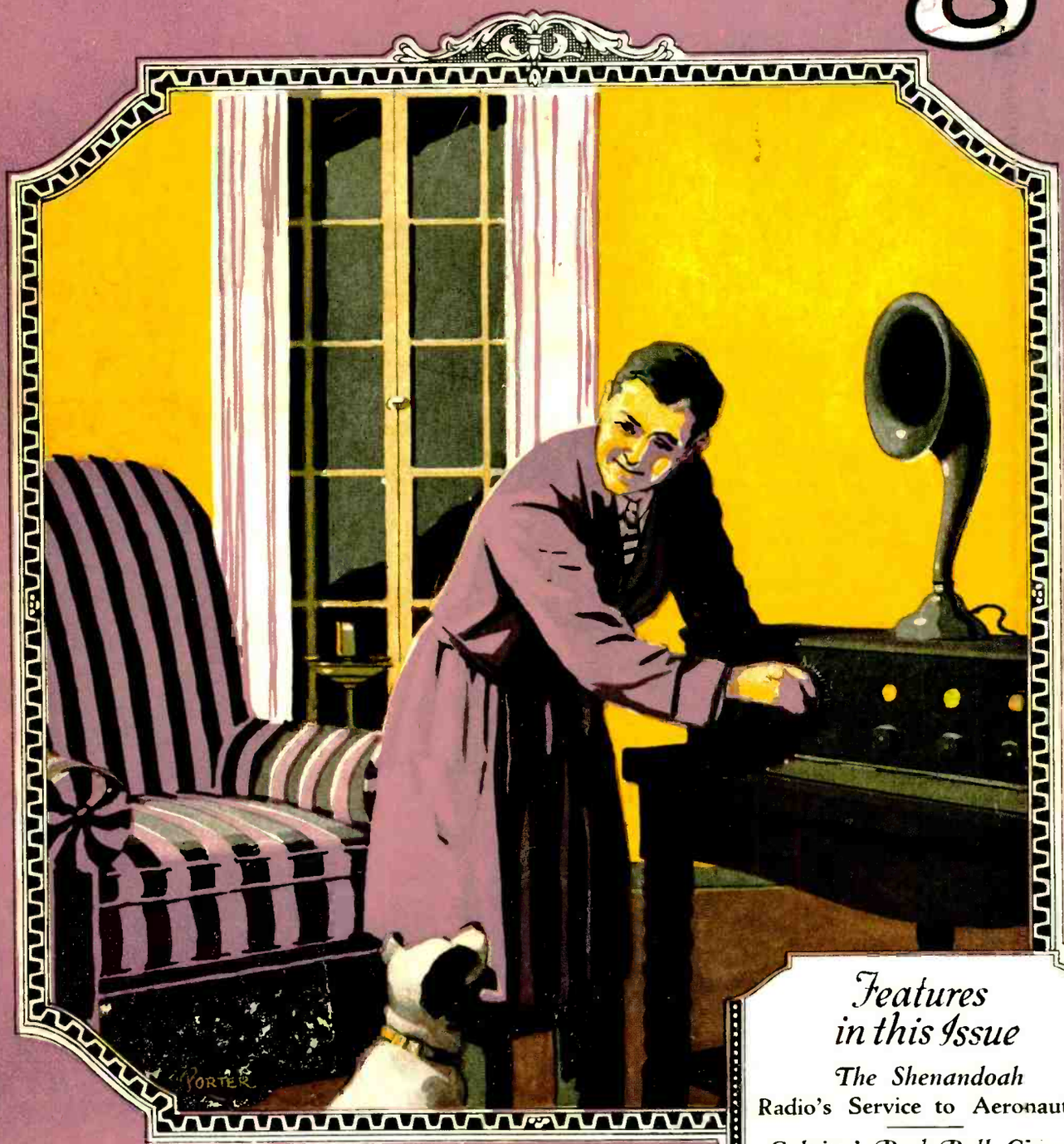
MARCH 1924 25 CENTS

The Wireless Age



Features in this Issue

"America's Foremost Radiophone Review"

Winners of the Cunningham $5000.00 Window Trim Contest held during Cunningham National Tube Week

September 24th to October 1st, 1923

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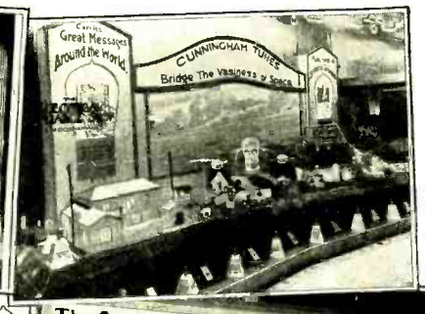

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The Judges for the Cunningham $5,000 Window Trim Contest held during Cunningham National Radio Tube Week, September 24th to October 1st, 1923, have after due deliberation, from a disinterested and unbiased viewpoint, allotted the fifty-one prizes as stipulated in the rules of the contest, declaring a tie for sixth place. Following are the names and addresses of the Radio Dealers who shared in the awards and the manner in which the prizes were awarded:

Lester's Radio Shoppe, Los Angeles, Calif.	**1000—First Prize**
Hennepin Hardware Company, Minneapolis, Minn.	**750—Second Prize**
Electrical Appliance Shop, Los Angeles, Calif.	**500—Third Prize**
Warner Hardware Company, Minneapolis, Minn.	**250—Fourth Prize**
Pincus & Murphey, Alexandria, La.	**150—Fifth Prize**

There being a tie for sixth place, the same prize has been allotted to the two dealers participating in the tie, increasing the total amount of the prizes from $5,000 to $5,100.

Geo. C. Wille & Company, Canton, Ohio	**$100—Sixth**	**Tie**
Hook Drug Company, Indianapolis, Ind.	**100—Sixth**	

$50 HONORABLE MENTION

The forty-five prizes as stipulated in the rules of the Contest are awarded to the following Cunningham Radio Tube Dealers for windows of Honorable Mention:

Banister & Pollard Co., Newark, N. J.
W. E. Berry—Radio, Waco, Tex.
Jesse C. Cutler, Brookings, So. Dakota.
Ehrler Radio Co., Chicago, Ills.
Equipment Sales Co., San Diego, Calif.
Ervin's Electrical Co., Parson, Kans.
Evers Hardware Co., Denton, Tex.
Fortner Camera Supply Co., Sterling, Colo.
C. H. Gilliam's Radio Store, Brownwood, Texas.
Robert A. Goodall, Ogallala, Nebr.
Thos. J. Green, Winona, Minn.
Haskell Electric Co., Holyoke, Mass.
Lazar & Son Music Center, Chicago, Ills.
Long Beach Radio Shop, Long Beach, Calif.
H. Lesser & Company, Cleveland, Ohio.
Lindermann Auto & Machine Co., Enderlin, No. Dak.
Louis D. Rubin Elec'l Co., Inc., Charleston, S. C.
Mason, Pyle & Parkhurst Radio Co., Webster City, Ia.
Mid-Continent Radio Corpn., Ft. Worth, Tex.
Midwest Radio Co., Kansas City, Mo.
Murphy Maclay Hardware Co., Great Falls, Mont.
Newark Radio Supply Co., Newark, N. J.
Oscar A. Huelsman, Fond du Lac, Wis.
Paramount Radio & Elec. Co., Atlantic City, N. J.
H. Y. Parrott, Dennison, Tex.
Pfahl Electric Co., Cleveland, Ohio.
Prest Electric Co., San Bernardino, Calif.
P. S. Radio Service Co., Cleveland, Ohio.
QST Radio Shop, Tacoma, Wash.
Radio Sales & Repair Co., Cleveland, Ohio.
E. M. Sargent Co., Oakland, Calif.
Selby & Reed, Martins Ferry, Ohio.
Harry H. Smith, Decatur, Ills.
Southern Plbg. & Elec. Co., Taylor, Tex.
Stoehrer's Electric Shop, Oxnard, Calif.
H. C. Tafel Co., Louisville, Ky.
The Broadcast Shop, Washington, D. C.
The Brown Pharmacy, Chanute, Kans.
The Motor Supply Co. Seattle, Wash.
The Radio Distributors, Long Beach, Calif.
The Salzer Electric Co., Cleveland, Ohio.
Thibaut & Mautz Bros., Marion, Ohio.
Weed's Radio Shop, Portland, Ore.
Willapa Electric Co., Raymond, Wash.
Wolf Electric Co., Beaver Falls, Penn.

We take this occasion to extend our deep appreciation to the thousands of Radio Dealers located all over the country who so whole-heartedly entered into the contest and while many of them did not carry off one of the prizes they nevertheless have placed themselves in the front ranks of live Radio Dealers in their respective localities and have the hearty co-operation and earnest support of this organization.

R. J. Cunningham Inc.

Home Office: 182 Second Street San Francisco | **154 West Lake Street Chicago** | **30 Church Street New York**

Imported PHONES give you a *new* radio set!

A PAIR of N & K Phones on your old radio set work a complete transformation. They make it sound new and different. Never before have high or low tones, loud or soft tones, come in so clear, so mellow, so free from distortion.

N & K was designed by one of the world's foremost makers of telephone and other scientific apparatus. It was designed especially for *telephone* reception, whereas most radio phones in use today were originally designed to receive *telegraphic spark signals.* The diaphragm is larger and more sensitive, and is placed at a carefully measured distance from the poles. Even the sound chamber is differently arranged. The workmanship lives up to the world-wide reputation of European precision instrument makers.

Last year this head set was submitted to hundreds of American amateur radio stations. Out of these 90% declared it to be the best head set they ever used.

"Get The World With N&K"

Famous for comfort

Every user of N & K Phones comments immediately on their comfort and the way they exclude outside sounds. This is due to two things—the extra size of the phones, covering the ear completely, and the leather-covered head bands, which have an additional sanitary value.

You shall be the sole judge

N & K Phones are sold by leading radio dealers everywhere. They are sold with the understanding that your money will be cheerfully refunded if you do not find that N & K Phones reproduce more naturally, give clearer, mellower tone, and fit more comfortably than any other head set you care to compare them with.

Dealers, read this!

We authorize you to refund the money on any N & K Phones returned after the above test. We will exchange or replace any that come back to you. Pending the announcement of jobber distributors, we will fill orders direct so that dealers may be prepared for the increasing demand for N & K Phones. They come packed ten to the carton, each carton containing an ample supply of display matter and literature. Wire or write your order today.

N & K Head Set, Model D, 4000 ohms. Nickeled brass sound chamber, 2¼ in. diaphragms, hard rubber caps, leather-covered bands, six feet of cord. Retail price, $8.50.

TH. GOLDSCHMIDT CORPORATION, Distributors, Dept. W3, 15 WILLIAM STREET, NEW YORK

The Wireless Age

America's Foremost Radiophone Review

Vol. XI — *No. 6*

March, 1924—Contents

Your Authors

A PRIZE-WINNER as a contributor to this number was secured in Jack Barnsley, of 9BP (Radio Breaks Arctic Silence). This amateur operator of Prince Rupert, British Columbia, has won a merited fame by receiving the first messages to be caught from MacMillan's arctic expedition and by serving for some time as the sole link connecting that party with civilization. He also won the prize of a fine receiving apparatus offered by the Chicago Radio Laboratory. His article in this number, since it tells of his own part in this valuable work, has an almost romantic flavor and will be an inspiration to all who are interested in radio.

SAMUEL C. MILLER (Colpitts' Push-Pull Circuit) is well known to many of our readers who have admired his technical articles in previous numbers. In the February number he contributed "How to Design Inductance Coils." Mr. Miller gained his first instruction in radio work during four years spent with Dr. DeForest. During the war he was a second-lieutenant in the Army Signal Corps and was assigned to the technical and test department. Upon leaving the service he joined the research department of the Radio Corporation of America. He specializes in the design of apparatus.

W. S. FITZPATRICK (A Radio Operator Sees the World) has been identified with radio fifteen years, eight of which he spent as a sea-going operator. In his present position he interviews more radio operators in the course of a day than any other person. He is, therefore, especially fitted to discuss the operators' problems, as in his article in this issue, and also give us an insight on the doings of the operators, as reported by him in our monthly feature, "Afloat and Ashore With the Operator," which through lack of space is omitted from this issue.

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When subscription expires you will find a renewal blank enclosed. Return with remittance promptly.

James G. Harbord, Pres. — L. MacConnach, Secy. — George S. DeSousa, Treas. — H. L. Welker, Adv. Mgr. — H. H. Reber, Bus. Mgr.
Major Jerome W. Howe, Editor — John R. Meagher, Technical Editor — C. S. Anderson, Associate Editor

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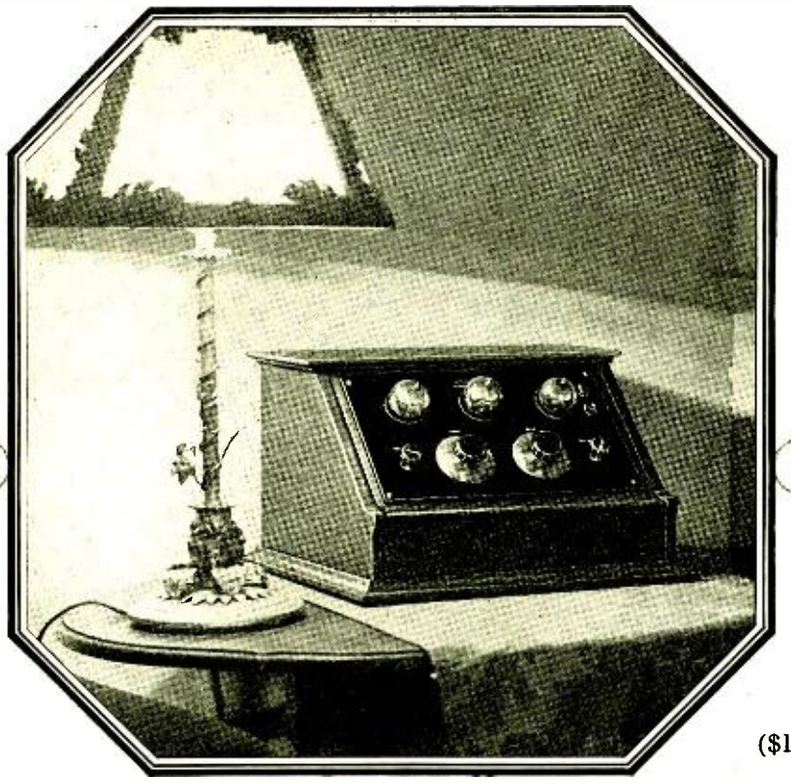


$125
fully equipped
($127.50 west of Rockies)

New Kennedy Radio Receiver, Model V

Simple to Operate—Selective—Mechanically Excellent!

This new Model V Kennedy Radio Receiver has established a high standard of tuning simplicity—combined with the same precision and selectivity formerly associated only with the more complicated Kennedy models. Added to this are all the characteristics of mechanical perfection that have made Kennedy "The Royalty of Radio."

Anyone can operate this new product of the Kennedy Engineering Staff. After a preliminary setting has been made, tuning is controlled by a single dial. Dial settings are always the same for a given station, regardless of where the receiver may be operated or the kind of antenna that may be used.

Model V is particularly free from "re-radiation." It reproduces music and voice with unsurpassed purity and operates on any ordinary antenna—outside type preferred. Embraces the entire broadcast wave range.

Selectivity is one of the outstanding features of this new Kennedy model. It will clearly differentiate between distant and nearby stations only a few meters apart—local interference can in most cases be eliminated as satisfactorily as with older Kennedy models.

Mechanically, Model V bears the same high stamp of excellence that has characterized Kennedy Receivers during the past twelve years. In every detail of construction the highest standards of precision and accuracy are rigidly adhered to.

Model V is an exquisite piece of furniture. The cabinet is of mahogany, hand rubbed to a beautiful satin finish. Its proportions are pleasing. The highly polished black Formica panel lends an elegance of finish—its height and angle have been established, after much thought and study, to provide comfort and ease in tuning.

The price of Model V, completely equipped with all tubes, dry batteries and individual Kennedy 3,000-ohm phones, with plug, is only $125.00 ($127.50 west of Rockies)—marking it as a feature value in radio equipment. Other Kennedy models range from $285.00 to $825.00 (slightly higher west of Rockies), completely equipped, including built-in loud speaker.

See the new Kennedy Model V at your dealer or write us direct for fully illustrated literature on this and other Kennedy Radio Receivers.

All Kennedy receiving sets are regenerative.
Licensed under Armstrong U. S. Patent No. 1,113,149.

THE COLIN B. KENNEDY COMPANY
SAINT LOUIS SAN FRANCISCO

KENNEDY

The Royalty K *of Radio*

San Francisco Hears Japan and Newark on the DICTOGRAND!

From the San Francisco Chronicle of December 4th

The Master Instrument That Made the Record

1. Operates without extra batteries.
2. Adjustable dial controls volume.
3. Handsomely compact in construction.
4. Finished in a rich ebony; set off by a glistening silvered rim on the bell.
5. Fully guaranteed.

ONLY

$24.50

Ready to Operate

The "Aristocrat" Dictograph Headset

1. 3,000 *ohms*
2. 10 *ounces (None lighter)*
3. *Head-fit headband*
4. *Cup-curved ear pieces*
5. *Finished in black and orange*
6. *Guaranteed fully*

WHAT a superb loud speaker! The instrument that broke all records by reproducing faint signals from far away Japan with audible loud speaker volume!

Clearly! With such clarity that this communication between the ends of the earth was understood distinctly by the 4 listeners-in!

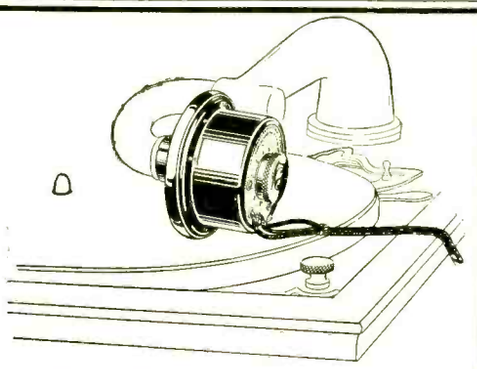
Why not get many more distant points on a loud speaker than you are now getting with your present equipment? Get a Dictograph today. Tune in some distant point tonight. See your dealer.

The Dictograph "Phono-Unit"

Makes a loud speaker of your phonograph!

1. *Uses no extra batteries*
2. *Has adapters* to fit any make of phonograph
3. *Attached and detached in a moment*
4. *Calibrated dial on back controls volume*
5. *Finished in nickel*
6. *Fully guaranteed*

$10.00



FREE

*"Applause Cards"**

"—Station K-C-L-X signing off. If you have enjoyed the artists' program, won't you write in and tell them?"

By all means! Quickly and easily with "Applause Cards."* They're handsomely printed mailing cards. All ready for you to fill in with your comments, sign, and drop in the mail box.

Keep a pack of them near your receiving set. You can use "Applause Cards"* liberally because they are FREE AT YOUR RADIO DEALER'S.

"Applause Cards"* were originated by this Company, makers of the popular Dictograph Loud Speaker and the Aristocrat Dictograph Headset. The only "Applause Cards"* are Dictograph Copyrighted "Applause Cards."*

A big FREE package of them awaits you at your dealer's. Or if he has not yet stocked, write us, and we'll ship you a generous supply of "Applause Cards"* free, prepaid, direct, provided you give us your dealer's name. Dept. F-3.

DICTOGRAPH PRODUCTS CORPORATION

220 West 42nd Street, New York City

* Reg. U. S. Pat. Off.

A Freed-Eisemann KNOCKDOWN NEUTRODYNE RECEIVER

Unassembled Model KD-50, Freed-Eisemann Neutrodyne Receiver

NEUTRODYNE has taken the country by storm. It is *the* remarkable distance getting, powerful, non-oscillating and non-whistling receiver.

A 32-page book answers every question. The panel is accurately drilled. A baseboard is furnished; in fact, everything down to the very last screw and nut, including all necessary parts excepting the cabinet.

Besides the book there is furnished schematic blueprints and template for drilling the baseboard, also full-size pictorial perspective wiring diagram, so that it will hardly be possible for the amateur with ordinary care and skill to make an error.

Remember that here are licensed parts—not a collection of apparatus trusting to luck that they will assemble properly. Each part is *designed* and fitted to work with each other part in this particular set. The instructions are so complete and the parts so accurately matched that you will be grateful for the manner in which we have eliminated guess work in the amateur construction of this receiver.

For sale by dealers of the better class throughout the country, for amateur and experimental building. Builders are cautioned against attempting to build a Neutrodyne Set with parts which are not recommended and designed by the manufacturer to work with each other.

NOW the opportunity is presented to obtain a complete set of parts, recommended by the manufacturer, to work with each other in building your Neutrodyne set. An illustrated 32-page book on how to build the Neutrodyne with full-sized diagrams and templates included.

Complete with full instructions

$80.00

DEALERS Write for Name of Nearest Distributor

Front View KD-50 Neutrodyne Being Assembled

FREED-EISEMANN RADIO CORPORATION
LICENSED BY INDEPENDENT RADIO MANUFACTURERS, INC.
NEUTRODYNE
UNDER HAZELTINE PATENT NO. 1450080 DATED MAR. 27, 1923 AND PATENTS PENDING

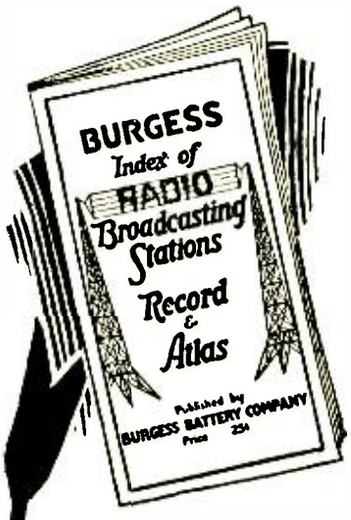
32 page illustrated book of instructions on "How to Build the Neutrodyne" with full size pictorial wiring diagram and full size panel and baseboard templates, $1. At your Radio Dealers.

Freed-Eisemann Radio Corporation

SPERRY BUILDING MANHATTAN BRIDGE PLAZA BROOKLYN, N. Y.

A Handy Booklet

for every Radio Fan



THE STATIONS you hear—who are they? Where are they? Who operates them? What are their wave lengths?

This new Burgess Index of Broadcasting Stations, Record and Atlas answers those questions. It contains in part, a revised list of every broadcasting station in America. There are maps of the United States, Canada and the World, together with accurate charts showing time divisions of the world.

Keep a record of every station tuned in

Several pages of this booklet are devoted to to space for a record of the stations you tune in, the date, call number, location, time, distance and dial positions. There's a lot of satisfaction in looking over a long list of stations brought in and showing your friends what a great little set you have.

The size is handy—The price is handy

This booklet fits the pocket — takes up little table space and the information you want is easy to find. It only costs a dime. This forty-eight page Index and Atlas was compiled to sell for 25c but in keeping with our policy of furthering the interests of radio enthusiasts, we are glad to distribute these booklets at cost. We believe you will be glad you secured your copy.

10¢ Brings it

Mail this Coupon NOW!

No more than three copies will be sold to one person for our first edition is limited.

Send us your dealer's name and ten cents and we will send your copy of the new Burgess Index of Broadcasting Stations, Record and Atlas at once.

Burgess Battery Company,
105 Washington, Madison, Wisconsin

Enclosed is.....cents for which send me....copies of the new Burgess Index and Broadcasting Stations

Name.....

Street.....

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

Dealer's Name.....

Street.....

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

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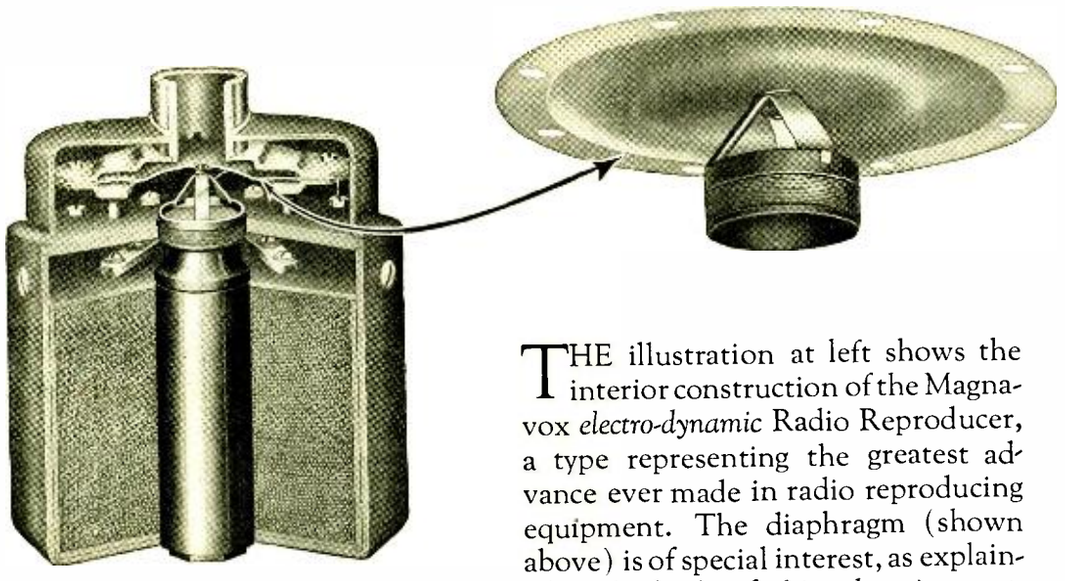


THE illustration at left shows the interior construction of the Magnavox *electro-dynamic* Radio Reproducer, a type representing the greatest advance ever made in radio reproducing equipment. The diaphragm (shown above) is of special interest, as explained in the body of this advertisement

A1-R—$59.00

This instrument (Magnavox Combination Set) consists of Magnavox Electro-dynamic Reproducer combined with a Magnavox Power Amplifier in one unit. It is an important addition to Radio in the home.

MAGNAVOX-True Radio Reproducer

THE basis of the operation of a Magnavox Reproducer is its diaphragm, the importance of which can be seen from the fact that it is required to render an almost human service in recreating every tone and quality of instrumental music as well as speech.

This diaphragm (as illustrated) has been designed and constructed in accordance with entirely new principles. Its shape, size and special character make it capable of responding to the widest range of tones.

But even this highly efficient diaphragm might be handicapped by operating restrictions—every diaphragm must have a vibrating force applied to it, and the inherent ability of any diaphragm will be injured if it is affected by mechanical operation or other foreign influences.

The use of the electro-dynamic principle of operation (found only in Magnavox Reproducers) removes all objectionable influences. This principle, utilizing the famous "movable coil" permits the Magnavox diaphragm to respond in perfect unison to the original tone.

These exclusive features, fundamental to radio reproduction, account for the superiority of Magnavox Radio equipment.

There is a Magnavox for every receiving set: Type R for storage battery sets, and M1 for dry battery sets.

THE MAGNAVOX CO., Oakland, Calif.

New York Office: 370 SEVENTH AVENUE

PERKINS ELECTRIC LIMITED, Canadian Distributors *Toronto, Montreal, Winnipeg*

3R

Editorial Chat

RADIO makes continual advances. We are calling attention by a story of Radio and the *Shenandoah* to the tremendous impulse radio is giving to aeronautics. In the sphere of national consciousness, we have lately experienced the impressive manner in which radio can bring home to us an event of such significance as the death and funeral obsequies of our revered War President, and the opening radio guns of the presidential campaign have already been fired. WJZ opens up an avenue of public usefulness that has interesting possibilities, in affording a channel of wider publicity to the educational programs of the New York City Board of Education. Everyone knows that our public schools are not keeping pace with the national progress and any means of awakening a keener interest in our school system is welcome. From the Telephone Company we get the remarkable long distance conversation that was broadcast simultaneously from stations so distributed geographically that all over the country listening fans could hear this conversation carried on by Telephone Company officials talking from such distant points as New York, San Francisco and Cuba.

* * *

RADIATION INTERFERENCE has become so general a nuisance that it has aroused a correspondingly general desire to be rid of it. General education on this subject will probably bring effective remedy. It is inconceivable that anyone who has had his evening's entertainment spoiled—and who has not?—by the radiation from some other fellow's receiver, should himself deliberately offend. The Chief Radio Inspector expresses the probably correct idea that most owners of radiating sets are in blissful ignorance of the trouble they are causing. This ignorance will probably be quickly removed by the publicity now being given to the matter, and if the movement to form local radio clubs is as successful as it deserves to be, set owners will find plenty of assistance in the installation of mufflers or in the proper operation of their sets so as to avoid causing trouble. Few people care to be known in their particular community as a "nuisance."

* * *

IT is inevitable that a new industry that is making such rapid development as radio should receive the attention of legislators and investigating commissions. It is natural and right that our proper government agencies should take cognizance of a development that has an intimate character to millions of citizens. Legislative investigation generally results in clearing the atmosphere, or as we shall soon become accustomed to say—the ether. In January the Federal Trade Commission lodged complaint against the leading companies in the radio industry, charging monopoly. Presumably this action has been inspired by a growing opinion in some quarters that the industry is becoming monopoly-ridden. Investigation will probably bring the facts in the case out in true light, and dissipate a lot of misinformation. The respondents are required to answer the complaint this month and their replies will be received with much interest. Public education in the matter of monopoly has traveled a long way since the Sherman anti-trust law was passed and the economic necessity of organization is now quite as well and generally understood as are the accompanying dangers of restraint of trade. The editorial newspaper comment upon this incident indicates that radio development need not fear a set-back because of ill-considered action at this time.

* * *

RADIOTRONS hit the Five Dollar mark a short time ago, and thus lend strength to the hope that 1924 will be measured by progress in the radio industry as great as that of last year. Reduced cost of radiotrons should lead quickly to reduced cost of receivers, which will certainly meet with general favor. The new standard-make sets coming out this spring show this tendency and are otherwise worthy of attention. We will give our readers some useful information about the new lines of receivers in our April number.

* * *

RADIO Dealers should appreciate that every buyer of good apparatus that works and is made to work—by the dealer himself if necessary—will be a future buyer of the successively improved apparatus that the development of radio will continue to put on the market; and that, on the other hand, every buyer of apparatus that fails to give satisfaction—*even if it be by reason of his own ignorance and incapacity*—will never buy of the dispenser of that dissatisfaction a second time, and, what is of more general importance, suffers a dampening of his radio enthusiasm. The wise dealer therefore, in his own interests as well as in the broader interests of the industry, will sell to his patron the kind of apparatus best calculated to give satisfaction and stimulate in him the desire for greater and greater satisfaction which the dealer will later be afforded the opportunity to gratify. This principle extends farther than to the kind of apparatus bought and sold, it may often involve a considerable amount of instruction and advice, of installation and maintenance service. That's the word, finally. The dealer will be called upon not for brass and wire and a mess of junk, but for service.

* * *

LET us hope that the censorship that Mr. Hays deplores in the moving picture industry will not descend upon radio broadcasting. Broadcast stations, in their desire to capture a wide field of interested listeners are subject to the same temptations that have led newspapers and periodicals and the movies to exploit the emotions with little regard to any factor other than self-interest. Considerable restraint is incumbent upon program managers and artists if censorship is to be avoided in this new field, and surely censorship is nowhere popular. There is small occasion for immediate alarm. But there is probably too strong a tendency to make the programs reflect the popular taste, so far as it can be determined. And popular taste is a poor standard of measure for anything but ice-cream and soda-pop. There have been instances of artists who have failed to appreciate their responsibility, probably because they have failed to realize the varied character of their unseen audience. As an example may be cited the reported talk of a rather well-known woman who sent some spicy gossip over the ether in apparent disregard of the little bedtime story listeners. Studio and program managers must exercise a high quality of taste. Broadcasting is too big to trifle with.

THE WIRELESS AGE

"America's Foremost Radiophone Review"

VOLUME XI MARCH, 1924 NUMBER 6

RADIO
AND THE GIANT OF THE AIR

BCL's Safeguarded the Nation's Pride In Her Struggle With a Winter Storm

In a Polar Expedition Radio Would Control the Shenandoah

By William A. Hurd

THE Shenandoh idled at her mooring mast—a giant ship 680 feet long, swinging at a height of nearly 200 feet above the earth.

Twenty-one of her crew had just gone aboard.

Gunner Robertson, a radio expert from Washington, D. C., had come to the Naval Base at Lakehurst, New Jersey, to replace the radio-compass experimental apparatus on board the Shenandoah with the permanent wireless station that would be the equipment used on her Polar expedition.

The transmitting apparatus was designed for sending continuous and interrupted continuous electric waves by the use of a rotating segment wheel. Six vacuum tubes were employed, supporting an input energy of 300 watts and an average output of 150 watts. The operating wavelengths were to be 507, 600, 800 and 975 meters.

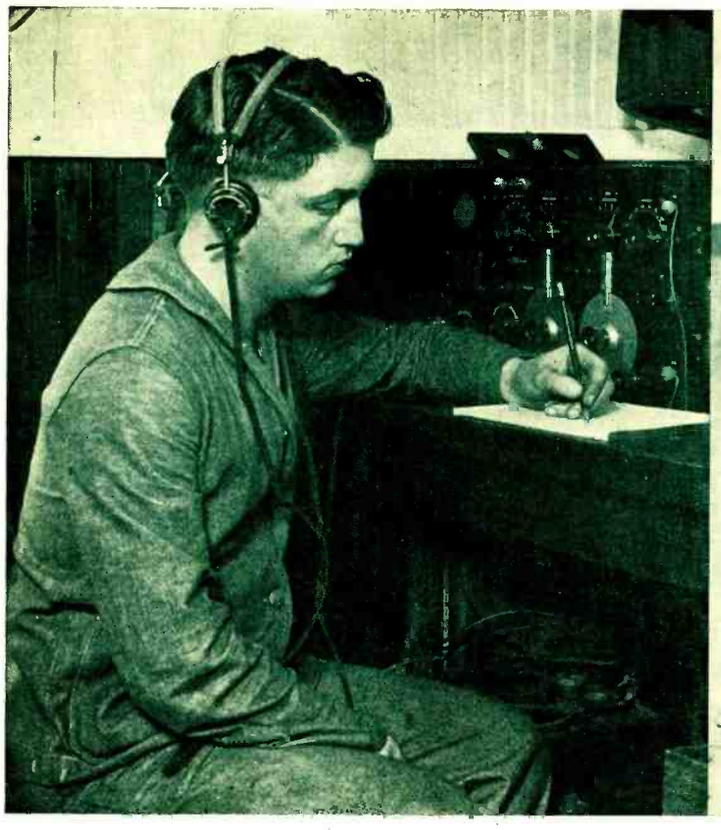
The antenna consisted of 300 feet of trailing wire that could be reeled up as the airship approached the earth. The ground connection was to be effected by using the framework of the dirigible.

Captain A. Heinen, test pilot, the hero of the wild ride

The receiving instruments, of the two-circuit type, employed three stages of radio frequency, two of audio frequency and a detector. The six tubes were SE-1444, Navy type. The long distance receiver was to operate on a range of 500 to 30,000 meters. Telephone jacks were arranged to allow the use of either radio or audio amplification in one or two stages.

A gasoline-driven generator, differing from the usual fan-driven generator for aircraft, was to be installed for the source of electrical energy. A storage battery was included which would supply power for about two hours in the event that the generator failed.

The installation work was well



Naval operator at the radio station at Lakehurst. The receiving set shown is the navy type employed at most of the naval land stations

Left, G. C. Schnitzer, chief radio operator at Lakehurst. Right, Gunner J. T. Robertson, the only radio operator aboard the Shenandoah when she broke away from her mooring. These two maintained communication between ship and station

under way, lacking but an hour or two for completion.

The lonely figure of a syndicate press correspondent lounged about the foot of the mooring mast. For days he had remained at his post hoping for some scrap of news. But there had been none for his pains, nor could the busy attachés of the Station pause to offer encouragement.

A wind whipped across the landing field, threatening, ominous. It seemed to pause, and then settled down to gale force. Rain followed. The wind increased in velocity.

And suddenly, a forty-mile gale swept down. But the giant airship rode easily at her mast.

Lieutenant Nelson, in charge of construction, stepped to his front door to reassure himself as to the safety of the Shenandoah. Through driving sheets of rain that reflected the light from his doorway he could get an occasional glimpse of the ship, swinging fitfully for brief moments, but apparently riding out the gale serenely enough. He was satisfied that adequate proof of her eligibility for the Polar flight had been established.

But the wind leaped to seventy miles an hour as he watched. A ripping crash brought a startled exclamation to his lips.

"There she goes!"

A figure tore its way through the blinding storm. For a moment, Lieutenant Nelson's gaze was averted and held by the apparition dashing madly toward the house. And then he recognized the figure.

It was the press correspondent! And he had every intention of reaching a telephone, quick!

Lieutenant Nelson again looked for the Shenandoah. But the great ship had been swallowed by the darkness.

Grabbing his coat he dashed over the scrub oaks and shrubbery intervening between his house and the mooring mast. An immediate attempt was made to establish communication with the ship. But the effort was futile as the alterations in progress at the breakaway had not been completed. The operator at the land station could only wait and listen.

Lieutenant William Nelson, in charge of construction at Lakehurst

The next move was to telegraph a brief message to WEAF, New York, explaining the plight of the Shenandoah and request that information of her position be sent to Lakehurst as soon as lookouts could be put on watch throughout the Eastern States.

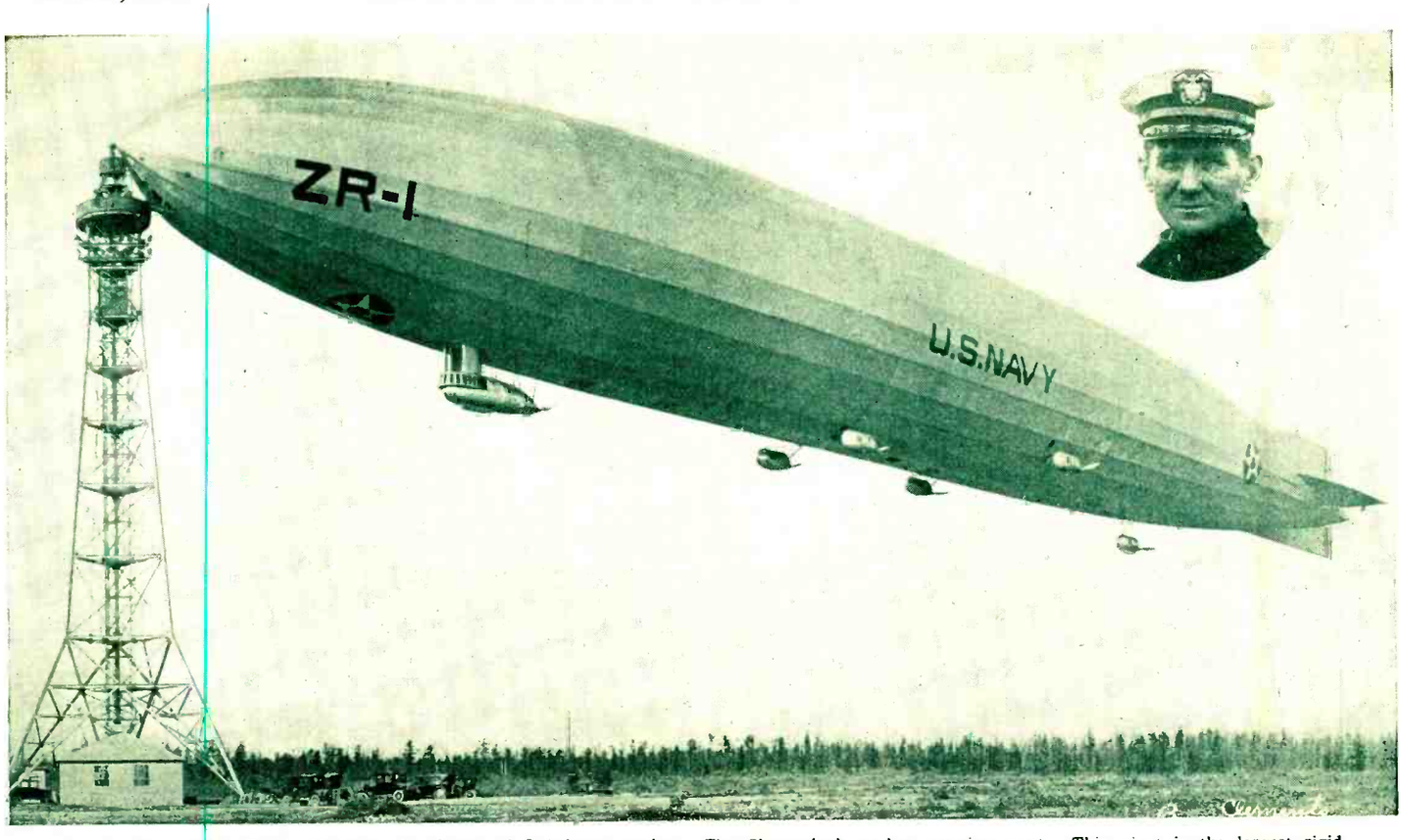
WOR, Newark, New Jersey, was in turn notified by WEAF, followed by a general alarm to broadcast stations along the coast. All broadcasting in the East was immediately shut down.

But it soon became evident that WOR could render a real service to the Shenandoah because that station happened to be strategically located for accumulating reports from points in the probable course of the ship. Government rules forbade broadcasting while a ship was in distress. A quick decision was needed. And it was made.

Putting on full power, the announcer broadcast a report of the situation as it was known, and requested that B. C. Ls. should listen and watch for the Shenandoah and telephone any information that would indicate her position.

So far, all that could be done had been done by wireless.

Broadcast listeners had been stimu-



Insert, Commander Frank McCrary, in charge of Lakehurst station. The Shenandoah at her mooring mast. This giant is the largest rigid airship in the world—nearly as long as the Woolworth building is high. The radio call ZR-1 will be changed to NERK if the ship goes on the contemplated North Pole trip

lated to the full realization of the powerful drama in which they had become active members of the cast. Reports began to pour in to WOR, and the whereabouts and probable condition of the Shenandoah was expeditiously relayed to Lakehurst.

In the studio, pandemonium reigned. Telephone calls from all points cluttered the switchboard. Some people wanted further details. But the most helpful calls came from the Plainfield section where it apeared the Shenandoah had won against the wind and was heading toward Newark on a starboard tack, fighting her way valiantly.

Someone in Westfield had heard a terrible crash and had forthwith notified the police and fire departments that the dirigible had struck, and protested against such an outrage.

An old lady telephoned to protest against the wanton negligence on the part of the government for sending the poor sailors out on a night like that and insisted that airplanes should be dispatched at once to tow in the crippled airship.

A small party from the studio went up on the roof to watch for the Shenandoah. They had to crouch behind a parapet and clutch at any available support to keep themselves from being swept from their feet. They searched the sky with eager eyes, but could only hear the muffled roar of the ship's motors circling around the city.

Suddenly, the giant form of the dirigible seemed to drop from the clouds directly above them. And the rain-soaked figures rushed down to the microphone to broadcast the information that the Shenandoah was well under control with all of her six motors running smoothly.

It was a thrilling moment for the broadcast listeners. The fate of twenty-one lives and a million dollar project, that night, depended upon a science held in the palms of unskilled hands. The B. C. Ls. had all been involved in the great event that marked another epoch in radio development.

Commander R. D. Weyerbacher, U. S. Navy, designer of the Shenandoah

Aboard the Shenandoah, before the breakaway, the crew had been busily engaged with routine matters. A man stood over each motor, oiling and polishing the mechanism.

In the control car, Commander Pierce and Captain Heinen were engaged with the delicate manipulation of the various instruments. Behind them Gunner Robertson labored with the final installation of the wireless equipment.

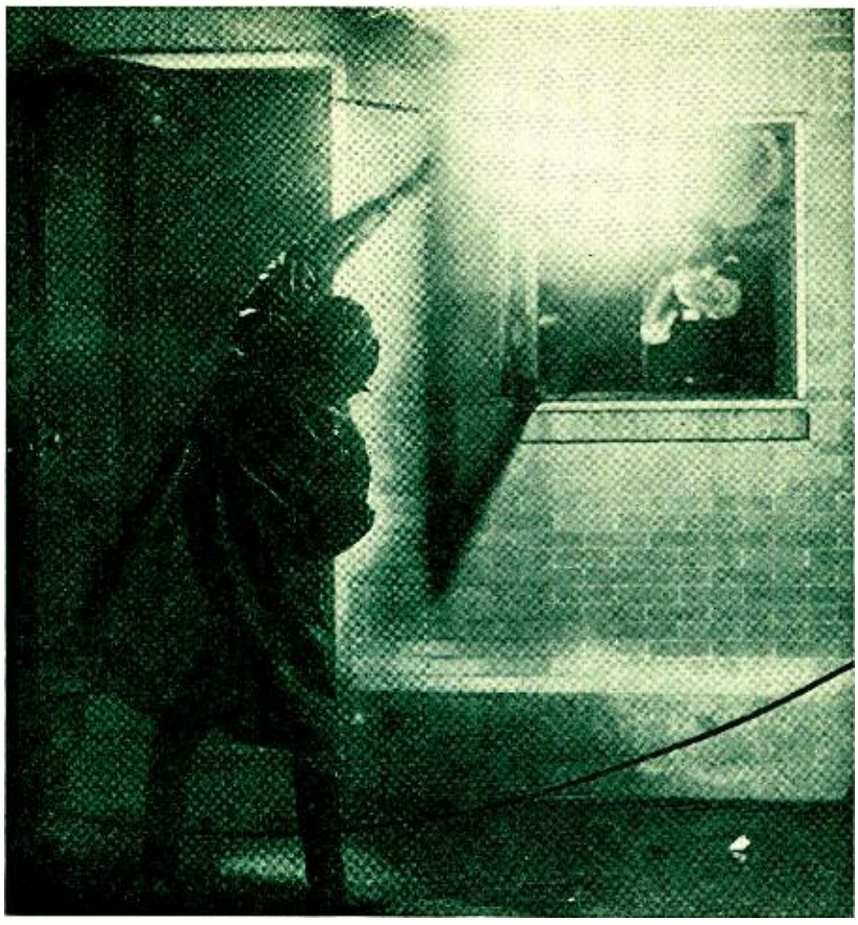
A violent lurch of the ship threw them headlong into the bulkheads. The cry went up as of one voice:

"There she goes!"

Captain Heinen jumped to the control lever and released 4,000 pounds of water ballast from the bow. The ship backed off toward the woods just west of the mooring mast. Her nose continued to rise until she stood at an angle of 60 degrees. For a moment it seemed that her tail must have caught in the trees.

Three huge gasoline tanks were let go, but the dirigible stood at such a precipitous angle they struck a main strut and carried it away with so much force the giant ship trembled. But she rose.

While the officers struggled to sta-



Trying to signal to the Shenandoah by flash light on the roof of station WOR. The announcer stood in a driving rain storm in constant danger of being swept from the roof by the 70-mile gale

bilize the Shenandoah in the seventy-mile gale, the men at the motors strained to get them started.

Captain Heinen refused all reports of the actual damage, preferring to "feel" the situation by the performance of the ship under his guidance.

The two forward gas bags had been destroyed when the nose pulled off at the mooring mast. And the third bag had sprung a leak. But Commander Pierce stood in the gap at the bow to patch the weakened section. Little else than nerve stood between him and death. But so, likewise, he stood between the crew and death.

The lone operator realized that radio communication was vital. But the quick assembly of the wireless equipment was seriously hampered by the violent lurching of the ship. Before long the work became a sort of dogged routine.

Powerful searchlights began to sweep the sky, seeking the Shenandoah as a result of the report broadcast by WOR. The lights served, in some measure, to guide the course of the stricken ship.

It was 6:52 when the dirigible left her mast. A 8:20 the first news of her whereabouts reached the Naval Station.

But at 9:10 the first message from the Shenandoah was received. It seemed like the voice of the ship herself speaking out to tell them at Lakehurst that she would soon be back.

"All O. K. Riding out storm. Over New Brunswick. Verify position. send us weather information."

The ship's radio was working!

Weather information was most important. Radio on radio was sent to the ship to supply them with weather predictions from all government bureaus in the east. Her positions were included in those reports.

The only links between the ship and her mother station were the messages exchanged. Communication kept up the spirit of each group.

And as the courageous crew managed to swing the ship around, nose into the wind, and finally make headway homeward, the landing gear at the station was prepared for receiving.

Word came in that she was waddling over Keyport. Later, a message reported cruising speed over Freehold and that brought all of the ground crew out so that the Shenandoah could be run into the hangar as quickly as possible.

Had the ship been delayed, another storm from the northwest would have driven her before its fury for several hours longer.

And it was radio alone that made possible the co-operation between ship and station that saved the Shenandoah from the ravages of the Northwester.

Lieutenant Nelson advanced the opinion that radio was largely responsible for the Shenandoah's escape from a greater disaster and possible destruction.

A thoroughgoing investigation was instigated without delay. The several constructional problems under consideration cannot be made public until official reports have been released. But the facts surrounding the inestimable service of radio throughout that night of anxiety was common knowledge long before the government could get the Shenandoah behind the tape-line for private observation.

And the responsibility for her safe conduct had been thrust upon the public quite unsolicited. Moreover, a rather unique situation was presented to the broadcast listeners. They had been aroused to active participation in an affair that had always been left to the management of supervisors indirectly appointed by them.

But a cry of distress from out of the

Upper portion of the Shenandoah's mooring mast with the nose of the ship clinging to the top after the dirigible had torn away

ether called upon the broacast listeners for active assistance. And it was through the same medium that aid was effected.

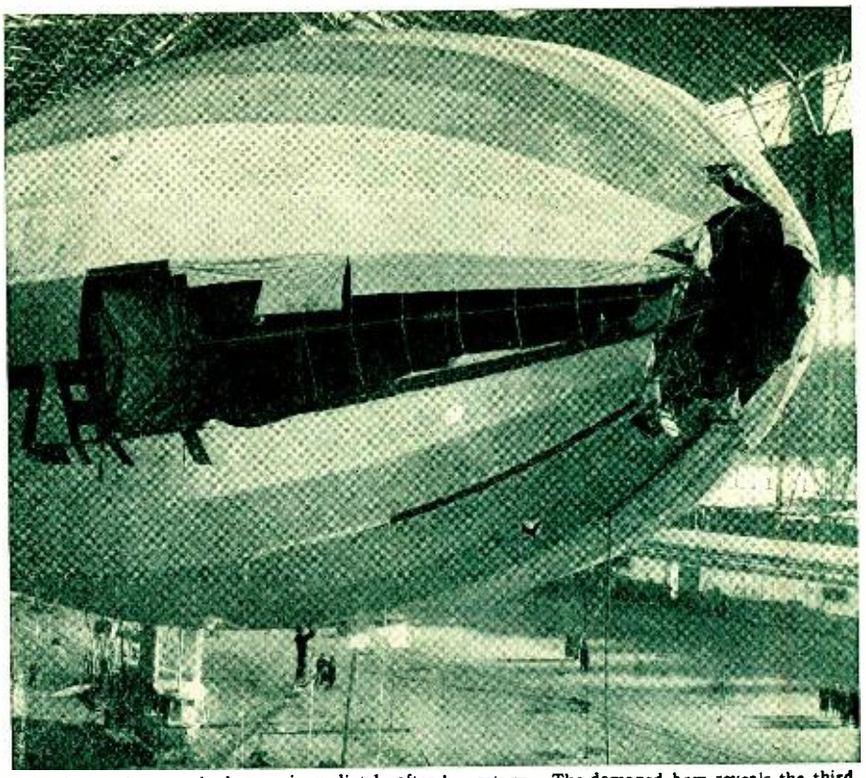
The relative importance of radio to airship navigation had been established.

In a contemplated North Pole flight, radio would serve as the only connecting link between the ship and the outside world.

Its practicability has been demonstrated in the Polar expeditions of Amundsen and MacMillan. In each case radio has served the dual purpose of maintaining an intimate contact with the outside world and a close inter-communication with scouting parties sent out to anticipate topographical difficulties.

An efficient radio compass has been erected at Lakehurst to direct the course of the Shenandoah on extended voyages. When the proper receiving equipment has been installed on the rigid airship, a trip to the North Pole would entail little more than accuracy in mathematics.

The stamina of the personnel and the element of danger in the unforeseen are matters that would naturally be subject to controversy. Lieutenant Nelson maintained that ignorance of aeronautics would very likely be the cause of most arguments that might arise over the contemplated Polar flight. But he entertained a lively conviction that the triumph of the Shenandoah in her valiant struggle against the seventy-mile gale, handicapped as she was at the outset, would prove her fitness to cope with a situation that could be calculated in advance and adequate measures adopted to insure her bon voyage.



The Shenandoah in the hangar immediately after her return. The damaged bow reveals the third section within, on the left, which was nearly damaged. Had that section been destroyed, the ship would have met with disaster

And it was notable that his optimism should find its inspiration in the splendid performance of radio during the most trying hours of the giant of the air.

The enthusiastic response of broadcast listeners had converted their passive concern in the mutual ownership of the great dirigible to an active sense of responsibility.

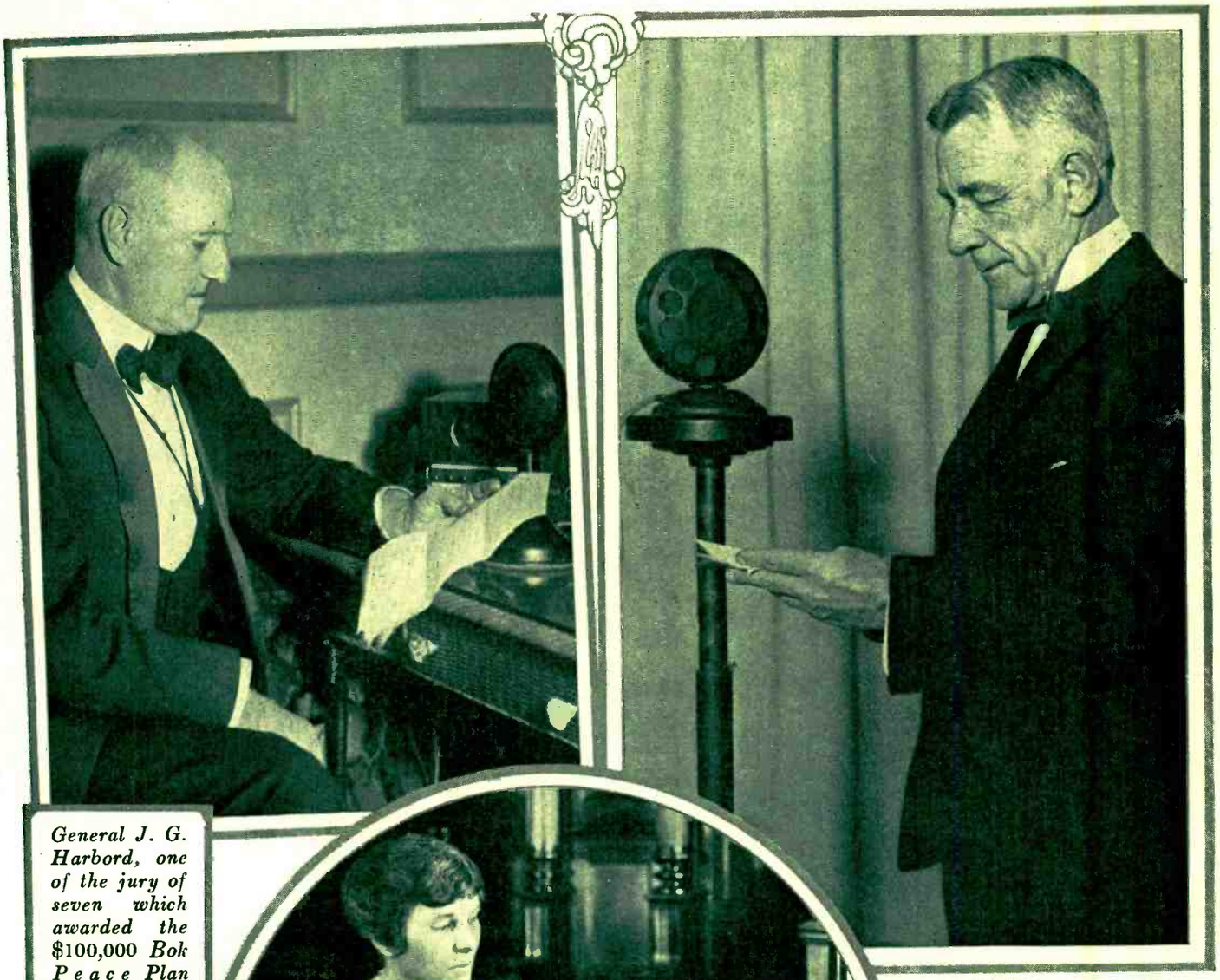
A pilgrimage of three thousand visitors daily for well over a week manifestly proclaimed the proprietary interest of the public in the Shenandoah and the toll of her wild ride throughout that memorable night. It was evident that they felt a sense of responsibility for her safe return.

The vast domain of broadcast listeners had become aware of a new era. They had, indeed, recognized their active participation in a world affair for the security of their firesides. And it was small wonder that they should view the Shenandoah somewhat more familiarly than was their wont in less personal affairs.

The new science of radio was that night dedicated to the service of aeronautics.

The inimitable Irene Bordoni was bitten by the "radio bug" when she broadcast, from WEAF, a scene from her Broadway success, "Little Miss Bluebeard." The story of her DX adventures is told on page 30

Broadcasting the Bok Peace Plan

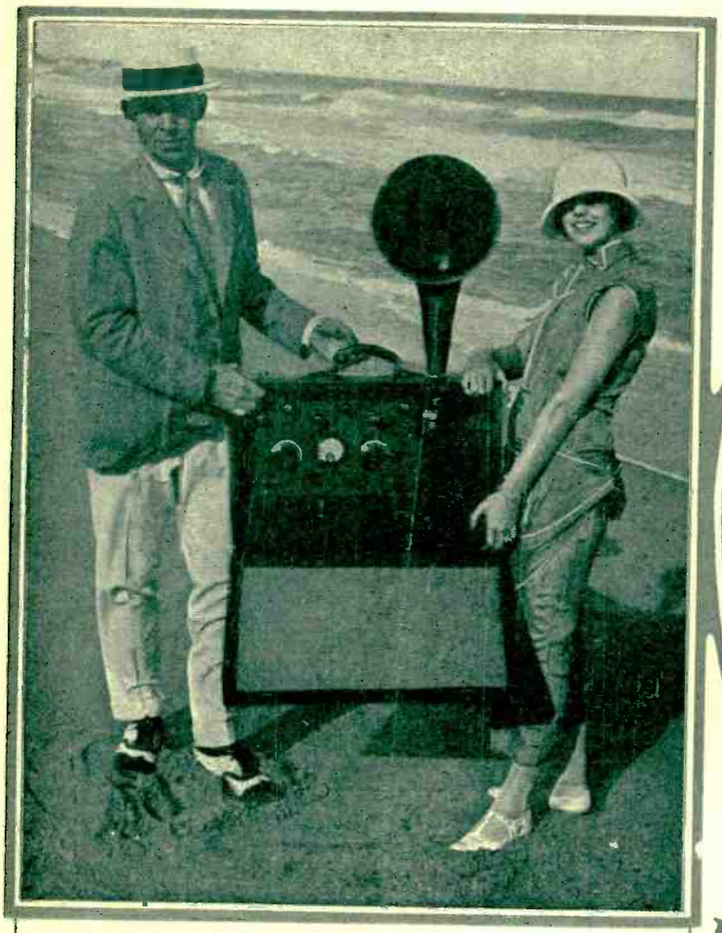


General J. G. Harbord, one of the jury of seven which awarded the $100,000 Bok Peace Plan prize, spoke from WJZ on the ending of war

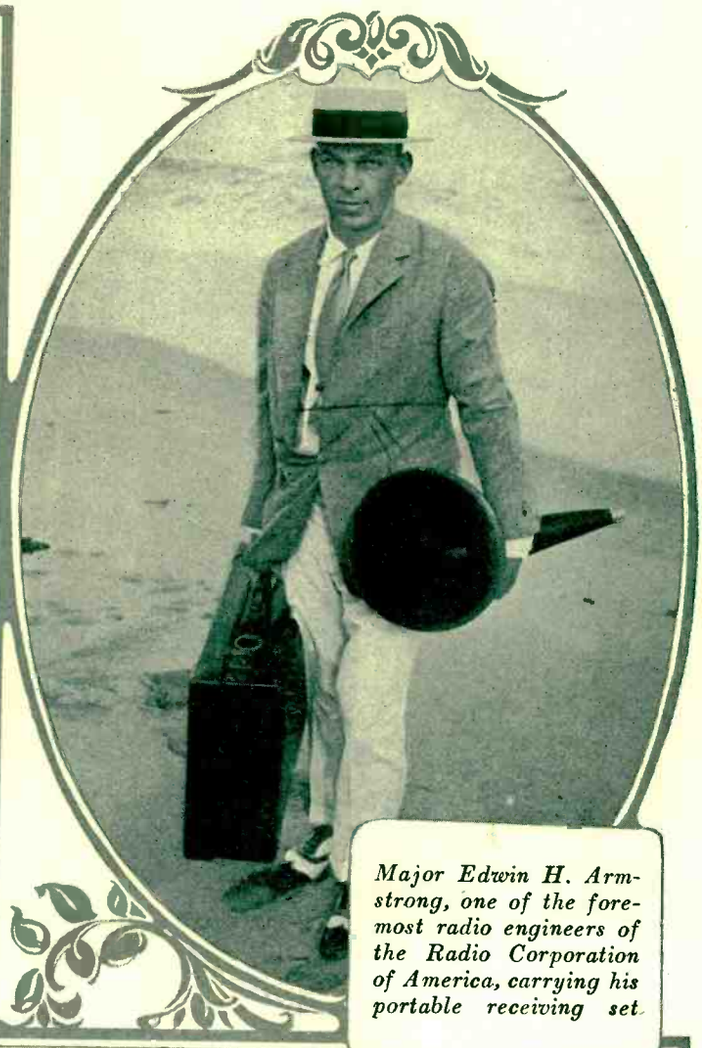
Edward W. Bok, a retired editor, broadcast from WEAF the winning award of his Peace Plan Contest

Mrs. Frank A. Vanderlip broadcast the Bok Peace Prize Plan from WGY. She also explained the referendum and encouraged all listeners to cast a ballot

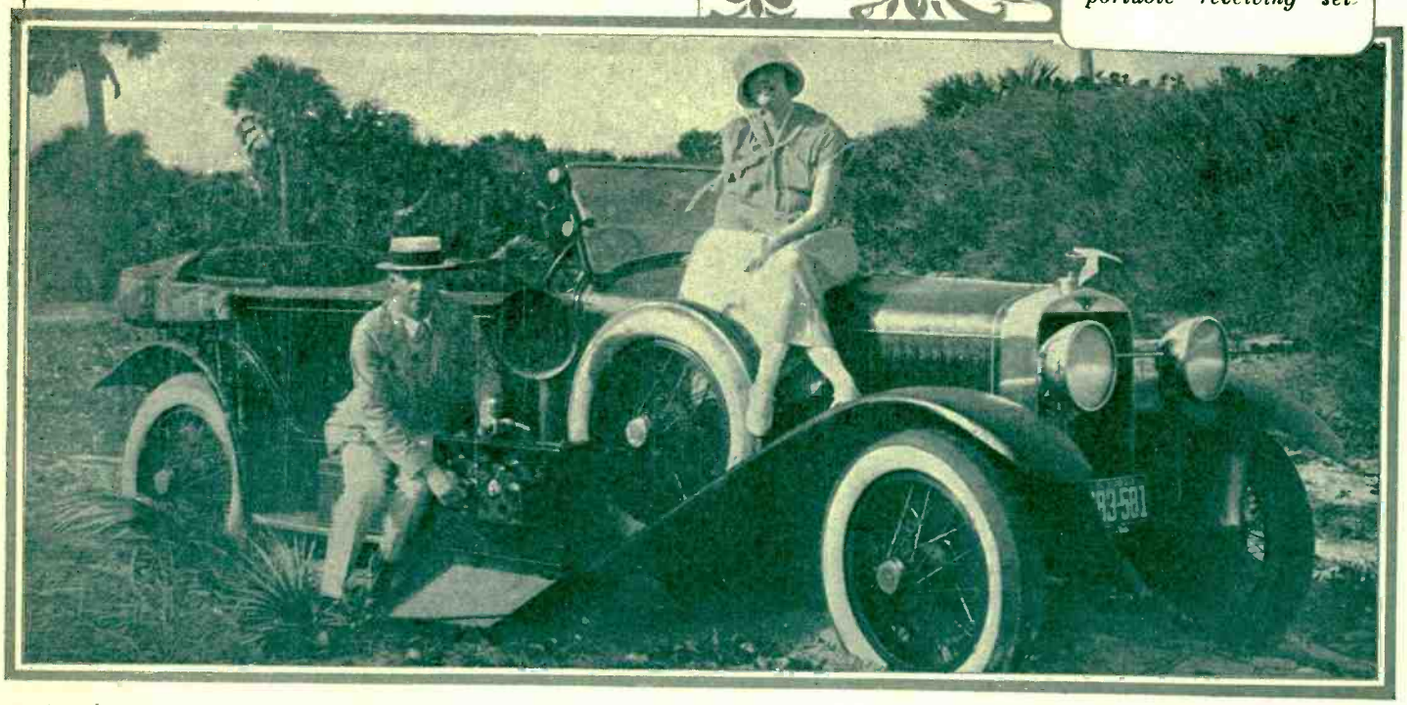
A Radio Engineer's Honeymoon



Major and Mrs. Armstrong sojourning at the popular winter resorts with a portable radio set developed for reception without aerial or ground connection



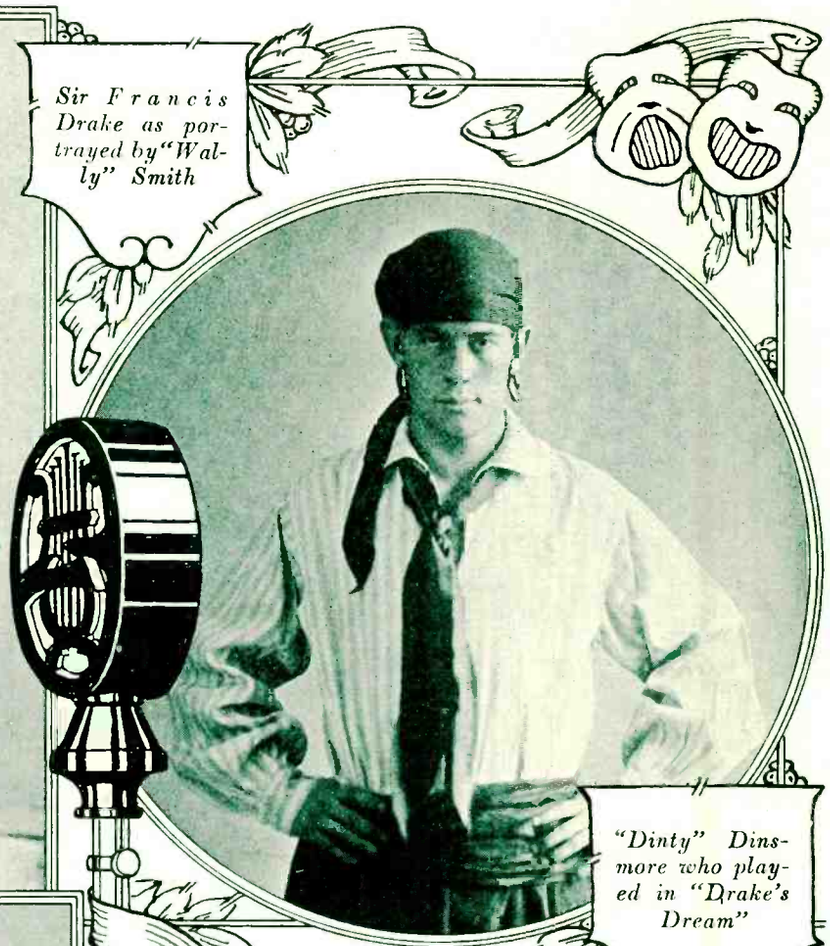
Major Edwin H. Armstrong, one of the foremost radio engineers of the Radio Corporation of America, carrying his portable receiving set



The bridal couple, Major and Mrs. Armstrong, acquired many new friends on their happy cruise through the South. Their portable radio set caused a sensation and was credited with the honor of gaining for them a great many of their new acquaintances, but the couple hardly needed support in attracting friendships

Princeton Students Broadcast Musical Comedy

Sir Francis Drake as portrayed by "Wally" Smith



"Dinty" Dinsmore who played in "Drake's Dream"

Ted Russel, soubrette in play broadcast from WJZ

"Lord Ascot," was played by W. R. Brenton

Jack Barnsley in a Marconi Company uniform

Jack Barnsley Tells How He Reached the MacMillan Arctic Expedition by Radio

An Exclusive Story for THE WIRELESS AGE

Radio Breaks Arctic Silence

By Jack Barnsley

FROM the number of communications that have come to hand it would appear that what is foremost in the minds of many radio amateurs and others interested in radio, throughout the United States and Canada, is how Canadian Amateur Radio Station 9BP located at Prince Rupert, British Columbia, was able to get into radio communication with the MacMillan Arctic Expedition aboard their wireless-equipped, auxiliary schooner *Bowdoin*, for a period of about two months before any other radio stations were able to establish the connection.

Previous Arctic expeditions under Captain Donald MacMillan were not equipped with radio apparatus. Before the present expedition left, however, MacMillan was persuaded by his friend, Mr. E. F. McDonald, of Chicago, to equip his little 15-ton schooner, with radio apparatus.

The apparatus selected is of the latest design, such as used by many radio amateurs throughout the country, the power of the transmitter being 100 watts and of the continuous wave type, energy for this being obtained from large Delco storage batteries which are charged each day by a generator driven by a gasoline engine. Power from the storage battery is used to drive a motor-generator supplying alternating current of 500 cycles, which is again stepped up through a transformer to about 2,000 volts, this voltage being applied to the plates of two Western Electric 50-watt transmitting vacuum tubes.

The receiving apparatus consists of a Zenith regenerative tuner with audio-frequency amplification, together with a loud speaker, in order that the ship's crew may listen and enjoy the programs broadcast.

The aerial that caught the Bowdoin's signals. Canadian radio station 9BP

The antenna system during the voyage north consisted of a small aerial stretched between the masts of the schooner with a lead forward to the forecastle, where the wireless apparatus is located.

After it was decided to equip the *Bowdoin* with wireless apparatus, it was necessary to choose an operator. As the American Radio Relay League was in charge of all the arrangements with respect to the expedition's wireless, this was the prerogative of the League. Most radio enthusiasts would have welcomed the opportunity to accompany the expedition to the Far North in order to see for themselves what thrills the Arctic had in store for them, particularly from a radio viewpoint. Luck seemed to have been with Donald Mix, a first-class amateur with plenty of practical radio experience, residing in Bristol, Conn., who was finally chosen by the League to accompany the MacMillan Expedition as their representative.

The expedition which left Wiscasset, Maine, in the latter part of June, 1923, intended if possible to keep in communication with the outside world by the aid of amateur radio stations located in all parts of North America, many of these having prearranged schedules with the *Bowdoin* which they were evidently able to maintain until the expedition passed north of Disco Island, situated less than halfway up the West coast of Greenland toward Refuge Harbor.

As the expedition left from the Atlantic Coast, and their destination, North Greenland, seemed so terribly far east from the Pacific, it was thought by many wireless amateurs on the latter coast that the *Bowdoin* would establish communication with Atlantic Coast amateurs only, and it would only be under very favorable conditions that signals from the Arctic regions would be heard on the Pacific Coast. This presumption proved to be entirely incorrect, however, as instead of being heard occasionally on the Pacific Coast, the *Bowdoin* has been heard and worked almost consistently by the West Coast stations, while only a very few of the East Coast amateur stations have been able to even hear the faintest sound of the *Bowdoin's* signals.

Nothing having been heard from the *Bowdoin's* wireless for a long period after the expedition went north of Disco Island, it was feared by those closely connected with the success of the expedition's effort to keep in communication, that the arrangements as far as wireless communication was concerned were to be a failure. The Chicago Radio Laboratory, to increase the vigilance of amateurs all over the country, offered as a prize for the first amateur to establish communication a duplicate of the receiving apparatus aboard the *Bowdoin*. Although this kind offer was unknown to the writer, he was keenly interested in the expedition, and was fortunate enough to win the prize. Sitting at my receiver on the evening of September 5, I first heard WNP (Wireless North Pole), the call signal allotted by the United States Government to the *Bowdoin*, endeavoring to establish communication by transmitting a general call to all stations. An answer to this call was sent out from my station, 9BP, at Prince Rupert, but without result. Communication was not effected this night. Then again on September 7, the *Bowdoin's* wireless was heard. Knowing that nothing was impossible as regards the distance that signals from an amateur station may be heard under favorable conditions, a reply was again transmitted to the *Bowdoin*. Imagine the thrill and surprise when WNP replied with "Hello, old top, your signals very loud here. You are the first station I have been able to raise. Surely glad to get you." This was the first breaking of the *Bowdoin's* apparent silence.

The first night of communication was given up to a few personal messages from members of the expedition to their several families and friends, giving them the first news of their safe arrival in winter quarters at Refuge Harbour, North Greenland, located in latitude 78.30 north and longitude 72.30 west, where they are now frozen in solid until the ice breaks up during the coming summer. After the *Bowdoin* had transmitted all of the messages on hand, they were asked if they had heard the news of the terrible earthquake disaster in Japan, and on receiving a negative reply, particulars of the earthquake and damage sustained were dispatched, together with other world news, which Mix advised they were all glad to receive—not having had any news for quite some time. After this a schedule was arranged in order that regular communication might be maintained between the *Bowdoin* and the little amateur station at Prince Rupert.

The second night of communication was then taken up with a long press dispatch for the North American Newspaper Alliance, advising the outside world how the expedition was faring and what their plans were.

Since the first radio connection almost regular communication has been maintained by the Prince Rupert station and the *Bowdoin*, frozen in at Refuge Harbour, thereby giving the expedition means of communicating with the outside world.

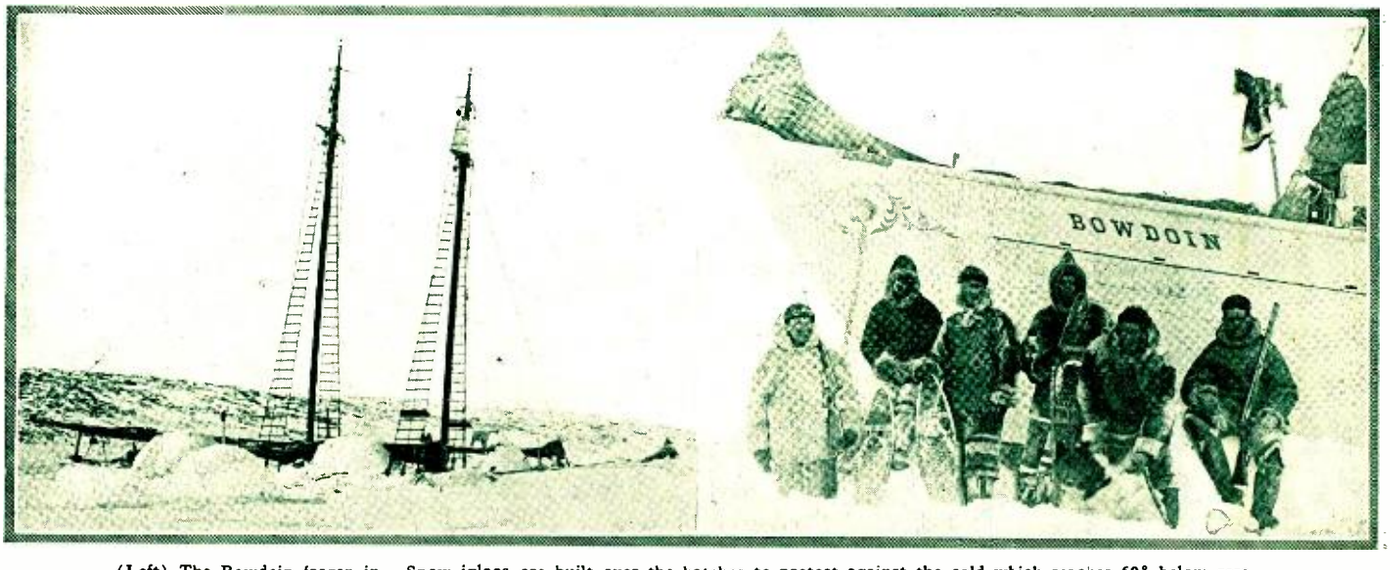
After the ice formed around the schooner a new aerial was erected leading from the mast of the vessel to a cliff nearby. A counterpoise for the transmitter was also built. It consists of a number of wires leading from the ship and lying flat on the ice beneath the aerial. Contrary to the general manner of erecting counterpoises, theirs is not insulated from the ice, this being impossible due to the fact that much snow will fall before the winter is over.

The present quarters of the expedition are located ten miles north of Etah and within five miles of Explorer

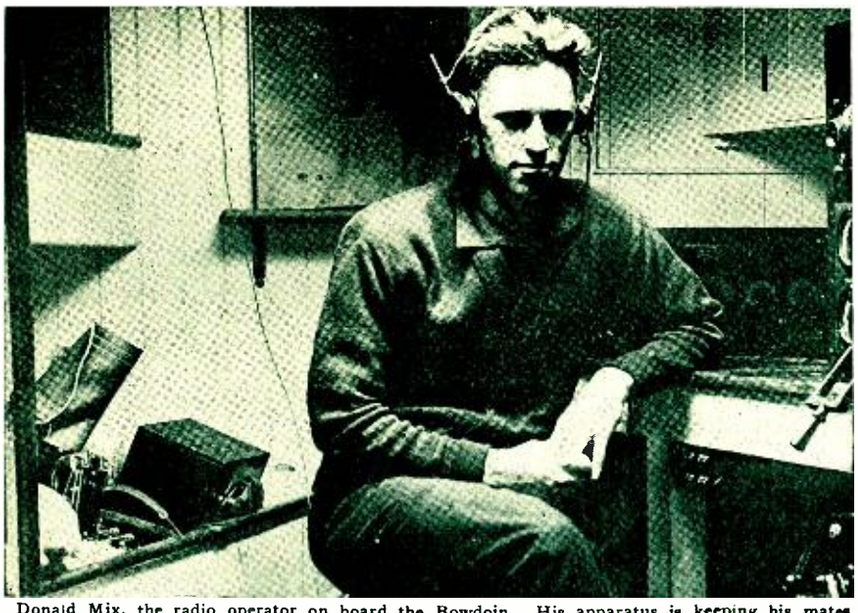
The explorer himself, Dr. Donald MacMillan

Peary's base, from which, in 1909, he was able to discover the North Pole. Had his expedition been able to communicate by wireless, news of his success would have been received in America months before it was possible for them to return home.

According to messages received from Captain Donald MacMillan, it is very apparent that future expeditions under him will never enter the Northland without radio apparatus, as not only have they been able to receive the news of the world and messages from



(Left) The Bowdoin frozen in. Snow igloos are built over the hatches to protect against the cold which reaches 60° below zero
(Right) The crew of the Bowdoin. Dr. MacMillan third from left



Donald Mix, the radio operator on board the Bowdoin. His apparatus is keeping his mates in constant touch with the world

home, but their radio set has eliminated the great hardship of the Arctic—namely the solitude. They are able to sit in their electric-lighted cabin aboard ship and listen to concerts and church services from home.

The neighboring Eskimos, who visit the expedition on moonlight nights have been entertained by the ship's radio, but this great invention of man is so far beyond their imagination that they cannot comprehend it, and consequently they just regard it as another phenomenon. Not only have the Eskimos been entertained by broadcast music, but in addition the expedition has also a motion picture machine.

The Arctic night, according to MacMillan, is preferred by the native Eskimos, as during these long winter days without light they are able to enjoy trips with their dog sledges on the frozen sea ice, visiting friends and relatives in other parts of the country, while during the late Spring, Summer and early Fall the ice is either melting or gone, which makes travel by this means impossible. Summer is their time of work, when they are bound to gather together their supply of meat and eggs for the winter food supply. In addition to not having time to visit other settlements in the summer, travel by land is nearly impossible, and for that reason is seldom ever undertaken. Is it possible to imagine that at some future time, Eskimo igloos will be equipped with radio receivers and possibly transmitters, which will add to their happiness and contentment in the land of winters without light—so ideal for the reception of wireless signals?

Since regular communication was established in September by the Prince Rupert station, much news relative to the present welfare of the Eskimos has been given the world by Captain MacMillan. Messages of great importance relative to the magnetic and atmospheric observations being undertaken by the MacMillan party have been received from the *Bowdoin* for relay to the Department of Research in Terrestrial Magnetism, Washington, D. C. The receipt of these communications by radio is, according to the Department at Washington, unique in the history of this work. Reports from previous expeditions doing this work for Washington, on account of the lack of communication means, had to be held by the observers until the return to America of the several expeditions.

Over 15,000 words in actual messages have been handled between the *Bowdoin* and the Canadian amateur station, and the characteristic 500-cycle note of the *Bowdoin's* wireless is a welcome sound at the Prince Rupert station. At times the *Bowdoin's* signals are as loud as many amateur stations a few hundred miles distant, and at other times the signals are so faint that it is impossible to read them.

The Radio Department of the Bureau of Standards, Washington, D. C., have established voluntary stations for making observations of the wireless signals from the *Bowdoin,* and it is to be expected that much data will be gathered with which they will possibly be able to ascertain more accurately the cause of the fading signals with a view to discovering a remedy. They possibly will alone be able to say why the Prince Rupert station was the only connecting link with the *Bowdoin* out of the thousands of amateur stations located throughout the country.

The work in connection with the relaying of messages to and from the *Bowdoin* is beyond the imagination of the average person. Not only does it mean a nightly vigil awaiting the time when non-interference from other radio stations will permit the relaying of messages, but on account of the press dispatches from the *Bowdoin* bearing the name of the Prince Rupert station and being read by millions over the entire country, many who are interested in radio and the expedition as well as amateurs desirous to hear or get into communication with the vessel telegraph or write requesting some information in connection with the relay work or relative to the kind of apparatus used by the successful station, which needless to say entails much correspondence to make suitable replies.

For the information of readers a brief description of Canadian radio station 9BP follows:

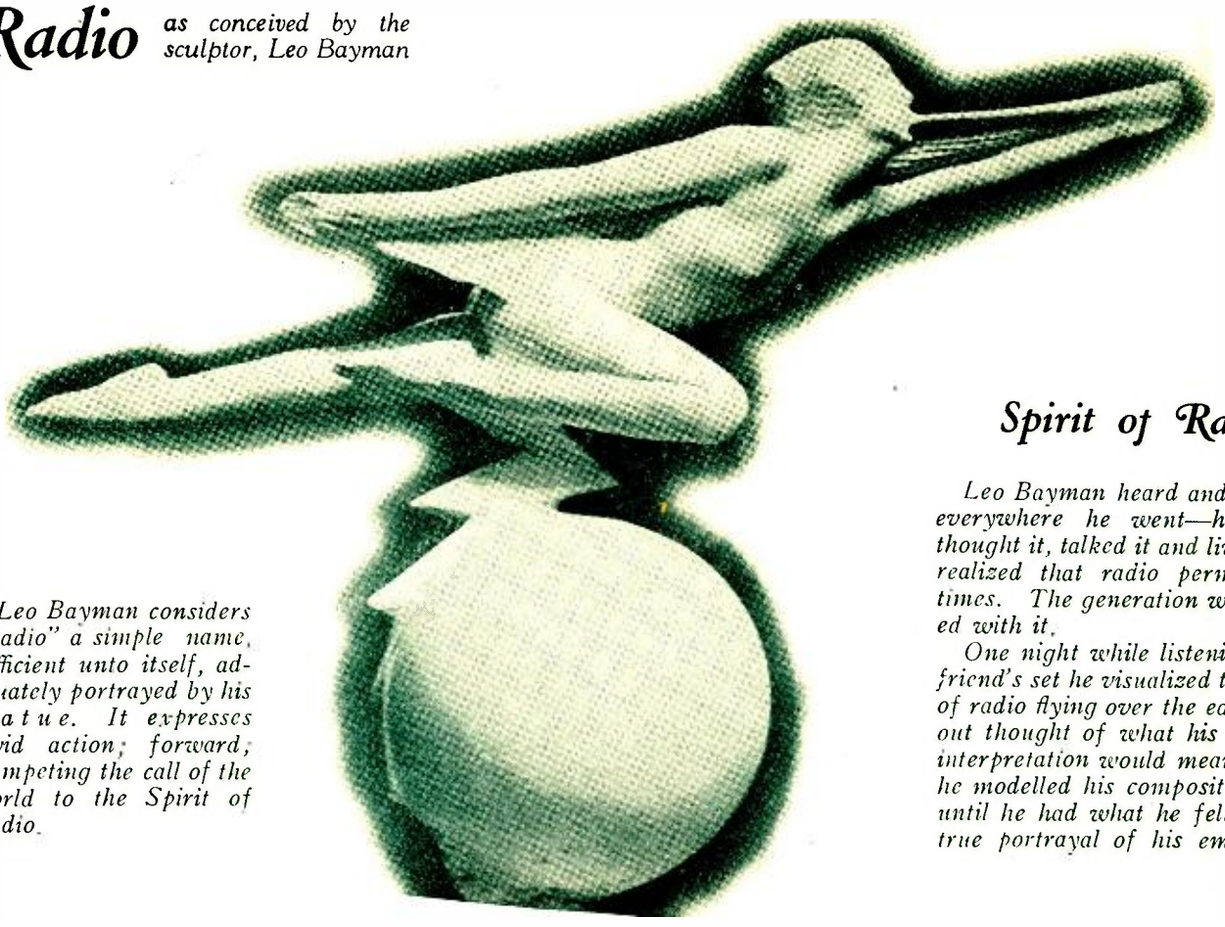
Antenna consists of a six-wire cage, 63 feet high, 75 feet top, with a cage lead-in 45 feet long. Counterpoise is 85 feet long, consisting of 12 wires spaced about two feet and being ten feet above ground. No ground connection is used with this counterpoise in connection with the transmitter.

The transmitter is of the continuous wave type and uses two fifty-watt Radiotron tubes in the reversed feed back circuit, using 1,500 volts of alternating current on the plates.

(*Continued on page* 88)

NOW the intrepid little ice-bound crew of the "Bowdoin" get a special program every night sent to them from WJAZ, Chicago, with news and personal messages; but until Jack Barnsley, in British Columbia, established communication by radio with Donald Mix, operator on the MacMillan ship, this brave group of men were lost to the world in the midst of the northern solitude and silence. In this story Jack Barnsley tells how he did it.

Radio *as conceived by the sculptor, Leo Bayman*



Leo Bayman considers "Radio" a simple name, sufficient unto itself, adequately portrayed by his statue. It expresses vivid action; forward, trumpeting the call of the world to the Spirit of Radio.

Spirit of Radio

Leo Bayman heard and saw radio everywhere he went—his friends thought it, talked it and lived it. He realized that radio permeated the times. The generation was saturated with it.

One night while listening-in on a friend's set he visualized the "spirit" of radio flying over the earth. Without thought of what his sculptured interpretation would mean to others he modelled his composition in clay until he had what he felt to be the true portrayal of his emotion.

I Am Radio—*By V. T. Miller*

I am Radio.
I am older than the rock of ages, yet I was born to man but yesterday.
I have been waiting for lo these many million moons for some one to bid me speak.
I came when light and air and water came to earth but all these countless years my tongue was tied.
I could not speak because no genius fashioned wood and wire in such a shape to catch my feeble whispers.
I have watched the world grow old and many times, if I could speak, I could have saved mankind its tears and disappointments.
Indeed, when Jesus came to earth, I knew and could have spread the news from far and near if some mere man had bent a wire into a coil for me.

I am Radio.
I know the ocean as you know home.
I know her storms and rocks and reefs and danger points.
I know and could have saved the countless hordes now buried in her cold, forbidding deep if God had told some one to build of wood and wire a tongue to speak the things I knew.

I am Radio.
What I could have done for man through all the ages gone I promise now to do for you.
My task from now will be to watch the ocean and warn the ships of every lurking danger.
To wrecks I'll send the rescue ships and while they come I'll cheer the crew with faith and hope and happy song.

I am Radio. I'll be up and at my task from morn till night and e'en till morn again.
Into the far corners of the earth I'll go.
When the hunter camps at night I'll be with him.
Into the land of midnight sun I'll go, and out of the cold, crisp air he will hear me sing sweet songs instead of the angry howl of hungry beasts.

My Name is Radio.
I'm not a freak seeking spectacular things to do.
I enter every home that bids me come and bring to it just plain old fashioned hope and cheer.
The farmer and his family listen in; I give him market news and weather forecast; I bring the city's band or concert to his home.
The isolation of the farm is gone; the link that binds it to the gathering place of men is me and I am free.
My name is Radio.

I am Radio.
Some call me fad and others say I'm but a passing fancy.
But I can sing and preach and teach a crowd of twenty thousand folks with perfect ease.
I can spread the voice of statesmen, poets, authors, from north to south and east to west across a continent, and, if need be, around the whole wide world.
I can sing the songs that stir the hearts of men like no one else can do.
These things I do and more, and do them free.
I am no fad.
I am Radio.

There's just one thing I make men do:
Each one must tune his set to mine if he would hear and understand.
To you who have no set I'll say that nature too can preach and teach and sing sweet songs if heart and mind are tuned to catch its meaning.
Out of the unknown, uncharted sky nature has been sending its hopeful, cheerful messages these countless ages gone to those "tuned in" to catch the voice of this great broadcasting station.
Think this over friend, and weigh it well.
My name is Radio.
I'm signing off.

Oh, It Is Too Much Radio!

According to Irene Bordoni

In an Interview By W. A. H.

Irene Bordoni

THE whirring of cup-tires on the wet pavement hummed in my ears as the blurred lights of lower Broadway sped by the taxi windows.

Irene Bordoni—the inimitable Irene—pouted.

Her manager idly speculated on the whereabouts of the dim figures glimpsed through the drizzle as they scurried along the nearly deserted streets. Actually, his troubled conscience sought surcease from temperament.

"Mlle. Bordoni," I coaxed, "why do you say that radio is *désagréable?*"

Her large eyes peered through the fur collar of her coat. Those eyes were baffling.

"I go to broadcast my act," she answered. "I get no pay; I have not my dinner; my dinner—he is so important; I am tired and I must be at the theater by seven."

But arrived at the studio, the warmth and comfortable luxury seemed to awaken some interest in her surroundings. Pointing at various instruments she repeatedly asked, "What's that thing?"

Mr. Warburton Gamble and Mr. Stanley Logan, the other two corners of the "triangle," had arrived earlier and were engaged in their preliminary try-out on the microphone. Miss Bordoni was delighted with that.

Turning to her manager she exclaimed, "I came down here to please you—now you would like to please me—yes?"

The man looked trapped, but he nodded affirmatively.

"This radio thing—I like him," she confided, "so we must make the scene longer."

And that in itself was encouraging because she had originally protested, and had devised ways by which the scene could be logically cut down.

Colette (Irene Bordoni) had been married to Bob Talmadge (Mr. Logan) but Bob had a lawfully wedded wife, back home, who might object so he blandly used the name of his friend, Larry Charters (Mr. Gamble).

Immediately following the ceremony Bob regretted his hasty act and at a loss as to what procedure was best under the circumstances finally decided to take Colette to his friend, Larry, whose name he had so outrageously exploited.

The characters went on the air at the point where Colette finds herself in the presence of the two men, her husbands—one in fact, one in name.

And who else than Irene Bordoni could untangle the complications of such a plot?

She concluded the performance before the microphone with a song hit, "So This Is Love."

This extract from "Little Miss Bluebeard," her Broadway success, had been done for the unseen radio audience with the master touch of the scintillating, spirited artiste. It was truly Irene!

Her reluctance at leaving the studio was evident. A few days later she had a small "headset" radio in her dressing room at the theater. But the phone hurt her ears.

Urged to buy a large set with a loud speaker, she protested, "*Merci*—I do not like the bug—I just tune a little!"

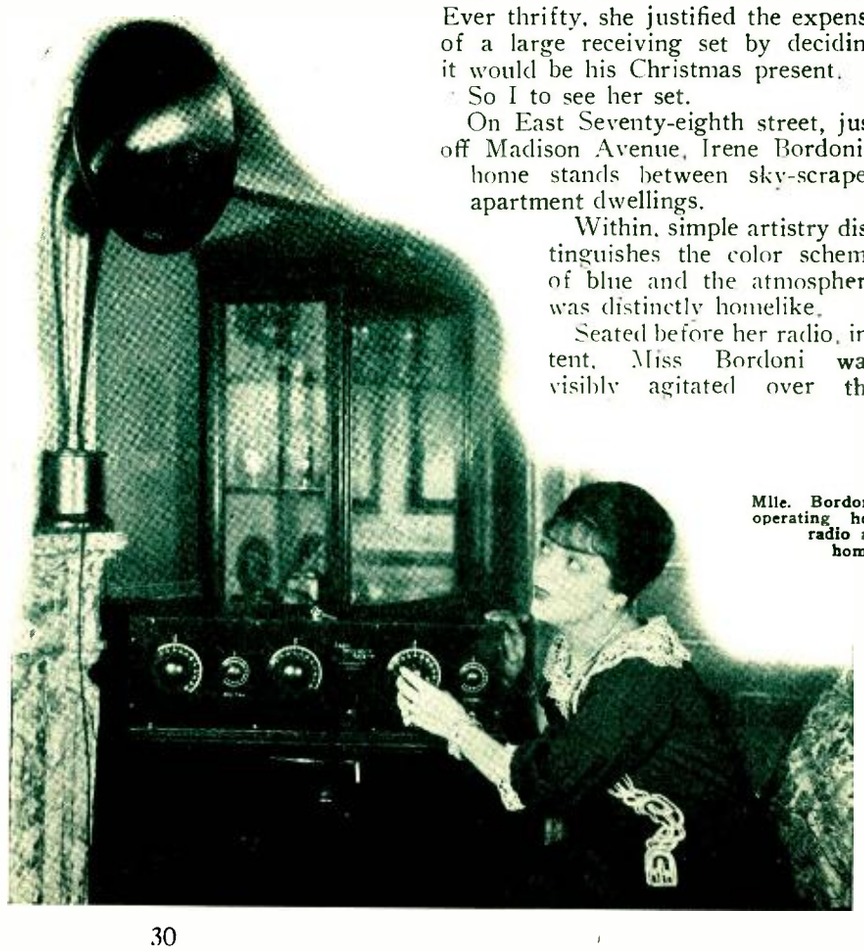
But her husband, E. Ray Goetz, would be in Palm Beach with Irving Berlin over the holidays and since they were broadcasting there, Miss Bordoni wanted to hear her husband's voice. Ever thrifty, she justified the expense of a large receiving set by deciding it would be his Christmas present.

So I to see her set.

On East Seventy-eighth street, just off Madison Avenue, Irene Bordoni's home stands between sky-scraper apartment dwellings.

Within, simple artistry distinguishes the color scheme of blue and the atmosphere was distinctly homelike.

Seated before her radio, intent, Miss Bordoni was visibly agitated over the



Mlle. Bordoni operating her radio at home

squealing and howling that emanated from the loud speaker.

"I try to get the Edgewater Beach Hotel in Chicago," she complained, "and look what I get—Swift and Company—Oh, it is too much radio."

"Why not listen for your husband, Mlle. Bordoni?" I asked.

Her round eyes studied me contemplatively.

"I get home from the theater at midnight," she explained, "and tune the radio thing but I cannot hear my husband."

She tried to tell me what stations she had heard, but the call letters invariably got tangled beyond recognition.

"I spent much money for this," she continued, "and all I hear is sometimes — weather reports — bed-time stories—sometimes jazz.

"But the baseball thing—the football thing—the President Coolidge thing—oh, that is so good, but oh-la-la, how good I would make it—this radio broadcast!"

I asked her what she would make it.

"The broadcast!" she exclaimed. "I make it like vaudeville—music ten minute—not so many pieces in one time—maybe one little play for twenty minute—and like that—many variety, but short."

Miss Bordoni had an excellent plan for broadcast programs so we covered the subject quite thoroughly.

She acknowledged that there were certain features, desired by a great many people, that could never be reconciled with vaudeville.

She maintained that market and weather reports should be broadcast from one station on a definite wavelength so the business man could have a set installed in his office that could be operated by pushing a button. The same station could likewise serve the farmer in the evening.

Lectures should be handled on a set wavelength from a station equipped for that purpose. In such manner people could subscribe to lecture courses just as they now do at the Town Hall in New York and at Chautauqua meetings in the rural districts.

Education, she thought, could be developed to the highest standard obtainable by the agency of radio, and that its proper handling would automatically gravitate to the "lecture-class" stations.

She was more reluctant, however, in granting that there would always be a large audience to demand jazz music. It seemed to her that jazz and classics could be adequately injected into the vaudeville programs. She was convinced that radio must ultimately develop in people a sensitive ear for music, which, of itself, must lead to an even more critical appreciation of the finer compositions. By way of illustrating her point she indicated the success of Grand Opera houses in the Ghetto, patronized by a people, abject and poverty stricken, but none the less hungry for the best in music.

Miss Bordoni agreed that Grand Opera should be broadcast, but individually and at regular intervals if a daily schedule were not feasible.

Her idea about radio plays was somewhat vague. She believed that any play, to be successful, would necessarily entail an organization of rather wide scope, and quite naturally defended the position of high salaried artists. But she felt equally certain that a play, to be broadcast must depart from the accepted structure for plots as we now understand them. Consequently, the recognized artist would be of less value than the play itself. And of course the supporting cast, theater personnel, corps of lyric writers and directors and the publicity staff would dwindle to studio proportions.

It was finally decided that the future of radio plays should be the handiwork of the muses.

As I was departing it occurred to me that she might have done something interesting with her "dressing-room" set.

"Oh, that!" she laughed. "I gave that to my manager."

"Well, what in the world did he do with it?" I queried.

"He is real bug," she confided, "he hide the radio in his desk. Every day he lock the door and tune a little—that is when his secretary say he is out!"

A tense, dramatic moment in the scene from "Little Miss Bluebeard" broadcast from WEAF. Irene Bordoni, as Colette, and Mr. Logan as Bob Talmadge.

Movement to Reduce Interference

AT a recent conference in New York, representatives of the radio manufacturers and publishers decided to make an effort to eliminate radio interference from objectionable receiving sets. Their plan is two-fold: First, they propose to urge all manufacturers to put out only non-radiating sets, being willing to aid in the designing of such sets; and, secondly, to inform the radio fans how to remodel or improve existing sets so that they do not cause interference among the receiving fans within a radius of some ten miles, as is now frequently the case.

Two committees were appointed; one technical, to handle designs and improvements, the other to distribute and make public operating instruction, data, and diagrams for improving regenerative sets. Prof. Hazeltine of Stevens was selected as chairman of the first committee and Stephen Coles as chairman of the publicity committee. The conference decided to recommend no particular type of receiving set, but to conduct an educational campaign. The desirability of non-radiating sets will be made clear, as an important move in reducing interference.

Major Armstrong, inventor of the regenerative hook-up, was present and entered into the discussion offering many suggestions, among them his plan to add a stage of radio frequency as a "muffler."

Chief Radio Supervisor W. D. Terrill, who was in New York in connection with departmental matters, attended and was selected as presiding chairman.

A Radio Operator Sees the World

in his own way

Operating is a sure path into a Radio Career

By W. S. Fitzpatrick

"MAKE your subject 'Radio Operating As a Career,' showing its possibilities and pit-falls; tell of the bright side with all the encouragement due the profession, but also speak frankly of the hard knocks and the discouragements; give the young fellows the information they need to enter the field; tell the parents what they should know about their boys traveling on ships; give the boys themselves some tips, and show how radio operating is a profitable calling, both in itself and as a stepping-stone to the more highly remunerative positions which radio affords."

Such were the instructions that accompanied the request of the editor of THE WIRELESS AGE to contribute one of the series of articles on "The Opportunities in Radio Today."

Our first analysis must necessarily attempt to discover whether radio operating is an inviting and profitable career for a young man to choose. As though there should be any doubt of it! The doubt that does exist, it is safe to say, is only in the minds of operators who have not made good and those with whom such operators have come in contact.

As with other branches of the radio game, operating holds out great possibilities for young men—or even the older ones—who really apply themselves the same as would be necessary to succeed in any other line of endeavor.

For those who use it merely as an opportunity to see the world or as a means of entering the radio field with the expectation that the prestige gained thereby will immediately land a post of district sales manager of a large radio house with an attractive salary, radio operating does not hold the same advantages.

Fellows of that kind are not interested at heart. They may be conscientious and really try to comply with all the written and unwritten regulations, but somehow or other they do not get anywhere. They become dissatisfied and begin complaining that "there's nothing in it; you can't get any thing out of it; there's no future to it."

A typical example is the fellow who becomes fascinated with radio through his or a friend's possession of a receiving set, by means of which he has learned the code, or perhaps through an operator friend who sent him post-card views of interesting and unusual scenes. He enters with the expectation that the same fascination will continue. There's nothing for him to do or think of except send messages for pretty girl passengers, receive important stock fluctuation dispatches for prominent business men and bankers aboard, spend his idle moments listening to concerts in distant cities at a distinct advantage over his friends ashore; then upon reaching a foreign shore, strut along, (mayhap in full uniform) watching the populace stop and adoringly nod and remark to each other: "He's the radio operator on that big ship that just entered port."

An observing eye watching radio activities over a period of fifteen years has noted the various types. It has noticed that this particular type has dropped out of radio at steady intervals, each with the same expression: "There's no future in radio."

A conservative estimate, based on available information, shows that approximately eighty-seven per cent. of the radio operators who left the game within the past fifteen years are not as well off in position, as well off financially or as well off in future prospects as they would be, had they remained as radio operators.

During the past fifteen years many have entered and left, but a large number have stayed. The general managers of such companies as the Radio Corporation of America, Tropical Radio Company, Marconi Wireless Telegraph Company of Canada, and the Ship Owners Radio Service, entered as radio operators within the past fifteen years.

The assistant treasurer, sales manager, advertising and publicity manager, practically all the superintendents and district managers as well as many of the force of the sales and traffic departments of the Radio Corporation were radio operators within the past few years.

The general manager of the Independent Wireless Telegraph Company was also an operator, but quite early became an official. Practically all the officials of that company were operators a short time ago.

The radio operator on board ship tours the world and accumulates interesting experiences and memories of quaint and wonderful scenes. His responsibility is great when his ship ploughs through storm swept seas. At other times he can enjoy the quiet port and the spell of the Orient

Thus we speak of the past fifteen years during which time radio made slow progress. What is going to happen during the next fifteen years with new departures coming to the fore every day? Can't you see opportunities galore?

Awaiting development is the static eliminator, the interference preventor, the concentrated tube transmitter, an ultra-sensitive detector! Is some operator, thinking things out during his spare time at sea, going to furnish the ideas? Maybe!

Of course, it is not meant to infer that a young fellow should choose radio as a career so that he can invent some new idea. But then, where is there an industry that offers more opportunities for the adoption of new ideas? In every industry isn't it usually the man actually using the apparatus that makes the suggestion for improvement, and almost always receiving a substantial financial reward?

There are very few, however, who would choose a line of work simply because there are opportunities of gain through stumbling across new ideas. Of the thousands of operators in the past very few have made extraordinary development. As a matter of fact they are prohibited from using any part of their apparatus for experimental purposes and are also prohibited from bringing any of their own apparatus along on ships with them. Mostly all radio development has been made by research men—generally ex-operators—who devote their entire time to experimenting.

Among the opportunities of radio operating and well to the fore comes that of "seeing the world." The commercial radio operator does not merely see it "through a port hole." If he can't get shore leave his cabin is located where he can at least get a view and he has the freedom of the decks; even the bridge and other advantageous points are not denied an operator in the good graces of the captain and officers.

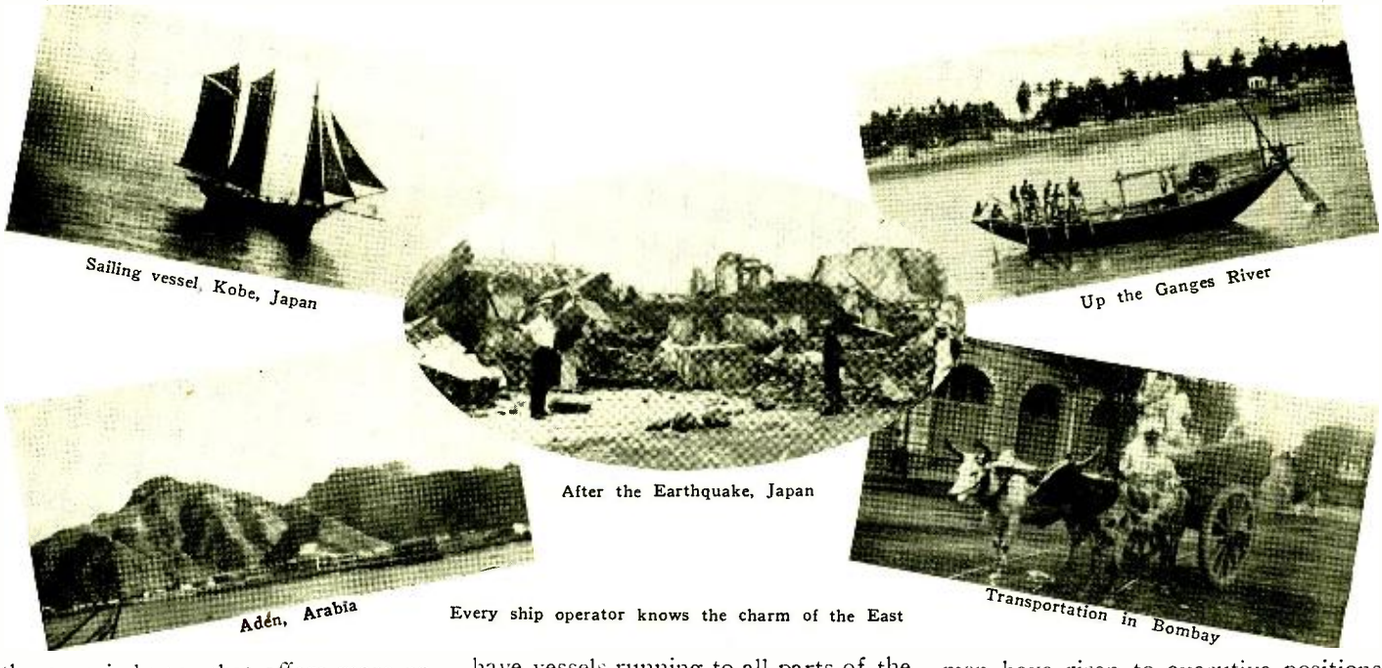
"Seeing the world" seems to have a different aspect to every one you meet. One sees art, another sees history, another is interested only in the customs of the people, and a number, it is unfortunate to have to admit, look only for the "pubs."

The operator in the service of a radio company having a large variety of vessels, can really see the world and see it in his own way. There are three large radio companies in America who have vessels running to all parts of the world. Their operators have an advantage of being able to transfer from one run to another while the men on ships where the owners manage their own radio see only the one or two ports at which their vessels touch.

Frank E. Golder, of Joplin, Mo., who quite recently returned from an extended voyage on the steamer *Selma City*, furnishes an excellent example of the sight-seeing advantages afforded radio operators. It was he who made our illustrations possible through his kindness in giving the photographs from among his collection of hundreds. He is one of the men who derive pleasure and profit through traveling.

* * *

Meeting and talking with different people throughout the world broadens any man's education, even without his seeking. Operators who run regularly to a particular foreign country have an advantage of learning the language of the country that cannot be offered by a school. A new language makes a new man.



Every ship operator knows the charm of the East

The problem of a career comes to the mind of every young man. Some turn to banking as their chosen work; some start as salesmen in retail lines; others like maufacturing; many choose railroading, and a number enter radio. In their respective vocations each man looks for advancement.

Pass over ten years and compare the status of the different men. A few of the bankers will be found to have risen to tellers and probably cashiers and on the road to presidencies. Some of the salesmen have become managers or owners. Certain of the manufacturers and railroaders have become superintendents or vice-presidents. Just as large a proportion of the radio men have risen to executive positions or something as good. The majority in each line, however, will still be bank clerks, salesmen, factory hands, railroad workers or radio operators. Let us make a comparison within this large group.

The radio operator's total income during the ten-year period will be found to compare very favorably with that of the average men who entered the other lines. He can show an advantage over the others who have remained in one place in so far as he has seen other lands and perhaps has learned other languages. He may have applied his spare time in studying other lines of business.

The salary of the average young man ashore does not run much over $130 per month. There are numerous radio operators who receive that much and many who receive more and it costs them nothing for board or room. The man ashore receiving $130 pays out half that amount in living expenses. Even at $105 per month, the average operator's salary, the net in-

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COLPITTS' Push-Pull Circuit Kills Distortion

Much Distortion comes from forcing your tubes. In the Push-Pull Circuit two tubes are balanced to counteract oscillation of tubes.

By
Samuel C. Miller
Member, Institute of Radio Engineers

IN the early days of radio broadcasting the radio listener was principally interested to obtain the maximum amplification possible. Radio fans in some cases would go to extremes to obtain this high amplification by using an unlimited number of tubes in combination with a loud speaker that gave the most noise. Good quality did not enter in, as noise was the predominant factor.

But gradually, as the broadcast stations began to eliminate the various distortions from the transmitting equipment, the radio fan began to realize the fact that his receiving equipment required an overhauling in order to make it reproduce what is actually being transmitted. Even dyed-in-the-wool radio fans became fairly well saturated with the ungodly howls that represented speech or music. Prospective buyers of radio receivers would go away very much disappointed after listening to a demonstration at a friend's home or at the local dealer with his eight-tube howler going at full blast so that it could be heard two blocks away. This condition put the radio art in a very precarious position and it only lately, due to the untiring labors of various investigators, that the causes for distortion are being overcome so that the most discriminate may listen and not complain regarding quality. The results of these investigations have appeared in periodicals, newspapers and other mediums, giving the amateur valuable instruction in methods of improving the quality of his receiver.

Radio broadcasting has jumped by leaps and bounds in popularity because it is now possible to obtain from the receiver system a very good reproduction of what is going into the microphone at the transmitting station. Although the major distortions have been eliminated, experimentation is far from completed. Researches are being continually conducted toward the point where the reproduction is perfect.

Distortion in a receiving set can be caused in many ways. It may be due directly to the apparatus used or it may be traced to the electrical design of the set. The following are some of the major causes for distortion:

1—Tube characteristics
2—Regeneration
3—Audio frequency transformers
4—Loud speaker
5—Tube overloading

Tube Characteristics

The working portion on the characteristic curve of the vacuum tube is almost a straight line. (A-B in figure 2.) This is true of the standard amplifier tubes on the market, but does not hold for the soft detector tube with its gaseous contents. Distortion can be eliminated in this case by using only the hard or highly evacuated tubes of the UV-201A or C-301A types even in the detector step. The amount of volume that is lost by using a hard amplifier tube in the detector step instead of the UV-200 type is compensated for in quality.

When using a tube as an amplifier, it is necessary to use the proper negative bias on the grid for distortionless amplification. The value of grid bias depends on the plate voltage and the relation between the two are, in standard tubes, as follows:

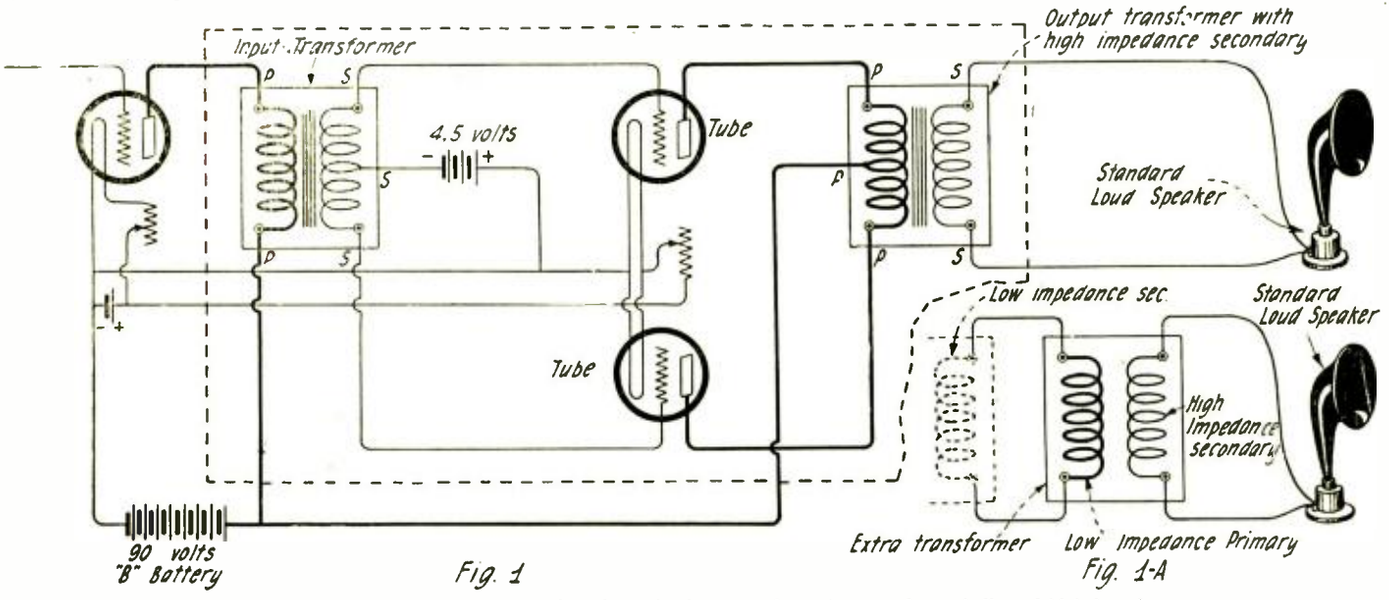

Fig. 1 Fig. 1-A

Push-pull circuit connected to a high impedance loud speaker from the secondary winding of high impedance

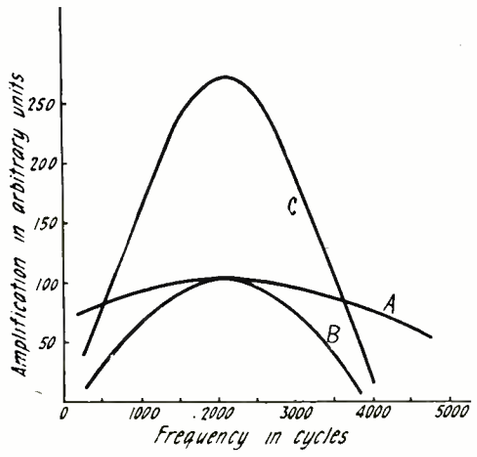

Fig. 2

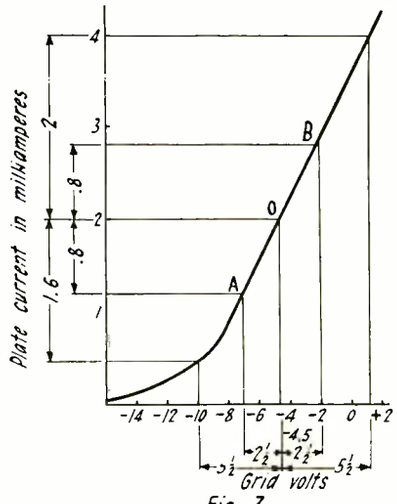

Fig. 3

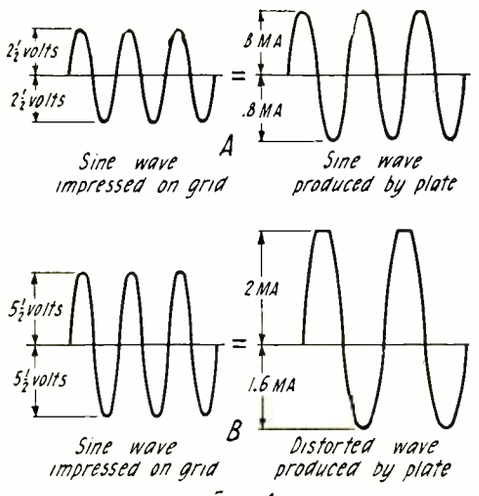

Fig. 4

Distortion characteristics of poor transformers

For 22 volts on plate use 0 volts on grid
For 45 volts on plate use 1½ volts on grid
For 67 volts on plate use 3 volts on grid
For 90 volts on plate use 4½ volts on grid

REGENERATION

Another cause of distortion can be traced to the inefficient handling of the controls on the receiver. The adjustment should never be set near the point of maximum regeneration for a given signal. The higher the gain in signal intensity by regeneration, the more chance there is of distorting the signal even though there may be no oscillations audible to the ear. Nevertheless, the set may be oscillating at a higher frequency than it is possible to hear and thus spoiling the quality. It is therefore always advisable to use only enough regeneration to give a good signal.

AUDIO FREQUENCY TRANSFORMERS

Good quality as understood by engineers means transmitting and receiving with equal intensity the band of frequencies between 25 and 10,000 cycles. Accordingly, the audio frequency transformer, if improperly designed, may be the serious defect in the receiver, causing distortion. A good transformer should, within physical possibilities, amplify with equal intensity the band of frequencies above, as indicated by A in figure 2. A poor transformer will have a curve as shown by B in figure 2 where the low frequencies and the high frequencies are amplified considerably less than certain frequencies between. The cause for loss of the lower frequencies in a transformer is due to insufficient inductance in the primary winding. The loss of the high frequencies is due to the leakage and capacity between windings of the primary. In a correctly designed transformer, the primary inductance is made high enough to give an impedance equal to the tube impedance at 100 cycles. This value is approximately 25 to 30 henries. The leakage and distributed capacity is kept at a minimum by the use of pancake windings and proper insulation between layers.

Distortion due to poor transformers becomes very serious when more than one stage of amplification is used. At the end of the second stage of amplification the curve "A" of figure 2 would be changed to curve "C," figure 2. The second transformer in the amplifier causes a further decrease in the lower and higher frequencies because it receives from the first transformer a signal already greatly lacking in the lower and higher frequencies. It is very imperative when purchasing audio frequency transformers to get only those which have data regarding their performance when plotted against frequency.

LOUD SPEAKERS

The writer in his contact with various radio fans and their respective sets has found that more sets are spoiled by poor loud speakers than any component part of the equipment. This applies especially to those reproducers consisting of ordinary earphone receivers used in combination with a tin

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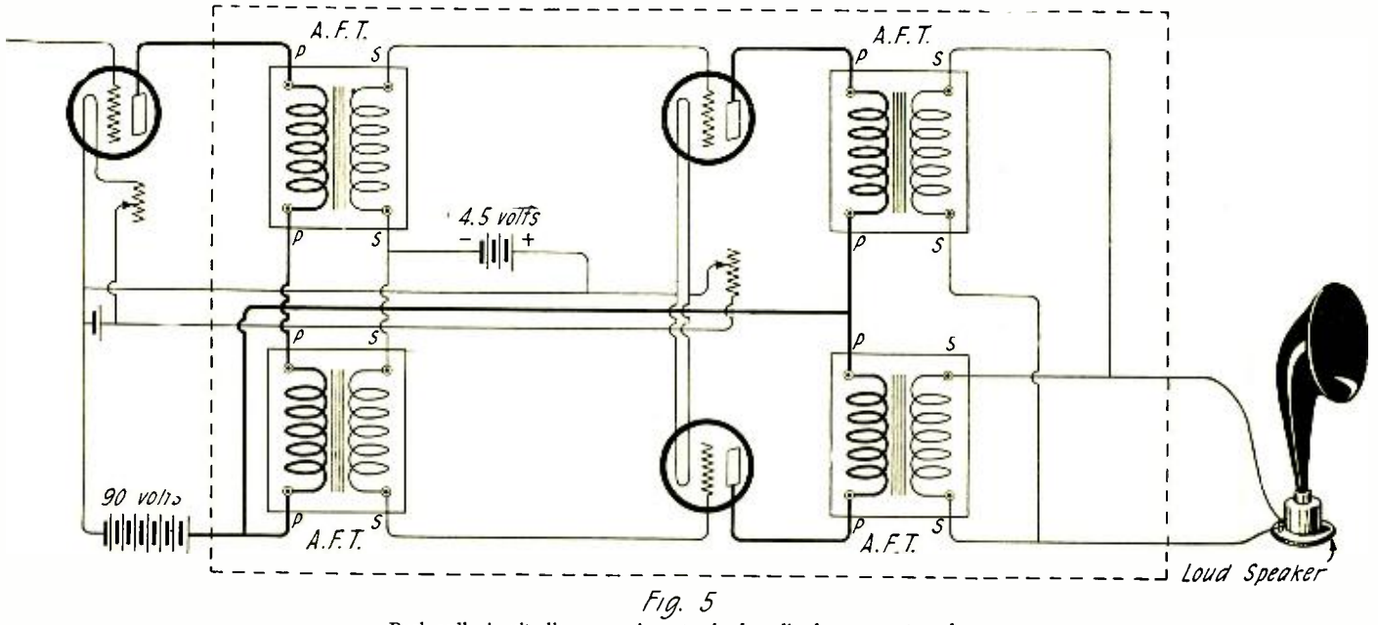


Fig. 5

Push-pull circuit diagram using standard audio frequency transformers

What Causes Fading?

Dr. Alfred N. Goldsmith

Enormous Mirror in Upper Atmosphere Responsible for Long Distance Reception. Ground and Sky Waves May Combine to Cause Fading Effects

By Alfred N. Goldsmith
B.S., Ph.D., Fellow I.R.E.
Director of Research, Radio Corporation of America

VERY peculiar things happen sometimes in the receiving of broadcast radio concerts. Every listener, as soon as he gets acquainted with a number of nearby and distant stations, finds that he is puzzled by some of the results he gets. How shall he explain such things as these:

1. Late at night he can hear stations hundreds of miles away clearly, while earlier in the evening, or by day, he can hardly hear fifty miles.

2. He will hear some stations at night very steadily, and particularly the distant ones, but some other nearer stations will "fade" in and out rapidly and in irregular fashion.

3. Still nearer stations, say twenty-five miles away, will not fade in or out at night or by day.

4. In one part of a city, Station A in that city will be heard loudly and Station B in that city hardly at all. In another part of the same city, the reverse will be the case. Outside the city both stations will be about equally loud.

5. A listener in the country will sometimes hear stations hundreds of miles away much better than he will hear stations in a nearby city, say fifty miles away.

Radio engineers have a theory to explain these effects. It can be simply expressed, but it should be remembered that it is not a positively proven theory, but only a very plausible and satisfying explanation of all the puzzling effects just mentioned. It is based on a theory of Sir Oliver Heaviside, the eminent English electrician and mathematician. Heaviside pointed out that, twenty-five or fifty miles up, the air enveloping the earth becomes very rare and is therefore an electrical conductor just as is the rarefied "violet ray" tubes sold for medical purposes. So that, far up in the sky, there is a layer of conducting air which scientists have called the Heaviside layer. It is also well-known that substances which conduct electricity, such as metals, are good reflectors for radio waves, so that this layer is actually a sort of curved reflector in the sky. It is therefore called the "mirror layer" in this description, for the sake of simplicity.

By day, the mirror layer is spoiled in several ways. In the first place, the brilliant sunlight falling on it causes disturbing air currents and irregularities, so that instead of being a smooth and polished mirror, it becomes a roughened irregular layer of little use as a reflector. Furthermore, sunlight has the property of converting rarefied air into a sort of "fog" which, while clear and transparent to ordinary light, does absorb radio waves vigorously. By day, the mirror layer is rough and mist-covered.

Probably most listeners have never speculated as to whether the radio waves which reach their receiving aerial come sweeping along the ground or whether they are shot down to the aerial wires after reflection from a mirror layer in the sky. Yet actually radio waves arrive by either or both of these dissimilar routes.

In the illustration of this article, part 1 is a general sketch of a sky wave. It leaves the radio transmitting station at the left, passes obliquely up until it strikes the mirror layer far up in the air, and is then reflected back again to the earth, arriving finally at the receiving station to the right. It may be mentioned that these sky waves do not die down very rapidly because their path is entirely through the air and they are but little absorbed or interfered with in their message. So that we should expect sky waves to carry radio messages loudly over great distances, particularly at night when the mirror layer is smoothest and most effective, and when the absorption of the radio waves by the "electrical fog" caused by sunlight is absent.

Part 2 of the illustration is the other sort of wave which may reach a receiving station. It is a ground wave, and clings closely to the earth. Naturally such a ground wave encounters all sorts of energy-absorbing obstacles in its path, which rapidly reduces its power and the loudness of the signals it can produce in the receiver. Such objectionable obstacles are steel-structured buildings, mountains—particularly those containing metal deposits—and to a less extent forests of large trees. The result is that a ground wave rapidly dies away, and this has been indicated in the diagram.

To take typical figures, which are very roughly correct for an average broadcasting station in the eastern portion of the United States, the ground waves are very strong near the transmitting station for the first few miles and rapidly die down, becoming relatively quite weak at a distance of a hundred miles or so. The sky waves, on the other hand, are hardly received at all near the transmitting station since their path is above the earth until after they have been reflected back to the ground. They come back to the ground and begin to be useful at distances of about seventy-five miles from the transmit-

ting station, and beyond that distance they are readily received with good intensity for distances of several hundred miles. It amounts to this, to summarize: for distances up to about seventy-five miles, the listener is depending almost entirely on the ground waves for his signal. From seventy-five miles to about two hundred miles, he gets both ground waves and sky waves. Beyond two hundred miles, most of his reception is dependent on the sky waves.

For locations where both sky waves and ground waves are received, reception may become very erratic with marked "fading effects." Part 3 of the illustration shows how this may come about. The two sets of waves, arriving at the receiving station by different paths, may help each other or they may actually annul each other. Furthermore, as the mirror layer shifts slightly from moment to moment, the ground waves may sometimes weaken or annul the sky waves, and thus cause fading. We can therefore explain the five puzzling effects mentioned at the beginning of the article as follows:

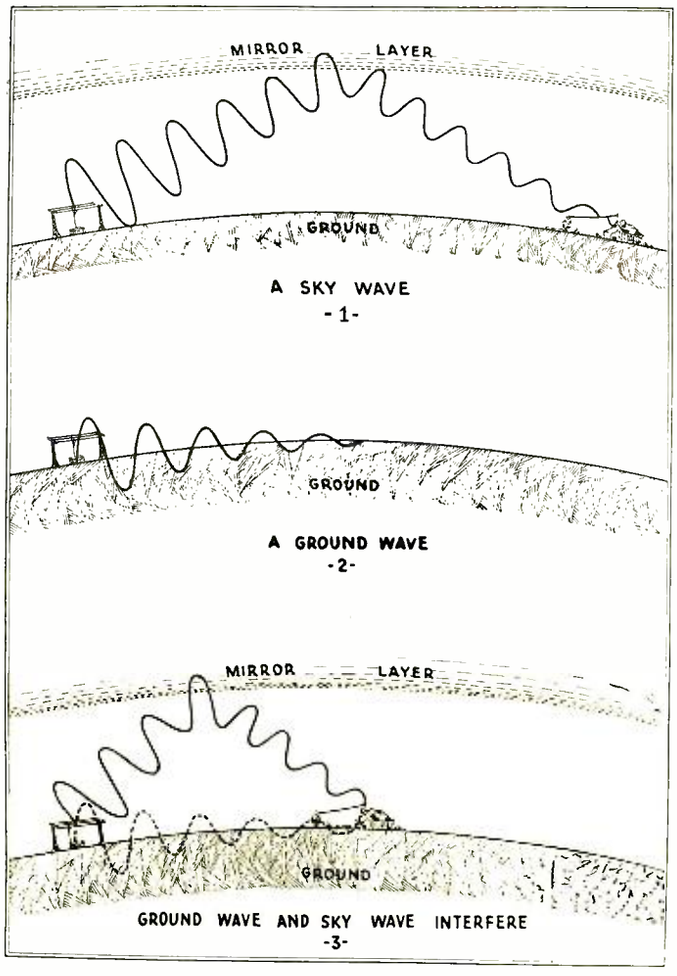
1. Night reception over long distances is accomplished by the slightly absorbed sky waves, and these cannot exist by day because of the absence of a smooth mirror layer and the disturbing presence of sunlight "fog." So that day reception is by ground waves, which do not reach out powerfully nearly as far as sky waves. This partly explains the superiority of night reception.

2. Night reception from very distant stations is by means of the sky waves only, and is therefore comparatively steady. Night reception from stations roughly from seventy-five to two hundred miles away is by a combination of sky waves and ground waves, and therefore fades in and out as these two sorts of waves interfere with each other.

3. Reception from stations nearer than seventy-five miles is chiefly by ground waves only, and is therefore reasonably steady.

4. Reception in a city from nearby stations is by ground waves, which are very badly absorbed by the steel structures of the city. A mile or two of city buildings will so weaken the signals from a city station, as received by a city listener, that reception may become very poor. As a result, in those parts of the city where the signals have first to plow through miles of steel to reach the listener, reception from that station will be poor. In other parts of the city the reception will be excellent. Far outside the city reception will be by the sky waves and about equally good from all comparable stations within the city.

5. A listener in the country will get signals from the city fifty miles away almost entirely on weak ground waves, but will get distant signals on the powerful sky waves. Thus the distant signals are sometimes astonishingly loud in comparison with the nearby signals.



Action of reflected waves and ground waves

It adds another chapter to the romance of radio to know that the concerts from distant cities have traveled up to the sky on their way to the broadcast listeners, and that an enormous mirror in the upper layers of the earth's atmosphere is chiefly responsible for the enjoyment of distant concerts.

Supplementing Dr. Goldsmith's clear explanation of the probable causes for fading we are able to add corroboration of his explanation by another engineer, Roger H. Bryant, radio engineer with the Westinghouse Electric and Manufacturing Company, who gives his explanation in the following words.—[Editor].

MANY of us have experienced a feeling of great disgust when listening to a good concert from a broadcasting station to have the music gradually die out. Frequently the regularity with which the signals die out at the crucial point leads one to think that something has control of this phenomenon.

The periodical dying out of radio signals is known as fading. There have been many attempts to make measurements on radio transmissions to determine the exact cause of fading but few of these measurements have produced any worth-while data. The best explanation of fading seems to be a theoretical one. It is believed that at a height of thirty or forty miles above the surface of the earth that the air becomes so rarified that it becomes a conductor of electricity. As such it acts like a reflector of the electromagnetic waves by which radio communication is effected. The result is that the waves reach the receiving antenna not by one definite path but by a number of paths of different length. The diagram will make this clear.

A radio transmitting station sends out electromagnetic waves which radiate in all directions. Some of them go directly to the receiving station, while others go by an indirect route up to the conducting layer and then down again. If the difference in length of these two paths is right, that is, a multiple of the wavelength, the waves will add and the effect produced will be greater than by the direct transmission alone. But the difference in length may also be such that the waves do not add and thus the effect may be less than it would be by direct transmission. The reflecting layer is constantly shifting so that the reflection varies momentarily between the limits described, resulting in varying intensity of the signal received. Thus the fading.

This simple explanation of fading leads to several interesting things. The reflecting layer is very indefinite during the day. Hence there is less fading during the day and this seems to be the case. On account of the lack of reflection, the range of a station is much less during the day than at night and this we all know to be the case. It would also appear that it is impossible to send radio signals away from the earth.

Scientific study of the upper atmospheric strata going on at present will undoubtedly shed new light on electromagnetic wave phenomena.

Design of Loop Antenna

PART II
Construction

By Ralph Batcher, E.E.

Author: "Prepared Radio Measurements" Wireless Press

(Part I of this article covering the theoretical design of Loop Antennas appeared in the February issue)

MANY claims are made by the sponsors of various styles of loops, when disclosing the value of their particular designs. The superiority of any particular type or shape is generally without much of a theoretical basis, and it is very likely that any unusual results obtained are due to the builder striking the right values for use on his own particular receiver.

It will be shown that two loops having the same number of turns and the same average area per turn, theoretically pick up the same amount of radio energy, regardless of whether the turns are round or square or have any other special shape. A square loop has the same effect whether mounted with edges oblique (Figure 1) or vertical and horizontal as in (figure 2).

The actual style is then a matter of personal taste only. Since the charts given in Chapter I of this article gave the inductance of square loops only, and since loops built in any other style generally require greater mechanical skill in designing the supporting rods, this style only will be taken up in detail. It is evident that a circular loop should give the greatest inductance with the least amount of wire, but this type is difficult to construct unless very stiff wire is used.

In nearly every case it is found that the feature of being able to rotate a loop about a vertical axis, to make use of its directional features, is well worth the extra constructional work necessary to produce it. In some places in a city where there are steel buildings near or over the loop it is advantageous to be able to rotate the loop also about a horizontal axis as well, but the gain in signal strength resulting from this is rarely worth the extra cost and work involved, so that its use is not recommended.

The favorable feature in the types shown in figures 1a and 2a rests in the economy of work involved in their construction. However—comparing loops with the same total inductance—in order to rotate these loops more desk or floor space is required. In the case of the types shown in figures 1b and 2b less space is required to rotate, but the constructional details are somewhat more difficult. Comparing loops of the same maximum dimensions this type will give somewhat louder signals since the mean area per turn is greater.

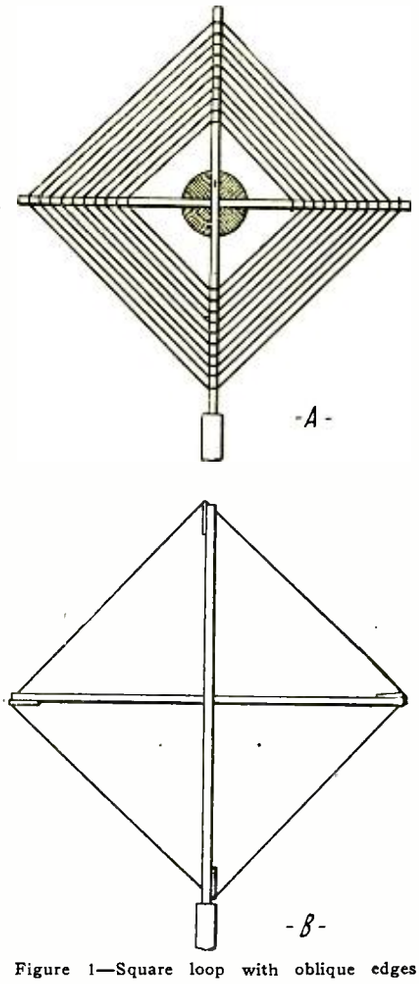


Figure 1—Square loop with oblique edges

In constructing loops the following details must be kept in mind. The framework should be substantial, symmetrical and stiff enough not to wobble before it is wound up, so that there will be no undue strain on the wire that will cause stretching and consequently sagging. To enable easy rotation and to keep it from swinging away from any selected direction, the framework must be mounted symmetrically about the vertical axis. Some suitable scale marked in degrees or in the points of the compass will assist in determining directions.

It is found that the size of the wire does not influence results to any great degree especially when using regenerative or radio frequency amplifying receivers. If wire smaller than No. 22 is used on loops over two feet square, there is a tendency for the wires to stretch and sag after some use. No. 18 or 16 or untwisted lamp cord is recommended. The use of Litzendraht is not warranted, in my experience, after comparing results with cost.

Figures 3 and 4 give common methods for the construction of the crosspieces at the end of the arms of a "box" type loop. All other details and all dimensions will of course depend on the results of the design problems previously outlined.

There are several ways of bringing out the connection leads from a loop. For small loops constructed of light rods, the rod supporting the whole loop can be connected to an ordinary phone plug. A jack can be mounted perpendicularly in the table or cabinet from which the connections can be made. This arrangement is not very

(*Continued on page* 80)

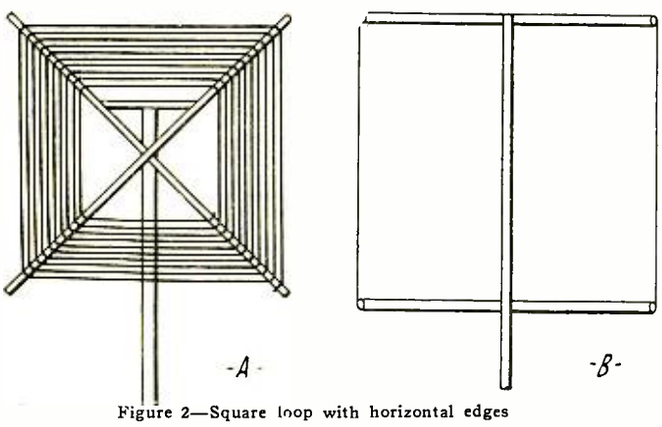
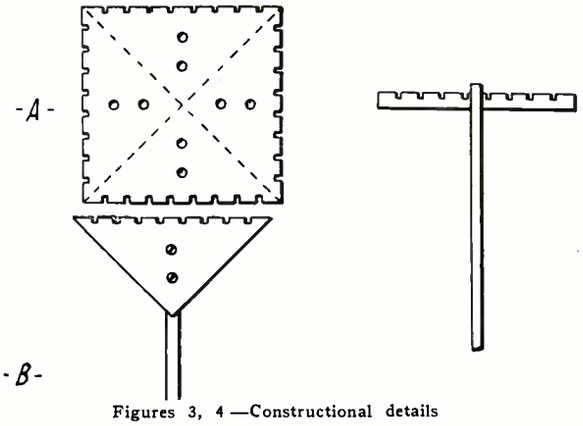


Figure 2—Square loop with horizontal edges



Figures 3, 4—Constructional details

Will Short Waves Revolutionize Broadcasting?

Frank Conrad's experiments result in sending broadcast programs to Europe

By W. W. Rodgers

BROADCAST stations will now be able to send their programs over great distances, and as well by day as by night. This is indicated by the results of short-wave broadcasting experiments which have lately reached remarkable results.

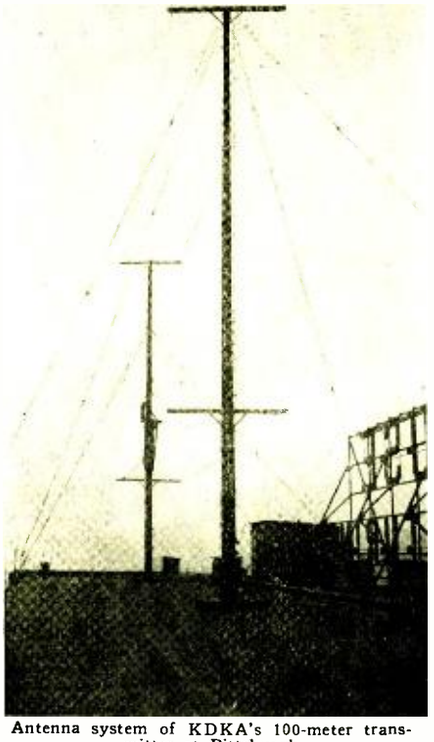
Experiments in short-wave broadcasting by means of extremely high frequencies have reached a climax in the recent repeating of American broadcasts by British stations.

The feat whereby American broadcasts are repeated on these short waves and received and rebroadcasted by English stations, thus reaching the peoples of Great Britain, France, Germany, Belgium and the Scandinavian countries, is the outcome of two years' experimenting and perfecting of high frequency apparatus by Frank Conrad, assistant chief engineer of the Westinghouse Electric & Manufacturing Company.

It was the old problem of interference that first brought the idea to Mr. Conrad and his associates that extremely high frequencies held many possibilities for the perfecting of broadcasting. He started experimenting with his own station and from a short-wave station installed on the roof of the Westinghouse plant, where the transmitting apparatus of KDKA is located.

The first experimenting with short waves under 100 meters was made between the station at KDKA and amateurs living in the Pittsburgh vicinity. Encouraged by the results of these tests, a receiving and rebroadcasting station was located in the Westinghouse building at Cleveland. The first of KDKA's broadcasts to be repeated were transmitted from the station, whose call letters are KDPM. Then tests were made between East Pittsburgh and Springfield, Mass., which also were successful, and finally, short-wave or high-frequency receivers were installed in the homes of amateurs living in some 20 cities located so that they covered the country. All holders of these sets reported that reception on short waves was very favorable and that there were none of the drawbacks to broadcast reception found on the higher wave lengths.

These experiments covered a period of two years, nearly up to the time when KFKX, the first radio repeating station in the world, was started by the Westinghouse Company at Hastings, Nebraska, last October. This repeating station made use of the high frequency broadcasting and reception for the repeating of KDKA's East Pittsburgh, Pa., concerts.



Antenna system of KDKA's 100-meter transmitter at Pittsburgh

The KFKX station operated so successfully that negotiations were started with friendly concerns located in Great Britain to test the reception of high frequency waves. It was found that the high frequency signals crossed the Atlantic with the same ease that they crossed the United States.

Europe Hears KDKA Concerts

The repeating was carried on with the British Broadcasting Co. Six or seven of this company's stations were tied together by means of telephone lines and the repeating of KDKA's concerts was started. The result of this was that the people living in Great Britain and Eastern Europe heard American concerts as plainly as they could hear their own stations and with the same receiving sets. It was the greatest triumph that radio had made in the past year and has actually changed the whole future of broadcasting.

The high frequency transmitter that does the repeating is located on top of a nine-story building in the Westinghouse plant at East Pittsburgh, Pa. Because of the fact that high frequency sets are sensitive and can be thrown off their wave easily, the whole set is mounted on springs to guard against jars. To prevent the swinging of the antenna, it is drawn taut between its uprights and the down leads consist of copper tubing. The various inductances on the set are wound on rigid forms with copper tubing forming all leads. The transmitting set consists of three panels, as follows: The rectifier panel, the modulator panel and the oscillator panel. All the equipment represents the last word in transmitting apparatus with water-cooled tubes and special condensers.

The short-wave transmitter is almost an exact duplicate of the big transmitting unit at KDKA with the changes necessary to efficiently work on the high frequencies.

Short Antennas Are Best

One of the most striking things about the short-wave transmitting set is the extremely short antenna used. The antenna at KDKA for use with the short-wave receiver is slightly in excess of 35 feet, in striking contrast with the 200-foot antenna used for regular broadcasts.

In England the law prohibits the use of large antennas, with the result that most of them are under 40 feet. The result of this is that radio frequency receivers are the common apparatus used, so that the reception of the short-wave signals is ideal on the Continent.

The great difference in frequency between the short-wave broadcasts (under 100 meters) and the common wave length band, approximately 360 meters, can be noted by comparing the kilocycle frequency of two such waves. East Pittsburgh commonly transmits to England on a wave length of 94 meters, which is a frequency of 3,200 kilocycles. At the same time KDKA is broadcasting to its regular broadcast audiences of 326 meters, which is a frequency of 960 kilocycles. This difference in frequency tells much of the story of the short-wave broadcasting.

Tests have proved that the high frequency broadcasts go farther with the same power input than the ordinary broadcast waves. It has also been proved that daylight has little effect, if any, on this carrying power. These two qualities of the short waves are what is going to affect the future of broadcasting.

Peeps into Broadcast Stations

WGY "Puts the Cat Out" on the Air

IN the selection of its announcers WGY has endeavored to get men who could do a little more than announce.

Kolin Hager, chief announcer and in charge of the studio is a tenor; during his college days he captured all kinds of medals for declamation and debate; he had an ambition for grand opera and studied Italian, Spanish, French and German. As a result when he gives the name of a foreign composer you are almost certain it's correct. Mr. Hager has also had considerable experience as an actor and for two years taught English in a High School. And it takes an actor to teach anything in a High School, nowaday.

Asa O. Coggeshall is a tenor, pianist and organist and when he isn't announcing he is directing a boy choir at St. Ann's Church, Amsterdam, N. Y.

Carl Jester is also a tenor—WGY runs to tenors. He is soloist in a Schenectady church and has mastered both French and German. He's the one who directs the numerous light operas given by WGY—the Gilbert and Sullivan group, and others.

Edward H. Smith can't sing and he admits it, but he has the voice for announcing. Mr. Smith has had several years' experience in the theatre. He knows the drama and as a director of the WGY players has had a hand in one of the most popular features of the station—the radio drama.

Mr. Smith has also planned special features such as "Farmers' Night," "Josh Quinby," "Minstrels," "A Night at the Club," and a "Cabaret Entertainment." These affairs are quite "different." The programs are continuous, the announcing being a part of the show so that the radio audience feels that it is actually present.

At the conclusion of Josh Quinby's golden wedding anniversary, after the guests had left the house Josh called for the kitty to put her out for the night. His "Here kitty, kitty" call went out over the country and within a few days WGY received six letters from listeners who reported how their own cats had acted when the "kitty, kitty" came through their loud speakers (the writers', not the cats').

Some time ago, a letter was received from Mrs. Dennis L. Wilson as an expression of gratitude for what their programs meant to the little community in the northwest corner of Orr's Island, Maine. She said that were it not for WGY, they would face a monotonous winter of bleak isola-

Marguerite Manierre

tion. There are weeks at a time in which the little community is cut off from outside world or even their nearest neighbors, except through radio.

"Three Thousand Years Ago" Spoils Rampage Nights

WCAE has been heard regularly in Hawaii, England, Alaska, and South America.

Mr. Thomas McLean, the chief operator, has a pet theory as to the consistent long range of this station. He claims that his small vertical antenna, without series condensers, does the trick. When a certain party was informed that the studio was located on the roof of the Kaufman & Baer Co. Bldg. they had visions of being housed in a large tent!

Thomas McLean, Chief Operator, was one time a signal officer in France and was several times commended for his ingenuity in offsetting German activities in the way of electrically operated machine guns, and loaded trip-wires and remote control of high explosives. Heinie was greatly surprised when they failed to work owing to the fact that Mr. McLean had playfully inserted a high resistance in series with the lines so that they appeared to be O. K. but, nevertheless, would not work.

Radio rampage nights have proven popular to WCAE's unseen audience, but just when things are breaking fine, Johnnie Mack, the announcer with the singing voice, has to spoil proceedings by singing, "Three Thousand Years Ago." Some day, it is hoped, he'll learn a new one. On rampage nights fifty to seventy-five entertainers are invited and the microphone is opened "wide" about eight o'clock and remains open until eleven-thirty, allowing "wise cracks" and the like to go on the air.

"Many Waters" on the Air

AWAY back in 1805, Lewis and Clark found an ideal location for a trading post.

The city of Walla Walla (many waters) was established in 1859 after the Hudson Bay Company had succeeded the original traders, the Northwest Company. And since that time this city has always been one of the leading towns in the state of Washington.

Station KFCF represents the latest progress of Walla Walla.

Through the Radio Committee of the Chamber of Commerce, the surrounding towns are co-operating to provide the best of talent on the programs from KFCF which has been heard in nearly every state of the Union.

Mississippi Steamboat Whistle

RADIO fans were startled when the innovation of broadcasting the Mississippi steamboat whistle was first inaugurated by Station WMC, Memphis, Tenn. It has now become known all over the United States, in Canada, Mexico and Cuba.

WMC specializes on general orchestral music with a sprinkling of Memphis Blues from Beale Street, home of the blues, with special midnight frolics on Tuesdays and Fridays!

Among their star performers are Bob Miller's Idlewild Orchestra. They

Princess Nacoomee

also broadcast the orchestras from the Hotel Chisca and Hotel Gayoso.

A particularly delectable bit of radio glee is the negro "spirituals" which have become a regular feature of the programs at WMC. And with a miscellaneous program of lively, Memphis-ized numbers, this station has won its "Down in Dixie" laurels.

Overtones of the Voice of the Capitol

SO many interesting people are broadcasting from WRC that it is impossible to mention more than a few of them in these pages. Among them are to be found some of the most important national figures, with which Washington naturally teems, especially in these winter months. Along in the first month of the new year came Secretary of the Navy Denby, and Secretary of War Weeks a little later. Mr. Denby surprised the station personnel by strolling in quite unattended. But he had plenty of company in the studio, which was crowded to its utmost capacity with the members of the famous Marine Band, who gave a concert the same evening. Mr. Roger Bruce Lum, studio director, states that Mr. Denby found his experience somewhat trying. Visiting battleships is evidently much more in the Secretary's line than broadcasting. He fidgeted and was quite impatient while awaiting his turn to talk into the microphone. And it might be remarked that there is nothing unusual in that. Many seasoned platform speakers display similar emotions when about to address by radio an unseen audience whose magnitude can only be guessed.

Not long ago the Washington audience was treated to a song recital by Marguerite Manierre, who has an exceptionally pleasing soprano voice, and sings occasionally from the New York stations. Her group of songs included such charming numbers as the ever popular "Fiddle and I," Rimsky-Korsakoff's "Chanson Hindou," "Sweet and Low," "The Last Rose of Summer," "Comin' Through the Rye," Schubert's "Who is Sylvia" and Jessie Johnson's "Pierrot."

Mr. R. E. Edmunds, the program manager, who generally constitutes himself a reception committee in the evening to receive with proper courtesy the artists and dignitaries who perform from his station, had the opportunity of welcoming royalty recently, when Princess Nacoomee broadcast a recital from WRC. Princess Nacoomee has several charming attributes. In the first place she is American royalty and not of the hyphenated variety. Her father is Chief Tahan of the tribe of Osage Indians, a personage well known throughout the country for his lectures and work in behalf of the Indian peoples. Then the Princess is an accomplished violinist and gives a unique recital wherein she combines the relation of the meaning of music in the life of the Indians, in their ceremonies and rituals, and the account of some interesting Indian legends, with the rendition on the violin of those same legends as done into music by some of our modern composers. The princess studied at the New England Conservatory of Music, but she gets her intimate and exact knowledge of Indian music from the considerable part of her life spent among the Indians.

Miss Florence Macbeth of the Chicago Civic Opera Company

The princess has become widely known through her appearance in most of the larger cities where she has given her recital. But she had never before broadcast, whereby hangs a bit of a tale. She customarily gives her recitals in costume, but she did not consider it necessary to don her Indian garb upon the occasion of her visit to

WGY FAMILY
Left to right: Carl Jester, Mrs. Wm. J. Cramb, Kolin Hager, Robert Weidow, Asa O. Coggeshall and Edward H. Smith

BROADCASTING SERVICES IN ZION TABERNACLE

Visitors are always welcomed at both station WCBD and Shiloh Tabernacle: it is a fallacy to think that Zion is a kind of Forbidden City, the portals of which are opened to only those who are adherents to the religious tenets observed by the citizens. Programs are made up of numbers by the Zion Junior Choir of 150 children, Zion Male Choir of 40 voices, Zion Women's Choir of 20 voices, Zion Band of 50 pieces and the Zion White-robed Choir of 500 voices

WRC, where she was to play Cecil Burleigh's "Snake Dance," Cadman's popular "From the Land of the Sky Blue Water," and "The Spirit of Wanna" by Lieurance.

A BEAUTIFUL INDIAN LEGEND

Prior to playing "The Spirit of Wanna" Princess Nacoomee tells the beautiful legend which is based upon a fine Indian love story. Wanna was a Kiowa (plains Indian) girl, and Wanna married a Pueblo man who forthwith took her to his home, built among the mesas and cliffs. There she became very homesick for her own people and longed with a great longing to visit again the familar scenes of her girlhood. With her husband she started upon the long journey to her former home, but she became ill on the way. With her strength exhausted she lay for days under a mesquite bush, hoping to regain sufficient strength to continue her journey. But one evening, as the sun "was slipping over the edge of the world" as the figurative Indian expresses it, she died. Her husband buried her under the mesquite bush, but not knowing the custom of her people of burying their dead with their ornaments, through which potency they were enabled to pass through the vale of darkness to the happy hunting ground, he buried Wanna without her ornaments. So Wanna still grieves where she lies under the mesquite bush and people who pass can still hear faintly the lament of her tortured spirit.

So much for the unfortunate Wanna. Now to return to the Princess Nacoomee who is telling this tale for the first time in a broadcast studio. Palpably nervous over the novel experience of talking to an unseen audience, she reached the point where she was to explain about the ornament business. At this point in the story it has been her habit to fumble at her throat and draw through her fingers a real Indian necklace which she thus displays by way of illustration to her audience. On this occasion too, she reached mechanically for her Indian beads. Her fingers found nothing to seize upon. Her mind, puzzled in subconscious fashion, failed somewhat in its certain control of things, and the voice in the microphone faltered. It is little things like this that throw an artist easily out of poise. Probably when the Princess broadcasts again she will find it advisable to wear her Indian garb.

Scholarship winners who recently entertained President Coolidge broadcast from WOR. Left to right: Angela Frances McCosker, Lillian Kay, Marion Stickel, Florence Hynes, Harold Polk, Buddy Egner, Elaine Egner and Elizabeth Mazalkovics

Musical Culture of Zion

ON the shores of Lake Michigan, midway between Chicago and Milwaukee, two graceful sturdy antenna masts tower 150 feet above Zion, the unique city founded by the late Dr. John Alexander Dowie. They mark the site of Station WCBD the radio telephone broadcasting station owned and operated by Wilbur Glenn Voliva, General Overseer of the Christian Catholic Apostolic Church.

Station WCBD is strategically located for perfect transmission. It is situated on a level plain a few miles south of the Wisconsin boundary line.

Laughter on the Radio Wave

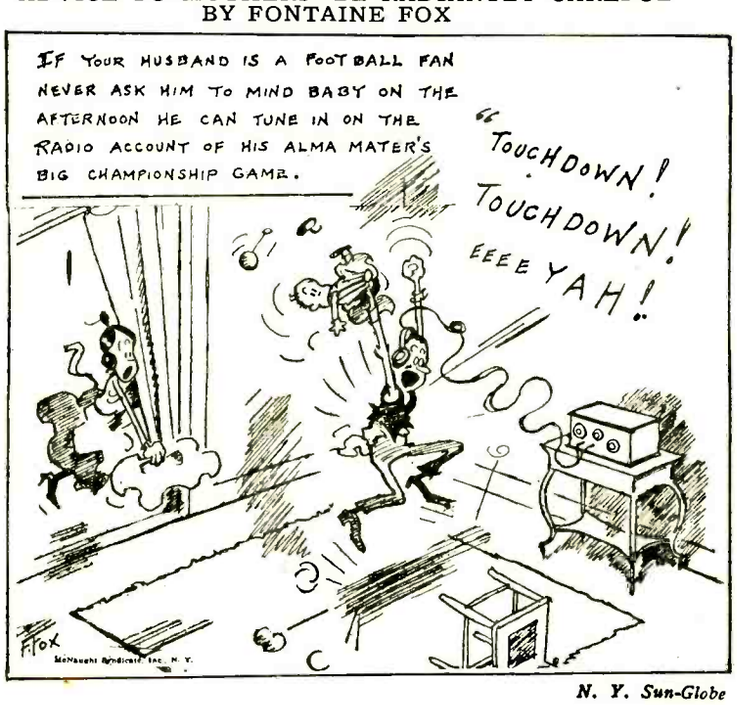
METROPOLITAN MOVIES

N. Y. World.

WHEN A FELLER NEEDS A FRIEND—BY BRIGGS

N. Y. Tribune

"ADVICE TO MOTHERS—BE RADIANTLY CAREFUL" BY FONTAINE FOX



N. Y. Sun-Globe

"WHY DO THEY CALL IT WIRELESS?"

From Tit-Bits

RADIO NEWS FROM ALL OVER THE WORLD

White's Radio Bill Practically Ready

THE revised White Radio Bill is now understood to have been generally approved by the Department of Commerce. The bill will be introduced in the House and referred to the Merchant Marine and Fisheries Committee. Public hearings will then be held, for suggestions and complaints from the interests affected. It is also believed a similar bill will be presented in the Senate.

In general, the bill will provide for the continued inspection and licensing of all American ship and shore transmitting stations, including commercial, private, broadcasting and amateur stations, as well as the examination and licensing of all operators by the Department of Commerce. General regulations of all sending stations and operators, together with license fees, location of stations, the assignment of wave lengths, power and hours, will be placed in the hands of the Secretary of Commerce. Existing licenses, however, will be permitted to run until they expire. An advisory committee of 15 experts, commercial and governmental officials will also be authorized to aid the Commerce Secretary. Assurance is given that receiving stations will not be required to secure licenses nor pay fees.

New Zealand Hears Massachusetts

ALL records were broken for commercial 600-meter continuous wave transmission when Operator M. A. Obradovic, of the *West Nilus*, while 95 miles north of Wellington, New Zealand, copied a number of messages direct from WIM, the Radio Corporation of America station at Chatham on the Massachusetts Coast. The distance is 9,300 miles and perfect reception was obtained in broad daylight.

Operator M. A. Obradovic, whose reception has been checked and confirmed, sent a letter to Chatham on December 23rd, in which he reported the history making achievement. The letter which reads in part as follows, reached the United States more than fifty days after it was mailed in New Zealand:—

"Enclosed is one of a number of a number of messages I have been copying from WIM on 600-meter C.W. The enclosed was copied in broad daylight at 7.10 P. M., New Zealand time, on December 16th (2.40 A. M. your local time), while 95 miles north of Wellington, N. Z., en route from Auckland."

Marshall Nielan directing a movie scene by radio

The Austro-Marconi Radio Co.

THE Austro-Marconi Radio Company inaugurated a regular Austrian wireless service. The opening was attended by the chiefs of the Government and representatives of the business world in Vienna.

The first messages sent out were addressed from Chancellor Seipel to the League of Nations at Geneva; from Burgomaster Sietz to Mayor Hylan of New York; and from the Chamber of Commerce of New York and London.

R C A in Public Interest

IN reply to the complaint of the Federal Trade Commission that great electrical companies have conspired to create a monopoly in radio apparatus officials of the three companies most concerned have issued statements to the effect that their methods have resulted in expansion rather than restraint of trade and have been in the best interests of the public.

The Radio Corporation of America was formed at the request of the Navy Department officials and for some time a representative of the Government served on the Board of Directors. It is also pointed out that the rapid development of the industry has been the result of the joint use of all the companies' patents.

Mr. Gerard Swope, President of the General Electric Co., said in part:

"The General Electric Company had developed a high frequency generator. The thought of the company at first was to sell this apparatus to any company that desired to have it, but at the request of one of the departments of the United States Government the General Electric Company was induced to take the lead in the reorganization of the American Marconi Company, which eventuated in the formation of the Radio Corporation of America, with the entire elimination of foreign interest.

"To make the Radio Corporation the most efficient instrument for transoceanic communication, the General Electric Company made a contract with the Radio Corporation giving to the latter the benefit and the advantage of all its inventions. Further to strengthen the position of the Radio Corporation in this art, similar contracts were made with other companies.

"This was all known to the Government, and a representative designated by the Government sat on the Board of Directors of the Radio Corporation for some time after its organization."

Major General James G. Harbord, President of the Radio Corporation of America said:

"The Radio Corporation has already opened all its records, correspondence, files, minutes of the meetings of its Board of Directors, together with all

its contracts and agreements, to the representatives of the Federal Trade Commission. The commission itself has fully reported the result of its survey to Congress.

"The Radio Corporation of America was organized as the outgrowth of a request of responsible officers of the Navy Department in Washington that there be established a strong, purely American company to carry the banner of the United States in this field of international communications and to effectively compete with foreign-owned or controlled systems of international communications."

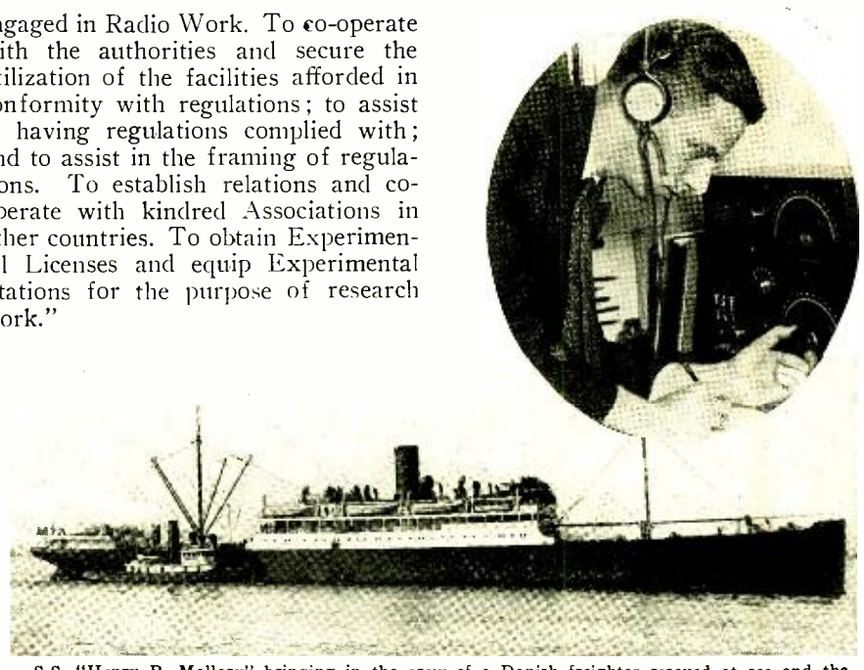
President H. B. Thayer of the American Telephone & Telegraph Company, of which the Western Electric Company, is a subsidiary, said:

"We presume that so far as we are concerned the complaint rests on a contract made by us with General Electric and dated July 1, 1920. In our first annual report after that contract was made we stated its purpose and scope which from our point of view was to clear up the patent situation which might hamper our development. The effect has not been to restrain trade, but to expand it. We believe the contract is in the public interest and have been advised that it stands on a sound legal basis."

Ireland Now Has Radio Association

THE awakening interest in radio development in the Irish Free State has prompted a group of professors, electrical engineers, and other prominent persons interested in radio work to organize a society which is to be called "The Radio Association of Ireland." This Association is to have its head office in Dublin, and according to its constitution its objects are:

"To foster the interests of members engaged in Radio Work. To co-operate with the authorities and secure the utilization of the facilities afforded in conformity with regulations; to assist in having regulations complied with; and to assist in the framing of regulations. To establish relations and co-operate with kindred Associations in other countries. To obtain Experimental Licenses and equip Experimental Stations for the purpose of research work."

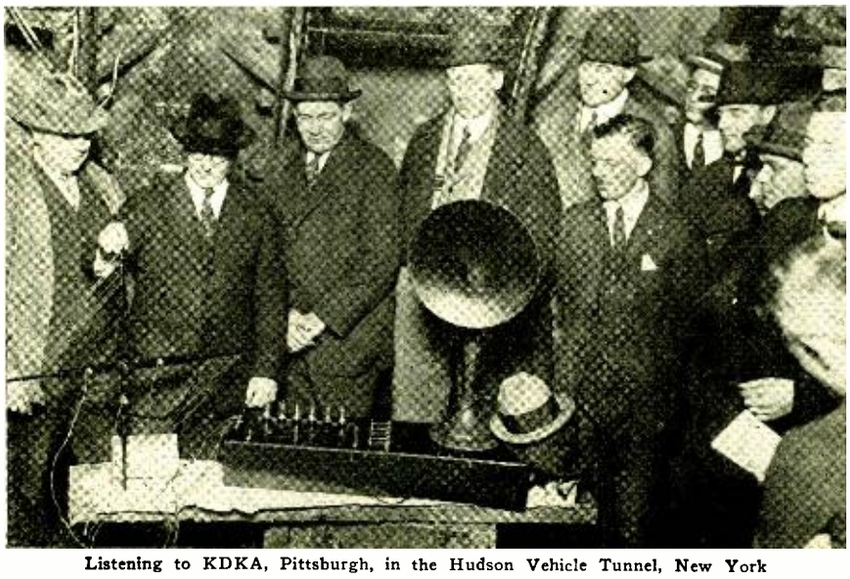


S.S. "Henry R. Mallory" bringing in the crew of a Danish freighter rescued at sea and the radio operator who heard the SOS

All radio license holders and others interested in the development of radio science and radio communication are eligible for membership. The membership fee is to be ten shillings per annum—equivalent to $2.20 at current rate of exchange—and the funds so collected are to be used in carrying out the various programs of the Association and in equipping experimental stations. The Association is also planning to publish a periodical devoted to radio work when its membership is large enough to finance such an undertaking. Already several hundred applications for membership have been received, and it is expected that the number of applicants will swell considerably when the contemplated Broadcasting Station has been established at Dublin, and the present restrictions upon private ownership of wireless sets have been removed.

American Radio Exports Grow

RADIO exports for the year 1923, totaled $3,448,112, compared with $2,897,799 last year, according to Department of Commerce statistics. While the shipments of radio apparatus form only about 5 per cent. of the total value of all electrical exports, which in 1923 passed the $72,000,000 mark, radio exports increased about 7 per cent. out of a total gain of $9,000,000. December radio exports totaled $335,308. compared with $381,827 for November and $270,061 in October. In November, the bulk of American radio apparatus sent out of the country went to Argentina, Quebec, Ontario, Australia, Panama, Mexico and England. Twenty-four countries purchased apparatus valued at over $1000 from American exporters.



Listening to KDKA, Pittsburgh, in the Hudson Vehicle Tunnel, New York

Radio Broadcasts Wilson Services

THE funeral services of President Wilson in Washington were broadcast Feb. 6, to probably 5,000,000 persons east of the Mississippi River by the American Telephone and Telegraph Company through three high-power stations, while the memorial exercises held in Madison Square Garden, N. Y., were broadcast by the Radio Corporation station WJZ.

The three large radio stations which were linked to broadcast the funeral services in Washington were the same that recently broadcast Mr. Wilson's address from his home in S Street, the same that broadcast President Coolidge's message to Congress, and the services of the Unknown Soldier in the National Cemetery at Arlington.

Chief Harry T. Baxter broadcasting the history of the "Liberty Bell" at Philadelphia

No Broadcasting Stations in Spain

ALTHOUGH no broadcasting stations have as yet been established in Spain, there is considerable interest in radio receiving sets of sufficient range to receive broadcasts from Paris, The Hague, Berlin and London. The principal drawback to a more extended use of radio receiving apparatus is the apparent lack of technical knowledge on the part of those who have undertaken the sale of radio apparatus. An investigation has disclosed that out of five dealers who carry radio receiving sets in stock, mainly of British and French manufacture, only one seemed to have much knowledge of the subject.

New Wireless Station Opened in Argentina

THE new wireless station which has been built at Monte Grande for the Transradio Internacional Compania Radiotelegrafica Argentina for the purpose of placing the Argentine in direct wireless communication with North America, Europe, and the Far East, was opened January 25 when an inaugural message was sent from the President of the Argentine to King George V. Direct services will be carried out between Monte Grande, New York, Paris and Berlin. It is intended to extend this direct service to England as soon as possible, but as Great Britain does not possess a wireless station sufficiently powerful to communicate with South America this service canot be brought into operation until a suitable station is available in that country.

The transmitting station at Monte Grande, 20 kilometers from Buenos Aires, covers an area of 1200 acres. There are ten steel towers 500 meters apart, each tower being 690 feet high. The power of the station is 800 kw.

The receiving center is at Villa Eliza, 39 kilometers from Buenos Aires and the same distance from the transmitting station.

The telegraph office, from which the transmitting station is automatically controlled and to which the receiving station is connected with telegraph lines and an automatic linking device is situated in the center of the commercial quarter of Buenos Aires.

British Restrict Radio on Foreign Ships

THE British Admiralty has issued an order restricting the use of radio telegraph or telephone apparatus by foreign warships when in or near British harbors.

If the harbor is a naval one, such ships must obtain permission from the naval port commander before employing any of these services; they must furthermore state the system, wave length and time of transmission proposed.

In other harbors, transmission on 600 meters is forbidden, except for distress signals. Interference with naval and military signaling must be avoided, and transmission must be discontinued on request of the authorities.

B C L's Relieved of Interference

SPARK interference from ships operating on 450 meters, which has been giving broadcast listeners along the coast considerable trouble since the broadcasting wave band was increased last May, became a thing of the past on Jan. 11, when the meeting presided over by Arthur Batchelder, Chief Radio Supervisor of the 2d District, came to the conclusion that the interference must go and raised the wave band of all ships using spark transmitters to between 600 and 800 meters.

The meeting took on an international aspect inasmuch as the Canadian Government sent C. P. Edwards, Director General of Canadian wireless and radio activities to advise and co-operate with the American authorities and interests in cleaning up an ugly situation. The commercial companies were all represented and were all unanimous in their approval of the change.

Wall Street Resorts to Radio

WIRE service with the West was so badly crippled by the recent sleet storm that Wall Street turned to radio for relief. The Radio Corporation showed its ability to handle business from New York to San Francisco and covered points in the southern section of the country as well. The American Telephone and Telegraph Company reported but one of its fourteen circuits to Chicago in working order, and it accepted only emergency messages over its single circuit. Wires of the Western Union and the Postal Telegraph around Chicago were reported in bad shape.

Japan Improves Stations

JAPAN is doing much to improve her short wave wireless communication, but thus far nothing has been done to make communication with the outside world quicker.

The Funabashi naval station just outside Tokio is being modernized and new short wave stations are being erected in Chiba and Niigata, but these are largely for communicating with ships and between different parts of Japan.

The syndicate headed by Viscount Shibusawa, which proposed erection of a trans-Pacific station, was somewhat embarrassed by the disaster, but is understood to be inclined to go on with its project if suitable arrangements can be made with the government for a subsidy.

Radio Traffic Grows

THE transatlantic traffic of the Radio Corporation of America is now at the rate of 90,000 paid words a day and is steadily increasing, because of the large number of new customers using radio letters as well as messages.

John W. Swanson, of the Dr. Alexander Rice expedition, operating a set in a South American jungle

BROADCASTING STATION DIRECTORY

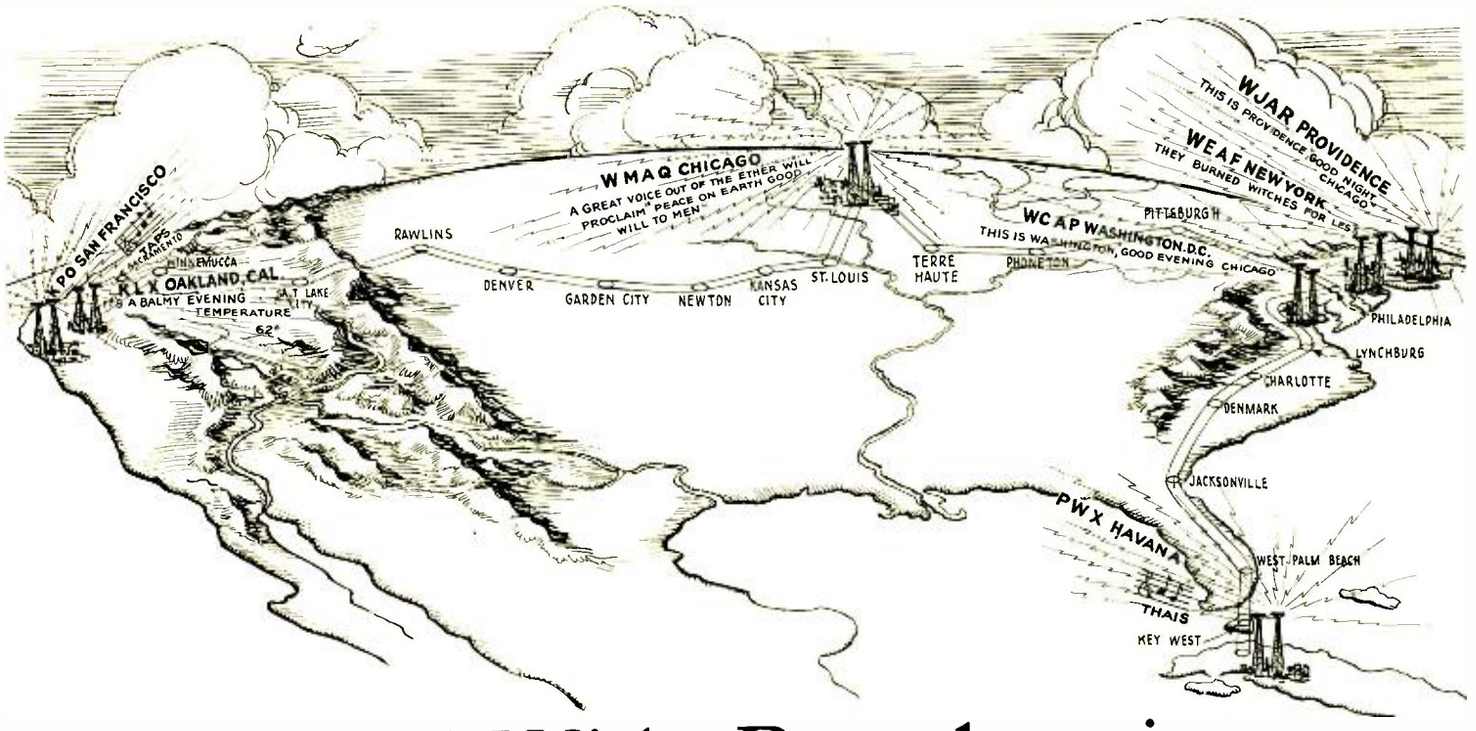
(Revised to February 15th, 1924)

KAO	Young Men's Christian Association, Denver, Colo.	360
KFI	E. C. Anthony.....Los Angeles, Calif.	469
KFZ	Doerr Mitchell Electric Co.....Spokane, Wash.	283
KGB	Tacoma Daily Ledger.....Tacoma, Wash.	252
KGG	Hallock & Watson Radio Service, Portland, Ore.	360
KGN	Northwestern Radio Mfg. Co.....Portland, Ore.	360
KGU	M. A. Mulrony.....Honolulu, Hawaii	360
KGW	Oregonian Pub. Co.....Portland, Ore.	492
KGY	St. Martins College.....Lacey, Wash.	258
KHJ	Times Mirror Co.....Los Angeles, Calif.	395
KHQ	Louis Wasmer .....Seattle, Wash.	360
KJQ	C. O. Gould .....Stockton, Calif.	360
KJR	Northwest Radio Service Co.....Seattle, Wash.	270
KJS	Bible Institute of Los Angeles, Inc., Los Angeles, Calif.	360
KLS	Warner Brothers .....Oakland, Calif.	360
KLZ	Reynolds Radio Co.....Denver, Colo.	360
KMC	Lindsay-Weatherill & Co.....Readley, Calif.	360
KMJ	San Joaquin Light & Power Corp., Fresno, Calif.	273
KMO	Love Electric Co.....Tacoma, Wash.	360
KNT	Grays Harbor Radio Co.....Aberdeen, Wash.	263
KNV	Radio Supply Co.....Los Angeles, Calif.	256
KNX	Electric Lighting Supply Co., Los Angeles. Calif.	360
KOB	New Mexico College of Agriculture and Mechanical Arts, State College, N. Mex.	360
KOP	Detroit Police Dept.....Detroit, Mich.	286
KOQ	Modesto Evening News.....Modesto, Calif.	360
KPO	Hale Bros. .....San Francisco, Calif.	423
KQP	Apple City Radio Club.....Hood River, Ore.	360
KQV	Doubleday-Hill Electric Co.....Pittsburgh, Pa.	360
KQW	Charles D. Herreld.....San Jose, Calif.	360
KRE	Berkeley Daily Gazette.....Berkeley, Calif.	278
KSD	Post-Dispatch .....St. Louis, Mo.	546
KSS	Prest & Dean Radio Rsch. Lab., Long Beach, Calif.	360
KTW	First Presbyterian Church.....Seattle, Wash.	360
KUO	The Examiner Printing Co., San Francisco, Calif.	360
KUS	City Dye Works & Laundry Co., Los Angeles, Calif.	360
KUY	Coast Radio Co.....El Monte, Calif.	256
KWG	Portable Wireless Telephone Co., Stockton, Calif.	360
KWH	Los Angeles Examiner.....Los Angeles, Calif.	360
KWY	Westinghouse Elec. & Mfg. Co.....Chicago, Ill.	536
KXD	Herald Publishing Co.....Modesto, Calif.	252
KYQ	Electric Shop .....Honolulu, T. H.	360
KZM	Preston, D. Allen.....Oakland, Calif.	360
KZN	The Desert News.....Salt Lake City, Utah	360
KZV	Wenatchee Battery & Motor Co., Wenatchee, Wash.	360
KDKA	Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.	326
KDPM	Westinghouse Elec. & Mfg. Co., Cleveland, Ohio	270
KDPT	Southern Electric Co.....San Diego, Calif.	244
KDLY	Telegram Publishing Co...Salt Lake City, Utah	360
KDYM	Savoy Theatre .....San Diego, Calif.	252
KDYQ	Oregon Institute of Technology...Portland, Ore.	360
KDYW	Smith, Hughes & Co.....Phoenix, Ariz.	360
KDYX	Star Bulletin Publishing Co...Honolulu, T. H.	360
KDZB	Frank E. Siefert.....Bakersfield, Calif.	240
KDZE	Rhodes Company .....Seattle, Wash.	455
KDZF	Automobile Club of So. Calif., Los Angeles, Calif.	278
KDZI	Electric Supply Co.....Wenatchee, Wash.	360
KDZQ	Pyle & Nichols.....Denver, Colo.	360
KDZR	Bellingham Publishing Co...Bellingham, Wash.	261
KDZU	Western Radio Corporation.....Denver, Colo.	360
KDZV	Cope & Cornwell Co.....Salt Lake City, Utah	360
KFAD	McArthur Brothers Mercantile Co., Phoenix, Ariz.	360
KFAE	State College of Washington....Pullman, Wash.	330
KFAF	Western Radio Corporation.....Denver, Colo.	360
KFAJ	University of Colorado.....Boulder Colo.	360
KFAN	Electric Shop .....Moscow, Idaho	360
KFAR	Studio Lighting Service Co.....Hollywood, Calif.	280
KFAT	Dr. J. T. Donohue.....Eugene, Ore.	275
KFAU	Independent School District of Boise City, Boise, Idaho	270
KFAV	Abbot Kinney Company.....Venice, Calif.	258
KFAY	W. J. Virgin.....Medford. Ore.	283
KFAW	The Radio Den, Ashford & White, Santa Anna, Calif.	280
KFBB	F. A. Buttrey & Co.....Havre, Mont.	360
KFBC	W. K. Azbill.....San Diego, Calif.	360
KFBE	Reuben H. Horn.....San Luis Obispo, Calif.	360
KFBK	Kimball-Upson Co. .....Sacramento, Calif.	283
KFBL	Leese Bros. .....Everett, Wash.	224
KFBS	Chronicle News and Gas & Elec. Supply Co., Trinidad, Colo.	360
KFBU	Bishop N. S. Thomas.....Laramie, Wyo.	283
KFCD	Salem Elec. Co.....Salem, Ore.	360
KFCF	Frank A. Moore.....Walla Walla, Wash.	360
KFCH	Electric Service Station.....Billings, Mont.	360
KFCK	Colorado Springs Radio Co., Colorado Springs, Colo.	242
KFCM	Richmond Radio Shop.....Richmond. Calif.	360
KFCP	Ralph W. Flygare.....Ogden, Utah	360
KFCQ	Motor Service Station.....Casper, Wyo.	360
KFCV	Fred Mahaffey, Jr.....Houston, Tex.	360
KFCY	Western Union College.....LeMars, Iowa	252
KFCZ	Omaha Central High School.....Omaha, Nebr.	258
KFDA	Adler's Music Store.....Baker, Ore.	360
KFDD	St. Michaels Cathedral.....Boise, Idaho	360
KFDF	Wyoming Radio Corp.....Casper, Wyo.	360
KFDH	University of Arizona.....Tucson. Ariz.	360
KFDJ	Oregon Agri. College.....Corvallis, Ore.	360
KFDL	Knight-Campbell Music Co.....Denver, Colo.	360
KFDO	H. E. Cutting.....Bozeman, Mont.	248
KFDR	Bullock's Hardware & Sporting Goods, York, Nebr.	360
KFDU	Nebraska Radio and Electric Co., Lincoln, Nebr.	240
KFDV	Gilbrech & Stinson.....Fayetteville, Ark.	360
KFDX	First Baptist Church.....Shreveport, La.	360
KFDY	South Dakota State College of Agri. & Mech. Arts. Brooklings, S. D.	360
KFDZ	Harry O. Iverson.....Minneapolis, Minn.	231
KFEC	Meier & Frank Co.....Portland, Ore.	360
KFEJ	Guy Greason .....Tacoma. Wash.	360
KFEL	Winner Radio Corporation.....Denver, Colo.	360
KFEQ	J. L. Scroggin.....Oak, Nebr.	360
KFER	Auto Electric Service Co.....Ft. Dodge, Iowa	231
KFEV	Radio Electric Shop.....Douglas, Wyo.	263
KFEX	Augsburg Seminary .....Minneapolis, Minn.	261
KFEY	Bunker Hill & Sullivan Mining & Const. Co., Kellogg, Idaho	360
KFEZ	American Society of Mech. Engrs., St. Louis, Mo.	360
KFFE	Eastern Oregon Radio Co.....Pendleton, Ore.	360
KFFJ	Jenkins Furniture Co.....Boise, Idaho	360
KFFO	Dr. E. H. Smith.....Hillsboro, Ore.	229
KFFQ	Markschoffel Motor Co....Colorado Springs, Colo.	360
KFFR	Jim Kirk .....Sparks, Nev.	226
KFFV	Graceland College .....Lamoni, Iowa	360
KFFX	McGraw Co. .....Omaha, Nebr.	278
KFFY	Pincus & Murphy, Inc.....Alexandria, La.	275
KFFZ	Al. G. Barnes Amusement Co.....Dallas, Tex.	226
KFGC	Louisiana State University....Baton Rouge, La.	254
KFGD	Chickasha Radio & Elec. Co...Chickasha, Okla.	248
KFGF	Buchanan Stevens & Co.....Mt. Vernon, Wash.	360
KFGH	Leland Stanford, Jr., Univ..Stanford Univ., Colo.	360
KFGJ	National Guards Co., 138th Inf., St. Louis, Mo.	266
KFGL	Arlington Garage .....Arlington, Ore.	234
KFGQ	Crary Hardware Co.....Boone, Iowa	226
KFGV	Heidbreder Radio Supply Co.....Utica, Nebr.	224
KFGX	First Presbyterian Church.....Orange, Tex.	250
KFGZ	Emmanuel Missionary Co., Berrien Spgs., Mich.	268
KFHA	Western State College of Colorado, Gunnison, Colo.	252
KFHB	The Rialto Theatre.....Hood River, Ore.	280
KFHD	Utz Electric Co.....St. Joseph, Mo.	226
KFHF	Central Christian Church.....Shreveport, La.	266
KFHH	Ambrose A. McCue.....Neah Bay, Wash.	283
KFHJ	Fallon Co. .....Santa Barbara, Clif.	360
KFHR	Star Elec. and Radio Co.....Seattle, Wash.	270
KFHS	Robert Washington Nelson....Hutchinson. Kans.	229
KFIB	Franklin W. Jenkens.....St. Louis, Mo.	244
KFIC	Phillip Laskowitz .....Denver, Colo.	224
KFID	Ross Arbuckles Garage.....Iola, Kans.	246
KFIF	Benson Tech. Student Body.....Portland, Ore.	360
KFIK	Gladbrook Electric Co.....Gladbrook, Iowa	234
KFIL	Windisch Elec. Farm Equipment Co., Louisburg, Kans.	234
KFIO	North Central High School.....Spokane, Wash.	252
KFIQ	Yakima Valley Radio Broadcasting Association, Yakima, Wash.	224
KFIU	Alaska Elec. Light & Power Co., Juneau, Alaska	226
KFIX	Reorganized Church of Jesus Christ, Latter Day Saints, Independence, Kans.	240
KFIY	Brott Laboratories .....Seattle, Wash.	236
KFIZ	Daily Commonwealth .....Fond du Lac, Wisc.	273
KFJB	Marshall Electric Co., Inc....Marshalltown, Iowa	248
KFJC	Post Intelligences .....Seattle, Wash.	233
KFJD	Weld County Printing & Pub. Co., Greeley, Colo.	236
KFJF	National Radio Mfg. Co...Oklahoma City, Okla.	252
KFJI	Liberty Theatre .....Astoria, Ore.	252
KFJM	University of North Dakota, Grand Forks, N. D.	229
KFJR	Ashley C. Dixon & Co.....Stevensville, Mont.	258
KFJV	T. H. Warren.....Dexter, Iowa	224
KFJW	Le Grand Radio Co.....Towanda, Kans.	226
KFJX	Iowa State Teachers College...Cedar Falls, Iowa	229
KFJY	Tunwall Radio Co.....Fort Dodge, Iowa	246
KFJZ	Texas National Guard, 112th Cav., Fort Worth, Texas	254
KFKA	Colorado State Teachers College...Greeley, Colo.	248
KFKB	Brinkley-Jones Hospital Association, Milford. Kans.	286
KFKH	Denver Park Amusement Co.....Lakeside, Colo.	226
KFKQ	Conway Radio Laboratories.....Conway, Ark.	224
KFKV	F. P. Gray.....Route, Mont.	283
KFKX	Westinghouse Electric Co.....Hastings, Nebr.	286
KFKZ	Nasour Bros. Radio Co...Colorado Springs, Colo.	234
KFLA	Abner R. Wilson.....Butte, Mont.	283
KFLB	Signal Electric Mfg. Co.....Menominee, Mich.	248
KFLD	Paul E. Greenlaw.....Franklinton. La.	234
KFLE	National Educational Service.....Denver, Colo.	268
KFLH	Erickson Radio Co.. Inc....Salt Lake City, Utah	261
KFLP	Everett M. Foster.....Cedar Rapids, Iowa	240
KFLQ	Bizzell Radio Shop.....Little Rock, Ark.	261
KFLR	University of New Mexico..Albuquerque, N. M.	254
KFLU	Rio Grande Radio Supply House, San Benito, Tex.	236
KFLV	Rev. A. T. Frykman.....Rockford, Ill.	229
KFLW	Missoula Electric Supply Co....Missoula, Mont.	234
KFLX	George R. Clough.....Galveston, Texas	240
KFLY	Fargo Radio Supply Co.....Fargo, N. D.	231
KFLZ	Atlantic Automobile Co.....Atlantic, Iowa	273
KFMQ	University of Arkansas.....Fayetteville, Ark.	263
KFMR	Morningside College.....Sioux City, Iowa	261
KFMS	Freimuth Department Store.....Duluth, Minn.	275
KFMT	Dr. George W. Young.....Minneapolis, Minn.	231
KFMU	Stevens Brothers .....San Marcos, Texas	240
KFMW	M. G. Sateren.....Houghton, Mich.	266
KFMX	Carleton College.....Northfield, Minn.	283
KFMY	Boy Scouts of America, Long Beach District Council, Long Beach, Calif.	229
KFMZ	Roswell Broadcasting Club.....Roswell, N. M.	250
KFNC	Echo Park Evangelistic Association, Los Angeles, Calif.	278
KFNG	Wooten's Radio Shop.....Coldwater, Miss.	254
KFNH	State Teachers College.....Springfield. Mo.	236
KFNJ	Warrensburg Electric Shop...Warrensburg, Mo.	234
KGO	General Electric Co.....Oakland, Calif.	312
KLX	Tribune Publishing Co.....Oakland, Calif.	509
WBL	T. & H. Radio Co.....Anthony, Kans.	261
WSB	May & Co.....Newark, N. J.	360
WBR	Pennsylvania State Police.....Butler. Pa.	286
WBT	Southern Radio Corporation....Charlotte, N. C.	360
WBZ	Westinghouse Elec. & Mfg. Co..Springfield. Mass.	337
WCK	Stix-Baer-Fuller .....St. Louis. Mo.	360
WCM	University of Texas.....Austin, Texas	360
WCX	Detroit Free Press.....Detroit. Mich.	517
WDM	Church of the Covenant.....Washington, D. C.	254
WDZ	James L. Bush.....Tuscola. Ill.	278
WEB	Benwood Co. .....St. Louis, Mo.	360
WEV	Hurlburt-Still Electrical Co.....Houston, Tex.	360
WEW	St. Louis University.....St. Louis, Mo.	261
WFI	Strawbridge & Clothier.....Philadelphia, Pa.	395
WFY	Cosradio Co. .....Wichita, Kans.	360
WGI	American Radio and Research Corporation, Medford Hillside. Mass.	360
WGL	Thomas F. J. Howlett.....Philadelphia, Pa.	360
WGR	Federal Tel. & Tel. Co.....Buffalo, N. Y.	319
WGV	Interstate Electric Co.....New Orleans, La.	242
WGY	General Electric Co.....Schenectady, N. Y.	380
WHA	University of Wisconsin.....Madison, Wisc.	360
WHB	Sweeney School Co.....Kansas City, Mo.	411
WHK	The Radiovox Company.....Cleveland, Ohio	360
WHN	Loew's State Theatre....New York City, N. Y.	360
WHX	Iowa Radio Corporation.....Des Moines, Iowa	360
WIK	K. & L. Electric Co.....McKeesport, Pa.	234
WIL	Continental Electric Supply Co., Washington, D. C.	360
WIP	Gimbel Bros. .....Philadelphia, Pa.	509
WIZ	Cinco Radio Mfg. Co.....Cincinnati, Ohio	360
WJD	Richard Harris Howe.....Granville, Ohio	229
WJH	White & Boyer Co.....Washington, D. C.	273
WJK	Service Radio Equipment Co.....Toledo, Ohio	360
WJX	DeForest Radio Tel. & Tel. Co., New York, N. Y.	360
WJY	Radio Corp of America—Aeolian Hall, N. Y. C.	405
WJZ	Radio Corp. of America—Aeolian Hall, N. Y. C.	455
WKA	Landaus Music & Jewelry Co., Wilkes-Barre, Pa.	360
WKY	Oklahoma Radio Shop....Oklahoma City, Okla.	360
WLB	University of Minnesota.....Minneapolis, Minn.	360
WLH	Hamilton Mfg. Co.....Indianapolis, Ind.	360
WLW	Crosley Manufacturing Co.....Cincinnati, Ohio	309
WMA	Arrow Radio Laboratories.....Anderson, Ind.	360
WMC	Commercial .....Memphis, Tenn.	500
WMU	Doubleday-Hill Elec. Co.....Pittsburgh, Pa.	261
WNJ	Shotten Radio Mfg. Co.....Albany, N. Y.	400
WNO	Wireless Telephone Co. of Hudson County, Jersey City, N. J.	360
WOC	Palmer School of Chiropractic..Davenport, Iowa	484
WOI	Iowa State College.....Ames, Iowa	360
WOK	Arkansas Light & Power Co...Pine Bluff, Iowa	360
WOO	John Wanamaker .....Philadelphia, Pa.	509
WOQ	Western Radio Co.....Kansas City Mo.	360
WOR	L. Bamberger Co.....Newark, N. J.	405
WOS	Missouri State Marketing Bureau. Jefferson City, Mo.	441
WPA	Fort Worth Record.....Fort Worth, Tex.	360
WPG	Nushawg Poultry Farm.....New Lebanon, Ohio	234
WPI	Electric Supply Co.....Clearfield, Pa.	360
WQX	Walter A. Kushl.....Chicago. Ill.	360
WRC	Radio Corporation of America..Washington. D. C.	469
WRK	Doron Brothers Electric Co.....Hamilton, Ohio	360
WRL	Union College .....Schenectady, N. Y.	360
WRM	University of Illinois.....Urbana, Ill.	360
WRR	City of Dallas (Police and Fire Signal Department), Dallas, Tex.	360
WRW	Tarrytown Radio Research Lab., Tarrytown, N. Y.	273
WSB	Atlanta Journal .....Atlanta, Ga.	429
WSL	J. & M. Electric Co.....Utica, N. Y.	273
WSY	Alabama Power Co.....Birmingham, Ala.	360
WSZ	Marshall-Gerken Co. .....Toledo, Ohio	360
WTG	Kansas State Agri. College....Manhattan, Kans.	360
WTP	George M. McBride.....Bay City, Mich.	360
WWI	Ford Motor Co.....Dearborn, Mich.	273
WWJ	The Detroit News.....Detroit, Mich.	517
WWL	Loyola University .....New Orleans, La.	280
WAAB	Valdemar Jensen .....New Orleans, La.	268
WAAC	Tulane University .....New Orleans, La.	360
WAAD	Ohio Mechanics Institute.....Cincinnati, Ohio	360
WAAF	Chicago Daily Drovers Journal....Chicago, Ill.	286
WAAM	L. R. Nelson Co.....Newark, N. J.	263
WAAN	University of Missouri.....Columbia, Mo.	264
WAAQ	New England Motor Sales Co., Greenwich, Conn.	360
WAAS	Georgia Radio Co.....Decatur, Ga.	360
WAAW	Omaha Grain Exchange.....Omaha, Nebr.	360
WAAZ	Hollister-Miller Motor Co.....Emporia, Kans.	360
WABA	Lake Forest College.....Lake Forest, Ill.	266
WABB	Dr. John B. Lawrence.....Harrisburg, Pa.	266
WABC	Fulwider-Grimes Battery Co.....Anderson, Ind.	229
WABD	Parker High School.....Dayton, Ohio	286
WABE	Y. M. C. A.....Washington, D. C.	283
WABG	Arnold Edwards Piano Co.....Jacksonville, Fla.	248
WABH	Lake Shore Tire Co.....Sandusky, Ohio	240
WABI	Bangor Railway and Electric Co....Bangor, Me.	240
WABJ	Radio Laboratories .....South Bend, Ind.	240
WABK	First Baptist Church.....Worcester, Mass.	252
WABL	Connecticut Agril. College.....Storrs, Conn.	283
WABM	F. E. Doherty.....Saginaw, Mich.	254
WABN	Waldo C. Grover.....La Crosse, Wisc.	234
WABO	Lake Avenue Baptist Church....Rochester, N. Y.	252
WABP	Robert F. Weinhig .....Dover, Ohio	266
WABQ	Haverford College Radio Club...Haverford, Pa.	261
WABR	Scott High School.....Toledo, Ohio	270
WABS	Essex Mfg. Co.....Newark, N. J.	244
WABT	Holliday-Hall .....Washington. Pa.	252
WABU	Victor Talking Machine Co.....Camden, N. J.	226
WABV	John H. De Witt, Jr.....Nashville Tenn.	263
WABW	College of Wooster.....Wooster, Ohio	234
WABX	Henry B. Joy.....Mt. Clemens, Mich.	270
WABY	John Magaldi, Jr.....Philadelphia, Pa.	242
WABZ	Coliseum Place Baptist Church.New Orleans, La.	263
WAJV	Indian Pipe Line Corp.....Princeton Ind.	360
WBAA	Purdue University .....West Lafayette, Ind.	360
WBAD	Sterling Electric Co. and Journal Printing Co., Minneapolis, Minn.	360
WBAH	The Dayton Co.....Minneapolis, Minn.	417
WBAN	Wireless Phone Corporation.....Paterson, N. J.	244
WBAO	James Millikin University.....Decatur, Ill.	360
WBAP	Wortham-Carter Pub. Co., The Star Telegram, Fort Worth, Tex.	476
WBAV	Erner & Hopkins Co.....Columbus, Ohio	390
WBAW	Marietta College .....Marietta, Ohio	248
WBAX	John H. Stenger, Jr.....Wilkes-Barre, Pa.	360
WBAY	Western Electric Co.....New York, N. Y.	492
WBBA	Newark Radio Laboratory.....Newark. Ohio	240
WBBD	Barbey Battery Service.....Reading, Pa.	224
WBBE	Alfred R. Marcy .....Syracuse, N. Y.	246
WBBF	Georgia School of Technology.....Atlanta, Ga.	270
WBBG	Irving Vermilya .....Mettapoisett, Mass.	240
WBBH	J. Irving Bell.....Port Huron. Mich.	246
WBBI	Indianapolis Radio Club.....Indianapolis, Ind.	234
WBBJ	Neel Electric Co.....West Palm Beach, Fla.	258
WCAD	St. Lawrence University.....Canton. N. Y.	280
WCAE	Kaufman & Baer Co.....Pittsburgh, Pa.	462
WCAF	Michigan Limestone & Chemical Co., Rodgers, Mich.	360
WCAG	Clyde R. Randall.....New Orleans, La.	268
WCAH	Entrekin Electric Co.....Columbus, Ohio	286
WCAJ	Nebraska Wesleyan University, University Pl., Nebr.	360
WCAK	Alfred P. Daniel..... ....Houston, Texas	263
WCAL	St. Olaf College.....Northfield, Minn.	360
WCAM	Villanova College .....Villanova, Pa.	360
WCAO	Sanders & Stayman Co.....Baltimore, Md.	360
WCAP	Chesapeake & Potomac Tel. Co., Washington, D. C.	469
WCAR	Alamo Radio Electric Co.....San Antonio, Tex.	360
WCAS	Dunworthy Industrial Institute, Minneapolis, Minn.	246
WCAT	South Dakota School of Mines..Rapid City, S. D.	240
WCAU	Durham & Co.....Philadelphia, Pa.	286

WCAV	J. C. Dice Electric Co.....Little Rock, Ark.	360
WCAX	University of Vermont.....Burlington, Vt.	360
WCAY	Kesselman O'Driscoll Music House, Milwaukee Wisc.	261
WCAZ	Carthage College .....Carthage, Ill.	246
WCBA	Charles W. Haimbach.....Allentown, Pa.	280
WCBC	University of Michigan.....Ann Arbor, Mich.	280
WCBD	Zion Radio Broadcasting Station.....Zion, Ill.	345
WDAE	Tampa Daily Times.....Tampa, Fla.	360
WDAF	Kansas City Star.....Kansas City, Mo.	411
WDAG	Martin J. Laurence.....Amarillo, Tex.	263
WDAH	Trinity Methodist Church.....El Paso, Texas	268
WDAK	Hartford Courant .....Hartford, Conn.	261
WDAM	Weston Electric Co.....New York, N. Y.	360
WDAO	Automotive Electric Co.....Dallas, Tex.	360
WDAP	The Board of Trade.....Chicago, Ill.	360
WDAR	Lit Brothers .....Philadelphia, Pa.	395
WDAS	Samuel W. Waite.....Worcester, Mass.	360
WDAU	Slocum & Kilburn.....New Bedford, Mass.	360
WDAX	First National Bank.....Centerville, Iowa	268
WDAY	Fargo Radio Service Co.....Fargo, N. D.	244
WDBC	Kirk Johnson & Co., Inc.....Lancaster, Pa.	258
WEAA	Fallain & Lathrop.....Flint, Mich.	280
WEAE	Virginia Polytechnic Institute...Blacksburg, Va.	360
WEAF	American Tel. & Tel.....New York, N. Y.	492
WEAH	Wichita Board of Trade.....Wichita, Kans.	244
WEAI	Cornell University .....Ithaca, N. Y.	286
WEAJ	University of South Dakota.....Vermillion, S. D.	283
WEAM	North Plainfield, Borough of Plainfield, North Palinfield, N. J.	252
WEAN	Shepard Co. .....Providence, R. I.	273
WEAO	Ohio State University.....Columbus, Ohio	360
WEAP	Mobile Radio Co., Inc.....Mobile, Ala.	360
WEAR	Baltimore Am. & News Pub. Co., Baltimore, Md.	360
WEAS	Hecht Company .....Washington, D. C.	360
WEAU	Davidson Brothers Co.....Sioux City, Iowa	360
WEAY	Will Horwitz, Jr.....Houston, Tex.	360
WEAZ	Donald Redmond .....Waterloo, Iowa	360
WFAA	A. H. Belo & Co.....Dallas, Tex.	476
WFAB	Carl C. Woese.....Syracuse, N. Y.	234
WFAF	Henry C. Spratley.....Poughkeepsie, N. Y.	273
WFAG	Radio Engineering Laboratory, Waterford, N. Y.	360
WFAH	Electric Supply Co.....Port Arthur, Tex.	236
WFAJ	Hi-Grade Wireless Instrument Co., Asheville, N. C.	360
WFAM	Times Publishing Co.....St. Cloud, Minn.	360
WFAN	Hutchinson Elec. Service Co..Hutchinson, Minn.	360
WFAQ	Missouri Wesleyan College & Cameron Radio Co., Cameron, Mo.	360
WFAV	University of Nebraska.....Lincoln, Nebr.	275
WGAC	Orpheum Radio Stores Co.....Brooklyn, N. Y.	360
WGAD	Spanish Am. Sch. of Telegraphy, Enconada, P. R.	360
WGAJ	W. H. Glass.....Shenandoah, Iowa	360
WGAL	Lancaster Elec. Supply & Const. Co., Lancaster, Pa.	248
WGAN	Cecil E. Lloyd.....Pensacola, Fla.	360
WGAQ	W. G. Patterson.....Shreport, La.	360
WGAW	Ernest C. Albright.....Altoona, Pa.	261
WGAX	Radio Electric Co., Washington Courthouse, Ohio	360
WGAY	North Western Radio Co.....Madison, Wisc.	360
WGAZ	South Bend Tribune.....South Bend, Ind.	360
WHAA	State University of Iowa.....Iowa City, Iowa	283
WHAB	Clark W. Thompson.....Galveston, Tex.	360
WHAO	Marquette University .....Milwaukee, Wisc.	360
WHAG	University of Cincinnati.....Cincinnati, Ohio	222
WHAH	Hafner Supply Co.....Joplin, Mo.	283
WHAK	Roberts Hardware Co.....Clarksburg, West Va.	258
WHAM	Eastman School of Music of Univ. of Rochester, Rochester, N. Y.	283
WHAP	Dewey L. Otta.....Decatur, Ill.	360
WHAR	Paramount Radio and Elec. Co., Atlantic City, N. J.	231
WHAS	Courier Journal & Times.....Louisville, Ky.	400
WHAV	Wilmington Elec. & Supply Co., Wilmington, Del.	360
WHAX	Huntington Press .....Huntington, Ind.	360
WHAZ	Rensselaer Polytechnic Institute....Troy, N. Y.	380
WIAB	Joslyn Automobile Co.....Rochford, Ill.	360
WIAD	Howard R. Miller.....Philadelphia, Pa.	254
WIAF	Gustav A. De Cortin.....New Orleans, La.	234
WIAI	Heers Stores Co.....Springfield, Mo.	252
WIAK	Journal Stockman Co.....Omaha, Nebr.	278
WIAP	J. R. Rudy & Sons.....Paducah, Ky.	360
WIAQ	Chronicle Publishing Co.....Marion, Ind.	226
WIAS	Burlington Hawkeye-Home Elec. Co., Burlington, Iowa	360
WIAU	American Sec. & Sav. Bank.....Le Mars, Iowa	360
WIAV	New York Radio Laboratories, Binghamton, N. Y.	360
WIAW	Saginaw Radio & Elec. Co.....Saginaw, Mich.	360
WJAD	Jackson's Radio Eng. Lab.....Waco, Tex.	360
WJAF	Press Pub. Co.....Muncie, Ind.	360
WJAG	Norfolk Daily News.....Norfolk, Nebr.	283
WJAI	Y. M. C. A.....Dayton, Ohio	360
WJAK	Rev. C. L. White.....Greentown, Ind.	254
WJAM	D. C. Perham.....Cedar Rapids, Iowa	268
WJAN	Peoria Star Co.....Peoria, Ill.	280
WJAR	The Outlet Co.....Providence, R. I.	360
WJAS	Capper Publications .....Pittsburgh, Pa.	360
WJAT	Kelly-Vawter Jewelry Co.....Marshall, Mo.	360
WJAX	Union Trust Co.....Cleveland, Ohio	390
WJAZ	Chicago Radio Laboratory.....Chicago, Ill.	448
WKAA	H. F. Paar.....Cedar Rapids, Iowa	268
WKAD	Charles Looff .....East Providence, R. I.	240
WKAF	W. S. Radio Supply Co. and Wm. Schack, Wichita Falls, Tex.	360
WKAN	Alabama Radio Mfg. Co.....Montgomery, Ala.	360
WKAP	Dutee Wilcox Flint.....Cranston, R. I.	360
WKAQ	Radio Corporation of Porto Rico, San Juan, P. R.	360
WKAR	Michigan Agri. College....East Lansing, Mich.	280
WKAV	Laconia Radio Club.....Laconia, N. H.	254
WKAW	United Battery Service Co. Montgomery, Ala.	226
WKAY	Brenau College .....Gainesville, Ga.	280
WLAG	Cutting & Washington Radio Corp., Minneapolis, Minn.	417
WLAH	Samuel Woodworth .....Syracuse, N. Y.	234
WLAJ	Waco Electrical Supply Co.....Waco, Tex.	360
WLAK	Vermont Farm Mach. Co.....Bellows Falls, Vt.	360
WLAL	Tulsa Radio Co.....Tulsa, Okla.	360
WLAN	Putnam Hardware Co.....Houlton, Me.	283
WLAP	W. V. Jordon.....Louisville, Ky.	360
WLAQ	Arthur S. Schilling.....Kalamazoo, Mich.	283
WOAR	Henry P. Lundskow.....Kenosha, Wis.	229
WLAS	Central Radio Supply Co.....Hutchinson, Kans.	244
WLAT	Radio and Specialty Co.....Burlington, Iowa	360
WLAV	Electric Shop, Inc.....Pensacola, Fla.	254
WLAW	New York Police Dept.....New York, N. Y.	360
WLAX	Greencastle Community Broadcasting Station, Greencastle, Ind.	231
WMAB	Radio Supply Co.....Oklahoma City, Okla.	360
WMAC	J. Edward Page.....Cazenovia, N. Y.	261
WMAF	Round Hills Radio Corp.....Dartmouth, Mass.	360
WMAH	General Supply Co.....Lincoln, Nebr.	254
WMAJ	Drovers Telegram Co.....Kansas City, Mo.	275
WMAK	Norton Laboratories .....Lockport, N. Y.	360
WMAL	Trenton Hdw. Co.....Trenton, N. J.	250
WMAN	First Baptist Church.....Columbus, Ohio	286
WMAP	Utility Battery Service, Inc.....Easton, Ohio	246
WMAQ	Chicago Daily News.....Chicago, Ill.	448
WMAV	Alabama Polytechnic Institute.....Auburn, Ala.	250
WMAW	Wahpeton Electric Co.....Wahpeton, N. D.	254
WMAW	Wahpeton Elec. Co.....Wahpeton, N. D.	360
WMAY	Kingshighway Presby. Church....St. Louis, Mo.	280
WMAZ	Mercer University .....Macon, Ga.	268
MNAC	Shepard Stores .....Boston, Mass.	278
WNAD	Oklahoma Radio Eng. Co.....Norman, Okla.	360
WNAL	R. J. Rockwell.....Omaha, Nebr.	242
WNAN	Syracuse Radio Telephone Co...Syracuse, N. Y.	286
WNAP	Wittenberg College .....Springfield, Ohio	360
WNAQ	Charleston Radio Elec. Co.....Charleston, S. C.	360
WNAR	Rhodes, C. C.....Butler, Mo.	231
WNAS	Texas Radio Corporation and Austin Statesman, Austin, Tex.	360
WNAT	Lenning Bros. Co.....Philadelphia, Pa.	360
WNAV	Peoples Tel. & Tel. Co.....Knoxville, Tenn.	236
WNAW	Henry Kunzmann .....Fortress Monroe, Va.	360
WNAX	Dakota Radio Apparatus Co.....Yankton, S. D.	244
WNAY	Ship Owners' Radio Service.....Baltimore, Md.	360
WOAC	Maus Radio Co.....Lima, Ohio	266
WOAD	Friday Battery & Elec. Co.....Sigourney, Iowa	360
WOAE	Midland College .....Fremont, Nebr.	360
WOAF	Tyler Commercial College.....Tyler, Tex.	360
WOAG	Apollo Theatre .....Belvidere, Ill.	224
WOAH	Palmetto Radio Corp.....Charleston, S. C.	360
WOAI	Southern Equipment Co.....San Antonio, Texas	385
WOAJ	Ervin's Electrical Co.....Parsons, Kans.	360
WOAL	Wm. Evans Woods.....Webster Groves, Mo.	286
WOAN	James D. Vaughn.....Lawrenceburg, Tenn.	360
WOAP	Kalamazoo College .....Kalamazoo, Mich.	360
WOAT	Boyd Martell Hamp.....Wilmington, Del.	360
WOAV	Pennsylvania National Guard.....Erie, Pa.	242
WOAW	Woodmen of the World.....Omaha, Nebr.	526
WOAX	Franklyn J. Wolff.....Trenton, N. J.	240
WPAB	Pennsylvania State College..State College, Pa.	283
WPAC	Donaldson Radio Co.....Okmulgee, Okla.	360
WPAG	Central Radio Co., Inc.....Independence, Mo.	360
WPAH	Wisconsin Dept. of Markets.....Waupaca, Wisc.	360
WPAJ	Doolittle Radio Corporation....New Haven, Conn.	268
WPAK	No. Dakota Agricultural College...Fargo, N. D.	360
WPAL	Superior Radio & Telephone Co., Columbus, Ohio	286
WPAM	Awerbach & Guettel.....Topeka, Kans.	360
WPAP	Theodore D. Phillips.....Winchester, Ky.	360
WPAQ	General Sales & Eng. Co.....Frostburg, Md.	360
WPAS	J. & M. Electric Co.....Amsterdam, N. Y.	360
WPAT	St. Patrick's Cathedral.....El Paso, Tex.	360
WPAU	Concordia College .....Moorhead, Minn.	360
WPAY	Bangor Radio Laboratory.....Bangor, Me.	360
WPAZ	John R. Koch.....Charleston, West. Va.	273
WQAA	Horace A. Beale, Jr.....Parkersburg, W. Va.	360
WQAC	E. B. Gish .....Amarillo, Tex.	360
WQAD	Whitehall Electric Co.....Waterbury, Conn.	242
WQAE	Moore Radio News Station.....Springfield, Vt.	275
WQAF	Sandusky Register .....Sandusky, Ohio	240
WQAH	Brock Anderson Elec. Eng. Co., Lexington, Ky.	254
WQAK	Appel-Higley Electric Co.....Dubuque, Iowa	360
WQAL	Cole County Tel. & Tel. Co.....Mattoon, Ill.	258
WQAM	Electrical Equipment Co.....Miami, Fla.	283
WQAN	Scranton Times .....Scranton, Pa.	360
WQAO	Calvary Baptist Church.....New York, N. Y.	360
WQAQ	West Texas Radio Co.....Abilene, Tex.	360
WQAS	Prince Walter Co.....Lowell, Mass.	266
WQAT	Radio Equipment Corporation.....Richmond, Va.	360
WQAV	Huntington and Guerry, Inc....Greenville, S. C.	258
WQAW	Catholic University of America, Washington, D. C.	236
WQAX	Radio Equipment Co.....Peoria, Ill.	360
WRAA	Rice Institute .....Houston, Tex.	360
WRAD	Taylor Radio Shop.....Marion, Kans.	248
WRAF	Radio Club, Inc.....Laporte, Ind.	224
WRAH	Stanley N. Reed.....Providence, R. I.	231
WRAL	Northern States Power Co..St. Croix Falls, Wisc.	248
WRAM	Lombard College .....Galesburg, Ill.	244
WRAN	Black-Hawk Electric Co.....Waterloo, Iowa	236
WRAO	Radio Service Co.....St. Louis, Mo.	360
WRAV	Antioch College .....Yellow Springs, Ohio	242
WRAW	Horace D. Good.....Reading, Pa.	238
WRAX	Flexon's Garage .....Gloucester City, N. J.	268
WRAY	Radio Sales Corporation.....Scranton, Pa.	280
WRAZ	Rensselaer Polytechnic Institute....Troy, N. Y.	380
WSAA	B. S. Sprague Elec. Co.....Mariette, Ohio	360
WSAB	Southeast Mo. State College, Cape Girardeau, Mo.	360
WSAC	Clemson Agri. College....Clemson College, S. C.	360
WSAD	J. A. Foster Co.....Providence, R. I.	261
WSAH	A. G. Leonard, Jr.....Chicago, Ill.	248
WSAI	U. S. Playing Card Co.....Cincinnati, Ohio	309
WSAJ	Grove City College.....Grove City, Pa.	360
WSAL	Franklin Electrical Co.....Brookville, Ind.	246
WSAN	Allentown Radio Club.....Allentown, Pa.	229
WSAR	Doughty & Welch Elec. Co.....Fall River, Mass.	254
WSAT	Plainview Elec. Co.....Plainview, Tex.	268
WSAW	Curtice & McElwee.....Canandaigua, N. Y.	275
WSAX	Chicago Radio Laboratory.....Chicago, Ill.	268
WSAY	Irving Austin Chamber of Commerce, Post Chester, N. Y.	233
WSAZ	Chase Electric Shop.....Pomeroy, Ohio	258
WTAB	Fall River Daily Herald.....Fall River, Mass.	248
WTAC	Penn Traffic Co.....Johnstown, Pa.	360
WTAG	Kern Music Co.....Providence, R. I.	258
WTAH	Carmen Ferro .....Belvidere, Ill.	236
WTAJ	The Radio Shop.....Portland, Me.	236
WTAL	Toledo Radio and Electrical Co., Toledo, Ohio	252
WTAM	Willard Storage Battery Co....Cleveland, Ohio	390
WTAN	Orndorff Radio Shop.....Mattoon, Ill.	240
WTAP	Cambridge Radio & Electric Co..Cambridge, Ill.	390
WTAQ	S. H. Van Gorden & Sons.....Osseio, Wisc.	226
WTAR	Reliance Electric Co.....Norfolk, Va.	226
WTAS	Charles E. Erbstein.....Elgin, Ill.	275
WTAT	Edison Elect. Ill. Co.....Boston, Mass.	244
WTAU	Ruegy Battery & Elec. Co.....Tecumseh, Nebr.	360
WTAW	Agricultural and Mech. College, College Station, Tex.	254
WTAX	Williams Hardware Co.....Streator, Ill.	231
WTAY	Iodar-Oak Leaves Broadcasting Station, Oak Park, Ill.	226
WTAZ	Thomas J. McGuire.....Lambertville, N. J.	283
WWAB	Swern Hoenig & Co.....Trenton, N. J.	226
WWAC	Sanger Brothers .....Waco, Tex.	360
WWAD	Wright & Wright, Inc.....Philadelphia, Pa.	360
WWAE	Alamo Dance Hall.....Joliet, Ill.	227
WWAF	Galvin Radio Supply Co.....Camden, N. J.	236
WWAH	General Supply Co.....Lincoln, Nebr.	360
WWAO	Michigan College of Mines....Houghton, Mich.	244

Canadian Broadcasting Stations

CKY.	Manitoba Telephone System.....Winnipeg, Manitoba	
CFAC	Radio Corporation of Calgary, Ltd...Calgary, Alberta	
CFCA	Star Publishing and Printing Co., Toronto, Ontario	
CFCB	Marconi Wireless Telegraph of Canada, Ltd., Vancouver, B. C.	
CFCD	Canadian Westinghouse Co., Ltd. Winnipeg, Manitoba	
CFCE	Marconi Wireless Telegraph Co. of Canada, Halifax, Nova Scotia	
CFCF	Marconi Wireless Telegraph Co. of Canada, Ltd., Montreal, Quebec	
CFCH	Abitibi Power and Paper Co., Ltd. Iroquois Falls, Ontario	
CFCI	Motor Products Corporation.....Walkerville, Ontario	
CFCN	W. W. Grant Radio, Ltd.....Calgary, Alberta	
CFCX	The London Advertiser.....London, Ontario	
CFPC	International Radio Development Co. Fort Frances, Ontario	
CFTC	The Bell Telephone Co. of Canadia....Toronto, Ontario	
CFUC	University of Montreal.....Montreal, Quebec	
CFVC	Roy Russell Brown.....Courtenay, British Columbia	
CFVC	Victor Wentworth Odium.....Vancouver, B. C.	
CFZC	Canadian Westinghouse Co., Ltd.....Montreal, Quebec	
CHAC	Radio Engineers, Ltd.....Halifax, Nova Scotia	
CHBC	The Albertan Publishing Co.....Calgary, Alberta	
CHCA	Radio Corporation of Vancouver, Ltd., Vancouver, B. C.	
CHCB	Marconi Wireless Telegraph Co. of Canada, Ltd., Toronto, Ontario	
CHCC	Canadian Westinghouse Co., Ltd., Edmonton, Alberta	
CHCF	Radio Corporation of Winnipeg Ltd., Winnipeg, Mantioba	
CHCQ	The Western Radio Co., Ltd.....Calgary, Alberta	
CHCS	London Radio Shoppe.....London, Ontario	
CHCX	B. L. Silver.....Montreal, Quebec	
CHCZ	The Globe Printing Co.....Toronto, Ontario	
CHFC	John Millen & Sons, Ltd.....Toronto, Ontario	
CHIC	Canadian Westinghouse Co., Ltd....Hamilton, Ontario	
CHOC	Canadian Westinghouse Co., Ltd....Vancouver, B. C.	
CHVC	Metropolitan Motors, Ltd.....Toronto, Ontario	
CHXC	J. R. Booth, Jr.....Ottawa, Quebec	
CHYC	Northern Electric Co.....Montreal, Quebec	
CJBC	Dupuis Frères .....Montreal, Quebec	
CJCA	The Edmonton Journal, Ltd.....Edmonton, Alberta	
CJCB	James Gordon Bennett.....Nelson, British Columbia	
CJCD	T. Eaton Co., Ltd.....Toronto, Ontario	
CJCE	Vancouver Sun Radiotelephone, Ltd., Vancouver, B. C.	
CJCF	News Record, Ltd.....Kitchener, Ontario	
CJCG	Manitoba Free Press Co., Ltd....Winnipeg, Manitoba	
CJCH	The United Farmers of Ontario.....Toronto, Ontario	
CJCI	MeLean, Holt & Co., Ltd....St. John, New Brunswick	
CJCN	Simons Agnew & Co.....Toronto, Ontario	
CJCS	Eastern Telephone and Telegraph Co., Ltd., Halifax, Nova Scotia	
CJCY	Edmund Taylor.....Calgary, Alberta	
CJGC	London Free Press Printing Co., Ltd., London, Ontario	
CJNC	Tribune Newspaper Co., Ltd.....Winnipeg, Manitoba	
CJSC	The Evening Telegram.....Toronto, Ontario	
CKAC	La Presse Publishing Co.....Montreal, Quebec	
CKCB	T. Eaton Co., Ltd.....Winnipeg, Manitoba	
CKCD	Vancouver Daily Province.....Vancouver, B. C.	
CKCE	Canadian Independent Telephone Co., Ltd., Toronto, Ontario	
CKCK	Leader Publishing Co., Ltd., of Regina, Regina, Saskatchewan	
CKCR	Jones Electric Radio Co.....St. John, New Brunswick	
CKCS	The Bell Telephone Co. of Canada...Montreal, Quebec	
CKCZ	Canadian Westinghouse Co. Ltd.....Toronto, Ontario	
CKKC	Radio Equipment and Supply Co.....Toronto, Ontario	
CKOC	The Wentworth Radio Supply Co....Hamilton, Ontario	
CKQC	Radio Supply Co. of London.....London, Ontario	
CKZC	Salton Radio Engineering Co.....Winnipeg, Manitoba	



World Wide Broadcasting

DX Reception Made Possible on Crystal Sets When Havana's Talk to San Francisco Is Broadcast in New York — 50 Million Fans Scattered Over the Country Listen to Hooked-up Broadcast and Telephone Stations

By C. S. Anderson

"YOUR audience is the wide, wide world!" sounded a voice that spanned the continent on February 8th, in a demonstration of the most advanced development of linked radio and wire telephony ever accomplished.

Twenty telephone and seven radio broadcasting stations reaching from coast to coast and from Providence to Havana, connected by five thousand miles of wire enabled General J. J. Carty, Vice-President of the American Telephone and Telegraph Company, from the Congress Hotel at Chicago, to speak to possibly the largest and most extensive audience man has ever addressed at any one time, and the conversation from the various stations to one another likewise went out on the air through the broadcast stations.

The "Roll Call" of stations comprising the trans-continental radio-telephone system consisted of broadcast stations WJAR, Providence, R. I.; WEAF, New York; WCAP, Washington, D. C.; WMAQ, Chicago; KLX, Oakland, Cal.; KPO, San Francisco; PWX, Havana, Cuba, and telephone stations at Sacramento, Calif.; Winnemucca, Nev.; Salt Lake City, Utah; Rawlins, Wyo.; Denver, Colo.; Garden City, Kan.; Newton, Kan.; Kansas City, Mo.; St. Louis, Mo.; Terre Haute, Ind.; Chicago, Ill.; Phoneton, Ohio; Pittsburgh, Pa.; Philadelphia, Pa.; Lynchburg, Va.; Charlotte, N. C.; Denmark, S. C.; Jacksonville, Fla.; West Palm Beach and Key West.

These stations were connected by five thousand miles of wire, one hundred ten miles of which traveled under sea, being at one point one mile below sea level, while out in Denver the line rose one mile above sea level. Two-way transmission occurred over this trans-continental system. Vacuum tube repeaters were an essential part of the equipment for the purpose of rejuvenating or strengthening the voice currents. The type of tube used is similar in operation to the amplifier tubes known to most radio fans. The total energy amplification was well over one hundred billion that of the modulated currents flowing over the line between Havana and San Francisco during the test.

The "Roll Calls," station conversations, musical entertainment, General Carty's speech, and the applause at the Chicago Bond Club Dinner were heard by BCL's throughout the entire country.

"Hello, Havana," said General Carty at Chicago.

"Hello, Chicago, this is Havana."

"Hello, San Francisco, this is Havana."

"Hello, Havana, this is San Francisco."

"Your audience is the wide, wide world," cut in General Carty, "be careful what you say," (laughter in Chicago).

"They burned witches for less," exclaimed J. G. Truesdell at WEAF, New York.

"Hello Havana, can't we have some music?" asked General Carty, and soon a violin solo from "Thaïs" came through the ether. "Home Sweet Home" was played on the chimes at San Francisco. Applause at Chicago came over the air strong.

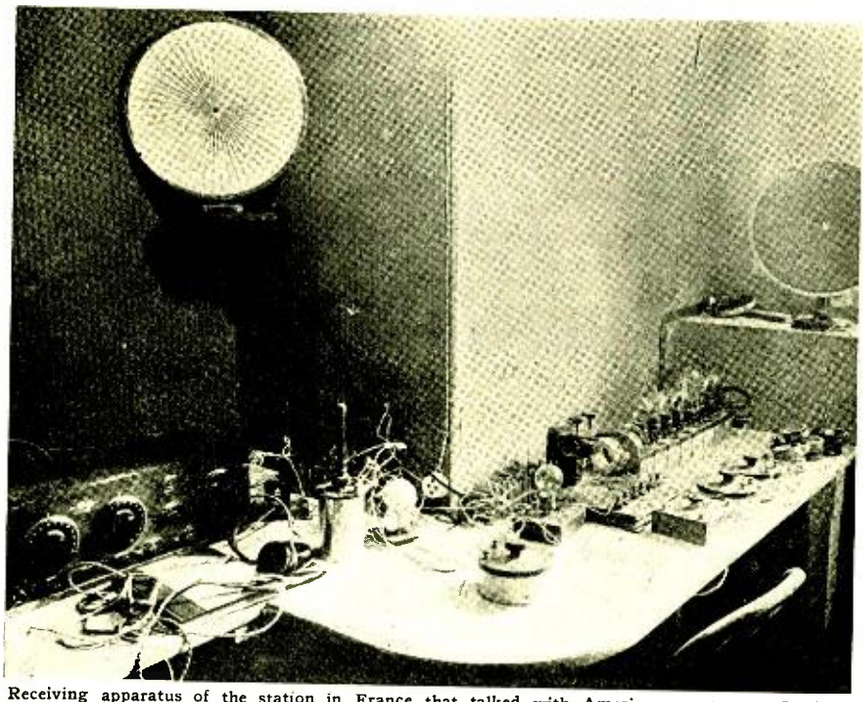
At 11:11 Eastern Standard Time, General Carty asked San Francisco the time. "It is 8:11 here—fine balmy evening, temperature 62 degrees," came the reply. Right here some fans in less comfortable parts of the country dropped their "ear muffs" to look after the furnace and others got ready for bed.

"Taps" sounded by a San Francisco bugler ended the demonstration after General Carty had finished his brief speech predicting a world wide telephone system using a common language that would unite all humanity and—"A great voice out of the ether will proclaim Peace on Earth, Good Will to Men."

A Midnight Party on Short Waves

Amateurs Shake Hands Across Atlantic

J. F. Schnell and John Reinartz of America Talk with Leon Deloy in France



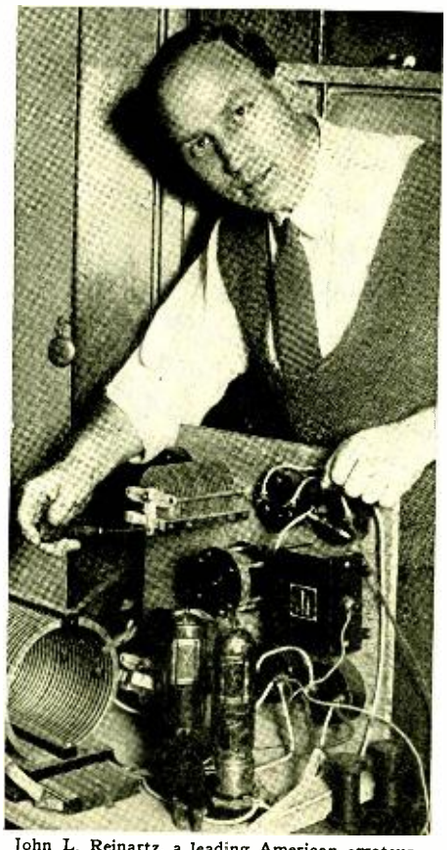
Receiving apparatus of the station in France that talked with American amateurs. Station French 8AB, owned by Leon Deloy, at Nice

IT was not chance that enabled two amateur radio operators, seated in their homes, to exchange messages across 3,500 miles of the broad Atlantic Ocean in the first successful two-way communication—making a world record and marking the greatest forward step in the history of short-wave radio since the first signal of an American amateur station landed in Ardrossan, Scotland, three years ago.

There is a big difference between turning on full power and blindly slamming away at a transmitter with the hope that one of several score listeners will pick up the signal miles away and the job of choosing from the hundreds and thousands of stations on the air the one that you want paricularly. That explains why the two-way communication between Monsieur Leon Deloy, of Nice, France, and two separate stations operated by F. H. Schnell, traffic manager of the American Radio Relay League, and John Reinartz, of South Manchester, Conn., was a deliberate effort requiring months of preparation.

The methods of the operators on either side of the Atlantic had to be worked out in painstaking detail the first time to prove that this seemingly impossible job could be done. After that it could be left to others to show, by following in the path they had blazed, that two-way radio code conversations could be carried on practically and efficiently between private citizens across the seas.

The remarkable feat was accomplished on the night before Thanksgiving when 1MO in Hartford, Conn., and French 8AB at Nice made the contact across the ocean and showed that



John L. Reinartz, a leading American amateur experimenter, who communicated with French station 8AB

it was entirely possible for one of the thousands of amateur transmitting stations in the United States to pick out and talk to one of the many hundreds in France and England—this while the other was sounding with the melody of thousands of CW transmitters and broadcast stations were hurling DX music over the continent.

While we marvel at the mechanism of the automatic telephone that enables us to choose the right party out of a city of several hundred thousand by the simple turning of the dial, we cannot help also but stand in wonder at the medium that allows private conversation to be carried on through the air, despite the great volume of other messages that penetrate the ether.

It is impossible to describe fittingly the great amount of detail, the careful recording of time schedule, and the exact precision in the tuning of respective sets that made it possible for Monsieur Deloy to transmit on his key the brief "GM, OM," meaning "Good Morning, Old Man," in answer to the clear call "8AB fu 1MO" that came from America. It was early morning in France when that message was heard though it was exactly 10:30, Eastern Standard Time, Thanksgiving Eve, in Connecticut.

The receipt of that simple greeting from the darkness out over the ocean to the point where it was nearing daylight on the other continent carried with it a feeling that only an amateur could appreciate, and only a ham that was used to "boiled owl" practices that keep him at his key through long anxious hours could adequately express, for it meant realization of the dreams of all short-wave radio fans.

This brings us to the scene at amateur station 1MO, at Hartford, which marked the beginning of the transmission tests with Europe on that night after Mr. Schnell had obtained the sanction of the radio inspector of the first district to transmit on 100 meters.

For two nights in succession Schnell had listened to the pecular note of 8AB like a string of r's run together and just the suggestion of an (h) like r-h-r-r r-h-r-r in steady beat and on the previous night he had copied two complete messages so that his fingers fairly ached to grasp the key and hurl 1MO's loud bark into the air. He sat down in front of the transmitter and ran his fingers nimbly over the set, tuning it down to the proper 100-meter wave length.

This was at 9:25 and he listened for fully fifteen minutes before he heard

the French amateur's note calling "A1MO (the prefix A being for America) de F8AB, GM, OM, here messages." Number 3 read:

"Your cable establishing midnight schedule received this morning. I consider it as cancelled by your agreement to my message No. 2, sig. F8AB." At 9:38 this message was ended and Deloy sent:

"No. 4 A1MO, tomorrow will not be on at this time, pse listen at 0500 and transmit at 0515, sig. F8AB." The figures given represent the transmitting time schedule in Greenwich Mean Time. Not knowing, of course, whether these messages had been received in the United States, Deloy went on and repeated both of them over a second time, after which he stood by for about ten minutes and repeated them a third time. At exactly 10:27 he signed off calling A1MO, A2BY CQ de F8AB.

At the moment that the lid went off for the amateur quiet period for the benefit of broadcasting at 10:30, Schnell closed his antenna switch and grasped the key to test the result of many months of planning. Thousands of amateurs could understand his emotions.

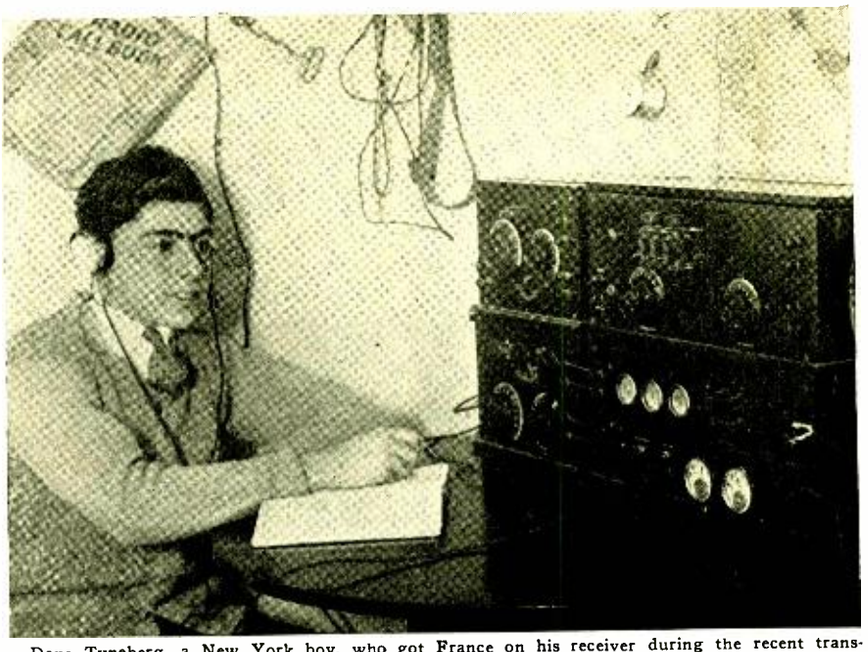
"8AB fu 1MO" clicked out into the air and traveled across to France where it struck and vibrated at Deloy's receiving antenna at Nice.

"ARR," he went on "messages received signals QSA." He called and repeated until 10:37 and a moment later the silence broke with:

"A1MO de F8AB rr QRK. Your signals QSA vy one foot from phones on Grebe. FB OM. Hearty congratulations."

Two-way communication between the continents was thus established, but to the great surprise of both operators it was not only for a brief second or two to give them credit for the accomplishment and nothing more. Instead, steady and reliable communication was continued for two hours.

F. H. Schnell whose receiver picked up French station



Dave Tyneberg, a New York boy, who got France on his receiver during the recent trans-Atlantic tests

"This is a fine day," called Deloy, joyously it appeared. "Pse QSL No. 1 and No. 2."

"O. K. FB QSA (meaning signals loud) I have messages. Are you ready to receive them?"

This was 10:50 and the French amateur came back. "Sure, go ahead with messages, words twice." As he was signing off, Schnell heard him call A1XAM, the station operated by John Reinartz at South Manchester, Conn., only a few miles away, saying: "Pse QRX until after A1MO."

"8AB fu 1MO" called Schnell and he transmitted message No. 1 from America address to General Ferrie, director of telegraphs for the French government, which was acknowledged at 11:06 and read as follows:

"America greets you for the first time by amateur radio across the ocean on 100 meters."

The message was signed A. R. R. L.

By this time Kenneth B. Warner, secretary of the A. R. R. L., and joint owner of 1MO, had come in at Schnell's request and the latter told Deloy that "KBW" wanted to talk with him. Warner took the key and talked with the French amateur for several minutes, then he sent a formal message No. 2 address to Dr. Couret of France.

It was considered remarkable that the transmission was not fleeting and "spotty" as might be supposed with the first two-way code "talks" across the ocean, but wholly reliable as though the two stations engaged in the tests were not more than a few blocks away. In fact, Schnell and Warner both were amazed at the consistency with which the conversations were being carried on and they believe it gave every indication that two-way amateur radio talks would not only become a common thing in a very short time, but that operators on either continent can maintain very satisfactory communication.

No one was more astonished by the result than Schnell, who had been working with Deloy for weeks to make this hour possible. Highly enthusiastic he was determined to carry on the conversation as long as he could. With visions of a great amateur radio "loop" by which messages might be sent from France to Hartford, from thence over the continent to Santa Catalina Island on the Pacific Coast and finally, over the Canadian mountains to the MacMillan arctic expedition at Refuge Harbor, Greenland, he grasped the key once more and asked Deloy to send a message to WNP. F8AB promptly complied with this request, but 1MO's operator failed to copy two words of the North Pole radio message.

Deloy then called 1XAM and asked for his location as apparently he did not know, or had forgotten it was Reinartz's station. Then Schnell stood by for a few minutes while 1XAM worked the French amateur.

At 12:22 Schnell sent Deloy's call signing his own, and when he had received an acknowledgment, he said that he had missed part of the last message and asked whether he could get it from 1XAM or if Deloy would repeat the text of the message again. F8AB repeated as requested, and apparently he was having trouble, for the added quickly QSL k and finished at 12:35 A. M. after making a schedule for the following night.

(*Continued on page* 78)

Principles of Design—Construction described in detail —How to operate properly

The Wireless Age 3-Tube Set

Our 1924 Spring Model, One Stage of Tuned R. F. A. Impedance Coupled to Crystal Detector and Two Steps of A.F.A.

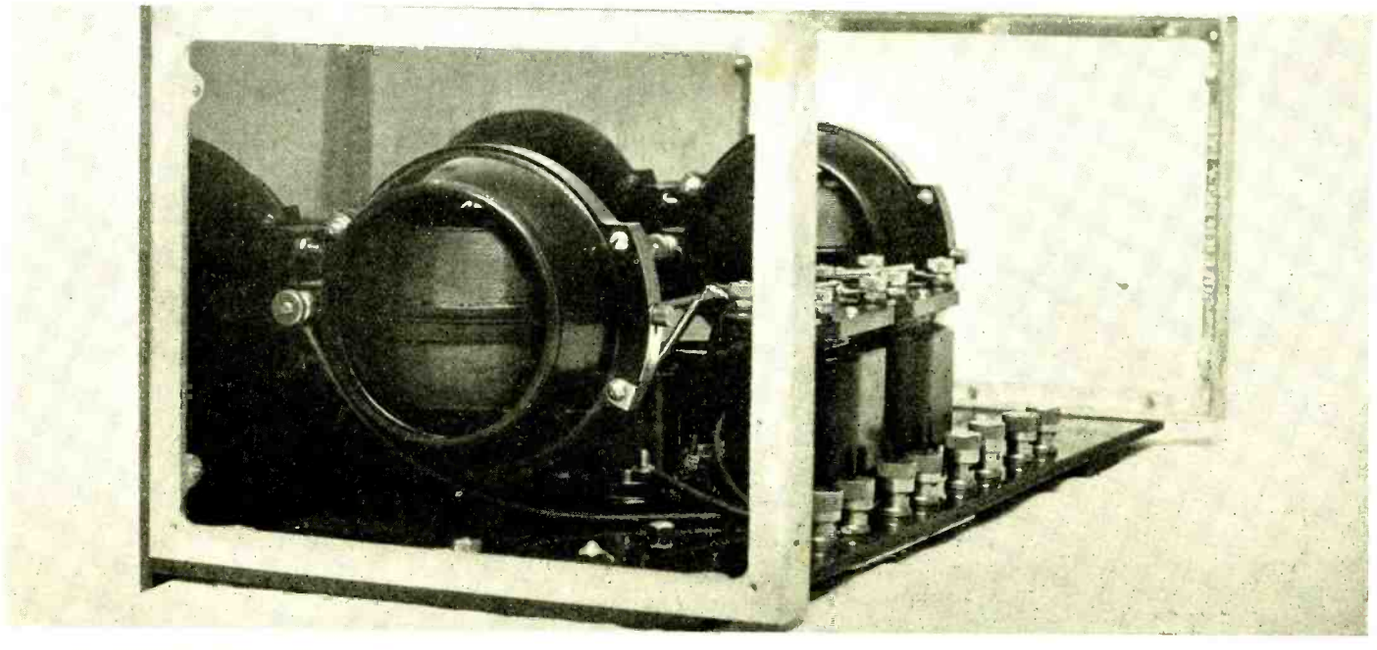
By John R. Meagher

NOTE—Certain patent owners permit amateurs to make up their own radio devices for their own use and not for sale. Relying on this policy this article gives suggestions to aid amateurs in their experimentation, but no license under patents is to be inferred from the publication of these suggestions. The license rights exist only through the generosity of the patent owners and if any owner should object, the amateur should refrain from using the particular invention involved.

An Easy Set to Tune — Gives Excellent Results — Smooth, Positive Control

THE circuit for this issue has three tubes and a crystal detector. The first tube is coupled to the detector through a tuned impedance—in this case a variometer—as shown in the simple circuit.

The action is somewhat as follows: The antenna and grid circuit are each tuned to resonance with the frequency of the incoming energy which is impressed on the grid of the tube and reproduced in magnified form in the plate circuit through the amplifying characteristics of the tube. The variometer in the plate circuit is also tuned to this frequency and then presents an infinite impedance so that the radio frequency energy cannot go through, but is shunted off to the detector and to the plate of the tube. The detector affords rectification and the signals are made audible in the headset. The choking effect of the variometer permits the small plate-grid capacity to act as an easier path for the radio-frequency energy than does the variometer, so part is transferred back to the grid and the current or "tube" oscillates. Self-oscillation of this sort is not desirable so an adjustable resistance is included in the grid return lead. Free oscillations depend (for one thing) upon the resistance of the grid circuit. This method of "stabilizing" is just as good as any and better than most schemes because manipulation of the "stablilizer" does not materially affect the wave-length adjustment.



The simplicity of the receiver is evident in this end view. Note how cast aluminum frames are used to support the front and sub-panels

Another good point about this circuit is the coupling between the radio frequency amplifier and the detector. We know of nothing better with a single control.

In addition, almost everyone will admit that a crystal rectifier, though a trifle troublesome, nevertheless seems to give better results in clarity of signal than a hard tube or an improperly adjusted gas content detector.

Now to this simple circuit all we have added is a regular two stage amplifier so that we have:

One stage of tuned radio frequency amplification for distance and selectivity.

One crystal detector for clarity and —two stage of audio frequency amplification for loud speaker volume.

The set itself is easy to make; the parts do not cost much and the appearance is rather good as the illustrations show. There are but two main controls or "station selectors" and one stabilizer (the Bradleystat) which operates very smoothly. The range with this set is about the same as a well designed and carefully operated regenerative detector and two step amplifier.

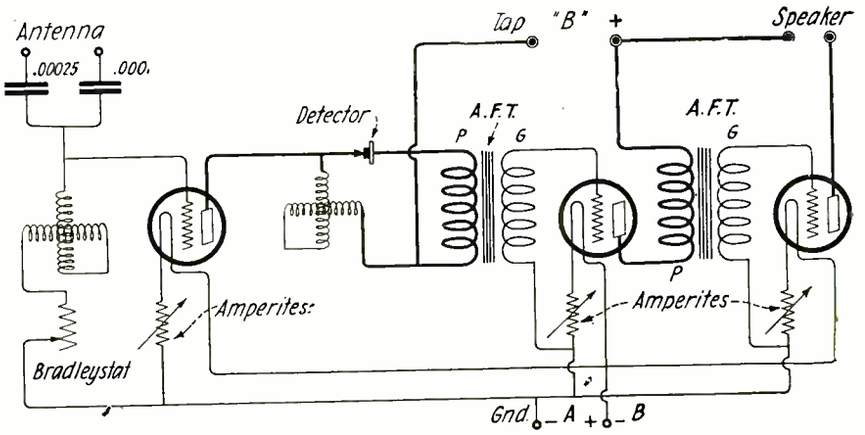
"But why a Bradleystat—it hasn't high enough resistance, has it?" queried our "C. E."

"Oh, yes it has. That's something we just found out. They average something like 100 ohms at maximum and of course they give such a smooth variation of resistance that they are ideal for control of regeneration."

"Now, about the arrangement," we said. "Let's use a nice long Radion front panel with the variometer mounted at each end and the sockets and transformers in between. That will give us good separation and a nice layout. Imagine how *spiffy* it will look if we use two Accuratune dials against a neat black panel!"

CONSTRUCTION

Many of the following notes have been extracted from the "C. E.'s" notebook which he entered while actually constructing the revised set.



Circuit diagram of The Wireless Age three-tube receiver using one step of R. F. A., crystal detector and two steps of A. F. A.

Secure all the parts first—have everything ready so when once started the work can progress smoothly. Here is a list:

MATERIALS

Again we caution the builder to purchase only good apparatus and to avoid use of anything that is all questionable. As usual, we indicate the make of each part, but many other manufacturers have equally good products.

Two variometers (Paragon). In place of variometers one may use tuned circuits consisting of .0005 mfd. (23 plate) variable condensers shunted across coils of 50 turns of No. 30 D. C. C. wire wound on 3-inch forms of thin material. Each coil may be mounted on the back of its tuning condenser. They should, however, be placed at right angles to each other on the panel.

This 3-tube receiver is going to attract the same wide-spread popularity won by the Wireless Age Uni-control Receiver by the same designer Published in an Earlier Number.

We have received a large number of appreciative letters about the Uni-Control.

Three Na-ald No. 400 standard tube sockets. The laminated double contacts and the careful design makes these sockets especially satisfactory.

Three 1-A Amperites for filament control of all three tubes. We removed the clips from the bases of these and screwed the clips to the sub-panel as shown in the photographs and explained in the text.

One Bradleystat for control of free oscillation of the R. F. A. tube. This make is specified because it is the only one we know of that has high enough resistance at the maximum position to be effective in this circuit. Of course wire wound resistances of about 100 ohms may be used, but the Bradleystat provides a smoother control—and this is a very important factor in good operation.

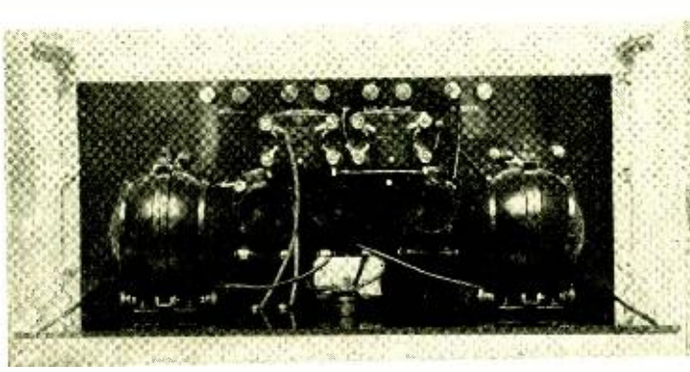
One Bradleyswitch to break and complete the filament circuit.

Two Kellogg transformers, ratio 4½ to 1.

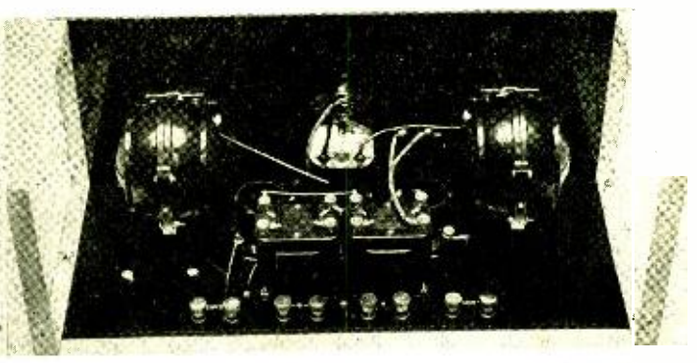
Two Accuratune dials: Read the instructions packed with each of these before using.

Two Quinby aluminum frames for 7-inch panels: This method of mounting enables one to add other panels from time to time and yet retain a uniform appearance.

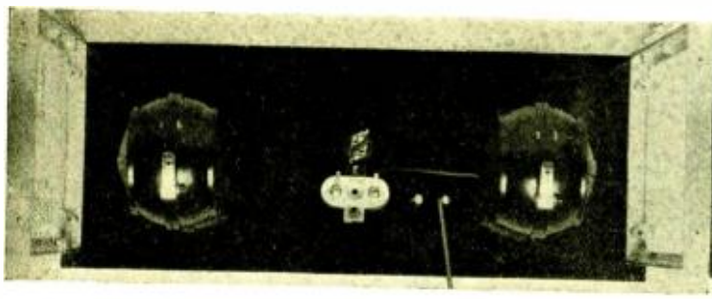
Two Radion panels 7x18x3/16-inches. These are selected because



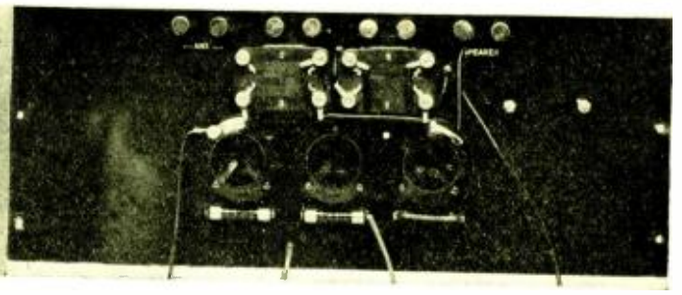
Top view—Through the use of straight direct connections run, in cambric tubing, wiring may be easily and quickly accomplished



Rear view—The Bradleystat in the center is not used as a rheostat for filament control, but as an adjustable grid circuit resistance to control self oscillations of the R. F. tube



Only the variometers, the rheostat and the filament battery switch are mounted on the front panel



The small cartridges in front of the tube sockets are ballast resistances for controlling the current in the filaments. View shows sub-panel on which are mounted the A. F. transformers, tube sockets, binding posts and the filament resistances

they are so easily worked and also because they are good electrically.

One crystal detector with a good mineral and a positive, firm adjustment. Do not mount a "fixed" crystal detector in the set unless it has proved satisfactory.

One .0001 mfd. Dubilier fixed condenser.

One .00025 mfd. Dubilier fixed condenser.

Eight Eby binding posts.

Three strips of black cambric tubing.

Four strips of square tinned bus bar wire.

Screws for mounting the sockets, variometers, transformers, etc.

ACCESSORIES

Three UV 201-A (C 301-A) tubes.

One 6-volt storage battery.

Two 45-volt "B" batteries.

One loud speaker.

One aerial; single No. 14 wire at least 100 feet in length, carefully insulated with porcelain at all points of suspension.

One good ground.

In the construction only those tools shown on page 59 of the January issue of THE WIRELESS AGE were used.

THE PANELS

Radion panels are specified, but of course bakelite, formica or other material may be used; the latter two are less pliable than Radion so they will make a more solid assembly. However, the first is much easier to drill. In the drilling care must be taken that the polished surface is not scratched or marred in any way.

First lay out and drill the holes for mounting both panels to the Quinby frames: These frames are 6⅛-inches high and in this set they are fitted flush with the sides and top of the front panel. However, we would suggest that they be moved in ¼-inch from each side and the same distance from the top so that ¼-inch wooden sides and top may be fitted to them in place of a cabinet. The sub-panel may be mounted inside the frame on the upper portions of the lower sides (instead of the lower portions). This will look better. We made it as shown for a special reason.

Having assembled the panels and frames, arrange the separate parts on the sub-panel, moving them about until there is sufficient clearance all around; using the general layout indicated in the photographs.

The filament terminals of the tube sockets are brought through the sub-panel by substituting longer screws for the ones on the sockets. The longer screws should extend about ⅜-inch below the bottom of the sockets. Mount the sockets with the filament terminals facing the front panel.

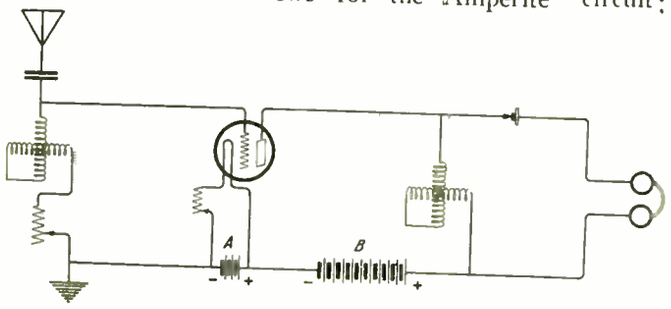
The clips are removed from the mounting bases of the Amperites and the second bent-over portions are cut off.

Mark the location of the mounting holes and drill—after which the panels may be engraved. Ours were done at W. W. Ackerman's 38 Park Place, New York City.

Re-assemble the panels, frame and apparatus.

WIRING

As the screws for the Amperite mountings and the filament terminals of the sockets extend through the sub-panel, the filament circuit may be wired on the bottom of the sub-panel, leaving only two leads up to the switch. The rest of the circuit is exceptionally long, and using No. 18 wire run in thin black cambric tubing, very little time need be spent on this section. Special attention should be paid to the return leads from the grids of the audio frequency amplifying tubes; they are connected to the negative side of the "A" battery.



Simple wiring diagram of The Wireless Age set without the audio amplifiers

The Amperites and battery switch will rarely cause trouble.

Then with a testing outfit composed of a dry cell and headset connected in series so that one headset lead and one battery connection are free to act as test terminals, test the transformer windings, the connections and the variometers (or fixed coils) for continuity of winding. And, of course, if everything is not O. K., fix it by repairing or replacing the faulty part. Test also the fixed condensers for short circuits. It would be a good plan to test the parts before the assembly, but as the makes shown are usually tested at the factory, this is not absolutely necessary. However, accidents can happen while wiring and for that reason it is well to test the completely wired set.

OPERATION

Use a good ground, a good aerial, good batteries connected properly and make sure that the tubes are in perfect condition.

In operating, one may consider the left hand variometer as the primary circuit; the right hand one as the secondary and the rheostat as the regenerative control, or better still, the two large dials as "wavelength selectors" and the Bradleystat as "volume control."

The first or left hand control is very critical, the other is not, but should be in approximate resonance with the first for best results. The Bradleystat, when screwed all the way in by turning the knob clockwise, permits the set to oscillate, but as this knob is turned counter-clockwise so that the ressistance increases, a point is reached at which the receiver stops oscillating; at this point loudest signals are secured.

As the aerial is part of the grid tuning circuit it should be erected so as not to sway. Under this condition the dials may be calibrated and stations picked up in much the same fashion as with a Neutrodyne.

Make Your Own Loud Speaker

By Max Abel

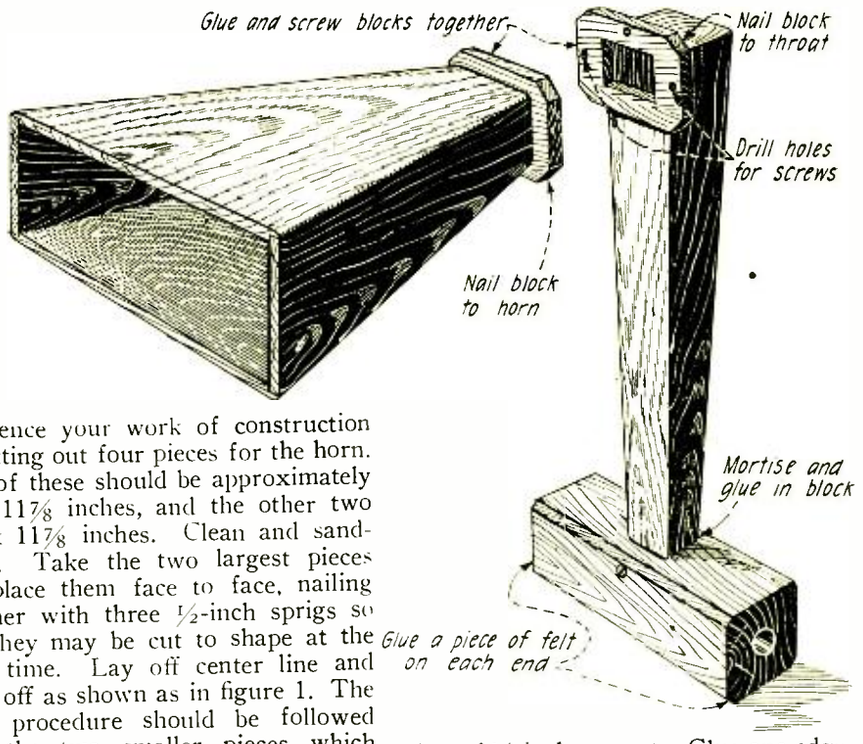
The horn described in this article, when used in connection with a pair of Western Electric 194W telephones, has carried a broadcast sermon to a distance of 800 feet from the set.

ONE of the greatest problems in connection with any of the many types of loud speakers, home-made or otherwise, is that of faithfully reproducing pure musical tones, without distortion or vibration. Metallic horns in many cases vibrate badly, and make the music "tinny" while others that eliminate this evil do not have distance-carrying properties. The loud speaker described herein has been tested under all sorts of conditions by a dozen different operators with remarkable results. The long throat and horn give a lower and more pleasing pitch than most loud speakers. Of course a great deal depends on the telephones used, the better the phone the greater will be the results attained.

A good hard wood should be selected out of which to make the speaker—3 linear feet of quarter-inch baywood, 16 inches wide, is all that is necessary. If you cannot get baywood, walnut or oak will do. But be sure it is dry and smooth, as this will save a lot of work later on. Baywood is the best because it is not only dry, but easy to work.

Having this nice piece of wood, you commence your work of construction by cutting out four pieces for the horn. Two of these should be approximately 8¼ x 11⅞ inches, and the other two 4¼ x 11⅞ inches. Clean and sandpaper. Take the two largest pieces and place them face to face, nailing together with three ½-inch sprigs so that they may be cut to shape at the same time. Lay off center line and mark off as shown as in figure 1. The same procedure should be followed with the two smaller pieces which make up the sides of the horn as shown in figure 2. Saw out these pieces to marks and be sure in cutting to cut straight and true. If the edges are rough use a sharp block plane on them and bring edge to line and square with face. Figures 3, 4 and 5 can be nailed together and cut to pattern and finished in like manner.

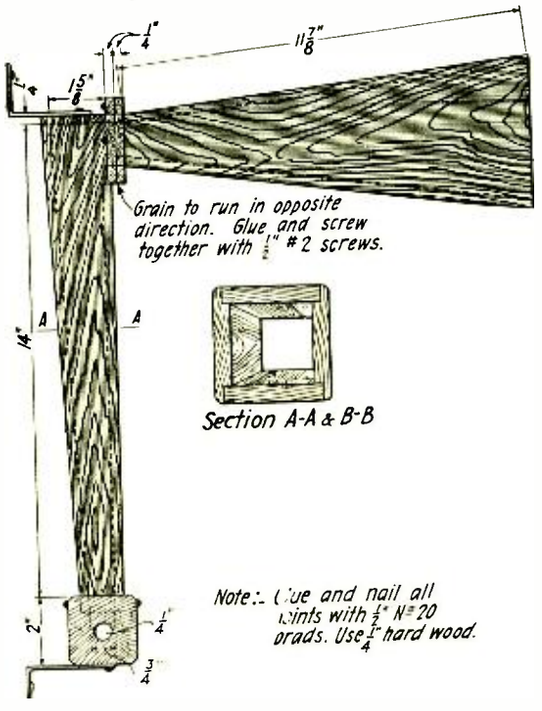
The pieces shown in figure 1, as well as those in figures 3 and 4 should have a rabbet cut on the long edge ⅛-inch deep by ¼-inch wide. Care should be used to get a neat joint. When this is finished try the pieces together and ascertain if the pieces fit. Start your brads so that you can nail the sides on. These brads should be spaced about 1½ inches apart. Glue one edge and nail large piece to sides of smaller ones. Then nail other side on, turn over and nail bottom of horn to sides. If not quite square, a little pressure on the corners will true it. Nail the throat the same way, but before nailing cut 1¾ inches off as shown in figure 3 to allow for block.

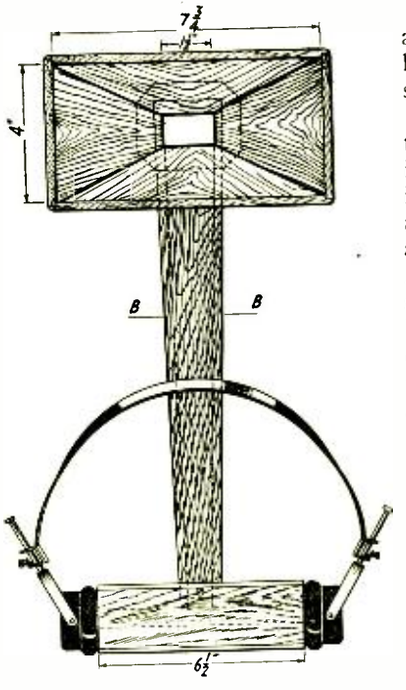


The next step is the construction of the two connecting blocks. The best procedure is to nail two pieces together, cross grain, with short sprigs and cut out as one piece. Mortise out center hole, being careful not to split—cut from one side half way, and then turn over and cut from the other side. When completed the measurement will be 2½ x 3 inches.

When the glue is thoroughly dry and set, square the small end of the horn and glue and nail on one of the small blocks. See figure 6, No. 3.

Clean and sandpaper the throat sections. Fasten a three-cornered block into the throat at the top. Drill holes in connecting block (figure 6, No. 1) and fasten block to throat with glue and nails, as shown in figure 6, No. 2. After all is clean and dry, glue and screw the horn to throat (figure 6, No. 4). Make the telephone block out of a piece of mahogany about two inches square by 6½ inches long. Bore a half-inch hole from end to end (bore half way from one end and then from the other). Then bore a three-quarter-inch hole from the top so as to meet the longitudinal boring. Mortise out to fit the throat about ⅜-inch deep, glue and put in a couple of small screws to hold fast. Glue a thin piece of rubber or felt on each end of the telephone block as buffers for the phone ear-pieces.





Improve Your Set

By Following These Instructions

Proper Arrangement of Parts and Addition of Units Will Give Wonderful Results

By
Edgar Terraine Johnstone

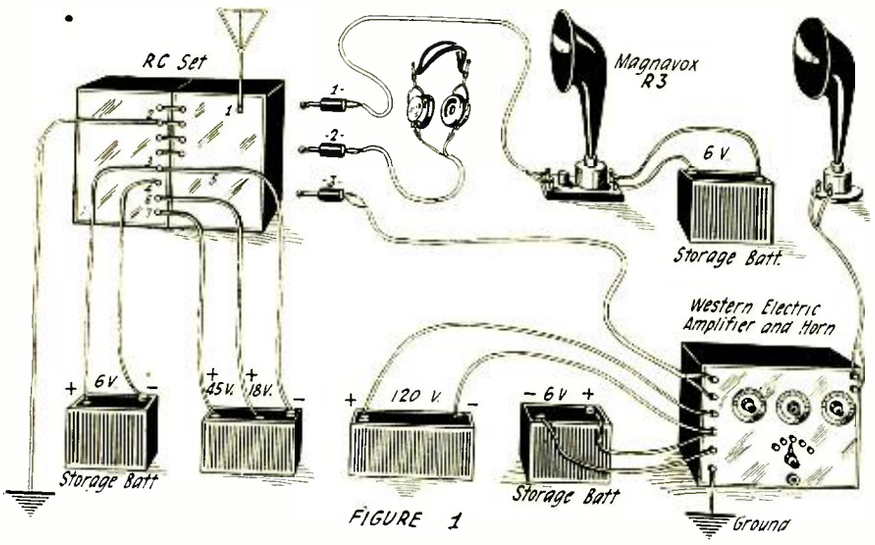


FIGURE 1

THE wise man is he who does the best he can with what he has. Thousands of radio fans—to make a moderate statement—have sets that do not satisfy or no longer satisfy when compared with the fine new sets which one's friends are always chirping about. And these people fail to realize what can be done with ease and at small expense to improve their own sets. Many of the methods of improvement I am going to give here out of my own successful experience apply quite generally, but to give specific help I am going to choose my old RC set as an example. The RC receiver has been a popular set and many of my readers probably have one.

Let me tell you, don't discard it. I have been able to get wonderful results with mine by making a few additions which I will tell you how to make.

Figure 1 gives you a very clear sketch of the RC receiver arranged for most efficient operation. The antenna is connected to post 1, the ground to post 2. The 6-volt 80-ampere hour "A" storage battery is connected to posts 3 and 4. It is absolutely necessary that the polarity be correct as shown in the drawing; positive to 3 and negative to 4. The negative connection of the 45-volt "B" battery is also to post 3—designated by No. 5. Eighteen to twenty-two and one-half volts on the detector tube plate to post 6 and the positive 45-volt battery lead to post 7.

Before going any further, and in order to give you a better understanding of the outfit, reference should be made to figure 2, where the elementary circuit of the RC is shown. This is nothing more than a single circuit receiver and is made clearer in the drawing 2a. In both cases the amplifier circuits are omitted for the sake of simplicity.

Clicks in the receiver or horn when operating the regenerative (tickler) handle can be eliminated by turning the tickler handle three-quarters (on) and operating the filament rheostat controlling the detector tube. In fact, this is true for most any receiver and is desirable because it offers a degree of selectivity not obtainable otherwise.

If this arrangement does not entirely satisfy you, then the circuit shown in figure 3 can be resorted to. This is not recommended, unless the variometer is properly shielded. If it is not shielded body capacity will be present and prove very annoying while tuning the variometer.

If the foregoing instructions are carried out, very good results will be obtained without the addition of external units such as variometers, etc. The RC is very compact and complete in every detail and requires no additional parts to assist regeneration. There is not a station in existence (of any consequence) that has not been received at my home in New Orleans with the RC receiver.

A loop antenna can be used with the RC receiver very efficiently. For the benefit of those desiring to duplicate my work along these lines I have shown in figure 4 the connections for the loop and RC receiver. Stations

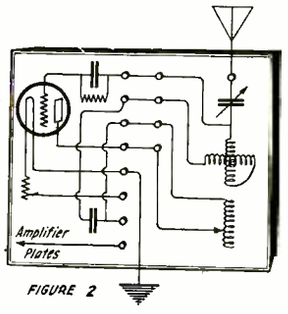


FIGURE 2

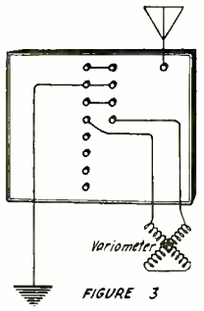


FIGURE 3

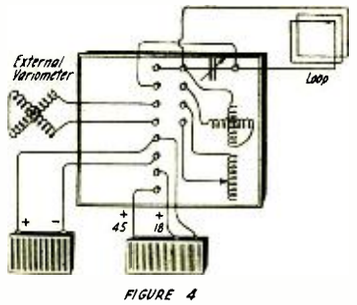


FIGURE 4

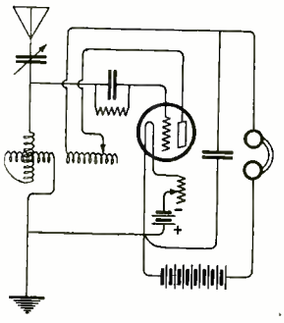


FIGURE 2A

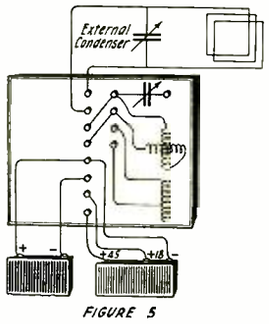


FIGURE 5

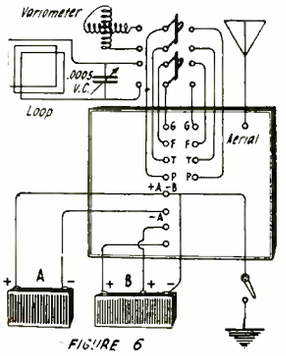


FIGURE 6

were picked up and their concerts enjoyed averaging from six to eight hundred miles distant. The variable condenser inside the tuning unit is shunted across the leads of the loop. Tuning is accomplished by turning the same handle formerly employed for tuning the RC receiver. The leads of the loop are then brought to the input of the detector-amplifier unit. In this case it is necessary to make use of an external variometer for regeneration—(see figure 3). It is also possible to use an external variable condenser across the leads of the loop and use the variometer (in the tuning unit) for regeneration. This is clearly shown in figure 5. Here the variometer is connected in the plate circuit of the detector unit and regenerative amplification accomplished by turning the large dial on the front of the RC receiver.

Having obtained such wonderful results from both the overhead antenna and the loop, I decided to arrange the set together with both types of antenna so that I could change from one to the other without very much trouble. With two double-pole double-throw switches this was easily accomplished. The entire circuit is shown in figure 6 where the four top posts of the detector-amplifier side of the set are connected to the blades of the switches. On the right hand side, the four posts of the tuning unit are connected to the jaws of the switches. When the switches are thrown simultaneously to the right they connect the RC set in the usual manner. When thrown together to the left the variometer is connected in the plate circuit of the detector; while the loop with its tuning condenser is connected to the input of the detector-amplifier unit.

The tuning condenser and variometer (both external) should be placed in a separate cabinet, special care being exercised to thoroughly shield the instruments not only to prevent body capacity, but from each other.

The above arrangement can easily be duplicated by any one in possession of this type of receiver by merely adding a loop, one variometer, one condenser and two double-pole double-throw switches.

RT Coupler Unit

So many new broadcasting stations went into operation since the date I purchased my receiver that it became next to impossible to tune in any particular station without interference. This of course was not the fault of the receiver. Something had to be done, and, as expected, the new RT Coupler was developed and placed on the market. I lost no time in obtaining one of these units and have received very beneficial results from its addition to the circuit.

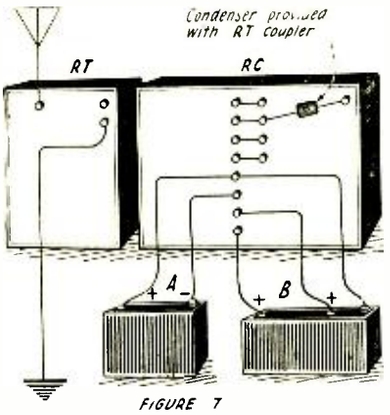
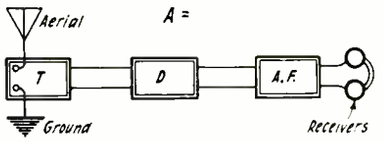


FIGURE 7



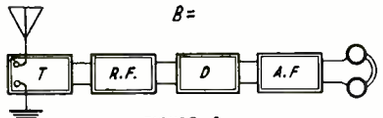


FIGURE 8

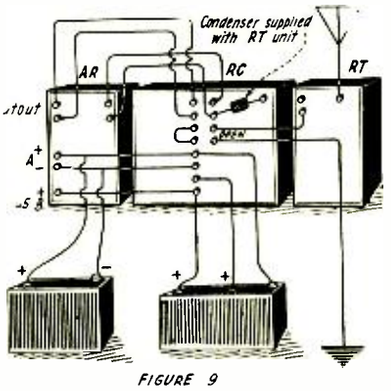


FIGURE 9

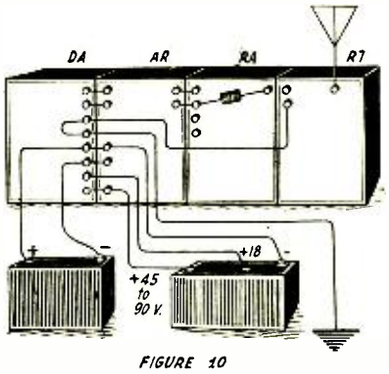


FIGURE 10

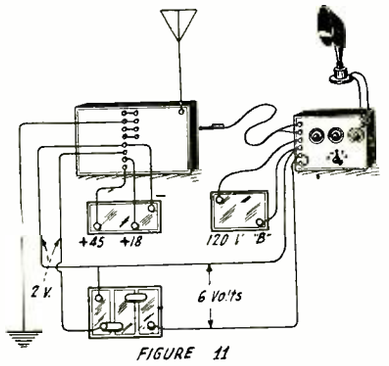


FIGURE 11

Radio Frequency Unit

The long waited for—and much talked about—radio frequency amplifier was next available for those owning RC receivers. This was added to the collection. This instrument, as I understand it, permits amplification of the extremely feeble waves which are being picked up, but which are not strong enough to operate the detector. They are then amplified by the two stages of audio frequency amplification. A very simple graphical illustration is given in figure 8.

At (a) we have the ordinary system employed in the RC receiver. First, a tuner T, then a detector D, and finally an audio frequency amplifier AF. Signals that are too weak to operate the detector will not be heard in the telephones no matter how many stages of amplification are added after the detector.

At (b) the new system is shown, employing the three-stage radio frequency unit with the RC receiver. First, the tuner T, then the three-stage radio frequency amplifier RF, which builds up the extremely weak signals to a value which permits operation of the detector. This is in turn amplified by the audio frequency amplifier AF.

Figure 9 shows the AR unit properly connected to the RC receiver to which has already been added the RT coupling unit. The best arrangement of the RC and new units is shown in figure 10 where the RC receiver is divided into the two component units, namely, RA and DA. RA (tuner) and DA (detector and amplifier) cabinets can be purchased and the two units after being removed from the RC cabinet can be installed in the individual cabinets. This permits the

(Continued on page 80)

SOME

Practical Radio Hook-Ups

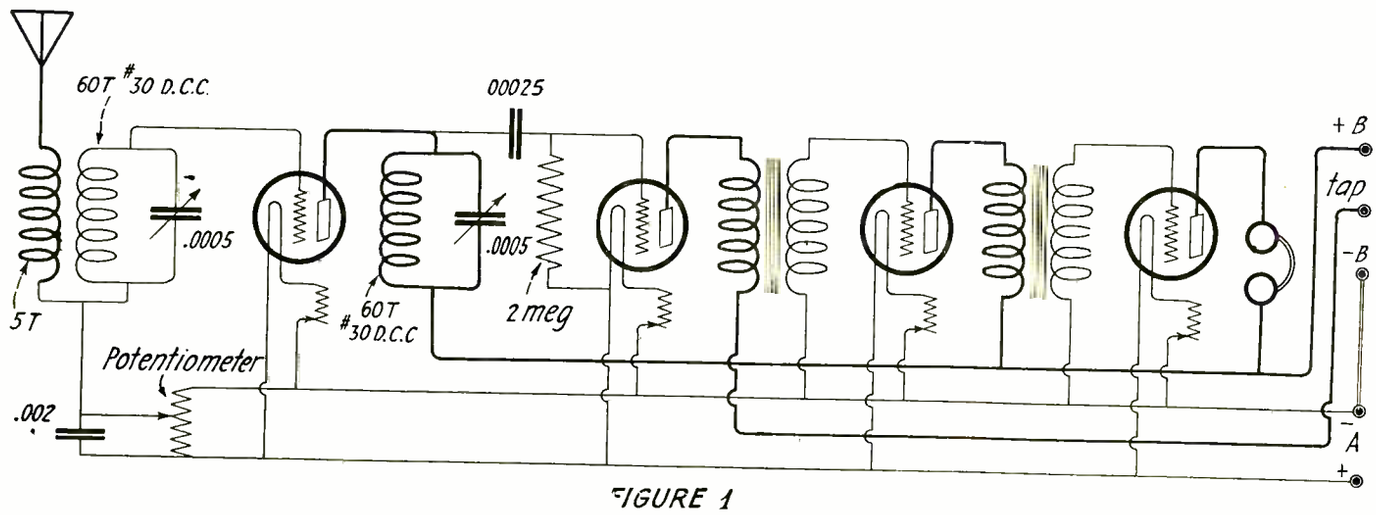


FIGURE 1

Figure 1—One step of tuned impedance R.F.A. and two-step A.F.A.—Long distance reception is easy with this easily constructed four-tube receiver using one step of tuned impedance coupled R.F.A.

The antenna coupler is wound on a thin 3" form with number of turns specified. Primary may be wound directly over the secondary near the filament end. Tuned impedance coil also wound on 3" form. Both forms may be mounted on their separate 23-plate tuning condensers, but should be placed at right angles to each other.

Use UV-201A's throughout or a UV-200 as detector.

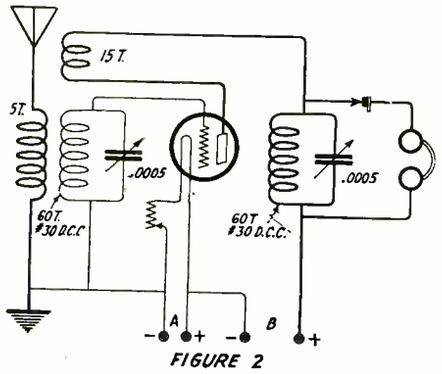


FIGURE 2

Figure 2—The "Superdyne" with a crystal—The "Superdyne" in modified form. Using a crystal detector with one stage of R.F. amplification; coupling of the tuned impedance type with reversed magnetic feedback to kill self oscillation.

An old coupler form may be used for this set. Rewind the rotor with 15 turns; the stator with 60 and over the stator wind a primary of 5 turns.

Use any vacuum tube. Reception will be found clear and distinct.

Figure 3—One-step R.F., crystal detector and one-step A.F.—A mighty fine portable receiver may be built up using this circuit with two UV-199 tubes. The Bradleystat provides an extremely smooth control of self oscillation. With a good aerial reception up to 2000 miles may be expected with this receiver under favorable conditions.

Wind both transformers on thin 3" forms and mount them at right angles to each other on back of their separate tuning condensers.

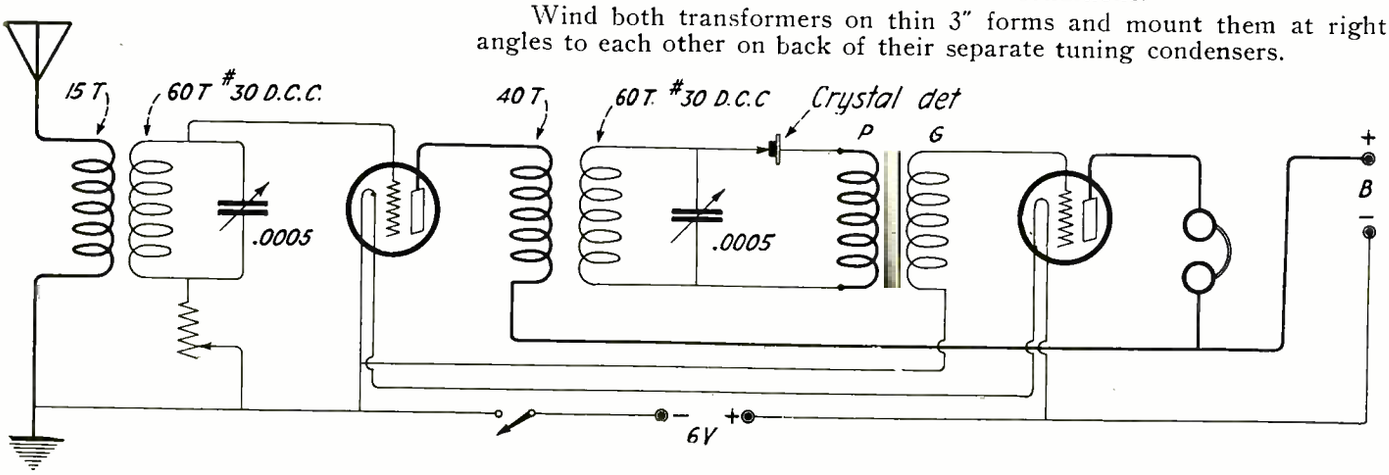


FIGURE 3

FOR THE "Build-Your-Own" Fan

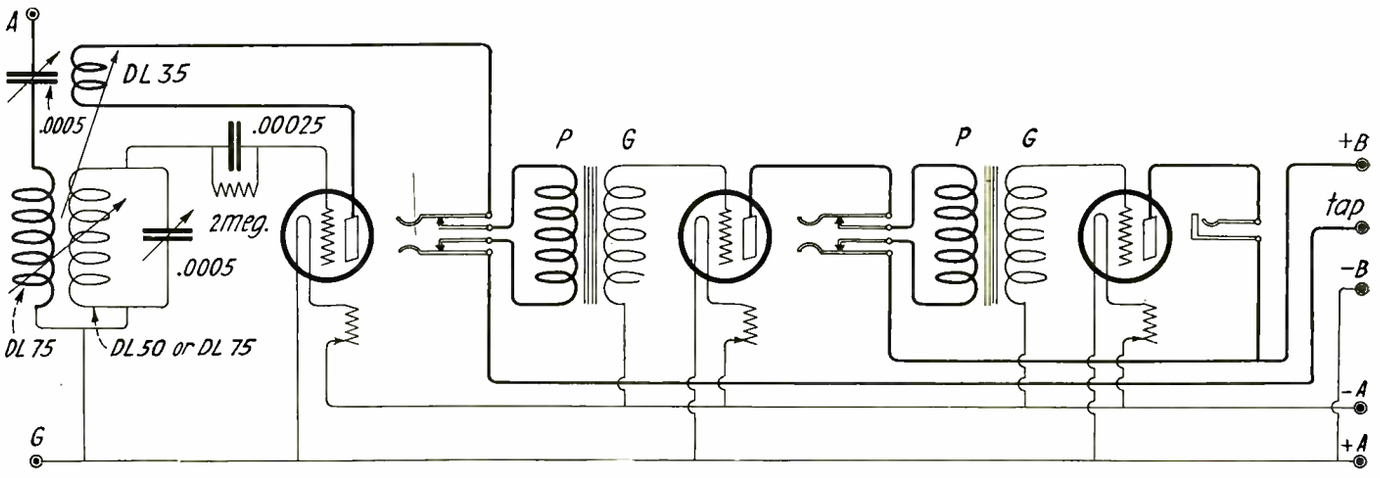


FIGURE 4

Figure 4—Standard three-coil set—The old reliable three-coil set that is still breaking DX records.

Honeycomb, duolateral, spider web, single layer, Curkoids and any suitable coils may be used. Be sure connections to them are electrically perfect. With the coils wound in the same direction the grid and plate should be connected to corresponding points on the tickler and secondary coils.

If a UV200 detector is used, a carbon pressure rheostat will enable one to secure maximum results. Use good variable condensers.

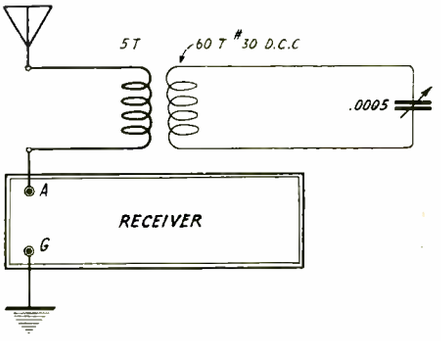


FIGURE 5

Figure 5—Inductively coupled wave trap—Tuning this wave trap doesn't seriously affect the adjustment of the receiver, but it does cut down interference from any one particular station.

The coils are wound on a thin 3-inch form and the form is mounted on the tuning condenser. Keep the coils away from the receiver in order to reduce the coupling.

The trap is tuned to the frequency of the interfering station and the receiver is tuned to any other station that one wishes to hear.

Figure 6—Four-tube (UV-199) loop receiver—A selective long distance loop receiver of the "Unicontrol" type. The feature about this set is the simplicity of construction and operation and the extremely low filament current, only .12 amperes.

See the December, 1923, issue of THE WIRELESS AGE for more detailed information about a similar set.

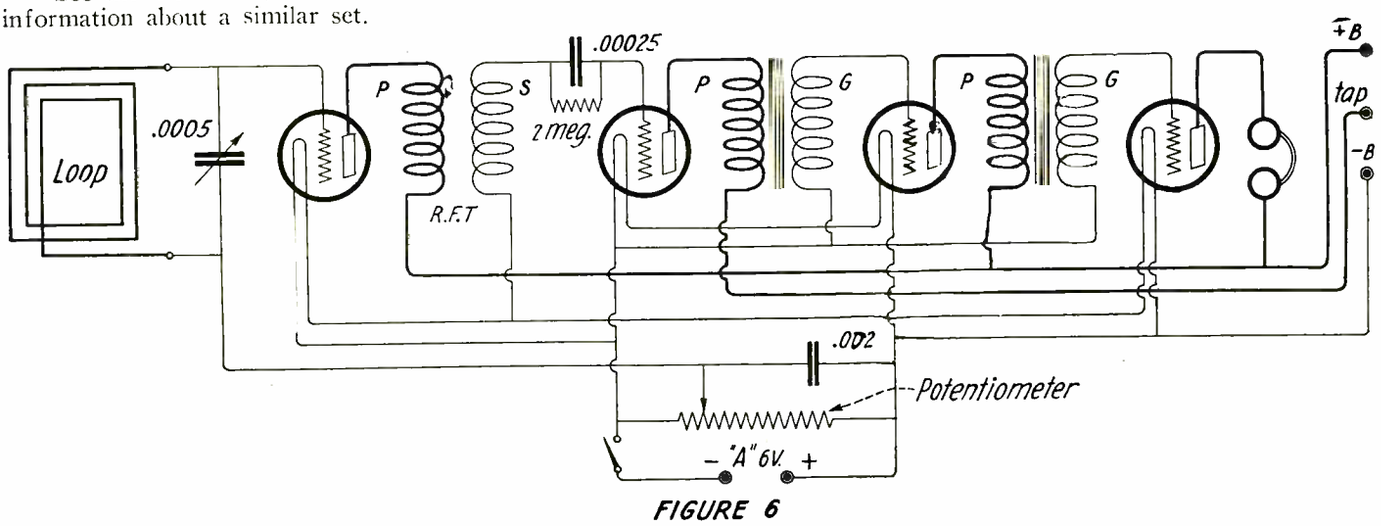
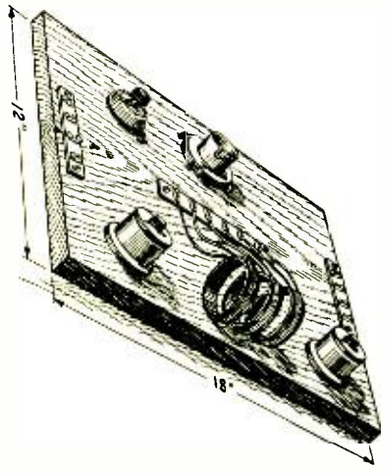


FIGURE 6

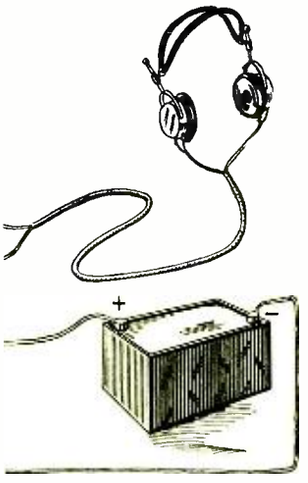
RADIO ENGINEERING



A Home-Laboratory Course in Simple and Advanced Radio Design

By John R. Meagher

Continued from the February Issue of THE WIRELESS AGE



LAST month in "Radio Engineering" we started something; now starting things is our specialty; it's the the windup—the finish—that cramps us. Happily, however, if we wished we could drop all the readers who intend to follow this series and we are confident that, leaving them to their own devices with only an experimental receiver and Bucher's "Wireless Experimenters' Manual," they would dig in for themselves and learn all those things which we intended to write up. And, learning by themselves, the knowledge would strike home far more effectively than the printed word ever could. So we have an idea—to hit only the high spots in radio, but to hit them hard—to pound at common fallacies and to pound at them hard—to reach down and drag up fundamentals stripped of haze and mystery and complications.

BUT first let us go back to the experimental set of last month. The student should have found that the secondary condenser was the main wavelength control; that the tickler coil was responsible for regeneration and that proper adjustment of both was necessary for maximum signal strength. He should have found the filament rheostat to be not at all critical so that a fixed resistance could be used instead. He should have mentally divided the circuit into four parts:

1—*The antenna circuit* comprising the aerial, the primary coil, the primary variable condenser and the ground.

2—*The grid circuit* comprising the grid, the grid condenser and leak, the grid or secondary coil; the secondary or grid tuning condenser and the return lead to the filament.

3—*The plate circuit* composed of the plate, the tickler or plate coil, the phones, the plate or "B" battery and the filament.

4—*The filament circuit* composed of the filament in the tube, the rheostat and the "A" or filament battery.

The last three are the vacuum tube circuits and when the second and third have been understood in elementary form the student will have taken an immeasurable big step forward.—More about this later.

If Bucher's book is handy—try some of the circuits he shows; do not be limited to those in which it is specifically stated that honeycomb coils may be used; remember that a coil and condenser serve the same purpose as a variometer,—etc. And remember that a coil of wire is a coil of wire whether it be wound as a single layer, or a basket weave, a honeycomb, a Curkoid, a figure 8, a double o, a spider web or any of the hundred and one forms a coil may take.

Try them out, experiment with them and then see if the following statement does not check up with observations:

In general, any regenerative receiver (or any receiver in a class) is just as good as any other regenerative receiver if the design of each is equally good.

That means a whole lot—it means that we shouldn't say, for instance, that a honeycomb regenerative set is better than a variometer regenerative set; that we shouldn't say a double circuit regenerative set is better than a single circuit regenerative set—and so on.

But understand that that statement doesn't prohibit one from saying a certain condenser, or tube or coil or headset is better than some other condenser or tube or coil or headset. In other words, the last eight words provide a solid bridge upon which we can walk back or retreat; the statement is correct.

One realizes then that an efficient receiver depends upon the design of each thing; not upon the trade name of the circuit. So, study the experimental set and note all the little things that go to make perfection. Observe that the grid return should go to the positive side of the filament at least when a grid condenser and leak is used in a detector circuit. (1) Does placing the primary condenser in either the aerial or the ground lead make any difference? (2) Does reversing the primary connections help any? (3) How should the tickler be connected to produce regeneration? (4) Is a variable grid condenser of any value? (5) Is a variable phone condenser of any value?

(1) Very little. (2) No. (3) If both coils are wound in the same direction the plate and grid should be connected to corresponding terminals. (4) Some; hardly worth while though. (5) Same as 4: In either case the condenser provides a fine control of regeneration.

NOTE: Read Bucher's book, especially the part on vacuum tube circuits and vacuum tubes. Also obtain "Radio Communication Pamphlet No. 40"—Bureau of Standards and read it thoroughly, but slowly, and digest each sentence; it will take many months to do this; but if it is done properly——!

In last month's issue we meant to specify D. S. C. wire; the D. C. C. would not fit easily on the 1 inch form. Next month we will try to clear up the problem of inter-tube coupling at both radio and audio frequencies.

(To be continued.)

How to Tune Out Local Stations

An Easily Constructed Wave Trap

By C. W. Horn

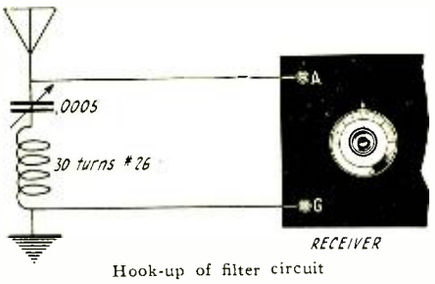
Supt. Radio Operations, Westinghouse Electric & Manufacturing Co.

THOSE of us who have sensitive radio receiving sets know how sharply a distant broadcasting station tunes in. We know from experience how carefully we must adjust our dials to get any particular station. A few divisions off on the scale and it is lost.

When a receiving set is located near a powerful broadcasting station, you are able to hear that nearby station over a considerable range of the dial because of what is known as "forced oscillations."

This can best be described by referring to that analogy so often used of a pond of water after a pebble has been thrown into it. Waves radiate from the center of disturbance. At some little distance from this center the waves are regular and travel smoothly, but right near where the stone struck the water, and particularly if it was a large one, you will notice a large number of irregular splashes.

Any device designed to be affected by the regular waves would also be troubled by these irregular splashes or waves as you may call them. It is the same thing in radio and the problem is to so arrange matters that these irregular splashes can be deflected or



Hook-up of filter circuit

so handled as not to interfere.

In your radio set you desire to pick up the tune or, as before named, the regular wave and weed out the irregular or forced oscillations. This may be done in several ways by devices called traps or filters. I will describe here a very simple one—something you can easily construct for yourself in a few minutes with simple apparatus usually used in radio.

This filter that I am about to describe is so arranged and connected that it tends to offer a very low resistance path to the wave that is not wanted, while the tuner dial is set to offer an easy path for the desired wave which, therefore, passes through your receiver and is registered. Therefore, this circuit must be connected in such a manner that it can be tuned to the undesired wave and also so that the energy so picked up blazes the receiving apparatus.

Take pencil and paper and jot down the figures and diagram I am about to give you.

The circuit consists of an inductance and capacity either of which may be variable. It probably is simpler to use a variable capacity or condenser as it is usually called. This variable condenser may be of the twenty-three-plate type and can be purchased for a nominal sum in any store handling radio equipment if you should not happen to have one.

Next, obtain a small inductance of about twenty-five or thirty turns of small wire, any size in the neighborhood of 24 or 26 B and S gauge, or if you have a so-called honeycomb or spiderweb coil, so much the better.

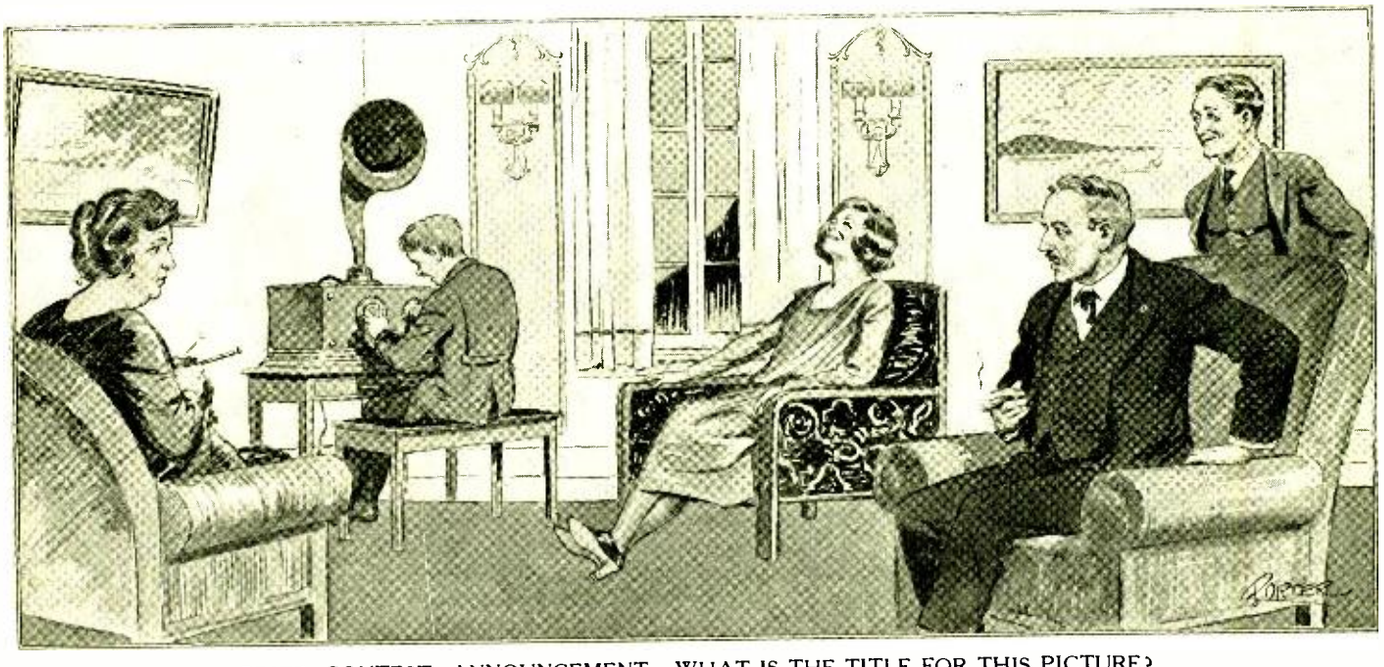
This inductance, however, easily can be made by winding about twenty-five or thirty turns of wire on a cardboard tube two or three inches in diameter. Caution! Do not wind on a metal tube.

Connect this inductance in series with the variable condenser and connect this combination across your receiving set between the antenna binding post and the ground binding post.

This is so that energy from the an-

(Continued on page 62)

Hundreds of Titles Have Been Received—Add Yours



PRIZE CONTEST ANNOUNCEMENT—WHAT IS THE TITLE FOR THIS PICTURE?

For the best title to this picture submitted before March 31, 1924, THE WIRELESS AGE will give as a FIRST PRIZE—A WIRELESS AGE Reflex Receiver (described in February number). The next best title will receive a Second Prize of Five Dollars. The 3d, 4th and 5th prizes which will be awarded in this contest will be subscriptions to THE WIRELESS AGE. THIS IS FOR YOU! What is this picture about? And what is the snappy title that is needed to give the clue? Send in your suggestion to the Contest Editor, THE WIRELESS AGE. Don't delay.

Mount Instruments on Sub-Panel

Metal Shielding is Not Effective in Home-Made Receivers

By Milton Lock

FREQUENT complaints made by owners of shielded receivers that their sets are still affected by hand capacity has prompted the writer to set forth herein the futility of shielding as installed in present day amateur constructed sets.

The usual method of construction is to mount most of the instruments on the panel while the shielding on the panel has holes cut just large enough to clear all current carrying metal. This shielding is then grounded.

In elaborately shielded sets not only the panel but also the base and all sides of the cabinet are shielded.

The writer has installed, and also taken out shielding on several different types of sets, and in each case the shield not only failed to decrease body capacity to any appreciable extent, but it actually reduced signal strength so that DX stations, which before shielding came in easily, were very difficult to pick up.

That there is a possibility of capacity effect between the instruments on the panel and the grounded shield a series of tests conducted by the writer has satisfactorily demonstrated.

The shield coming close to condensers and inductances act with each as a miniature condenser, coupling them with the ground.

The shield acts as one plate while the nearest metal part of the instruments serve as the other conducting surface and the air or paneling act as the dielectric.

In one test where a rotary plate condenser was mounted parallel to the panel a capacity as high as 46.21 micro-microfarads was found to exist between it and the shield.

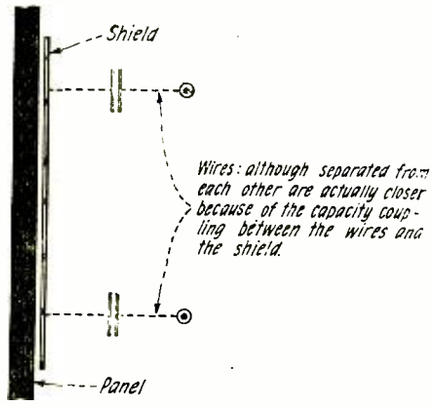
Wire leads were found to be subject to the same capacity effect if run close to the panel. Moreover further complications arise here for any two wires even if at right angles to one another, but both parallel to the panel, will have a capacity effect between them which will be approximately equal to the capacity of the same two wires running parallel and spaced the same distance apart as the sum of the spacing of both from the shield.

In summing up the foregoing it follows that not only does the shield capacitively couple all instruments to the ground, but it also serves to couple them to one another.

In the course of the above tests it was also found that in cases where poor insulating material was used in panel or instruments there was a direct—but of course high resistance—short to the shielding. The ordinary battery and light, or even phones would not show this, but with delicate instruments connected across resistances as low as 14 megohms were found in some sets.

Such relatively low resistance shorts may seem negligible to the average reader, but for those who want the acme of efficiency to go after DX records these details must be taken into consideration.

The reason this type of shielding does not effectively prevent body capacity is really due to this capacitive



Showing capacity coupling of wires because of shield

coupling between shield and instruments.

The hand being brought near the set is coupled to the shielding both by the ground and the capacity of hand to shield hence the effective surface of the shield is augmented by the surface of the hand or body, thereby increasing the capacity betwen shield and instruments. Any change in the capacitive coupling of hand to shield will cause a change in the capacity to the instruments.

From the above discourse on shielding the reader may be led to believe that by discarding it from his set greater distance and volume might be obtained. This is exactly the opinion that it is wished to convey.

The writer does not want to say that there are no sets which shielding will help, but in none of the various sets which have come under his notice, has the shielding effectively performed its purpose. The only real method of doing away with body capacity is to mount the instruments on a sub-panel at least three inches from the main panel and then bring the control knobs and dials out by means of shafts made of insulating material.

[Note:—Mr. Lock's statements are applicable only to amateur constructed receivers: Commercial sets with shielding of proper engineering design have proved immune to detuning effects due to external body capacity variation. The RC set is a splendid example. For effective shielding, in addition to spacing the instruments from the metallic shields so they will be in a weak portion of the electrostatic and electromagnetic fields it is advisable to have all the live shafts connected in the circuit in such a way to keep them at ground potential. Likewise, the metal shields should have sufficient thickness to be of benefit. Where the front panel only is to be shielded and the instruments cannot be spaced back from it, separate shields for each part rather than a single large shield for the entire panel should be provided. If carefully carried out this will reduce hysteresis losses to an appreciable extent.—Technical Editor.]

How to Tune Out Local Stations

(Continued from page 61)

tenna also can flow through the filter circuit, or as we have described "inductance and capacity in series," through to the ground—as well as enter the receiving set. Make sure that there is no coupling between these two circuits and in order to prevent this keep the filter circuit several feet away from the receiving apparatus.

After having done all this, we are now ready to try it out. Wait until a local station begins operating and then try and tune in another station. That means you have set your dial at the point where the desired station can be heard, but it is being interfered with by the local station.

Now adjust the variable condenser of the filter circuit until the interference has been reduced to a minimum, at the same time readjusting your receiving set so that the desired station comes in as strong as it is possible to make same. A little practice will soon enable you to obtain sharp tuning.

This filter circuit is not a hundred per cent. perfect, but it is believed that for the amount of money invested and the simplicity of this arrangement, the results are worth while.

This device depends upon low losses in the filter, particularly in the condenser. Great care should be taken to make sure the variable condenser used is a "low loss" condenser.

This device will drain unwanted frequencies off the antenna, but it will not weed out unwanted frequencies from the receiving circuit itself.

NEW APPLIANCES AND DEVICES

Kellogg Transformer

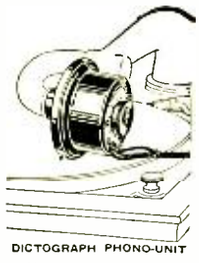
THE engineers of the Kellogg Switchboard & Supply Company were given the problem of producing an audio-frequency transformer that would function as well in the amplification of low frequencies as high frequencies. After a great deal of research work and numerous practical tests, they designed a really splendid transformer.

Kellogg Transformer

This audio frequency transformer embodies many excellent features: First, the iron core is of proper size and construction to operate properly on low voice frequencies and it has no holes for mounting or other purposes, so eddy current losses are reduced. Secondly, the windings have the correct impedance to work properly with modern vacuum tubes over a wide range of frequencies. The insulation between separate wires and between the coils is of high quality so that breakdowns are unknown. Lastly the transformer is encased in a special enameled brass case and the terminals are brought out to plainly marked binding posts so that the user is assured of maximum results with his amplifier.

Dictograph Phono-Unit

THE Dictograph Products Corporation is now marketing the Dictograph Phono-Unit, a phonograph attachment that is



DICTOGRAPH PHONO-UNIT

adaptable to all makes of phonographs and requires no extra batteries.

A calibrated dial on the back of the Phono-Unit permits the user to determine accurately and select a quality of reproduction equal to that secured with a loud, medium, or soft needle on the phonograph.

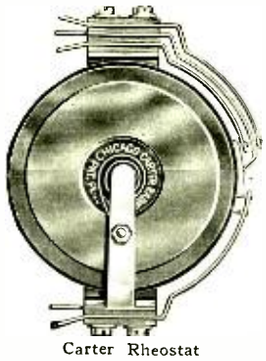
A handsome, heavy nickel plate finish insures the Phono-Unit harmonizing with the richest of phonograph cabinets.

Cutting & Washington Radio Corp. Adopt New Rheostat

THE Cutting & Washington Radio Corp. has adopted the new Carter Automatic Control Rheostat which is practically a combination of rheostat and jack. The method at present is to use a filament control jack to plug-in for detector, first, second and third stages. With such an arrangement a rheostat has to be used and there are the two operations of plugging-in and then regulating the filament by the rheostat.

When the Carter Automatic Control Rheostat is used in a circuit you plug-in your head phones or loud speakers, which remain in the same position whether you use the detector or one or several stages of amplification.

Immediately when you turn the rheostat the plate circuit is automatically cut in without the necessary plugging in of your head phones. All you have to do is to adjust your filament.



Carter Rheostat

The Automatic Rheostat is a fundamentally new method of amplifier control. It gives vernier control without additional knob or parts. The contact is stationary. The resistance wire is wound in a small spiral. This spiral rests in a groove around the outer edge of a disc and revolves past the stationary contact.

This Automatic Control Rheostat does away with a lot of extra parts, is simpler to wire into a circuit and provides the simplest method of inter-stage control. It is made in three resistances—6, 20 and 30 ohms—and can be used with all tubes.

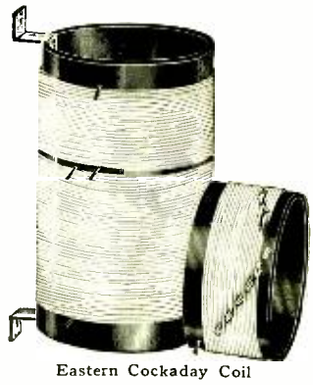
Tungar Charger for Two and Four-Volt Batteries

THE General Electric Company has developed an adapter to the standard Tungar Battery Charger so that it may be used to charge not only the regular six-volt storage battery, but also the two and four-volt ones used in conjunction with dry-cell tubes such as the WD-11 and the WD-12 and the UV-199.

This adapter fits inside the Tungar case and can be attached in a few moments. It should meet an enthusiastic welcome from the fans who use small storage batteries.

Eastern Coil Sets for Cockaday Circuit

A NEW and improved coil for use in the famous Cockaday circuit is being placed on the market by the Eastern Radio Mfg. Co., New York. This coil has several distinctive features and is built exactly in accordance with Mr. Cockaday's specifications.



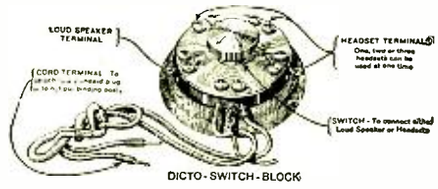
Eastern Cockaday Coil

A circular describing this four-circuit tuner may be secured upon request from the Eastern Radio Mfg. Co., 22 Warren Street, New York.

Dicto-Switch-Block

IN one compact unit, the Dictograph Products Corporation's Dicto-Switch-Block provides a means for throwing into circuit a loud speaker, or one to three pairs of headphones—simply by a short turn of a knob switch. No matter how often the switch is thrown, the most delicate adjustment of the receiving set is left undisturbed.

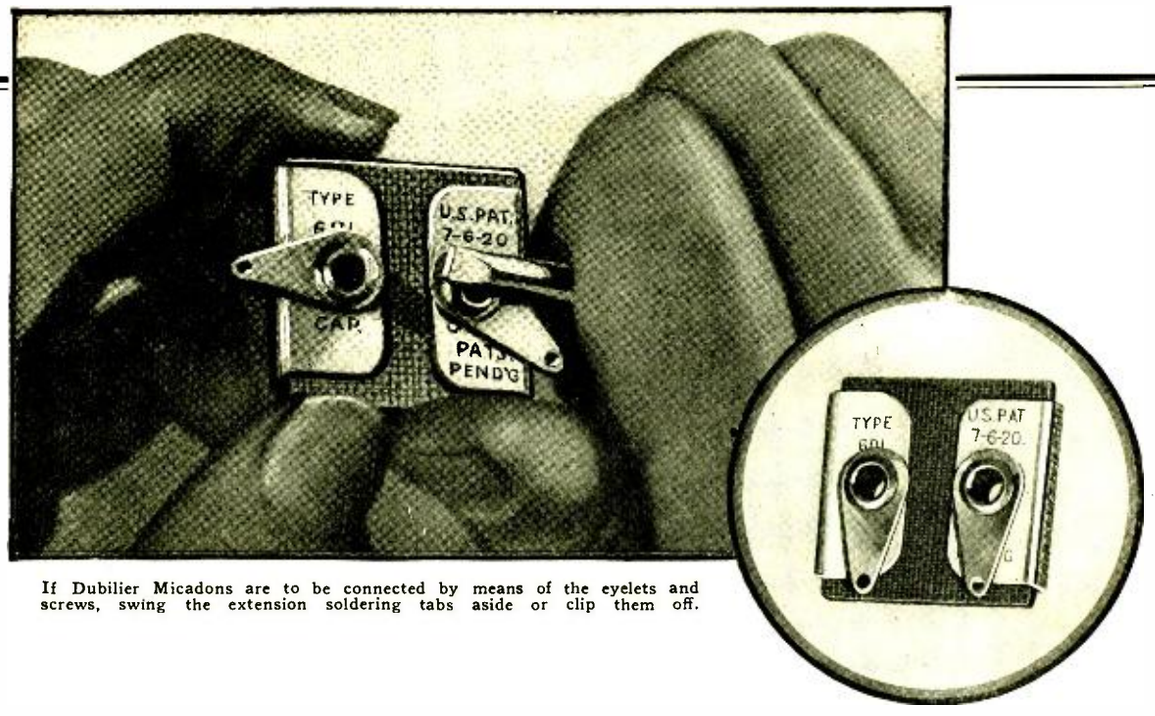
The Dicto-Switch-Block is provided with a regular phone cord which may be permanently attached to the output terminals of the receiving set, or inserted in any standard plug. This arrangement permits delicate tuning with the headphones after which the headphones may be cut out and the loud speaker brought in, all with one quick twist of the switch.



DICTO-SWITCH-BLOCK

With the Dicto-Switch-Block permanently connected and attached to one, two or three headsets, and to a loud speaker, all bothersome attaching and detaching of receiving units is done away with, thus facilitating operation for those unfamiliar with radio sets.

Finished in mahogany and capped with genuine hard rubber, the Dicto-Switch-Block will match any standard set.



If Dubilier Micadons are to be connected by means of the eyelets and screws, swing the extension soldering tabs aside or clip them off.

Dubilier Micadons for any Circuit

Dubilier Micadon, type 601, is now made with extension soldering tabs. These facilitate mounting. The hot soldering iron need not touch the Micadon directly. Hence the capacity cannot be affected by the heat.

If Dubilier Micadons are to be mounted with screws simply push the soldering tabs aside or clip them and use the eyelets.

Thus the Dubilier Micadon, the standard of radio because of its permanent capacity, becomes even more convenient.

Dubilier Micadons are retailed at 35 cents up, depending on style and capacity.

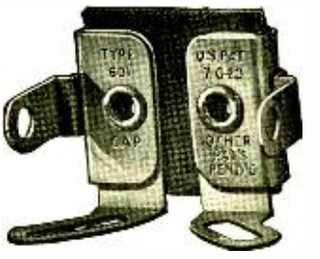
There is a Dubilier Micadon for every circuit requirement. If your dealer cannot supply Micadons write to us.

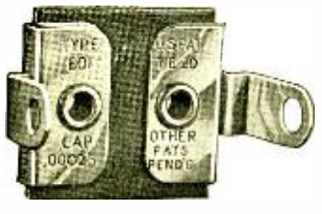
Dubilier Condenser and Radio Corporation

40-44 West Fourth Street New York

Micadon type 601 T has adjustable clips which slip over transformer and other binding posts.

Micadon type 601 G-T has clips to hold a fixed grid-leak and adjustable clips that slip over binding posts.





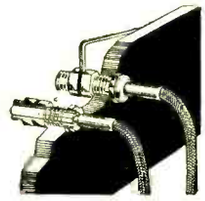
Micadon type 601 G has clips to hold fixed grid leaks (Grid leaks not supplied with Micadons).

Micadon type 601 L has eyeletted tabs that slip over the terminals of a variable grid leak.

Na-ald Phone Tip Jacks

NA-ALD Phone Tip Jacks make a very easy and a very satisfactory means of connecting as many sets of phones and loud speakers as are desired, either in series or in parallel. To install these jacks all that is necessary is to bore ¼-inch holes in the panel, clamping the bus wire under the nut and lock nut provided. Extra sets can be connected either in series or parallel.

The Na-ald Jack grips all sizes of terminals, making positive contact and holding them firmly. At the same time the tension



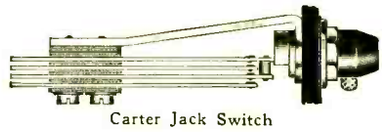
Na-ald Phone Jacks

is such that they can be easily removed and changed from one stage of amplification to another. They have an advantage over the ordinary jack in the various combinations of connection possible as well as cost and ease of installation. It is not necessary to solder the bus wire connection.

New Carter Jack Switch

A COMPACT and durable radio switch to open and close circuits has been devised by the Carter Radio Company.

The principle is the same as used in a jack, though unlike push and pull switches, there are no snaps to wear out or work loose and make poor contacts. A quarter turn of the knob operates the heavy low-resistance, phosphor-bronze contact springs, connecting or disconnecting the silver contacts. The insulation is Westinghouse Micarta 1/16-inch thick between the springs. This material will not contract, expand or absorb moisture. The frame is heavily nickel-plated and highly polished on all sides. The switch is easily mounted on the panel, like a jack. One adjustable lock-nut holds the switch securely in place. An "On and Off" name plate mounts on the



Carter Jack Switch

front of the panel and is furnished with the switch; also a knob and pointer. This switch will safely carry 10 amperes.

The switch is made in the following four styles: Two springs—closes one contact. Can be used to close the "A" battery. Three springs—opens one and closes one contact. Can be used for switching from long to short wave, and from one dry "A" battery to another. Four springs—closes two contacts. Can be used in second head set; also for adding a second cell in parallel; also for closing the "A" and "B" battery circuit. Six springs—opens two and closes two contacts. Can be used as a series parallel switch or to switch battery charger or loud speaker on and off, etc.

The Carter Radio Company have prepared diagrams showing some of the uses for this switch and will be glad to mail copies to those readers who are interested.

Eby Tip Top Post

THE H. H. Eby Company have put on the market a unique development in binding posts.

The Tip Top Post is designed to take the place of the conventional phone binding posts, and is constructed to take three pairs of phones or two pairs of phones and a loud speaker.

The terminals are marked so that proper connections are assured.

Eby Tip Top Post

Cutting & Washington Receiver

A NEW entirely self-contained 3-tube and double circuit regenerative receiver, designed for long range and selectivity, is announced by the Cutting & Washington Radio Corp., of Minneapolis, Minn.

The receiver was designed by Dr. Fulton Cutting and Bowden Washington, designers of U. S. Naval and Allied radio apparatus during the war, and was built under their direction.

It uses three UV-199 tubes, three large A batteries, B batteries, shock absorbing tube mounts to prevent vibration howls, shielded panel and automatic rheostat switches with all wires back connected. The receiver is known as the Model 11-B.

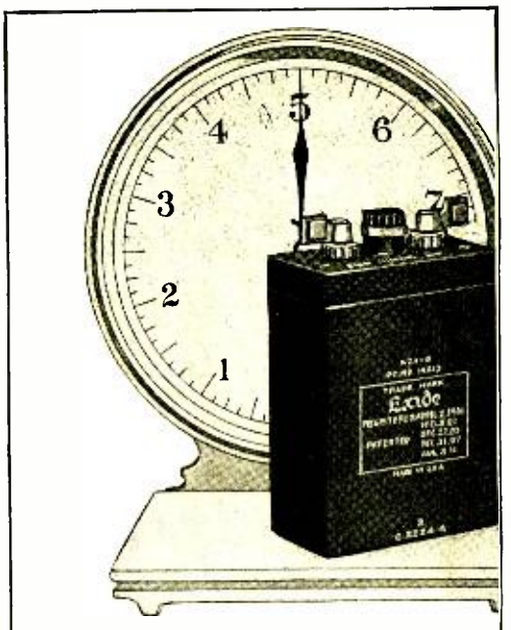
Alexanderson High Frequency Alternator in Europe

E. F. W. ALEXANDERSON, consulting engineer of the General Electric Company and chief consulting engineer of the Radio Corporation of America, has been awarded the Order of the Polonia Restituta by the Polish Government, in recognition of his meritorious services in connection with the building of Poland's new radio station near Warsaw.

The Polish station is the first in Europe to make use of the Alexanderson high frequency alternator now used in all Radio Corporation stations for trans-oceanic communications. During the two months the Polish station has been in operation it has gained the reputation of being the most efficient transmitting station in Europe.

A similar station, being built in Sweden, is expected to be ready for operation by mid-summer. These two new stations will not only serve their own countries with an adequate and quick means of communication with America, but will tend to more closely link Eastern Europe with this country.

To get best results with low-voltage tubes

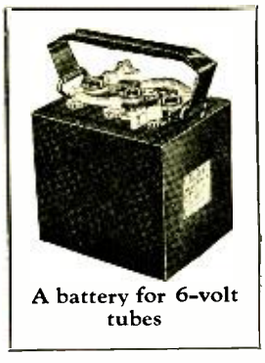


This 2-volt A Exide storage battery weighs only 5 pounds

FOR perfect clearness you must use a storage battery with uniform current. This is particularly true if you are a fan for long distance. When signals are weak, the steadiness of a dependable A storage battery is indispensable to good receiving.

There are two tiny but sturdy Exide A Batteries designed specially for WD-11 and UV-199 vacuum tubes, and they give fine service with any low-voltage tubes.

You can carry one of these little batteries in the palm of your hand, yet they are powerful enough for long-distance receiving and have the true Exide ruggedness built into them.



A battery for 6-volt tubes

Three sizes of A batteries

The 2-volt battery has a single cell and weighs five pounds. It will heat the filament of a WD-11 or other quarter-ampere tube for approximately 96 hours. The 4-volt battery has two cells, weighs six pounds, and will light the filament of a UV-199 tube for 200 hours.

The Exide A Battery for 6-volt tubes is made in four sizes—of 25, 50, 100, and 150 ampere-hour capacities. These batteries have extra-heavy plates, assuring constant voltage and uniform current over a long period of discharge.

A battery with a pedigree

A good storage battery does not just happen. It is the result of long experience. The skill acquired and the resources developed in making batteries for every purpose since the beginning of the storage battery industry thirty-five years ago are built into the Exide Batteries made specially for your radio.

Wherever batteries *must* be reliable—such as on submarines, in the telephone system, in firing the guns of our battleships, in the central power stations of our great cities—there you will find Exides doing their unfailing duty. While the weight of the smallest Exide radio battery is only five pounds, the great Exides used in central power stations sometimes have as many as 150 cells, each cell weighing three tons—or nearly a million pounds for one battery.

A majority of all government and commercial radio plants are equipped with Exide Batteries.

Exide Radio Batteries are sold by radio dealers and Exide Service Stations everywhere.

Ask the dealer, or write direct to us, for booklets describing the complete line of Exide Radio Batteries.

Exide
RADIO BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, PHILADELPHIA

Manufactured in Canada by Exide Batteries of Canada, Limited, 133-157 Dufferin Street, Toronto

Industrial Inklings

MANY manufacturers in the radio field are making rapid progress in the development of their merchandising efforts.

In the majority of cases, the progress is being made by the manufacturers of sets, phones, loud speakers, etc., whose product is

sufficiently bulky to permit of an impressive display.

Manufacturers of small parts are handicapped in displaying their products because of size, and ingenuity has to be exercised to impress the buying public as to the merits of goods that may be lost sight of in the proverbial commercial haystack.

The latest Eby stunt is the container pictured above, which combines the two virtues of displaying a small product and creating sales through the suggestion of a complete set of marked parts to the man who is buying the material for a set. This is real selling.

THE Belden Manufacturing Company has combined a circular letter and catalogue with a four-page fly, that ought to be an inspiration to other manufacturers of very small parts and accessories. The outstanding feature of this circular is a talk to the trade on "How to increase their counter profit."

FRANK T. CHASE has joined the Zinke Company, as vice president in charge of merchandise.

AS announced in "Continental News" and through printed announcement to the trade, and extensive advertising in the trade and national magazines, Continental Radio and Electrical Corporation have closed their retail store at 6 Warren Street and are devoting their entire energy to the expansion and building-up of their wholesale business. The present main office at 15 Warren Street is being enlarged and a carefully laid out show-room is being added.

WASHINGTON'S first radio show will be held in Convention Hall from March 19th to 26th. The show will be staged under the auspices of the Radio Merchants Association of Washington. Many of the popular features of the Chicago, New York, Philadelphia and Boston shows will be incorporated in the Washing-

ton program. but they will be supplemented by unique "stunts" arranged by members of Congress and Government officials.

One exhibit of marked historic value will be the $25,000 exhibit of the Radio Corporation of America. Virtually all the important working committees for the show have been organized. Fred S. Lincoln, a prominent Washington business man is chairman of the general show committee. Alfred L. Stern is the director. Officers of the Washington Radio Dealers Association who are responsible for the show are William P. Boyer, president, Fred Huber, vice-president, and W. H. Schultz, secretary-treasurer.

THE Strand Radio-Kraft Corporation has recently opened an exclusive studio at 635 Fulton Street, Brooklyn. Practically every well-known radio set is demonstrated daily, and their plan of selling radio on easy payments will no doubt please the populace of that Borough.

THE Adams-Morgan Company, Upper Montclair, New Jersey, has a new Paragon booklet which presents their small parts in a comprehensive fashion.

THE Howard Radio Company, Inc., Chicago, has put out a booklet that describes the Howard rheostat, potentiometer, multi-terminal receiver plug, and other radio essentials, in a way that enhances their importance.

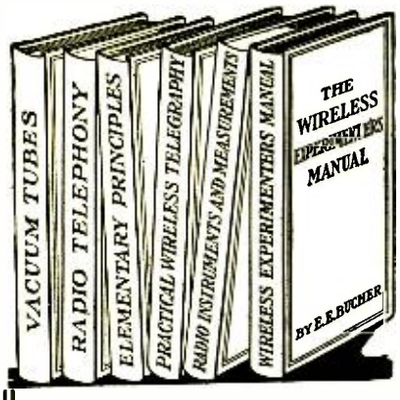
THE Goldschmidt Corporation, 15 William Street, New York City, who are sole importers for United States and Canada of the N & K imported phones, appointed Mr. Harry E. Sherwin marketing manager of their organization.

Mr. Sherwin was for many years associated with Robert Ingersoll & Brothers, both in this country and abroad in the merchandising of Ingersoll Watches. He was sales manager of the A. C. Gilbert Company of New Haven for many years and was particularly responsible for the distribution secured for the Polar Cub Electric Fan and other Polar Cub electrical specialty products. He recently completed a contract for introducing the Bobolink Phonograph Books for children, on which a national distribution was secured in less than six months time.

CONVERSATION between Japan and WOR, Newark, New Jersey, was heard on a Dictogrand Loud Speaker in the laboratories of Howard Radio Company. A statement of this remarkable feat was issued by Thomas L. Kennon, manager of the Howard Radio Company and an affidavit was signed by a notary public.

THE Federal Telephone and Telegraph Company at Buffalo, New York, issues a monthly bulletin worthy of comment.

OTHER catalogue-booklets of unquestionable value to radio fans, are those published by the Newark Sunday Call, Newark, New Jersey, Progress Press, Union, South Carolina, and the Charleston Electrical Supply Co., Charleston, West Virginia.



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Here is the greatest list of radio books ever presented. In this list are books that are known and used the world over.

Our stock room is overcrowded—we must reduce the weight per square foot. This gives you the chance to buy these books at a tremendous saving. Take advantage of this opportunity to complete your radio library.

BOOK	AUTHOR	Regular Price	Class No.
Practical Wireless Telegraphy	E. E. Bucher	$2.25	35
Vacuum Tubes	E. E. Bucher	2.25	35
Wireless Experimenter's Manual	E. E. Bucher	2.25	35
How to Pass U. S. Government Wireless Exams.	E. E. Bucher	.75	10
How to Conduct a Radio Club	E. E. Bucher	.75	10
Alexanderson System	E. E. Bucher	1.25	18
Radio Telephony	A. N. Goldsmith	2.50	37
Practical Amateur Stations	J. A. White	.75	10
Sound Method of Learning Code	J. A. White	.50	6
Acquiring the Code	Gordon	.50	6
Signal Corps Manual	J. A. White	2.25	30
Practical Aviation	J. A. White	2.25	30
Prepared Radio Measurements	Batcher	2.00	30
Modern Radio Operation	J. O. Smith	1.75	26
Radio Inst. and Measurements	Bureau of Standards	1.75	26
Experimental Wireless Stations	Edelman	3.00	45
The Radio Pathfinder	Ranger	1.50	20
Elements of Radio Communication	E. E. Stone	2.50	40
Mast and Aerial Construction	Ainsley	.75	10
Construction of Amateur Valve Stations	Douglas	.75	10
Crystal Receivers for Broadcast Reception	Harris	.75	10
Continuous Wave Wireless Telegraphy	Eccles	8.00	120
The Oscillation Valve	Bangay	2.75	40
Elementary Principles of Wireless—Part 1	Bangay	1.75	25
Your Broadcast Receiver	Harris	.75	10
Standard Tables and Equations	Hoyle	3.25	50
Wireless Telegraphy and Telephony	Dowsett	3.50	55
Thermionic Vacuum Tube	Van De Bijl	5.00	80
Thermionic Valve	Fleming	5.00	80
A. B. C. of Wireless	Harris	.30	4
Wireless Transmission of Photos	Martin	2.00	30
Telephony Without Wires	Coursey	5.00	80
Selected Studies in Elementary Physics	Blake	2.00	30
Pocketbook of Notes, Formulae, Etc.	Fleming	3.50	50
Operation of Vacuum Tubes in Radio	Brown	.35	4
Pocket Dictionary of Radio	Ward	1.00	15
How to Build Amateur Valve Sets	Coursey	.75	10
Practical Wireless Sets for All	Harris	.75	10
Amateur's Book of Wireless Circuits		1.00	15

BOOK	AUTHOR	Regular Price	Class No.
Wireless Telephone—How It Works	Coursey	$1.25	18
Technical Instruction for Wireless Telegraphists	Hawkshead and Dowsett	3.50	55
Elgie's Weather Book	Elgie	2.00	20
Alternating Current Work	Shore	2.00	25
Oscillation Valve	Penrose	.50	7
1½ KW Ship	Penrose	.50	7
Direct Current	Penrose	.50	7
Auto-Time Morse System	Perry	.75	10
Magnetism for Home Study	Penrose	2.25	30
Radio Directory and Call Book		1.00	12
1923 Year Book of Wireless Tel. & Tel. (Cloth)		6.00	80
1923 Year Book of Wireless Tel. & Tel. (Paper)		2.50	30
Lessons in Wireless Telegraphy	Morgan	.35	3
Operation of Wireless Telegraph Apparatus	Cole	.35	3
Wireless Construction for Beginners	Morgan	.35	3
Experimental Wireless Construction	Morgan	.35	3
Home Made Electrical Apparatus Vol. 1	Powell	.35	3
Home Made Electrical Apparatus Vol. 2	Powell	.35	3
Home Made Electrical Apparatus Vol. 3	Powell	.35	3
Home Made Toy Motors	Morgan	.35	3

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Include a year's subscription with your order.

AND GET ANOTHER BARGAIN

Send all orders to

WIRELESS PRESS, Inc.

326 Broadway **New York City**

THE name of the Precision Equipment Company has been changed to the Crosley Radio Corporation. An arrangement has been made whereby the business of the Crosley Manufacturing Company in its entirety has been taken over by the Crosley Radio Corporation. Many economies will be effected in production, administration management, effective as heretofore, with the same personnel in charge.

The Crosley Radio Corporation now occupies three large plants in the city of Cincinnati including its own woodworking cabinet plant. A fourth plant, larger than the present three combined, has just been purchased for additional expansion.

Information Desk

By John R. Meagher

A self-addressed envelope will assure a prompt reply to any queries on radio.

Combining the Super With the Super

M. V. inquires: "Would it be possible to combine both the super-regenerative and the super-heterodyne receivers into one?"

Yes, indeed; we could make use of the short wave amplifying powers of the super-regenerative receiver by heterodyning our incoming energy and producing a beat note of 50 meters or less and passing this along to a suitably adjusted super-regenerative set. Here we would be using the super-heterodyne idea reversed in order to take advantage of the ability of the super-regenerative to amplify well at short wavelengths.

The first WIRELESS AGE reader who gets this combination working properly will be awarded a free and complete assortment of bakelite wavelengths.

The "Autoplex" Super-Regenerative Receiver

Mr. R. P. V. Brudny of New York writes: "I have an Autoplex receiver and am securing fairly good results with it. I have attempted to add an amplifier, but have not been able to secure as good results. Can you give me any dope on this receiver and how I may add the amplifier without causing the set to cease working?"

The autoplex is, of course, a modified super-regenerative receiver—at least the name is modified. For causing the tube to oscillate at radio frequencies, variometers are included in the plate and grid circuits. For the low frequency oscillation, a large honeycomb coil is in series with the grid while the phones or "speaker" or primary of the first audio frequency transformer serve as the corresponding plate inductance. The impedance of the latter must be high enough, depending upon the tube characteristics, the plate voltage and the value of the grid inductance to cause the low frequency oscillation. If anything is done to lower this impedance or throw it out of tune with the grid inductance, the tube will not oscillate at the low frequency. For this reason condensers across the low frequency plate inductance are not advisable; and if the plate inductance is the phones and they are worn on the head, the extra capacity across them

and from them to ground will have a similar effect. Likewise, if an audio frequency transformer, the primary of which has excessive distributed capacity is used, the tube will not oscillate at the low frequency.

All of this means that using the low frequency output for the dual purpose is not reliable. It would be better to include a coil similar to that in the grid circuit in series with the plate variometer and the low frequency output—the latter would then be not at all critical.

It may be seen that we could still further modify the already much modified, but little changed "super" by replacing the grid honeycomb coil with a pair of phones—and so on.

Audio Frequency Howl

Mr. Irving Wiebl of Brooklyn, New York, writes: "I have a standard detector and two stage amplifier connected to a regenerative tuner; an 'A' battery potentiometer is used to regulate the 'B' battery voltage. Now when I have the slider of this potentiometer at any point other than either the negative or positive ends an audio frequency howl is produced that completely drowns out signals. The negative side of the 'B' battery is connected to the slider. What is the cause and how may I eliminate the howl? Also, just what is the action of the potentiometer in this circuit?"

From your description of the trouble we believe the howling is caused by the resistance coupling common to all three tubes when the slider of the potentiometer is adjusted to include resistance between the negative terminal of the "B" battery and either side of the filament. A large, 5 mfd. fixed condenser shunted from the slider to one side of the filament will undoubtedly fix matters. Better still, use a separate detector plate battery; bring its negative terminal to the potentiometer slider, but bring the negative terminal of the amplifier "B" battery to the positive side of the filament.

About the action of the potentiometer; its purpose in this circuit is to serve as an adjustment of the detector plate voltage. Consider that the "B" battery in a simple detector circuit has a voltage value of 18; if the negative terminal of this battery goes to the negative side of the filament the effective plate voltage will be 18. But if the negative "B" is connected to the positive "A," the effective plate voltage will be 18 plus the voltage of the "A" battery; with the latter of 6 volts the plate voltage would be 24. By placing a potentiometer across the "A" battery and bringing the return lead of the "B" battery to the slider, any value between 18 and 24 may be secured.

Incidentally, as most detector tubes work best at about 18 volts, the detector plate battery should have a tap at 14 volts.

In considering the action of the potentiometer one must remember the position of the rheostat in the filament circuit. If it is in the negative side the plate voltage is reduced below the "B" battery value to an amount equal to the drop across the rheostat (when the slider is at the negative side of resistance). This fact explains the action of the rheostats in a radio frequency amplifier because when they are adjusted the effect is similar to moving the slider of the potentiometer, and because of this, many people have erroneously been led to believe that adjustment of the R. F. filament current is necessary for good results.

Tuning a Variometer Receiver

R. V. K. writes: "I have a regenerative receiver composed of two variometers, a variocoupler and a UV-200 detector tube. A great deal of difficulty is had in tuning this set. Are there any suggestions which would enable me to master the controls?"

It is possible to give pages and pages of operating suggestions, but whether or not they would enable you to master the controls is rather difficult to say.

To start, it's well to realize the relative importance of each control and to have some knowledge of its action in the receiver. The grid variometer is first—let us call it instead the "wavelength selector" for that is its purpose—to choose the particular wavelength that is to be received.

Next is the plate variometer or "regenerative control." This is the jigger that means so much in strength of signal, but which, if handled improperly, results in squealing and howling and terrible distorted reception.

The other controls, the primary switch or switches, the coupling of the variocoupler and the rheostat knobs are secondary in importance. In general, they can be set and left in one position—at least do not bother with them till later. Set the coupling at a mid point between minimum and maximum—that is, so the planes of the rotor and stationary windings are at about 45 degrees. Fix the primary inductance switch to include about 20 turns of wire between the aerial and the ground. Adjust the knob of the detector rheostat till the tube (UV-200) filament lights brightly, but not so much as to cause a "rushing" noise in the phones.

Now, set the plate variometer anywhere and slowly move the wavelength selector until a station is heard; center this control for maximum response and then move the regenerative control for best results. At the same time make slight readjustments of the wavelength selector. Thereafter for other stations, keep the wavelength and regenerative controls in step with each other; sort of balancing the two for best results, remembering, however, that the wavelength selector and the regenerative controls have special purposes. That is to say, if the receiver is oscillating so that the carrier wave of stations can be heard, adjust the regenerative control. Do not bother the wavelength adjustment or the amplifier rheostats.

We believe that merely thinking of the two main controls in terms of what they do rather than their technical description will go a long way in helping one to tune properly For instance, imagine calling the brake and throttle in an automobile by lengthy and technically descriptive names—one might "step on it" instead of stepping on the brake—and that wouldn't be so good—would it?

Amateurs Shake Hands Across Atlantic

(*Continued from page* 51)

It is certain that reliable two-way communication would have been resumed on the following night had it not been for the fact that the atmospheric conditions were decidedly poor. There was plenty of static and noise. F8AB changed his wave length and apparently had trouble. His note was

poor and his signals faded badly. Although a schedule had been arranged, he exchanged call with 1MO at midnight and that was all except that 1BGF in Hartford was also listening and he managed to copy F8AB as did also 1XAM in South Manchester.

Even the holiday did not keep the amateurs on either continent from making a third attempt and Thanksgiving night found Deloy and Schnell once more at their transmitters. This time F8AB was right on KDKA's short wave, about 103 meters, and he could be heard distinctly only when the broadcast station was fading out. 1XAM succeeded in connecting with him twice and at 10:40 asked Deloy to change his wave length. However, he was not heard again.

There is a strong opinion among A. R. R. L. officers that the short wave made the transoceanic accomplishment possible and that it might have been extremely difficult on a wave length of 200 meters owing to the interference from other stations in this country.

Design of Loop Antenna

(Continued from page 38)

reliable, however, and if used, the connections should be frequently inspected to see that there is satisfactory contact. If the wires of the loop terminate at the lowest corner flexible connections can be dropped at that point to the set, with enough slack in the wire to permit the rotation of the loop for one revolution.

In connecting a loop of the "plane" type—figure 1a or 2a—always connect the wire from the outer edge to the portion of the circuit nearest ground potential and the inner end of the loop to the grid. This precaution will insure a larger wave-length range, as the distributed capacity of the coil is materially reduced. There appears to be no advantage in connecting a "box" type loop in any particular way, as the same is more or less symmetrical.

Improve Your Set

(Continued from page 57)

arranging of the units and reduces the possibility of regeneration from cross leads running from the various units. This is very important. It is to be noted that in figure 9 the connections are very short. Maximum efficiency is obtained in this way.

TUBES

I have obtained best results by using the UV-200 tube as a detector and the new UV-201A tubes as amplifiers. Approximately the same volume of sound can be obtained with three WD-12 dry cell tubes. Instead of using dry cells to operate the tubes—because it was necessary to have the

storage battery to operate the Western Electric Amplifier tubes—I used the arrangment described in figure 11. It is clearly shown that the WD-12 tubes were operated from one cell of the battery (2 volts) while the W. E. amplifier was operated from the three cells of the 6-volt battery. When using the storage battery in this way do not use one cell at all times because it will become discharged to a point which will be considerably lower than the other cells and it will not be possible to fully recharge it. Change cells often. In other words: Use the first cell for a while, then the middle cell and finally the last cell—repeating the process until the battery requires recharging to operate the power amplifier.

The two-volt battery will not damage the tubes if the rheostat is properly operated. It will be found in most cases that it is only necessary to barely turn on the rheostats in order to obtain good results. Never use the rheostats past the "half in" position.

Colpitts' Push-Pull Circuit

(*Continued from page 35*)

horn for signals of an intensity that almost knocks the loud squealer from its resting place. Engineering ability and many hours of research are the necessary requisites in the planning and designing of an effective loud speaker. It is therefore impossible to get a five-dollar reproducer that will be in any way as good as the higher priced ones manufactured by reputable concerns.

However, the best loud speakers on the market today do not give perfect reproduction. The loud speaker is practically the only unit in the radio art that has not been radically changed by some new invention. It still uses the principle of a magnetized iron core and diaphragm. Unless some one can discover a new principle in sound reproducers, perfect quality will not be obtainable from the receiving system.

Tube Overloading and Its Remedy

Since the advent of the dry cell tubes, many of the radio fans have found their use very convenient. The advantage of employing them lies in being able to design a compact set without needing the cumbersome storage battery with its continual need for charging and keeping in order. The big disadvantage lies in not being able to obtain a very loud signal without getting distortion due to tube overloading. Many of the fans are still clamoring for the loud signal as they are not satisfied with one of comfortable intensity.

To study the reason for distortion on a loud signal when using the dry

cell tube, it is necessary to refer to figure 3 which is the characteristic curve of this type of tube.

When the dry cell vacuum tube is normally operated as an amplifier on 90 volts plate battery it requires a negative voltage of 4½ volts in order to bring the pivot point "0" at the center of the straight portion of the characteristic curve. This gives a D.C. plate current of 2 milliamperes. A loud speaker signal of fair intensity requires a current through the loud speaker of about .8 milliampere. The voltage impressed on the grid to produce this change is 2½ volts. As seen from the curve, the grid swinging 2½ volts each side from "0" will produce an equal plate current change of .8 milliampere on each side of "0" as in "A," figure 4. However, in order to produce a good loud signal, a plate current change of about 2 milliamperes is required through the loud speaker. To produce this change, a voltage of 5½ volts must be impressed on the grid. But due to the characteristic of the curve, 5½ volts impressed on the grid to the left of "0" will produce a plate current change of only 1.6 milliamperes with a 2 milliampere change when the grid swings 5½ volts to the right. This unequal change in plate current causes distortion as in "B," figure 4. Additional distortion is also obtained due to the fact that, when the grid swings 5½ volts to the right of "0," it becomes charged 1 volt positive, causing it to draw current. The effect of this is to flatten the upper peaks of the waves. The above results clearly indicate that a dry cell tube is not designed for a very loud signal as forcing or overloading the tube will cause distortion. The Radio Corporation of America emphasizes this point in the circular issued with each dry cell tube.

However, distortionless amplification can be obtained by using two tubes in a special arrangement. This arrangement is known as the "push-pull" circuit and was invented by Colpitts of the Western Electric Company. The circuit is shown in figure 1. There are two special transformers used. The input transformer has two secondaries while the output transformer has two primaries.

Distortion is eliminated in the "push-pull" circuit in two ways. First, each tube takes only half of the input load. If a voltage of 5½ volts is impressed on the secondary of the input transformer, each tube will have but 2¾ volts impressed on the grid. This will cause the grids to operate on the straight portion of the characteristic curve and no distortion will occur. As the plate of each tube is connected to a primary winding of the output transformer where both are coupled to a common secondary, the total energy in

the secondary will be the product of the energy of the primaries.

The second reason for using the "push-pull" circuit is that the fundamental waves through the output transformer are additive and any harmonics present in each primary will be out of phase, therefore neutralizing each other in the secondary. As harmonics cause distortion, further advantage is gained by the use of the "push-pull" circuit.

The input and output transformers for this circuit are already available on the market. Care should be taken in purchasing an output transformer with a secondary that has an impedance equal to that of the loud speaker. If the secondary winding has a low impedance, then a step-up transformer must be used as shown in figure 1A.

Should any one find it difficult to secure these transformers, standard audio frequency transformers may be used as shown in figure 5 and practically the same results will be obtained.

A Radio Operator Sees the World

(*Continued from page 33*)

come is greater than that of a man ashore receiving twice that amount. And ten to one the man ashore has not had as pleasant work nor the opportunities for self-improvement that radio operators have.

WHAT DOES THE OPERATOR'S JOB COMPRISE?

Beyond the primary task of sending and receiving, the up-keep of the apparatus is a very important part of the radio operator's work. To be a real man at the business he must know, not only the theory, but the practical working of each part. It must be kept in good running order the same as any other mechanical or electrical machinery so as to get the best results and prevent undue deterioration.

To gain attention and prove his worth he must have his set clean and in perfect order at the time of inspection. There are some operators who run along for a year without a cent of expense needed on their ships.

This is all very easy to the man who: first, is not simply fascinated, but has a real liking for radio; second, has studied it, mastered it and continues to study; third, has the intuition and ambition to apply his knowledge, and fourth, is not averse to taking off his uniform and getting his hands dirty. The job of radio operator is only for full-blooded young Americans who are ready to give to the job their full purpose and unstinted devotion.

The real purpose of radio aboard ships is the protection of life and property. It follows then that the set must

always be keyed up to the highest state of efficiency and ready for use at a moment's notice. The operator must know how to adjust the set so as to immediately obtain the maximum of power and the broadcast wave.

When life and property is not in jeopardy, radio is used in connection with government matters, such as the reception and transmission of hydrographic information, weather reports and government traffic. Next in order are messages pertaining to the movements of the ship, the cargo or the captain's official business. Later come personal messages of passengers or members of the crew.

It is plain, therefore, that the radio operator's work is of great importance. Upon him rests a heavy responsibility; first, a responsibility for thousands of dollars worth of equipment; second, the much larger responsibility involved in handling efficiently a traffic upon which may depend big business transactions, national affairs and precious human lives.

Radio Breaks Arctic Silence

(*Continued from page 28*)

The receiver is a three-circuit regenerative tuner, "Paragon" type RA-10, with a detector and two steps of audio-frequency amplification only being used, the receiving tubes being of the standard type and using a storage battery for heating the filaments.

Many false reports have been circulated about the *Bowdoin*. One was to the effect that the expedition was in peril. This was quickly denied, however, by the schooner's operator upon being advised of the report.

The first instance of radio forgery is believed to have been a case where some unknown person, impersonating Captain MacMillan, spoke into a radio telephone transmitter. The message was picked up by a Philadelphia banker, who believed he was hearing the radio station of the expedition. As the *Bowdoin* carries only a telegraph transmitter and has no apparatus aboard for the transmission of voice, this was of course impossible.

Donald Mix has assuredly lived up to his previous good radio record. Aboard his ship several records have been made. A message was telegraphed by him eleven degrees from the North Pole to an amateur station in Honolulu, Hawaii, and an answer received. In addition to this through Operator Mix's skill, music broadcast from Glasgow, Scotland, has been picked up and enjoyed by the crew of his ship. Winter may have other records in store which will astound the radio world.

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The AFRICAN "Drum talk" of TODAY

Boom! Boom! Boom! Boom!

THUS the drum talk of the natives of Africa broadcasts to a radius of fifty or sixty miles the departure of white men leaving one village for another. To the weird Boom! Boom! of the huge drum, the travelers with their porters commence the perilous journey, knowing that their arrival is expected at the next village.

What a far cry this crude method of sending messages is from our modern, useful, pleasure-giving radio. And how very backward it seems when we consider the rapid strides made in the radio industry in just a few years time as exemplified by the Crosley story.

Three years ago Crosley Radio Receivers were unknown. To-day, The Crosley Radio Corporation is the largest manufacturer of radio receivers in the world. In every part of the United States, happy users are enjoying the beautiful concerts, useful lectures and valuable news that Crosley instruments unfailingly bring in from the distant points desired.

Real merit at moderate prices has brought about this Crosley popularity. Crosley engineers have continually kept abreast and perhaps a little ahead of the rapid advancement that radio has made.

We Firmly Believe that Crosley Radio Receivers Are the Best that have Ever Been Offered to the Public.

Insist upon Crosley Radio Apparatus.
For Sale By Good Dealers Everywhere.

Following is a List of the Most Popular Crosley Receiving Sets With Their Prices:

Crosley Type V (formerly Ace) one tube regenerative	$16.00
Crosley Type 3B (formerly Ace) three tube regenerative	42.00
Crosley Type 3C (formerly Ace) consolette model	110.00
Crosley Model VI, two tube incorporating radio frequency	24.00
Crosley Model X-J, four tube, incorporating radio frequency	55.00
Crosley Model X-L, four tube consolette	120.00

The Crosley regenerative receivers, formerly called Ace, listed above, are licensed under the Armstrong U. S. Patent No. 1,113,149.

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Better-Cost Less
Radio Products

The Crosley Radio Corporation owns and operates Broadcasting Station WLW

CROSLEY MODEL X-J. PRICE $55

A four-tube radio frequency set combining one stage of Tuned Radio Frequency Amplification, a Detector, and two stages of Audio Frequency Amplification. A jack to plug in on three tubes for head phones, the four tubes being otherwise connected to the loud speaker, new Crosley multistat, universal rheostats for all makes of tubes for dry cells or storage batteries, new condenser with molded plates, filament switch and other refinements add to its performance and beauty.
We believe that for bringing in distant stations it cannot be equaled.
Cost of necessary accessories from $40.00 up.

THE CROSLEY RADIO CORPORATION
Powel Crosley, Jr., President
Formerly
The Precision Equipment Company and Crosley Manufacturing Company
328 Alfred Street **Cincinnati, Ohio**

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The Crosley Radio Corporation,
328 Alfred Street, Cincinnati, Ohio.

Gentlemen: Please mail me free of charge your complete catalog of Crosley instruments and parts.

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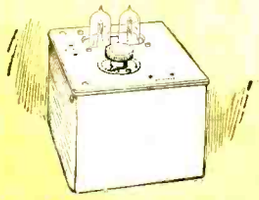
There's a Radiola for every purse

New and Revolutionary Radio Achievements in the new Radiolas

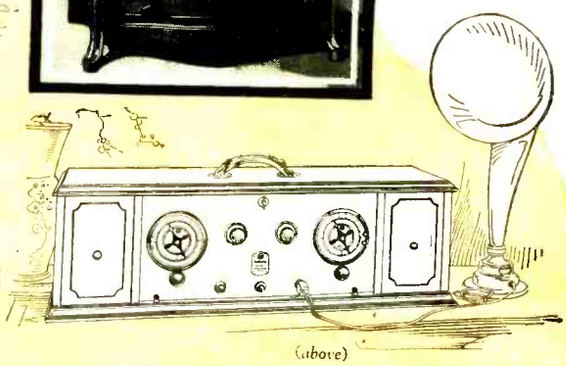
Radiola III, an improved two tube receiver of antenna type, sensitive and selective. *Complete* with two WD-11 Radiotrons and headphones (everything except batteries and antenna) . . . $35.

Radiola III Amplifier
Two tube balanced amplifier for Radiola III, including two Radiotrons WD-11 . $30.

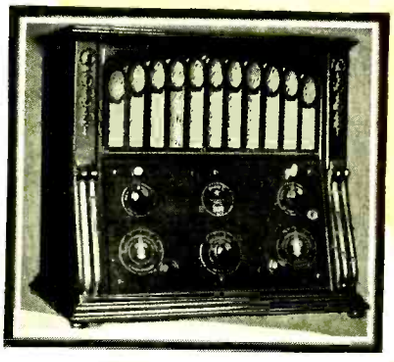


(above)
Radiola III-a, which is Radiola III and its balanced amplifier complete in one cabinet; including four WD-11 Radiotrons, headphones, and Radiola Loudspeaker (either type FH or UZ 1320.) Everything except antenna and batteries . . . $100

Radiola Super-VIII —an improved Super-Heterodyne. Selective and non-radiating. With *no antenna,* and no ground connection, it receives far distant stations, even while local ones are operating. Loudspeaker built in. *Complete* with six UV-199 Radiotrons — everything except batteries . . . . $425.

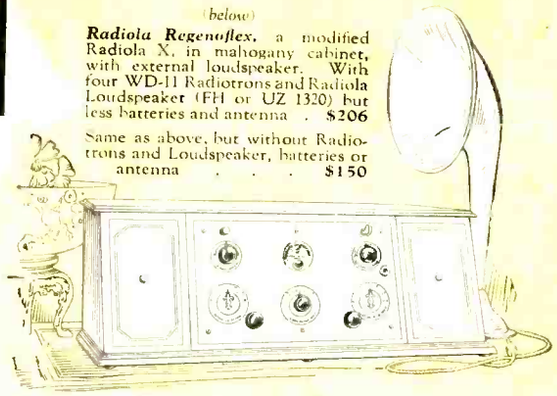


(above)
Radiola Super-Heterodyne (second harmonic) same as Super VIII but semi-portable in mahogany finished cabinet, with separate Radiola Loudspeaker of either type, FH or UZ 1320. With six UV 199 Radiotrons, but without batteries, $286.
Same as above, but without Radiotrons or Loudspeaker . . . . . $220.



(above)
Radiola X —ultra refined receiver of the antenna type, selective and non-radiating. Remarkable for distance reception and perfect reproduction. Built-in new type loudspeaker. Complete with four WD-11 Radiotrons—everything except batteries and antenna. $245.

(below)
Radiola Regenoflex, a modified Radiola X, in mahogany cabinet, with external loudspeaker. With four WD-11 Radiotrons and Radiola Loudspeaker (FH or UZ 1320) but less batteries and antenna . $206
Same as above, but without Radiotrons and Loudspeaker, batteries or antenna . . . $150



$35	$206
65	220
100	245
150	286

$425

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