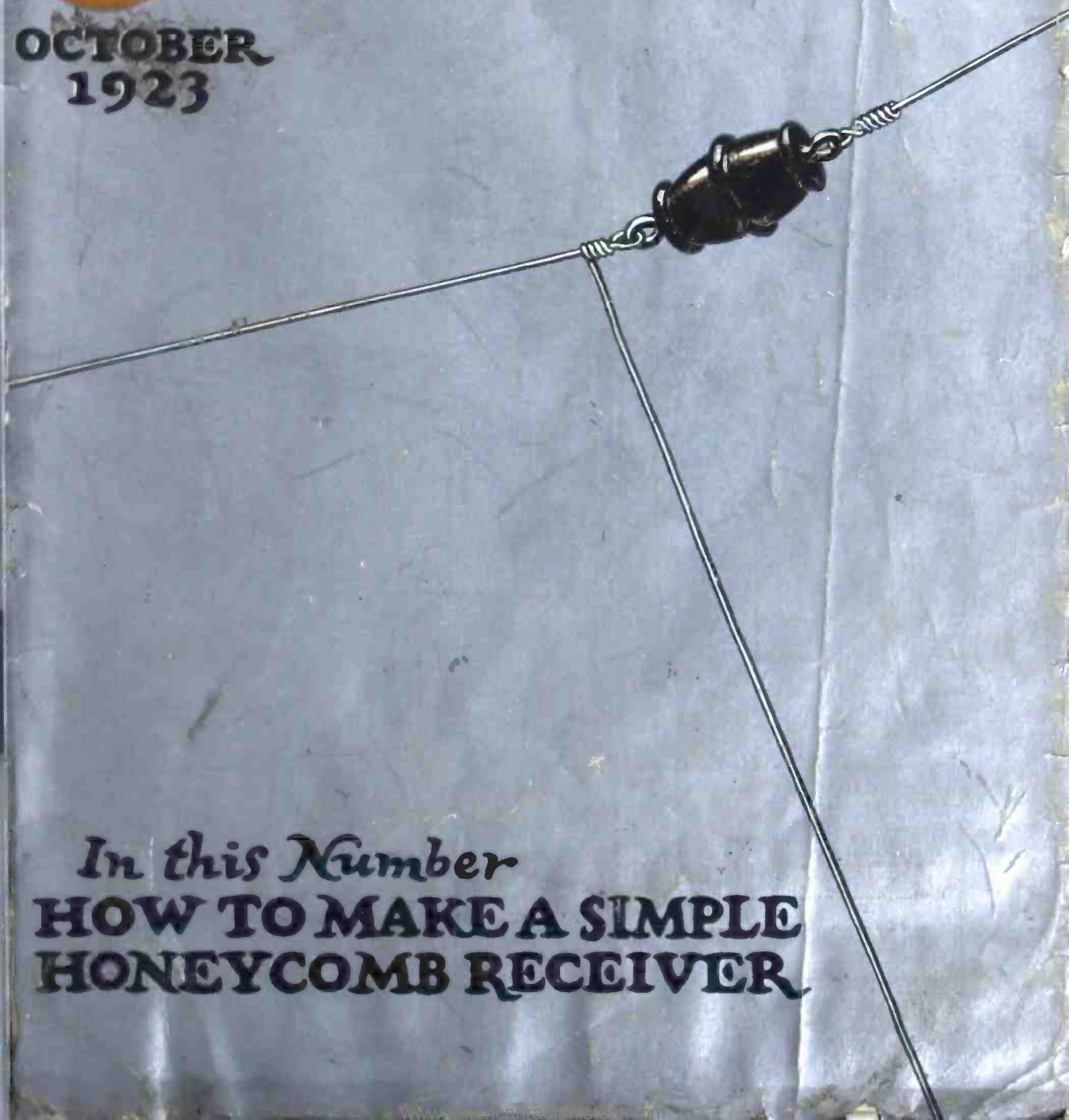
Popular Radio

Edited by KENDALL BANNING

20¢

OCTOBER
1923



In this Number

HOW TO MAKE A SIMPLE HONEYCOMB RECEIVER

Are You Receiving this FREE Monthly Magazine?

The Only Radio Magazine that is devoted entirely to Radio Entertainment

The only radio publication of its kind! Features in pictures and story what the big stations are broadcasting; gives personality to the artists who furnish entertainment; tells what radio means to the millions; treats scientific facts so you can understand them. It's FREE. Mail the coupon at the right, giving your dealer's name.

DEALERS: Let us send you a copy of "What's in the Air?" explaining how you can mail it to your customers. Send coupon at left.

Cutting & Washington Radio Corp.

Minneapolis **Minnesota**

Dealer's Coupon

Cutting & Washington Radio Corp.
Minneapolis, Minn.
Gentlemen:
Please send FREE Copy of "What's in the Air?" and explain how I can mail it to my customers, with my imprint on front cover.

Name.....

Name of firm.....

Address.....City.....State.....

Mail Your Coupon

Reader's Coupon

Cutting & Washington Radio Corp.
Minneapolis, Minn.
Gentlemen:
Please send me FREE copy of "What's in the Air?"

Name.....

Address.....City.....State.....

Dealer's name and address.....

.....

Brandes

NEW PRICES

Superior
$6.00

Navy Type
$8.00

Grandpa joins the fans!

When Grandpa first "listened in" it was through a noisy, uncomfortable headset, and he wouldn't try it again till some one called him old fashioned. Then he heard a concert through a Brandes *Matched Tone* Radio Headset. Now his dinner grows cold when there is something good coming over!

He says the Brandes makes all the difference. It fits so comfortably and he gets real music or a clear message every time.

Grandpa may not appreciate what *Matched Tone* means, but he likes the result.

Made in Canada and England by
Canadian Brandes Limited Toronto and London
C. BRANDES, Inc. 237 Lafayette Street, New York City

Matched Tone

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

Radio Headsets

POPULAR RADIO

EDITED *by* KENDALL BANNING

CONTENTS *for* OCTOBER, 1923

(Cover design by Frank B. Masters)

VOLUME IV NUMBER 4

VOLUME IV OCTOBER, 1923 NUMBER 4

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E. E. FREE, Ph.D., *Contributing Editor* LAURENCE M. COCKADAY, R.E., *Technical Editor*

PAGES WITH THE EDITOR

ONE of the most carefully written, re-written, edited and illustrated of articles that the Editor has ever struggled with will appear in the next number, "How Ether Waves Really Move," written by the scientist who evolved the Gliding Wave theory, Dr. Reginald A. Fessenden himself. The story of how this article was developed may give the reader an intimate glimpse into the editorial sanctum and its method of work.

* * *

FIRST of all, Dr. Free, the Contributing Editor, travelled from New York to Boston, and spent a day with Dr. Fessenden in his study. The notes gathered there were then reduced to typewritten form, to serve as the framework for the article.

* * *

AFTER this outline had been studied by Dr. Fessenden and the numerous references and other data had been supplied, the Editor sent his private secretary, Miss Weintz, from New York to Boston to transcribe the article direct from Dr. Fessenden's dictation.

* * *

THE next step was to re-check the data —a task that occupied a good part of Dr. Free's time for several days—and re-submit the completed article to the author for his final revision and O.K.

* * *

AND after all that a photographer was sent to Dr. Fessenden's study to make exclusive pictures for use as illustrations, and Dr. Fessenden's private files were ransacked for photographs of scientific and historical value that could not be had anywhere else in the world—pictures that will be published for the first time in POPULAR RADIO for November.

* * *

IT may be interesting to observe, in this connection, that the four foremost authorities on the Heaviside Layer theory (the four "Biggest Guns," as one scientist calls them) may properly be designated as Dr. Fessenden, Dr. Elihu Thomson, Sir Oliver Lodge and Major-General George O. Squier. And all of them have written articles on the subject for POPULAR RADIO.

* * *

IMPRESSIVE evidence of the eminently practical service that POPULAR RADIO is rendering to the amateur and to the novice by stimulating his experimental work is offered by one of the largest and best radio stores in New York, which recently bought several hundred copies of the magazine for distribution among its customers.

* * *

WHAT more convincing proof can be offered of the value of POPULAR RADIO to the radio industry? Yet the unique feature of this value lies in the fact that POPULAR RADIO serves the industry not by telling the dealer how to sell—but by telling the fan what he really needs and what he ought to get.

ALL of which imposes a trust upon the editors which they are and must be jealous in guarding in the protection of our readers. The technical and semi-technical articles must be sound scientifically, authoritative—and like Caesar's wife, above reproach, free from bias and from commercial influence.

* * *

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

* * *

So great and so many have been the demands of our readers upon the Technical Editor that during the past few months his office has been assuming less and less the semblance of an editorial sanctum and more and more that of a reception room of a public service corporation. Radio fans who seek his advice, not satisfied with letters, telegrams and telephone conversations, have been calling upon him personally, in many cases lugging along with them their receiving sets that require expert treatment, and await their turn in the outer office with varying degrees of patience.

* * *

OF course, this personal and expert service is very delightful to the visitors as well as to the Technical Editor; he is an old-time amateur himself and he takes the real amateur's pleasure in helping along a fellow fan. But the time he has devoted to this Good Samaritan business takes his time away from his editorial work on POPULAR RADIO—and our 500,000 readers are the losers!

* * *

IT is obviously unfair to our readers to deprive them of any part of the Technical Editor's services. So a new ruling has had to be put into effect that all questions from our readers, including personal calls, must be referred to the Service Department—and the Technical Editor thus be relieved of a distracting burden and be enabled to devote his attention exclusively to the preparation of material that can be published in POPULAR RADIO *for the benefit of the many.*

* * *

WHAT other solution is possible?

* * *

HAVE you noticed the distinctly international flavor of POPULAR RADIO? The scientific world (which knows no geographical boundaries) is literally being combed for material of value and interest to our readers. General Ferrié and Edouard Belin of France, Sir Joseph J. Thomson, Sir Oliver Lodge and Prof. J. A. Fleming of England, Senator Marconi of Italy, Nikola Tesla of Serbia, Dr. Emil Wiechert of Germany, to say nothing of such Americans as Dr. Irving Langmuir, Dr. Lee De Forest, General Squier, Dr. Elihu Thomson, Dr. Ernest F. Nichols, Prof. J. H. Morecroft, Dr. Reginald A. Fessenden, John Hays Hammond, Jr., John V. L. Hogan, Paul

(Continued on page 8)

The DUBILIER Duratran—

Amplification on all wavelengths

THE Dubilier Duratran is the supreme radio-frequency transformer. It amplifies powerfully and uniformly *over all the wavelengths* now used by broadcasting stations.

Price $5.00
At all good dealers

DUBILIER CONDENSER AND RADIO CORP.
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DUBILIER DEVICES

PAGES WITH THE EDITOR

(Continued from page 6)

Godley and our own Laurence M. Cockaday (to mention only the first to come to mind) furnish a galaxy of talent that no magazine can excel.

* * *

THE steady and gratifying growth of POPULAR RADIO is bringing with it a correspondingly steady pressure upon the Editor from manufacturers, dealers and inventors of radio apparatus for what is technically known in publishing circles as "write-ups." Apparently every manufacturer of and dealer in radio parts and radio sets wants to see his particular product exploited in our editorial pages. This desire can be easily understood. But in the protection of our readers no article or item or picture has been or will be used in the editorial pages of this magazine except those that (in the belief of the Editor at least) convey information of practical value and interest, that are sound scientifically and that are *entirely free from the taint of commercialism.*

* * *

The editorial pages of POPULAR RADIO *are not for sale!*

* * *

IN the September issue the Editor cited a typical instance in which a prospective advertiser attached an $1,800 contract to a write-up—the contract to be in force only in case the write-up was published. Both the contract and the write-up were sent back by return mail.

* * *

DURING the past month several similar instances have come up. As evidence of the definite and clean-cut attitude of POPULAR RADIO toward all attempts to prostitute its editorial pages with write-ups, reading notices and other forms of press agentry, the Editor is quoting below his response to a well-known advertising agency which submitted, with an advertising contract, pictures and descriptive matter of a patented and manufactured device that is on the market. The letter speaks for itself:

* * *

"I WISH that I could give you some practical evidence not only of the number of similar requests that pile in upon this office, but also some conception of the pressure that is being applied by manufacturers and dealers to force their way into the reading pages of this magazine. In not a single instance, however, has any press agent propaganda of any kind whatever intruded upon our text pages. This ruling is applied to everyone without discrimination and no exception can be made.

* * *

"IT is no small part of my editorial task to explain to manufacturers and dealers—particularly to those who advertise in this magazine—the compelling necessity of establishing such a policy and adhering to it most carefully. Many of these manufacturers and dealers have been accustomed to advertise in the trade papers whose editorial columns are more or less open to the advertisers; indeed, in many cases the publication of write-ups is entirely dependent upon the amount of advertising that accompanies it.

* * *

"POPULAR RADIO is not a trade paper nor a technical journal; it is a strictly high grade magazine of standing in scientific circles, with large and constantly growing circulation among radio novices, radio amateurs, scientists and laymen who are interested in science. In order to attract and to hold this discriminating circulation it is of paramount importance that our editorial pages will be absolutely devoid even of the *suggestion* of commercialism.

* * *

"NO article or item or picture that has ever appeared in POPULAR RADIO has been published directly or indirectly as the result of pressure from our business office.

* * *

"AS a matter of policy, POPULAR RADIO has not published nor will it publish knowingly any picture of a patented and manufactured article that is on the market.

* * *

"IN brief, POPULAR RADIO is edited solely for big circulation and that big circulation cannot be attained except by an editorial content of the highest possible standards that is entirely untainted by commercial considerations.

* * *

"THIS policy has not been adopted haphazardly or as a matter of mere theory; it has been adopted as the result of twenty-five years of practical experience in professional publishing. It is the only policy that can assure a large circulation of the unusual character which this magazine enjoys—a circulation from which the advertisers must ultimately and necessarily profit."

* * *

With the next number—November—POPULAR RADIO will be enlarged by about 60 pages, and the price will advance from 20 cents a copy to 25 cents a copy. The November number will be on the newsstands October 15th. Ask your newsdealer to reserve a copy for you. *Do it today!*

* * *

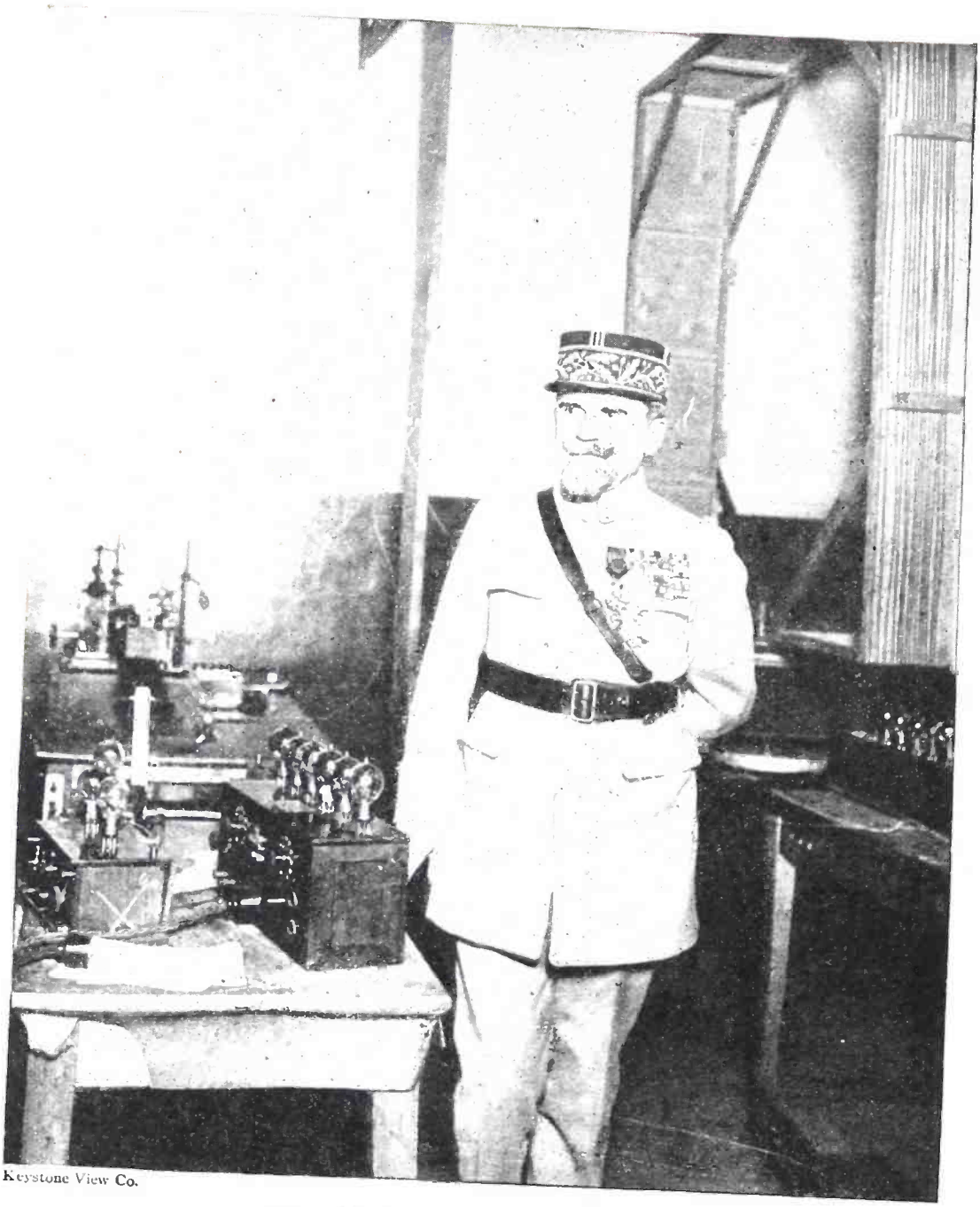
EVERY reader can help the Editor produce the kind of magazine that he likes best by writing in his suggestions. In what specific ways can POPULAR RADIO be improved?

Editor, POPULAR RADIO

"I believe that radio will prove to be our single best medium for pursuing criminals in many kinds of difficult cases, and that it will rank among the best of crime preventives."

—WILLIAM J. BURNS

Chief, Bureau of Investigation, Department of Justice



Keystone View Co.

The Radio Genius of France

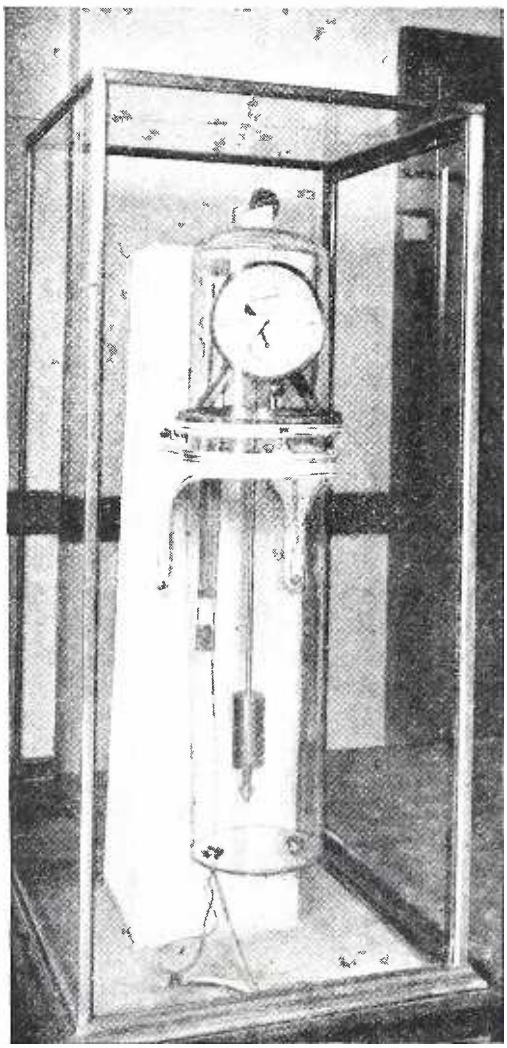
General Gustave Ferrié—the author of the article that begins on the opposite page—is the active head of all the radio activities of the French Government, including the broadcasting station in the Eiffel Tower. And as a scientist he ranks among the foremost in the world.

Popular Radio

OCTOBER 1923

Checking Scientific Measurements

mine the value of the precision actually obtained. Without entering into the details of the project, it is interesting to point out that in the operation new processes and highly perfected apparatus will be employed, as well for the astronomical observations as for the radio-telegraphic operations. A first series of preliminary observations, with the object of checking the methods and calibrating apparatus, is likely to be made at the end of the present year or in 1924.



U. S. Naval Observatory

ONE OF THE GOVERNMENT'S "OFFICIAL CLOCKS"

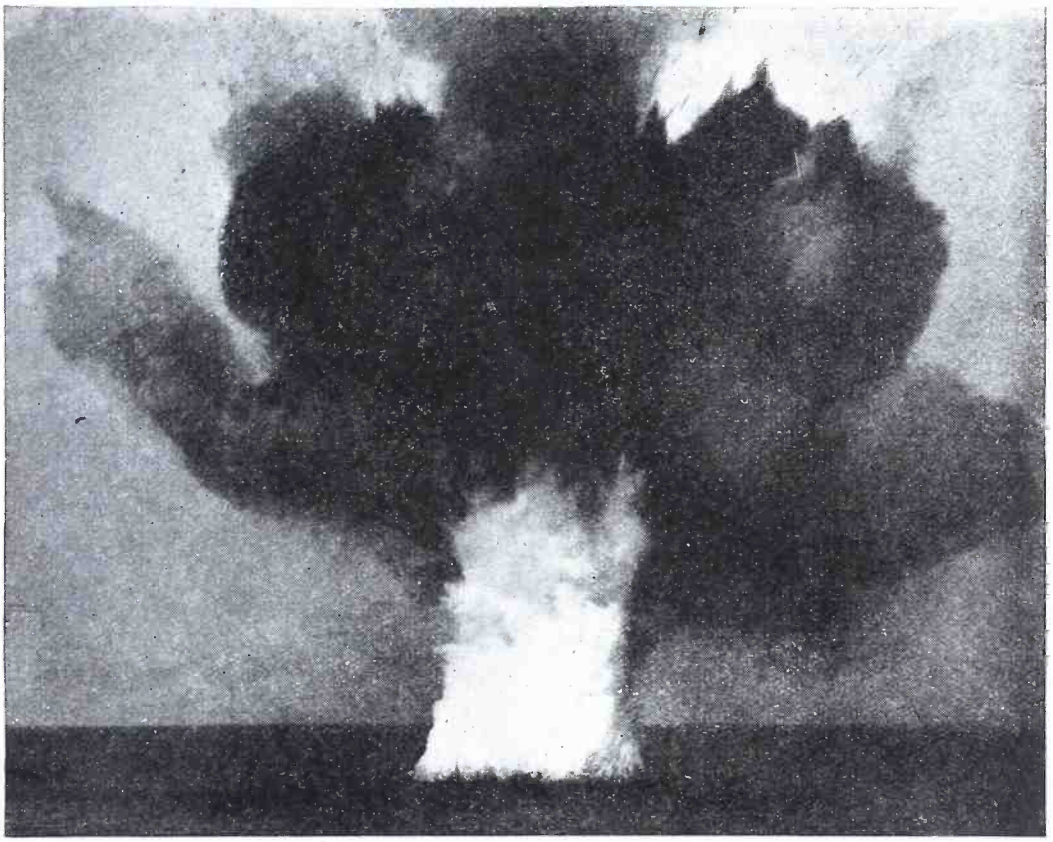
One of the three special clocks used in controlling the radio time signals sent out by the Arlington station of the United States Government. Each clock is kept in a sealed glass case from which part of the air has been pumped out, and which is kept at a temperature of 84 degrees.

If the precision with which the relative positions determined is only a few meters, as it is hoped, it will be possible, in repeating the operations several years later, to be assured that these relative positions have not changed, taking into account the displacement of the pole. If otherwise, the difference observed would be attributable to a deformation of the earth's crust, and a methodical study of that subject might then be undertaken.

In operations of the kind just outlined it is necessary to know as exactly as possible the velocity of propagation of Hertzian waves on the surface of the earth. Already it has been shown that this velocity differs very little from the velocity of light. New measurements are shortly to be undertaken to increase the precision of this determination. Will it be possible to devise a method by means of Hertzian waves, leading to a repetition of an experiment analogous to that of Michelson? That appears very difficult, but not absolutely impossible. With the Dufour cathodic oscillograph*, it is possible to measure practically, on a photographic plate, intervals of time of the order of the twenty millionth of a second, perhaps even a hundred millionth, counted on the record made by Hertzian waves. It may be possible to devise a method of utilizing this marvelous apparatus for the problem in view.

I may again call attention to the value of Hertzian impulses in investigations on the variation of the intensity of gravity at a given station at different times or at several stations at the same instant. The process is in effect a comparison of the periods of free pendulums at these points; that is to say, a comparison of the number of oscillations of these pendulums during a given time. This comparison is easily effected by

*June issue of POPULAR RADIO.



Brown Bros.

HOW RADIO MAY BE USED FOR MEASURING THE VELOCITY OF SOUND UNDER WATER

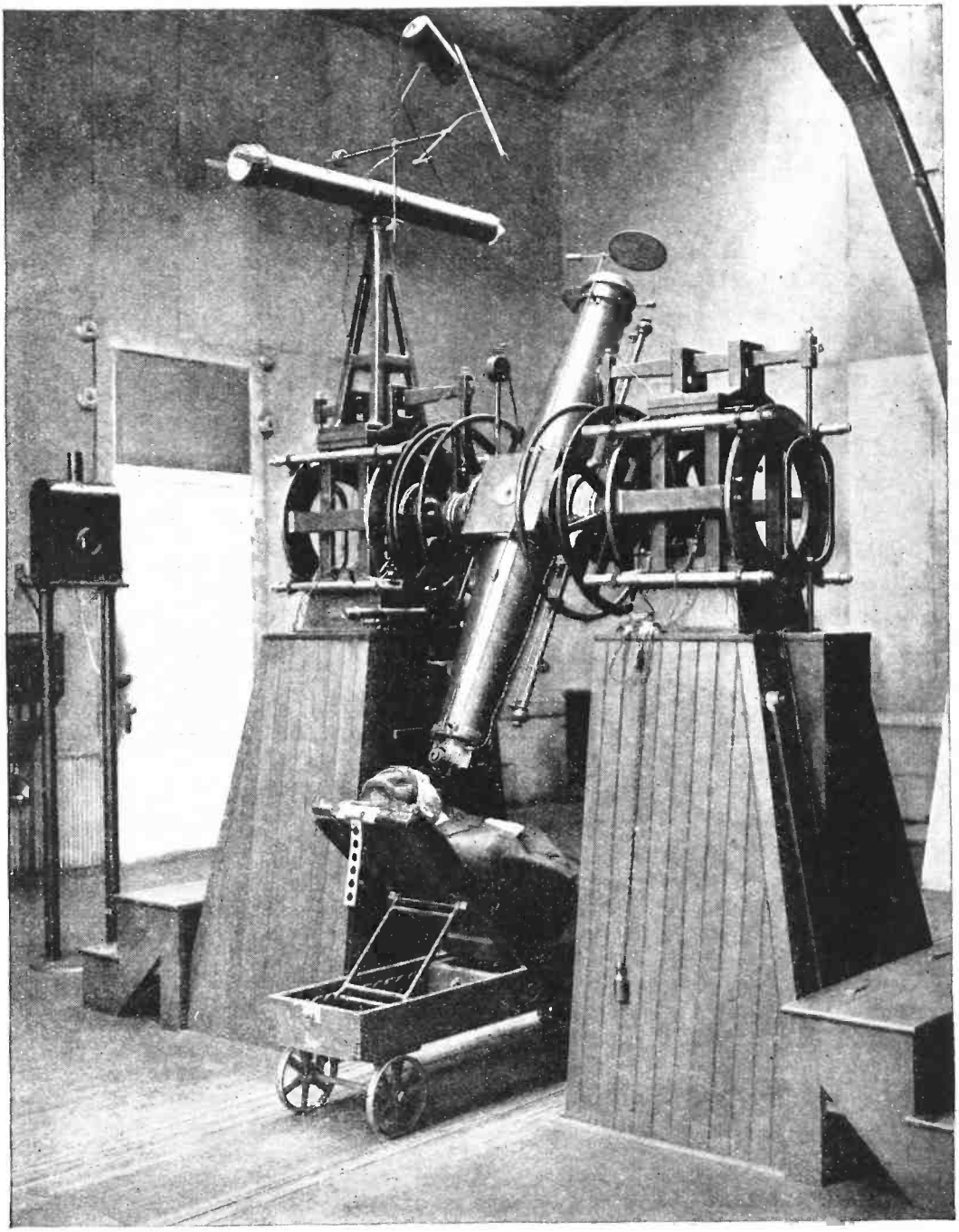
By causing a great explosion like this under water and measuring the time of arrival of the sound through the water, as compared with the arrival of a simultaneous radio wave at a series of distant stations, it will be possible (General Ferrié says) to determine the velocity of sound in water more exactly than it is now known.

inscribing at each station on the same recorder the oscillations of the pendulum and two Hertzian signals at an interval of several minutes which appear at all the stations.

It has even been possible for Mr. H. Abraham to contrive, by means of three-electrode tubes (audions or triodes) used in radio telegraphy, a kind of clock which is entirely electric and devoid of any mechanical element, capable of producing electric "ticks" of extremely short duration at rigorously equal intervals and adjustable at will. By means of such "ticks" the intervals of time, measured from any origin, registered in the determinations above mentioned, can be subdivided with all necessary precision. Perhaps we may contemplate, in the not too distant future, the employment of these electric clocks in place of the astronomical clocks now used, for these would not be subject, like the latter, to errors and variations due to mechanical causes, seismological, *et cetera*.

Astronomy is even further indebted to the development of Hertzian science. In judiciously combining radio-telegraphic amplifiers with potassium photo-electric cells, it is possible to record luminous signals in the same manner as electric signals. The measurement of the luminosity of stars can then be realized.

For example, by simultaneously re-



U. S. Naval Observatory

This Telescope Checks Up Uncle Sam's "Standard Time"

The clocks that control the radio time signals and thus set the "right" time for all the United States as well as for thousands of ships at sea are checked each day by observing the exact instant at which each one of a group of selected stars passes the spider-web crosswires inside this telescope. "Standard time" is set, therefore, by the stars by means of light waves coming through the ether, and is distributed over the country by means of other ether waves—the radio waves.

cording the trajectory of a star in the field of an equatorial telescope and the beats of the astronomical clock, it may perhaps be possible, during the time, to determine precisely the position from the points of the curve which correspond to the passages of the star behind the wires of the reticule. The personal influence of the observer will thus be eliminated and with it a serious source of error. This combination of photo-electric cells and radio-telegraphic apparatus will certainly develop many scientific and practical applications. Will it perhaps lead to a solution of the problem of electrical vision at a distance?

The phenomena of the propagation of waves in air, in water, in the ground, considered either separately or simultaneously with material vibratory movements, have also either made possible or indicated interesting solutions of a variety of problems. In effecting, for example, by means of radio-telegraphic devices, vibratory movements of high frequency, Mr. Langevin has succeeded in producing under water, ultra-audible pencils of rays which could be directed at will and which were reflected from objects in their path. A method of making soundings at sea of very great precision is a notable application of this phenomenon.

It may incidentally be mentioned that it has likewise been possible to measure the velocity of sound in water with great precision, by the following method:

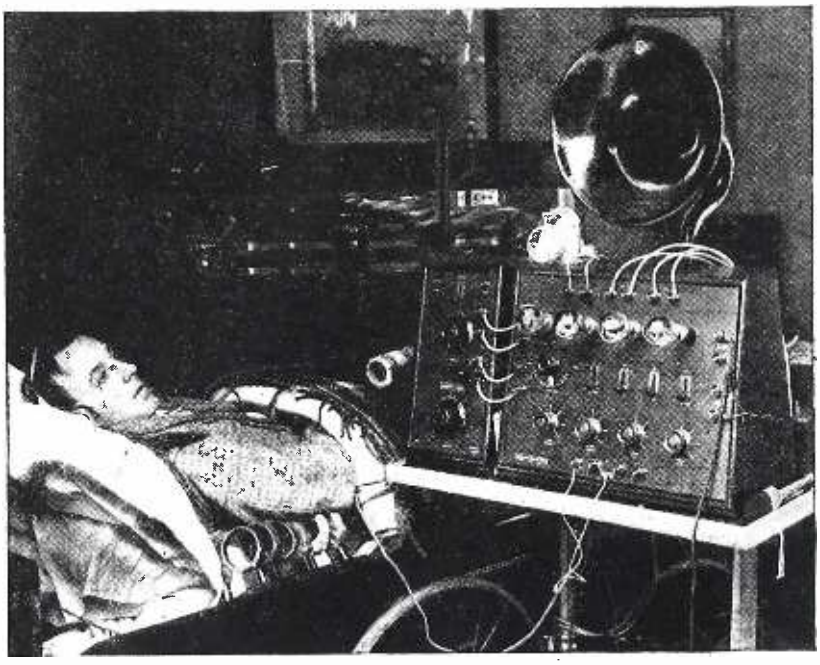
An explosion in the water and a Hertzian signal are simultaneously produced at a given station. At another station, a microphone receives the sound impulse and an antenna the Hertzian signal. Both are recorded on the same chronograph and the difference of time indicated determines the velocity.

Other investigations are in progress for applying the propagation of high-frequency oscillations to the study of the nature and disposition of geological strata. Already interesting results have been obtained.

In a different field, the development of Hertzian technic has considerably improved the precision and increased the variety of methods of electric measurements: Capacitance, inductance, resistance and specific inductive capacity. The measurements of frequency and electromotive force phase, have equally been carried to a degree of precision previously unattainable. With respect to measurements of frequency, it is likewise notable that it will shortly be possible to control the frequency of a transmitter by means of the standard apparatus itself. This prospect will insure the attainment, on questions of frequency employed in practice, of an agreement very difficult to attain with other physical magnitudes.

It has been possible to extend the study of the magnetic properties of iron by making use of currents of very high and adjustable frequency, and by employing the devices of radio-telegraphic technic. The application of waves of very short length may possibly lead to a determination of the periods of vibration of atoms. The application of amplifiers has already made it possible to determine the appreciable time occupied by the molecules of iron in acquiring magnetization. It is also with this apparatus that Mr. Hollweck has rendered audible the emission of alpha particles. Measurements of the terrestrial magnetic field, moreover, can very easily be made by means of a new method evolved by Mr. Perot which again admits the employment of certain apparatus utilized in radio telegraphy.

It would be possible to cite many other researches and scientific work undertaken, in which either radio telegraphy itself or methods and apparatus evolved for it, are utilized. It is, accordingly, obvious that there is a boundless future for the applications of Hertzian waves and that it is to the greatest advantage of all physicists, whatever their specialty, to keep in close touch and cooperate in the development of this branch of science.



THE NEW INTERNE MAKES A BEDSIDE CALL

This elaborate portable receiver has been installed in one of the London hospitals; it is wheeled to the bedsides of the invalids who call for it.

The Doctor Who Comes Through the Walls

Scientists are learning that broadcast entertainment for invalids has such a distinct therapeutic value that radio receiving apparatus is becoming a part of hospital equipment. Here are some specific cases.

By MRS. CHRISTINE FREDERICK

RADIO is the newest and most welcome sick-room visitor. Its companionship is not limited to a stated period on special days, but it can bring hourly cheer and diversion every day to those whom illness or disability confines to their rooms or to the bare walls of a hospital. Although the radiophone is rapidly revolutionizing such widely separated fields as the detection of crime and the education of the schoolboy, nowhere else has it a greater field of usefulness as a medium of recreation than in that of entertaining vast numbers of invalids.

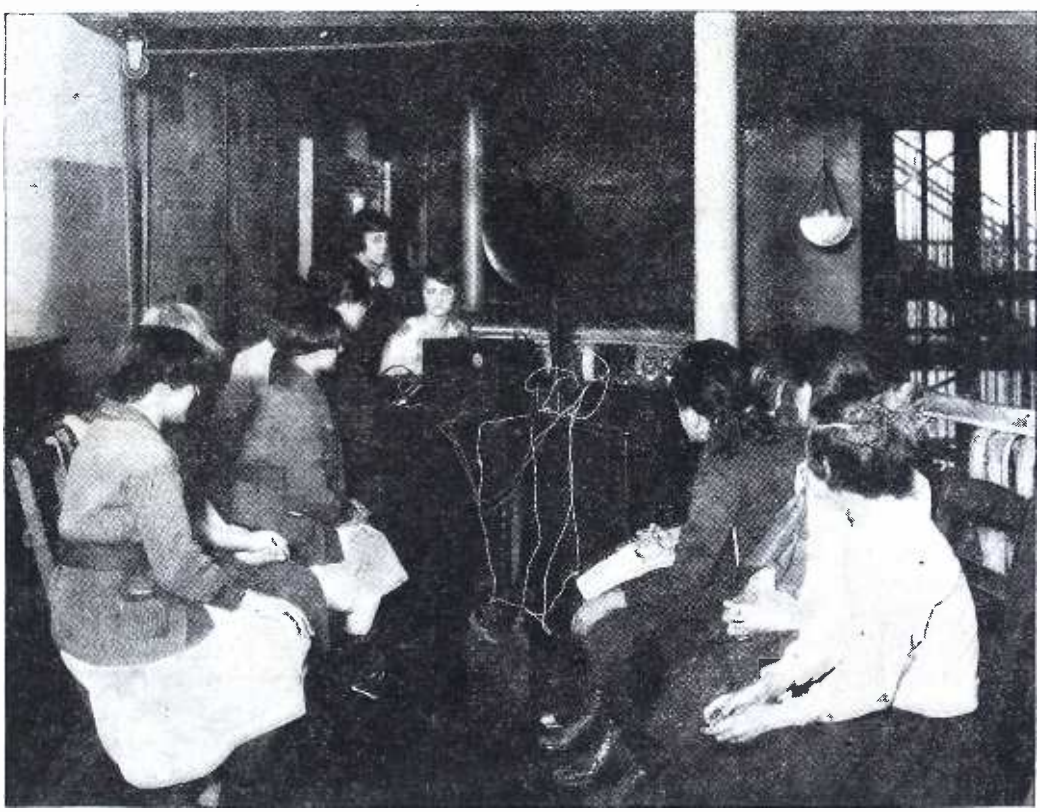
One of the first institutions to give the benefits of radio inspiration to its patients was the Pittsburgh Tuberculosis Sanitarium. Here both adults and children may enjoy the entertainment and music over the radio—entertainment which keeps them contented and cheerful during the long weeks when these patients must remain isolated from the outside world. Every one of the 112 beds in the hospital can listen in

to radio programs. In the adult wards, headphones are used by such of the patients who may care to use them, while the entertainment in the children's wards is received through a loudspeaker. In describing this installation the superintendent reports:

"In some form we have had radio installed for six years, in its present manner for the past three years. We tune in particularly to KDKA our local and nationally known station, although many distant stations are picked up. We have had great success with the plan and would not now be without it."

Other hospitals are meeting with the same success in the use of the radio. One of them is the Bronx Hospital in New York City. It has installed a radiophone on the roof garden where concerts are given to convalescent patients. It also plans to have a receiving set in the wards of those who are bedridden, using headphones so as not to disturb other patients who may not desire to listen in.

Many other institutions are installing some type of radio set to give its patients the advantages of music and cheering entertainment to obviate usual loneliness. The Manhattan Eye, Ear and Throat Hospital, New York City, the Post-Graduate Medical School, and the new Beth Israel on New York's East Side are taking advantage of this distinctly modern sick-room visitor. As L. J. Frank, superintendent of Beth Israel states, "The effect on the patient is bound to be good, and will in my



From a photograph made for POPULAR RADIO

A NEW KIND OF "ETHER" WAVE ENTERS THE LIVES OF THE BLIND

These little patients in the New York Association for the Blind are getting acquainted with a new and far less dreaded type of "operator," who twists the dials of a receiving set instead of plying the instruments of surgery.

opinion facilitate his recovery. It will be of special value to those patients in separate rooms and also in those cases where the patients are required to remain in the hospital over a lengthy period."

The Broad Street Hospital, located in the financial center of New York City, is planning a new addition in connection with which a complete radio installation is to be made. The director, Dr. A. J. Barker Savage, believes that they are installing radio because "we want to do anything that will add to the patient's happiness, and radio will do it as nothing else can. I am very much in favor of it."

The Fox Hills Hospital (New York), where disabled veterans were sent to convalesce, was one of the first to utilize radio with a Signal Corps set. In other cases local branches of The American Legion raised money for radio equipment in their local hospitals. Still another large hospital with vision to foresee the possibilities of radio to its inmates, is the Worcester State Hospital of Worcester, Mass., of which William A. Bryan is superintendent. In a recent letter he writes: "We wish to place a receiving set in our large chapel which holds six or seven hundred people, so that between dances and while changing reels at picture shows we may have something entertaining other than piano or orchestra. I am also contemplating placing smaller sets in our hospital wards for bed patients. I am convinced that radio will be of considerable aid in making our patients more contented and bring the outside world to them."

We would naturally suppose that persons deprived of eyesight would enjoy more than any other group, music and song from the air. This has been well proved in the case of the New York Association for the Blind, popularly known as "The Light House," in New York City. Early last spring a receiving set was installed; at once these sightless ones began to enjoy the programs. When asked their preference they replied that concerts were the most appreciated of any feature and that the installation was a complete success. It is interesting to note that the letter giving this information to the author of this article was "dictated to and written by one of our blind stenographers." To bring increased joy and amusement into the lives of those so badly handicapped, is one of the most humane uses to which the marvels of radio may be applied.

Probably there is no more restless invalid to be found in the world than a small boy confined to bed and convalescing from scarlet fever or diphtheria. Gee, how a fellow longs to be outdoors! Think what the other boys are doing, and isn't it the hard luck you went and caught this darn old fever! That, surely, is the time "a feller needs a friend!" And just such a friend is being found in radio, who can enter any contagious sick room without any danger, and who will talk to you and sing for you, and tell you whether Princeton and Harvard tied, and everything you're dying to know.

Lucky indeed are patients in the Bergen County Hospital, of Oradell, New Jersey. This is an isolation hospital and the majority of patients confined there are boys and girls. Away over a year ago the boy scouts of Troop 1, under the direction of Patrol Leader K. Wanamaker, made a radio installation in this hospital. It is a standard tube set with loudspeaker, and was erected in the Communicable Disease Building in March, 1922. A little later another set was placed in the Tubercular Pavilion. When the superintendent was recently asked whether the plan had proved satisfactory, he expressed himself as greatly gratified at the results and pleasure given the boys and girls. They have heard broadcasting stations as far distant and separated as Louisville, Kentucky, and Detroit,

Kadel & Herbert

DR. BROADCAST GIVES HIS PATIENTS THE ABSENT TREATMENT

The use of earphones avoids the danger of disturbing the patients who desire silence in the Beth Israel Hospital in New York, while loudspeakers may be used for the entertainment of an entire ward of convalescents.

Mich., as well as Schenectady and Boston. The children give impressive evidence of their joy in the concerts.

It is easy to understand why radio may play such an important part in the hours of the invalid of the future. Whether confined to one's own room for a slight illness or compelled to endure lingering weeks in a hospital or sanitarium, radio is peculiarly fitted to bring comfort to the invalid. Even a case of slight indisposition causes the

From a photograph made for POPULAR RADIO

WHERE DISABLED VETERANS LEARN THE RADIO ART

The value of wireless in rehabilitating invalids is not confined to listening in. In the U. S. Veterans' Hospital No. 81 in New York the patients are encouraged actually to build sets in the laboratory—an absorbing and instructive phase of radio work that leads the experimenter into the ranks of the real amateurs.

muscles to relax and make reading in bed a strain to the eyes. Often use of the eyes is forbidden entirely, as in many maternity cases. In countless other instances the patient must lie so flat on the back as to preclude any enjoyment of even a pictorial magazine. After abdominal operations particularly, the body must be kept so still and so much confined to one position as to be almost a torture, while all the time the active mind restlessly seeks something to amuse it and distract it. It is here that the radiophone enters the sick room with its magic charm. The headpieces and earphones may be comfortably adjusted in a lying-down position, or a loudspeaker will enable an entire ward or larger group to listen in collectively.

How the ward of a veterans' hospital (Chelsea Naval Hospital) makes use of radio is picturesquely described by H. C. McNary in the following words; they have the ring of reality:

Several hundred beds are here, all containing hospitalization cases. Some of the invalids are drawing full compensation; some, calling their buddies lucky who have more legs and arms off than they have, are drawing only partial compensation, while others draw nothing and fervently pray that the man from the Veterans' Bureau will succeed in connecting their disability with service—the only way under the law by which they can receive any financial assistance from the government.

Each bed has a phone and a wire runs from each bed to the big receiver that is also placed near a bed. The veteran who operates this lies on his stomach; the nature of his disability prevents him from lying otherwise. But he has cheerfully accepted the inevitable and gets the maximum of enjoyment out of his experiments with the receiver. The only fly in his ointment is that his experiments are

harshly criticized by several hundred pairs of lungs whenever anything goes wrong.

In one respect at least the disabled veterans are away ahead of other listeners. One of the faults of radio today is that it is too much like arguing with one's wife—all one can do is to listen. But the vets have overcome this by the simple experiment of answering. That these answers have no more effect than can be given them by limitations of puny sound waves has no bearing on the case whatsoever. They answer and their answer certainly adds to the concert.

1st Veteran—"Hey, hurry up will yah, Jimmy. I let me chauffeur take me Rolls Royce out tonight just so's I could listen in."

Jimmy—"All right, I'm gettin' somethin' I tell yah."

Radio—"Brrrr— blink-blank; Station B. V. D. speaking. Prof. Topkicker will give setting up exercises, the first—

1st Vet.—"Wow!"

2nd Vet.—"Raspberry!"

3rd Vet.—"Tell that guy the war's over."

4th Vet.—"Who d'yah think yah talking to?"

Radio—"The first exercise, arm exercise—"

5th Vet.—"What with?"

6th Vet.—"Friends, Romans, countrymen, lend me a pair of arms."

7th Vet.—"Hey, Topkicker, where were you durin' the war?" That's the time I want to take 'em in bed."

8th Vet.—"Hey, Jimmy, shove off. That's too sad."

9th Vet.—"Give us a dancing act."

Radio—"Brrrr, spit, spit—"

10th Vet.—"Who let the cats in?"

11th Vet.—"Is Murphy eatin' soup again?"

Murphy—"Don't talk about me, Clarky, I ain't the guy what said he always eats butter on his demi-tassies."

Radio—"Brrrr! Station S. O. S. broadcasting. Potatoes should be planted six inches below the surface.

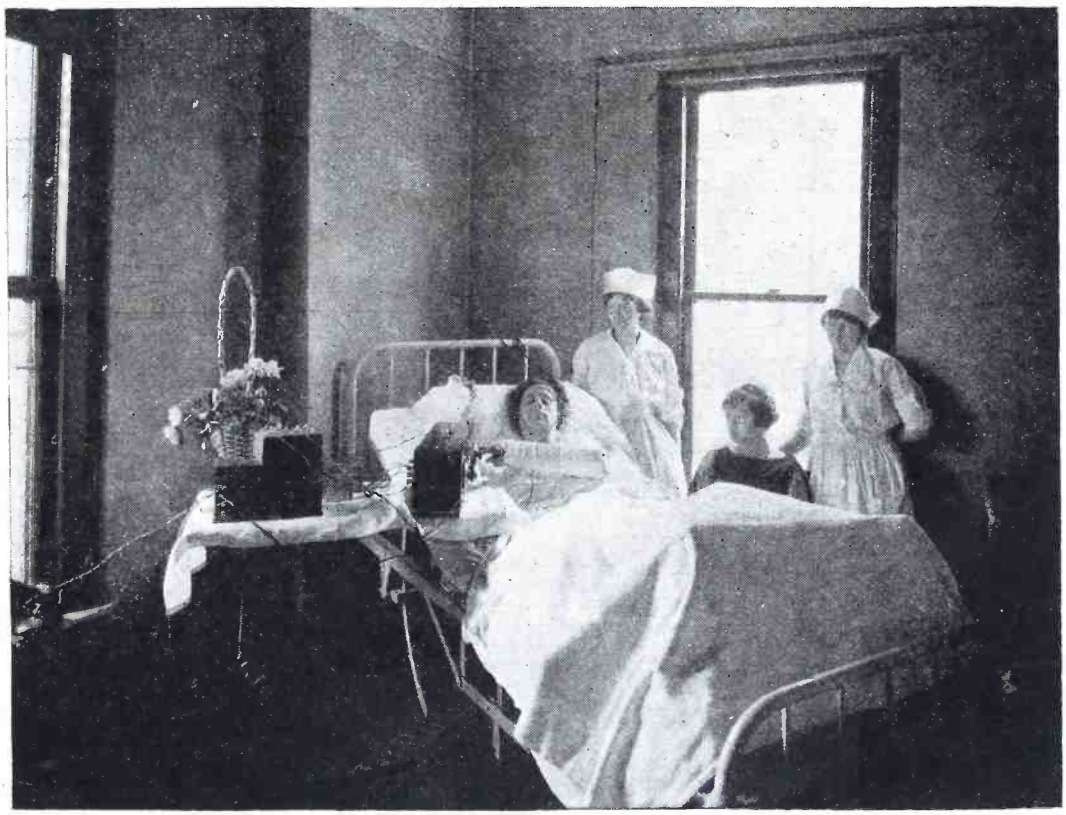
12th Vet.—"For the love of Pete, how did that hayshaker get into this man's army?"

Radio"They should be in rows of four—"

13th Vet.—"With a corporal in each squad."

Radio—"Brrr, crash! Station QMC broadcasting. Bedtime story—"

14th Vet.—"Whadayamean bedtime? We don't go to bed till nine."



Trade Press Service

BEDSIDE VISITORS COME AND GO AT THE TWIST OF A WRIST

To select the callers he wants when he wants them and to dismiss them at will without offense, is one of the inestimable advantages that a receiving set brings to the invalid. This picture shows an installation in a private ward of Mercy Hospital in Canton, Ohio.

15th Vet.—"Jimmy, yah musta got Philadelphia—lay off that."

Radio—"*Brrr! Brr! Brrr! Brrr!*"

16 Vet.—"Whatya doin' Jimmy, shiverin'?"

17th Vet.—"Hurry up, Jimmy."

Jimmy—"Keep still. I'm tryin' to get Cuba."

18th Vet.—"Well, if somebody don't give me a blanket, I'm gonna get Chile."

Radio—"*Station GHQ broadcasting. Mr. Higgins will speak on clean speech or the curse of profanity. One moment please. . . .*" (A faint but audible voice is near) "Do I speak into this damn little thing? How the blinkity, blink, blank, blank—"

19th Vet.—"Hot dog!"

20th Vet.—"Take him off, Jimmy, he musta been a second lieuy."

21st Vet.—"Give us some music."

22nd Vet.—"Shove off."

Jimmy—"All right, I'm tuning into COD. Lissun."

23rd Vet.—"Hey, Jimmy, I said *music*."

Jimmy—"That's grand opera, y' dumb-bell. Ain't you got no education?"

24th Vet.—"Hey, Jimmie, ring off and see if you can find any jazz. We want jazz. Altogether fellows."

All Vets.—"*We want jazz!*"

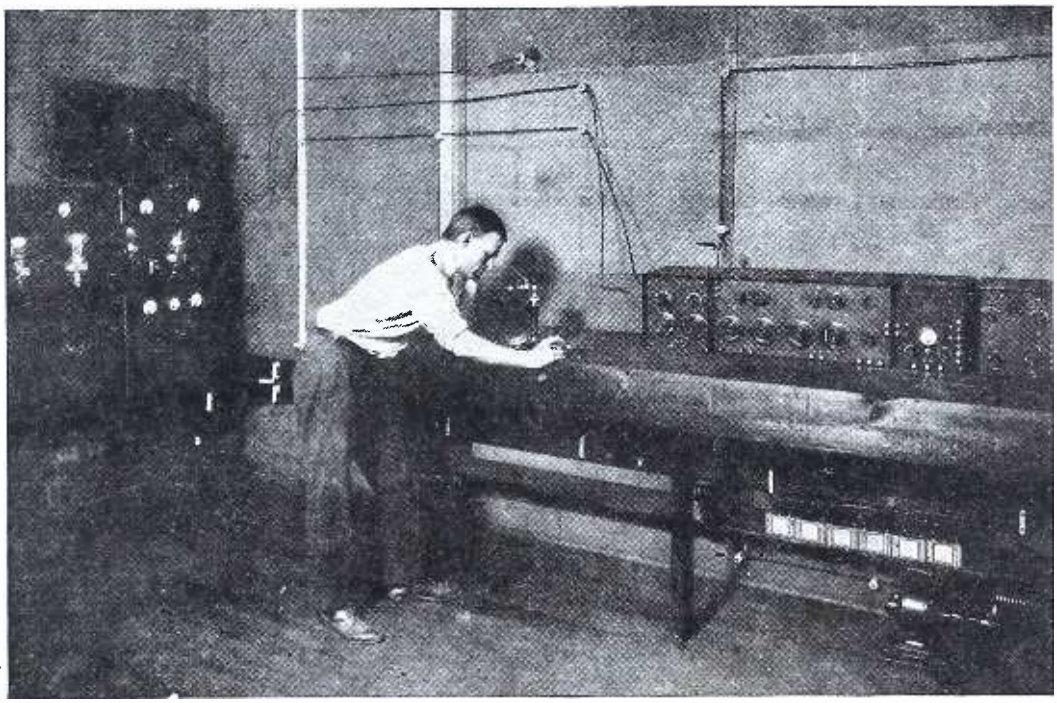
The popular Sunday services which are features of practically every broadcasting station may truly be classed as those especially appreciated by the shut-in or aged. The weather may be inclement, the distance too far, the conveyance out of order. Yet grandmother may be able to hear her cherished hymns and Sunday sermon! Many a young mother whose small children make it impossible for her to attend Sunday worship, may nevertheless restfully listen in to an uplifting talk and hear an inspiring anthem. Indeed, it is not too much to say that the words of the preacher as heard by radio are more effective than when spoken in the church edifice. There are no new hats to cause our attention to wander, nor no incentive to see what new people are sitting in the Smith's pew. The very fact that the voice comes so directly into the ear, and the attention of the listener is so strained to catch every word, makes the radio message more effective and permanent. Also, the fact that such radio talks are limited to a short fifteen minutes may force the speaker to condense his sermon to better advantage.

If in the year 1950 we could all be looking backward we should probably see that every institution like a hospital or a sanitarium as well as a home was equipped with a radio receiving center. At all events the radiophone will have been proved to be the sick room's most welcome visitor.

International

HIS LOUDSPEAKER DISTURBED THE NEIGHBORING TOWN

When Col. Edward R. Green—known to radio fans everywhere as the owner of Station WMAF in South Dartmouth, Mass.—recently set up a huge amplifier so that his townsmen could all listen in, he received complaints from folks living several miles away!



THE COMPLETE SENDING AND RECEIVING APPARATUS

It is necessary merely to "dial" a number—in the same manner as on an automatic telephone—in order to communicate immediately by wired wireless over 50 or 100 miles of 100,000-volt power lines, even to the furthest sub-station on the line.

The Human Voice with a 100,000 Volt Kick

How "wired-wireless" waves are being used commercially in a remarkable manner to establish telephonic communication of a most reliable and important nature over the high tension lines of a great electric light and power company.

By LLOYD JACQUET

WHEN Marconi sent the letter "S" across the Atlantic Ocean in his initial attempt to span the seas by radio some twenty years ago, the telephone, the telegraph and the cables, all wonderful inventions at the time, dropped out of the spotlight to make way for the newcomer in the communication field, the radio telegraph.

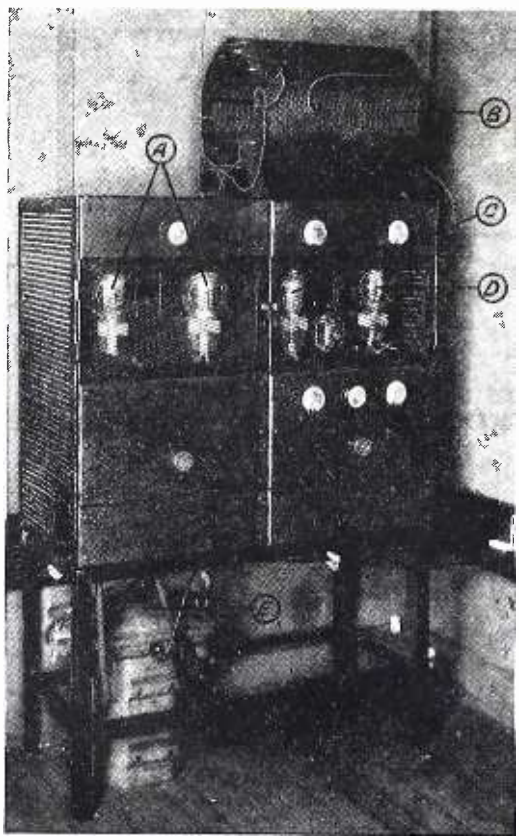
The art of radio has since developed rapidly, and today we have achieved the dream of scientists and engineers ever since the invention of radio telegraphy: the transmission of human speech without wires.

We are now again on the threshold of a new era, in which the many merits of radio telephony are combined with the advantages of wire telephony.

It is well known that radio waves

radiate in all directions, in the manner of the concentric water-wave rings which result from the dropping of a stone in a pool of quiet water. This property of radio waves of spreading out in all directions makes broadcasting possible.

Now, radio waves have been caused to follow a conductor—to be guided by a wire—instead of being allowed to travel unrestricted in all directions. To the uninitiated this may appear to be a step backward, but engineers of the Westinghouse Electric & Mfg. Company, who have made an installation of their system on the lines of one of the big western power companies, are convinced that the utility of this system will be as great if not greater than that of its predecessors in the communication field.



THE TRANSMITTER

A, shows the two rectifier bulbs; B, the tuning inductance; C, the modulator tube; D, the oscillator, and E, shows the transformer which furnishes the power to the set.

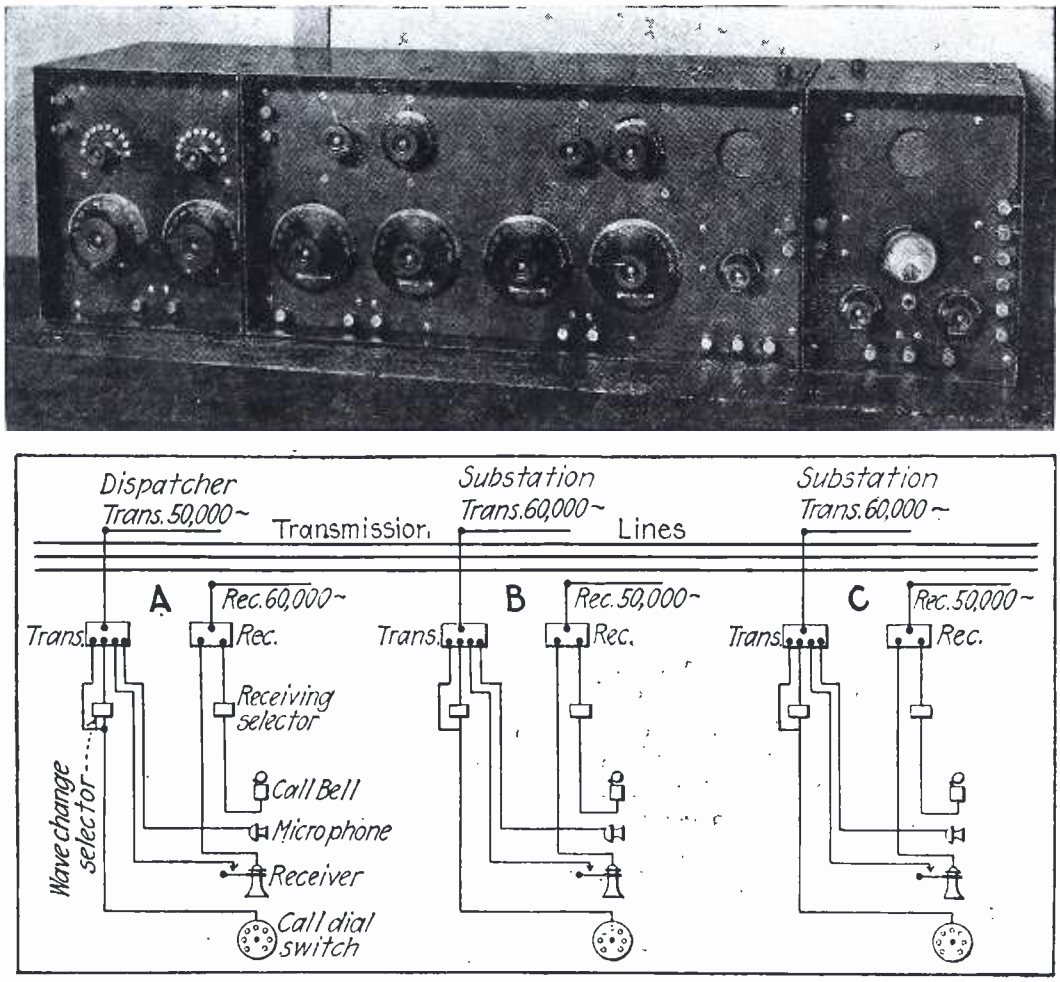
The name "carrier-current telephony", or wired wireless, has been given to this development of the radio art. It makes use of existing conductors to serve as the medium along which the radio impulses are guided from one point to another. As this system was especially designed for use on power or railway systems, the transmission lines in either case serve as a transmission medium. Sets can thus be placed in generating plants and sub-stations and also on trains, and communication carried on without difficulty.

It is in the electric power services, however, that the Westinghouse system finds its greatest field. The current which we use to light our houses, run motors, and do other work is generated in a power plant. The amount of current needed by a section served by such a generating station varies from hour to hour. For instance, the demand may be greatest during the early part of the evening, or (if in a manufacturing center) during the working day. However, a storm may come up, and many lights are called into service. This imposes upon the generating station a "peak load" as it is called, which must be met.

This proper regulation of the generating plant and sub-stations to take care of the load is in the hands of the "load dispatcher." He is in complete control of the power system and upon his efficient management depends the ability of the system to supply an unusual demand for power.

It is necessary, therefore, that the load dispatcher be in instant touch with all of the sub-stations comprised in his system. A carrier-current system of communication places the load dispatcher in constant touch with any of the operating personnel.

An installation of this type of carrier-telephony system is not any more complicated than that of an ordinary



THE RECEIVER AND THE SYSTEM LAYOUT

This picture shows the receiving apparatus, including the tuning units and the amplifiers, which are mounted in strong metal cabinets. Below it is the schematic diagram showing how the receivers and transmitters are connected to separate antennas and tuned to different frequencies—the transmitters to 60,000 cycles and the receivers to 50,000 cycles. The waves pass along the transmission lines to and from the receiving and transmitting antennas.

radio installation, although its simplicity, from an operating standpoint, is much greater.

On entering the office of the load dispatcher or of any other operating personnel on the system, one would scarcely suspect the presence of a carrier-current telephone system. The dispatcher has on his desk an ordinary desk set practically identical with those used for automatic wire telephony. There is a little dial on the base of the instrument which is used for calling the station desired. The only other piece of apparatus in the dispatcher's office is the call bell.

Let us see now what happens when the dispatcher desires a station. He simply removes the receiver from the switch hook, puts his finger in the proper numbers in the dialing mechanism to call the station desired and, in a twinkling, he has the operator at the distant station on the line and is in direct communication with him.

Suppose the dispatcher has a gen-

eral order that he desires to give to all of his operating stations. Instead of having to call up each one of them separately on his carrier-current telephone, he simply dials a general call and all of the operators respond. He then reads his general order, and they reply in turn acknowledging receipt.

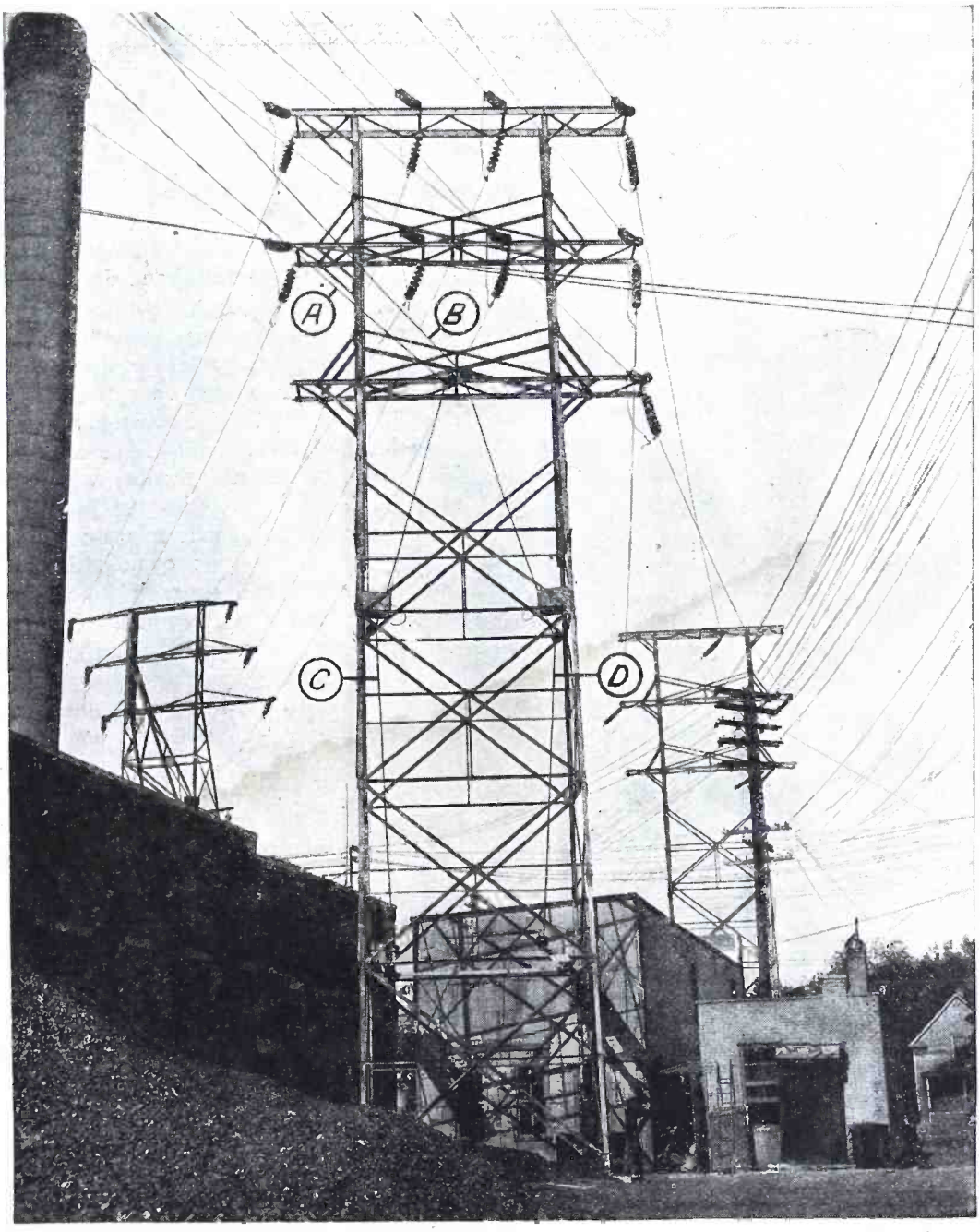
While discussing the operation of the carrier-current system with the dispatcher, doubtless his telephone call bell will ring, as load dispatchers have very little leisure time. In taking up the receiver from the switch hook, his call bell stops ringing and he talks to the calling party. Perhaps he is talking to a distant generating station, 100 miles away, who desires permission to talk direct to an adjacent sub-station. It might be mentioned here that the Westinghouse system can be arranged so that no conversation can take place between stations except with the permission of the dispatcher. Having obtained this permission, the dispatcher hangs up and the distant station and sub-station are allowed to communicate without further interference.

We will now enter the room in which the remainder of the apparatus is placed. On the one side we see a neat switchboard panel upon which are mounted two glass vacuum tubes, very similar to those used in broadcasting stations. Adjacent to this panel is another panel also mounting two similar looking tubes, known as rectifier tubes. (See Figure 1). In another part of the room is the receiving apparatus entirely enclosed in metal boxes and sealed so as to prevent any adjustment except by authorized parties.

The load dispatcher now favors us with a demonstration and through the open door we see him lift the telephone receiver from the switch hook. Immediately a slight hum is heard and all of the tubes glow brightly. We are told that the rectifier tubes take ordinary alternating current such as is used for lighting and power purposes and rectify it to make it suitable for use on the tubes on the right hand panel. (Figure 1.) Of the two tubes to the right, one is known as the oscillating tube and the other as the modulating tube. The oscillator supplies the necessary power for transmittting and the modulator tube modulates or moulds the current into the form of the voice when the dispatcher speaks into the telephone desk set. There are a number of instruments dotted around on the equipment and our attention is directed in particular to one, the needle of which shows severe disturbances whenever one speaks into the telephone. The whole equipment seems to work quietly and performs without fuss or flurry. The dispatcher hangs up his receiver and the brightness of the tubes gradually diminishes until they are completely "out."

Upon being invited, we are allowed to talk over the carrier-current telephone to a distant sub-station some 50 miles away. We follow instructions and lift the receiver from the switch hook, dial three different numbers and almost immediately we talk to the operator. Speech is remarkably clear and one would never know but what he was talking over a wire telephone. There is scarcely any perceptible hum and much less frying noise than over the regular wire telephone lines.

On discussing the carrier-current system with the dispatcher, we are advised of certain almost unbelievable facts. We are told that the current that is used to carry the voice variations over the transmission lines does not flow in one direction continuously, as water flows through a pipe, but that it reverses hundreds of thousands of times in a second. This is an almost unconceivable rate but this kind of current is necessary to obtain clear transmission. This high-frequency current is generated by the oscillating tube of the transmitter, the tube being connected in an Armstrong oscillating circuit familiar to all radio fans, and the oscillating currents are



RADIO ANTENNAS INSTALLED ON POWER TRANSMISSION TOWERS

Here are shown how the transmitting antenna A, and its lead-in C, and the receiving antenna B, with its lead-in D, are suspended by insulators from the steel framework of the tower, and directly underneath the power lines. This close proximity of the power lines enables the radio waves to "jump the gap" to and from the power lines without any danger of the high-tension current leaking across in the same manner.

sent along a wire suspended near to the transmission line. The modulator tube moulds or controls this rapidly reversing current and changes its magnitude as one speaks into the transmitter.

The current is transferred from the elevated wire to the transmission line and flows along it in much the same way as does the regular power current. All of the receivers are likewise connected to elevated antennas suspended near the transmission line and they are tuned to the dispatcher's transmitter. These antennas are simply single conductors about 500 feet long and are coupled by being strung on insulators on the transmission towers as close to the transmission conductors as safety will permit. The current passes from receivers, thence to the ground and back to the transmitter.

It has been the aim of the Westinghouse company to make its carrier-current telephone system at least as flexible as a wire-line telephone and the system is consequently, *duplex;* that is, conversation may be carried on in both directions and simultaneously. This is accomplished by using two carrier frequencies, one for transmission and another, differing enough from the first to cause no interference, for receiving. Thus, two stations talking, A and B, would work as follows: A might transmit on 7,500 meters and receive on 5,000, and B would then transmit on 5,000 meters and receive on 7,500. By the use of these two different frequencies, A and B can both talk and listen without interference, and, without operating switches, or other apparatus, can carry on this conversation in the same manner as over an ordinary telephone line.

You may wonder how the dispatcher can call one operator and not another when he has only one line, so to speak, to all of his stations. The little dial on the base of the telephone desk stand is arranged to make a definite number of contacts, depending upon how far it is pulled around. These contacts send electrical impulses out over the transmission line. These impulses are received by all receiving stations and are led down to a little device, which is almost human in its action and which is called a selector. Each selector is adjusted for a different combination of impulses. We will suppose for a moment that the station which the dispatcher desires is adjusted for the number 949. The dispatcher pulls down the dial first to the number 9, and then to the number 4, and then again to the number 9. The impulses are received by all receivers and all selectors connected to the line, but only the selector that is adjusted to operate at 949 rings its bell. The operating action of the system is akin to the combination of a lock. Only one type of key will open a good lock although many different keys may be inserted into the keyhole. If the operator desires to call some other station, he simply hangs up his receiver for an instant, then removes it and calls the station desired.

How to Build the Super-Heterodyne Receiver

In the next number of POPULAR RADIO*—the first issue of the enlarged magazine—will be published another of the famous "How to Build" series of articles. The Technical Editor, Laurence M. Cockaday, R.E., has been experimenting for months with apparatus which he has built for the express purpose of insuring not only the highest possible efficiency of the set itself, but also the technical accuracy of the article down to the minutest detail. Out October 15th.*

PRACTICAL HINTS FOR

Coil Calculation

[illegible]

To operate your radio set efficiently, you require a coil of correct design. This series of articles is based upon new and practical laboratory experiments, conducted for the special benefit of amateurs, by—

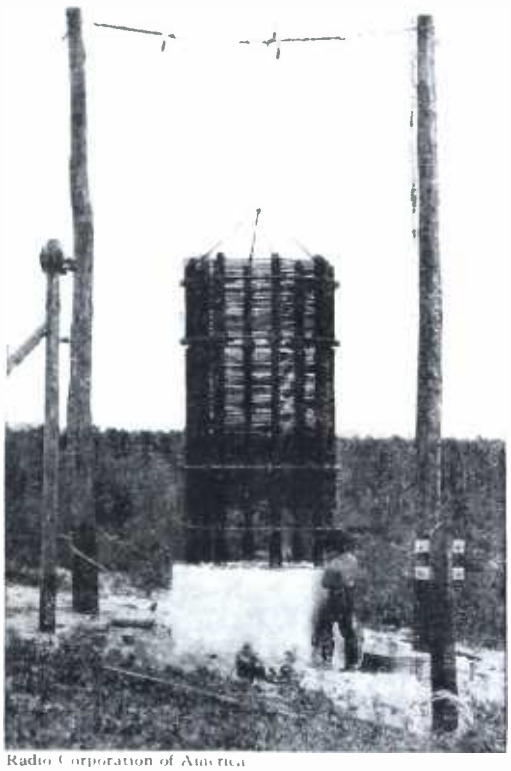
SIR OLIVER LODGE, F.R.S., D.Sc., LL.D.

THE first idea of self-induction originated with Faraday, long ago, but he was quite vague about it, and called it "the electrotonic state of a conductor." It puzzled him a good deal, and he treated it almost as if it were some chemical property of the metal, acquired under electrical influence. He named it "electrotonic state" in November, 1831, during his great discoveries in electromagnetic induction generally.

The idea became rather more definite in the hands of Sir William Thomson (Lord Kelvin), who in 1853 gave the mathematical theory of electrical oscillation. He perceived a sort of analogy between Faraday's electrotonic state and electrostatic capacity—only he perceived it was kinetic instead of static—and he therefore called it "the electrodynamic capacity of a discharger." In other words, he found that it was a *constant* belonging to all the wire circuit through which a Leyden jar discharged. Thus in an oscillating circuit there were the two things, both essential to oscillation:

First, the electrostatic capacity of the charged areas;

Second, the electrodynamic capacity of the connecting wire or discharging rod. Resistance came in subordinately, as a damper of oscillation, in a comparatively simple way which he thoroughly understood.



Radio Corporation of America

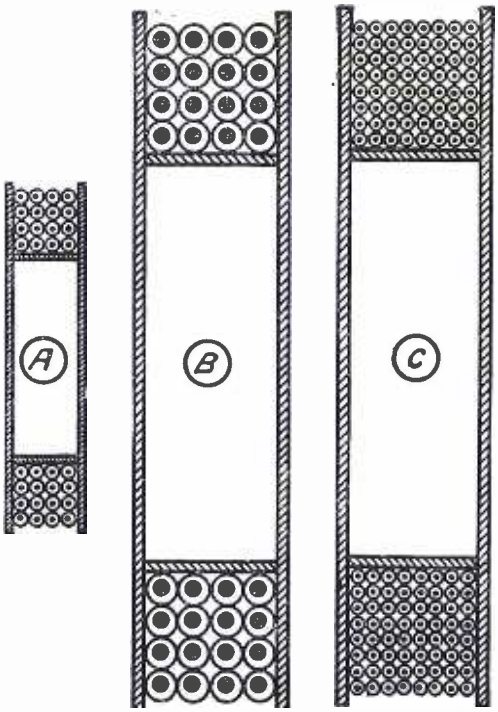
THE WORLD'S LARGEST OUTDOOR INDUCTANCE

A detail of the enormous multi-tuned antenna of the transatlantic radio station at Rocky Point, Long Island. Compare this giant apparatus to the helix ordinarily used by amateurs, 8 inches in diameter and 12 inches long.

Then, later on, it was realized that just as two wires lying alongside of each other had a mutual coefficient of induction, so that the one induced currents in the other (as discovered by Faraday)—each being susceptible to the rate of variation of the current in the other—so it might be said that every longitudinal part of a single wire reacted on the other parts of the same wire, or, in other words, that the wire was itself

susceptible to the rate of variation of the current in itself. Hence it was possible to speak of not only the mutual induction of two parallel conductors, but of the self-induction of one. And so Maxwell introduced the term "self-induction," and made it quite definite and calculable. Later, Heaviside styled it inductance, to correspond with resistance.

There are two ways of calculating this quantity, now commonly denoted by the letter L. One is to reckon the number of magnetic lines of force which effectively surround a wire carrying a current —the momentum, so to speak, of its magnetic field—and to call that momentum LI, where I is the strength of current. The other is to treat the wire as if stranded, and to reckon the mutual induction of the strands on each other. This can be done by taking it as equal to the mutual induction of two parallel wires at what is called the "geometric mean distance apart": that is to say, at a distance determined by the shape and size of the cross section of the single wire—a distance which can be reckoned as the average distance of the points in such a section from each other. It is all worked out in Maxwell's great treatise, published in 1873; and he gives an expression for this geometric mean distance for different shapes of section. It is important, because it applies, not only to a single wire, but to the cross section of the wound channel in a coil. That cross section may be square, or oblong, or round—as when the coil is shaped like a curtain ring.



It is interesting to note that if we build a coil of certain dimensions A, it will have a certain inductance. If we double all its dimensions, including the diameter of the wire (as in coil B), the inductance will increase very slowly in proportion to the added size. If, however, we keep the wire the same size as in the first coil and at the same time double all the other dimensions of the coil, as in C, we will find that the coil has inductance 32 times greater than coil A.

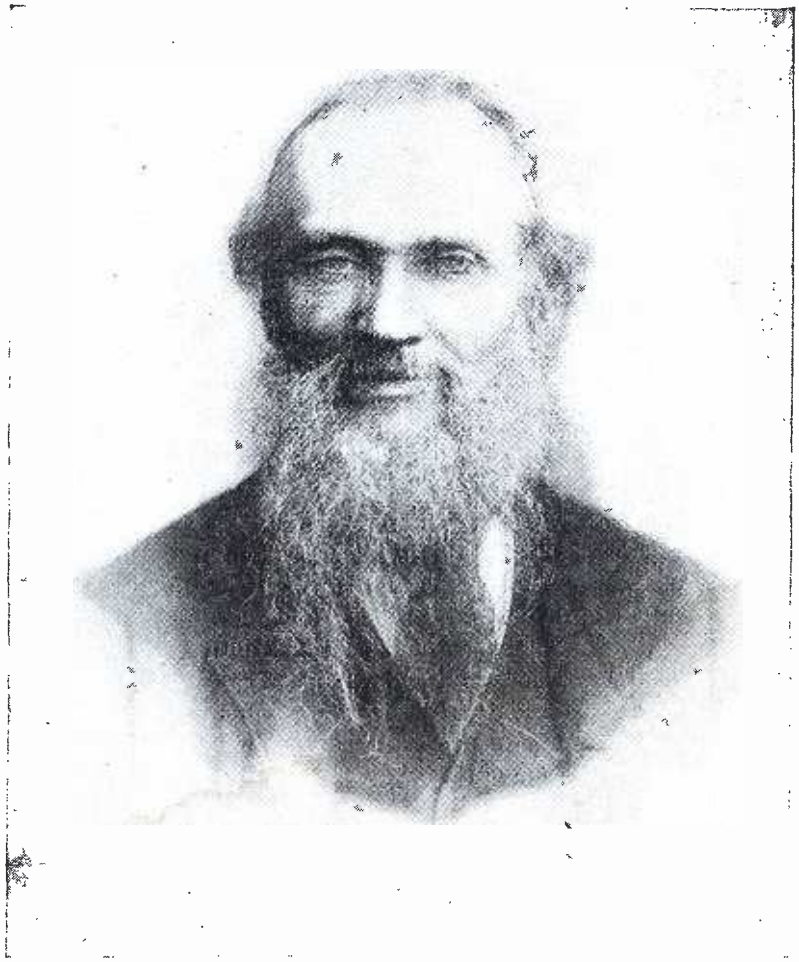
In practice the section is usually oblong or square. It may be oblong *broadways,* as when one or a few layers are wound cylindrically on a tube; or oblong *depthways,* as when short layers are wound so as to be piled on top of each other, making a sort of disc.

For a coil with one narrow dimension (that is to say, for a winding whose section is a thin oblong, whether the coil is wound horizontally or vertically) the geometric mean distance asunder of its parts is .223, or say a quarter, of its larger sectional breadth.

For a square section, the value is .45 times the length of one of the sides, that is, about half the side of the square.

For a circular section it is .78 or say three quarters of the radius.

For an oblong section in general, the accurate expression is decidedly complicated, involving logarithms and tangents, but it may be taken as approximately a quarter of the width and depth of the section added together; more accurately, $\frac{b+d}{\sqrt{(20)}}$, which is very nearly right. The complete formulas will be found in Maxwell, or quoted in Professor Fleming's comprehensive



Elliott & Fry, London

THE SCIENTIST WHO EVOLVED THE THEORY OF ELECTRIC OSCILLATION

Sir William Thomson (Lord Kelvin), first perceived that there was both kinetic and static energy in oscillatory electrical discharges. His development of this theory was based upon a thorough understanding of the theory of induction.

treatise and I need not attend further to it now, because I want to concentrate on the most compact section—either a circle or a square. For it is this compactness which gives the maximum self-induction.

That, however, is not all that is necessary to be known, by any means. That only determines the shape of the channel in which the wire is wound. We must know the average size of the channel in relation to the circle of wire so formed, that is to say, we must know the external and internal diameters of the coil in terms of its sectional dimensions. Maxwell calculates that too, though he says it was first worked out by the mighty mathematician Gauss, in 1867; though under what circumstances and for what reason Gauss can have calculated it, I do not know. It will be instructive to some of my readers if I indicate the manner of calculation, though those who like may skip the algebra, which I will defer for the immediate present. Anyhow, the *result* is clear and definite and simple enough. The width and depth of the channel's cross section

Brown Bros.

HE GAVE THE WORLD THE MATHEMATICAL FORMULAS FOR EXPRESSING INDUCTANCE

"Self-induction" is the term that James Clerk Maxwell gave to the phenomenon that we now call merely induction. He was also the first man to establish the theory of light as an electromagnetic phenomenon.

must be approximately three-fourteenths of the external diameter of the coil, or three eighths of the internal diameter, the external diameter being $\frac{14}{8}$ or $1\frac{3}{4}$ times the internal. That determines completely the shape of the best coil, whatever its size may be. Every coil that we now proceed to speak of is to be of this shape, they will differ only in size, one will be like another magnified. But the wire which is wound on the coils will not be magnified. If it were, the number of turns would remain the same, and the inductance would increase very slowly in proportion to the additional size. It would, in fact, in that case simply increase with the linear dimensions, or, what amounts to the same thing, it would be proportional to the length of wire used.

But if the wire is maintained at a constant thickness, no matter what the size of bobbin on whch it is wound, the inductance increases vastly as the dimensions increase. It increases not only because of the greater length of each turn of wire, but also in proportion to the square of the number of turns. If the linear dimensions are doubled, the number of turns are quadrupled, and therefore the length of wire is quadrupled. The inductance depends on the square of the number of turns, and therefore is quadrupled twice over, making it 16-fold, and the linear dimensions being doubled makes it altogether 32-fold. That is to

say, increasing the size of the coil, for a given thickness of wire, increases the inductance as the fifth power of the size. In other words, doubling all the linear dimensions multiplies the inductance by 32.

The formula connecting the three things—outside diameter of coil (D), thickness of covered wire (T), and maximum inductance (L_m)—is as follows:

$$\frac{D^5}{T^3} = 66.6L_m$$

Here the D, T, and L must all be expressed in the same units, no matter what those units are; and for convenience L should therefore, in such cases, always be expressed as a length, not in such units as henries or fractions thereof, though these are useful for other purposes.

So also it is best, for radio apparatus, to express capacity as a length, and not in farads or microfarads or micromicrofarads. It is much better to express it in meters, because one usually wants to employ it to calculate the wavelength. The wavelength is 2π times the geometric mean of the inductance-length and the capacity-length, that is, about 6 times the square root of their product. Thus, suppose L is 10 kilometers, and C is 1 meter, the wavelength would be 600 meters. If L is 1 kilometer, and C is 10 meters, the wavelength is the same. If L is 16 millihenries, or 16 X 10^6 centimeters, and C is 100 centimeters, the wavelength will be 240,000 centimeters, or about 2½ kilometers.

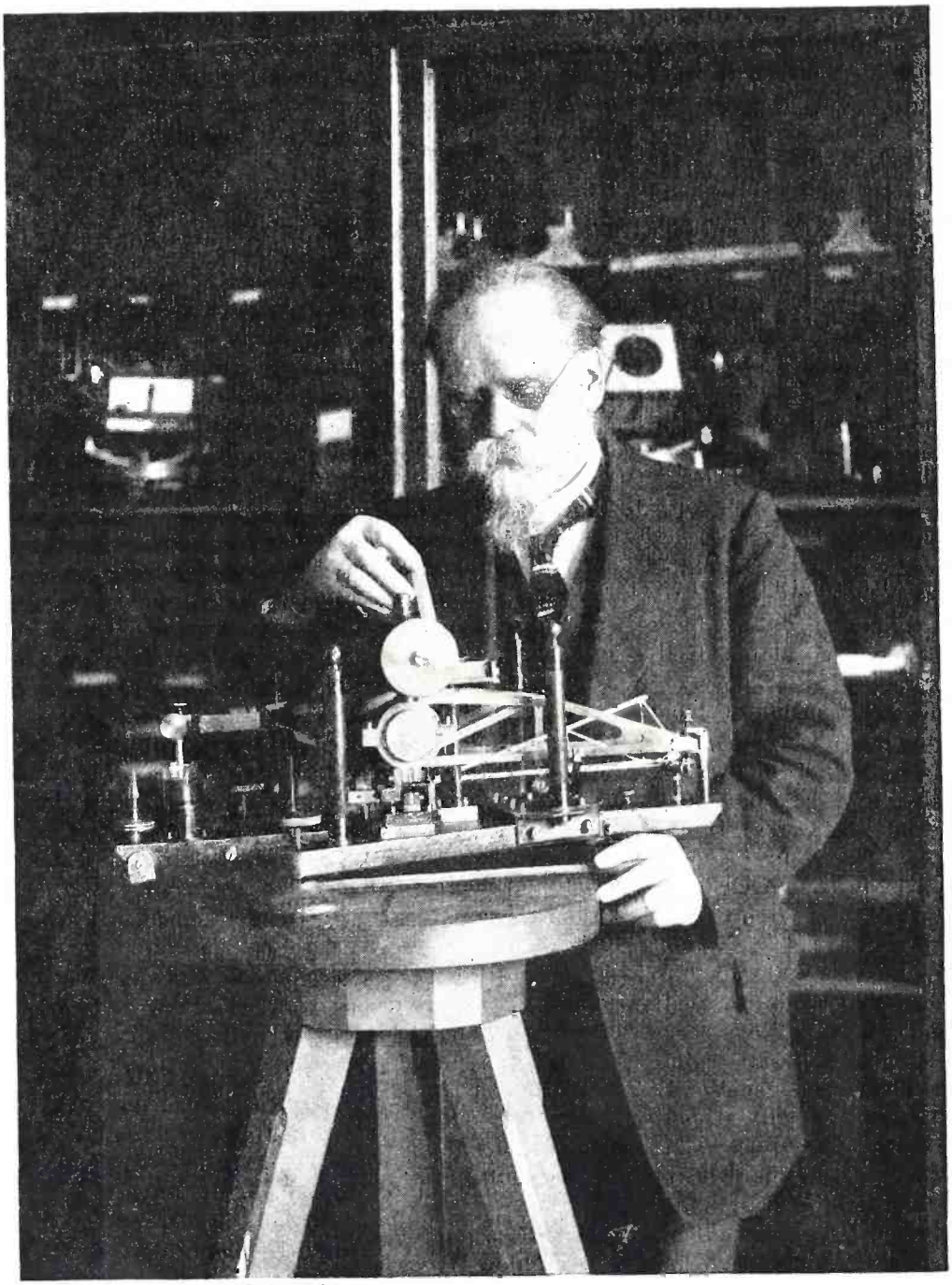
By thus working in length units, the calculation is quite simple, and can be done in one's head; and slips of extensive magnitude can be avoided, because there is a common-sense feeling about the size of the quantities dealt with, all the time, which prevents their being accidentally taken hundreds or thousands of times too big or too small, as may easily happen when hastily dealing with meaningless units of quite unsuitable size. To measure things in farads and henries when we want the dimensions of a coil in inches, or a wavelength in meters, is not practically convenient.*

*Sir Oliver Lodge's article in POPULAR RADIO—"A Plea for Easy Specification," September, 1923.

Harris & Ewing

RADIO AS AN EMPLOYMENT MEDIUM

To bring the man without a job to the job that is waiting for him—somewhere—has been one of our important economic problems. The Secretary of Labor, James J. Davis, is using radio for broadcasting practical information concerning just what kind of labor is needed in different localities.



From a photograph made for POPULAR RADIO

"From Ether This Life Comes, and to it This Life Returns"

So states Dr. Emil Wiechert, Professor of Geophysics and head of the Geophysical Institute of the University of Göttingers, Germany. In addition to his work in electrical theory he has made a special study of the mathematical theory of the transmission of earthquake waves inside of the earth. In this picture he is shown adjusting a seismometer that magnifies 100,000 times.

Are Men Made of Ether?

A remarkable conception of the basic unity of life, matter and electromagnetic waves, as developed from the ether hypothesis by—

EMIL WIECHERT, Ph.D.

WE see in the world an abundance of apparently autonomous bodies. Physics, however, teaches that this autonomy is an illusion, that it is a misconception that is brought about by the imperfections of our senses. As a matter of fact, everything in the world is interrelated. It is remarkable, and may well incline us to humility, to realize that our human senses show us absolutely nothing of the connecting forces—of the force of gravity, of the electrical and magnetic forces, and of the forces which bring about the agglomeration of the atoms into solid bodies.

Physics first had to seek out these forces, but even then it succeeded only in making us acquainted with a few superficial aspects of the processes that are involved. The most important conception which resulted was that there is everywhere present, eluding perception by our senses, a basic substance that is known in Germany as *Weltuntergrund,* or in the parlance of physics, the ether, which secures the connections between molecularly-material bodies.

Strangely enough, it was Einstein's theory of relativity, seeking to deprive the cosmic basis or *Weltuntergrund* of its corporeity, that led to the conclusion that the apparently tremendous effect of the force of gravity which shackles the planets to the sun and ourselves to the earth is engendered by even extremely small differences in the condition of the basic substance, ether.

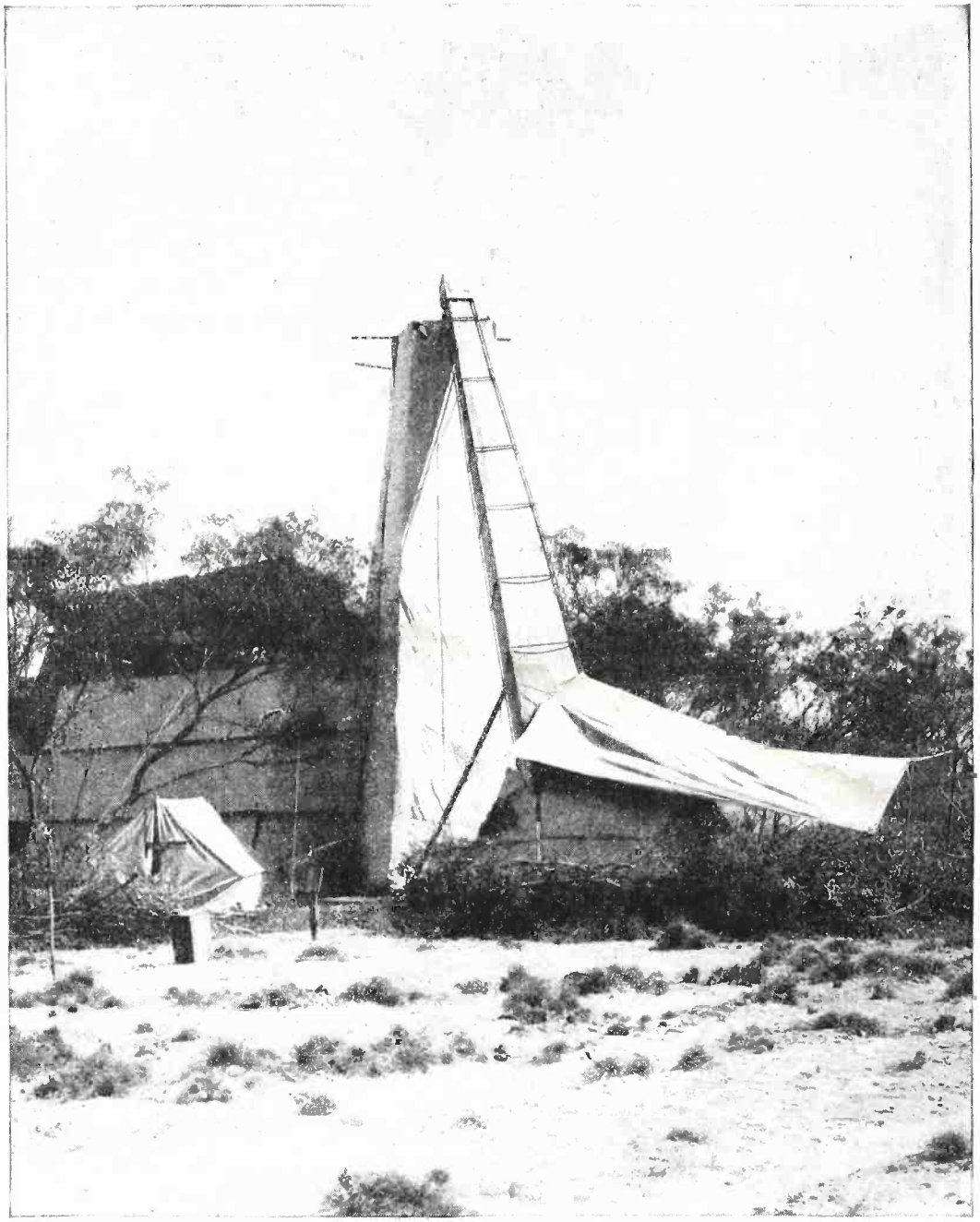
To understand this, let it be noted that the velocity of light is a measure of this condition. Gravitation on the earth results because here the velocity of light increases from 1 to $2 \times 10 - 16$ of its amount with one meter of elevation.

On the other hand, molecular matter exerts but an extremely trivial influence upon the condition of the basic structure, ether; even the great mass-aggregation of the sun is unable to alter the velocity of light at its surface more than a 1/500,000th part from the velocity obtaining at great distances.

Thus the ether appears to have predominance over molecular matter.

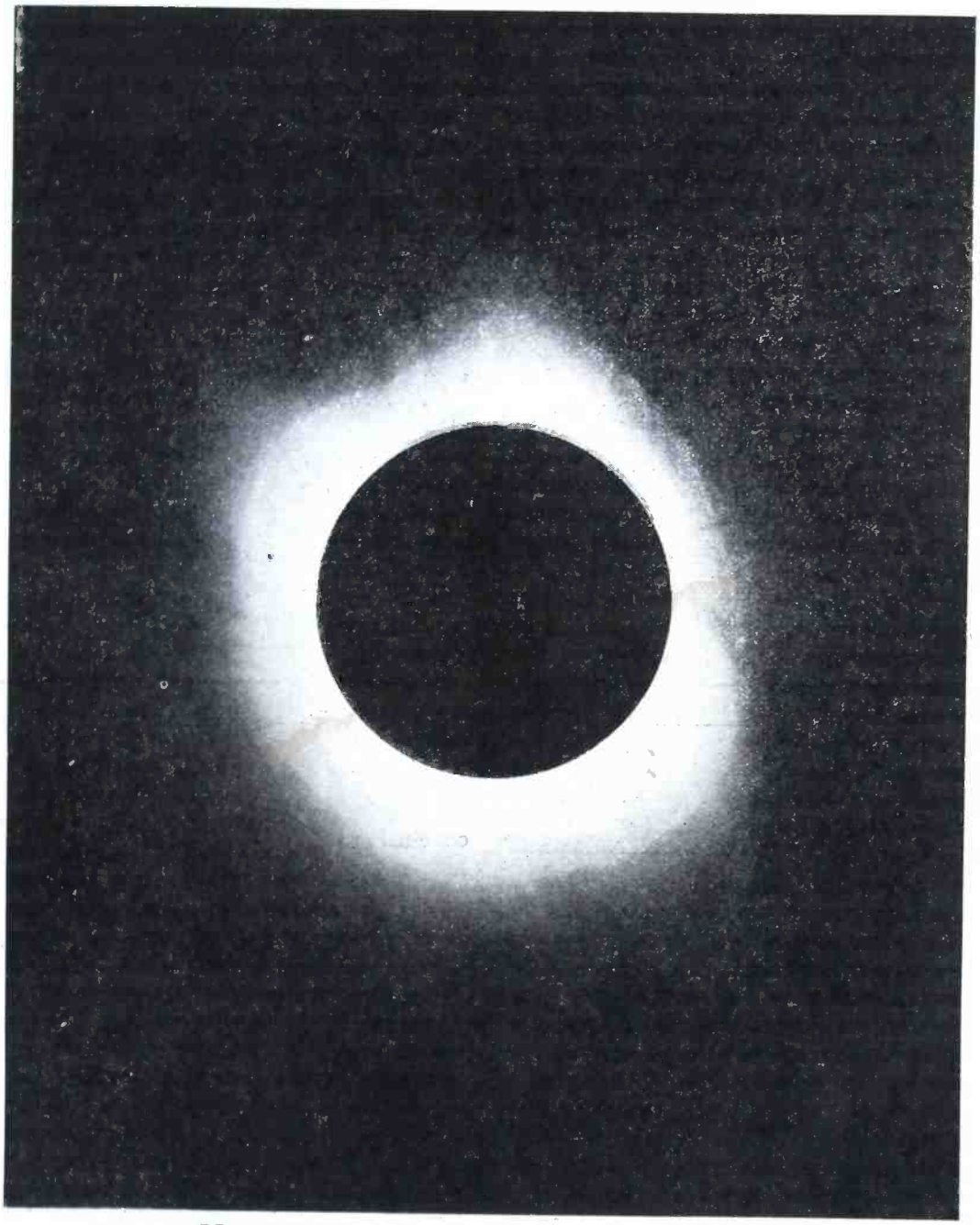
This impression, much as it does contradict naïve observation, becomes stronger as the physical details are more fully considered. One is accustomed to regard inertia and opacity as those attributes which really give matter its corporeity. But electro-dynamics instructs us to look for the cause of inertia in the basic substance ether, with which matter is held together.

The discovery of radio activity has furnished the means for the establishment of the fact that matter is not at all opaque. At sufficiently high velocities an atom is able to force its passage between many thousands of other atoms. Hence the modern physicist is not amazed by the observation that matter travels through the ether without forcing the latter to partake of its motion. In this, too, the insignificance of the influence of matter is made manifest. A further indication of this insignificance is furnished by the observation that, according to the findings of astronomy and geophysics, even such great masses of matter as are supplied by the sun and the earth are unable perceptibly to influence the reciprocation, called gravitation, between two particles, one located in the interior of the earth



At This Remote Camp in the Antipodes the Einstein Theory Was Confirmed

In this crude laboratory at Wallal, an isolated oasis on the northern coast of Australia, the astronomical expedition from the University of California took the celebrated photographs of the eclipse of the sun on September 21, 1922. One of them is shown on the page facing. According to measurements made by Dr. W. W. Campbell, the newly elected president of the university, these photographs are in exact accord with the predictions of the Einstein theory.



How the Sun Looks During the Moment of Total Eclipse

This photograph of the fringe of light or corona seen around the sun during a total eclipse is one of those taken at Wallal through the great forty-foot telescope shown on the opposite page. The gigantic fiery streamers of the corona, extending often more than half a million miles above the sun's surface, are visible only for the few minutes each century when the sun is in eclipse. While this issue of POPULAR RADIO *is in press scientists are gathering in California to study the eclipse of September 10, 1923, mainly in an attempt to solve the mysteries of the corona.*

and the other in the interior of the sun.

Add to this mass of fact what the formula of equality of apparent motion (of light) places before our eyes, and we encounter the most stupendous and surprising thing in the whole realm of phenomena. We learn that matter is constrained not to leave the field of "less-than-light-velocity" prescribed by the ether; that its shapes flatten and the processes within it become more and more inert the nearer its velocity approaches the limits set by the velocity of light in the ether.

Thus molecular matter, with its entire physical being, appears subjected to the domination of the ether, while on its own part molecular matter must content itself with a most insignificant influence. The ether appears as the carrier of all the forces of the universe and as that which gives the latter its corporeity.

Nevertheless, when our organs of sense make us conscious of molecular matter only and not the ether, the explanation lies no doubt in this, *that we consist of molecular matter ourselves*, and our organs of sense are consequently *built for the observation of matter only*. . . .

In view of the intimate relations existing between matter and the ether, it seems unnatural to picture them as strangers to each other. Rather it should be assumed that in their very nature they belong together. Authoritative physicists have repeatedly asserted that *the atoms of molecular matter mark spots of distinguished condition in the ether*. . . .

A gauge for the activity of matter is given us in physics by the concept of "energy." Electro-dynamics shows plainly how this energy participates in the aggregation of matter in the ether. Hence, if we regard the atoms of matter as creations in the ether, we will have to ascribe to the ether an energy-content. And because the ether retains *within* matter all the characteristics which it displays *without*, it must be assumed that the energy which we find *in* matter —*in* the electrons, for instance—and which represents specially organized ether-energy, is of equal rank with the energy inherent in the ether generally. . . .

Within matter we note a constant exchange of energy between particles; why should not a similar exchange also be taking place between matter and the ether? It appears to me that two indications of this are discernible:

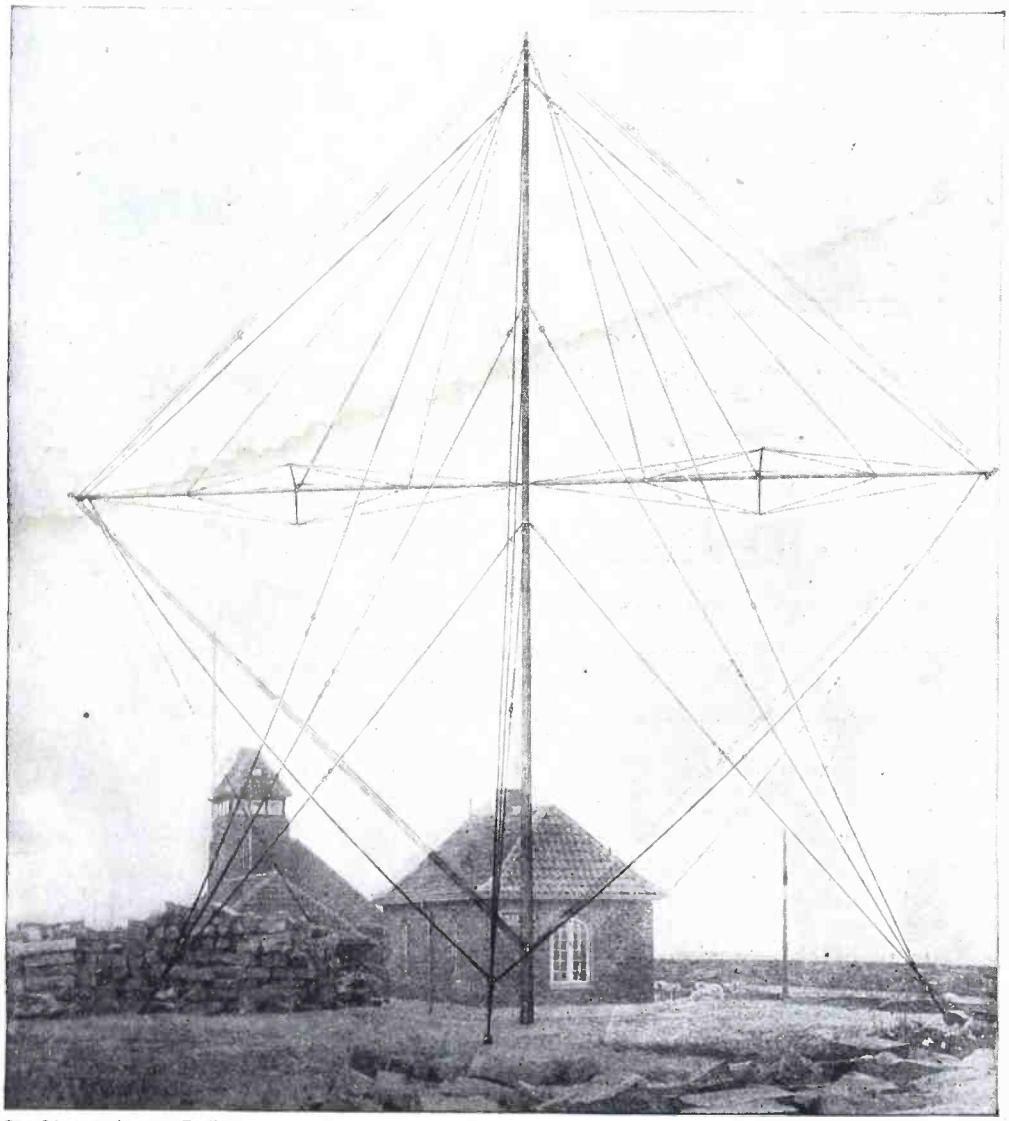
First, in the behavior of radio-active bodies. The physical cause of the gradual bursting of the atoms of such bodies is unknown to us; all the physical agencies with which we are acquainted have proved impotent to explain this. It appears to me quite possible that a purely accidental exchange of energy with the ether may effect the destruction of the atoms.

A second indication of this I believe is recognizable in the interior heat of the celestial bodies. The known sources of heat hardly suffice to account for a period of twenty million years of such heat as the sun sends out at present, yet the history of our earth forces the conclusion that the sun has existed much longer than that. It appears to me highly probable that here we have to do with a transference of ether-energy to matter. . . .

Such a view ascribes to the ether the rôle of a general reservoir of all physical life. From it this life comes, and to it it returns. Let us now think of our own bodies, which, so far as the testimony of our senses goes, are molecularly constructed. The atoms of matter form our organs of sense and even our brain (the organ to which is attributed our ability to think). But our consciousness is not divided into atoms by any means. We see connected pictures, we form connected series of impressions and thoughts. What supplies here the connection between the atoms? Evidently we must, here, as in the case of physical forces, credit the ether with the rôle of

mediator. Hence for our mental life, too, does the basic substance, ether, furnish the foundation. When thus we connect our spirit with the ether, we are doing nothing more remarkable than when we associate our lives with matter, which to our senses appears to be dead.

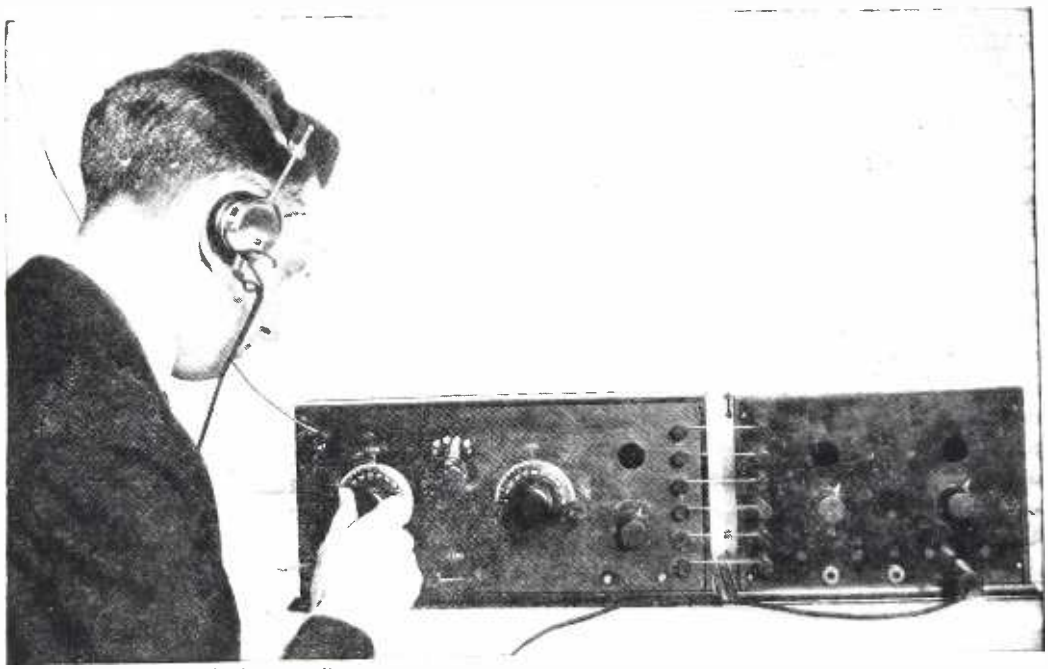
We must free ourselves from that materialism which would accord recognition to only those things in the world which our senses show us. Beyond the world which we see there lies another world whose influence we can feel, but for the recognition of which we are most imperfectly equipped. Man is not "all-seeing" and will never become "all-knowing."



Star Literary Agency, Berlin

A REMARKABLE ANTENNA

This duplex transmitting and receiving station, situated at Ronnehafen on the Danish island of Amagar, is one of the few European stations that is capable of holding simultaneous two-way conversation.



From a photograph made for POPULAR RADIO

THE COMPLETED AMPLIFIER

Here is the instrument (on the right) as it appears when connected to the tuner (on the left). It is equipped with jacks so that the detector or one or two stages of amplification may be used at will.

HOW TO MAKE A TWO-STAGE

AUDIO FREQUENCY AMPLIFIER

This instrument may be added to any set to strengthen the received signals so that they will operate a loud-speaker. The amplifier is simple to construct and efficient yet should cost no more than $15.00 for materials

BY LAURENCE M. COCKADAY, R.E.

IN the design of an amplifier for use with a detector and tuning unit, to strengthen the currents which actuate the telephone receivers, there should be four main objects aimed at. These are:

A—Maximum amplification with a specified number of tubes.

B—Minimum noticeable distortion of signal currents.

C—Amplifier should work well on all types of tubes.

D—Simplicity in construction and operation.

Due to the fact that music and voice signals have such a wide range of frequencies, it is important that the transformers have a wide range also. This means that the amplifier should have a flat curve of response and that the curve should be as high in amplitude as possible. (The curve under consideration refers to "audibility amplification" plotted against "frequency.")

Here we see that the amplifier must

have A, at all frequencies within the audible range and so insure B; if the amplifier possessed A, at one particular frequency or band of frequencies, this frequency would be brought out and amplified more than the others and distortion would surely follow.

In the amplifier described, all these points have been incorporated by Mr. A. J. Haynes the designer; the radio fan should be able to make a first-class amplifier from these directions, with little trouble.

The amplifier was designed especially to go with the single-tube Haynes circuit receiver described in the September issue of POPULAR RADIO, which it matches in size and general design, as is shown in the photograph on this page. In this picture the cabinet at the left contains the tuning and detector unit and the cabinet at the right contains the amplifier unit.

The amplifier may be used, however, with any type of detector and with any tuning circuit that you have on hand. It will operate on the same "A" and "B" batteries that you use on your present tuning and vacuum-tube detector unit. For loudest results, however, an additional 45-volt "B" battery should be used on the amplifier.

The electrical circuit diagram is shown in Figure 1.

The 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 receiver may easily determine how to mount the instruments in the correct places and connect them properly in the electrical circuit. The same designating letters are used in the text and the list of parts below.

¶ *The list of parts here given includes the exact instruments used in the set from which these specifications were made up; however, there are many other reliable makes of instruments which may be used in the set with equally good results.*

If instruments other than the ones listed are used it will necessitate only the use of different spacing of the holes drilled in the panel for mounting them.

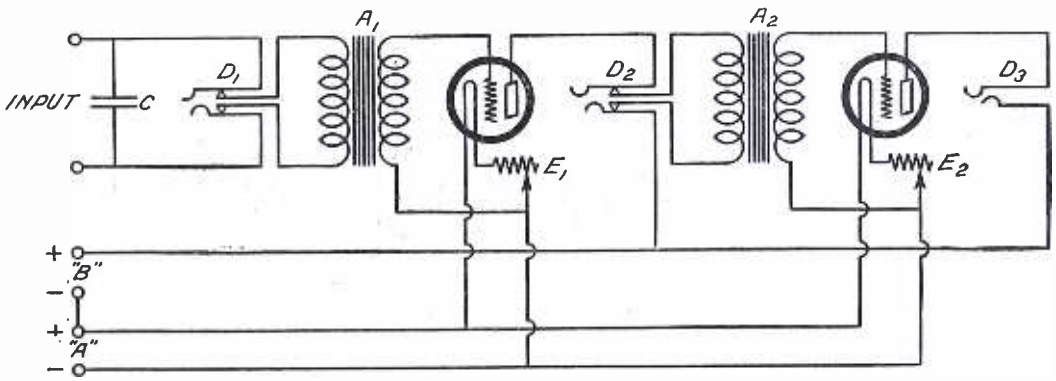
A—Ford-Mica amplifying transformers;
B—Fada panel mounting tube socket;
C—Dubilier mica fixed condenser, .002 mfd.;
D—Federal jacks, two double circuit and one single circuit;
E—Fada rheostats, 6 ohms;
F—Haynes-Griffin binding posts;
G—composition panel;
H—cabinet;
connecting wire;
varnished cambric tubing (spaghetti);
connecting tabs.

How to Construct the Amplifier

After procuring all the instruments for building the receiver, the amateur should set about preparing the panel G (shown in Figures 2, 3, 4, and 5).

First of all, the panel should be cut to the correct size (7 by 10 inches); then the edges should be squared up smoothly with a file. The center for boring the holes (which are necessary for mounting the instruments) should be laid out on the panel as shown in Figure 4.

The holes outlined here with a double circle should be countersunk so that the flat-head ma-



THE CIRCUIT-DIAGRAM

FIGURE 1: *This gives the exact electrical connections for the apparatus used in the amplifier. The parts are designated by letters which correspond to those used in the text and in the other diagrams and illustrations.*

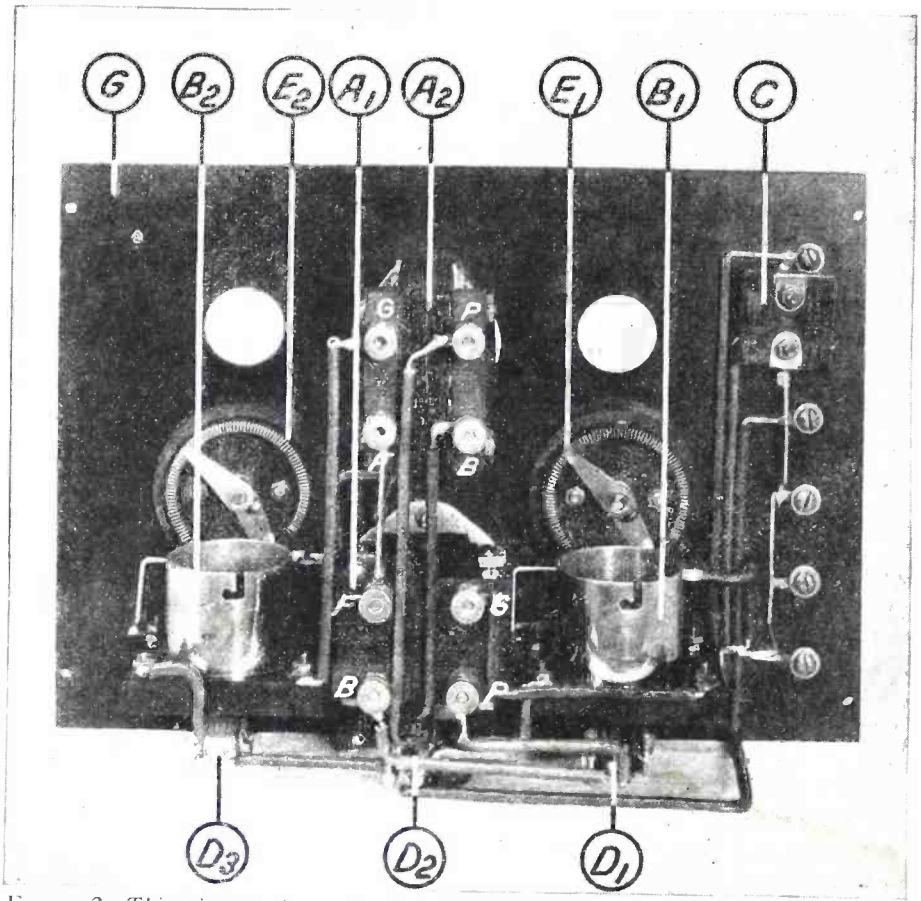


FIGURE 2: *This picture shows the interior arrangement of the apparatus, together with the general locations for the sockets, rheostats, transformers, jacks, condenser and the binding posts.*

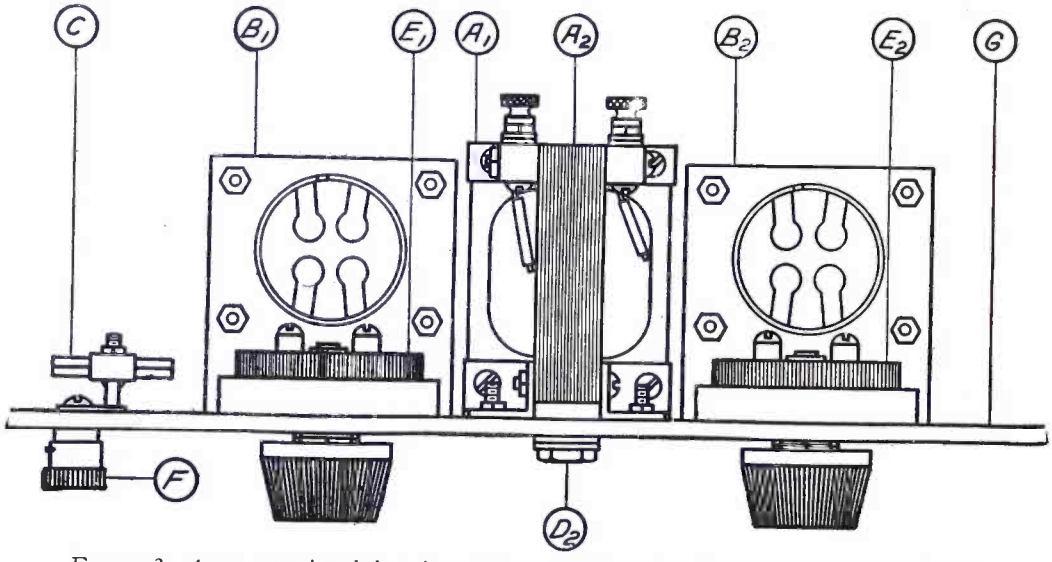
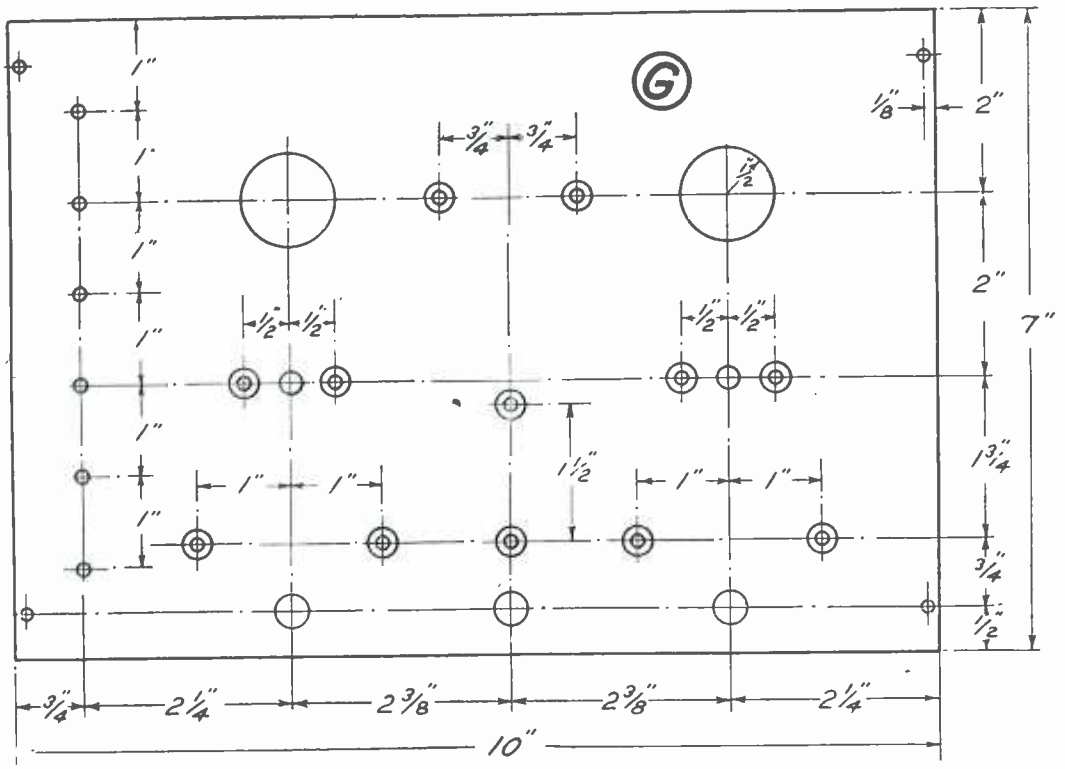


FIGURE 3: *A constructional drawing of the amplifier, showing the layout from above. Notice that the transformers are mounted at right angles to each other.*



HOW TO DRILL AND CUT THE PANEL

FIGURE 4: *This diagram gives the correct locations for the holes for the instruments and the binding posts. The holes outlined here with a double circle should be countersunk; the rest of the holes are straight drill holes.*

chine screws used for fastening the instruments will be flush with the panel. All the rest of the holes in this 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 have to go through the holes.

When the panel is drilled, it may be given a dull finish by rubbing lengthwise with smooth sandpaper until the surface is smooth, then the same process should be repeated except that light machine oil should be applied during the rubbing. The panel should then be rubbed dry with a piece of cheese-cloth, and a dull permanent finish will be the result. Or the panel may be left with its original shiny-black finish, if care is exercised so that it is not scratched during drilling.

Next the two transformers A, should be mounted as shown in Figures 2, 3 and 5, so that the letters beside the connection posts correspond to those of the photograph in Figure 2. The transformers are fastened to the panel G, by two screws to each transformer. The screws are inserted through the holes in the panel and through the brackets on the bottom of the transformers and fastened with hexagon nuts.

Three telephone jacks are used, which allow the phones or loudspeaker to be plugged in on either the detector, first or second stage of amplification as desired.

It will be noted that two of the jacks, D1 and D2, are double circuit; that is, with four spring leaves and connection points, while the third, D3, is a single circuit jack with only two connections on it. The latter is for use in the last stage of the amplifier, while the former are used for the detector and first step.

These should be fastened to the panel G, in their respective positions as shown in Figures 2 and 5. It will be noticed that they are mounted sidewise instead of in the regular up and down position. This is necessary so that they will not interfere with the cabinet.

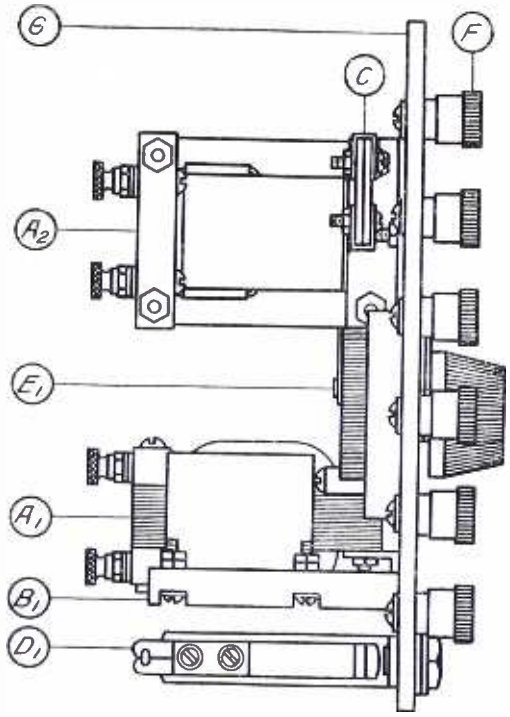
Now mount the two rheostats E, using two screws to each rheostat, as shown in Figures 3 and 5, and adjust the spring levers with the correct tension so that they run smoothly.

Then fasten the two tube sockets B, to the panel with flat-head screws as indicated in Figures 2, 3 and 5, and the construction work on the set will be complete.

The condenser C, is supported by the wiring and may be left until that job is in process.

How to Wire the Amplifier

The constructional design of this piece of apparatus is such that the circuit wiring may



THE WORKING DRAWING OF THE SIDE ELEVATION

FIGURE 5: *The jacks are mounted on the lower part of the panel with the two transformers taking up the center section. The binding posts are arranged in a vertical line at the left edge of the panel.*

be made as short as possible. This will be evident from an inspection of the photograph in Figure 2.

With the wiring diagram in Figure 1 before you, start wiring up the primary circuit of the first transformer, including the two top input binding posts, the condenser C, the terminals of the jack D1, and the two terminals of the transformer which are marked "B" and "P."

Then wire the filament circuit of the two tubes, including the rheostats, the two terminals of the sockets marked "F," the terminals of the transformers marked "F," and the two lower binding posts, the lowest of which is the negative "A" battery connection and the other is the positive "A."

The third binding post from the bottom is for the negative "B" and it should be connected to the same wire as the second binding post from the bottom, the positive "A."

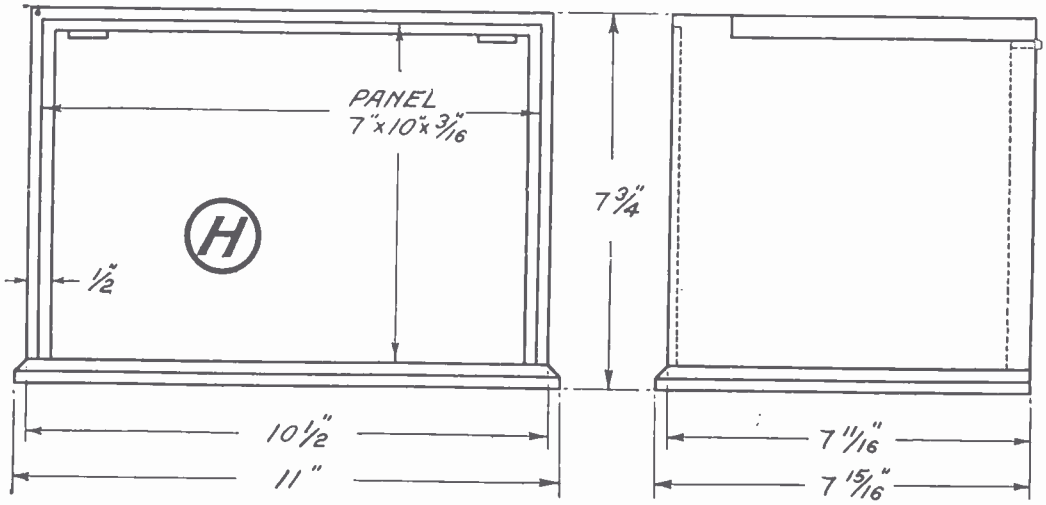
Now connect the post "G," on the first transformer to the grid terminal of the first tube.

Then, connect up the third binding post from the top, the positive "B" battery post, with the jacks D2 and D3, and wire the plate circuit of the first tube which includes the terminals on the jack D2 and the terminals on the second transformer "B" and "P."

Finish up by connecting the terminal "G" on the last transformer to the grid terminal of the last tube, and by connecting the plate terminal of the last tube to the jack D3, as shown.

Operating Data

The operation of this amplifier is extremely simple. It is connected to the receiver merely by bridging the binding posts straight across from the tuner and detector panel to the amplifier with the exception of the two "B" battery posts. When the same "A" and "B" batteries are used for both sets, as is almost invariably



THE DIMENSIONS OF THE CABINET

This may be made by the builder himself, or the plan may be turned over to a cabinet maker. The woodwork may be done in any kind of hardwood that conforms to the owner's taste.

done, the "B" negative post of the amplifier is left disconnected altogether. The 45-volt "B" battery should be added to the 22½-volt "B" battery already in use for the detector, the negative post of the 45-volt battery being connected to the positive 22½-volt post of the smaller battery and the positive 45-volt post on the large battery is connected directly to the "B" positive post on the amplifier panel. The original connections from the 22½-volt "B" battery to the detector being left exactly as previously connected.

This arrangement allows the small battery to be used with the detector while the full voltage of both batteries, 67½ volts, is applied to the amplifier tubes.

To put the amplifier into operation place the telephone plug into the first, second or third jack, depending on whether you wish to listen in on the detector alone, the first or the second stage of amplification, and turn up the rheostats to the proper value.

The tubes should be burned as low as possible without impairing the signal strength or quality. Turning on the rheostats beyond this maximum point will only shorten the life of the tube.

If the receiver is tuned to a signal, the amplifier should immediately begin to work and produce a strong signal that will operate a loudspeaker successfully on the second stage.

Ten Good Rules for Broadcast Listeners

1. Don't try to hear DX till cold weather. Be satisfied to enjoy the nearer stations most of the time.

2. Don't be disappointed if an occasional storm interferes with your autumn radio evening. There are many fine concerts coming. You can't expect to find a pearl in every oyster nor to receive a record-breaking concert every night.

3. If you want louder signals, use a longer antenna, more tubes, higher plate voltage, more sensitive loudspeakers, and more careful tickler and receiver adjustment.

4. A pleasant signal filling a moderate sized room should be enough to give satisfaction. It is not worth while producing signals which deafen the neighbors. It is wasteful to insist on tremendous signals which are generally less pleasant than moderate signals.

5. If your local station comes in too loudly and drowns others out, a smaller antenna will help in tuning him out, with a smaller condenser connected between antenna and ground. And if all measures to get rid of the local station fail, why not enjoy his concerts? He is working hard for you and it is nobody's fault that you are so close to him that you are bound to hear him. Broadcast stations have to be closer to some people than to others.

6. For the new longer waves above 450 meters, use a condenser connected between the antenna and ground terminals of your set.

7. A little patience in learning to handle your receiver yields rich returns in satisfaction from fine signals. Remember that "Rome wasn't built in a day" and keep on getting more and more familiar with your set and how it works.

8. It is a good idea to read POPULAR RADIO and the radio column of a newspaper or two. It helps you to know how your set works and keeps you up-to-date in radio. Information of this sort is an aid in getting the concerts loud and clear.

9. Ask your radio dealer for advice; he can probably tell you what you want to know and will be glad to do so. The manufacturer of your set is also willing to help you get the desired results from its use.

10. Do not throw away the direction sheets or booklet that came with your set and with the tubes. Read all such material carefully now and then. If you have lost the direction sheets, write to the dealer or manufacturer for another. The direction sheets must answer most of the questions which have been puzzling you and preventing you from getting the best out of your set.

WHY DOUGLAS FAIRBANKS SMILES

"The public doesn't care a whoop who plays the parts; it is interested only in the story," claimed one astute producer thirteen years ago—when the public's early interest in the movies was where the interest is in broadcasting today.

Who Will Be the Mary Pickfords of Radio?

Will the new art of radio create its own stars who will shine in the new world of the ether that is rapidly being opened?

By WILLIAM G. SHEPHERD

A PROMINENT editor, thirteen years ago, was coaxed to go into a movie theater to see the crude film of the day. No one thought it was crude then, of course. The photography was spotted and bad, the acting was poor, and no one in these days would sit five minutes before such a picture. But the editor, like the rest of us, did not know any better—and he became a movie fan.

One day this editor called me into his office.

"Who are all these actors and actresses whose pictures appear in the cinematograph films?" he asked me.

"I don't know," I said. "I've never seen their names printed."

"Well," said the editor, deliberately—

and remember, please, that this was only thirteen years ago—"I want you to go out and get me photographs and little life stories of about two dozen cinematograph actors. I think the public will be interested in the personalities of the actors who appear on the films."

So I started out. I went to the office of a man who then headed a firm that has since become one of the greatest in the moving picture world. I told him that my editor wanted to run a photograph and a little life-story sketch of every one of the men, women and children who then appeared in his films.

"These stories will interest our readers," I explained, "and they will advertise your players."

"Advertise blankety-blank blank," he yelled, that afternoon thirteen years ago. "We don't want our players advertised."

"Why not?" I insisted. "There'll be no cost or trouble for you. I'll send a staff photographer to the actors and actresses and I'll get their stories myself. It won't bother you in the least and it will be telling the public something about the people who are playing in your films."

Westinghouse

A BIG STAR ON THE CONCERT PLATFORM IS NOT ALWAYS SUCCESSFUL IN BROADCASTING

Some voices do not broadcast—they literally cannot be transmitted successfully by the microphone. Madame Lucila Melius, the grand opera singer, is fortunate in that she charms the invisible radio audience just as much as those who actually hear her in a concert or in an opera.

American Tel. & Tel.

THE ARTIST IN THE WORLD OF RADIO MUST DEPEND UPON HIS MUSIC ALONE

When Guy Hunter, the popular blind pianist, plays to his invisible audience, he cannot resort to mannerisms, stage tricks, settings or other conventional accessories for "putting over" his recital. Will not these very limitations tend to raise the art of the broadcaster to a high level?

"The public doesn't give a whoop who plays in my films. It doesn't care for anything but the story and the film. The actors are only actors to them and nothing more."

I didn't know whether he was right or wrong; the movie game was too new for an outsider or even an insider to judge.

That man got really mad before I got through with him. (Today, as I say, he is one of the biggest men in the business and, of course, has spent millions of dollars in advertising.) Finally I pinned him down to his actual objection to publicity for his players.

"Look here, young fellow," he said, "here's the truth about it. Every film maker in the business is looking for all the good actors and actresses he can find.

"Do you suppose after I've found an actor or an actress that everybody likes that I'm going to put a picture in the paper and advertise my find to all the other moving picture men? Why, we'd get to trying to outbid each other for the stars, and the first thing we knew the moving picture business would go up in smoke. No, sir, I'm going to keep all my stars a secret just as long as I can and I don't want their pictures or write-ups about them in the newspapers."

Gentle radio fan, can you beat that?

But my editor had sent me out on a job and I had to produce something. That evening I was telling my troubles to a man named Hullette, an old star newspaperman on Park Row, New York.

"Why, I think I can help you out on that stunt;" he said. "My daughter, Gladys, is in a moving picture that is being staged in an old barn over on Long Island. She's only twelve years old, but she's taking a prominent child's part. I'll ask her tonight if she can't get you the names and addresses of the people she's playing with. That'll be a bargain, if you will put Gladys' picture in the paper

with a little write-up like the rest."

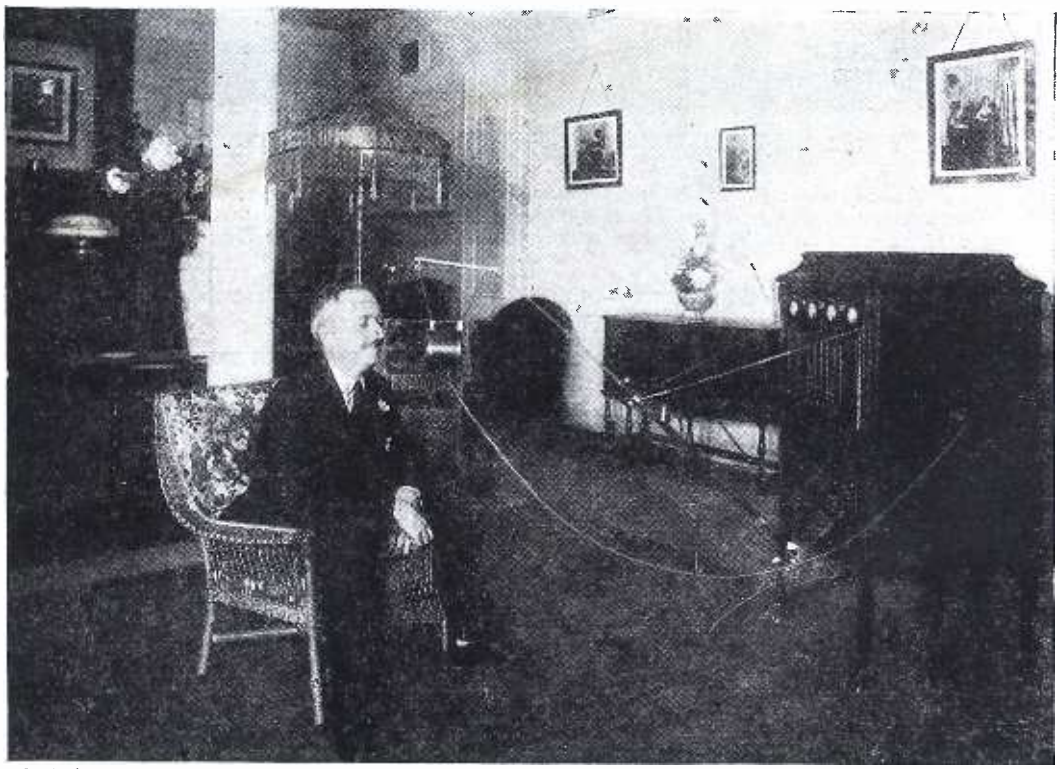
"It's done," I replied.

Gladys Hullette is a famous movie star these days, but perhaps she'll remember how, thirteen years ago, she sneaked around among those moving picture people over on Long Island and asked for their names and addresses and told them that a newspaperman wanted their pictures and a little write-up of each one. She turned over some twenty or thirty addresses to her father, who brought them to me.

It was a three weeks' job to meet these people and get their photographs and stories. Needless to say, most of them were hungry for publicity.

Those twenty-five sketches of moving picture actors and actresses were the first of the sort ever published in the United States. The manager threatened to sue the newspaper for making public the names of his players. Yet, as I have said, he has spent millions of dollars in advertising his stars since that day; has had many of his stars coaxed away from him, and has coaxed as many more away from his competitors.

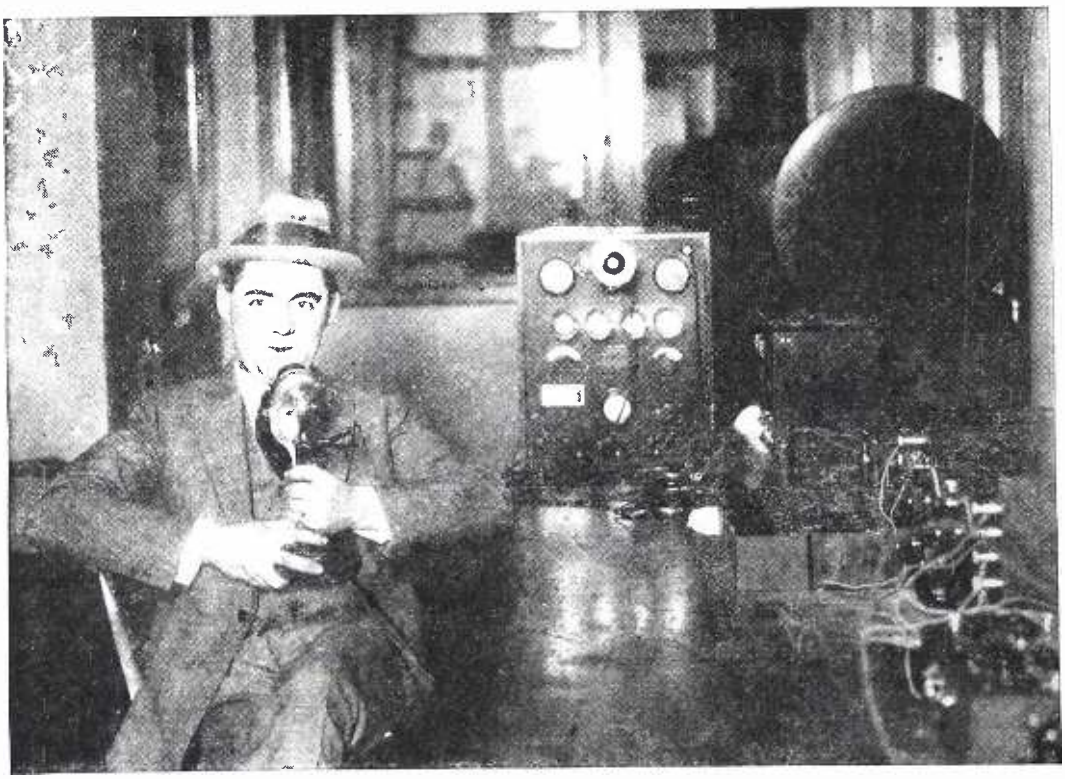
He was one of the longest-headed men in the moving picture business, but he couldn't tell what a score of months would bring forth. He did not see how business was heading or what form it would take. He was on an unblazed trail. Within two years after I had so ungraciously offended him by my unwelcome publicity "stunt," he was paying money for advertising and had a press agent who was trying to sneak items into the newspapers of the country.



Westinghouse

ONE OF THE MOST POPULAR OF THE "STARS" IN THE NEW RADIO FIRMAMENT

Hundreds of thousands of American youngsters will grow up and carry with them fond memories of the famous bedtime stories of David Corey, whose "Peter Rabbit" adventures were reckoned among the important features from the earliest days of broadcasting.



THE MOST DIFFICULT FORM OF ENTERTAINMENT TO "GET OVER" BY RADIO IS HUMOR

Particularly does the stage comedian depend upon facial expression and physical action for giving point to his remarks. But fun that depends upon the spoken word alone is an entirely different matter—as the comedian Frank Tinney is learning.

So today we are encountering much the same problem in another field. Wireless telephony now is even younger than was the moving picture business at the time that I offered free advertising to the moving picture stars. There isn't a man in the wireless telephony business who is any smarter or any more long-headed than my friend of the movies.

They don't know, even the wisest of them—though some of them may think they do—how widely broadcasting is going to develop and what direction it will take. As for seeing its maximum limits, they are stone blind; it is beyond human power for them to follow with their thought the great sweep and progress of radio.

At present there are men in the United States wondering whether or not the wireless telephone will do away with newspapers, the wired telegraph, or the telephone. Many men are wondering not only how much good it will do, but how much it will change things in this ever-changing world of ours—and what things it will change. Will it hurt the movies? Would people rather sit at home of a summer evening and listen to concerts than to ride in their automobiles? Will it hurt the passenger car industry? Will it leave the churches with empty pews? Will it increase the size of sermon audiences? Will it bring the end of the talking machine? These and many other questions cannot be answered yet with any more truth than were mine about advertising movie stars such a short time past.

The movie eventually fitted into every department of our lives. It found its way into the laboratories and into the

very heart of science. It found its way into war and it has furnished us a new art. The wireless telephone will likewise find its true place and will have its part in our daily lives; though how, even the wisest among us cannot tell.

The time will come, indeed, when the free broadcasting of concerts and entertainments will come to an end. I believe the man who denies this is as far at sea as was my movie friend. The day will come when only the most mediocre artists will sing, free of charge, into a transmitter. The day will also come when broadcasting audiences will demand far greater merit in performances than they often discover in these early, crude days. These are the spotted film days of broadcasting. Undoubtedly new forms of entertainment, appealing to the sense of hearing, will be developed. You know that only the most beautiful of the world's singers find their way to the operatic or concert stage; they must appeal as much to the eye as to the ear. How many thousands of exquisite singers never find their way into public favor?

But the broadcasting audience asks only a beautiful voice; however beautiful and gracious the singer may be at the broadcasting end of the line, this audience is taking the music to its heart through the ears alone. If the music be beautiful and appealing, that is all the radio public asks.

Is it not possible that we shall develop in the United States artists who will sing for broadcasting alone—singers with voices especially adapted to broadcasting—readers of poetry or fiction, with golden voices, for the sick or the leisurely or the lovers of literature?

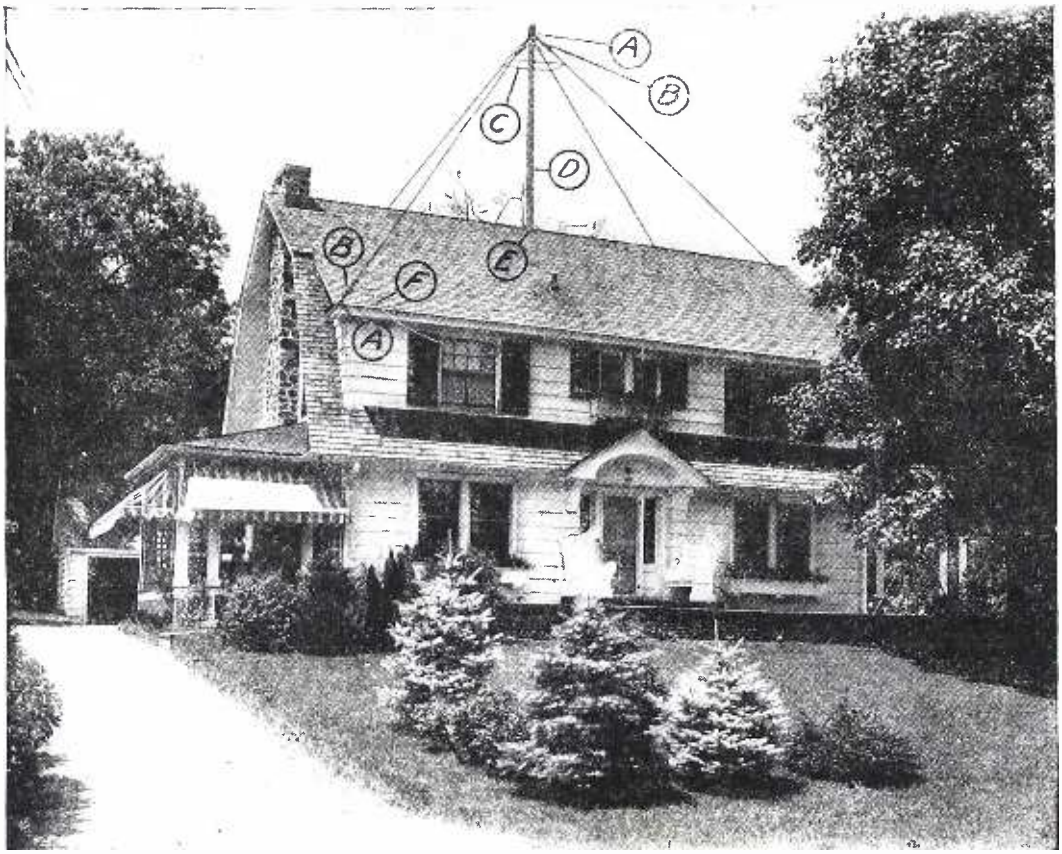
Now we have our free entertainments which show us the wonders of wireless telephony and persuade us to buy receiving sets. The American people are taking these machines almost faster than they can be made. The time is coming soon when the owners of receiving sets will be asking for something better in the form of entertainment than they are receiving now. Some will ask an evening of classical music; others may want to hear poetry or the latest book; some will call for a program of dance music, and some for addresses from well-known men on live topics of the day.

We Americans have all kinds of tastes. We shall show this, soon, in the world of wireless entertainment. And then the entertainment givers of today will have to step out of the way and permit the impresarios of radio entertainment, the men who control the great radio stars and pay them heavy salaries, to have their radio way. We shall probably have meters on our receivers which will show to whom we listened and when. Then will come the day of the Mary Pickfords and the Douglas Fairbankses of broadcasting; and we shall be watching the programs for the days when they will perform and at what stations they will sing, read, lecture or just talk. Also we shall probably be ready to pay more money to hear the good artists than the lesser ones. Now we have our stars of the movies, our stars of baseball, of lawn tennis and of football. Soon we shall have, too, our stars of the radio.

As a mere means of entertainment it is impossible to measure the limits of wireless telephony. It is even more impossible to surmise what place wireless telephony will take in our daily lives. We must learn to use it as we learned how to use the telephone, the telegraph, or, in olden days, the postage stamp.

How to Build a Combination Short and Long Wave Receiver

In the next number of POPULAR RADIO—for November—will appear a complete detailed description of a set that combines the advantages of a three-coil honeycomb tuner for long waves with the advantages of the variocoupler, two-variometer regenerative tuner for short waves.



From a diagram made for POPULAR RADIO

THIS ANTENNA DOES NOT ENCROACH ON YOUR NEIGHBOR'S PROPERTY

The parts designated are: A, the insulators (8 are required); B, the screw-eyes of the insulators through which the wires are fastened; C, the bonding wires; D, the mast which is cut in a V-shape at E, to fit the ridgepole, and F, the lead-in wire which may be attached to any of the sloping wires which run near the window which is nearest the instruments.

A Compact Antenna

THE UMBRELLA TYPE

The Fifth of a Series of Short Articles on the Various Types of Aerials and Their Uses

By HOWARD S. PYLE,* I.R.E.

MANY articles have appeared lately in the various periodicals, relative to antennas suitable for broadcast reception. The chief difficulty with most of those that have been considered, however, lies in the fact that to be really effective they require a length (in a single span) so great that in ninety percent of the cases it is necessary to carry the wires outside of the property of the owner.

There is a considerable reticence among owners of receiving equipment to ask their neighbor for permission to use his chimney or tree as a sup-

*Assistant U. S. Radio Inspector, 8th Radio District.

port for one end of their antenna. The larger majority of people much prefer to confine the antenna to their own property lines.

For this purpose, the writer has conducted experiments with one of the earlier types of antenna, the famous "umbrella type," which adapts itself readily to a small space. Since 1901 it has been a standard with the U. S. Army Signal Corps, not only in the field but in some of the permanently established stations.

This antenna derives its name from the resemblance it bears to an opened umbrella—without, of course, the customary cloth covering.

A mast or pole is erected in the middle of the space over which it is desired to erect the antenna proper, and from the top of the mast wires are run in the same manner as guy wires to each of the four corners of the building on which the pole is set. In fact, these wires act as guy wires, serving to hold the mast rigidly in place. They serve a dual purpose, however, inasmuch as they are insulated both from the mast and from the ground, and are all electrically connected together to form the antenna proper.

Umbrella antennas have proved to be very effective; they have one particular advantage in that they are *non-directional:* that is, they receive signals equally well from all directions.

For installation in the average case, it is recommended that a pole ten feet high and two inches in diameter be erected in the exact center of the roof of the building, and painted or stained, for appearance sake. Four suitable antenna insulators are secured to the top of the pole by short pieces of antenna wire through small holes bored in the mast, or by heavy screw eyes; one in each side near the top of the mast. A V-shaped notch is cut in the bottom of the pole, to fit the ridge pole, to which it may be secured with a few nails. One strand of antenna wire is then secured to the free end of each of the insulators attached to the pole, and carried to each of the four corners of the roof, where they are secured after being connected to another insulator just above the point of attachment.

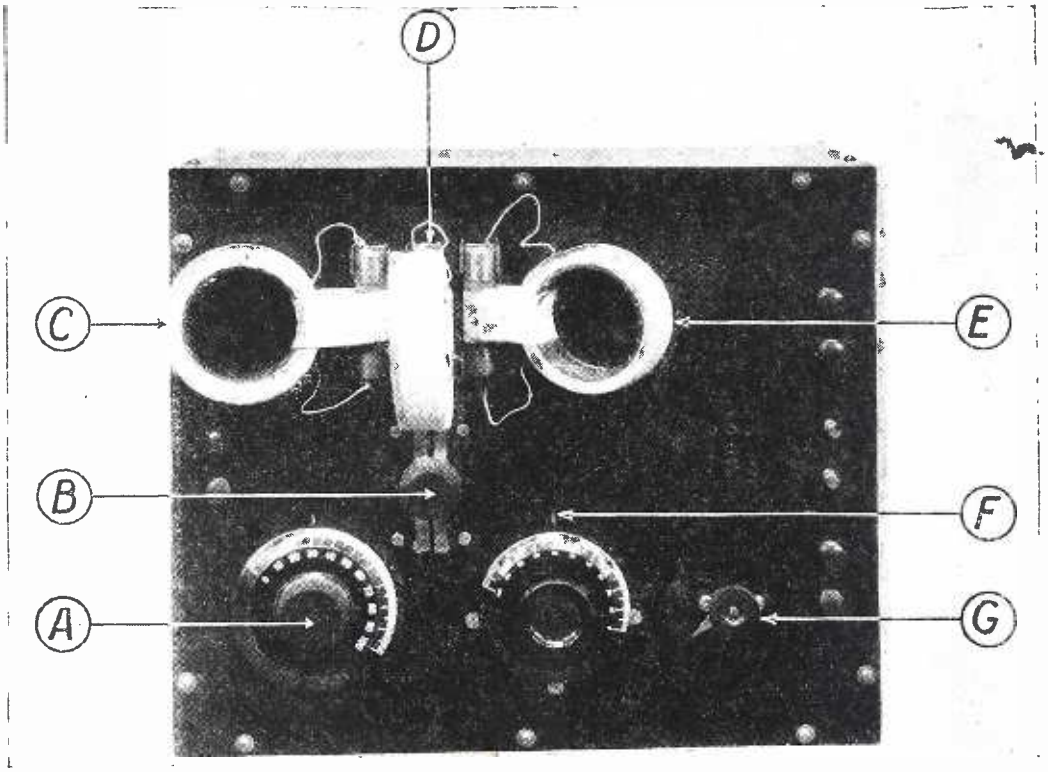
Before raising the mast, the four strands should be electrically connected together at the top just below the insulators, by binding a piece of antenna wire around each wire, forming a loop around all four. The joints should be carefully soldered. Where the roof is not broken by obstructions, such as dormer windows, skylights or chimneys, it is well to connect the wires together at the base also, just above the lower insulators by passing a bonding wire completely around the edge of the roof, soldered to each strand of the antenna proper.

The lead-in may be taken from any of the four wires, convenient to the point of installation of the set, or at any point along the lower bonding wire, where used.

Such an antenna permits of excellent reception, keeps the entire arrangement on the radio enthusiast's own property, and presents a neat, inconspicuous appearance. The writer, in Cincinnati, experienced no difficulty in picking up the broadcasting from Kansas City in broad daylight, using a single stage of audio frequency amplification with a standard regenerative receiver, which speaks well for results.

How to Use the Four-circuit Tuner as a Portable Set With a Loop Aerial

A clever modification of the famous Cockaday receiver that gives satisfaction with local reception will be described in the coming—November—number.



THE PANEL VIEW OF THE COMPLETED RECEIVER

FIGURE 1: *A, is the primary condenser, B, is the series-parallel switch, C, is the primary coil and D, and E, are the secondary and tickler coils respectively. F, is the secondary condenser and G, is the rheostat.*

HOW TO MAKE

A Simple Honeycomb Receiver

A complete description of a simple method for making your own honeycomb coils at home and also how to build a receiving set that accommodates them and enables reception on all wavelengths between 200 and 3,000 meters. The complete equipment should not cost more than $15.

By S. GORDON TAYLOR

WHEN the use of home-made honeycomb coils is suggested to the amateur he usually passes the matter up with a shrug. His reasons are these:

First, he does not believe that honeycomb coils can be made at home by the average amateur.

Second, he considers that the cost of a set of coils sufficient to cover a broad band of wavelengths is out of reach of his pocketbook.

In direct contradiction to these beliefs, however, is the fact that I have made a set of honeycomb coils at home and at a surprisingly low cost. Furthermore, they were made without special equipment and the work was done in a short period of time.

There has been prevalent an idea that honeycombs are of little use on the broadcasting wavelengths around 360 to 400 meters. This belief, however, is not

based on fact. Perhaps the honeycombs *are* less efficient on short waves than some other types of sets, but in actual practice I have not been able to notice the difference. Station WJZ, thirty miles away comes crashing in so loud on the detector tube alone, that I can hear him ten feet away with the phones lying on the table; with one stage of amplification and using the phones I can hear him three rooms away. Then again, distant stations come in with surprising clearness on one tube. This is equal to or better than anything I have been able to do with other types of regenerative sets.

But a great advantage of the honeycomb set over others is that it is capable of covering any wavelength desired. For one who reads code, or wants to learn, this is a decided advantage.

The honeycomb set I made at home is simple in construction. In Figure 1 the complete set is shown mounted in a cabinet. Coils suitable for reception on 3,000 meters are in position. The first dial on the left is the primary variable condenser. The series-parallel switch, just above it to the right, is used to throw the condenser in series or parallel with the primary coil, or to cut it out entirely. To the right of the primary condenser is another variable condenser, shunted across the secondary coil. Next comes the rheostat knob, and on the right hand edge the connections for receivers and "A" and "B" batteries. Incidently, I am using a WD-11 tube requiring only 1½ volts on the filament. With the storage battery thus eliminated the "A" and "B" batteries may be mounted in the cabinet, making the outfit entirely self-contained and portable.

There should be no difficulty in winding the coils; a 25-turn coil can be wound and mounted on a plug in about fifteen minutes, while a 250-turn coil can be completed in an hour. From this it is obvious that the job is not a complicated one.

The eight coils selected are enough for ordinary use and cover all wavelengths from about 200 up to slightly over 3,000. They consist of the following numbers of turns; 25, 35, 50, 75, 100, 150, 200 and 250. Larger coils may be made but I have adopted this set as a standard on which to base the list of materials needed and the cost.

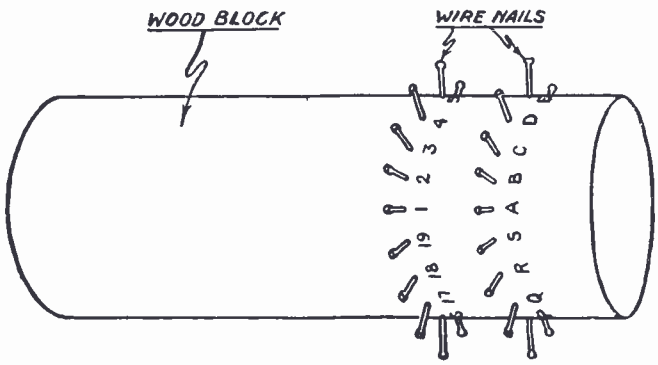
The following table shows the materials needed for winding eight coils, together with the costs:

Winding form

One cylindrical wooden block, about 2 inches in diameter; length optional, but preferably about 8 inches;
38 wire nails 1¼ inches long.....$ .05

Coils

One cardboard tube, 7 inches long, and



THE COIL-WINDING BLOCK

FIGURE 2: *The wire is wound lattice fashion between two rows of nails driven into the periphery of the circular block. All the coils specified are wound on the same block and differ in dimensions only in the number of layers of wire used.*

just large enough to slip snugly over the wood cylinder	.10
¾ pound No. 26 DCC copper wire	1.20
5-yard roll of 1-inch adhesive tape	.25
small bottle of white shellac	.25
Plugs and plug mounting	
One rectangular wooden block, 8x1x⅞ inches;	
8 cartridge fuses, 2½ long by ⅝ inches in diameter	1.20
Panel mounting	
6 fuse clips to fit above fuses	.18
Total cost	$3.23

How to Make the Winding Form

The first step is to make the winding form. Once this has been done the form can be used indefinitely for winding as many coils as desired. The wooden cylinder and the nails are used for this purpose. The location of the nails on the surface of the cylinder is best determined by the use of a piece of paper, cut so that its length equals the circumference of the cylinder.

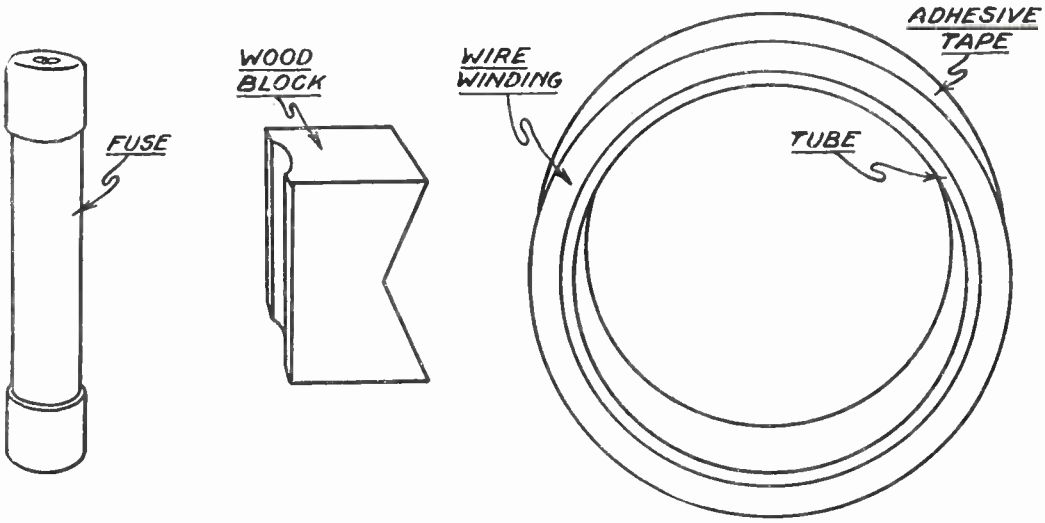
On this paper draw lengthwise two parallel lines, ⅞ of an inch apart. Beginning at one end of the paper, divide each line into nineteen equal parts indicated by dots or short lines. When this has been done place the paper around the block so that the two ends of each line will just meet. With a pin, prick a hole through each of the dots on the paper and into the wood so that when the paper is removed these pin pricks will appear on the cylinder in two parallel rows around the circumference. It is best to have these near one end of the cylinder for later convenience in handling when winding the coils. Drive a wire nail a short distance into each pin prick, say about one-quarter inch. The nails should hold securely but be easy to remove with a pair of pliers. It is important that the nails are driven directly toward the centre of the block, and that each is at right angles to the axis of the block. Figure 2 shows the winding form complete and ready for use.

For convenience in winding the coils it is well to number the points at which the nails are driven. Start with any nail and mark it No. 1, the next one in the same row No. 2, and so on. These numbers will run up to No. 19. Mark the other row in the same way, but use letters instead of numbers, starting with the nail opposite No. 1 and marking it "A," marking the one opposite No. 2 as "B," and so on.

How to Prepare and Wind the Coils

The cardboard tubing should be cut into ⅞-inch lengths. Eight of these pieces should be cut, one for each coil that is to be wound. Two coats of shellac should be applied to each, to make them proof against dampness, and also for greater stiffness. When they are thoroughly dry place one on the wooden cylinder between the rows of nails by removing one row, slipping the tube on the cylinder and replacing the nails.

Everything is now in readiness for the actual winding. Let us assume that the 25-turn coil is the first to be wound. Starting with the free end of the wire outside of the rows of nails take a couple of turns around 1, so as to hold the wire secure. From 1, the wire passes diagonally across the tube to "K," out around this nail and continuing in the same direction, but crossing diagonally back to the other side of the tube to 2. When this has been done it will be noticed

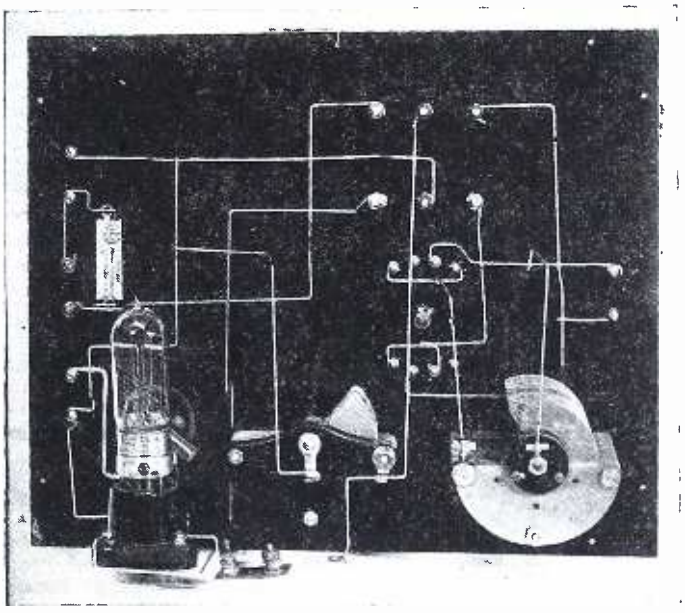


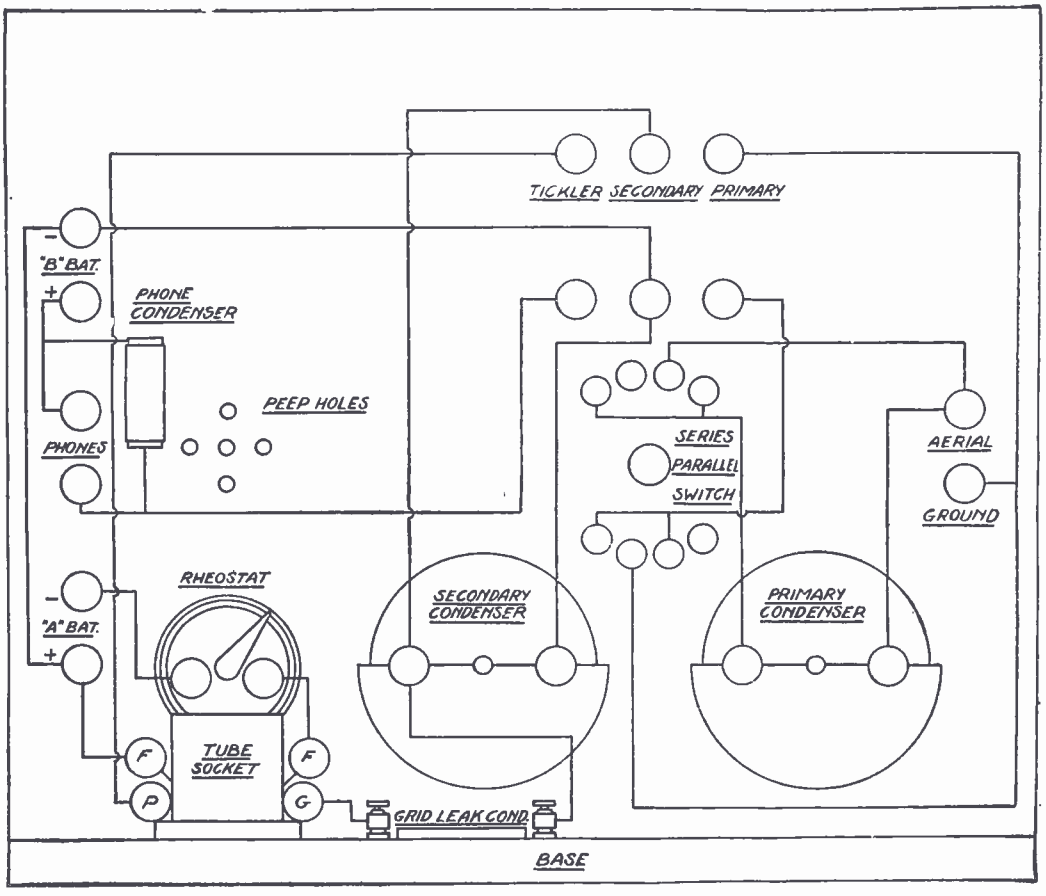
THE FUSE, THE BLOCK AND THE COIL

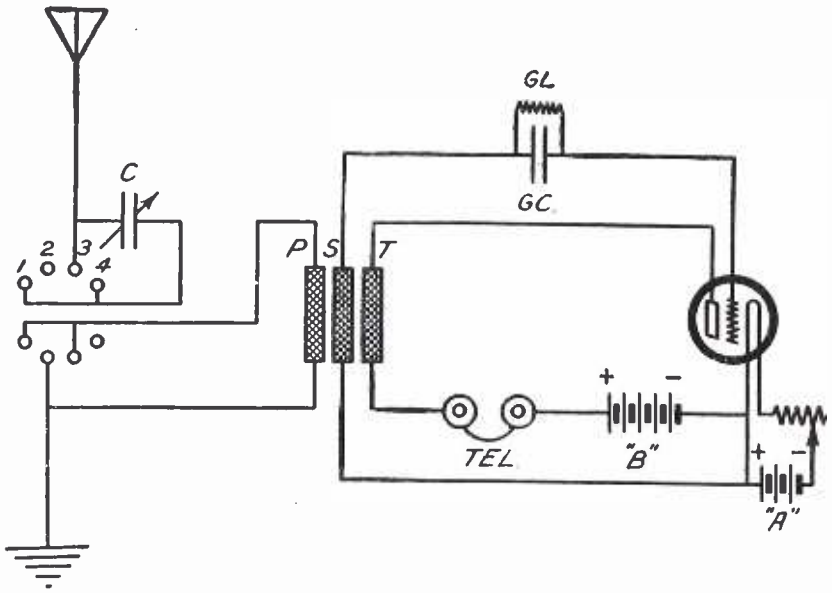
FIRURE 3: *Just before these units are assembled the three parts are brought together and fastened with adhesive tape. The two ends of the coil are then soldered to the two metal ends of the fuse.*

HOW THE SET SHOULD BE WIRED

FIGURE 4: *The photograph at the right shows the interior arrangement of the instruments and the wiring, which should help in connecting up the set. The diagram at the bottom of the page, however, gives a clearer idea of the connections; between the two, even the greenest novice should have no difficulty in wiring up correctly.*







THE ELECTRICAL DIAGRAM OF THE CONNECTIONS

Here is the regular wiring circuit that shows how the various instruments are to be connected in their proper places in the circuit. This is the regular hook-up for a triple coil set.

that one complete turn has been wound, but that it zigzags from one side to the other and back, and instead of ending up where it started at 1, it goes past this point to 2.

This is the whole idea of the honeycomb winding; each turn starts a little beyond the preceding one and thus successive turns, while parallel, are spaced a fraction of an inch apart, reducing the distributed capacity effect. From 2, the wire passes to L, from there to 3, from 3, to M, and so on. When the winding comes back to 1, again it will be found that nineteen turns have been placed on the tube, and that they lie in a perfect lattice-work formation. For twenty-five turns the process is continued until 7, is reached; here a couple of turns are taken around this nail and, after leaving a few inches of free wire for making connections with the plug later on, the wire is cut. Except at the beginning and end it is not necessary to make a complete loop around each nail. It is better to simply run the wire around the outside of each nail, because this method of winding holds the turns secure.

When the winding has been completed cut a piece of the adhesive tape in half, lengthwise, so that one layer may be wound around the circumference of the coil to hold the wire in place while the nails are removed. Then with a pair of pliers pull each nail straight out in such a way that the wire will not be injured or pulled out of place. The tube is then slipped off the block and a layer of the one-inch adhesive tape placed over the previous layer of narrow tape. With this done the coil is completed. The other coils are wound in the same way.

It is well to remember, in winding larger coils, that each completed layer of winding consists of nineteen turns; therefore it is easy to keep track of the number of turns wound by multiplying the number of layers on nail 2, by nineteen. This will give the number of turns in the completed layers; the total may be found by adding the number of turns that have been wound on the top, but uncompleted, layer.

How to Prepare and Attach the Plugs

The plug consists of one of the fuses and a piece of the rectangular wooden block. Remove the fuse wire from the inside of the fuse by taking off one of the brass ends; cut out a piece of the fuse wire and replace the end. If burned out fuses of the proper size can be obtained so much the better, as it will then be unnecessary to remove the fuse wire.

Now prepare the wood block. Cut it up into one-inch lengths, one piece for each of the eight coils. Each of these blocks must have cut in it two grooves as shown in Figure 3. One is a rounded groove just large enough to allow the fuse to lie in it, and about ¼ inch deep; the other is also ¼ inch deep, but it is "V"-shaped and extends the entire width of the block. Shellac the block and when dried proceed to assemble the plug and mount on the coil. First put a drop of glue in the rounded groove and lay in the fuse in such a position that it will project an equal distance on each side. After the

glue has "set" the plug is finished and ready to be mounted on the coil. Figure 3 shows the relative positions of the coil, block and fuse about to be assembled. They are fastened by winding adhesive tape through the coil and around the outside of the block and fuse. To complete the job one end of the coil winding is soldered to each brass end of the fuse. The end of the winding which runs back over the tube toward the fuse should be soldered to the top end of the fuse while the lower lead from the coil goes to the lower end of the fuse. It is important that the connections are made in this way; otherwise it will be found that when the coils are put into operation the windings of some are opposed to those of others.

How to Mount the Panel

The six fuse-clips are used for mounting. The positions on the panel are shown in Figure 1. An ordinary binding post is passed through the hole in the base of the clip and through the back of the panel, where it is secured with a nut. Contact is made to the other instruments by means of these binding posts on the back of the panel.

Figure 1 shows the front layout of the panel, Figure 4 shows the rear view with all connections. Plenty of space should be left clear at either side of the coil mountings; in tuning with honeycomb coils it is sometimes found necessary to have the primary and tickler coils swung around almost flat against the panel and there should be no obstructions to interfere.

In tuning with this outfit, coils suitable for the desired wavelengths are plugged in. It is difficult to give a table of the exact sizes to use for various wavelengths because the length of the antenna governs the sizes used for the primary coil, and the size of the tickler depends to a certain extent on the vacuum tube used. The chart printed below shows a table of the coils I use for the various types of stations that are within reach of the eight-coil set described. These are for use with an antenna of about 150 feet in length. The tickler sizes given are best for my set, but with different tubes larger or smaller sizes may be found best. This must be determined by experiment.

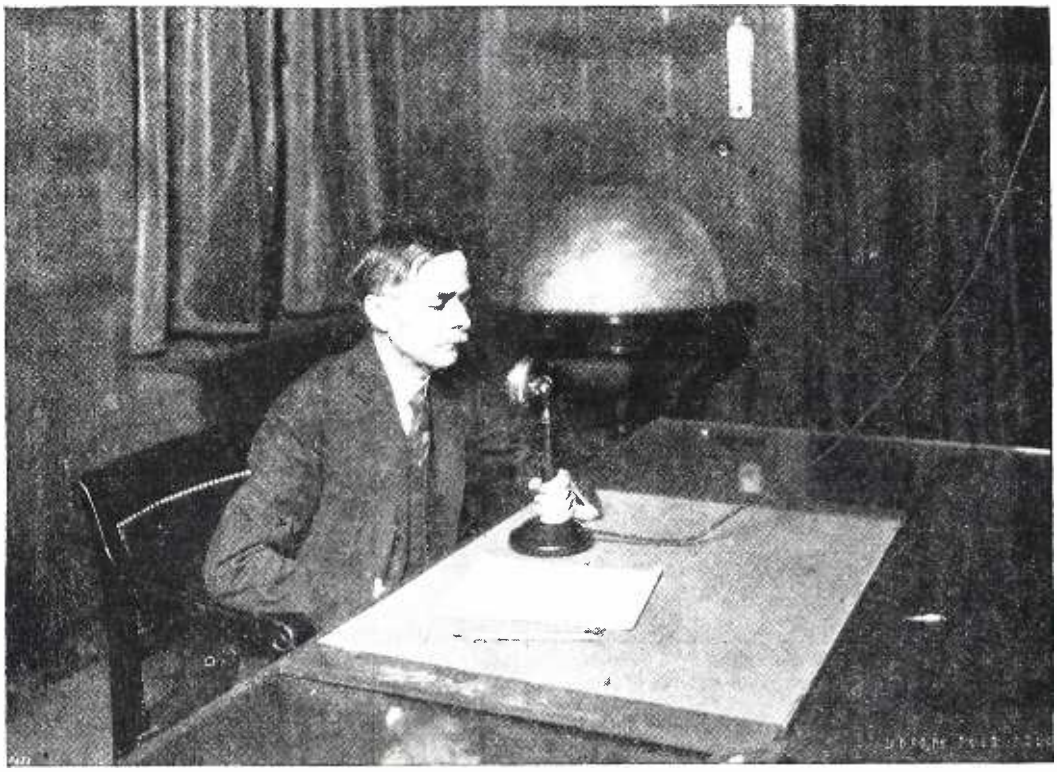
How to Tune

Until the adjustment of the set for the various wavelengths becomes familiar it is advisable to swing the primary and tickler fairly close to the secondary, say about one inch away. The primary condenser can be cut out entirely at first by throwing the series-parallel switch to the center position. Rotate the secondary condenser dial until the desired station is heard, until maximum volume of sound is obtained. Next move the tickler toward the secondary. If this process does not bring in the desired station it can be repeated with the primary condenser in series, or in parallel, depending upon whether the wavelength for which the set is being tuned is lower or higher than the normal wavelength of the primary coil used. I use the primary condenser only when tuning for amateurs on low wavelengths, when I throw the condenser in series with the antenna, or for very critical tuning, when I am trying to cut out nearby stations and to tune in distant ones.

Hard and fast rules for tuning cannot well be given; practice is necessary to give you such a knowledge of the set that will make tuning easy and enable you to cut out practically all interference.

THE WAVELENGTH CHART FOR THE HOME-MADE COILS

Class of Station	Approximate Wavelength	Primary Condenser	Primary	Secondary	Tickler
Amateur	200	Series	25	50	35
Broadcast	360	Cut out	25	50	35
Ship	600	Cut out	50	75	35
Navy Yard	1,800	Parallel	150	200	100
Arlington	2,700	Cut out	200	250	100



TRANSMITTING IN NEW YORK—
Mr. John J. Carty—known to army men as Brigadier General Carty of the Signal Corps—chief engineer of the telephone company, talking into the microphone during the transatlantic tests.

"Hello, Europe!"

How Single Side-band Radio Telephone Transmission is Bein Developed for Talking Across the Ocean

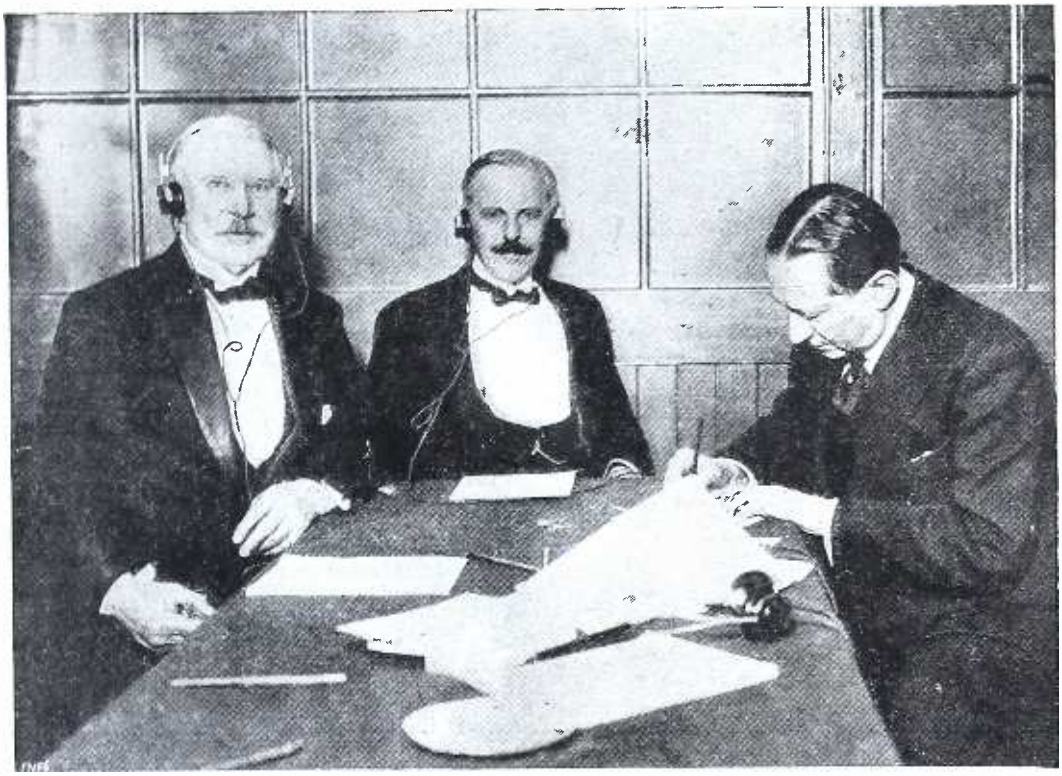
This article tells how the experimental suppressed-carrier system works to increase the efficiency of transmission, how it cuts out useless wastage of electrical energy, how it takes up less wave-space in the ether, and how it puts all of the power where it can be used—in the modulated portion of the wave.

By HARRY A. MOUNT

THE first transmission of the human voice across the Atlantic was accomplished by means of radio in 1915. Using the navy's antenna at Arlington, Virginia, with a special transmitter, the telephone engineers stationed at the Eiffel Tower, Paris, were able to hear disconnected words and parts of sentences.

Last January the experiment was repeated, this time using the antenna of the Radio Corporation of America at Rocky Point, L. I. This time a group of prominent men and scientists in London listened for two hours to speeches made into an ordinary desk telephone by officials of the American Telephone and Telegraph Company in New York.

The guests in London heard what was said with as much clarity as over an



—AND RECEIVING IN LONDON

Those who participated in the tests overseas are (left to right) Sir Evelyn Murray, Secretary of the British Post Office, Sir A. Sherley Benn, M. P., and Guglielmo Marconi.

ordinary telephone line. During a part of the time a loudspeaker was used, and reporters easily made transcriptions of what was said. This was made possible by a new system of radio telephony, here employed for the first time. It is known as the suppressed-carrier, single side-band transmission scheme and represents in many respects a great advance in radio telephony over the ordinary methods of transmission and reception.

Tests which have been carried on almost continuously between New York and London since January have served to confirm the results first obtained. As compared with the ordinary system, the new method has the following advantages:

1. The increase in the effectiveness of transmission is because all of the energy radiated is used to carry the message, whereas by the ordinary method probably only about one-third of the radiated energy is effective:

2. The stability of transmission is improved:

3. The frequency band required for transmission is reduced, thus conserving wavelength space in the ether.

4. The system makes use of new water-cooled vacuum tubes, by means of which the power of the transmitted currents is amplified to the order of 100 kilowatts or more:

5. A highly selective and stable type of receiving circuit is employed, by means of which static and other interference is reduced to a minimum.

It is well known that when a carrier wave is modulated by a voice current, the power given out is distributed over a small frequency range, and may be considered in three parts: (1) energy

THE BASIS OF THE TRANSATLANTIC SYSTEM

One of the large high-powered water-cooled tubes that are used in the new system. It is capable of delivering ten kilowatts of electrical energy.

at the carrier frequency; (2) energy distributed in a frequency band extending from the carrier upward, and having a width equal to the frequencies appearing in the telephone wave, and (3) energy in a band extending from the carrier downward and having a similar width.

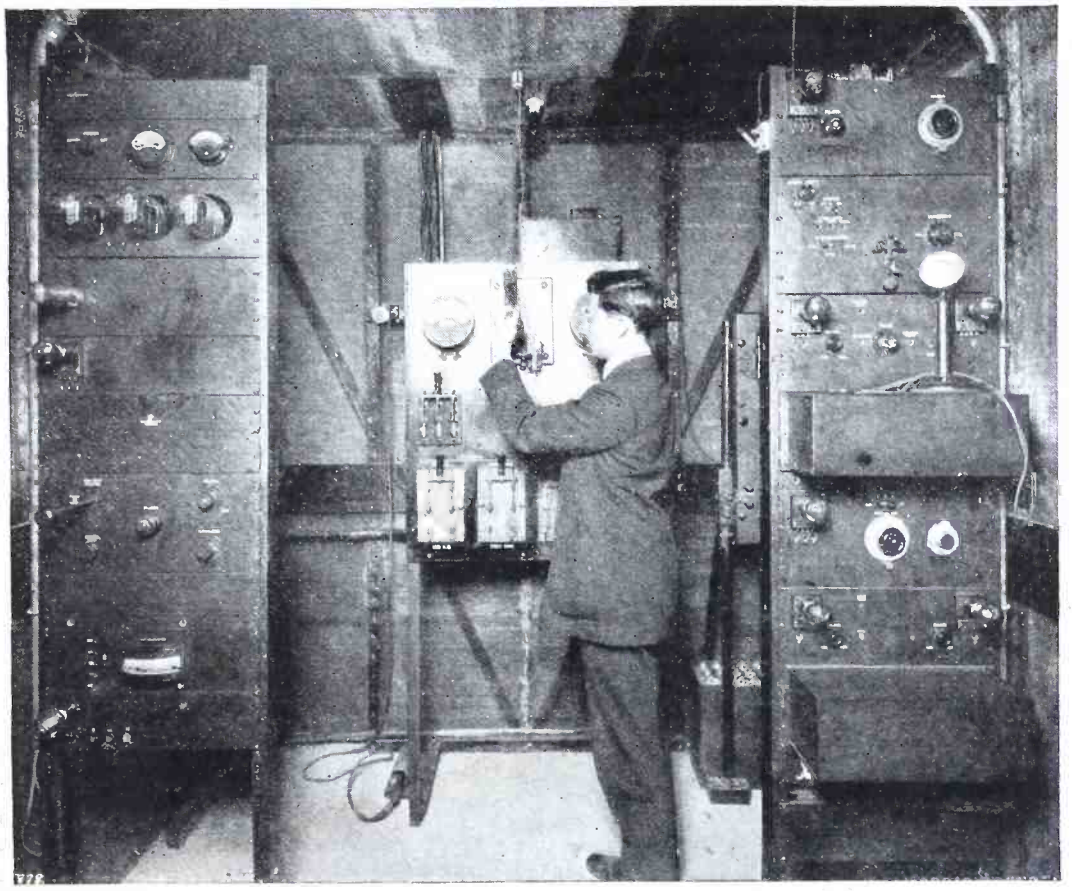
Ordinarily about two-thirds of the total power is in the unmodulated part of the carrier wave, which, in itself, carries no message, and the remaining one-third of the power is distributed equally between the two side bands. In this system a method is employed for suppressing the unused part of the carrier wave so that it is not sent from the antenna, and so that all of the active power is concentrated in that portion of the wave which carries the message. Furthermore, it is only necessary to transmit one side band, the other is suppressed with the unmodulated carrier.

The sending of a single side band makes necessary the use of a very special type of receiver—but before we consider this, let us see just how the suppression of the carrier and one side band is accomplished.

Figure 1 is a diagram of the transmitting circuit. The circuits drawn in light lines represent those stages of the process carried out at low power, while the high-power rectifier and amplifiers are indicated in heavy black lines.

Beginning with the voice input on the lower left corner of the diagram, we at once notice two devices, unusual in radio practice. These are the balanced modulator and the band filter. The balanced modulator is the device which eliminates the carrier. It consists of two vacuum tubes connected back to back in a balanced system, as shown, whereby the carrier frequencies in the output of the two tubes balance and cancel each other, while the modulated portion of the wave is not affected and is passed through the split transformer to the band filter.

This electrical wave filter is one of



Western Electric

The low-powered control board which consists of the electric-wave filter circuits, the balanced modulators, and the smaller power amplifiers.

the most important developments of the telephone laboratories. It is a combination of inductances and capacities which allows a predetermined band of waves to pass, but turns back all other frequencies. The filter functions best at the audio and lower radio frequencies, and in this range it is much better adapted to the sorting and separating of various frequencies than the tuned circuit.

In this case the frequencies selected for transmission (55,800 to 58,500) are above the range for close selection by the filter, and so modulation and selection are carried out in two stages. The purpose of the first is to widely separate the side bands, so that selection will be easier.

In the first balanced modulator a carrier frequency of 33,000 cycles is employed. In the output circuit of this modulator there are present only the two side bands, one ranging from 33,300 to 36,000 cycles, and the other extending from 32,700 down to 30,000 cycles, the speech frequencies being taken as a band extending from 300 to 3,000 cycles. In this case the filter is designed to pass *only* the lower side band and to suppress the upper side band. This lower side band is then used in the second modulator to modulate a carrier wave with a frequency of 58,500 cycles a second. As in the previous stage, the carrier is suppressed in the balanced modulator, and in the output of this modulator appear two side bands

widely separated in frequency. The upper side band represents the sum of the two input frequencies, and extends from 118,500 to 121,200 cycles, while the lower side band represents the difference of the two frequencies and extends from 58,500 down to 55,800 cycles. Again the lower side band is selected by the filter and the upper band is suppressed.

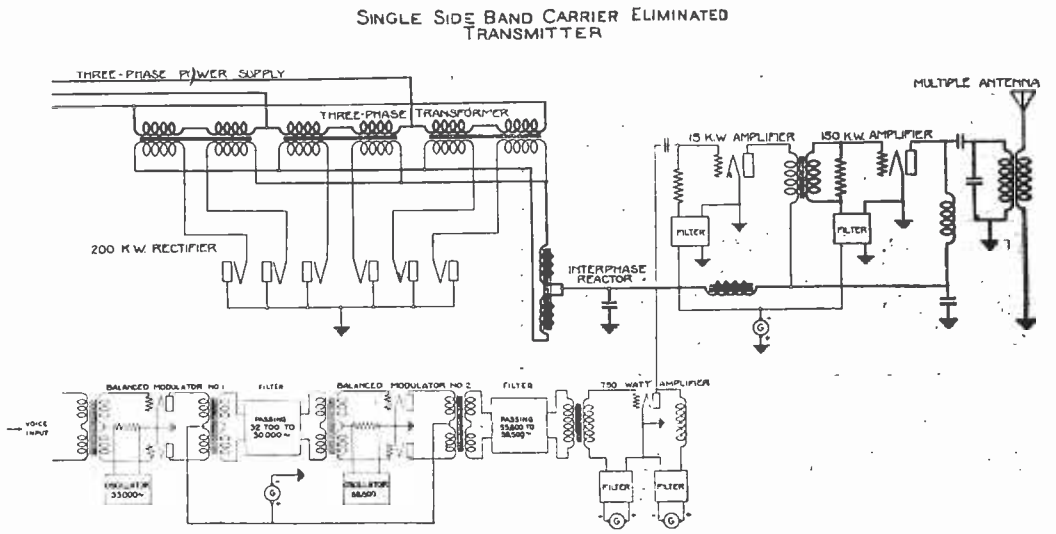
Having thus prepared *at low power* a high-frequency current embodying the original voice current, but representing only a single side band and without any unmodulated carrier current, it is then put through a series of amplifier tubes before reaching the transmitting antenna. The amplification is carried out in three steps.

The first stage employs three glass vacuum tubes rated at 250 watts each and operated at 1,500 volts plate potential. These increase the power to about 750 watts. The output of the 750-watt amplifier is applied to the input of the high-power amplifying system, beginning with the 15-K.W. amplifier of Figure 1. This consists of two water-cooled tubes, rated at 10 K.W. each, operating in parallel, at approximately 10,000 volts.

The high-voltage D.C. supply is furnished by a large vacuum-tube rectifier unit, consisting of twelve water-cooled two-element tubes, rated at 200 K.W. It utilizes a 60-cycle, 3-phase current and rectifies both halves of each wave, the two halves being combined by means of an inter-phase reactor, which with the retardation coil and condensers shown, smooth the ripples out of the current.

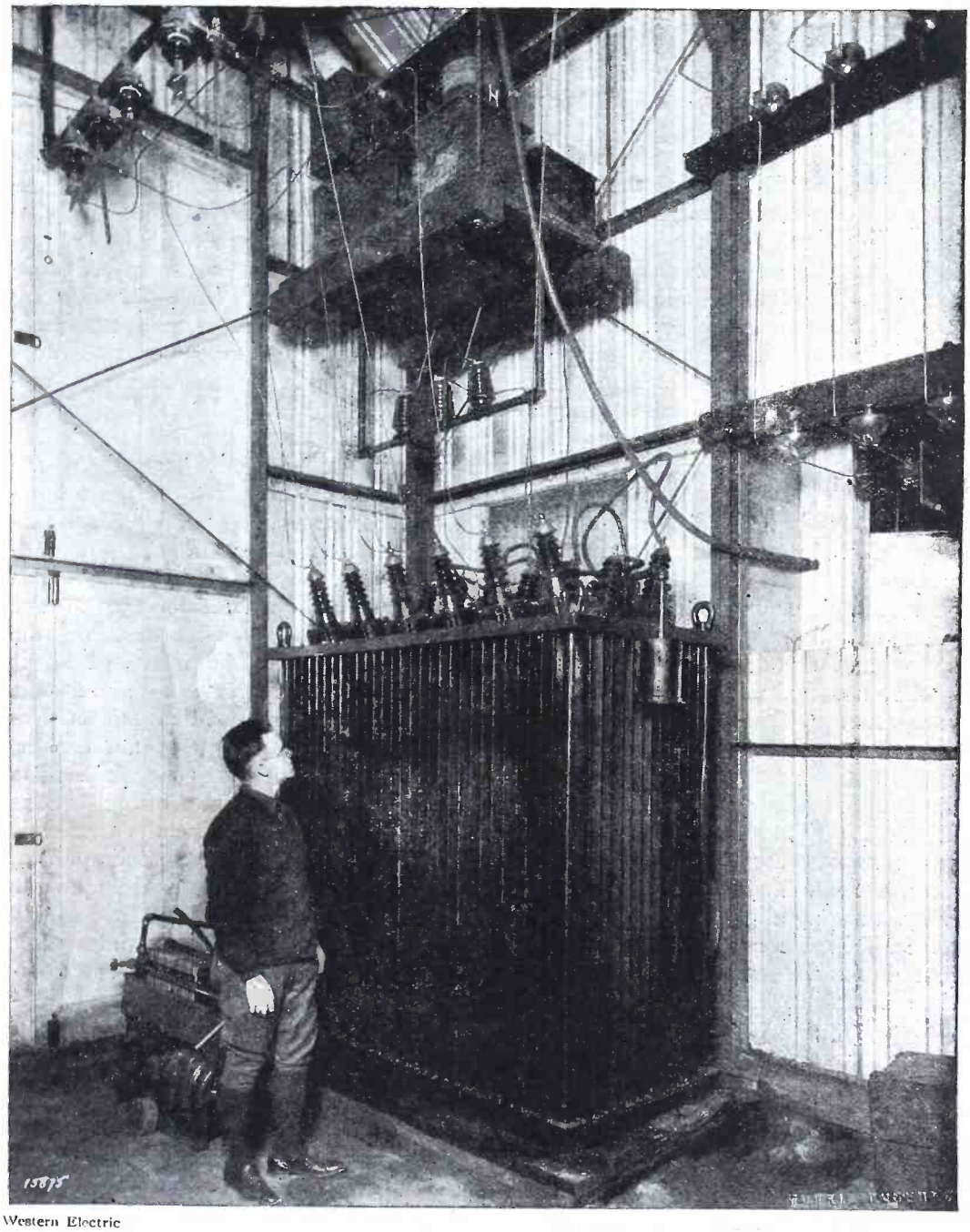
The final super-amplifier consists of two units of ten water-cooled tubes each with a total capacity of 150 K.W. The enormous power of this transmitter may be realized from the fact that most of the "large" radio broadcasting stations use a power of about ½ K.W.

In this scheme for reception a continuous oscillatory current of the correct frequency has to be supplied in the receiving set before detection of the signal is possible. Thus a small vacuum-tube oscillator is used to feed into the receiving circuit a small current with a frequency of the original carrier current, 58,500 cycles. This, when de-



THE TRANSMITTING SYSTEM

FIGURE 1: *This is a schematic drawing that shows the complete transmitting system; it shows the general connections for the modulators, the heterodynes, the filters and the low and high-powered radio-frequency amplifiers.*



Western Electric

SOME OF THE ENORMOUS APPARATUS USED IN THE TESTS

The giant 60-cycle, 3-phase, oil-cooled power transformer which supplies the 200-kilowatt rectifying tubes with high-potential alternating current. The tubes change this current to direct current and pass it on to the plate circuits of the radio-frequency amplifiers.

modulated with the received side band, which has a frequency of from 55,800 to 58,500 cycles, a difference in frequency of 300 to 3,000 cycles (that is the voice frequency) will result. A variation of about 50 cycles either way, in the sup-

plied carrier frequency is allowable, but a greater difference will produce distortion of the speech. There has proved to be no difficulty, however, in keeping within this limit.

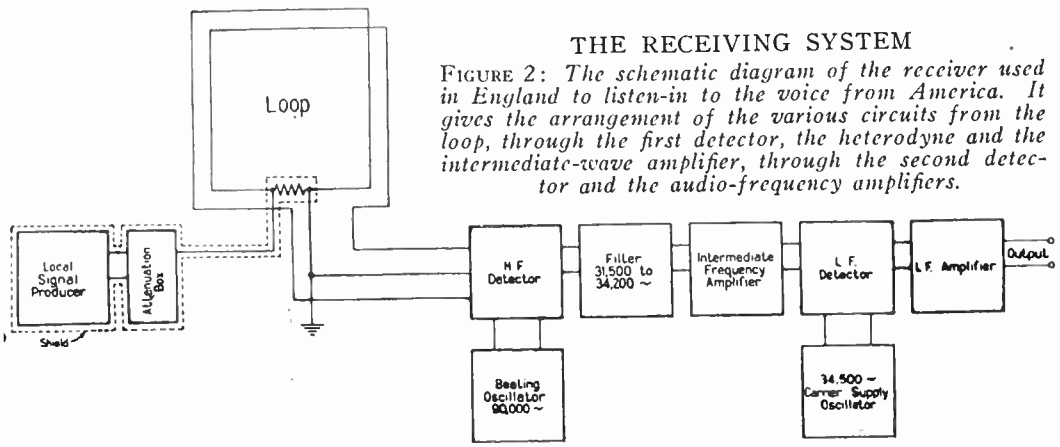
Actually, the procedure is not quite as simple as this. Use of the intermediate wave amplifier and the band filter is made at the receiver also, and, in order that the filter may function effectively, the received side band is also stepped down in frequency. This stepping down action is accomplished by combining in the first detector, the incoming band with a locally generated current of 90,000 cycles. Two different frequency bands are produced, the lower of which is from 34,200 to 31,500 cycles. This is selected by a band filter, which provides an extremely sharp discrimination against all other frequencies. Another local oscillator supplies to the second detector a current of 34,500 cycles, and the difference in frequency in the output of this tube is the original voice wave. This current is passed through the audio-frequency amplifiers and to the receivers. (A schematic diagram of the receiver is shown in Figure 2.) Variations in tuning, without changing the values of the band filter, are possible in this receiver, merely by changing slightly the frequency of the 90,000-cycle current supplied to the first detector, so that the receiver is at once a flexible and a highly selective device.

This elaborate arrangement is not necessary, however, to receive a single side-band radio wave. The well-known heterodyne circuit will receive it and sometimes the ordinary regenerative circuit can be made to serve, although in either case adjustment of the local oscillations is somewhat difficult.

In view of the great advantages inherent in the system, however, it is considered not unlikely that broadcasting may some day be done on this scheme. In this case, each receiving set would have in addition to the tubes now employed, an oscillating tube to supply the continuous oscillatory current.

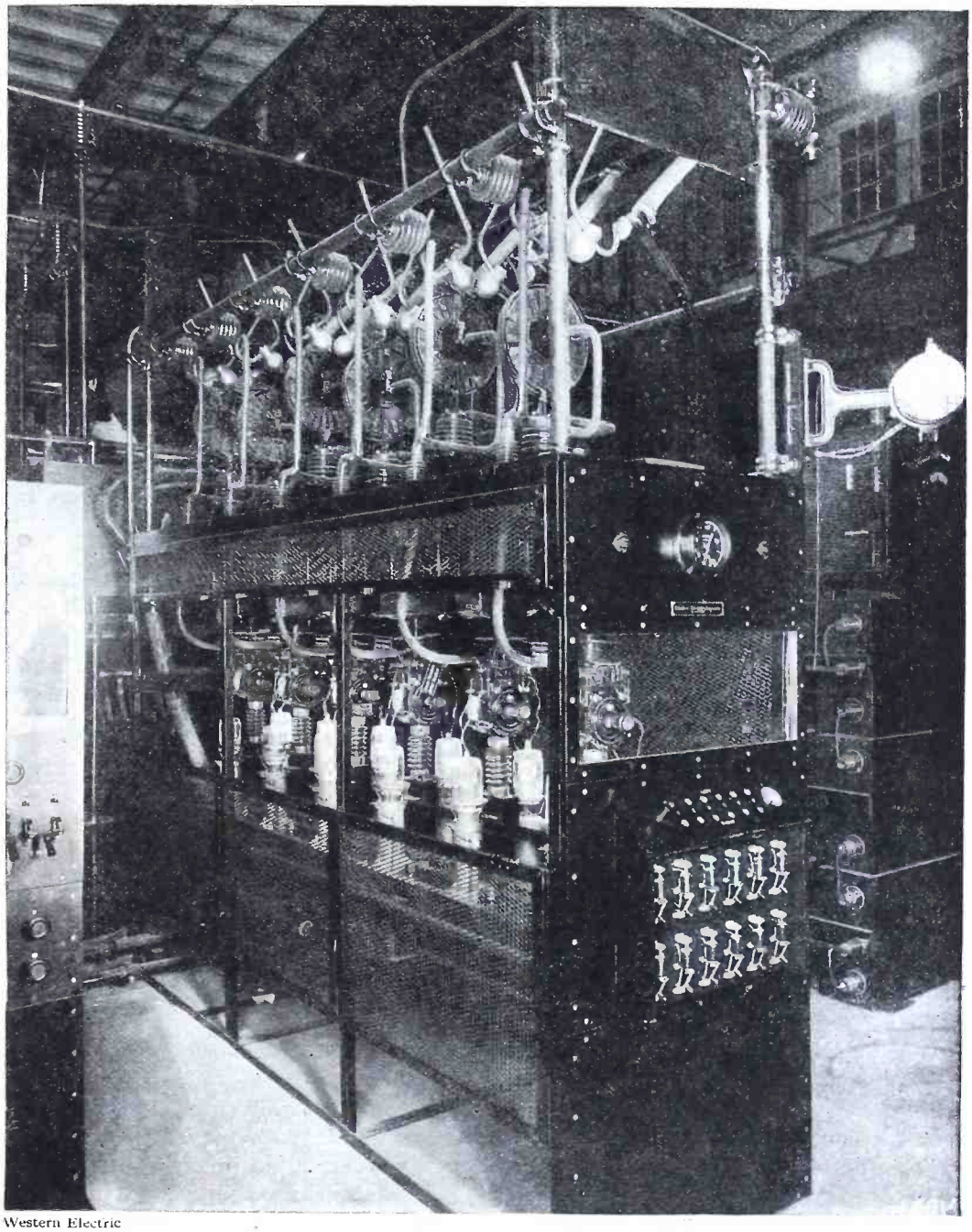
Such a system would have many advantages, some of which are the following: When only one side band is transmitted, nearly twice as many broadcasting stations could operate simultaneously without interference in the ether. Also the effectiveness of the power used would be increased about three-fold. Furthermore, since the strength of the received signals is proportional to the energy of the carrier, the receiving of very weak signals could be more readily accomplished in the present system where the carrier is supplied locally and its energy can, therefore, be controlled by the operator of the receiving set.

This system opens up an interesting field of possibilities, in which radio listeners may suddenly find a very intimate interest.



THE RECEIVING SYSTEM

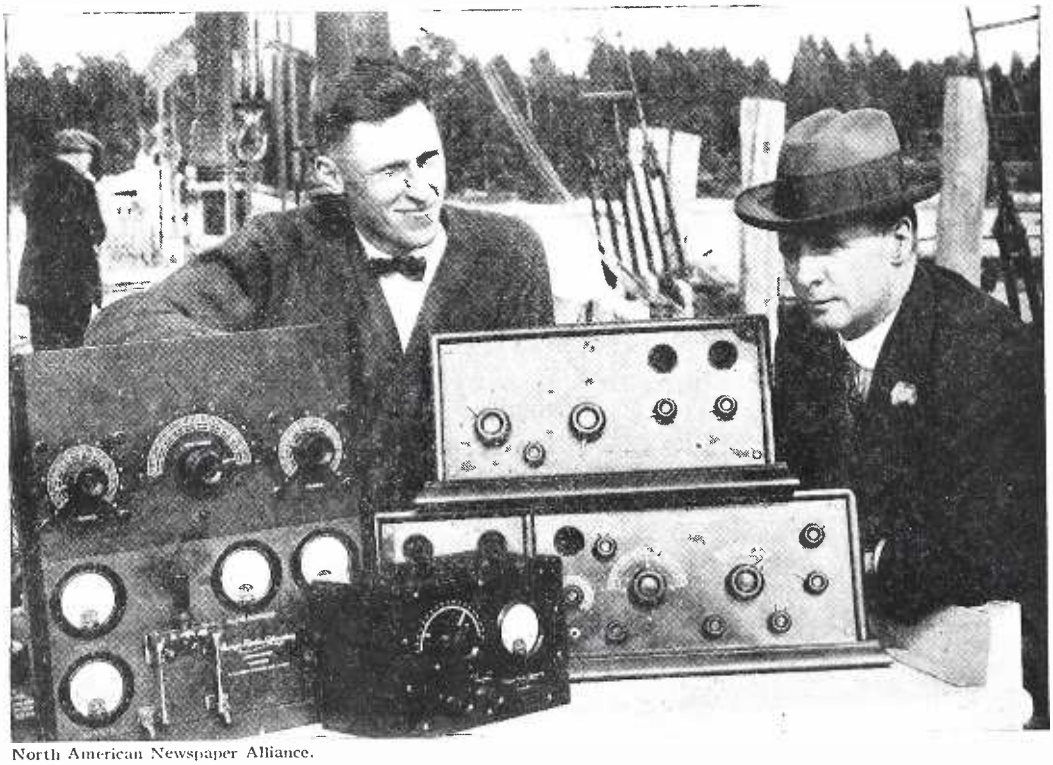
FIGURE 2: *The schematic diagram of the receiver used in England to listen-in to the voice from America. It gives the arrangement of the various circuits from the loop, through the first detector, the heterodyne and the intermediate-wave amplifier, through the second detector and the audio-frequency amplifiers.*



Western Electric

THE RECTIFYING APPARATUS
SET UP IN ITS PROTECTING FRAME

Here are included the high-tension bus, the insulators and choke coils in the upper compartment, with the rectifier tubes and circuit breakers in the lower screened compartment. The plates of these large tubes are made of metal and form part of the wall of the tube. They are set into a water-cooling system which carries away the great heat which is set up by the electron stream within the tube.



North American Newspaper Alliance.

THE RADIO VOICE AND EARS OF THE EXPEDITION

At the left is shown the modern C.W. transmitter, which can be tuned to an exact amateur or broadcasting wavelength by means of the wavemeter shown in front. At the right the long wave receiver (above) and the short wave receiver (below) will insure reception from all classes of stations. The operator, Donald Mix, is shown at the left, and Capt. Donald B. MacMillan at the right.

Radio's Farthest North

The adventuresome voyage of a radio amateur on the polar ship BOWDOIN, and what it may mean to science

By ROBERT W. HARWOOD

"WNP," for the next fifteen months or perhaps longer, will signify the call of Dr. Donald B. MacMillan's latest polar expedition. The call letters are unforgettable for they mean ("Wireless North Pole.") Unless the most careful plans miscarry, they should play an important part in the history of radio.

Setting sail on the tiny auxiliary schooner *Bowdoin* the MacMillan expedition is to permit itself to be locked in the ice during the long winter nights. And each night Donald Mix, an operator who is known to "hams" all over the country by his old call, 1TS, will communicate with the amateurs.

Much scientific interest attaches to the MacMillan expedition. It is a two-phase interest—radio and the study of glacial action. It would be difficult to say which is of the most importance.

MacMillan first went to the Arctic with Peary in 1909, the trip that won discovery of the North Pole, and since then he has spent four years in the Arc-

tic in pursuit of scientific data. His studies of the glaciers has led to a theory, entertained by himself as well as other scientists, that a new Ice Age is approaching. In support of his theory he has found signs of increased glacial activity, or rather the greater activity he discovered among the glaciers, led to the theory. He now intends to make an accurate survey of certain of the great glaciers, and the great ice cap over Greenland to learn if it has advanced.

Scientists know little of the causes of the irregular return of the Ice Ages, the last of which retreated from New England and other parts of the United States about 30,000 years ago, and from Northern Europe more recently. Any search for the causes has, therefore, a paramount interest in scientific circles. Scientists want to know if there is any indication that Manhattan Island, for instance, will once more be covered with a mighty glacier, higher than the Woolworth tower.

It is in radio equipment, however, that the MacMillan expedition makes a departure which marks history for exploration of the north. Never before have plans been made to keep closely in touch with the outer world. Explorers have spent long years in the north with nothing heard from them until they returned. Many of them have perished miserably for the lack of radio communication.

The aurora borealis, weird electrical phenomena of the Arctic, has been known to interfere with radio and with telegraph lines as well; it has, in effect, erected a great static wall in the air.

International.

THIS MAY PROVE TO BE ONE OF THE HISTORIC RECEIVING SETS

If the plans carry, this apparatus installed in the radio shack of the BOWDOIN *will not only reach the farthest north of any similar equipment but will be the means of acquiring scientific information of real value to radio everywhere.*

But Mix and his chief, MacMillan, and other experts who have installed the radio equipment on the *Bowdoin*, are not afraid of the aurora borealis. In the first place they plan to be far north of the latitude in which it exists. And there is no comparison between the crystal detector and tuning coil of former days with the sensitive apparatus on the *Bowdoin*. In the early days of radio equipment it would have been impossible to have kept in touch with the outer world, but now MacMillan plans to have a careful study made of the aurora borealis by means of radio.

Radio communication plans for the expedition were worked out by officials of the American Radio Relay League and the *Bowdoin* is to communicate with members of that organization of amateurs. At certain hours each night Mix listens-in and all calls he receives are logged and sent back for study. Each week MacMillan sends out a story of the expedition and its findings to some one of the amateurs. The amateurs hand over the story to the press.

Mix tunes down at times and at other times he broadcasts so that there is ample opportunity for most of the 25,000 amateurs in the country to hear him at one time or another.

Many obstacles to radio communication with the Arctic are presenting themselves, but the radio engineers who have worked on the *Bowdoin* believe these have been overcome. All of the equipment was tested and retested for cold and other Arctic conditions before the vessel sailed.

The *Bowdoin* is small and shallow and every inch of space on her counted. She is a schooner and there was difficulty in rigging her antenna and the lead-in wire. Proper insulation of the lead-in wire alone was a difficult problem for the boat will often be in a temperature of 70 degrees below zero while the inside of the cabin will be 70 degrees above, and the slightest metallic connection with the exterior and interior under such conditions makes it almost impossible to prevent forming of ice on the inner end of the conductor.

The over-all length of the *Bowdoin* is 89 feet. She is purposely small in order that she may easily arise when the ice floes close in. While powerful ships are apt to be crushed, a shallow, light craft will be lifted out of the water. Not since the days of the vikings have explorers braved the Arctic in so small a boat.

As to her success in the Arctic the world is to learn more—by radio.

How to Select Your Radio Parts

THE efficiency of your set is largely dependent upon the efficiency of the various units of which it is made up. Do you know how to pick out a good variometer? Can you tell a well-made from a poorly-made condenser? Do you know how to test a pair of headphones? In the following issue—the big November number—an expert will give you practical pointers for selecting your apparatus.

HELP *your neighbor. If you have discovered any little Kink that helps to eliminate trouble in your radio apparatus, or if while experimenting with the connections of your set you should run across some interesting phenomenon, or if you should discover some new hook-up that gives better results—send it to the "Listening In" page.*

Impressive Tribute Paid by Radio to the Late President

THE important part that is played in our daily life by radio was forcibly impressed upon the public when, following the death of President Harding, a majority of the broadcasting stations throughout the country closed down for varying periods as a mark of respect. From Washington, D. C., comes the following comment:

The almost complete cessation of broadcasting brought home as could nothing else the important niche which radio has carved out for itself in our daily routine in the past two years. People in all walks of life commented upon the gap in their evenings, a gap which they found hard to fill, and while practically all agreed that it was but fitting that the broadcasting of entertainment should temporarily halt while the country sorrowed, probably nothing else connected with the final honoring of our dead President made as deep an impression.

In the death of President Harding, radio lost a good friend. He was one of the first officials of the Government to turn radio fan when, following the first radio conference in 1922, the attention of the country was turned toward the new method of entertainment. The set built for his use in the White House was the last word in reception, but, while he liked to "play" with it, he had but little time to devote to amusement and found himself for a long time unable to cope with the interference which prevailed when there was but one wavelength for broadcasting.

In many ways the President evinced his interest in radio. He gladly accepted the invitation extended to him by the National Press Club of Washington to attend the exercises incident to the "christening" of its receiving set, and while the music and speeches which were to have been broadcast from a near-by Government station especially for the occasion failed to "come through" the President "stuck around" like the "good fellow" he always was, chatted with the members of the club—which is composed of newspaper men—and gave them a little talk on the difficulties of being President which gave them much inside dope on the great task which confronts the Nation's Executive from day to day.

While the failure of Congress to pass the White Radio Bill kept radio from becoming an official subject of consideration at the White House, Mr. Harding frequently expressed his interest in the matter and the hope that legislation could be enacted to eliminate interference, give the amateurs the privileges they desired and which he thought they were entitled to, and put radio on a concrete foundation. President Harding was radio's friend, and no finer tribute could have been paid than the silencing of more than five hundred stations, while the country ceased its activities and a hundred million people mourned.

—CARL H. BUTMAN

A Chance for the Radio Dramatist

RADIO broadcasting station WGY at Schenectady, N. Y., is offering a prize of $500 for the best "radio drama" submitted in competition during the three months period beginning September 1. The prize-winning play will be presented during the winter months when transmission conditions are best. Other plays offered in competition will be produced *via* the ether, if they are found suitable, and the authors will be remunerated.

THE DETECTOR IN USE

The last step in construction is to solder the crystal in place by means of "Wood's" metal. Adjustment is then made with the pointed brass rod.

Silicon and Carborundum as Crystal Detectors

IF you do not want to use a bulb, and if you find that galena gets out of adjustment too easily, here is a suggestion from a New Jersey amateur that will help you out. The pressure-contact detector here described has these inestimable advantages—it can be easily and cheaply made, and it will "stay put":

To the majority of broadcast listeners the names of "silicon" and "carborundum" are little known. The knowledge of crystals of the ordinary novice extends to galena and to one or two crystals that are sold under trade names. A little experimenting with the two first-named crystals will, however, reveal possibilities and furnish an interesting line of study with gratifying results.

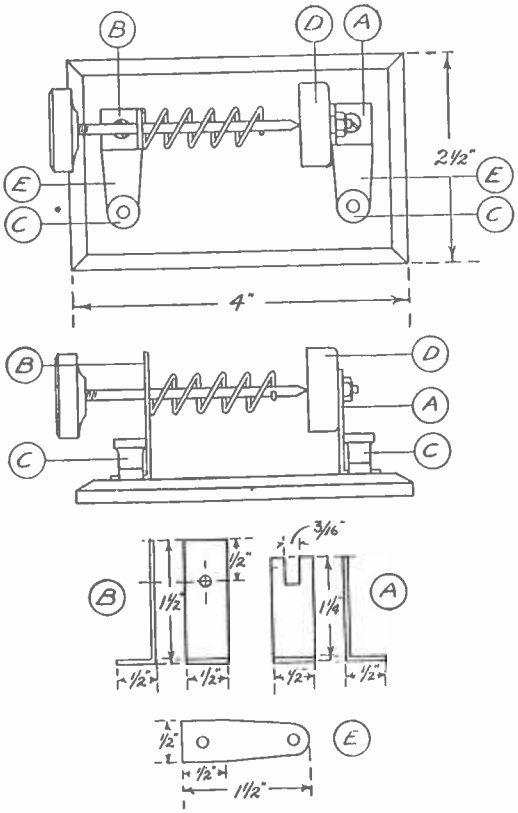
These two crystals are not natural minerals; they are products of the electric furnace. They both possess the properties of rectification to a more or less marked degree and they have several points of value in radio reception not found in other crystals or minerals. Stability of adjustment is one of the greatest of these; long life is another. Because of the heavy contact used, the film left on the surface of the crystals when they are handled does not affect the operation of them as it affects other crystal rectifiers. Dust and weather conditions (important factors in the use of light-contact detectors), are practicaly negligible with either carborundum or silicon.

Up to a few years ago carborundum was used almost universally on board ship where all kinds of conditions were met with; there it gave good service. Now, however, the audion has superseded the crystal except on board small coastal and harbor vessels.

The accompanying diagrams show the details of an easily constructed yet efficient detector-stand in which either carborundum or silicon may be used. The base, made of any good insulating material, is 4 inches long by 2½ inches wide, with neatly beveled edges. The component parts of the detector may be mounted directly on either a horizontal or vertical panel; in the latter case, the cup support should be the lower one.

The two standards are made of a 1/16-inch brass strip ½ inch wide. Two strips are required, one 2 inches long and the other 1¾ inches long. A ¼-inch hole is drilled in the longer one, the center of the hole being ½ inch from the end. The other end is bent at right angles at a point ½ inch from the end. In one end of the second strip a slot is cut. The other end of this strip is bent as in the first strip.

A stiff spiral phosphor-bronze spring, ¼ inch in diameter and 1½ inches long when at



HOW TO MAKE THE DETECTOR

A and B show the standards; C shows the binding posts; D shows the detector cup; and E shows the metal connecting strips.

rest, is next obtained. One end of this is soldered to the upright with the hole in it as shown. A 3-inch piece of ⅛-inch brass rod is now threaded for ¼ inch on one end and filed to a point on the other. A suitable insulation now is screwed on the threads, and the pointed end passed through the hole and the spring as shown. The free end of the spring is soldered to the rod, ¼ inch from the point. The standards are now mounted and connected to the binding posts.

Mounted crystals may easily be slipped into the supporting standard by the slot that has been made. It will be necessary for the amateur to mount his own crystals in cups with mounting screws. The cups may be obtained from the tops of the carbons in old dry cells and the crystals held in them by means of "Wood's" metal.

This stand, when used with silicon, should be connected in the circuit in the regular way, but with carborundum it is sometimes found advantageous to employ a dry cell or two in conjunction with a potentiometer.

In selecting crystals care should be taken to use only fused silicon and carborundum made specially for radio reception. Because of their ruggedness and the ease with which they may be adjusted, these crystals will be practicable for use in crystal sets.

While this type of crystal, which utilizes the pressure contact, may be slightly less sensitive than the more critical kind, it will be found to be much more stable and better able to stand up under the "knockout" blows of heavy static.

—Le Roy Western

Transmitting and Receiving on a Loop

WE have heard much in the last few years of reception of radio signals on a loop antenna; in fact, it has become common practice. Here is a new development that permits of both transmission and reception on a loop.

The set developed by the Signal Corps (SCR-112) consists of a combination send-receive unit with a portable, collapsible loop that is capable of two-way communication by CW. with a range of three to five miles. When the set is connected up for operation (as shown in the illustration) it takes up only as much space as an average man with his arms extended. The set was designed for army use and should prove of great practical value in maneuvers where directional work of short range is of the utmost importance. The unit has a wavelength range of 110 to 140 meters for transmitting and from 85 to 165 meters for receiving.

It will interest the amateur to know that such a set has been made and that it works, and amateur experimentation along this line would assuredly lead to the development of a set for short range work that would undoubtedly cut down local interference to a minimum.

—Frederick Siemens

A CW. Transmitter That Employs a Loop

This apparatus should be of more than passing interest to the amateur, especially if the amateur is located in a congested locality, for it offers a solution to the problem of local QRM (interference). By the use of such a set, two amateurs could send and receive messages without causing QRM to other amateurs in their vicinity; this is because the loop transmitter is exceedingly directive.

S. R. Winters

First Aid to Seamen by Radio

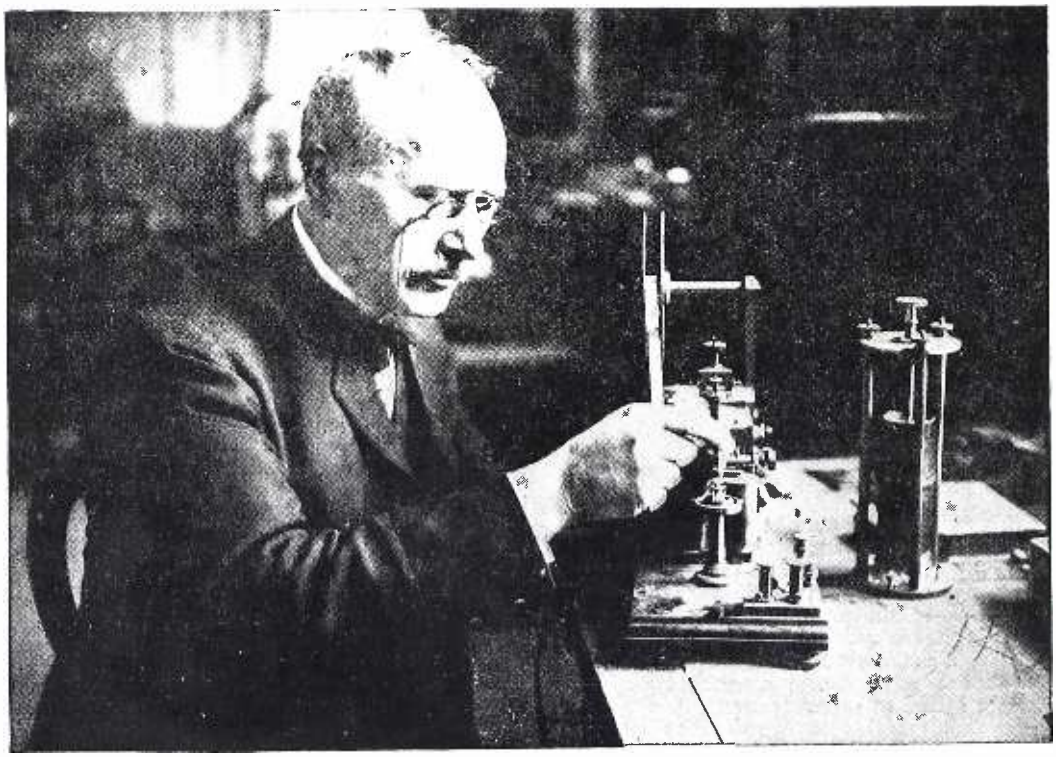
THE saving of life at sea by carrying medical advice to ships which are not provided with a doctor is now a recognized service of radio. How this service is being provided by the U. S. Government is described as follows in a bulletin from the Department of Commerce:

The probability that some masters of seagoing vessels may not as yet have been fully informed in regard to the right of members of their crews to medical service by radio while at sea and to treatment in hospitals of the U. S. Public Health Service on reaching port has caused Surgeon General H. S. Cumming to direct the preparation and sending of posters giving full information to all vessels of the American Merchant Marine.

Curiously enough, the medical service afforded by our department is really a sort of subsidy to merchant ships and sailors. A century and a quarter ago, when Congress established the Public Health Service under the title of the Marine Hospital Service, it directed it to render medical aid to every American seaman who applied for it. For this service each seaman was required to pay twenty cents a month. This was in 1798; in 1870 the tax was doubled; but in 1888 it was abolished. Since then all such aid has been rendered free. Even the expense of calling the Service by radio from ships at sea is borne by the radio companies without expense to either ship or sailor.

The U. S. Public Health Service provides hospital care and out-patient treatment for sick and disabled seamen. Hospitals with modern equipment, skilled physicians, specialists, dentists and trained nurses are open to all persons employed on documented American vessels, and to the coast guard, lighthouse keepers, and to all others who help to keep the flag on the seas.

An ambulance will go to the dock at any time upon telephonic request from a ship's officer, and any Marine Hospital will prescribe emergency treatment through radio shore stations.



Kadel & Herbert

THE EMINENT FRENCH SCIENTIST WHO INVENTED THE COHERER

Dr. Edouard Branly, one of the earliest investigators of radio waves. It was Dr. Branly's invention of the coherer in 1890 that made possible the first success of wireless telegraphy. On June 7, 1923, many of the most distinguished scientists and radio experts of France honored Dr. Branly by a jubilee meeting held in the same room in Paris in which Dr. Branly made the address announcing his great discovery nearly thirty years ago.

International

OPEN-AIR RADIO CONCERTS IN ENGLAND

This picturesque canvas-covered cottage, built on a Ford chassis, has recently been touring about John Bull's little island and entertaining groups of villagers with entertainment picked up from the broadcasting stations. The loudspeaker may be seen through the window. A short antenna is mounted on the roof.

Back to the Farm for a Loudspeaker

THE radio fan who cannot invest in an expensive loudspeaker will welcome this practical hint as to how to make one at home; it comes to us from a reader who spent his boyhood upon a farm:

Here is a loudspeaker which can be made at home for about $7.00; the only materials you need to obtain are a loudspeaking unit (such as the Baldwin type C, for example), a brass rod, some string, washers, screws, and an ordinary gourd.

Cut a slice off one side of the gourd as if for a dipper; then remove the seeds. Do not scrape out the seed tissues, however; let them dry to the walls of the gourd. When the gourd is thoroughly dried out, the shell with these tissues will be hard. You may then stain, varnish and finish it to suit your own special taste.

When the gourd has been thus prepared, drill a ⅛-inch hole through each side of the handle about one inch from the end; insert a ⅛-inch brass rod through these holes to act as an anchor rod.

Take two silk fishing lines, cut them to a length a little greater than the length of the gourd and resin them thoroughly. Drop these lines into the opening in the handle of the gourd and tie them to the brass rod at points about ⅛-inch to ¼-inch apart.

Next make a small round brass concave washer of a size to fit over the center of the head of the gourd. Drill two holes about ¼-inch apart in the washer and insert two 1½-inch screws in these holes. (See that the screws have nuts screwed back to the shoulder or head.) Drill a small hole in the threaded end of each screw which is large enough for the ends of the lines to be put through it and tied. Tie the lines, then grip each nut in turn with a pair of pliers, and back out the screws with a screwdriver until both the lines become taut.

Saw off the small end of the handle of the gourd and fasten the loudspeaking receiver unit in place in any suitable manner. You are then ready to tune in with a loudspeaker that will give excellent results.

—W. H. RUNYAN

WHAT READERS ASK

This department is conducted for the benefit of our readers who want expert help in unravelling the innumerable kinks that puzzle the amateur who installs and operates his own radio apparatus. If the mechanism of your equipment bothers you—if you believe that you are not getting the best results from it—ask the Service Bureau.

THE flood of inquiries that has poured in upon the Service Bureau has not only furnished evidence of the need of this department, it has also necessitated a system of handling the correspondence that will insure the selection of and answer to only those questions that are of the widest application and that are, consequently, of the greatest value to the greatest number of our readers. Our correspondents are, accordingly, asked to co-operate with us by observing the following requests:

1. Confine each letter of inquiry to one specific subject.
2. Enclose a stamped and self-addressed envelope with your inquiry.
3. Do *not* ask how far your radio set should receive. To answer this inquiry properly involves a far more intimate knowledge of conditions than it is possible to incorporate in your letter.

¶ *In justice to our regular subscribers, the Service Bureau is compelled to restrict this special service to those whose names appear on our subscription list. A nominal fee of 50 cents is charged to non-subscribers to cover the costs of this service and this sum must be enclosed with the letter of inquiry. No inquiries can be answered personally or by telephone.*

Question: How many tubes are necessary to receive from broadcasting stations located in the same town with enough volume to operate a loudspeaker in a small room?

Edwin Morris

Answer: Two tubes. One, a detector tube in a regenerative circuit, and the other, used for an audio-frequency amplifier, will give you the requisite amount of volume for your purpose.

* * *

Question: What is the longest antenna length that can be used successfully for listening to broadcasting with a standard make of receiving set?

Will Atkinson

Answer: The two limits are 75 to 200 feet. The best length to use will be around 150 feet. If you use a short antenna it would be better to use a variable condenser shunted across the primary coil of the set, and if you have a long antenna, a variable condenser connected in series with the primary coil will help.

Question: I have found that I can tune my single-circuit receiver by inserting a large iron nail inside of the primary coil. If I push it in all the way I increase the wavelength and receive the higher stations, and if I insert it only a little way I get the lower stations. Why is this? Have I discovered something new?

O. F. Johnstone

Answer: No, you have discovered nothing new. This is one of the elementary principles of induction. If you use a coil with an air core, the coil will have a certain value of inductance. If, however, you wind the same coil, with the same dimensions, on an iron core, you will find that the inductance has increased enormously. That is what you are doing with the nail, and when you use a larger inductance you raise the wavelength. This kind of tuning is not as efficient as the ordinary tuning by means of variable condensers or variable coils, as the nail introduces losses (somewhat similar to resistance) into the coils at a radio frequency.

QUESTION: I have a single-circuit set that employs two honeycomb coils in a double-coil mounting used in connection with one variable condenser and a vacuum tube, type WD-12. I have heard a number of long-distance stations with this set, but the tuning is not good. I have to sit up very late in order to get any distance at all, and then the distant stations seem to interfere with each other a lot.

Is there any way I could turn my present set into a four-circuit tuner? If this is possible, I would like to get the circuit.

A. VICKERS

ANSWER: It is not possible to convert the single-circuit set into the four-circuit, without obtaining almost a complete new set of parts. You may, however, use the principle of the stabilizer coil with your present set, by changing from the two-coil mounting to a triple-coil mounting, and using the third coil, L1, an L-35 honeycomb coil shunted with a .0005 mfd. variable condenser, to control regeneration to a finer degree. This will improve your present set considerably. The circuit is shown complete in Figure 1. Tune with condenser, VC2, almost "all in."

QUESTION: What is the proper way to check up on "B" batteries to tell when they are run down? Is it all right to use a 110-volt lamp to connect across them in order to see whether or not they have any juice left in them? A friend of mine told me that this was bad for the batteries. Is this so?

FRANK J. FINCH

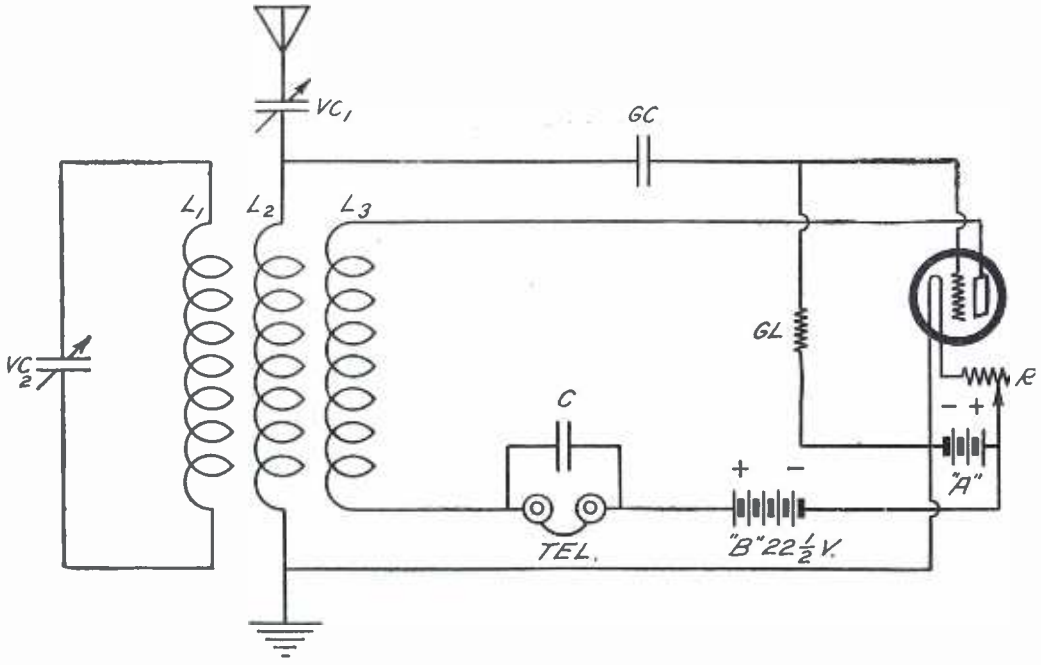
ANSWER: The method you describe is not good for the batteries. If you do this you probably run the batteries down more in a second than you would by a month of steady usage on the receiving set.

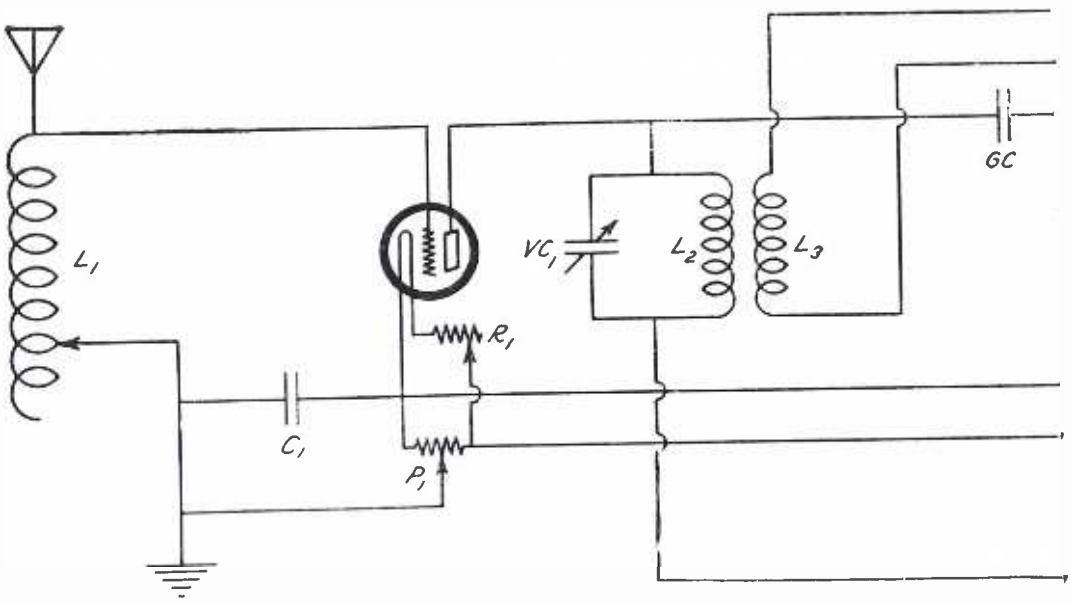
The proper way is to obtain a small battery voltmeter, which can be obtained for three or four dollars, that will tell you at a glance just what is the voltage of each battery in the circuit. By this method you can pick out instantly any battery that is low or defective. At the same time you will be sure that you are not spoiling the batteries while testing them.

* * *

QUESTION: I can receive with my regenerative set from local stations without any "B" batteries. The signals are not as loud as when the batteries are used, but they come in comfortably well. I have a single-tube set and all

FIGURE 1: *A stabilizer circuit VC1 and L2, added to a single-tube regenerative circuit to aid in tuning.*





I do is to connect the positive side of the "B" battery to the post marked Positive "B" on the set, as well as to the post marked Positive "A", and the signals come in. Is this something new?

AL. DRUMMOND

ANSWER: No, this is not particularly new. You are utilizing the voltage drop across the filament rheostat for the plate voltage. In other words if you are using a six-volt "A" battery and if the rheostat is only turned up three-quarters of the way you are getting approximately one or two volts on the plate. This is sufficient to operate a set on local signals on most tubes.

* * *

QUESTION: The wonderful results that the English are getting with their receiving sets, in picking up American broadcasting, seem to be dependent upon their use of a peculiar radio-frequency hook-up that I have heard they use almost exclusively. The circuit contains a tuned coil in the plate circuit of the first radio-frequency amplifier, coupled up with the plate coil of the detector tube. I remember seeing the circuit somewhere, but I cannot find it, and would like to know if you are familiar with it. If so will you kindly let me have it with the addition of one stage of audio-frequency amplification?

I would like to try to duplicate some of their results, in my own receiving station.

CHAS. DOWNING

ANSWER: The British tuned-anode circuit using one stage of tuned radio-frequency amplification with a detector feeding back into the tuned circuit and one stage of audio-frequency amplification is shown in Figure 2. The parts you will need are the following:

L1—single slide tuning coil;
L2—honeycomb or duolateral coil, L-50;
L3-honeycomb or duolateral coil, L-75;
VC1—variable condenser, .0005 mfd.;
VC2—variable condenser, .0005 mfd.;
C1 and C2—mica fixed condensers, .002 mfd.;
C3—mica fixed condensers, .0005 mfd.;
P1—potentiometer, 300 ohms;
R1, R2, and R3—filament rheostats;
GC—grid condenser, .00025 mfd.;
GL—grid leak, 2 megohms;
AFT—audio-frequency amplifying transformer.

The first and last tubes should be "hard" tubes and the second tube used as a detector should be either a soft tube or a hard tube.

If a hard tube is used the circuit will be as shown in the diagram, but if a soft tube is used the "B" battery should be tapped at 22½ volts for the detector plate.

The circuit will be found to be selective, and very sensitive to weak signals. The tuning with the two variable condensers is extremely critical and will bring up a weak signal to great strength when properly adjusted.

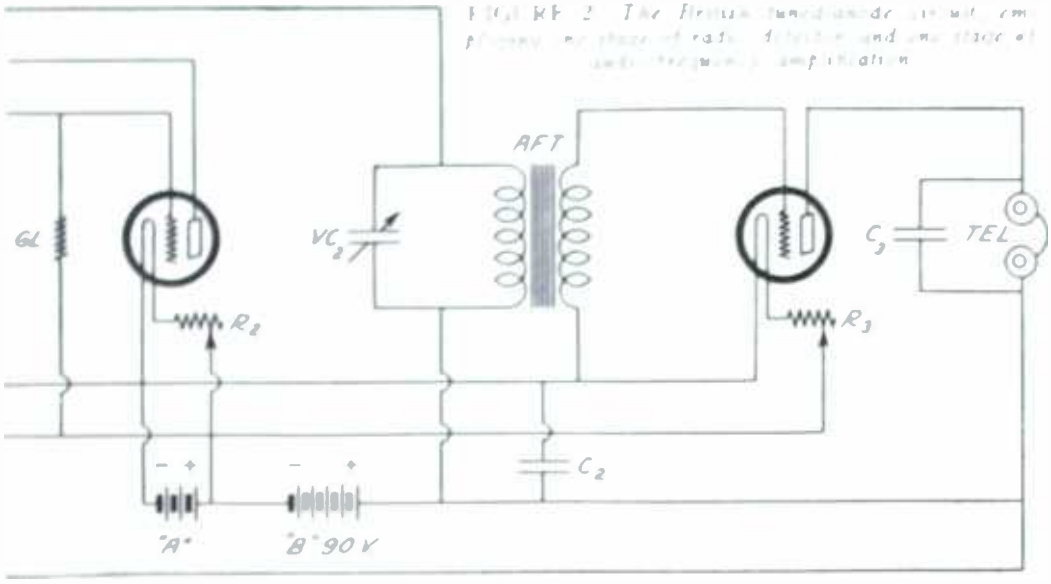


FIGURE 2. The Reflex tuned-anode circuit, employing one stage of radio frequency and one stage of audio frequency amplification

QUESTION Is resistance coupled amplification as efficient as transformer coupled amplification for audio frequency work? Does resistance coupled amplification give more or less distortion of voice signals than transformer coupled amplification?

AMOS W. CHURCH

ANSWER Resistance coupled amplification requires more stages of amplification to obtain a given signal strength than transformer coupled amplification although on a properly designed resistance coupled amplifier there is less distortion due to the fact that the coupling resistances respond to voice frequencies of different ranges with equal facility. The transformers are always somewhat more apt to respond to voice frequencies of one particular band more than others but in the best transformers this band is widened out to cover the important frequencies in speech and music.

• • •

QUESTION Can I use a wire about 70 feet long strung along the picture-moulding in my hall to receive from the local stations? I cannot put up an outside antenna, and a friend has offered to sell me a regenerative set and install the indoor antenna along the lines described. I want to know if this will be feasible for reception up to about fifteen miles.

S. D. PERRY

ANSWER For the short distances over which you want to operate the plan outlined will be suitable. You should have about two stages of audio frequency amplification to use with the set for good results, however.

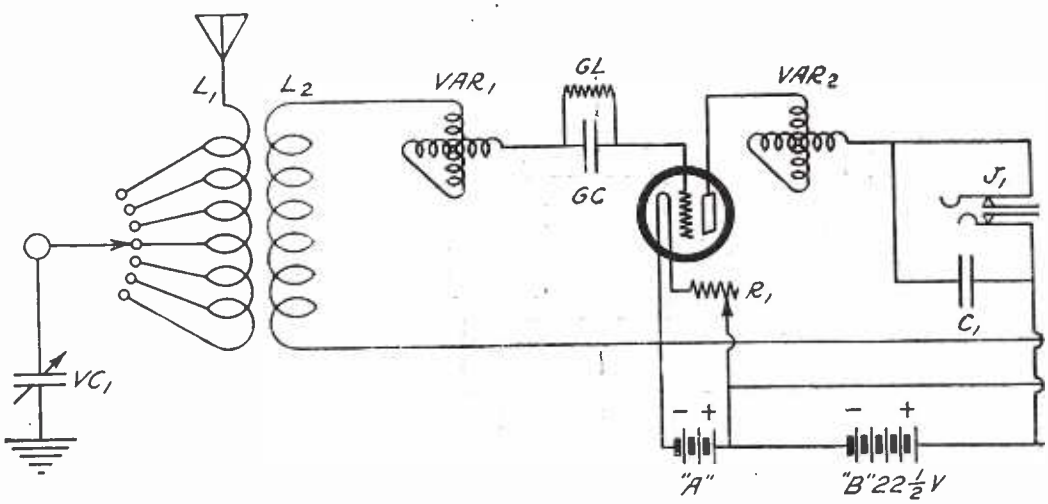
If you want at some future time, to operate over a wider area you may also include two stages of radio frequency amplification which should boost the range up to several hundred miles.

• • •

QUESTION Does the antenna wire have to be bare copper or can it be coated with any kind of insulation? If the wireless waves can go through anything I should think that the wire could be covered and yet work just as well. However, when I asked the local expert in our town he said it would not be very good and he was too busy at the counter to tell me why.

A. T. G.

ANSWER Electrically the covered wire and the bare wire would be equally efficient, but mechanically the bare wire would be the better. The covered wire would have a greater weight (the weight of the insulation) to carry when arranged in a span, and when it is exposed to the weather for any great length of time the insulation becomes decomposed and hangs in unsightly shreds and fragments from the copper. The bare copper is the stronger for a given diameter of wire, looks better, has the same efficiency and, therefore, it is the best to use.



QUESTION: Please give me a circuit diagram showing the proper way to hook-up a variocoupler, two variometers and a two-stage audio-frequency amplifier with a .001 mfd. variable condenser in the ground circuit to further facilitate the sharp tuning of the antenna. Also, please include telephone jacks in the detector circuit, the first stage of amplification and the second stage.

ANDREW JORDAN

ANSWER: The diagram in Figure 3 gives you the proper wiring to use for the standard regenerative circuit. The detector rheostat is included in the positive side of the filament and the amplifier rheostats are placed in the negative side of their respective filaments. This is to insure proper free grid potentials on the detector and amplifier tubes to insure their operation on the part of the characteristic curve where detection and amplification are effected most efficiently.

The other parts you will need are:
GL—grid leak, 2 megohms;
GC—grid condenser, .00025 mfd.;
C1—mica fixed condenser, .0005 mfd.;
AFT1—audio-frequency transformer, high ratio;
AFT2—audio-frequency transformer, low ratio;
R1, R2, and R3—rheostats, 5 or 6 ohms;
"A" and "B" batteries of correct voltages to fit the tubes used.

* * *

QUESTION: In which direction should my antenna point to get stations east and west? Should I put it up running north and south or east and west?

M. W.

ANSWER: To receive east and west, the antenna should be strung east and west. To receive north and south the antenna should be strung north and south. The lead-in should be fastened at the end pointing in the one direction you want to receive from best. To illustrate: If you want to receive in an easterly direction the antenna should be stretched east and west with the lead-in at the eastern end of the antenna.

* * *

QUESTION: How long should the large sized "B" batteries last on a set employing three radiotrons in a regenerative circuit and two stages of audio-frequency amplification if two 45-volt batteries are used and the set is operated for about three hours a night for six nights of the week?

ARTHUR BROWN

ANSWER: The batteries should be serviceable for a period of approximately five months if they are of a reliable make.

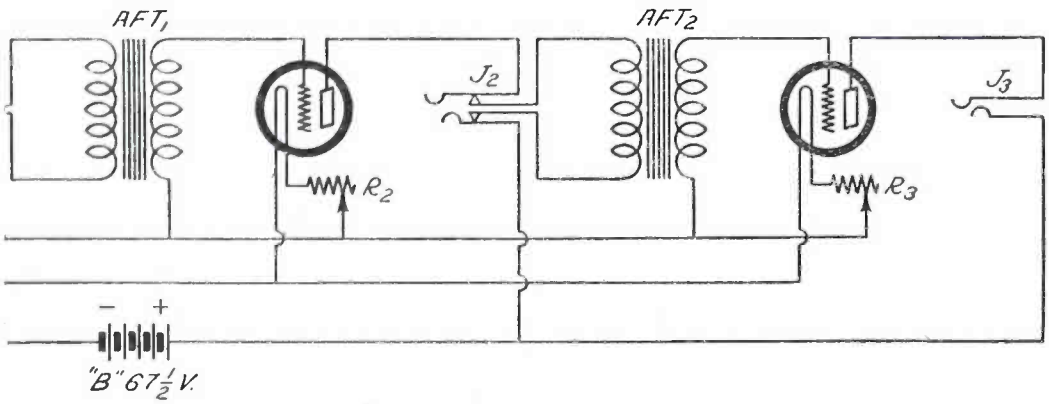
* * *

QUESTION: Is transformer coupled radio-frequency amplification as efficient as tuned radio-frequency amplification?

LAWRENCE KENNEY

ANSWER: No. The tuned radio-frequency method is the most efficient because the resonance phenomena which takes place when the plate circuits and grid circuits are in tune makes possible a greatly increased plate current and a correspondingly increased grid voltage on the next tube. This is not so with a coupling transformer that is only roughly tuned to a whole band of wavelengths. The tuned method is still more efficient when some method for preventing feedback is used in conjunction with it, as the circuits may be exactly tuned without being thrown into oscillation.

FIGURE 3: *The standard regenerative hook-up which shows how to use a vario-coupler, two variometers and a variable condenser with two stages of audio-frequency amplification.*



QUESTION: I would like to get a hook-up of the modified Colpitt's circuit for receiving with one bulb and a honeycomb coil. Please tell me the correct capacity of the condensers necessary to use with this circuit, if any.

R. B. MANY

ANSWER: You will find the circuit you have asked for in Figure 4. You will require one variable condenser, VC, of .0005 mfd. capacity, for tuning and one fixed condenser, GC, of the same capacity for the grid circuit. The grid condenser should have a capacity of .00025 mfd. and coil, L1, is a honeycomb or duolateral, size L-50. All the tuning is done with the condenser, VC, and the regeneration is controlled by the 6-ohm rheostat, R.

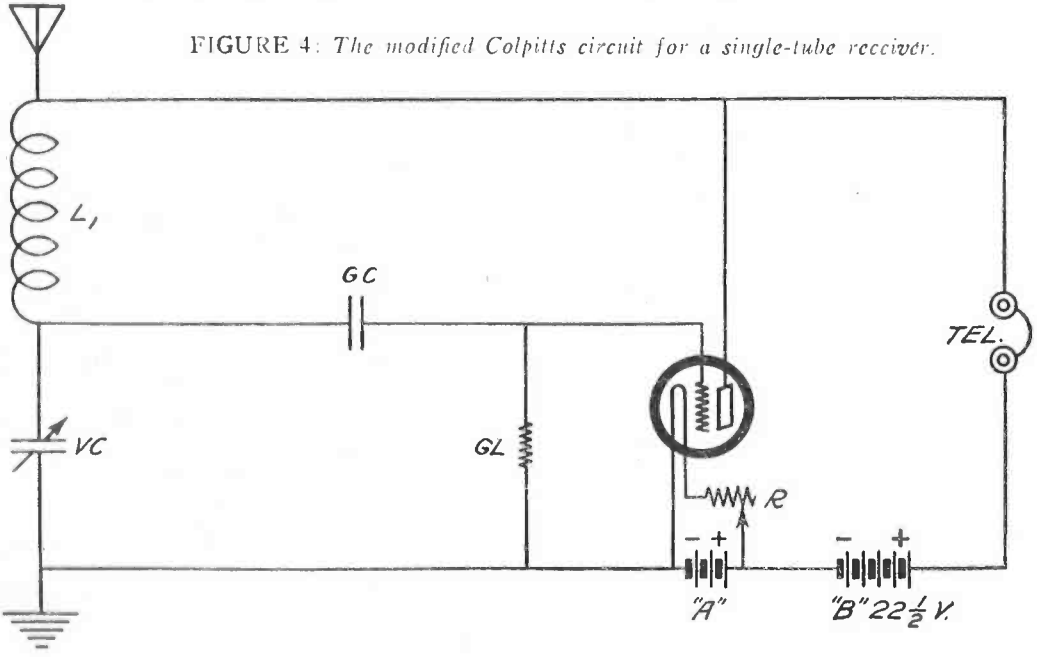
* * *

QUESTION: Is it possible to use a loop antenna with the four-circuit tuner? I find that I will be unable to put up an antenna on the roof.

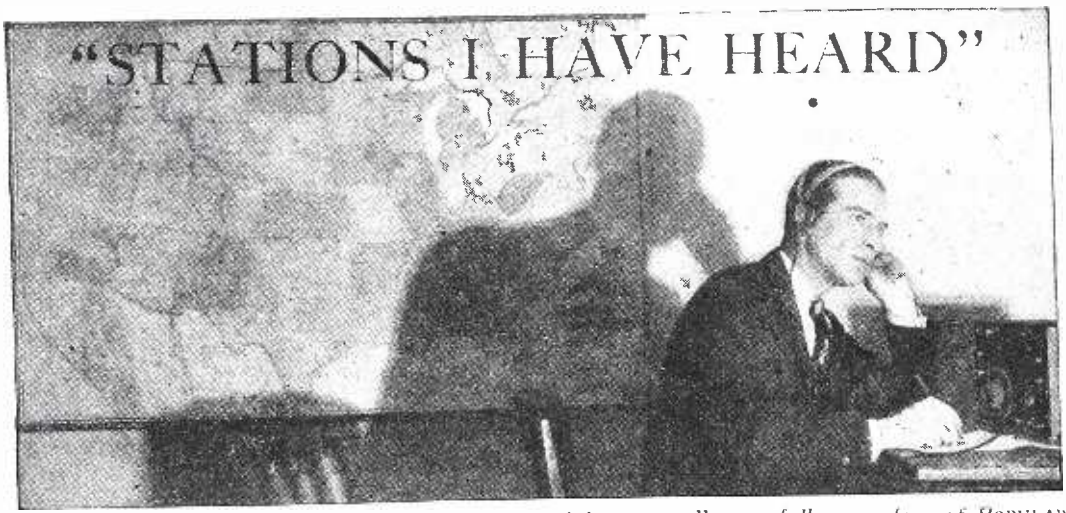
A. N. TAYLOR

ANSWER: In a near future issue of POPULAR RADIO there will appear an article describing a modification of the four-circuit tuner which employs a loop of special design. The set will operate a loudspeaker and operates on three dry-cell tubes.

FIGURE 4: *The modified Colpitts circuit for a single-tube receiver.*



"STATIONS I HAVE HEARD"



IF *you are getting good results with your receiving set, tell your fellow-readers of* POPULAR RADIO *how you get them. Give the call letters of the stations you hear, the locations of them, the type of apparatus that you are using and* HOW YOU ARE USING IT.

NEW WAVES HELP HIM

BECAUSE of the new arrangement of waves, I. Schwartz of Revere, Mass., is able to hear 75 stations with little interference when using only two tuning instruments. His record was obtained during a period of three months, using a variocoupler, a variable condenser and a UV-200 tube.

Care in erecting his antenna, he thinks, is responsible for part of his record. It is made of two wires each 75 feet long, with a 30-foot lead-in. One end of his antenna is 35 feet high while the other is only 20. He heard CJCB, Nelson, B. C., 2,400 miles away; CJCA, Edmonton, Alta., Can., 2,350 miles; PWX, Havana, Cuba, 1,500 miles; CKCK, Regina, Sask., Can., 1,775 miles; WPA, Fort Worth, Tex., 1,650 miles; WDAF and WHB, Kansas City, Mo., 1,300 miles; WEAV, Rushville, Neb., 1,700 miles, and seventeen other stations more than 1,000 miles away.

* * *

THIRTEEN STATIONS TO THE PINT

"You may not believe it," begins Victor Wade Sandberg of Mont Belvien, Texas, "but I receive thirteen stations with a crystal and a coil I wound on a pint glass jar."

He is fourteen years old and he made his double-slide tuner himself. The stations he heard, most of them at night, are WEAY, Houston, Tex.; WJB, Austin, Tex.; WFAA, Dallas, Tex.; WBAP, Fort Worth, Tex.; WOAI, San Antonio, Tex.; WHAB, Galveston, Tex.; WHB and WDAF, Kansas City, Mo.; KSD, St. Louis, Mo.; WOC, Davenport, O.; WMC, Memphis, Tenn.; WXY, Birmingham, Ala., and WOS, Jefferson City, Mo.

* * *

WHAT ONE CRYSTAL DID

A CRYSTAL set made entirely at home by C. E. Van Kirk, Saint Paul, Minn., has picked up WOC, Davenport, Ia.; KDKA, Pittsburgh, Pa., and a number of closer stations.

A CRYSTAL DETECTOR ON THE HIGH SEAS

R. H. FREY, chief operator aboard the S. S. *Eilago,* reports hearing WWJ of Detroit, Mich., while listening at the ship's crystal set while the ship was approximately 250 miles southeast of Cape Hatteras, a distance of 1,100 miles.

* * *

GOOD WORK ON A SIMPLE SET

WITH little more than "a rag, a bone and a hank of hair," Edward Foster of Dearborn, Mo., hears 32 stations. He has a wire, a phone, a "hank" of pasteboard tubing and a crystal. The sliding coil tuner is his own make, and with a wire 160 feet long for an antenna, he hears WSB, Atlanta, Ga.; WSY, Birmingham, Ala.; WGY, Schenectady, N. Y.; WFAA, Dallas, Tex., and WHD, Morgantown, W. Va.

* * *

A SINGLE TUBE TAKES HIM A LONG WAY

IN regard to covering great stretches of territory with a single tube, R. E. Jones, Jr., of Bay City, Mich., mentions the fact that his set reaches 2,300 miles to KPO, San Francisco, Cal. In order to cover the distance he employs a single-circuit tuner at the sacrifice of considerable selectivity. He uses a variocoupler and a 23-plate condenser.

In his list of eighty-one stations in twenty-five states are KFI, Los Angeles, Cal.; CHBC, Calgary, Canada; WCAR, San Antonio, Tex.; KFDF, Casper, Wyo.; KFAF, Denver, Colo.; WWL, New Orleans, La.; WFY, Wichita, Kans., and WKY, Oklahoma City, Okla.

* * *

HEARING ACROSS THE PACIFIC ON A GALVANIZED IRON ROOF

USING the roof of his house as his antenna, S. G. Lewis, of Hobart, Tasmania, claims that he has heard signals which came from stations in places as far distant from him as Manila and Panama.

HE LIKES HIS SINGLE CIRCUIT

USING two duolateral coils in a unique regenerative circuit, Frank D. Stagio of Brooklyn, N. Y., says he receives over great distances without interference which is usually encountered in the use of a single-circuit tuner.

He has received KDKA of East Pittsburgh, Pa., with his detector tube alone, and local stations can be heard a dozen feet from his phones.

With a primary coil of 50 turns and tickler coil of 35 turns, he covers all wavelengths from 150 to 600 meters. His two variable condensers, one of which is in the ground circuit, and the other in series with the tickler are of .0005 mfds. capacity.

Using two stages of audio-frequency amplification and a loudspeaker, he receives the following stations loud and clear without interference from local stations: KYW, Chicago; WDAP, Chicago, Ill.; WCX, Detroit, Mich.; WOO, Philadelphia, Pa., and NAA, Washington, D. C.

* * *

HE LIKES ONE STAGE OF AUDIO

WITH but one stage of audio-frequency amplification, Rodney Plimpton of Southbridge, Mass., has heard 22 stations within his first three months.

His antenna consists of one wire 125 feet long, with a 25-foot lead-in. His set employs three honeycomb coils in the usual regenerative circuit.

His best records are WSB, Atlanta, Ga.; WMAQ, Chicago, Ill.; WKAZ, Wilkes-Barre, Pa.; WDAP, Chicago, Ill.; WOC, Davenport, Ia.; WSY, Birmingham, Ga.; 3XW, Parkesburgh, Pa.; WDAR, Philadelphia, Pa.; WMC, Memphis, Tenn.; WOAW, Omaha, Neb., and CFCF, Montreal, Canada.

SURPRISED BY HIS CRYSTAL SET

"A FEW nights ago," writes W. C. Robbins of Okmulgee, Okla., "while listening in with my single-slide crystal set I was surprised to catch the last few bars of *The Star Spangled Banner* played on a violin. I knew of no station near me that was broadcasting that night. I called up the local station and asked if they were broadcasting, and was told that the music had come from Kansas City, Mo. It was hard to believe, as Kansas City is 200 miles away, but I listened again and heard the announcer. I was still more surprised when later I heard a program from St. Louis, Mo., more than 400 miles away.

"I can't always do this, but the fact that it is sometimes possible makes me think that a crystal set is not so much to be despised after all."

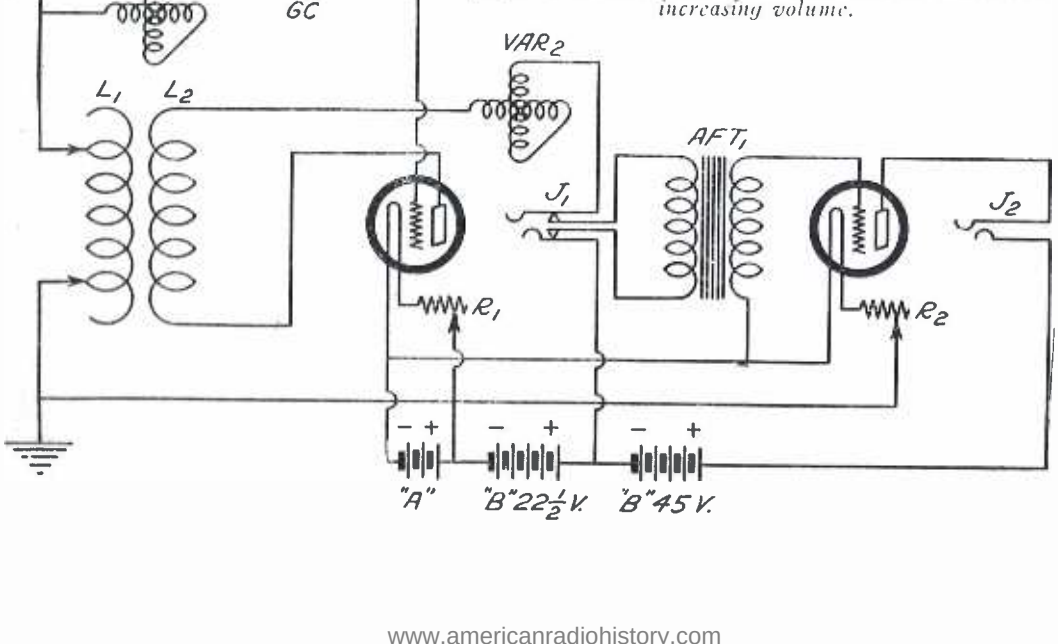
* * *

NAVY HOOK-UP MAKES A RECORD

FROM his home in Mechanicville, N. Y., Robert Irwin reaches to Porto Rico and to Nebraska with two dry-cell tubes, and believes that his luck is due to a navy hook-up which employs a variocoupler, two variometers and a 43-plate condenser in a manner somewhat out of the ordinary.

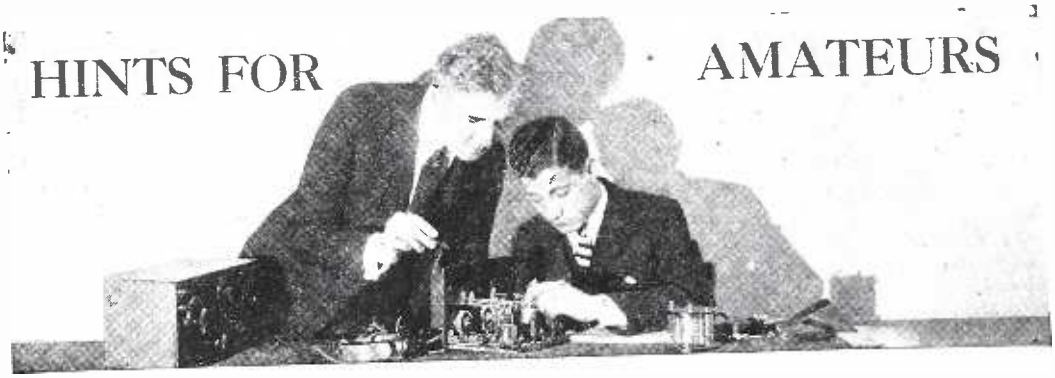
His record includes WKAQ, San Juan, Porto Rico; WOAW, Omaha, Neb.; WMC, Memphis, Tenn.; WDAJ, College Park, Ga.; WSB, Atlanta, Ga.; CFCA, Toronto, Can.; CHYC, Montreal, Can.; WDAP, Chicago, Ill.; KSD, St. Louis, Mo.; WLAG, Minneapolis, Minn.; WHA, Madison, Wis.; WHAS, Louisville, Ky.; WWJ, Detroit, Mich., and WDAL, Jacksonville, Fla.

All of the stations he hears except WKAQ, were received on one tube. His single stage of audio-frequency amplification increases their volume, however.



A novel circuit for two tubes which employs two variometers and a variocoupler and makes use of regeneration for increasing its reception range. One stage of audio-frequency amplification is added for increasing volume.

HINTS FOR AMATEURS



In finishing a radio cabinet with an open grained wood such as chestnut, ash or oak, it is a comparatively easy job to give it an antique gray finish. This finish is permanent and has a good appearance.

Rub the wood down with a little linseed oil, and clean off with a cloth until the surface of the wood is dry. Then fill the grain of the wood with a filler made of white lead mixed with lampblack so that it is colored a light gray.

When the filler has hardened in the grain the whole surface should be rubbed down again, with fine sandpaper, until it is smooth and then a wax finish put on with a cloth.

* * *

Never run the antenna lead-in any long distance through the house. Make it as short as possible from the window where the wire is brought in. If the lead-in is long inside the house the walls and ceilings will absorb most of the radio-frequency energy that should be used in the set for producing signals; in other words the signals will be much reduced in strength.

Place the receiving apparatus near the window and run the ground wire to a *waterpipe!*

* * *

Gassy tubes such as used for detectors function at plate voltages between 16½ volts and 22½ volts; usually they function best at a plate potential of about 18 volts.

Hard tubes, when used as detectors usually function best at plate potentials of about 45 volts and as amplifiers at plate potentials of 90 volts or more according to the type of tube used.

* * *

Do not paint any of your radio instruments or coils; leave them dry.

* * *

When a 100-foot antenna is specified for use with a certain receiving set, the 100-foot length refers to the length from the spot where the lead-in joins the horizontal wire to the furthest tip of the antenna.

To illustrate: In an antenna with a horizontal wire 100 feet long, if the lead-in were taken off at one end, the antenna would be referred to as a 100-foot antenna. If the lead-in were taken off at the center, the antenna would be only a 50-foot antenna. It would have about the same characteristics as a two-wire antenna 50 feet in length.

* * *

When using SCC copper wire to wind coils for a receiving set, be sure that the insulating wrapping of cotton is not damaged, as this may cause two adjacent turns of wire to short-circuit. If two turns do touch in this manner, the radio-frequency currents induced in the coil will induce a heavy secondary current in the short-circuited part which will drop the voltage across the whole coil so that the signal strength will be materially lowered. *Do not damage the insulation when winding the coils.*

It will assist in obtaining quiet reception, without any extraneous noises, in a radio receiver, if a .5 mfd. fixed condenser is connected across the "A" and "B" batteries as shown in the diagram on this page.

* * *

Be sure that you obtain a good grid condenser and reliable grid leak, as these two instruments, more than any others in the set, will determine the sensitivity of the receiver as a whole.

* * *

When trying out a receiver for the first time, try out one tube in each of the sockets, one socket at a time, with all the batteries connected. In this way, if you have made a wrong connection, you will burn out only one tube instead of all the tubes in the set; but first make sure that you have everything hooked up correctly.

* * *

Do not erect your antenna either over or underneath any sort of power wires, because the power wires may carry a dangerous voltage, and if they or the antenna fall while the set is being used the operator may receive a serious shock.

* * *

Never charge your battery without disconnecting it from the receiving set. If you leave it connected to the set, and turn on the charger, you may expect to blow out the line fuses, or the tubes. This is because one side of the lighting line is grounded, and as the filament circuits in most receiving sets are also at ground potential, you may expect to see or hear fireworks.

* * *

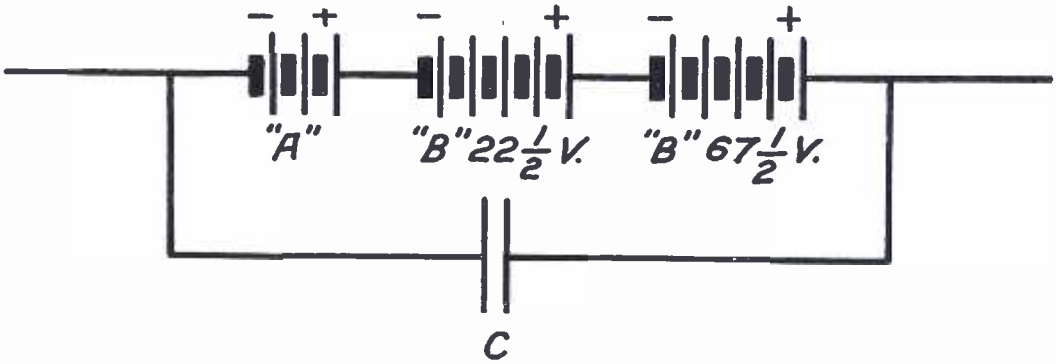
Do not oil the levers on the rheostats used in the set for making contact with the resistance unit. This will finally result in "frying" noises in the receivers, due to the varying resistance junction formed when the oil heats up and carbonizes. The rheostats now on the market are correctly designed to work without any form of lubrication between the lever and the resistance wire.

* * *

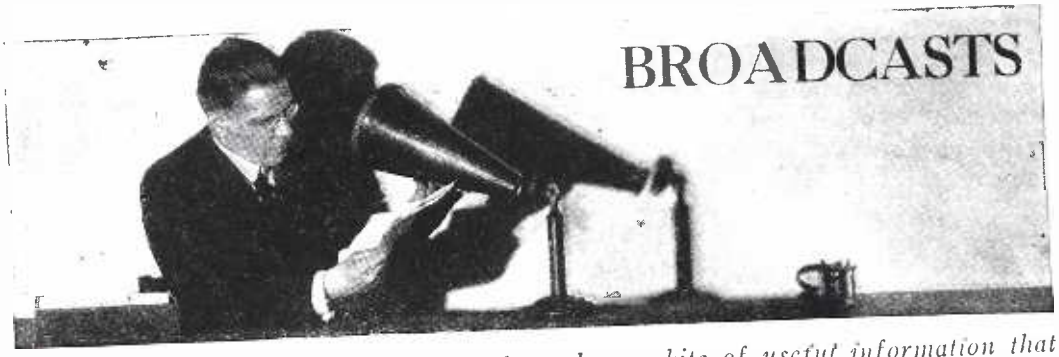
A loop antenna cannot be used with any real success with a crystal detector or non-regenerative vacuum-tube circuit unless used in conjunction with radio-frequency amplifiers. A regenerative vacuum-tube circuit will give only fair results with a loop, for local reception, unless it is used with audio-frequency amplifiers.

* * *

Don't try to make an amplifying transformer for audio-frequency amplification. In the end you will give yourself a lot of trouble and will be able to produce an instrument of only inferior quality. Buy one of the reliable standard makes and get a good instrument.



A fixed condenser, of approximately one-half microfarad, connected across the "A" and "B" batteries will keep out battery noises from your set.



BROADCASTS

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

Radio Announces the President's Death

ONCE again radio played an important part in the dissemination of news of a national character, when President Harding died in San Francisco on August 2nd. The President's death occurred at 7.30 P.M., Pacific time, and the Associated Press had the story out within five or ten minutes, the report being received at the Washington office of that organization at 10.55 P.M., eastern standard time, or twenty-five minutes after Mr. Harding died. The first intimation the general public had of the President's death, however, was when various newspapers with broadcasting licenses sent out the Associated Press dispatch. As a result of the broadcast announcement, the news of the President's death was generally known from thirty minutes to two hours before the newspapers in the larger cities were on the street with an extra.

* * *

Have We Passed the Peak in Number of Broadcasting Stations?

THE number of broadcasting stations is apparently subsiding. The peak of the curve of this popular service was reached in May, when 591 stations were on the lists of the Department of Commerce. On June 30, there were 573 or 18 fewer stations than in May, although there were 115 more than in June, 1922.

On June 30 the total of 573 stations was distributed as follows: Class A, 203; Class B, 42; Class C, 327; and Class D (development), 1.

* * *

Radio Saves Uncle Sam $20,163

ALL War Department telegrams, cablegrams and radio messages are handled directly through the Army Message Center, located in the Munitions Building, and under the direction of Major-General George O. Squier, Chief Signal Officer of the Army. An average of 322 messages a day is now handled, the bulk of the dispatches being sent and received by radio. As a financial saving to the government, the Message Center is a unique factor. Through the operation of its radio net it has reduced the telegraph tolls from $5,500 in July, 1922, to $1,650 in March, 1923. Through the use of its radio net, now including 112 stations in every corner of the country, the Message Center handled 62,222 official radiograms, totaling 2,235,417 words, during the last calendar year. If this traffic had been handled over commercial telegraph lines, the cost to the government would have been $38,202, but the army cost was only $18,039, exclusive of enlisted operating personnel. The saving to the country amounted to $20,163.

* * *

The Nine Radio Inspectors

EVERY amateur and broadcaster should know the officials of the Radio Section of the Department of Commerce in his district, so that he can get advice, keep in touch with new regulations and not be imposed upon by bogus representatives.

At headquarters in Washington, Chief Supervisor of Radio W. D. Terrell is in charge under Secretary Hoover and Commissioner Carson. Mr. Terrell is assisted by W. E. Downey, Supervisor of Radio. In the nine districts with headquarters as shown, the following men are in charge:

District	*Headquarters*	*Supervisor of Radio*
1st	Boston	C. C. Kolster
2d	New York	Arthur Batcheller
3d	Baltimore	R. Y. Cadmus
4th	Atlanta	R. Y. Cadmus (until relieved by Van Nostrand)
5th	New Orleans	Theodore G. Deiler
6th	San Francisco	J. F. Dillon
7th	Seattle	O. R. Redfern
8th	Detroit	S. W. Edwards
9th	Chicago	E. A. Beane

* * *

Broadcasting Stations Break Into Mexico

Two radio-telephone broadcasting stations were recently opened in Mexico City, Consul Thomas D. Bowman, reports. Various efforts have been made in recent months to obtain concessions for the establishment of such stations, but it is only recently that the government granted permission. It is reported that other broadcasting stations are to be erected in Mexico.

"What panel shall I use?"

ONE of the first questions you probably will ask yourself when you get ready to build your radio set will be about the choice of a good panel. Your answer will determine, to a large extent, the efficiency of your set.

Of course you want a panel that has superior insulating properties. Celoron Radio Panels are used by fans who appreciate the value of a good radio panel. They have high dielectric strength and great volume and surface resistivity. Celoron panels are uniform in quality, and do not warp or crack.

You will find Celoron panels easy to saw, drill, and tap. They engrave evenly without feathering, and enable you to build a set that is neat and attractive as well as efficient.

Approved by Uncle Sam

Celoron Radio Panels are approved by the U. S. Navy Department Bureau of Engineering and the U. S. Signal Corps. Many of the leading manufacturers of radio equipment use Celoron in their standard parts.

Each panel is wrapped separately in glassine paper and carries complete instructions for working and finishing. Ask your dealer for one of the following sizes:

1—6 x 7 x $\frac{1}{8}$	5—7 x 18 x $\frac{3}{16}$
2—7 x 9 x $\frac{1}{8}$	6—7 x 21 x $\frac{3}{16}$
3—7 x 12 x $\frac{1}{8}$	7—7 x 24 x $\frac{3}{16}$
4—7 x 14 x $\frac{3}{16}$	8—12 x 18 x $\frac{3}{16}$

We also furnish Celoron in full-sized sheets and can cut special sizes if desired. If your dealer has not yet stocked Celoron panels, ask him to order for you, or write direct to us. Indicate by number the size you want.

Send for free booklet

Our booklet, "Tuning in on a New World," contains a list of the leading broadcasting stations in the United States and Canada, several efficient radio hook-ups, and an explanation of the symbols used in radio diagrams. Write at once and be sure of getting yours before the supply is exhausted.

To radio dealers: Send for special dealer price list showing standard assortments

Diamond State Fibre Company

BRIDGEPORT (near Philadelphia) **PENNSYLVANIA**

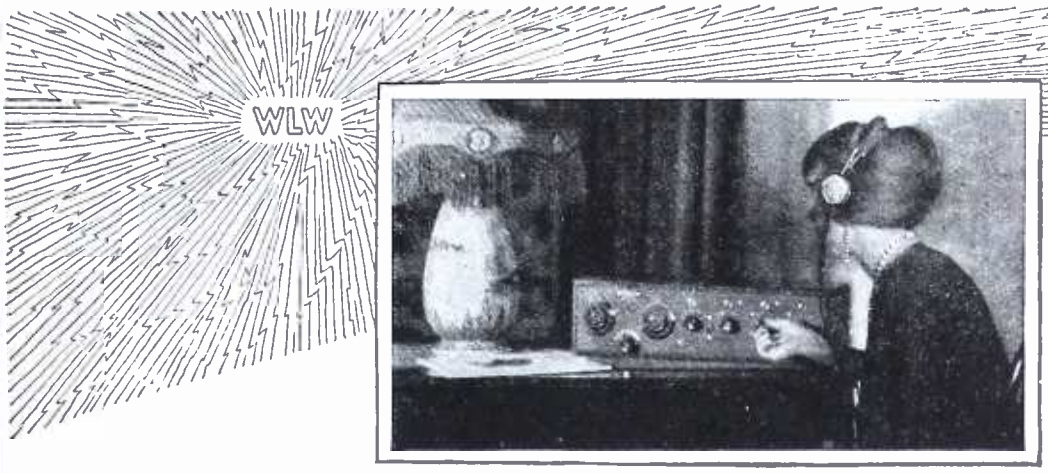
BRANCH FACTORIES AND WAREHOUSES

BOSTON CHICAGO SAN FRANCISCO

Offices in Principal Cities

In Canada: Diamond State Fibre Company of Canada, Limited, 245 Carlaw Ave., Toronto

CONDENSITE CELORON STANDARD RADIO PANEL



Announcing—
THE NEW CROSLEY MODEL X-J
PRICE $65.00

The Crosley Model X, has in just a year's time established itself as the most popular and successful receiver ever marketed. Hundreds of unsolicited endorsements like the following constantly come to us. A man writing from Belleville, Kansas says:

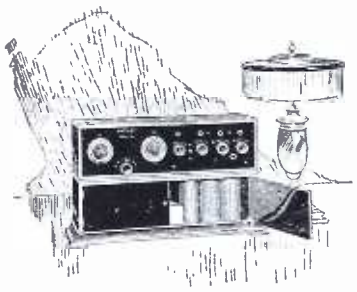
"I have found the Crosley Model X to be the best radio receiving set I have used and permit me to say that I have been interested and using radio sets since spring of 1922 including all standard makes."

Now comes a companion, the new Crosley Model X-J, embodying all the good points of the Model X together with greater refinement of detail. Some of the new features of this wonderful receiver which make for greater distinction and beauty are:

1. ***KNOBS AND DIALS***—larger, easier to control and better looking.
2. ***FILAMENT CONTROL SWITCH***—snaps filaments on and off.
3. ***JACK***—allows you to plug in with head phones on three tubes. When tuned in, just pull the plug and you are switched to the loud speaker.
4. ***ELIMINATION OF BINDING POSTS ON FRONT PANEL.*** By removing the binding posts to the rear, the beauty of the set is greatly enhanced.
5. ***SOCKETS***—Porcelain sockets are replaced with black compound sockets which are just as efficient and better looking.
6. ***CONDENSER***—The New Molded Crosley Condenser made of specially prepared compound will out-perform any condenser on the market.
7. ***MULTISTAT***—Allows the use of all makes of tubes. (Now a feature of the standard Model X).
8. ***RFTA COIL***—New low resistance coil permits sharper tuning.

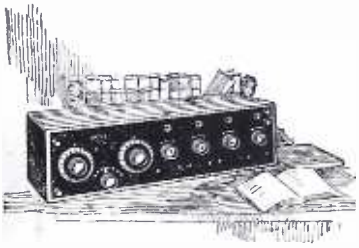
Write for Descriptive Pamphlet

For Sale By Good Dealers Everywhere



CROSLEY MODEL X-J
With Battery Cabinet

This combination makes the set completely self-contained. The batteries are housed in this handsome mahogany, wax finished cabinet. Price of cabinet alone—$16.00.



CROSLEY MODEL X

This remarkable receiver—still priced at $55.00—contains many new features such as the R. F. T. A. Coil and the Multistat. The battery cabinet, illustrated above, may be fitted to it, thus adding to its present beauty.

CROSLEY MANUFACTURING CO.

1016 Alfred Street **Cincinnati, Ohio**

New York Office, C. B. Cooper, 1803 Tribune Building, 154 Nassau street, Beekman 2061
Boston Office, B. H. Smith, 755 Boylston street, Room 316.
Chicago Office, 1311 Steger Bldg., 28 E. Jackson Blvd., R. A. Stemm, Mgr.
Philadelphia Office, J. H. Lyte, 65 North 63rd street.
St. Louis Office, Rob't W. Bennett Co., 1326 Syndicate Trust Bldg.

CROSLEY

Better-Cost Less Radio Products

The Greatest Advance in Radio Since Radio

Weighs 6 lbs.

6″ square

PATENTS PENDING

BASUB uses electric light current (AC) in place of storage battery or dry cells for the "A" battery of any radio set for radio frequency, detection, and audio frequency

Buy a Basub power unit for your present set, or have your new set furnished with Basub built in as an integral part, and so insure uniform voltage and consistent service without recharging or testing.

No tubes, acids or sulphated terminals.
Can be mounted in any position.
Furnishes 75 watts output.

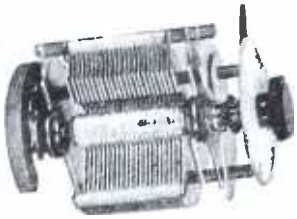
Various models to cover the entire field of commercial voltages and cycles, $30 to $35.

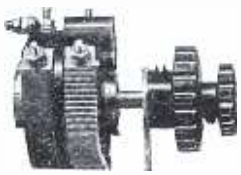
If your dealer hasn't Basub, send us his name and address

Simplex Electrical Laboratories, Inc.

144 Livingston St., Brooklyn, New York City

We will Exhibit at Booth 58, American Radio Exposition, Grand Central Palace, New York City, October 6th to 13th, 1923





Whether You "Build Your Own" or Buy Complete Sets— Rely on De Forest!

BEFORE anyone else was thinking of radio, nearly a quarter of a century ago, Dr. Lee De Forest was doing the first radio broadcasting.

All during the development of the art the De Forest Company has been making the laboratory tested parts, out of which experts all over the United States made their experimental sets.

When radio became popular the people in general found out that if a part was marked "De Forest"—it *worked.*

During the "rush months" when radio production couldn't catch up with the demand, De Forest parts were still manufactured with that painstaking care and exactness and knowledge of electrical science which mean the best possible kind of service to the user..

The De Forest name has always been too famous for the De Forest Company to allow anything to go out which was not laboratory tested and guaranteed to function.

Ask the De Forest Agent to show you the laboratory tested De Forest parts. Ask him to tell you about the various hook-ups which are possible. If you are interested in complete sets let him show you the famous De Forest Reflex, whose range on indoor-loop varies from 1,500 to 3,000 miles, according to atmospheric conditions, and which is known all over the country for clearness of reception and unusual ease of control.

Whether you "build your own" or buy complete sets, rely on De Forest —the most famous name in radio.

Send us a postcard for the free De Forest catalog with complete details of sets, parts, and the perfected De Forest dry cell and wet cell audions.

DE FOREST RADIO TEL. & TEL. CO.
Dept. P. R. 2 Jersey City, N. J.

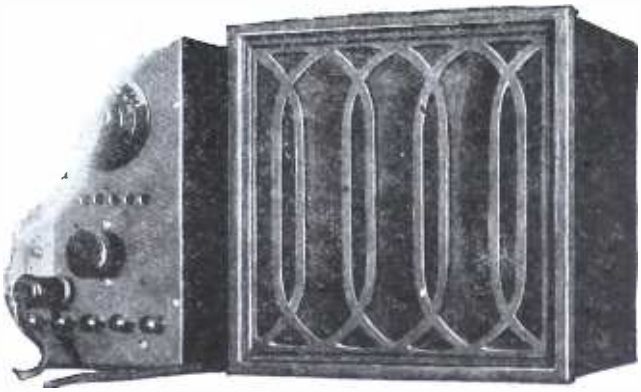
If located west of Pennsylvania, address

DE FOREST RADIO TEL. & TEL. CO.
WESTERN SALES DIVISION
Dept. P. R. 2, 5680-12th St. Detroit, Mich.

De Forest Products are sold only through exclusive agents, direct to the public for your protection. The De Forest Company will be glad to hear from representative dealers in various communities who wish to become exclusive De Forest agents.

Illustrated above are the De Forest Vernier Variable Condenser, $15.60; the De Forest Combination Audion, $5.00; the De Forest Tube Socket, 80c., and the De Forest Combination Rheostat and Potentiometer, $2.00. Prices plus approximately 6% for transportation west of the Rockies.

The new Timmons Talker with stationary magnet. The Gothic scroll design is the same as the adjustable type. Price $25.



The Most Beautiful Loud Speaker in the World

Just as the phonograph had to develop from its many shaped horn stage, so is radio going ahead right now.

Today the radio cabinet with its polished panel, knobs and hand stained wood, belongs in the room with the piano and phonograph; but the loud speaker—is it also at home there? Or does it appear out of place, grotesque or gawkish?

Our thought in designing Timmons talkers was to make them beautiful in appearance as well as in tone.

Both types have a finely executed grill of Gothic design. Similar to the talker cabinet, these have a rich hand-rubbed mahogany finish. Type "A" (adjustable) has a bronzed screen and dial, while the other, type "N" (non-adjustable) has a copper color screen of material similar to silk but much stronger.

Both talkers use the principle of reflected tone—that is—two horns, both, however, are hidden behind the screen. These horns are metal, one of them—the reflecting horn—is finished with "accousticoat," a substance which is built layer upon layer and makes it less liable to false vibrations and distortions than any wooden horn.

But let your dealer show you both Timmons talkers, then hear them; you will know that we actually have made Timmons talkers beautiful in tone as well as in appearance.

Your dealer has the new Timmons talker folder "Volume Without Noise"—or write us.

The adjustable type which now has a grill of Gothic scroll design backed by a screen of light gold color. Price $35.

Note in the illustration how the lines of Timmons Talkers are in harmony with those of all radio sets—there's no jarring conflict of shapes.

J. S. TIMMONS

339 East Tulpehocken St.
Germantown, Phila., Pa.
Manufacturer of Radio and Loud Speaking Telephone Apparatus

Silent Circuits

CLARITY of speech and music can only be accomplished thru the use of well designed RADIO PARTS. Absolutely dependable insulation is a requisite of first importance.

Radio, a science of high frequencies and electrical stresses, requires perfect insulating materials to eliminate the leaks and losses solely responsible for noisy circuits.

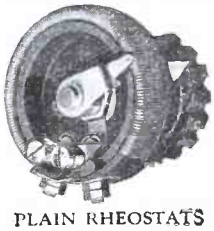
GENUINE BAKELITE parts insure an efficiency resulting in perfect, SILENT CIRCUITS.

TUBE SOCKETS
R730 Standard Tube Socket
R732 UV-199, C-299 Socket
Genuine Bakelite Base, furnished either in Black or Mahogany.

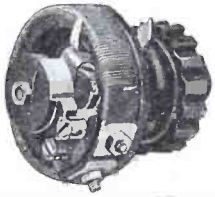
RHEOSTAT DIALS
R294 White Dial
R295 Black Dial
Knobs of genuine Bakelite; Black or White Face Dials.

INDUCTANCE SWITCHES
R750 White Dial
R751 Black Dial
Made of Moulded Bakelite; Beautifully designed knobs and dials.

SWITCH LEVERS
R773 1½ in. Lever
R774 1¾ in. Lever
R775 1 in. Lever
Black or Mahogany Bakelite knob; Highly polished finish.



PLAIN RHEOSTATS
R630 6.5 ohms
R632 25 ohms
R634 40 ohms
Furnished either in Black or Mahogany Bakelite.



VERNIER RHEOSTATS
R631 6.5 ohms
R633 25 ohms
Genuine Bakelite; vernier control gives micrometer adjustment of resistance.

KING QUALITY
ALL THE NAME IMPLIES
RADIO APPARATUS
Radio Apparatus Division
KING SEWING MACHINE CO., Buffalo, N.Y.

A New Thrill!

Listen-In Tonight with a Kellogg Head Set

Clear reception with plenty of volume is necessary to satisfactorily hear distant stations.

Kellogg head sets should not be classed as ordinary radio receivers. Today Kellogg stands foremost in the manufacture of a high-grade head set that actually surprises listeners in comparitive tests.

Maximum volume, unusual clearness, extreme lightness in weight, are a few of the many outstanding advantages. The head band is unusually light, though durably built.

The magnets are of special tested steel and hardened by our own special method which controls the heat and time electrically and mechanically, eliminating any possible variation.

The magnet windings are of great accuracy, the mountings, end plates, wire, insulation, etc. are of the highest grade.

Our twenty-five years experience in building receivers for telephone work has proven invaluable in turning out a real radio receiver of merit.

Listen-in tonight with a pair of Kellogg receivers and get a new thrill from your radio set. With Kellogg radio equipment, USE Is The Test.

Kellogg Switchboard & Supply Company

CHICAGO

COLUMBUS KANSAS CITY SAN FRANCISCO PORTLAND

Kellogg apparatus exclusively is used in building The Symphony Receiver

"RED-HEAD"

—a triumph in radio receiver design

HERE'S what we say about "Red-Heads"— they're EXTRA-ORDINARY radio receivers. We believe they're the best receivers on the market today. Superlatives are easy to say and hard to back up. Here's how we back up ours. We GUARANTEE that you'll like "Red-Heads." You take no risk in buying them. We'll refund your money plus postage if you don't agree with us after trial.

"Red-Heads" are the lowest priced, high-grade, aluminum-backed receivers on the market. Nine years of receiver experience are behind their quality.

What One User Says

Waupun, Wis., July 26, 1923

The Newman-Stern Co.,

Gentlemen: In 1915 I purchased a pair of your "Red-Head" phones. This pair of phones was one of the first you put out. They are still in good condition and, I believe, beat most of the other phones on the market. Very truly yours,

D. J. SAXON.

And "Red-Heads" are better today than they ever were.

READY NOW! *The New 1924 Model F— 3000 Ohms*

The new Standard "Red-Heads" have ELEVEN improved features—new this year. Beautiful and graceful in appearance; light in weight; aluminum case; the famous brown-red ear caps; military headband; high-grade cord; exquisitely sensitive and line toned. 3000 OHMS PER PAIR.

At your dealer's or prepaid on receipt of price. Per pair, Complete **$6.50**

THE NEW "RED-HEAD" JR. *2000 Ohms*

Makes its bow to the public this year in response to a demand for an extra fine 2000 Ohm phone. A remarkable production with the same workmanship and guarantee as on our standard Model F. Complete with headband and cord.

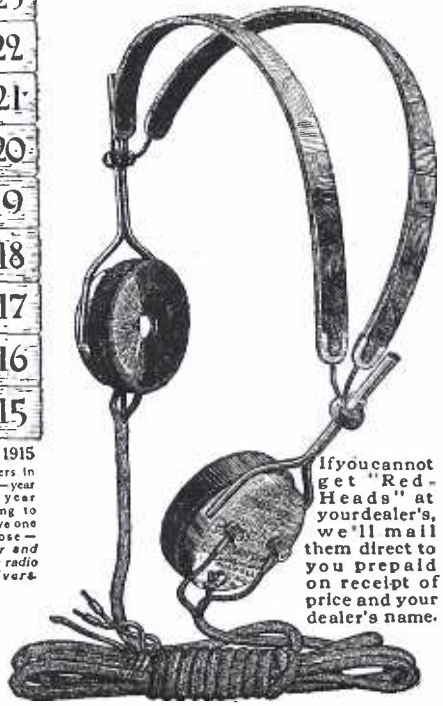
At your dealer's or prepaid on receipt of price. Per pair, Complete **$5.00**

THE GUARANTEE

Money back if after 7 days trial you're not satisfied that Red-Heads are the BEST receivers on the market at the price.

Since 1915
Pioneers in Radio—year after year striving to achieve one purpose—*better and better radio receivers.*

The Newman-Stern Co.
Dept. PR., East 12th St., Cleveland, O.



If you cannot get "Red-Heads" at your dealer's, we'll mail them direct to you prepaid on receipt of price and your dealer's name.

"Since the Dawn

of intelligence the advancement of civilization has been hand in hand with the improvements in methods of communication, until today the world may be considered to be one vast family. This is especially true in relation to the United States and Canada where the art of conveying the human voice from point to point has been developed to a very high degree."

From "The Story of Service"

Your home life and the unity of the family demand that "touch" with the outer world which Radio alone can supply. Satisfaction should be your demand in the purchase of Radio equipment. "Service" Type 212 Radio Receiver *will* give satisfaction. When you operate the set you instinctively "feel" the great distances over which you may bring desired programmes to your home.

Ask your dealer or write us.

This is a TELEFORCE product.

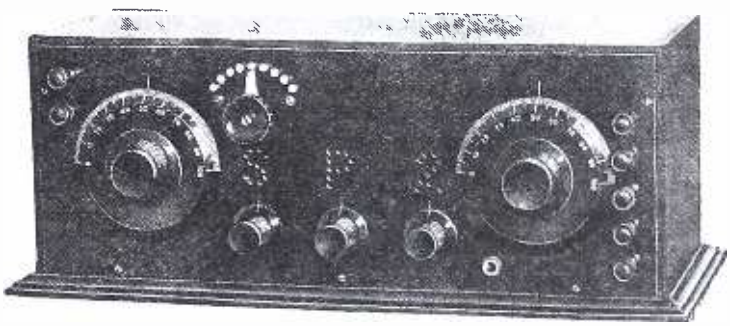
SERVICE RADIO COMPANY

4727 Montgomery Ave.
Dept. D.
Cincinnati, Ohio

S P 2

1. Unlimited range
2. Perfect reproduction
3. Simplicity of operation
4. Genuine entertainment
5. No large antenna needed
6. Beautiful workmanship
7. Factory guarantee

W.E.A.F.	W.H.A.S.
W.O.R.	W.H.B.
K.D.K.A.	W.D.A.P.
W.F.I.	W.W.J.
W.D.A.R.	W.L.A.G.
W.L.W.	W.O.C.
W.S.B.	K.S.D.
P.W.X.	W.H.A.B.
W.J.A.Z.	K.F.C.
K.Y.W.	



THE S. P. 2 Receiver stays sold, minimizes service expenses, unlimited range offering good volume and good distance, absolutely guaranteed. What more can you ask, Mr. Radio Business Man? Your letter head brings our proposition.

Catalogue 101A:—To "Radio Fans" on receipt of 10 cents

PITTSBURGH RADIO SUPPLY HOUSE

963 Liberty Avenue **Pittsburgh, Pa.**

S P 2

Three Aces!

IN the experience of radio engineers, amateurs and experimenters there is a suggestion which clearly points the way to the battery buyer who desires the most fitting and practical combination of electrical energy, low cost per hour of service, long shelf life and uniformity of discharge.

"ASK ANY RADIO ENGINEER"

These "Three Aces," the famous Burgess "B" —the new *double strength* Radio "A" and our latest product, the Vertical "B" Battery are playing an important part in correct and dependable reception of radio broadcast. Each is

"A Laboratory Product"

Good dealers everywhere recommend and sell Burgess Batteries

BURGESS BATTERY COMPANY

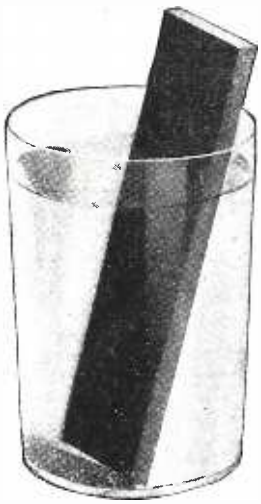
Engineers—DRY BATTERIES—Manufacturers
Flashlight - Radio - Ignition—Telephone

General Sales Office: Harris Trust Building, Chicago
Laboratories and Works: Madison, Wisconsin

Branches: New York Boston Washington St. Paul
Kansas City New Orleans

In Canada:
General Offices and Works: Niagara Falls, Ontario
Branches: Toronto, Montreal, Winnipeg, St. John

The Supreme Insulation



RADION Panels

are impervious to moisture

Moisture is a conductor of radio frequency currents. When a panel or part absorbs moisture from the air it causes short circuits between terminals. These short circuits reduce volume and frequently are the cause of distortion.

Tests have proved Radion Panels impervious to moisture. Try them and notice the difference.

Send 15c. for sample test pieces 2 x 3 inches.

18 Stock Size Panels

Radion being an insulation material especially made for wireless use, has the lowest phase angle difference, lowest dielectric constant, highest resistivity and supreme moisture, gas and acid repelling properties.

American Hard Rubber Co.
11 Mercer St., New York

RADION

Panels-Dials-Knobs-Sockets-Insulators

FORMICA

is used in the new

FREED-EISEMANN

N R Neutrodyne Receiver*

THE panels of the new Freed-Eisemann Neutrodyne Receiver are Formica. This is natural because Freed-Eisemann have long been consistent users of Formica in all their past radio products.

It is the endorsement of leading radio concerns of this caliber from one end of the country to the other that makes Formica so staple and desirable a product for the radio dealer to handle. Amateurs know and want it.

Formica panels may be had promptly in any desired size. It isn't necessary to take a size that some one else wants to sell.

THE FORMICA INSULATION COMPANY
4641 Spring Grove Ave., Cincinnati, Ohio

SALES OFFICES

50 Church Street . . New York, N. Y.
422 First Avenue . . . Pittsburgh, Pa.
1042 Granite Bldg., Rochester, N. Y.
415 Ohio Building. . . . Toledo, Ohio
1210 Arch Street. . . . . Philadelphia, Pa.
1819 Lyndale Ave., S. Minneapolis, Minn.
Sheldon Building. . . . San Francisco, Cal.
Whitney Central Bldg. . . . New Orleans.
414 Finance Bldg. . . Cleveland, Ohio
9 S. Clinton Street . . . Chicago, Ill.
313 Title Building . . Baltimore, Md.
47 King Street. . . . Toronto, Ontario

*Reg. U. S. Pat. Off.

FORMICA
Made from Anhydrous Redmanol Resins
SHEETS TUBES RODS

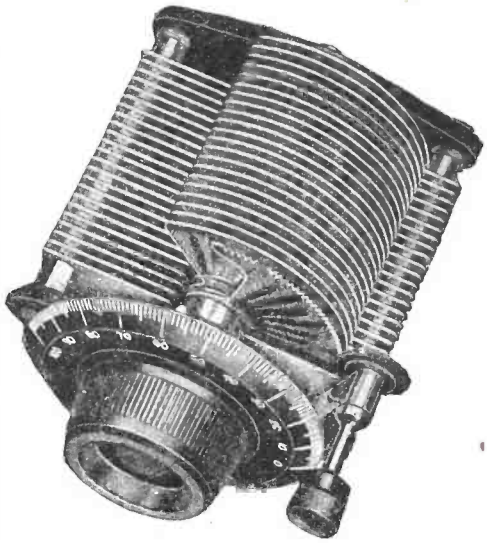
Send 50c for this FADA NEUTRODYNE BOOK

It tells in simple language how to construct a Neutrodyne circuit receiver using FADA parts. Nothing is left in doubt. Both four and five tube Neutrodyne wiring diagrams are included. In addition, in the rear of the book there are both four and five tube full size paper panel drilling templates.

This 32-page book and the use of FADA Neutrodyne and standard parts will insure successful Neutrodyne circuit receiver construction.

F. A. D. ANDREA, INC.
1581-D JEROME AVE., N. Y. C.

The special FADA Neutrodyne parts including three Neutroformers, two Neutrodons and the HOW-TO-BUILD-IT book sell for $25.00.



Radiant Condensers

Tempered Plates

THE greatest condenser trouble—*warped plates*—is made IMPOSSIBLE in *Radiant Condensers*. No more readjusting, bending and makeshift supports. Both the rotating and stationary plates are PERMANENTLY FLAT as a straight edge———. Flattened under powerful presses, and tempered by a new process, the plates of *Radiant Condensers* are unaffected by temperature changes. You can identify *Radiant Condensers* by the radiating rays design on rotary plates. *Permanent alignment is "the best condenser buy."*

Geared Vernier

Infinitely fine control of this delicate adjustment. Micrometer accuracy without special effort. Neat, smooth-working, trouble-proof gear. Another advantage for the price of just an ordinary condenser.

Write for illustrated booklet and the name of the nearest Radiant dealer.

PRICES
Vernier Type

13 Plate including 2⅞" dial and knob. **$5.00**
25 Plate including 2⅞" dial and knob. **5.50**
45 Plate including 2⅞" dial and knob. **6.50**

Jobbers and Dealers Write Immediately for Proposition

HEATH RADIO & Electric Mfg. Co.

204 First Street
Newark, N. J. U. S. A.

Magnavox Radio

Reproducers and Amplifiers

IT has been the dream of every Radio user to own in one unit a Power Amplifier and electro-dynamic Reproducer, thus insuring perfect radio reproduction. The new instruments of the unit type here illustrated in one and two stages of amplification may be had through dealers everywhere.

New Magnavox Combination Set A1-R

There is now a Magnavox for every receiving set. The full line embraces:

Magnavox Reproducers

R2 with 18-inch curvex horn . . .	$60.00
R3 with 14-inch curvex horn . . .	35.00
M1 with 14-inch curvex horn. Requires no battery for the field	35.00

Magnavox Combination Sets

A1-R consisting of electro-dynamic Reproducer with 14-inch curvex horn and 1 stage Amplifier . . .	59.00
A2-R consisting of electro-dynamic Reproducer with 14-inch curvex horn and 2 stage Amplifier . . .	85.00

Magnavox Power Amplifiers

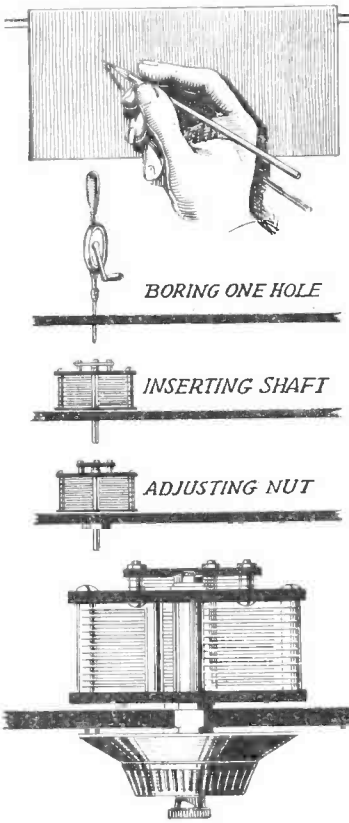
A1—new 1-stage Power Amplifier . .	27.50
AC-2-C—2-stage Power Amplifier . .	55.00
AC-3-C—3-stage Power Amplifier . .	75.00

The new Magnavox semi-dynamic Reproducer M-1, designed for dry battery receiving sets, is also of great interest to radio users. Write for complete catalog.

THE MAGNAVOX CO., Oakland, Cal.

***New York Office:* 370 Seventh Avenue**

PERKINS ELECTRIC CO., LTD., MONTREAL, CANADIAN DISTRIBUTORS



RATHBUN

SINGLE-HOLE MOUNTING

SUPERIOR CONDENSERS

QUICKER and easier to mount. No template, no danger of spoiling panels. Shafts exactly at right angles to panel so that the dial runs perfectly true. Positive contacts made SEPARATELY from vernier and rotor shafts. No current through bearings, hence no noise, no loss. The vernier turns inside the rotor shaft but is absolutely independent. These are but a few of the many points of Rathbun superiority—points of added value.

LIST PRICES—RATHBUN CONDENSERS

with Knob and Dial

11 Plate	.00025	Mfd.	$4.50
23 "	.005	"	5.00
43 "	.001	"	6.00

Write TODAY for the name of the nearest Rathbun dealer and for illustrated literature.

RATHBUN MANUFACTURING CO.
Jamestown, New York

RHAMSTINE*

Electric Soldering Iron

For Home or Laboratory

Specially designed for radio fans and experimenters. Attractively finished in nickel; heating element Nichrome resistance wire; soldering tip, when worn can be quickly and cheaply replaced. Use with either D.C. or A.C. Guaranteed one year. And like all Rhamstine products quality is combined with low price.

$2.50

Postpaid
Complete with 6 ft. cord, two-piece plug and self-fluxing solder.

You've always wanted an electric soldering iron; you need one for radio work, and here's your opportunity to get one specially adapted to the purpose. The Rhamstine* name guarantees quality and satisfaction.

Send $2.50 and we'll send it postpaid; or if you prefer, we'll send it Parcel Post, collect.

J. THOS. RHAMSTINE,* 2162 E. Larned St., Detroit, Mich.

** Maker of Radio Products*

"I traveled 20,000 miles in one evening!"

Mr. M. J. Doherty, of Oak Park, Ill., writes: "Many nights I hear Station KHJ (Los Angeles), CFCN (Calgary, Canada), WEAF (New York) and others as far away. In one evening I heard 30 stations, a total distance of 20,575 miles from my home."

Many wonderful and unsurpassed distance records have been made during 12 years' wide use of Tuska-made radio instruments.

Tuska Popular No. 225

3-bulb Regenerative Receiving Set. Piano finish mahogany cabinet. Amplifier switch. Concealed binding posts. Armstrong circuit, licensed under Patent No. 1,113,149. Price $75, without bulbs, batteries or loud speaker. Ask for special circular No. 15-D, describing this set.

Let the day's troubles sink with the sun

THEN turn to your Tuska Radio, and be whisked around the world. A touch of the dials, and you are in Davenport. A slight movement brings you to Philadelphia to hear the majestic music of the greatest organ. Or *anywhere* you please to go. In those precious hours between work and sleep, you live in Radio Fairyland, where you are master of distance and ruler of a host of entertainers.

Will you give your family the pleasures of Tuska Radio, which educates, soothes, amuses, and takes you traveling inexpensively? Here is the receiver that annihilates miles; bringing in music and voices sweetly, clearly and undistorted. It is the ideal set for busy people who want the thrills of radio without the tinkering.

For 12 years, Tuska Radio has been famous for advanced design and painstaking New England workmanship. The Tuska receiving set of to-day is not only up to date; it will still be serviceable in five years.

THE C. D. TUSKA CO., Hartford, Conn.

TUSKA RADIO

Every Question ANSWERED for only $1

At last you have under one cover a Complete Radio Handbook

JUST OUT
562 PAGES

Compiled by
HARRY F. DART, B.S.E.E.

Formerly with the Western Electric Co., and U. S. Army Instructor of Radio.

Technically Edited by F. H. DOANE

NO more need you turn from book to book, hoping to find what you want. It is all here, in 562 pages crammed full of every possible radio detail. Written in plain language, by engineers for laymen. Clears up the mysteries, tells you what you want to know. A complete index puts everything within your reach in a few seconds.

IT EXPLAINS: Electrical terms and circuits, antennas, batteries, generators and motors, electron (vacuum) tubes, every receiving hook-up, radio and audio frequency amplification, broadcast and commercial transmitters and receivers, super-regeneration, codes, license rules. Many other features.

Under one cover. Yes, it is all in one volume of 562 pages of clear type with hundreds of diagrams and illustrations. Takes the place of eleven or more specialized texts, each costing from two to ten times the dollar you pay for this single book. Belongs in every radio-equipped home, on every amateur's table.

Send $1 to-day and get this 562-page I. C. S. Radio Handbook—the biggest value in radio to-day. Money back if not satisfied.

— — — — — TEAR OUT HERE — — — — — —

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 8254, Scranton, Penna.

I enclose One Dollar. Please send me—postpaid—the 562-page I. C. S. Radio Handbook. It is understood that if I am not entirely satisfied I may return this book within five days and you will refund my money.

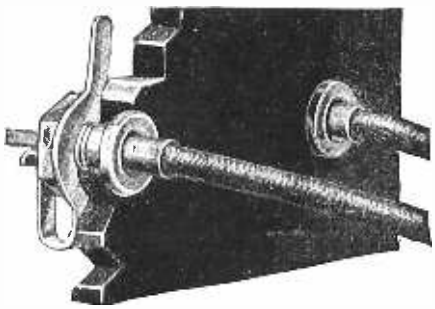
Name.....

Address.....

For All Temporary Hook-ups

UNION RADIO

TIP JACKS



Cost Only 25c a Pair

They give you quick, positive connections for all hook-ups—when you are building your own set or are experimenting with new circuits.

They can be attached to all standard thicknesses of panels. The bushing is ¼" in diameter and fits a $\frac{17}{64}$" hole. Will grip all wires from 24 B & S gauge up to antenna wire, battery leads, loading coils and vacuum tube lugs.

No parts to chip, lose or deteriorate. All parts heavily nickeled.

Other Guaranteed Parts

Dial adjusters for minute variations in capacities of variable condensers. Price 60c.

Variable Condensers. Famous for performance. Without dials, 3 Plate—$1.00; 13 Plate—$2.00; 23 Plate—$2.30.

Tube sockets of molded condensite highly polished. Phosphor Bronze contact springs. Reinforced bayonet slot prevents breakage. Accommodates all standard tubes. Price 75c.

Should your favorite Radio Store not carry Union Radio Tip Jacks and Guaranteed Parts send your order direct to us, also write for your copy of "The Union Radio Catalog A."

Retailers and Wholesalers

Samples of our guaranteed, reasonably priced "Quality Products" sent on request. Our terms and trade discounts are liberal. Write for our proposition.

UNION RADIO CORPORATION
200 MT PLEASANT AVENUE, NEWARK N.J.
NEW YORK OFFICE 116 WEST 32 STREET

Symphony at your Fireside!

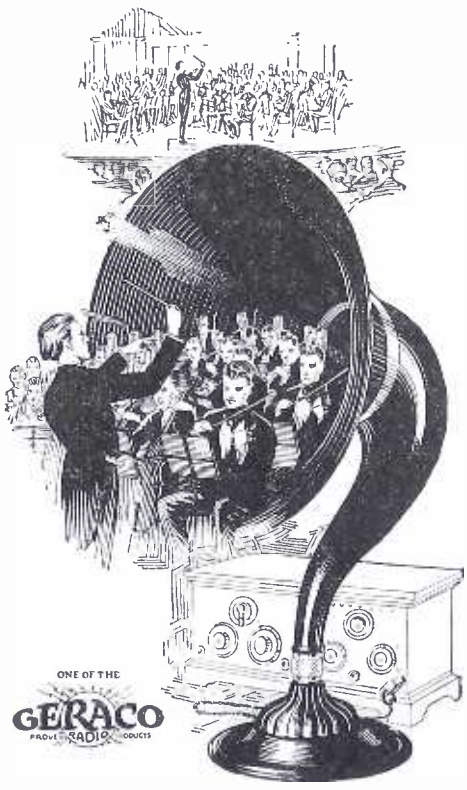
FINER music is now being broadcast. Let your whole family hear it—for both pleasure and musical education—through radio's marvelous medium, MUSIC MASTER.

Concerted band and orchestra numbers flow from MUSIC MASTER with the same clearness and fidelity of tone as the human voice or single instrument. Music at its grandest!

MUSIC MASTER is true to tone; unrivaled in clarity. It does not squawk, grate, vibrate or warp sound. Experts on acoustics, in long study, have eliminated those reproducer-faults and the result is perfection.

But hear! That is the test. Listen to MUSIC MASTER at the home of a radio-friend or at your dealer's. Let it speak for itself!

JOBBERS and DEALERS: Write for full description of the entire GERACO Line and prices.



14-inch Horn for the home $30

21-inch Horn for Concerts and Dancing $35

GENERAL RADIO CORPORATION

Makers and Distributors of High-Grade Radio Apparatus

CHICAGO PHILADELPHIA PITTSBURGH

S. W. Cor. 10th & Cherry Sts.

Music Master

RADIO REPRODUCER

The "B" Battery is the Life of Your Radio Set

THIS IS NUMBER ONE OF A SERIES

THE only function of your Radio set is to produce sound-waves—those mechanical disturbances in the air caused by some rapidly vibrating body. So far as the Radio set itself is concerned the actual source of the sound is the "B" Battery. It is not an exaggeration to say that the "B" battery is the "life of your Radio"; for the set itself is simply a device to reproduce sounds, and the sounds all have their origin in the "B" Battery.

The "B" Battery is simply a box full of electrical energy; harnessed for you by experts. Without the Radio wave the flow of energy from the "B" battery is smooth, steady and *silent*. It is the final aim and purpose of all the many parts which go to make up a Radio receiving set, to convert the otherwise steady flow of electrical energy from the "B" Battery, into a rippling, vibrating, throbbing, audible current.

As the sound-waves—whether caused by the human voice in talking or singing, or by musical instruments—are modulated up and down—now high—now low; so does the current from the strongly vital "B" Battery follow the modulations and the variations, so that the original message, in all its delicacy of tone and vibration, comes clear and distinct through your Radio set.

Not a mere adjunct to the pleasure-giving quality of your Radio set is the "B" Battery—instead, it is the vital, life-giving part—the very heart of your Radio set.

Do not slight this vital part—give your Radio set the advantage of the best—use Eveready "B" Batteries.

Note: This is No. 1 of a series of informative advertisements which will appear in this Magazine. They are designed to help Radio users get the most out of their Batteries and Radio sets. If you have any battery problem, write to G. C. Furness, Manager Radio Division, National Carbon Co., Inc., Long Island City, N. Y.

The *New* Metal Case Eveready "B" Battery

(No. 766)

"The Life of Your Radio"

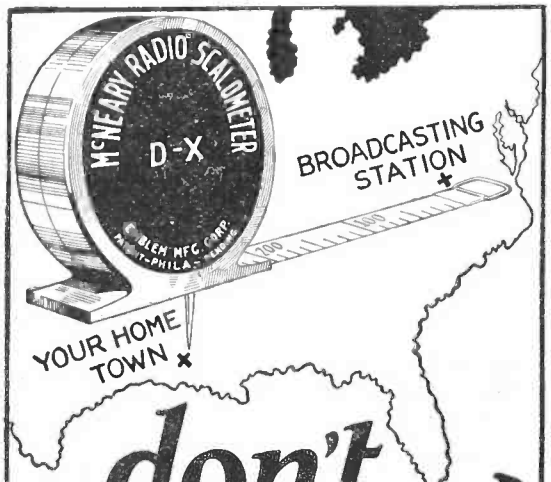
The same popular 22½ volt Eveready "B" Battery in a *new*, handsome, durable, waterproof, metal container. Eveready quality throughout. At all dealers, $3.00.

The "B" Battery is the vital part of any radio receiving set. Eveready Batteries—especially made for Radio—serve better, last longer and give better results.

Manufactured and guaranteed by

NATIONAL CARBON COMPANY, Inc.
Long Island City, N. Y.

EVEREADY
Radio Batteries
—they last longer



don't guess!

A SCALOMETER TELLS YOU THE CORRECT DISTANCE — *immediately!*

When that "D X" call comes in, you'll want to know the exact number of miles. No need to guess! The Scalometer tells you quickly—correctly.

With the Scalometer mounted on the official Radio Map at your receiving point—extend the tape to the broadcasting point—and you have in plain type the exact mileage.

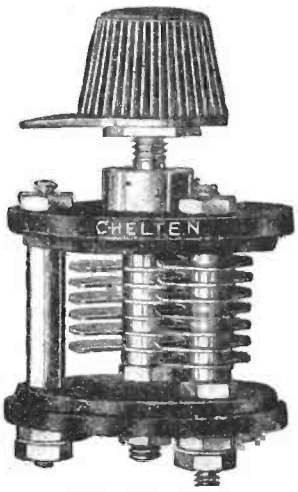
Get the complete set—the Scalometer, the official Radio Map and comprehensive Broadcasting Directory—all for $1—at your dealers, or write us.

COMPLETE **$1**

EMBLEM MFG. CORPORATION
251 Middle City Bldg., Philadelphia

McNeary RADIO Scalometer
OFFICIAL RADIO MAP AND BROADCASTING DIRECTORY

CHELTEN RADIO SPECIALTIES



Sells for **$1.50**

Patent Pending
Actual size

The Chelten Midget
(*VARIABLE CONDENSER*)

Is one of the newest things in Radio. It adds a Vernier feature to your ordinary condenser. But one hole to drill in your panel. Fits in a space 1⅜".

A precision instrument made to micrometer measurements. The seven stationary and six rotor plates permit of close graduation of capacity and when connected with any condenser the Chelten Midget makes possible sharper tuning and clearer signals.

Capacity .000045 Mfd. or about the same as a 3 plate condenser. The price puts it within reach of everyone.

We also manufacture a full line of High Grade Variable Condensers—Tube Sockets—Switches—Jacks—Plugs—Rheostats—Dials—Knobs—Crystal Detectors, etc.

Your Dealer Should Have These in Stock. If Not Please Write Us Direct.

Since 1910 Manufacturers of High Grade Electrical Specialties

Chelten Electric Company

4861 Stenton Avenue PHILADELPHIA

CHELTEN RADIO SPECIALTIES

The World's Most Popular Battery Charger

Nothing speaks so eloquently of HOMCHARGER satisfaction as the fact that thru sheer merit alone it has become the *standard* by which all other battery chargers are judged. Over 125,000 HOMCHARGERS already in use offer the most convincing proof that it is the most efficient, economical and fool-proof battery charger at any price.

A NEW TRADE-MARK FOR A TRIED AND PROVEN PRODUCT

Its phenomenal success has led to the introduction of many inferior and make-shift imitations. To insure our reputation and **protect** the buying public against substitution, the Radio De Luxe HOMCHARGER henceforth will be sold under a new Trade-Mark, viz:

GOLD SEAL HOMCHARGER

Retaining the same fundamentally correct operating principle and beautiful appearance of our Radio De Luxe model, it is a step nearer ultimate perfection through adoption of several construction refinements dictated by the policy of Progress.

HOMCHARGER'S 10 POINTS OF SUPERIORITY

1. **Simple**—Only one moving and wearing part, replaceable after thousands of hours use for $1.00. Will last a lifetime.
2. **Efficient**—Uses less than one-half the current of any bulb or liquid type rectifier. Will charge any radio or automobile battery for a nickel.
3. **Quick**—Its high charging rate of 7 amperes eliminates long waiting for battery to become charged. Will charge any "A" or "B" battery over night, or three times as fast as a 2-ampere machine.
4. **Clean**—No expensive bulbs to break or acids to spill or replace. No acid fumes. Charges without muss, fuss or bother.
5. **Dependable**—Tungsten contacts insure continuous operation—prevent sticking and stopping.
6. **Fool-Proof**—Can be operated by anyone. Attach to lamp socket and connect battery either way, it will always charge. High-grade ammeter eliminates guess work.
7. **Safe**—No danger of shock or fire. Tested and approved by Fire Insurance Underwriters everywhere. Gives tapering charge—will not overheat or injure battery.
8. **Beautiful**—Mahogany and Gold Finish.
9. **Unqualifiedly Guaranteed.**
10. **Popularly Priced**—Retails at $18.50 complete ($22.00 Canada). No extras to buy. Sold by all dealers.

FREE BROADCASTING LIST. Send to-day for Free List of Broadcasting Stations, and Circular Describing the Gold Seal Homcharger.

DEALERS! JOBBERS!

GOLD SEAL HOMCHARGERS will outsell any other radio device this season. "GOLD SEAL Business Builders" illustrates many attractive sales helps and explains how we are prepared to co-operate with the Trade in making this a "HOMCHARGER Year." Send for your copy and Trade Discounts TODAY.

Insist on the GOLD SEAL

LOOK FOR IT

GENUINE GOLD SEAL HOMCHARGER REG. UNQUALIFIEDLY GUARANTEED

It is your protection against substitution. When buying *order by name* and *verify by the GOLD SEAL*, which appears on the carton as well as the nameplate.

The Automatic Electrical Devices Co., 132 West Third St., Cincinnati, O.

Largest Manufacturers of Vibrating Rectifiers in the World

L'RADIO PARTS

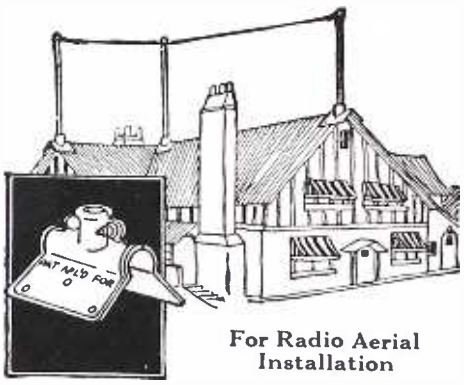
Good Plugs on your Headphone and Loud Speaker cords are as important as any detail of a Receiving Set. L'Radio plugs are your best guarantee of uninterrupted service, and L'Radio Plugs are built to last. Barrel or handle removed from plug for changing cords by unscrewing lock nut from the end of the center support. Most convenient. Made in single and two phone series models.

L'Radio Two-Phone Series Plug, No. 61, Price $1.00. Single Phone Plug, No. 60, $.90.

The use of Jacks in a receiving set is a convenience of great importance. At the low price of L'Radio Jacks, it is economy to use a jack wherever a detachable connection is made. The compact design of the L'Radio Jacks makes their use permissible in locations where space limitations make it impossible to use other Jacks. The connections at the panel end allows greater neatness in wiring up a new set. Buy L'Radio Parts at your dealers or write for Bulletin No. 101F.

L'-Radio Series Jack—50 Cents

LEICH ELECTRIC CO.
GENOA, ILL.
Mfrs. Non-Tune Radio Rectifiers Leich Comfortable Head Phones.



For Radio Aerial Installation

THE BULL DOG MAST SEAT

FILLS A LONG FELT WANT by enabling anyone to install a firm and rigid mast, on either a peaked or metal ridge roll type of roof, with ordinary tools found around the home, thereby eliminating customary trouble, labor and expense. Supplying neat, substantial construction throughout the entire aerial.

Seat for 1½" mast, hinged type	$3.00
Seat for 1½" mast, peaked type, plain	2.50
Seat for 1" mast, peaked type, plain	2.00
Seat for 1½" mast, flat base	2.50

Jobbers and distributers write for discounts.

MAST SEAT MFG. CO.
119 5TH ST. S. E.
MINNEAPOLIS MINN.

Listen in with a

Dodge TONE AMPLIFIER

A scientifically perfect instrument, with wood pulp sound chamber, designed by one of the foremost acoustical specialists. This Perfect Tone

RADIO LOUD SPEAKER

insures the most delicate reproduction of voice or music and positively eliminates distortion and metallic sound.

The Dodge Tone Amplifier is enclosed in a handsome mahogany cabinet, with front panel and sound chamber finished in black. Size of complete outfit: 12 in. high, 9¾ wide, 8¼ in. deep.

The Dodge Tone Amplifier is made especially for home use, with any set of three tubes or more. No batteries necessary. No adjustments. Complete, ready for immediate use. Merely hook up and listen. Price..... **$25.00**

Liberal Discounts to Jobbers and Dealers

Model No. 10

ACKERMAN BROTHERS COMPANY, Inc.
Dept. "PR," 301 W. 4th Street, New York, N. Y.

Radio Veterans Demand

"Dependable"

TRIMM HEADSETS

"Professional" $7.65 **"Dependable" $5.00**

Positively the only headset on the market sold with a lifetime guarantee that covers every detail of materials and workmanship, excepting only cords and shells which cannot be guaranteed against breakage if dropped. Absolutely no charge AT ANY TIME for repairs, replacements or re-magnetizing. The headsets to buy and to sell.

See! Hear! These

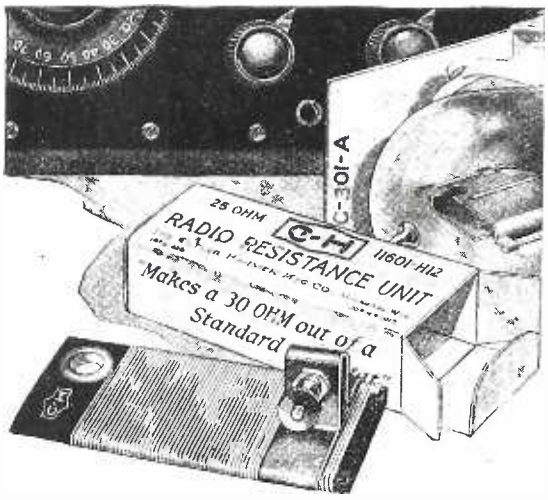
TRIMM LOUD TALKERS

All fitted with Special TRIMM jumbo size loud talker unit

ACOUSTICOLA	Phonograph Attachment	$10.00
ACOUSTICOLA	with composition horn	22.50
ACOUSTICOLA GRAND	with cast aluminum horn	35.00

Write for folder. Or order samples with privilege of return after 5 days examination and test

TRIMM RADIO MFG. CO.
Dept. 45, 24 S. Canal St., Chicago



The C-H Radio Resistance Unit attaches instantly to your present rheostats for control of the "A" type tubes. Saves the cost of new rheostats, as well as the trouble of redrilling your panel. Buy one with each new tube and enjoy better reception tonight. Price 25c at dealers everywhere.

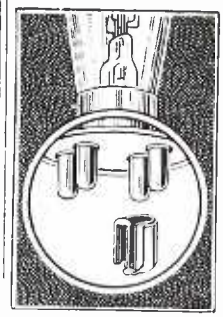
THE CUTLER-HAMMER MFG. CO.
Milwaukee, Wisconsin

C-H

More than one-half million C-H Radio Rheostats now in use.

CUTLER-HAMMER

PROTECT
THE HEART OF YOUR RADIO SET



Vacuum Tubes are costly and extremely delicate. B battery or any other excessive current applied for only the fraction of a second to the filament leads will burn out your tubes.

You have probably already had this experience and it is apt to happen again at any time.

A burnt-out tube means money lost—the set out of commission—inconvenience to you.

WHY TAKE THESE CHANCES WHEN RADECO SAFETY FUSES

will absolutely protect your tubes. Applied in an instant to the filament terminals. Will fit any standard tube or go in any standard socket. Fully guaranteed. **50 cts. each.** *Sent Postpaid.* Delay may be costly. Write now. Specify type of tube used.

DEPT. 2
RADIO EQUIPMENT COMPANY
630 Washington Street Boston, Mass.
New England's Oldest Exclusive Radio House
Distributors of many other successful Radio Specialties.
Dealers:— Write for our proposition and full details.

Why Put a Poor Link in a Good Chain?

The best hook-up, with the best condenser, carefully wired and with the best tubes will not give the best results without the best Transformers.

All-American
Audio Frequency
—Radio Frequency
Transformers

Radio Frequency Transformer

have been proclaimed in actual use the standard of the Radio World.

Send 2c for postage and we will send you our illustrated book of successful hook-ups.

Audio Frequency Transformer

RAULAND MFG. CO.
200 No. Jefferson St., Chicago, Ill.

DISTRIBUTORS MANUFACTURERS

The knob of the *"Ideal"* has an arrow as indicator, and the dial is made in aluminum-litho letters.

"Ideal" Rheostat and Potentiometer 100% Perfect (see illustration)

Individually packed in attractive boxes—complete with dial and knob

100 Rheostats 6 ohms **$17.50**
100 Rheostats 30 ohms **$19.50**
100 Potentiometers **$22.00**

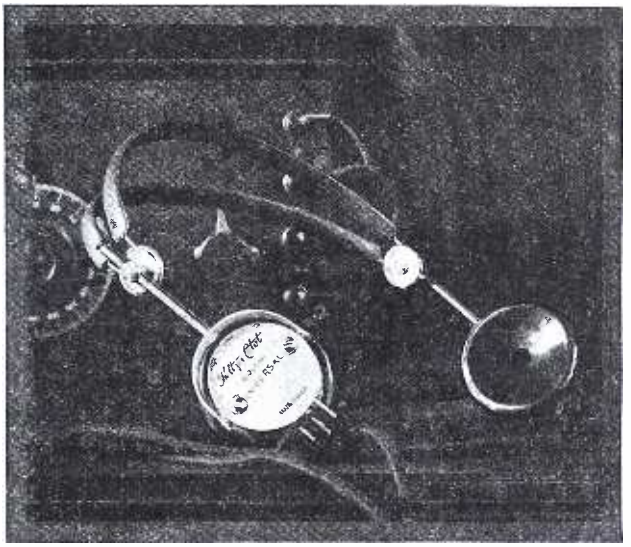
Base and all other parts in brass nickel plated. Resistances guaranteed 100% perfect

We are making rheostats and potentiometers in composition and bakelite—the *"Marvel"* and the *"5 Star Art Works,"* switch levers, test clips, in and outside brass coil aerials, all kinds of cat whiskers, telephone brass connectors (eight to listen in) and square bus bar wire.

We sell at wholesale only.
Write at once for literature.

L&W. SPRING CO. INC.

Manufacturers
161 GRAND ST. NEW YORK CITY



THE RADIO EXPERT KNOWS

That the varied and harmonious strains of music coming through his set—are nothing but electric current till they reach his headphones.

That the highest priced outfit is mediocre without the best headphones obtainable.

That perfect headphones preclude scientific knowledge, superior skill, and long experience in their manufacture.

That the Holtzer-Cabot Electric Company has devoted 25 years of constant research and painstaking manufacture to sensitive telephone instruments.

That the perfected Holtzer-Cabot Universal No. 2 is the ideal Headset for any radio outfit.

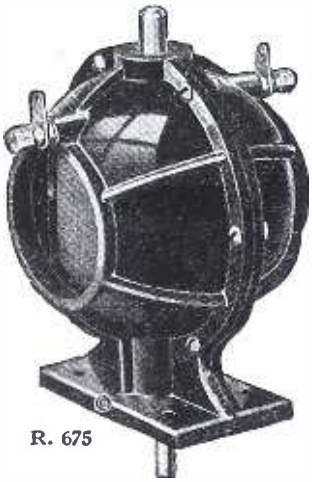
Holtzer-Cabot Universal No. 2, $8.50
Holtzer-Cabot National No. 4, $5.50

Be Sure to send for a copy of our booklet
"What You Should Know About Radio Reception."

THE HOLTZER-CABOT ELECTRIC CO.
125 AMORY STREET, BOSTON, MASS.
6161-65 South State Street - - Chicago, Ill.
Dept. B

Holtzer-Cabot
BUSINESS ESTABLISHED 1875

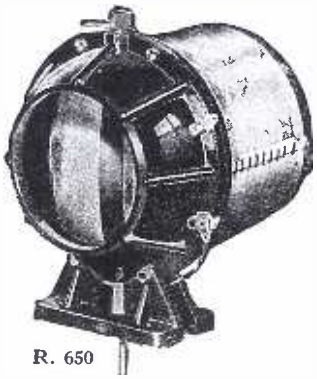
HEAD-SETS



R. 675

VARIOMETERS

Highest electrical efficiency. Made in 2 sizes of moulded brown bakelite, split bronze bearings. R 675 — overall height — 4⅜" Diameter of hemispherical shell 3⅜". Thickness over shell 3¾". Weight 10 oz. Wound for wave lengths approx. 150 to 500 meters. R 100—overall height 6½". Diameter of hemispherical shell 5¼". Diameter of Rotor ball 4". Wght. 1 lb. 5 oz. Wound for 150 to 700 meters approx. wave length receiving range.



R. 650

VARIOCOUPLERS

None finer. Made in 2 sizes of moulded brown bakelite, split bronze bearings. Winding tapped at 15 points for very close tuning. R 650 Overall height 4⅜". Dia. of hemispherical shell 3⅜". Overall length 4½". Weight 12 oz. Wound for approx. 150 to 500 meters. R 125 overall height 6½". Dia. of hemispherical shell 5¼". Length overall —5½". Weight 1 lb. 11 oz. Wound for 150 to 700 meters approx. wave length receiving range.

Gilfillan Radio Parts

Meet Requirements

Every Gilfillan Radio part carries inbuilt to users, the assurance of *perfection* in that service detail for which it is intended.

The satisfactory operation to be obtained from any set is always limited by the *efficiency* and *dependability* of the various units contained.

Owners of sets constructed of Gilfillan Radio Parts receive that *full measure of satisfactory service* expected because Gilfillan parts are the *last word* in high quality scientific radio construction.

The experience of years gained in noteworthy manufacture of electrical apparatus is in each Gilfillan product.

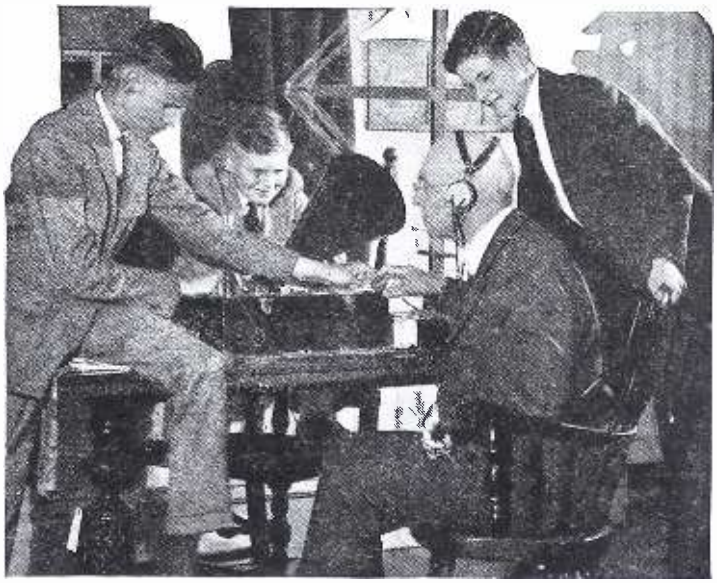
Use Gilfillan Radio Parts—you'll find them reasonably priced—at leading dealers. If your dealer does not carry this line, write for names of dealers near you and price list.

GILFILLAN BROS. Inc.

1925 McGee St., Kansas City, Mo.
225 W. 57th St., New York, N. Y.
1815 W. 16th St., Los Angeles, Cal.

Licensees of General Bakelite Co.

Every genuine Gilfillan Radio Part carries this Mark—look for it—it's your SEAL OF SERVICE.



You Owe Your Business to the Boys

The magical growth of the radio business in America has been brought about by the boys. Over two and a half million installed and operating sets testify to the energy, ingenuity and contagious enthusiasm of boys for radio.

The appeal of radio is to the imagination of youth, and youth, inoculated, has spread the whole country with radio virus. It is the boys' dollars which have built the dealers' parts business. Boys' savings have financed uncounted complete sets. To-day boys are the recognized authorities on radio equipment, construction, installation and operation. And in a vast majority of cases the interest of fathers and older brothers in radio is due to the insistence and persistence of the boy in the family.

THE AMERICAN BOY
"The Biggest, Brightest, Best Magazine for Boys in All the World"

goes straight to the source of radio sales. It places the radio advertiser's product before half a million up-to-date sons of well-to-do families—boys who average 15½ to 16 years old.

These AMERICAN BOY readers are radio "bugs," because the Radio Department of THE AMERICAN BOY is one of the most reliable sources of information on the subject. Its readers regularly "eat up" Armstrong Perry's instructive and authoritative articles. Your advertisement broadcasted to these keen, interested boys will find the greatest market in the world tuned in and listening eagerly.

Copy reaching us by the fifteenth of October will catch the December issue.

THE SPRAGUE PUBLISHING COMPANY
(Member A.B.C.)
548 Lafayette Boulevard, Detroit, Mich.

Another Use For Loud Speaker

When the static is too great for radio reception your AUDIOPHONE Loud Speaker can be used with the Bristol Phonograph Record Reproducer on your phonograph. Then you may have concert or dance program without interruption.

Attached instantly without mutilating the instrument in any way—the Bristol Phonograph Record Reproducer can be used with any make of phonograph.

Equipped with such an outfit there are no disappointments—it is always ready—never fails. For dance music you have the equivalent of an orchestra, but without the expense.

The tone of the phonograph thus amplified through the AUDIOPHONE has volume enough to fill large rooms and the quality is round—smooth—and beautiful—entirely free from mechanical noises.

Remember that the same AUDIOPHONE Loud Speaker is used in common for both radio reception and phonograph record reproduction.

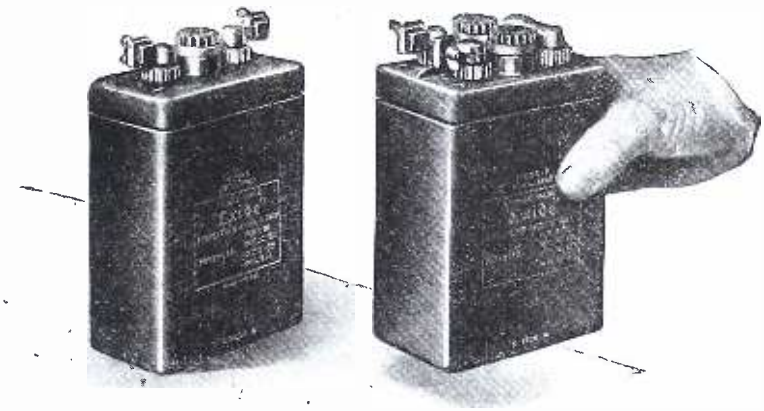
Write for Bulletin 3007-L and we will advise where you may hear a demonstration.

TRADE MARK
AUDIOPHONE
REG. U. S. PAT. OFFICE

THE BRISTOL COMPANY
WATERBURY, CONN.

Branch Offices:

Boston New York Pittsburgh Philadelphia
Detroit Chicago St. Louis San Francisco



Midgets in size—but giants in power

IMAGINE a radio storage battery so light you can lift it on the palm of your hand, but powerful enough to supply all the current you need for long-distance receiving—and then some!

The new two- and four-volt Exide A Batteries for low-voltage tubes weigh only five and six pounds each. And they are wizards of efficiency—right in step with the latest developments in radio receiving.

These sturdy little batteries are neat and compact. They were specially designed for WD-11 and UV-199 vacuum tubes, but can be used with any low-voltage tube. The two-volt Exide A Battery consists of a single cell. It will heat the filament of a quarter-ampere tube for approximately 96 hours. The four-volt A Battery, having two cells, will light the filament of a 60-milliampere tube for 200 hours.

For six-volt tubes

Like all Exide Storage Batteries, the Exide A Battery for six-volt tubes is dependable and long-lasting. It is made in four sizes, of 25, 50, 100 and 150 ampere hour capacities.

As you know, any variation of current in the plate circuit produces weird sounds in your phones. With an Exide B Battery hooked up to your set, static is the only interference you will have to contend with. The Exide B Battery supplies steady, noiseless current. It permits the niceties of adjustment that make radio receiving an unalloyed pleasure. The Exide A Battery for six-volt tubes has extra-heavy plates, assuring constant potential and uniform current over a long period of discharge. Like all Exide Batteries, it embodies the finest materials available.

In marine and commercial wireless

On sea and on land the Exide plays an important role in the industrial life of the nation. In marine wireless, Exide Batteries provide an indispensable store of emergency current. A majority of all government and commercial wireless plants are equipped with Exides.

Exide B Batteries

give noiseless, full-powered service over a long period of discharge. Designed throughout to prevent electrical leakage. Capacity, 3 ampere hours.

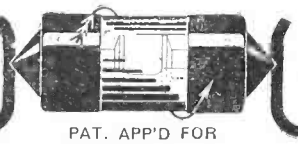
Exide Radio Batteries are sold by radio dealers and Exide Service Stations everywhere. Ask your dealer for booklets describing in detail the complete line of Exide Radio Batteries. Or write direct to us.

Exide
RADIO BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, PHILADELPHIA

Oldest and largest manufacturers in the world of storage batteries for every purpose

Service Stations Everywhere **Branches in Seventeen Cities**



PAT. APP'D FOR

75¢ TURN-IT 75¢

GRID-LEAK

"ADJUSTABLE"

Sometimes a fixed leak just happens to be satisfactory, and the right value for tube and signal, but *why fuss with fixed leaks* to find the one required when a TURN-IT adjustable grid leak has a thousand values at your demand.

The high resistance liquid with its flowing, velvety contact, gives you instantly any value necessary to develop your detector tube's maximum output.

Just clip it into your standard mount, Turn-it until that distant signal comes in clear and loud, and it will stay put. Can be conveniently rigged for panel control.

Your dealer should have one for you, if not send 75 cents to—

Charles E. Bonine
20 South 15th St. Philadelphia

---

for
PURE TONE QUALITY
and MAXIMUM VOLUME

Price $7
Ask your dealer.

Or, sent carriage charges collect. (Wt. 1 lb.)

The AMERTRAN

AUDIO TRANSFORMER

—recognized by the Radio Profession as the
STANDARD of EXCELLENCE

Turn ratio, 5:1. Amplification ratio, 30-40 times audibility in the flat part of the curve.

Send for Circular 1005

American Transformer Company

Designers and builders of radio transformers for over 22 years.

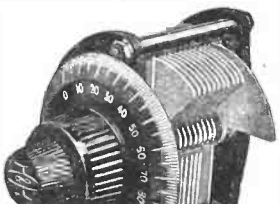
175 Emmet St., Newark, N. J.

H&H Radio Material

Nutmeg Brand

Based on 30 Years' Manufacturing and Electrical Development-Work

We carefully fill orders direct where the goods are not sold locally, if sent along with the name and address of your Dealer.



Features of H. & H. Variable Air Condensers: Double-cone bearings with adjustment screw; smoothest possible action. Blades assembled with absolute precision; anchored solidly in large supporting posts; —proper spacing is permanent. Aluminum alloy blades, extra large brass center post; bakelite ends. The utmost in engineering skill, at prices you may well take advantage of:

W605	5-Plates, .000125 mfd.	$2.50
W611	11-Plates, .00025 mfd.	3.00
W623	23-Plates, .0005 mfd.	3.50
W643	43-Plates, .001 mfd.	4.00
W621	11-Plates with Vernier Dial Control	4.25
W633	23-Plates with Vernier Dial Control	5.00
W643	43-Plates with Vernier Dial Control	6.00

Ask for interesting circulars

THE HART & HEGEMAN MFG. CO.

HARTFORD, CONN.

3,250 Hours' Service From a $15.00 F-F BATTERY CHARGER

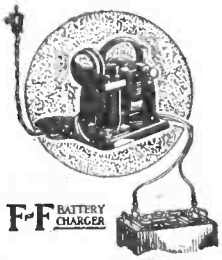
Dear Sir: Find enclosed fifty-four cents for which please send one set of carbon brushes for an F-F Battery Charger, Type 6.
This charger has been in use on an average of 25 hours a week for about two and one-half years and the Carbons have never been renewed. The machine is giving very good service.

Yours very truly,
(Signed) RALPH C. PETERS.
1810 Pine St., Boulder, Colo.

This unsolicited report is but one of thousands. It is the result of ten years specialization. You, too, can benefit just as Mr. Peters above, by insisting on the F-F Charger.

There's a type for every need. Buy from your dealer. If he cannot supply you, write for literature or enclose remittance covering express or postal charges on 9 lbs.

IT'S FREE—Write for Bulletin No. 44
Dealers! Get the F-F proposition



$15.00

F. O. B. CLEVELAND

Type 6 charges, 6 Volt Storage Battery from any 110 Volt 60 Cycle lamp socket at average rate of 6 amperes.

The France Mfg. Co.
10444 Berea Road
Cleveland, Ohio

Coto

"Built First to Last"

Only the Set You Build for Yourself Will Suit You

If you have just half the soul of a real radio fan, a complete, ready made set will pall on you in a week. Build your own!

You want radio performance, to be sure, but you want it of your own creation. What so fascinating as to plan, to assemble, to adjust and construct? And finally to get the radio results and the set compactness made possible by this splendid line of distinctive parts—different and better.

Coto for Efficiency and Compactness

Demand Coto—

—and Get Coto

New Coto Compact Variable Air Condenser with Vernier

Only 2⅞ inches square. Ruggedly constructed on metal frame. Rotor Plates soldered to shaft; stator plates soldered at three points. "Built First to Last." Unique, positive acting vernier. Two capacities—.0005, $5.00; .001, $6.00.

Jobbers! Dealers!

The Coto line, also including Honeycomb Coils, Cotogrip Sockets, and Coto Special Audio Frequency Transformer ($2.50) has the efficiency, the appearance and the advertising for big selling. Write today for latest price lists.

Coto Coil Co.

Providence, Rhode Island

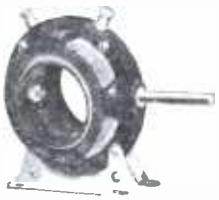
Pacific Coast Branch,
329 Union League Bldg.,
Los Angeles, Cal.

Northwestern Branch,
Geo. F. Darling,
705 Plymouth Bldg.,
Minneapolis, Minn.

Southeastern Branch,
C. P. Atkinson,
Atlanta Trust Co. Bldg.,
Atlanta, Ga.

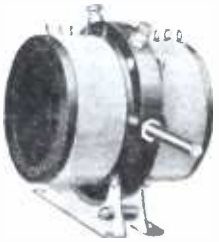
Radio Frequency Transformer

[illegible] type [illegible] PLD [illegible] [illegible] (000 A, $5.50).



New Coto Compact Variometer

A little gem in molded bakelite. Stator [illegible] fine cut [illegible] wound. Range [illegible] (600) meters. Size 3½ x 3¾ x 3¾ inches. Back of panel mount. Type 8,000, $5.00.



New Coto Compact Variocoupler

Twin sister of the Variometer. Size only 3¼ x 3 x 3¾ inches. Range 200 to 600 meters. Back of panel mount. Type 9,000, $5.50.

Audio Frequency Transformer

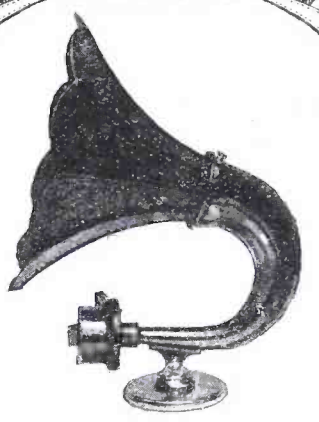
Compact and efficient. Handles large volume with uniform amplification and minimum distortion. Approved shell type. Ratio 5 to 1. Type 4,000, $5.00.

England

AMPLION

Canada

Scotland



Australia

Wales

New Zealand

Ireland

So. Africa

WITH the Amplion Loud Speaker the infinite clearness and softness of tone achieves an unsurpassed reproduction welcomed and admired everywhere. The human voice or musical sounds come to you in their true richness, without the slightest distortion, unalloyed —just as they are rendered.

It is hard to believe you are listening to reproduction. Originality is so unmistakably registered in every tone.

The Amplion is made by the world's oldest manufacturer of loud speaking instruments. It is not a head set receiver used as a loud speaker, but a development for radio purposes of a loud speaking device, used exclusively on every ship of the British and other leading navies.

The Amplion requires no battery. You simply attach it in place of head phones. The Amplion is being extensively used in every country mentioned in the border of this announcement.

That it has been adopted as standard by the leading countries of the world is the tribute it has achieved through its brilliant performance.

All models on view at the New York Radio Exposition, Booth 5, at the New York Show—Oct. 6th to 13th.

Norway

India

Sweden

France

Denmark

Italy

SIGNAL ELECTRIC MFG. CO.
Sole United States Distributors Menominee, Michigan

Holland

Spain

BURNDEPT OF CANADA, LTD.
Canadian Distributors 172 King St., West, Toronto

The Supremacy of the AMPLION is the Supremacy of Actual Performance

Belgium

Japan

Branston D. L. Honeycomb Coils and Mountings

R-61 Three Coil Geared Type. Front panel mounting. **$5.00**

Substantial gears give vernier adjustment. Very neat appearance. Made of Genuine Bakelite, complete with flexible leads.

R-73 Three Coil Bakelite Mounting. **$4.50**

Neatest three coil mounting on the market. Made of Genuine Bakelite and complete with flexible leads.

R-77 Bakelite Coil Mounting with brackets instead of screws for mounting. **50c**

STUDY these mountings carefully. Our new No. R61 3-coil front panel mounting and No. R62 rear panel mounting are equipped with strong brass nickel plated gears, insuring smooth vernier adjustment with no chance of stripping gears. Back geared type is equipped with arrow knobs that show position of coils. Mountings are substantially constructed of genuine Bakelite and are equipped with flexible leads.

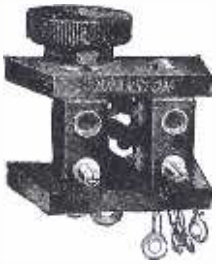
Branston D. L. Honeycomb coils are accepted as standard in regard to superior construction and electrical unit of mountings. Your dealer can purchase Branston Coils and Mountings from his distributor. Insist on the Genuine.

Send 2c in stamps for Series 1 "Hook-Up" circulars showing five good Honeycomb Coil Hook-Ups and Catalog of famous Branston Radio Apparatus. Write today. Give us name of your radio dealer. If he can't supply you, write

Chas. A. Branston, Inc.
811 Main St., Buffalo, N. Y.
In Canada: Chas A. Branston, Ltd., Toronto, Ont.

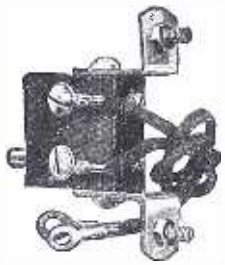
R-62 Three Coil Bevel Geared type. Back Panel Mountings. **$6.00**

Bevel gears provide very smooth operation and vernier adjustment. Made of Genuine Bakelite, complete with flexible leads. Arrow knobs show position of coils.



R-71 Two coil Mounting. **$3.25**

Very neat and capable of smooth operation. Only two mounting screws required. Complete with flexible leads.



R-68 Single movable Bakelite Plug with extension angle brackets and flexible leads. **90c**

R-69—Same as No. R-68 only stationary. 90c

On the Wings of the Air

NORTH, South, East, West, over mountain ranges, across rivers and ravines, through storms and clear weather fly the magic voices of radio. Throughout the country a multitude of eager listeners, old and young, settle down to enjoy the entertainments. Hundreds of stations are broadcasting every evening. There is always something going on to please every listener.

PARAGON

Reg. U.S. Pat. Off.

RADIO PRODUCTS

With the Paragon Three-Circuit Receiver you can pick the program you want to hear, tune in on the station that is broadcasting it, and *you will get it.* The messages will be understandable, the music clear and harmonious. In fact, you will first realize the full enjoyments of radio the first time you listen in with a Paragon set.

An illustrated Catalog of Paragon Radio Products Is Yours For the Asking

DEALERS—The Adams-Morgan Company has an interesting proposition to make to reputable radio dealers who believe in quality merchandise. Details on request.

ADAMS-MORGAN CO., 20 Alvin Ave., Upper Montclair, N. J.

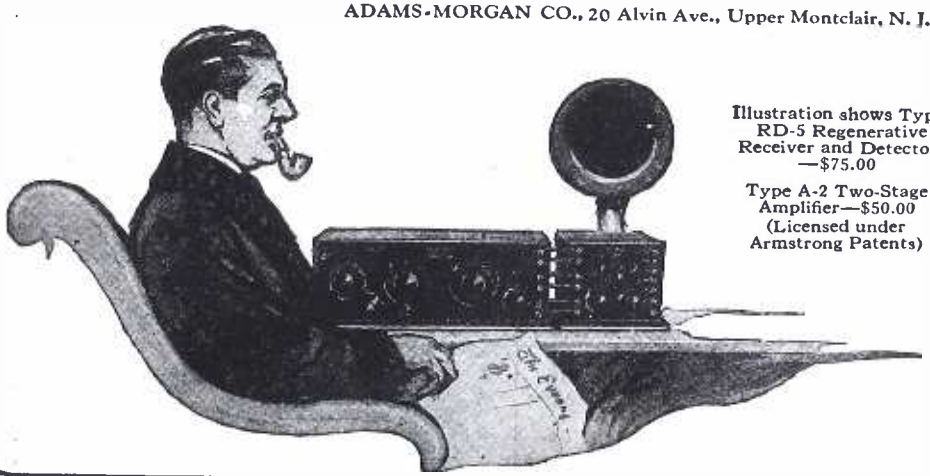
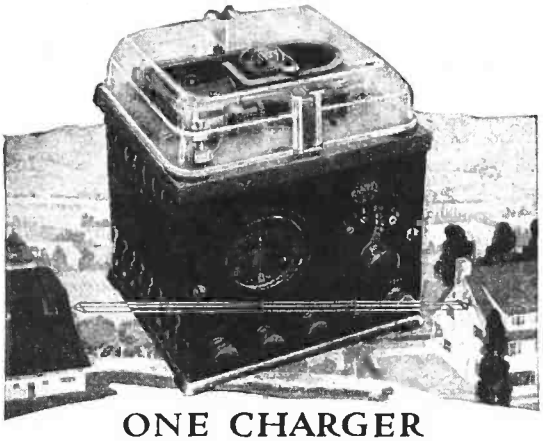


Illustration shows Type RD-5 Regenerative Receiver and Detector —$75.00

Type A-2 Two-Stage Amplifier—$50.00 (Licensed under Armstrong Patents)



ONE CHARGER
for Every Radio Battery

—And, in fact, *the only one* which you need. Keeps strong clear signals in your set by keeping the batteries to full capacity.

The Valley Type ABC Battery Charger is made for all storage batteries—2-volt peanut tube batteries, 6-volt A Batteries and 1 to 4 B Batteries. Bakelite panel, glass top —belongs to a radio receiving set.

Frankly, production is limited. Late buyers are going to be disappointed. A lot were last year. Ask to see the Valley Type ABC Charger at any good radio shop.

VALLEY ELECTRIC CO.
3157 S. Kingshighway St. Louis, Mo.

Valley Battery Charger

The Condenser Sensation of Modern Radio

FRESHMAN
NOISELESS
TESTED MICA
CONDENSER
MFG. BY
CHAS. FRESHMAN CO. Inc.
NEW YORK CITY

Through the accuracy and dependability of Freshman Condensers, hook-ups and circuits have been perfected which have completely revolutionized the art of Radio Reception.

These little Storers of energy and rectifiers of Radio Current are the very heart of a well-built radio set.

The proper fixed condenser will make all the difference in the world in the reception, clarity and selectivity your set affords.

Capacity	Each	Capacity	Each
.0001	$ .35	.002	$ .40
.00015	.35	.0025	.50
.00025	.35	.003	.60
.0002	.35	.004	.75
.0003	.35	.005	.75
.00035	.35	.006	.75
.0005	.35	.008	1.00
.0006	.40	.01	1.00
.0008	.40	.015	1.50
.001	.40	.02	2.00
.0015	.40	.025	2.50

The FRESHMAN is so designed that constant equal pressure is exerted on the condenser plates over the entire area. They are the only condensers that do this and therefore the only condensers that avoid noises, which are due to variable pressure on the plates.

At your dealers, otherwise send purchase price and you will be supplied without further charge.

Chas. Freshman Co. Inc.
Radio Condenser Products
106 SEVENTH AVE., NEW YORK

$3.50 THE RITTER GRAND CRYSTAL SET $3.50

Has proven to be the survival of the fittest. The reasons are:-

1. Dependability
2. Simplicity of operation
3. Low Popular Price

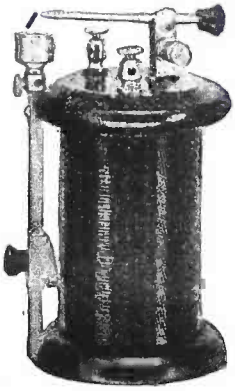
Sold at all stores or direct.

We are the originators of the famous

$1.00 Ritter Portable Loop $1.00

The only knockdown Loop Aerial sold. We supply complete instructions with every outfit.
Our guarantee: The Ritter Portable Loop will give as good results as any $10.00 Loop.
By mail 10 cents extra.

Agents and dealers write for our proposition.



RITTER RADIO CORPORATION
232 Canal St. New York City

TYPE
AI
$25.00
21" Fibre
Horn

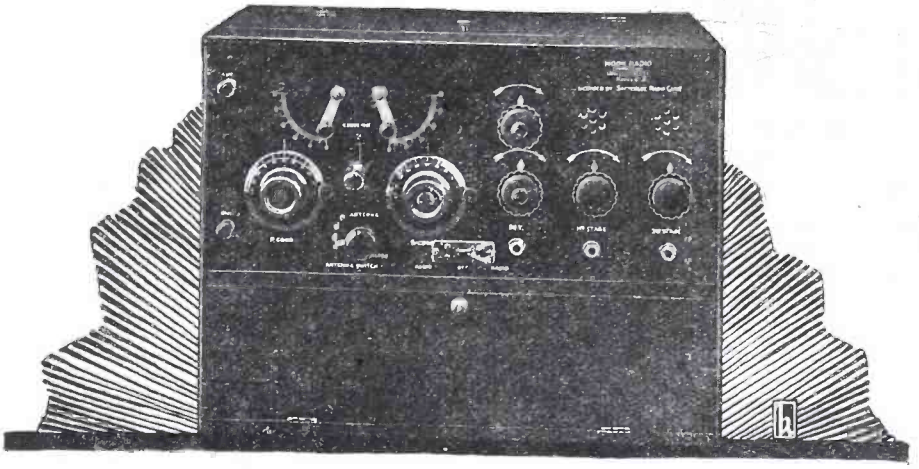
The TRINITY LOUD SPEAKER

The Trinity Loud Speaker is an instrument that combines the best qualities of a phonograph reproducer in combination with electro-magnetic principles best fitted for radio amplification.

Perfect reproduction of all music and speech without distortion. No storage batteries required. The instrument is of a heavy duty type and is guaranteed fully by the manufacturers.

For sale by good dealers.
Literature upon request.

TRINITY RADIO CORPORATION
446½ Tremont Street, Boston, Mass.



The Apex of Achievement

Our New Factory

Progressive growth of any organization obviously deserves a just reward and we are not an exception. Proudly pointing, through rapid expansion and the overcoming of almost unsurmountable obstacles, to the acquiring and immediate occupancy of our new three story building at 501 Steinway Ave., Long Island City, N. Y.

Moving into new quarters produced an invigorating abundance of initiative and efficiency. Undisputable evidence of sane progress and instant service.

THE Moon Radio Corporation offers to the public a set that operates on very different principles from any other set on the market. By means of a single connection, broadcasted programs are now received through the land, sea or air.

It is the result of the synthetic evolution of a well defined theory of "Inductive Amplification" which adds to the embryonic receiver another revolutionary advancement in the development of antennaless reception, by the use of a "Terrapoise," "Aquapoise" or an "Aeropoise."

The development of a perfect radio receiver that would operate under this system was made possible through intensive research and exhaustive experimentation by its inventor, Dr. Francis LeRoy Satterlee, with the co-operation and assistance of an able staff and the Executive Departments of the Moon Radio Corporation.

The **Moon C-2 Receiver** will span the Continent from North to South or from East to West. And no matter where you are, at home, at the camp, in your motorboat or on a railway train, reception will be maintained with loud speaker volume of perfect quality, for a conservative thousand mile range.

The **C-2 Receiver** costs $157.50. At your dealer. Or send us his name and ask for literature.

MOON RADIO CORPORATION

Manufacturers of "Satterlee" and Antennaless Receiving Sets.

502 Steinway Ave. Long Island City, N. Y.

MOON C-2 RECEIVER

Last Chance to Get Your Favorite Magazines at Lowest Bargain Prices!

Enter your subscription to POPULAR RADIO *now* and take advantage of these special money-saving clubs before the offer is withdrawn.

UP to October 29th only, we offer our friends and subscribers this broad selection of leading magazines at very special bargain prices with a year's subscription to POPULAR RADIO.

If you are already a subscriber to POPULAR RADIO, these special club offers allow you the privilege of renewing or extending your subscription at a **great saving of money**. If you are not already a subscriber, don't delay taking advantage of this opportunity to get POPULAR RADIO and *your choice* of these other leading magazines at *greatly reduced prices.*

As already announced, the subscription price of POPULAR RADIO will soon be advanced from $2 to $3 a year. Yet all of these magazine combinations are figured at a price for *each* magazine **far lower than even the present subscription prices.**

There is hardly a home where one of these magazines does not already bring pleasure and profit to *some* member of the household. The magazine requirements of your whole family for the coming year can be taken care of *now*, by simply checking the club offer you want and mailing the coupon to us with your remittance before October 29th.

But do not delay. Our special arrangement with these other publishers is for a few weeks only. After October 29th the prices on these clubs must be advanced. But by acting *now* you safeguard yourself, and in addition, you get POPULAR RADIO at even less than the **present** subscription price, which will soon go up to $3 instead of $2 as at present.

McCall's **Popular Radio** $3.60 Newsstand Value For..... **$2.25**	**Modern Priscilla** **Popular Radio** $4.80 Value For..... **$3.00**
Today's Housewife **Popular Radio** $3.60 Value For..... **$2.25**	**People's Home Journal** **Popular Radio** $4.20 Value For..... **$2.50**
McClure's **Popular Radio** $5.40 Value For..... **$3.75**	**Christian Herald** (52 issues) **Popular Radio** $5.00 Value For..... **$3.00**
Youth's Companion (52 issues) **Popular Radio** $5.00 Value For..... **$3.75**	**Boy's Life** **Popular Radio** $4.80 Value For..... **$3.50**
Scientific American **Popular Radio** $6.60 Value For..... **$4.75**	**Collier's** (52 issues) **Popular Radio** $5.00 Value For..... **$3.75**
American Magazine **Woman's Home Companion** (both to one address) **Popular Radio** $7.20 Value For..... **$5.00**	**Pictorial Review** **Modern Priscilla** **Popular Radio** $6.60 Value For..... **$4.50**

Or You Can Make Up Your Own Club of POPULAR RADIO With:

Boy's Magazine	$3.60 val., for...	$2.60
Century Magazine	8.40 val., for...	6.25
Country Life	8.40 val., for...	5.75
Judge (52 issues)	7.60 val., for...	6.25
Movie Weekly	7.40 val., for...	6.25
Physical Culture	5.40 val., for...	4.50
Popular Science Monthly	5.40 val., for...	4.25
Radio	5.40 val., for...	4.00
Radio Broadcast	5.40 val., for...	4.25
Radio Digest (52 issues)	7.60 val., for...	6.25
Radio News	5.40 val., for...	4.00
Radio World (52 issues)	10.20 val., for...	7.25
Review of Reviews	6.60 val., for...	4.75
World's Work	6.60 val., for...	5.00

Note: If you wish TWO or more of these magazines with POPULAR RADIO, simply deduct $1.75 from the club price quoted, then add POPULAR RADIO at $1.75. For example:

Radio (San Francisco) $4.00 less $1.75 =	$2.25
Review of Reviews... 4.75 less 1.75 =	3.00
POPULAR RADIO, at only	1.75
Remit this amount	**$7.00**

POPULAR RADIO, Dept. 101,
9 East 40th Street, New York City.

Enclosed is $..... Please see that yearly subscriptions are at once entered in my name for each of the magazines I have checked in the special bargain club list at the right.

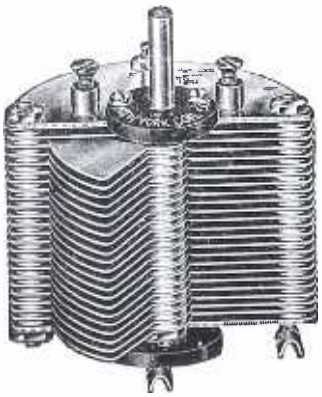
Name.....

Street and Number.....

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

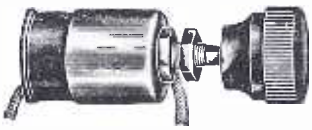
(If not a NEW subscription, please mark R after the name of the magazine, to indicate RENEWAL.)

Are leaders everywhere due to quality, ease of installing and assurance that your set will bring in the results when finished. Used by leading constructors and handled by the best informed dealers.



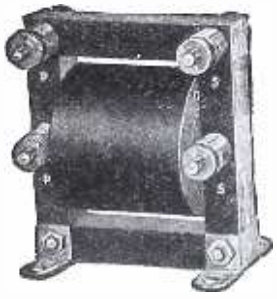
New York Condensers bring in the broadcasting loud, and clear with the true tone, because the construction eliminates all leakage and electrical losses—the standard by which others are judged.

11 Plate	.....	**$1.50**
23 "	.....	**2.00**
43 "	.....	**3.00**
3 "	.....	**1.25**



Supplementary Vernier Condenser $1.00

Insist on New York Amplifying Transformers. Do not be satisfied with something claimed to be "just as good." They are universally recognized for their marvelous amplification, purity of tone and ability to produce uniformly perfect results with any style of standard tube. Price $4.00 and worth it.



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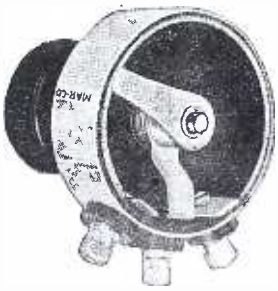

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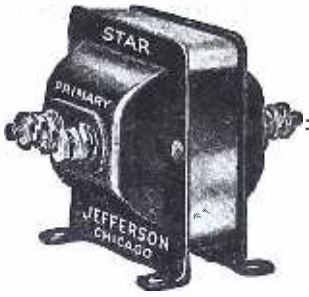

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have gained an enviable reputation for audibility and amplifying power. In tens of thousands of receiving sets they are insuring 100% amplification—increased range, super-sensitivity, and the elimination of howling and distortion.

This positive preference rests on the unmistakable superiorities of design and operation which make Jefferson Amplifiers the choice of discriminating radioists.

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The five Jefferson types meet the demand for an audio-frequency transformer for every requirement. In this assortment you are sure to find the transformer which will make your set super-sensitive, and enable you to tune in distant stations with ease, and freedom from distortion.

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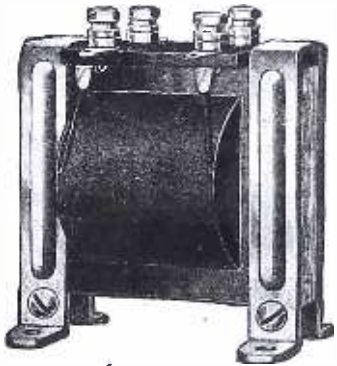
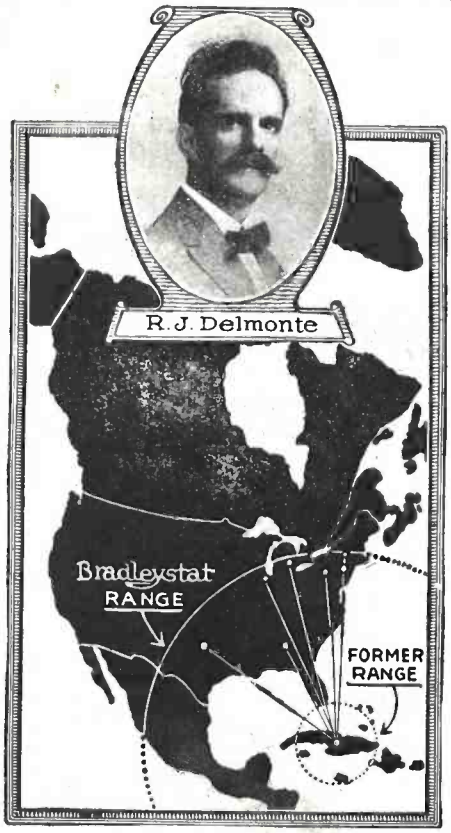


The Universal Bradleystat subdues static in Cuba!



The Universal Bradleystat provides perfect, stepless, noiseless filament control for every tube on the radio market. Try any tube with the Universal Bradleystat.

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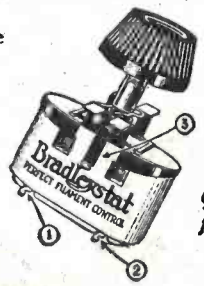

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Remarkable improvement in radio reception follows installation of Bradleystats and amazes experimenter in Tropics. Read his letter!

Camaguey, Cuba, July 17th, 1923

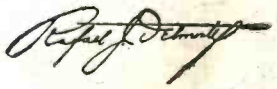
"My experimental room is located in the center of Cuba, amidst the Gulf, which is reputed to be the general headquarters of static and all atmospheric disturbances of the whole universe.

I had my sets equipped with wire rheostats having vernier adjustments and my radius of reception was 350 miles from Havana with imperfect reception from Atlanta, Georgia.

After installing Bradleystats, I increased the radius 1000 miles without distortion and picked up Detroit, Schenectady, Pittsburgh, Fort Worth and other stations. When static is performing one of its infernal displays, I lower the filament heat with the Bradleystat to reduce noises. There is only one point of filament heat where this condition is fulfilled and the wire rheostat cannot furnish this with critical detector tubes.

For this reason, I claim the Bradleystat is the only apparatus for controlling filament heat, and if proper adjustment is made, static noises are practically eliminated.

Yours very truly,



Beware of Imitations—Avoid Substitutes

Numerous attempts have been made, without success, to duplicate Bradleystat performance by using carbon powder in tubes and other containers instead of the scientifically-prepared graphite discs found only in the genuine Bradleystat. For perfect filament control and uninterrupted performance, be sure to ask for the Bradleystat. The name Bradleystat is embossed on the porcelain container for your protection.

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