteresis loss to a negligible minimum. All the energy is saved for amplification.

Fact No. 5

Controlled Air Gaps

Usual uncontrolled air gaps in iron cores

offer a high reluctance to lines of force, preventing low frequencies from exerting their full force on the secondary windings. Result—an amplification factor much lower than rated.

Karas Harmonik one piece core laminations, with fully controlled air gaps, present practically no reluctance and insure big amplification gain, especially of low frequencies.

Fact No. 6

No Core Saturation

Small iron cores are quickly saturated and retain only part of the lines of force delivered by the primary. Much energy is wasted.

The iron core of the Karas Harmonik, being greatly oversized, cannot possibly become saturated. Therefore, Karas Harmonik Transformers deliver the greatest possible amount of amplification of all frequencies.

Fact No. 7

Scientifically Shielded

Inter-coupling of the electrostatic and electromagnetic fields of unshielded transformers causes howling and squealing.

Karas Harmoniks are 100% scientifically shielded against all inter-coupling. They may be placed in any relative position and as close together as the builder wishes.

Fact No. 8

No Vital Parts Exposed

Transformers having exposed lead wires between coil terminals and binding posts are easily tampered with and frequently broken by accident.

All of the wiring of the Karas Harmonik is enclosed within the shield. Only the binding posts with their soldered lugs appear outside.

Fact No. 9

High Amplification of Low Frequencies

Hysteresis reluctance and impedance—losses unavoidable in cheap transformers, preclude the possibility of any amplification to the extremely low frequency harmonics, which carry the bulk of volume of most musical sounds. This results in unnatural and exceedingly unmusical reception.

Karas Harmoniks reach over 60 per cent of their maximum amplification at 100 frequency, with rapidly increasing efficiency. Thus greatly amplified, these bulk-carrying low frequency fundamental harmonics insure a full, round, rich, natural tone.



Fact No. 10

Covers Entire Band of Frequencies

Most transformers have a peak of amplification covering only a narrow band of frequencies which are blasted out overbalancing all other frequencies.

Karas Harmoniks, by giving equal amplification to all frequencies, deliver beautiful, natural sounding music—greater volume with low ratio than cheap transformers with high ratio.

Fact No. 11

Transformers Perfectly Matched

The inductance reactance, and impedance factors of the Transformers of a set, should be as closely matched as possible.

Karas Harmoniks are made in one ratio only. Their inductance, reactance, impedance and resistance factors are uniform. There is no distortion in the first stage and therefore, there can be none in the second.

Fact No. 12

The Ideal Transformer

The ideal transformer must perfectly reproduce and amplify in the secondary circuit, all sound currents supplied to the primary circuit. This means uniform reproduction of all frequencies, ranging from the lowest piano notes (16 frequency) to the highest overtones (30,000 frequency).

Karas Harmoniks embody all of the favorable factors of the ideal transformer so perfectly that they impart to radio reception a musical quality far beyond anything heretofore attained.

An Exceptional Money-Back Guarantee

The remarkable performance of Karas Harmoniks justifies an unusual guarantee. Instead of the usual meaningless guarantee of "material and workmanship" we give you a straight-from-the-shoulder, money-back guarantee of SATISFACTION. Put a pair of Karas Harmonik Transformers in your set. Use them for 30 days. If you do not feel that they are giving you truly marvelous reception—a tremendously more pleasing reception than you have ever heard before, return them to your dealer. He is authorized to immediately refund your money without question or quibble. No strings to this offer! No reservations! No chance to lose a single penny by accepting it.

Karas Harmoniks will convert your radio set into a real musical instrument.

KARAS ELECTRIC CO.

Dept. 58-33

4040 N. Rockwell St., Chicago

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY

New!
The biggest little thing in Radio
 From 50,000 ohms
Grid Leaks
 to 10 megohms

The biggest little thing in Radio
DURHAM
 cannot be excelled

and—
here's why!

METALIZED Filaments, glass coated with a combination of rare minerals—what could be more stable? Absolutely guaranteed noiseless and permanent.



Actual tested value on label

Each DURHAM Grid Leak is measured for resistance. Its value (permanent for all time) is labeled on the air-tight glass enclosing tube.

Standard on these sets

DURHAM Grid Leaks used by Eagle, Eismann, Howard, Thompson, Zenith — and fit all others.

At all dealers or postpaid

Over $\frac{1}{4}$ meg. **50^c**

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All about Resistance Amplifiers—25c

Build a distortionless amplifier. Parts for two stages cost less than one good transformer. Complete detailed instruction booklet, 25c. At your dealers or postpaid.

Satisfaction Guaranteed

DURHAM & CO., Inc.
 1936 Market St., Philadelphia

Canadian Dist., De Forest Radio Corp., Ltd., Toronto



SIMPLEX SR 5
\$57

If they're on the air Simplex will get them. Five tube, tuned radio frequency, non-oscillating. Every piece of apparatus of guaranteed Simplex Standard. Low loss. Genuine mahogany, hand-rubbed cabinet.

Write for details

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Manufacturers
 1015 Ridge Ave. Philadelphia

Radio Dealers HEADQUARTERS

The House of a thousand values

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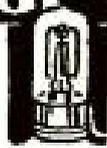
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W.D. 11 or 12
 U.V. 199 or C. 299 \$2⁰⁰
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 C. 300 or 301



U.V. 202 Repaired, \$3.00

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APPROVED!

Our "WRS" Cockaday Superheterodyne Kits are approved by Popular Radio Laboratories, Mr. Cockaday, director. With our "WRS" Kits and Popular Radio Blue Prints prepared under the personal supervision of Mr. Laurance Cockaday, it is possible to build this highly efficient Reflex Superheterodyne without any previous knowledge whatever. Not even an understanding of a hook-up diagram or radio symbol is necessary. "WRS" Kits contain every authorized part for building this circuit. You can start right in to build the minute you get the kit. And you are sure to get results when finished. No more hours of trouble shooting. No more hunting for this or that missing part. Everything is there! Down to the last screw nut and wire, packed in sealed cartons that eliminate all difficulty and doubt in the purchase and assembly of proper materials.

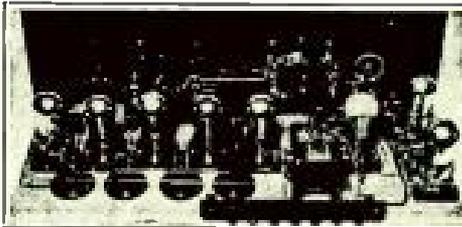


COCKADAY 8-TUBE REFLEX SUPER-HETERODYNE

The Cockaday Super-Heterodyne Surpasses all Conceptions of SENSITIVITY and SELECTIVITY—it Represents the Peak of Super-Heterodyne Engineering Skill

COMPLETE PARTS EXACTLY AS SPECIFIED BY MR. COCKADAY

- 1 General Instrument .0005 mfd. NO LOSS with Insulantite Insulation..... \$5.50
- 1 General Instrument .001 mfd. NO LOSS with Insulantite Insulation..... 6.00
- 1 Haynes Griffin Input Transformer (new type).....
- 3 Haynes Griffin Intermediate Transformers (new type)..... } 20.00
- 1 Precision Autodyne Coupler..... 3.50
- 1 Karas Harmonik Audio Frequency Transformer..... 7.00
- 1 Amplex Grid-denser..... 1.25
- 1 Benjamin Clear-tone Socket..... 1.00
- 7 Federal Sockets No. 16..... 8.40
- 1 Facent Double Circuit Jack..... .50
- 1 Facent Single Circuit Jack..... .50
- 2 NAALD 4 inch Dial..... 1.50
- 1 Amsco Rheostat 2 ohm..... 1.35
- 1 Amsco Rheostat 400 ohm..... 1.50
- 2 Daven Resisto-Coupler Mounts..... 2.50
- 1 Daven Grid Leak Mounting..... .35
- 2 Daven Resistors .5 megohm (500,-



- 000 ohm)..... \$1.00
- 1 Daven Resistor .5 megohm..... .50
- 1 Daven Resistor .005 megohm (5,000 ohm)..... 1.00
- 2 Daven Resistors .25 megohm (250,000 ohm)..... 1.00
- 2 New York Mica Condensers .0001 mfd..... .70
- 4 New York Mica Condensers .006 mfd..... 3.00

- 1 New York Mica Condenser .00025 mfd. with grid leak mounts.. \$.46
- 1 Duratran Radio Frequency Transformer..... 4.00
- 1 Walbert "A" Battery Switch..... .50
- 7 Eby Marked Binding Posts..... 1.40
- 1 7 x 24 drilled and engraved Bakelite mirror-finished panel..... 3.00
- 1 Mahogany Baseboard..... 1.00
- 1 Drilled binding post panel..... .25
- 1 Boxsorted screws, nuts, washers, lugs, etc..... .50
- 40 feet of extra heavy No. 12 tinned buss bar wire..... .75
- 1 Set of angle brackets for mounting post panel..... } .20
- 1 Special Cockaday bracket for mounting Amplex gridenser..... } .20
- 1 Set of three Popular Radio blue-prints covering complete constructional details for building this receiver..... 1.10

LIST PRICE..... \$81.30

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Write for your FREE COPY of our 80-page Catalogue. You will be amazed how much you can save by sending your orders to

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Be sure to consult our catalogue before making your purchases. See what is the lowest price for standard quality goods. REMEMBER! "WRS" sells direct to you by mail at WHOLESALE PRICES.

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The above Super-Heterodyne Built by Competent Engineers of the exact same parts as Listed above in a beautiful mahogany piano hinged cabinet, beautifully made and guaranteed to be wired according to Mr. Cockaday's specifications for only (without tubes or accessories)..... **\$99.50**

NEW COCKADAY FOUR CIRCUIT TUNER WITH RESISTANCE-COUPLED AMPLIFIER

All Parts Exactly As Specified by Mr. Cockaday. Our Kit Is Absolutely Complete To Last Screw. A Full Description of This Set is Contained in our Catalog at "WRS" Money Saving Prices.

WHOLESALE RADIO SERVICE CO.

9 CHURCH STREET
DEPT. P. R.
NEW YORK CITY

Gets DX— SLOW MOTION Tuning



REMEMBER how the "slow-motion" picture helped you see details that were unnoticed in the usual running?

In a similar way the "slow-motion" (12-to-1 ratio) of the new UNIVERNIER helps you find dozens of stations that are missed if "searching" is done with the usual coarse adjustment (as you are compelled to do with many so-called vernier dials which merely duplicate the action of the obsolete vernier condenser.)

With its continuous "slow motion," the UNIVERNIER first finds the station you want—then clears it up. That's why it's such a record-breaker for locating those hard-to-get distant stations and bringing them in so easily, quickly, clear and loud. Promise yourself a real surprise—replace your dials with UNIVERNIERStonight! At your dealer's or sent postpaid on receipt of purchase price. (Please mention dealer's name.)

Mahogany Knob and Gold-plated dial . . . \$1.50

Black Knob and Silver-plated dial \$1.25

Jobbers and Dealers: Write for Discounts

WALBERT MFG. CO.

933 Wrightwood Ave., Chicago, Ill.



WALBERT
UNIVERNIER
Micro-Selective Tuning Control

AMPLEX
GRID-DENSER

WANT more distance, clearer tone? You can get it without ripping out a single wire. Just replace all fixed condensers with GRID-DENSERS!

Follow the lead of men like Cockaday, Haynes, and Sleeper. They ALWAYS specify GRID-DENSERS.

In either the .0005 with or without gridleak clips or .001 type or type N (neutralizing) **\$1.25**

FREE—Eleven Hook-ups Free!
AMPLEX INSTRUMENT LABS.
88 W. Broadway, Dept. P-3, N. Y. C.

*Better than a Fixed Condenser**

More Power **CELERUNDUM** *Greater Volume*
The Crystal With a Soul

DE-TEX-IT

Complete \$1.25

**LOW LOSS—POSITIVE CONTACT
FIXED DETECTOR**

Best for Reflex—Requires no adjustment—will not burn out
CELERUNDUM RADIO PRODUCTS CO.
Wollaston (Boston) Mass.

Wire Your Set With
CELATSITE

You can't beat it for a neat job. It's No. 14 tinned copper wire with varnished insulation. Highly dielectric; moisture proof. Bends without cracking. Strips like the bark on a whistle! Looks like spaghetti, but smaller. 5 beautiful colors. Send for Free Folder, "How to Solder"; also describes "Celatsite" and other Acme products.

THE ACME WIRE COMPANY
Dept. P New Haven, Conn.

ACME WIRE
RADIO  **NEEDS**

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at \$3,000 to \$10,000 a year



Yes—\$3,000 to \$10,000 a year! These are the opportunities that exist everywhere today for big, easy money in Radio. Radio is the fastest growing industry in the world. If you are in a routine job with poor pay and no future, here's the chance of a lifetime. Investigate! Look into the amazing money-making possibilities of Radio. In a few short months of training at home by mail, we can make you an expert representative of our Association. Learn to install, repair, build and sell high-

grade radio sets. Become the Radio expert of your neighborhood. Find out how the Radio Association of America now makes all this easy for you. Radio offers not only big-salary jobs, but is a business you can easily get into for yourself.

Become a Radio Expert

Train at Home in Three Months

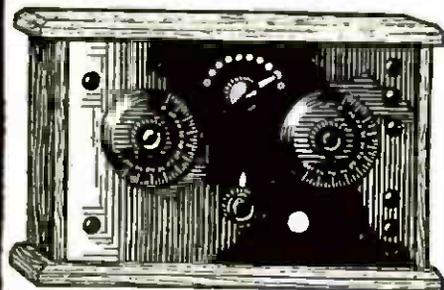
Get your share of the big money being made in Radio. Find out how in your spare time at home, without giving up your present position or losing a dollar of pay, you can become a Radio Expert in a few short months. No previous experience is necessary. For the man who prefers a salary, big-pay jobs are waiting with the U. S. Government, Steamships, Railroads, and thousands of corporations and business houses. For the man who wants to get into business for himself and be independent, Radio offers unlimited possibilities—either on a spare or full time basis. In no other line can ambitious men find the opportunities that Radio now offers. You can train under one of America's leading Radio authorities. Read Mr. A. G. Mohaupt's offer to train you personally in everything about Radio—construction, installation, repairing and selling. By enrolling with us now you get the benefit of the direct personal guidance of this well-known expert.



A. G. MOHAUPT, B. A., M. S.

Head of the Radio Association of America, Graduate Electrical Engineer, University of Wisconsin. Former Radio Instructor for U. S. Government. Author of "Practice and Theory of Modern Radio."

"I give my personal attention to every student taking my course. Your individual problems and questions are answered by myself. I work with you at every stage of the course, guiding you, directing you to your goal to be a Radio Engineer in the big-pay class. My course prepares you to successfully pass Gov't examination for Operator's License."



FREE—1000 MILE RADIO OUTFIT

This set when completed has a range of over 1000 miles. Right now we give it free to each member taking our course of training. Mr. Mohaupt's clear, simple instructions will show you how to build similar sets to sell at a big profit. When you have finished the course, you can sell this free set at a price that will practically pay the cost of your training.

Get The Facts—Mail Coupon

Radio knowledge is not only interesting and the means to the greatest form of entertainment the world has ever known, but is the most cashable knowledge a man can possess. Let us prove to you that there is nothing difficult about Radio—that any intelligent person can easily learn it right at home by mail under our simplified and approved methods. Mail the coupon now for all the facts. Let us prove that Radio is easier to learn and offers bigger money than any other business or profession you can get into. Don't wait—act while our Free Offer of a 1000 mile radio outfit is still in effect.

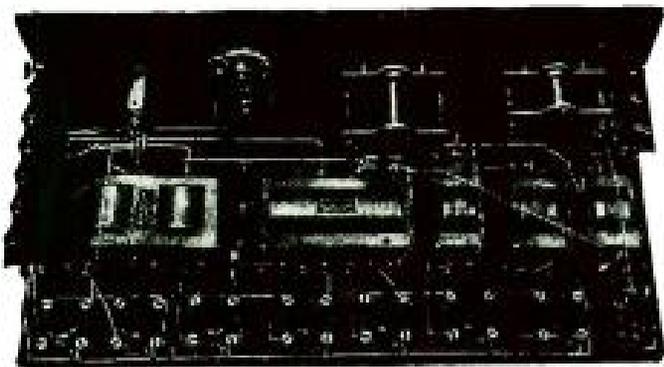
A. G. MOHAUPT, Radio Engineer
RADIO ASSOCIATION OF AMERICA
4513 Ravenswood Avenue Chicago, Ill.

RADIO ASSOCIATION OF AMERICA
4513 Ravenswood Avenue
Dept. 53 Chicago, Ill.

Please send me details regarding your Expert Home Training Plan and offer to representatives, also your offer of a 1000 mile Radio Set FREE.

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Address.....
City..... State.....

BRANSTON RADIO



Build Your Own Super-Heterodyne Save \$100 or More—Have a Better Set

Branston's Transformer Kit No. R-199 (\$35.00) contains eight matched transformers; Branston Accessory Kit No. R-199-A (\$50.00) contains panel, condensers, rheostats, wire, etc., etc. Partially assembled. Any amateur, in a few evenings, can easily build a reflexed Super-Heterodyne of coast-to-coast range, remarkable tone quality, great volume, and hairline selectivity.



Branston Accessory Kit No. R-199-A (Partially Assembled) contains

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|---|--|
| 1 7 x 21 Drilled and Engraved Panel | 2 .001 Tested Fixed Condensers |
| 2 23 Plate Straight Line Low Loss Condensers | 2 .005 Tested Fixed Condensers |
| 1 60 Ohm Rheostat | 1 .0001 Tested Fixed Condenser |
| 1 25 Ohm Rheostat | 1 .00025 Tested Fixed Condenser |
| 1 Battery Switch | 2 Grid Leak Mountings |
| 1 Single Circuit Jack | 1 Variable Grid Leak |
| 1 Two Circuit Jack | 1 Fixed Grid Leak |
| 2 Branston Cam-Vernier Dials | |
| 2 Sub Panels and Ten Binding Posts, assembled | |
| 1 Baseboard 20" x 9 1/4" | Sufficient square bus bar, spaghetti, nuts, screws, terminals and rosin core solder to complete wiring of set. |
| 7 UV-199 Sockets | |
| 1 3 Plate Vernier Condenser and Mountings | |

Be sure to state whether you intend to use UV-199 or UV-201-A Tubes.

Send 25c for Super Heterodyne, Radio Frequency, and Honeycomb Coil circuits and complete catalog. Your dealer has Branston Kits or can get them for you. If not, write us.

Chas. A. Branston, Inc.

811 Main Street Buffalo, N. Y.

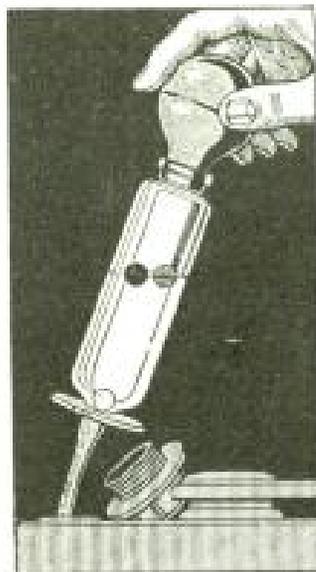
Manufacturers of Branston Violet Ray High Frequency Generators

In Canada—CHAS. A. BRANSTON, Ltd., Toronto, Ont.

S O S HYDROMETER

Best by Test for Radio and Automobile Batteries

Simple - Durable - Accurate



The CHASLYN BALLS are used as Charge Indicators by leading battery manufacturers.

These Patented Balls show the condition of the Battery.

Swim all Three,
Charged Fully

Sinks the White,
Charge Still Right

Sinks the Green,
Charge is Lean

Sinks the Red,
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Sent postpaid if your dealer doesn't have it.

Have you seen the new CHASLYN A.F. TRANSFORMER?

75c.

THE CHASLYN COMPANY

3845 Ravenswood Ave., Chicago

GILFILLAN NEUTRODYNE SETS — KITS — PARTS

Made in our three Radio factories with years of Radio experience behind them.

Send for Literature

GILFILLAN BROS. INC.

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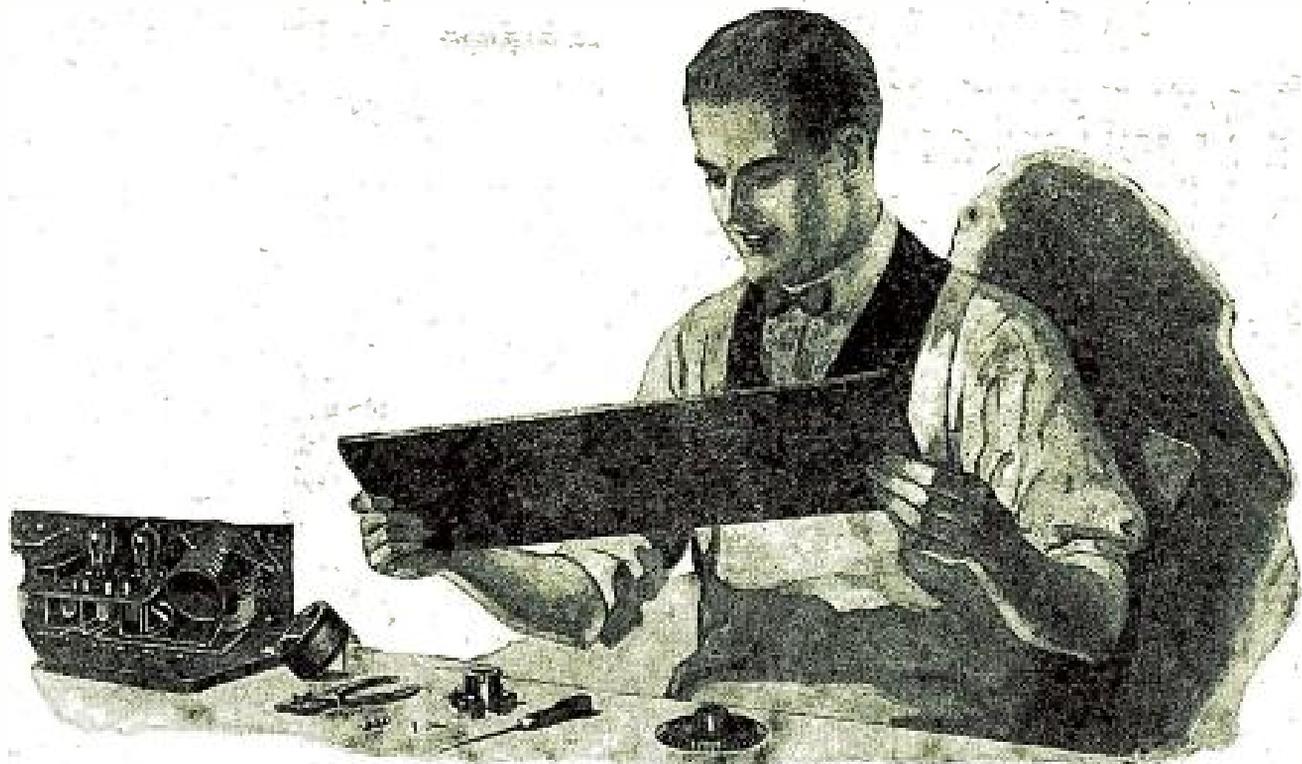


Exclusive choice of Dr. MacMillan for his North Pole Expedition

Seven Models, from \$95 to \$550

They Cost More—but—They DO More

Zenith Radio Corporation 328 So. Michigan Avenue CHICAGO, ILL.



Notice the rich finish on this panel —built to order for radio

A SURFACE that is good-looking and useful, too. That was one of the demands we made of the engineers who developed Radion especially to order for radio purposes.

The high-polished, satin-like finish of Radion Panels does more than add to the beauty of your set. It keeps out dirt and moisture, thus preventing the possibility of causing short circuits from this source and reducing good reception.

Lowest losses and greater efficiency

BUT the worth of Radion is not just on the surface. Authoritative laboratory tests give it the highest rating as radio-frequency insulation. It reduces surface leakage and leakage noises. This means lowest losses and greater efficiency, especially noticeable in super-sensitive circuits.

Radion Panels resist warping. It's the easiest material to cut, saw or drill. It comes in eighteen stock sizes and two kinds, Black and Mahogany.

Better performance will make it worth your while to ask for Radion by name and to look for the stamp on the panel and the name on the envelope. Radio dealers have the exact size you want for your set.

Send for booklet, "Building Your Own Set"

OUR new booklet, "Building Your Own Set," giving wiring diagrams, front and rear views, showing a new set with slanting panel, sets with the new Radion built-in horn, lists of parts and directions for building the most popular circuits—mailed for ten cents. Mail coupon today.

Other Radion Products

The same qualities of low-loss insulation and attractive appearance characterize Radion dials (to match panel), binding post panels, insulators, knobs, etc.—also the new Radion built-in horn.

AMERICAN HARD RUBBER COMPANY. Dept. B-3, 11 Mercer St., New York City

Chicago Office: Conway Building

Pacific Coast Agent: Goodyear Rubber Co., San Francisco—Portland

RADION

The Supreme Insulation

PANELS

Dials, Sockets, Binding Post Panels, etc.

American Hard Rubber Company,
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New York City.

Please send me your new booklet, "Building Your Own Set," for which I enclose 10 cents (stamps or coin).

Name

Address

City State

Coast to Coast reception on loop with loud speaker Guaranteed with Vir Bren DX Transformer



VIRBREN DX TRANSFORMERS completely change your Super-Heterodyne set so it brings everything in America you want to hear to you as clearly as though Singers, Orchestras or Speakers were on a stage in front of you. . . . You tune in and out stations operating close together at the same time without a single rasp. . . . You get Canada, Cuba, Los Angeles or New York on a 16-inch loop when using wonderful **VIRBREN DX TRANSFORMERS AND COILS** in your Super-Heterodyne.

VIRBREN APPARATUS

- DX-2H Transformer, 5000 Meters, - - \$6.60
 - DX-Input Transformer, 5000 Meters, - 6.60
 - Oscillator Coil, - - - - - 3.00
 - Blue Print, - - - - - .75
 - Antenna Coil, - - - - - 2.50
 - DX-18 Transformer, 220-550 Meters, - 6.40
 - DX-19 Transformer, 220-550 Meters, - 6.40
- Contacts for mounting furnished with all Transformers.

**RADIO STATIONS RECEIVED ON LOOP—
LOUD SPEAKER RECEPTION**

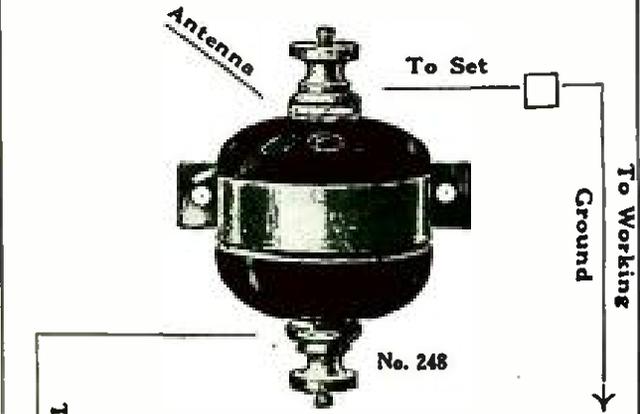
STATION	CALL	TUNER	OSCILLATOR
Elgin, Ill.	WTAS	12	14
New York	WGOB	15	17
Oakland, Cal.	KGOH	15	22
New York	WAGH	16	22
Denver, Colo.	KWH	17	24
Cleveland	WBS	18	24.5
Birmingham	WLSA	20	19.5
Chicago	WLSA	21.5	21
Pittsburgh	KDKA	22	22
Chicago	WGN	25	35
Holersstadt	WGY	29	35
Havana	WEX	34	26
Chicago	WFLA	34.5	29.7
Minneapolis	WLAB	35	30
Montreal	WKB	37	31.5
Atlanta	WRS	38	32 - 47.2
Ottawa	CHRO	42	34
Chicago	WMAQ	43	34.5
Local	WRC	48	55.5
Jefferson City	WOS	60	60.5
Portland	WHA	51	40.5
New York	WEAA	58	49 - 66
Dallas	WFAA	49	58.5 - 89
Cleveland	WOAW	62.5	76
Chicago	KYW	66	80

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Supply us with your dealer's name.

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for ATTRACTIVE PROPOSITION**

RADIO INSTRUMENT CO., Inc.
Manufacturers of Virbren Apparatus.
939 D. St. N. W., WASHINGTON, D. C.

The "LITTLE JOE" Lightning Arrester



Card No. E-5841
Jan. 5, 1923, Underwriters Approval
Especially designed for Radio Work
Made of Porcelain, small, neat, rugged and serviceable. Can be suspended on antenna or fastened to wall.
Ask your dealer or write for further information
CIRCLE F MFG. CO.
Succeeding
E. H. FREEMAN ELECTRIC CO.
and **TRENTON PORCELAIN CO.**
TRENTON, NEW JERSEY

RADIO SALESMEN and SET BUILDERS—

We need you and you need us. If you are reliable and well known in your community, we will appoint you our representative and furnish you with standard well advertised sets and parts at prices that will enable you to sell at a handsome profit. Write at once for catalogue and sales plan.

WAVELAND RADIO CO.
DIV. 56, 1027 N. STATE ST.
CHICAGO, ILL.

The EAGLET Neutrodyne 3 TUBES DRY CELL OPERATED



\$75

The World's
Greatest
Popular Priced
Set

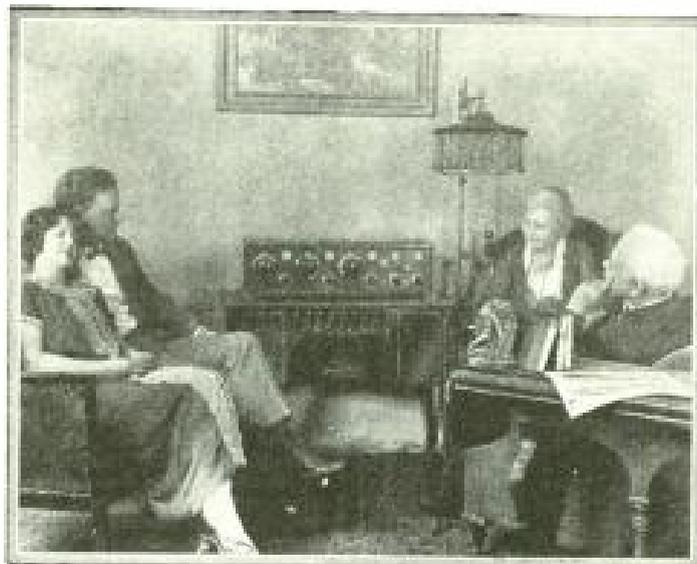
WRITE FOR LITERATURE
EAGLE RADIO COMPANY
18 Boyden Place, Newark, N. J.

Radio Without the Horn!



Goodbye to the Old-Fashioned Horn Speaker!

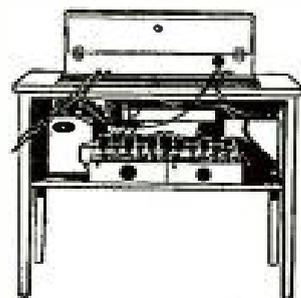
A Vastly Better Reproduction With this New Radio Console!



"Our old horn speaker never gave tones like this! An artistic addition to the living room—everything in its place—it's a joy!"

New Console Has Its Own Perfect Loudspeaker!

Ample Space for All the Rest of Your Outfit!



HERE is something that enables you to enjoy radio in the home without the clutter of unsightly apparatus that plays havoc in the decorative scheme of your living room! The horn speaker is out of date and out of place in radio for the home. This console, with its in-built loudspeaker, is scientific and sightly.

A Truly Wonderful Tone

It does a good job of reproducing, for it has a good unit and its sound-box is of resonant wood instead of metal, fibre, or composition.

The appearance of a Windsor loudspeaker console is a delight. Its convenience is a joy. A piece of real living room furniture of pleasing lines and finish—and it accommodates all the miscellany of equipment which hitherto had no place except on table tops, shelves or floor. Ample space on top for any set, with plenty of elbow room in front. Nothing in sight but the console and receiving set. Everything else goes inside—from behind—in spaces cleverly designed to hold the largest batteries and outfit for home use—besides the self-contained loudspeaker—all unseen and protected from dust or disturbance.

You Need This Console Whatever Your Present Outfit Is

It makes no difference what kind of radio outfit you have—this console was designed for your use. The graceful exterior of this console gives no hint of its inner utility, for it is a simple and effective piece of furniture in every line. But a glance at the interior reveals a most ingenious arrangement of the in-built loudspeaker with space either side and in back. These spaces are ample for the largest A battery, and the largest wet

B batteries and the largest charging outfit for home use. It is 38 in. long, 18 in. deep, and 29 in. high. Notice the artistic grill that conceals sound-box, and the provision for "knee room" beneath. Made in mahogany or walnut finish, and the price is only \$40! (West of the Rockies, \$42.50.)

Dealers!

The sale of these consoles has already reached extraordinary figures. They are selling in surprising quantities in even smallest stores where there is one in the window or on the floor. It is a convenience and a value not to be duplicated.

Write us for discounts and particulars.

INVESTIGATE!

Dealers everywhere are now showing the Windsor loudspeaker console, and have them for immediate delivery to your home. If you haven't already seen this

remarkable contribution to radio enjoyment and convenience, write us now for the name of a nearby store where you may view it. We will also send you complete information. Remember, this console gives you not alone a reproducing unit and sound-box, but an altogether new beauty and utility in the provision for your entire radio outfit. Mail coupon or postal.

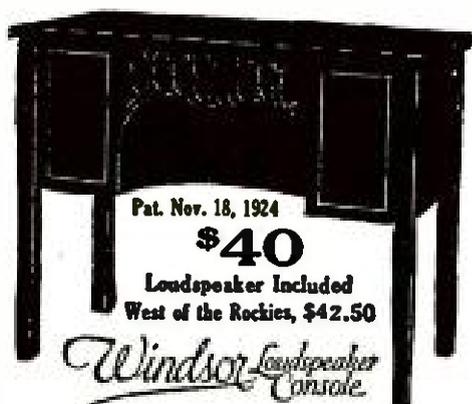
If you wish to use your own favorite unit, a deduction will be made for omission of unit.

WINDSOR FURNITURE COMPANY (15)
 1422 Carroll Ave., Chicago

Please furnish pictures and full details, also name of nearest dealer who has the new Windsor loudspeaker console.

Name

Address

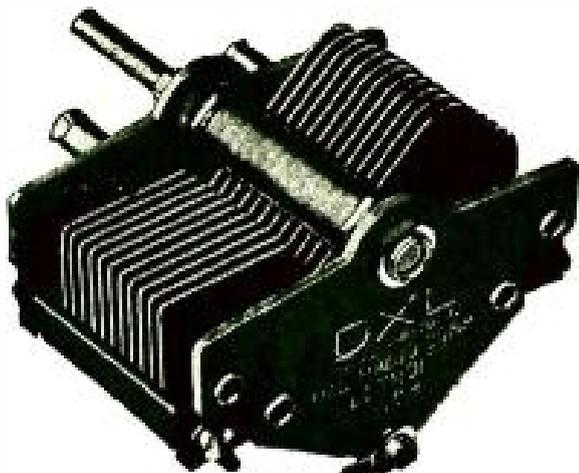


Pat. Nov. 18, 1924

\$40

Loudspeaker Included
 West of the Rockies, \$42.50

Windsor Loudspeaker Console



D X L

TRADE

MARK

Straight Line Low Loss Variable Condenser

Increased distance and volume, better still, much greater Selectivity, are certain results with D X L Straight Line Low Loss Variable Condensers. No D X L Condenser leaves the factory that doesn't meet the quality tests outlined by D X L engineers. Set builders can use D X L Condensers right out of the carton with the certainty that each one is perfect. Use D X L Condensers and you are sure of the best performance.

New D X L Kit

Now ready—the D X L 5 Tube Tuned R. F. Receiver Kit absolutely Straight Line and Low Loss. Will separate two stations only 6 meters apart, broadcasting simultaneously. No squeals, non-oscillating coast to coast reception on loud speaker. Less static interference. Positive results guaranteed if built in accordance with detailed instructions and blue print, free with every D X L Kit.

Get our booklet—full of interesting and valuable information—free

D X L RADIO CORPORATION
5767 Stanton Ave.
DETROIT, MICH.

"Take No Chances—Use Como" COMO DUPLEX

The World's Standard Push Pull
Transformer



PRICE \$12.50 per pair

For maximum volume without distortion

What Prominent Writers on Radio
Subjects say About Como.

Lewis B. Hagerman, Technical Editor, *Chicago Post*: "Actual Tests show this transformer to be far superior to any others of similar makes."

R. J. Robbins, *New York Sun*: "After consideration of several well-known makes of push pull transformers which are available 'COMO DUPLEX' was selected as most satisfactory."

C. White, *Radio World*: "'COMO DUPLEX' is infinitely superior—most other push pull transformers seem to be ordinary transformers with a center tap brought out as a makeshift."

E. P. Gordon, *Open Road*: "A system of audio-amplification which is becoming increasingly popular. Its use . . . will give surprising results in both quality and volume, and is thoroughly recommended by this department."

NEED WE SAY MORE?

COMO APPARATUS COMPANY

Manchester, New Hampshire
For Sale at Leading Dealers

The Famous BEL-CANTO LOUD SPEAKERS NOW at your DEALER

10" Bell, 22" High, \$10 15" Bell, (Goose Neck) 29" High, \$15

If Your Dealer Cannot Supply You, Write Us and We Will Advise Where to Purchase One.

Distributors: Sunbeam Radio Corp., 1834 Broadway, N. Y. C.; Knickerbocker Talking Machine Co., 831 Broadway, N. Y. C.; Walter S. Gray Co., 1054 Mission St., San Francisco, Calif.; 328 Midway Place, Los Angeles, Calif.; 2802 Fourth Ave., Seattle, Wash.

BEL-CANTO RADIO & TEL. EQUIP. CO., Inc.
872 B'way, N. Y. C. Tel. Stuy. 1921

**Protects
Radio
Tubes**

GEM RADIO FUSE BASE

You can protect tubes against destruction from short circuits for a few cents by installing the "Gem" Radio Fuse. Then when there's a "short" the fuse blows and the tubes aren't injured. Easily installed.

Base for attaching and three fuses sent postpaid for \$1.25, if not at your dealer's.

CHICAGO FUSE MFG. CO., 1507 West 15th St., Chicago, Ill.

"GEM" RADIO FUSE

All parts are specially built for the kit. Not a collection of open market parts.

Highly polished Bakelite panel. All necessary holes drilled. Markings plainly engraved in white.

King Quality Cardwell low loss condensers—the most serviceable condensers for precision and long distance tuning.

The King Quality cable solves the wiring problem. The wiring goes into receiver as a unit—no chance of mistakes.

All bus wires are cut to proper length and bent to shape.

The dials are one-piece Bakelite. They cannot run out of true. They fit the fingers. Figures and markings white.



A Complete Five Tube Neutrodyne Receiver in This King Quality Kit

HERE is what radio "fans" have been wanting—a kit from which they can build their own Neutrodyne Receiver, an opportunity to have a high quality neutrodyne receiver at only a fraction of what it would cost to buy the outfit complete.

Every step in the assembly of this "kit" is carefully described in instructions which accompany it, written in plain language. No need of having a technical knowledge of radio.

The intricate wiring which has always been a difficulty in the assembly of radio receivers, has been overcome by the King Quality telephone switch

board type of cable. The wiring goes into the receiver as a unit, each wire in its proper position. Bus wires are cut to proper length and bent to shape.

The King Quality Radio Kit embodies the latest developments in neutrodyne reception combined with the practical experience of engineers who have devoted years to the study of radio apparatus. Uncertainty has been eliminated.

This kit is made up for either storage or dry battery operation.

Kit R-1400—storage battery type.

Kit R-1500—dry cell type.



Ask your dealer to show you this kit or write

KING QUALITY PRODUCTS, Inc.
BUFFALO, N. Y. BRIDGEBURG, ONT.



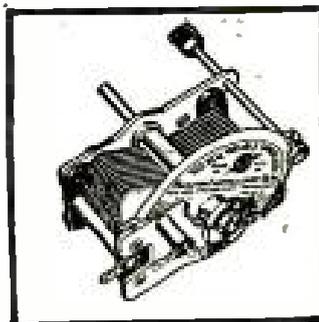
KING QUALITY RADIO

All apparatus advertised in this magazine has been tested and approved by POPULAR RADIO LABORATORY

There are Real Reasons for the Quality Plus of both these RED SEAL Products



RED SEAL
the Comfortable
HEAD SET
\$6



RED SEAL
VARIABLE
CONDENSER
(25 plate) \$6

Not just any iron, steel or wire, materials that will "get by" and produce signals—but only the best and most expensive are used in the Red Seal Headset. Compare it with the average headset. Magnets of Tungsten Steel; pole-pieces of silicon steel; light cases of genuine Bakelite; comfortable molded rubber headband and a coordination of design—these are the unique Red Seal features that give plus results. Yet the Red Seal costs but \$6. Your set is only as good as its mouthpiece and a good set deserves a Red Seal Headset.

The Red Seal Variable Condenser is the better tuning element for supercritical reception. It is of the straight-line type with losses so low as to be practically immeasurable. Brass plates, securely soldered and balanced; bearings free for smooth operation. And, best of all, the Red Seal is controlled by a vernier of an improved patented type. No gears, no "back-lash," but that easy "hair-line" adjustment so necessary for critical work. These are the quality plus features. A Red Seal Condenser will make a good set better.

"Red Seal"—your guarantee of quality.



Makers of famous Red Seal Batteries.

NEW YORK

CHICAGO

ST. LOUIS

SAN FRANCISCO

THE Summit TOROIDAL

used in exactly the same manner as the open radio frequency coils—they are self-balanced and self-neutralized. They have no stray fields nor leakages, nor can they feed back, thus assuring the radio set builder of correct operation without howling or squealing.

RADIO FREQUENCY TRANSFORMER

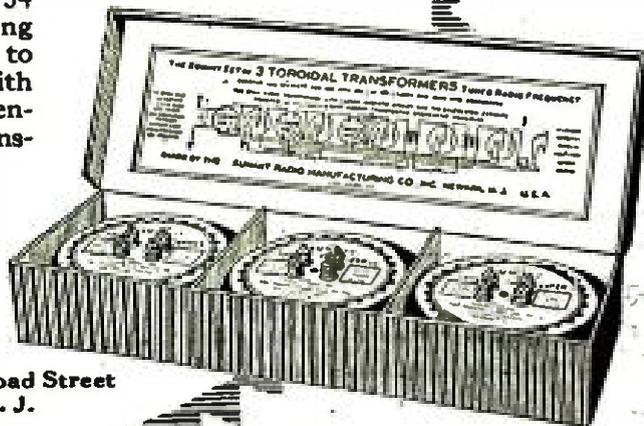
One builder using these Transformers in the SUMMIT circuit received 54 stations in two nights, traveling West to Denver and South to Mexico City. This circuit, with instructions for building, enclosed with each set of Transformers.

List Price (Set of 3 mated units)..... **\$10.00**

Distributors and Jobbers Wanted

SUMMIT RADIO MFG. CO., Inc.

Dept. 31 481 Broad Street Newark, N. J.



Pat. Applied for



MORE DISTANT STATIONS

WITH THE **APEX** VERNIER DIAL

Greater range, bigger volume, finer selectivity, less interference. Lasts forever. The one big advance yet made in tuning. Ratio 12 to 1.

Quickly applied to any shaft.

For sale by all good Radio Dealers.

If unable to obtain from dealer, enclose

\$2.00 for Royal Brass Finish.

\$2.50 for Satin Silver Finish.

\$3.50 for De Luxe Gold Plated Finish.

The Apex Super Five

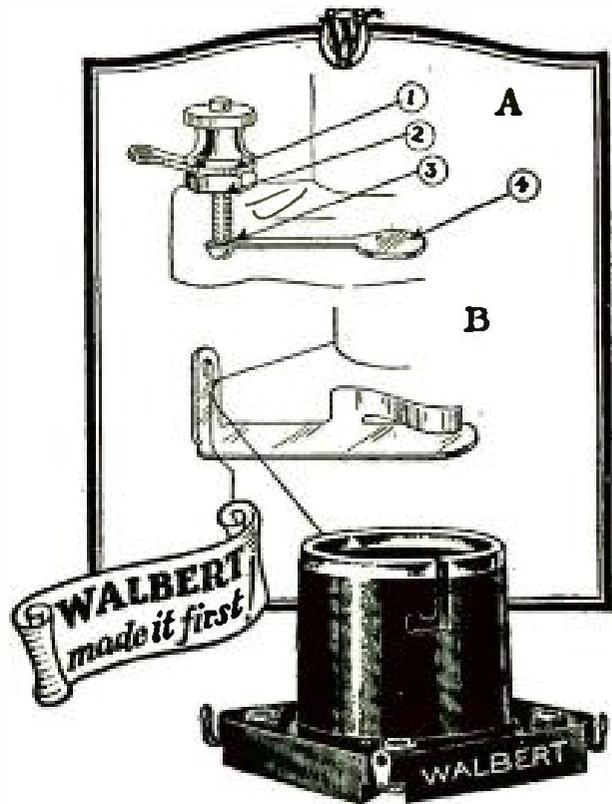
is a tuned radio frequency receiver of the highest type. Built into a highly finished walnut cabinet—complete with Jones Multiple Battery Cable—all settings highly gold plated. List price \$95.00 complete.

7 Tube Microdyne Super-Heterodyne for \$97.50

Receive the parts complete to assemble your set. Coast to coast on an 18 in. loop. Assemble this 7-tube Microdyne Super-Heterodyne on a 7 x 18 in. panel in 3 hours. Parts complete. Price of cabinet, to fit, on application. If your radio dealer cannot supply, send check or money order and name of dealer.

Apex Electric Mfg. Co.

1410 West 59th Street Dept. 302 Chicago



80 "LOSSES" ELIMINATED— Count them!

Do you know that on each contact spring of the average socket there are at least 4 "contact-losses" (see Fig. A. above) or 16 "losses" counting all four springs? On a 5-tube set there would be 80 possible "contact-losses." What a chance for increased volume if these "losses" could be eliminated.

They can be! The WALBERT SOCKET does it. Positive contact with each tube prong is made possible by a unique side-wiping and bottom-pressure phosphor bronze spring. There are no other contacts—soldering lug is part of the spring! (See Fig. B). Losses are eliminated where they count the most.

And UNBREAKABLE!

A special protective rim absolutely prevents breaking or chipping at the slot. The WALBERT is the real lifetime socket! Special All-bakelite design decreases inter-element capacity thereby utilizing all available grid voltage for producing signals. (New tubes have bakelite bases for same reason). Socket is extra deep. Covers entire base of tube. Aids in holding tube firmly and makes a strikingly handsome socket.

For BETTER RESULTS!

Eliminate those 80 losses on your set by replacing your sockets with Walbert Sockets. Get more volume and clearer reception. At your dealer or sent postpaid on receipt of purchase price.

Walbert Socket 75c

Jobbers and Dealers: Write for Discounts

WALBERT MANUFACTURING CO.
933 Wrightwood Ave. CHICAGO, U. S. A.

WALBERT SOCKET

3 TUBE LOW SPEAKING **only**

29.50

FULLY GUARANTEED

LONG DISTANCE RADIO

Users everywhere report Miraco Tuned Radio Frequency sets get programs coast to coast; outperform sets 3 times as costly. Send for proof they are radio's most amazing values. One tube guaranteed, completely assembled long distance outfit, only \$14.95. Three tube outfit, \$29.50. Five tube \$75.

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479-B E. 8th St., Cincinnati, Ohio

AGENTS DEALERS
Our proposition's a winner. Write.

MIRACO RADIO GETS 'EM COAST TO COAST



MULTIPLE CONDENSERS

(Licensed under Hogan Patent 1014002)

Insulated with PYREX
or CORANTUM

Of Extreme Precision

For Single Control Circuits

All Capacities

General Instrument Corporation

Manufacturers of Laboratory Equipment

423 Broome Street, New York, U. S. A.

S. HAMMER RADIO CO., 303 Atkins Ave. Brooklyn, New York

First in the Field — Specializing in Cockaday Kits !
WE SELL GENUINE PARTS ONLY !

As authorized and specified by Mr. Laurence M. Cockaday. The parts listed in these kits are complete in every detail. Nothing else to buy to assemble. **COMPARE OUR OFFER!**

<h3 style="font-size: 2em; margin: 0;">5 TUBE NEW COCKADAY 4 CIRCUIT TUNER WITH RESISTANCE COUPLED AMPLIFIER KIT</h3> <table border="0" style="width: 100%; font-size: 0.8em;"> <tr> <td style="width: 50%;"> 1 "Precision" Cockaday Coil Set.....\$5.50 1 "Cardwell" Vari. Cond. .0005.....5.00 1 "Cardwell" Vari. Cond. .00035.....4.75 2 "Accuratune" Dials.....7.00 1 "Amplex" GRID-DENSER.....1.25 1 "N.Y." Fixed Cond. .00025......35 9 "N.Y." Fixed Cond. .005.....5.40 5 "Benjamin Cle-ra-tone" Sockets.....5.00 1 "Bradley"leak".....1.85 3 "Bradley"ohms" No. 25.....6.00 1 "Amsco Dobl-Wundr".....2.00 4 "Amperites" No. 1-A with mountings.....4.40 </td> <td style="width: 50%;"> 1 Switch Lever.....\$ 30 3 "Improved" DC Jacks.....5.00 1 "Improved" SC Jack......70 1 "Improved" Battery Switch.....1.00 1 "Precise" Transformer.....5.00 3 "Electrad" 1/4 meg. Leaks.....1.50 3 "Electrad" Mountings.....1.05 8 Rajah Binding Posts.....1.60 7 Switch Points—2 stops......15 1 Baseboard......75 3 Sub-Panels (Genuine Bakelite).....50 Bus Bar, Brackets, Screws......75 Genuine Bakelite Panel, Drilled and Engraved.....3.00 </td> </tr> </table> <p style="text-align: right; margin: 0;">Total Price.....\$67.80</p>	1 "Precision" Cockaday Coil Set.....\$5.50 1 "Cardwell" Vari. Cond. .0005.....5.00 1 "Cardwell" Vari. Cond. .00035.....4.75 2 "Accuratune" Dials.....7.00 1 "Amplex" GRID-DENSER.....1.25 1 "N.Y." Fixed Cond. .00025......35 9 "N.Y." Fixed Cond. .005.....5.40 5 "Benjamin Cle-ra-tone" Sockets.....5.00 1 "Bradley"leak".....1.85 3 "Bradley"ohms" No. 25.....6.00 1 "Amsco Dobl-Wundr".....2.00 4 "Amperites" No. 1-A with mountings.....4.40	1 Switch Lever.....\$ 30 3 "Improved" DC Jacks.....5.00 1 "Improved" SC Jack......70 1 "Improved" Battery Switch.....1.00 1 "Precise" Transformer.....5.00 3 "Electrad" 1/4 meg. Leaks.....1.50 3 "Electrad" Mountings.....1.05 8 Rajah Binding Posts.....1.60 7 Switch Points—2 stops......15 1 Baseboard......75 3 Sub-Panels (Genuine Bakelite).....50 Bus Bar, Brackets, Screws......75 Genuine Bakelite Panel, Drilled and Engraved.....3.00	<h3 style="font-size: 2em; margin: 0;">8 TUBE NEW COCKADAY SUPERHETERODYNE REFLEX RECEIVER KIT</h3> <table border="0" style="width: 100%; font-size: 0.8em;"> <tr> <td style="width: 50%;"> 1 General Instrument .0005 Condenser (Isolantite Insulation).....\$5.50 1 General Instrument .001 Condenser (Isolantite Insulation).....6.00 1 Haynes Griffin input transformer (new type).....5.00 3 Haynes Griffin intermediate transformers (new type).....15.00 1 Precision Autodyne Coupler.....3.50 1 Karas Harmonik Audio Frequency Transformer.....7.00 1 Amplex Grid-Denser .0005.....1.25 1 Benjamin Cle-ra-tone Socket.....1.00 7 Federal Sockets No. 16.....8.40 1 Patent Double Jack......60 1 Patent Single Jack......50 2 Na-Ald 4 inch Dials.....1.50 1 Amsco Rheostat 2 Ohms.....1.35 1 Amsco Potentiometer 400 Ohms.....1.50 1 Daven Grid Leak Mounting......35 </td> <td style="width: 50%;"> 2 Daven Resisto - Coupler Mountings.....\$2.50 2 Daven Resistors .5 Megohms.....1.00 1 Daven Resistor 5. Megohms......50 1 Daven Resistor .005 Megohms.....1.00 2 Daven Resistors .25 Megohms.....1.00 2 New York Mica Condensers .0001 Mfd......70 4 New York Mica Condensers .006 Mfd.....3.00 1 New York Mica Condenser .00025 with clips......45 1 Duratran Radio Frequency Transformer.....4.00 1 Walbert "A" Battery Switch......50 7 Eby Binding Posts.....1.40 1 Sub-Panel 1 x 9 Genuine Bakelite......15 1 Baseboard (Hardwood)......35 Genuine Bakelite Panel, Drilled and Engraved.....3.00 </td> </tr> </table> <p style="text-align: right; margin: 0;">Total Kit Price.....\$78.00</p>	1 General Instrument .0005 Condenser (Isolantite Insulation).....\$5.50 1 General Instrument .001 Condenser (Isolantite Insulation).....6.00 1 Haynes Griffin input transformer (new type).....5.00 3 Haynes Griffin intermediate transformers (new type).....15.00 1 Precision Autodyne Coupler.....3.50 1 Karas Harmonik Audio Frequency Transformer.....7.00 1 Amplex Grid-Denser .0005.....1.25 1 Benjamin Cle-ra-tone Socket.....1.00 7 Federal Sockets No. 16.....8.40 1 Patent Double Jack......60 1 Patent Single Jack......50 2 Na-Ald 4 inch Dials.....1.50 1 Amsco Rheostat 2 Ohms.....1.35 1 Amsco Potentiometer 400 Ohms.....1.50 1 Daven Grid Leak Mounting......35	2 Daven Resisto - Coupler Mountings.....\$2.50 2 Daven Resistors .5 Megohms.....1.00 1 Daven Resistor 5. Megohms......50 1 Daven Resistor .005 Megohms.....1.00 2 Daven Resistors .25 Megohms.....1.00 2 New York Mica Condensers .0001 Mfd......70 4 New York Mica Condensers .006 Mfd.....3.00 1 New York Mica Condenser .00025 with clips......45 1 Duratran Radio Frequency Transformer.....4.00 1 Walbert "A" Battery Switch......50 7 Eby Binding Posts.....1.40 1 Sub-Panel 1 x 9 Genuine Bakelite......15 1 Baseboard (Hardwood)......35 Genuine Bakelite Panel, Drilled and Engraved.....3.00
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WIRED COMPLETE In \$85.00
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WIRED COMPLETE In GENUINE MAHOGANY CABINET \$110.00
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Write for circular about these Parts and complete Kits also for our Radio Catalog—sent free. No obligations, do it now

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Says of

E-Z-TOON

(EASY TUNE)

RADIO DIALS

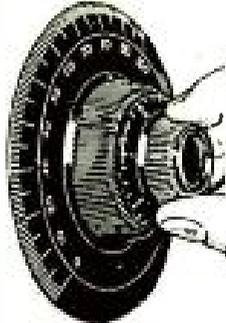
The Key to Simplified Tuning

"Tuesday night, November 25th, I heard station 2 L. O., London, England, with a 3-tube single circuit type receiving set, built by myself and equipped with an E-Z-TOON 4-inch dial on aerial tuning condenser.

My whole success I contribute to the exceptional close tuning of the variable condenser, with vernier type dial; this condenser was not in itself a vernier type, but became one and better with the addition of your dial."

If your dealer cannot supply, write us.

3-inch Dial, Black, \$2, Mahogany, \$2.20. 4-inch Dial, Black, \$2.25, Mahogany, \$2.45. 2-inch non-vernier dials for rheostats, switches, etc. Black, 40c., Mahogany, 45c. All vernier dials made with zero mark on either right or left side.



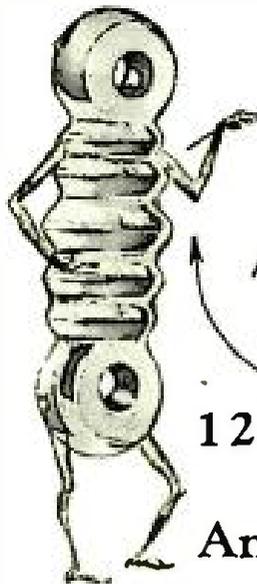
Requires only a small screw-driver to install—no changes in shaft—no redrilling of panel—dial arranged to accommodate single hole mounted condensers. No cogs, gears, backlash or lost motion.

E-Z-TOON RADIO CO.

3236 W. Washington St.

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PYREX All-Weather Insulators



Antenna collect mighty little radio energy at best. If the antenna insulators are leaky of course you can't get distance or good reception.

12 Reasons For PYREX Antenna Insulators

1. Give stronger signals.
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4. Have strain resistance over 450 lb.
5. Have super-smooth surface.
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9. Retain no surface moisture.
10. Small phase angle difference (0.25°).
11. Made stronger to stand rough handling.
12. Used by the Navy and other Government Departments.

PYREX Antenna Insulators are used under severest conditions by United States Coast Guard Service. Their phase angle difference does not change appreciably with various wave lengths. Their structure is continuously uniform, not relying on a glazed surface for insulating properties.

To insure best results make sure your set is equipped with PYREX Broadcast Antenna Insulators. Retail at 45c.

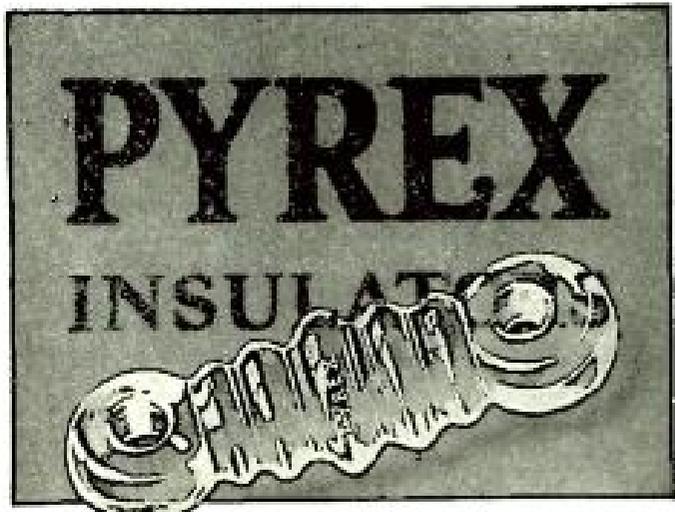
Inquiries from jobbers invited

CORNING GLASS WORKS

Industrial division

CORNING

NEW YORK





\$3⁵⁰

**PRECISION
AUTODYNE
COUPLER**

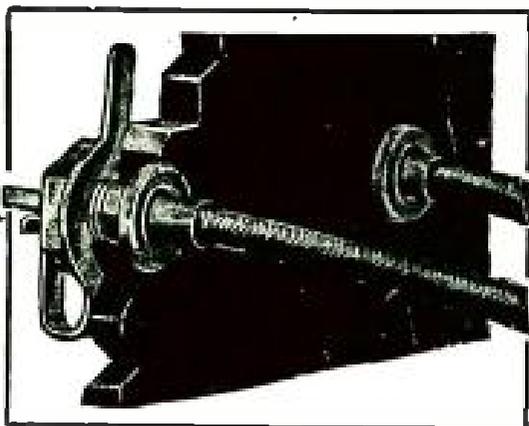
Again Precision leads! L. M. Cockaday specified in the January issue of POPULAR RADIO the new Precision Autodyne Coupler for his 8-Tube Superheterodyne Reflex Receiver.

The Autodyne Coupler is a new development for use in connection with a vacuum tube for producing a continuously variable alternate current. Used as a laboratory vacuum tube oscillator, the frequency of which may be calibrated and thus the apparatus used as a standard, also as an oscillator and detector in some of the more specialized forms of the Super-Heterodyne.

At your dealers—otherwise send purchase price and you will be supplied postpaid.

Made by the makers of the genuine "Cockaday" Coil.

Precision Coil Company
209-B Centre St., New York City



*Leading Set Manufacturers
Endorse and Use*
**Union Radio
Tip Jacks**

- Because they give tight, positive contacts.
- Because there are no parts to lose.
- Because they improve the looks of the set.
- Because all you have to do is plug in.

Only 25c a pair

Will firmly grip any wire from No. 11 to No. 24 B & S gauge and can easily be reamed to hold antenna wire and loading coils.

Three Sizes for All Mountings

- Standard Type A for panels $\frac{3}{8}$ " to $\frac{1}{4}$ " thick.
- Special Type B for panels, cabinet walls, and partitions $\frac{5}{8}$ " to $\frac{1}{2}$ " thick.
- Special Type C for panels up to $\frac{1}{8}$ " thickness.

Other Guaranteed Union Radio Parts

TUBE SOCKETS of highly polished moulded condensite. Phosphor bronze contact springs. Reinforced bayonet slot. For all standard tubes—Price 70c.

DIAL ADJUSTERS for minute adjustment of dials, necessary in close tuning—**Price 60c.**

Retailers—Wholesalers:

Write for free samples. Get details of our dealer proposition. Ask for illustrated pamphlet "A."

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NEW-YORK OFFICE - 116 - WEST-32 - STREET

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It contains a thousand bargains of everything in radio: parts, supplies, complete parts for sets, complete sets, etc., also a mine of very latest information on all different circuits, complete list of broadcasting stations and other valuable data. Send your name and address and we'll send FREE catalog.



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Loud Speaker**

With American Adjustable Unit. Wonderful volume, clear reception. Speaks for itself without coaxing. 10-inch bell—made of non-vibrating material.

\$3.95
without unit
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with unit



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2200 Ohm moulded headset, properly designed to give strong and clear reception. Biggest headphone value ever offered.

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RANDOLPH RADIO CORP.
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Loop Aerials**

Electrically and
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4-Point Tapped Loop

More Loop for Less Money

The most efficient, moderate priced tapped loop on the market. The Lincoln 4-point tapped loop is built for any circuit where it is desired to vary the inductance of the loop. Exceptionally fine for Superheterodynes. Price, \$8.00.

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Better and Cheaper**

The only loop of this type offered at a low price. For any set employing radio frequency amplification. . . . for certain Superheterodynes requiring a center tap. Price \$6.50. If your dealer cannot supply you, order direct, giving your dealer's name.

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Write us for our sales proposition. Lincoln sells the legitimate trade only.

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224 North Wells St. CHICAGO

NEW YORK PRECISION MICA FIXED CONDENSER

Adds the real undistorted true tone quality to your receiver



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MORE UNIFORM CAPACITY and superior construction improves selectivity and distant reception with marked freedom from noise. Endorsed by leading radio engineers, and standard equipment with most discriminating manufacturers — yet they cost no more than the ordinary products.

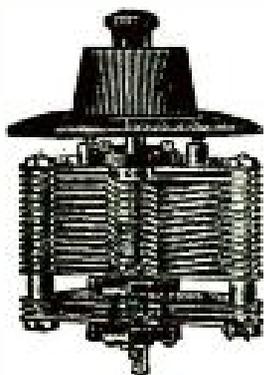
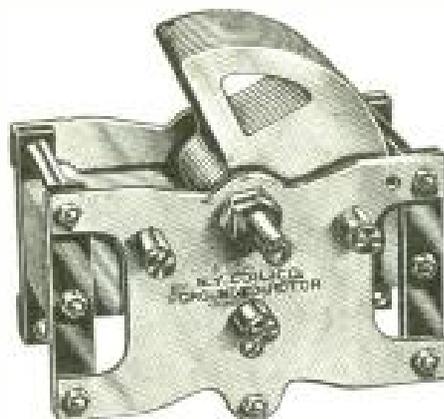


TYPE B.

The supreme pleasure of radio is secured only from a set constructed by yourself, but be sure to use reliable parts

OUR GROUNDED ROTOR CONDENSER is superlative in low loss construction—no other manufactured incorporates so many actual improvements.

PRICE .0005 (23 plate) without Vernier, \$4.50; 17 plate, \$4.25; Geared Vernier attachment, \$1.50.



OUR STANDARD VARIABLE CONDENSERS are universally recognized for their efficiency, workmanship, DX reception and sharp tuning qualities. They equal many others selling at *double our price* —made possible by large production.

Price, without Vernier or dial—17 plate, \$1.80; 23 plate, \$2.00; 43 plate, \$3.00. Price with Vernier, including dial and knob, 23 plate, \$3.50; 43 plate \$4.50.

NEW YORK COIL COMPANY

338 Pearl Street, New York City, N. Y.

PACIFIC COAST—MARSHANK SALES CO., 926 Insurance Exchange Building, Los Angeles, Calif., also San Francisco, Portland.

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another inventor and designer of radio apparatus specifies

FIL-KO-LEAK

SCIENTIFICALLY CORRECT
VARIABLE GRID LEAK

FIL-KO-LEAKS are specified for the Hoyt System of Signal Augmentation by the inventor, Francis R. Hoyt. We have a limited number of blue printed copies of Mr. Hoyt's original laboratory notes on this new system together with nine circuit sketches, which will be sent free on receipt of four cents postage.



You will get
Improved
Reception
with
FIL-KO-LEAK

YOU can "log" your FIL-KO-LEAK just as you do your other tuning units. You will get stations you never heard before. You will clear up distortion on nearby broadcasters and increase volume of weak, distant stations and get them with crystal clarity. You read FIL-KO-LEAK resistance in exact terms of the megohm through a peep-hole in the panel. (It's also equipped for baseboard mounting.) Resistance element is constant and accurate, and is not affected by atmospheric conditions, wear or jarring. Every FIL-KO-LEAK is guaranteed to be perfect electrically and mechanically, and to be accurately calibrated over the operating range for all tubes ($\frac{1}{4}$ to 5 megohms). This calibration is doubly checked. Send 2c stamp to Dept. P. R. 325 for literature on improved reception.

FIL-KO-LEAK \$2
SCIENTIFICALLY CORRECT
VARIABLE GRID LEAK
Individually Calibrated

In Canada \$2.90

If your dealer has none, send his name with remittance direct to



Harrisburg, Pa.

BLUEBIRD

Radio Tubes

DISTINCTLY NEW

AND EFFICIENT



satisfying every radio fan's wish in performance and price. Our direct sales plan enables us to sell at this low figure. "Bluebird" assures increased range and undistorted volume.

- TYPE-400
5 Volts, 1 Ampere Detector Tube
- TYPE-401A
5 Volts, .25 Ampere Amplifier and Detector
- TYPE-499
3-4 Volts, .06 Ampere Amplifier and Detector
- TYPE-499-A
3-4 Volts, .08 Ampere with Standard Base Amplifier and Detector
- TYPE-412
 $\frac{1}{4}$ Volts, .25 Ampere Platinum Filament Amplifier and Detector

ALL STANDARD TYPES..... \$2.50

Type-402 5-Watt Transmitters \$3.00

EVERY TUBE GUARANTEED

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Have You Heard These Stations?



Aberdeen, Scotland
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Major Schoonhoven has heard all of them using Ray-Coils in a five-tube set.

Ray-Coils "A" for Reinartz, Ray-Coils "B" for RCS and Ultra Audion Circuits, Ray-Coils "C" for RCS, Ultra Audion and Tuned Radio Frequency Circuits. Ray-Coils

- A = \$2.50 "D" for Tuned Radio Frequency and Neutralizing Circuits of 4, 5 and 6 Tubes.
- B = 2.00 Ray-Coils "E" for Reflex Circuits.
- C = 2.00 Use the RCS Circuit with or without Radio Frequency for Simplicity in operation and results. Not equalled by any set for volume and distance.
- D = 2.00
- E = 2.00

Coils in Separate Box
With Wiring Diagram

Working Blue Prints of four sheets 12 x 18 of all standard circuits, as Variometer Hookup, Reinartz one and three tube, R.C.S. three and four tube and R.C.S. five tube Tuned Radio Frequency, 50 cents a set.

We also carry a complete line of Carter, Howard, Kellogg, Modern, All-American and Trimm parts.
If your dealer cannot supply you, we will mail direct.

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Major Q. M. R. C.
310 SENECA ST. ELGIN, ILL.



**Dealers find this
a Quick
Seller**

**The Jos. W. Jones
Knockdown Receiver
Completely Assembled**

In your home, it will take its place pleasingly alongside the choicest furniture. Its cabinet is leather covered and its panel is beautifully arranged.

Easy NOW to Build Your Own Radio

All the parts and elements needed to build your new set—in one purchase—in one compact package. No more shopping around or doubt of results. Not just ordinary parts, but the famous Jos. W. Jones parts, made by expert precision parts makers. Remember, a radio receiver is only as efficient as the workmanship and precision of its parts.

JOS. W. JONES

RADIO

TRADE MARK

4-Tube Knockdown Receiver

With this complete kit you can quickly build a 4-tube set that will give you amazing volume and distance. It is non-regenerative—highly selective. Simple to operate—easy to build. Complete, detailed assembling directions with each kit, which any one can follow successfully. To be absolutely sure of results, get the Jos W. Jones 4-Tube Knockdown Receiver.



**The Jos. W. Jones Knockdown Receiver
Showing the Parts Making the Kit**

The set consists of a finely finished oak cabinet, a completely drilled bakelite panel, and all the other parts and elements from a Vernier Condenser to the smallest bit of wiring—all ready to be assembled and give perfect results.

Price \$50 at your dealers

**JOS. W. JONES RADIO
MFG. CO., Inc.**

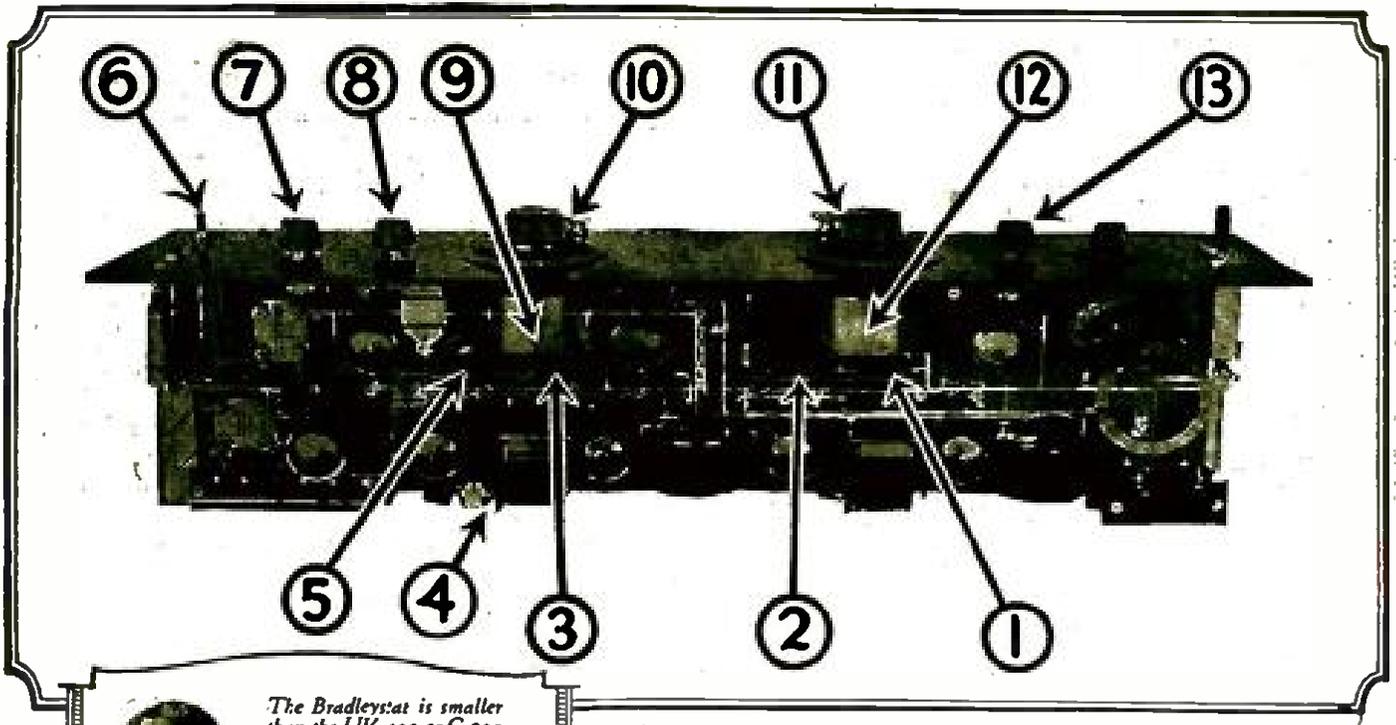
40-42-44-46 W. 25th St., New York

99 Bedford St.,
Boston, Mass.

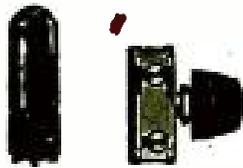
53 W. Jackson Blvd.,
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Victory Bldg., 1011 Chestnut St.,
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Branch Offices: Boston, Philadelphia
and Chicago

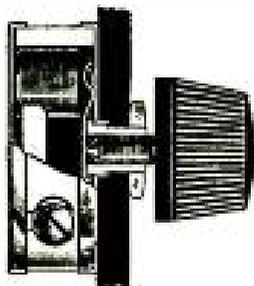


The Bradleystat is smaller than the UV-199 or C-299 tubes. It is much smaller than the 6-volt tube.



Graphite Discs provide smooth control

Observe the compact construction of the Bradleystat, shown below. Note the two columns of graphite discs, the pressure screw and the internal switch. Only two terminals, and yet the range is from approximately 1/4 ohm to 100 ohms. The entire range is stepless and noiseless.



Bradleystat

PERFECT FILAMENT CONTROL

For All Sets and Tubes

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The super-heterodyne receiver, shown above, is equipped with Bradleystats at 1, 2, 3, 5, 8, and 13. Within the set, they are mounted on the baseboard; the others are on the panel. A Bradleyleak is used at 4, a Bradleyswitch at 6, and a Bradleyometer at 7. Bradleydensers are used at 9 and 12, and micrometer dial control is obtained with Bradleyniers at 10 and 11. This Allen-Bradley-equipped set is typical of thousands of multi-tube sets using the new Allen-Bradley line for maximum efficiency. Build for better radio by following this example.

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The unique Trirdyn circuit—a combination of Armstrong Regeneration, Radio Frequency Amplification and Reflexed Audio Amplification—has proven beyond a doubt that the features of selectivity, volume and ease of operation can be obtained with three tubes better than heretofore has been possible with five or even six.

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It is this continued remarkable performance that has created such a tremendous demand for Crosley Radios. And it is this great popularity that now allows us to decrease our production costs and pass this large saving along to you.

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In order to allow even a greater selection, three new Crosley Radios have been added to our extensive line. Taking its place with the well known Crosley 50 and Crosley 50-P is the leatherette covered, one-tube 50 Portable, a utility set in which the dealer can quickly make the necessary connections and allow you to carry it home complete.

The New Crosley 51 Special, a two-tube receiver similar to the Model 51, is housed in a cabinet large enough to hold the necessary batteries and has a sloping panel.

Similar to the Crosley 52, but with sloping panel and cabinet to house the batteries is the new Crosley 52 Special.

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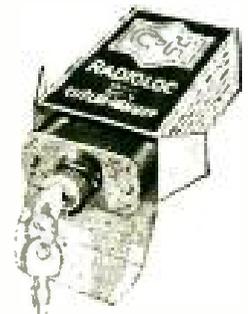
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