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THE WIRELESS AGE

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In Our Opinion

Radio's Universal Service

THERE is nothing new in the story of how medical aid obtained by radio saved the lives of men who go down to the sea in ships. This feat is a commonplace, a part of the regular service which radio renders to the world afloat. But medical aid for an injured man in the Great Sahara Desert is a new one.

The news report is brief but dramatic. Angus Buchanan, an explorer for the British Museum, was badly hurt by a fall while in the heart of the desert, 150 miles from the nearest settlement. His helpers carried him many weary miles to a small French military outpost which was equipped with radio and was in communication with the settlement from which medical advice was obtained. Within a few days the explorer was able to sit up and shortly afterward resumed his work.

Whether over the cool, blue ocean, or over the burning sands of the desert, radio serves mankind, faithfully and well.

* * *

A Mile-High Antenna

ABOUT fifteen years ago an American well advanced in the radio engineering of the time had a vision — and was rewarded with the Ha! Ha! equivalent of the present day raspberry. His idea was to save the cost of constructing enormous steel towers for antenna supports at trans-oceanic stations by suspending aerials from the high mountain peaks of the Adirondacks and other ranges.

And now, after fifteen years, the idea has come to life again; for according to recent advices (unconfirmed) an immense station for trans-oceanic work, utilizing two mile-high precipitous mountain peaks to support a monster antenna, will be ready for operation late this summer. Water power is to be used for generating the electrical supply and it is confidently announced that the station, which is being erected in a valley between the mountains, near Munich, Bavaria, will easily be heard all over the world.

If the unheard-of dimensions as reported are facts, then the wavelength will be so great and the frequency so low that the signals of the station will be audible without heterodyning. Further advices on the progress of the unparalleled undertaking in radio engineering will be awaited with interest. In the meantime the radio world is wondering if, after all, a vision of long ago is about to be realized. Whether or not it's true is another matter. Anyway, it's interesting.

Emphasis in the Wrong Place

WHEN a man who believes in radio says he cannot afford to buy himself a receiving set—and you learn that this man has given away millions of dollars and is still giving—it seems trite to term that person a remarkable individual. Dr. Russell H. Conwell disclosed this situation as applying to himself personally.

His words carry great weight. And it is more than a little gratifying to have his appreciation of the benefits being derived by boys who are building their own sets out of odds and ends—to know that they gain through radio not technical knowledge alone, but habits of industry, a purposeful pursuit and the mental concentration of creativeness.

In the logically following thought that these boys are not seeking the satisfaction of gazing proudly upon the completed assemblage of wires and knobs and tubes and viewing it as a scientific toy, but rather that their objective is the actual reception of speech and music, there is a lesson for the trade interests concerned with radio.

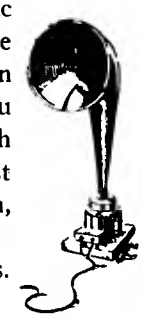
The thing that counts is, not what you receive with, but what you receive.

In our opinion, a lot of radio apparatus is being bought —and sold—on the wrong basis. Expert salesmen are selling radio receivers, and there are many more self-styled "keen buyers," but the commodity they discuss and deal in consists of such details as variometers, sockets, circuits and wiring, tubes and cabinets, gold plating, and piano finish.

With due respect to the importance and essential character of such things, radio is more than that, and he who thinks it is only apparatus is fooling himself very badly.

The set is but the medium, the magic carpet, the Aladdin's lamp, the key that opens the door upon new spheres of thought and activity. When you buy a receiving set you are not getting so many ounces and pounds of metal, insulation, wood and finish, nor so many hours of labor in manufacturing it.

The receiver gives you all these as incidentals; its main purpose and use to you is to act as the medium, to carry you away to strange fields like the magic carpet, to rub the lamp that the genii of space may be at your command, to turn the key in the door of new ideas. With a radio set you are invited to share the riches of the air with hundreds of thousands, to partake of feast after feast of beauty, knowledge, instruction, amusement and entertainment.



The radio set is not the end, but the means.

—THE EDITOR.

ANNA CASE, whose glorious voice once was known only to opera goers, has two radio distinctions: pioneering in New York's first series of broadcast concerts, and singing this year to the greatest audience in history. How she was thrilled is told on page 34

Radio Celebrities Seen at Close Range

Robert Havcn Schauffler is sponsor for the pharmacopoeia of medical music and the designation Radio, M.D., explained on page 35

Gaze upon the popular trio of composers—Kin Carroll, with the Uke; Art Conrad, with the hat, and Harry Hanbury, with the mustache

Mrs. Martin Johnson uses devices other than the microphone for entertainment and education; here she is, in Africa, with her motion picture camera—page 33 tells of it

Who's In the Radio Audience?—Everybody

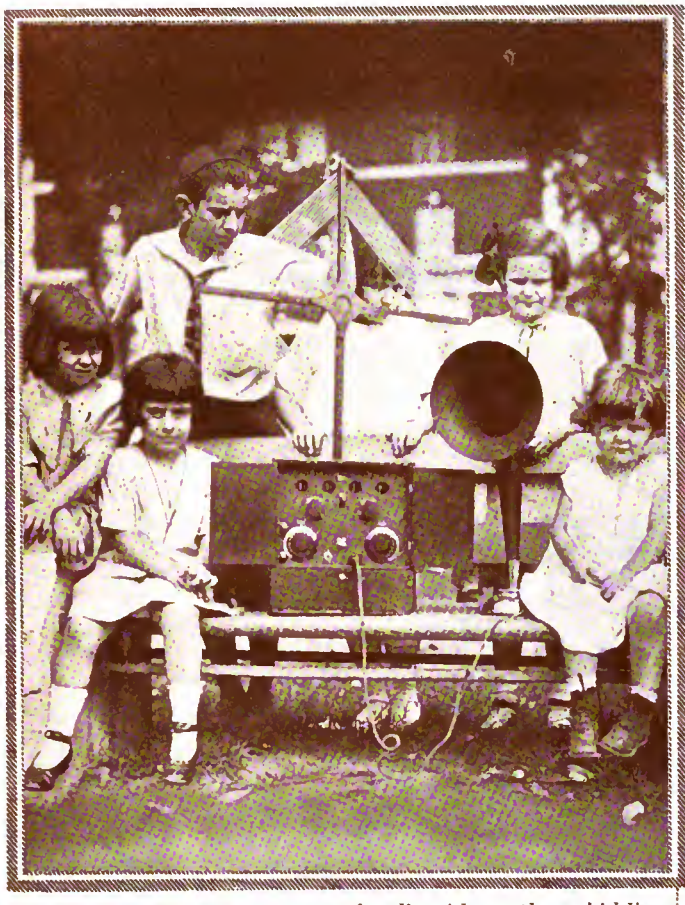
Inspiration plus recreation is credited to this radio arrangement by Ivan Andre, noted artist

Hot wiggly dog! Breakfast, a swim and a broadcast sermon are all represented here, says Lucy Fox, of movie fame; and she otta know; it's her picture

Michael Bourke, proud of his Brooklyn home, his slide tuner and adjustable sandwich, appreciates the noon hour broadcasting in a manner way above the heads of most people

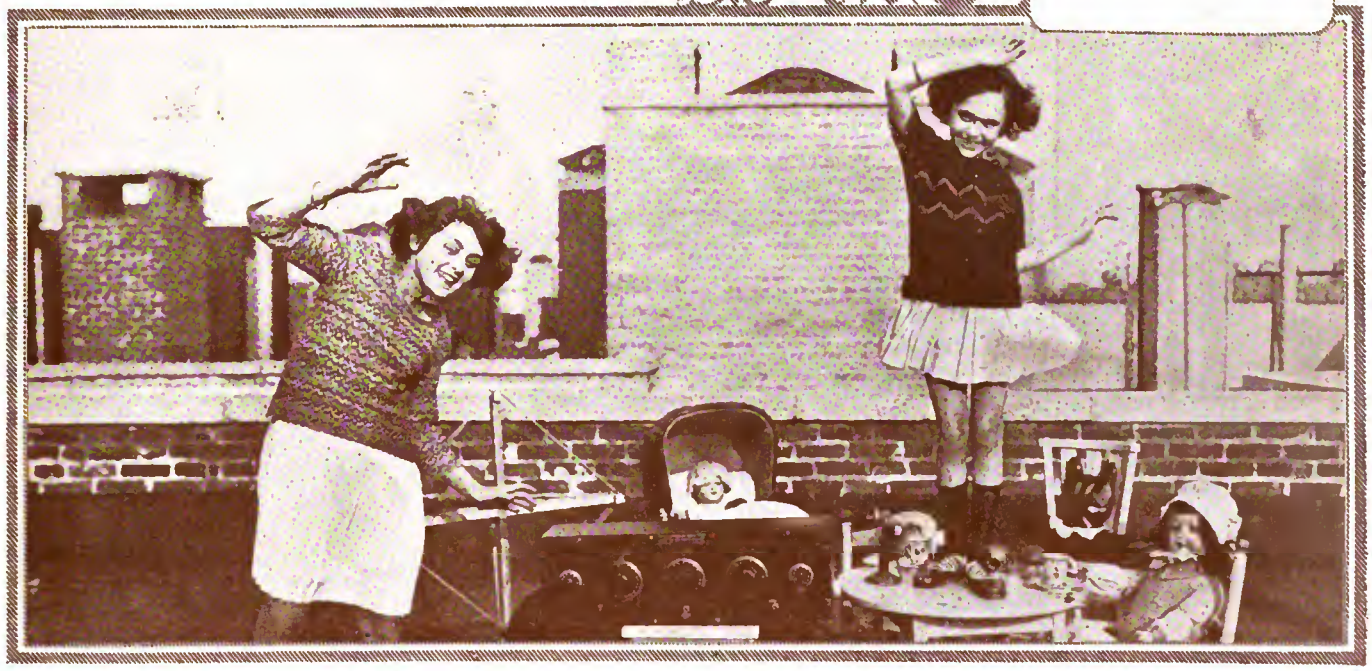
"Iss it static, Mr. Gallagher?" "No, it's DX, Mr. Shean!" Actually—in person; yes, the famous comedians doing their stuff back stage in the Ziegfeld Follies

Childhood's Happy Hours Modernized



If Edmund Keene ever runs for President, these kiddies have promised to vote for the New Yorker who brings his portable set to Central Park every day to please them

The Beth Israel Hospital patients keep happy and smiling, for each room now has broadcast receiving equipment



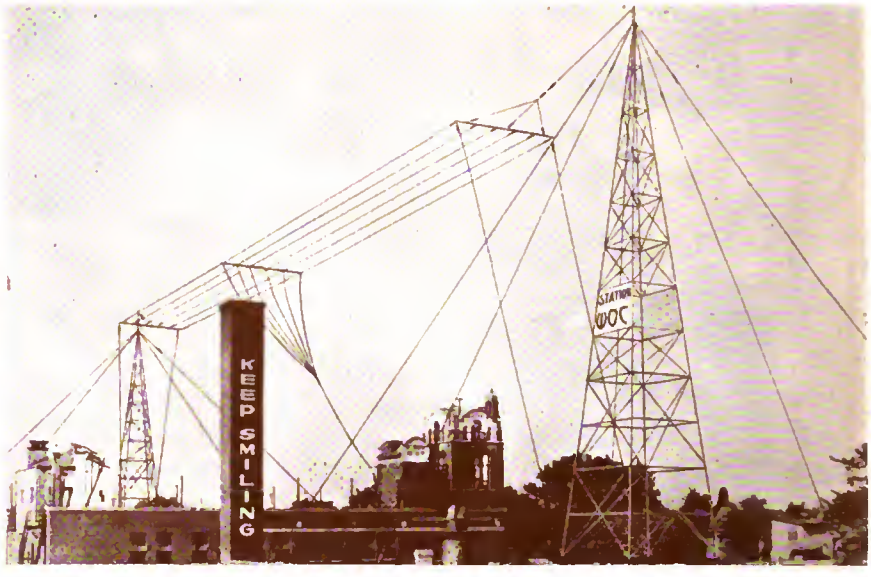
The long grind of rehearsals has become a lark for the "Roth Kids," for on the roof of their home they now alternate between playing with their dolls and trying out the new steps for their vaudeville act with radio accompaniment

Voices You Have Heard

Announcers, Artist and Studios

Announcer BWS (Stanley W. Barnett) of WOC, Davenport

KFI, the station of Earle C. Anthony, Inc., at Los Angeles, is operated by the tall young man seen in the photo, A. MacDonald, who has to handle also the remote control programs from the studios of two local newspapers and a hotel, and incidentally an organization comprising sixty-one musical organizations which furnish programs for the good of the community



Flood lighting makes these towers visible at night for miles, for this antenna system marks the highest point in the Tri-Cities, 300 feet above the Mississippi

When George S. Neill speaks into the microphone at KFI the studio and George S. take on the appearance above, enhanced more than a little, incidentally, by the presence of Esther Ritter, at the piano. A slogan that runs: "Their line is gone out through all the earth and their words to the end of the earth," and the electric chimes which open and close the program are familiar features of this Los Angeles station

How Big Is the Radio Audience?

Some Say the Radio Audience is a Million—Some Say It Totals Many Millions

SOME say the radio audience is a million. Some say the number of listeners totals many millions. Nobody knows, everybody guesses. The best guess to date, made by THE WIRELESS AGE as a result of a country-wide survey, is—

2,790,045

That is admittedly but an estimate. It was arrived at by tabulating reports received from broadcasting stations of all classes. With just two exceptions, these reports of the broadcasters were in themselves estimates, and were by no means based upon actual counting of the number of receiving sets within their territories. The figure of 2,790,045, therefore represents (in the main) a country-wide average of the estimates. It is the consensus of opinion of the broadcasters as to the number of receivers in use—arrived at by grouping the broadcasters according to the radio districts, tabulating the reports from each district and then consolidating the district totals into a grand total covering the whole country.

Obviously this figure of over two and three-quarter millions, representing the number of receiving sets, must represent only a portion of the total of radio audience. At least 99 per cent. of the receiving sets are operated in homes, in other words they are family possessions. If the average family is considered to contain four persons, the total radio audience therefore, may be considered to consist of

11,160,180

Of course this audience never as yet has been reached with one program. It would require simultaneous transmission by at least nine stations to broadcast to this enormous audience of about 10 per cent. of the American people. It is an entirely feasible project in the present status of wire transmission of distant events, and no doubt at some time in the near future it will be accomplished, as a further development of the dessemination of the speeches of President Harding during his trip to Alaska.

HOW LARGE IS THE RADIO AUDIENCE?

Tabulating the estimates of the broadcasters.

Radio Districts	
First	92,500
Second	900,000
Third	210,000
Fourth	85,000
Fifth	34,876
Sixth	12,208
Seventh	67,000
Eighth	986,000
Ninth	402,461
Total	2,790,045

The social hour brings together part of the radio audience

The Results of a Country-Wide Survey by THE WIRELESS AGE

In the meantime artists and speakers visiting the studios of the different broadcasting stations have a very large audience waiting for them, ranging from over 900,000 in the second and eighth districts, covering the most densely populated sections of the country, to the low figure of some 12,000 in the sixth district, on the Pacific Coast. The latter figure incidentally is considered to be abnormally low, and probably is erroneous, but reports of several low-power transmitters in this district drag the average down far below that of the others.

The questionnaire sent by THE WIRELESS AGE to all broadcasting stations asked for reports on the number of letters received from the audience, and the number of duplicate names among them, and it is from these reports that the tabulations have been made.

Strangely enough, however, very few stations have been keeping accurate account of their mail, most of them

In rural districts the country school house is a gathering place for radio audiences where selected programs are listened to from loud-speaker outfits

figures. Only a very small percentage showed evidently accurate figures, as for example, those of Station WPAH, which reported 12,383 letters received in four months. In the main the stations estimate their mail in round figures.

The most definite information possessed by any broadcasting station is contained in the records of Station KSD, which made as the basis of its report a town-to-town canvass last winter. KSD writes as follows:

"In reply to your inquiry, 'How Large is the Radio Audience,' station KSD of the *St. Louis Post-Dispatch* has something more than a guess to offer in reply. While these figures are approximate, they at least have substantial foundation for the making of an estimate.

"Last Fall the *Post-Dispatch* made an actual canvass in some 200 small cities of Missouri, Illinois, Iowa, Arkansas and Texas, widely scattered, to find out how many receiving sets, in each place, were capable of hearing KSD. This, of course, eliminated crystal sets.

"These figures were tabulated, and then in the middle of last January, the same towns were canvassed to ascertain what increase there had been in the meantime. It may interest you to know that the average increase, for the 200 towns, was well over 300 per cent. and in some cases ran over 500 per cent.

"The total population investigated was 856,000, giving an average of a little more than 4,000 to each town. This eliminated our own St. Louis audience, and those in the larger cities of the five states.

"With the figures thus obtained we found there was a receiving set capable of hearing KSD to every 130 of population, or, in the five states mentioned, 155,900 sets.

"The broadcasting of President Harding's speech on the World Court, delivered in St. Louis, June 21 last, gave us an excellent opportunity to check up on the use of these sets. I will refer merely to the mail from Illinois alone.

"From many scores of cities in that state reports came of lawn-parties which gathered to hear the President's address on loud speakers. The attendance at these lawn parties varied from 40 to 150 each. Eight letters alone gave a total audience of more than 1,000. Similar gatherings were held in country churches. Nearly all country banks, in this part of the Mississippi Valley, have very fine receiving sets since KSD is broadcasting news and a variety of market reports eight times a day. These banks had their audiences, too, in some cases as high as a thousand.

"Where President Harding's speech was heard in homes it was quite usual to find letters signed by all the listeners. These signatures, at a guess, averaged at least eight each.

"So far as St. Louis and its suburbs are concerned we know that, including crystal sets, there are at least 60,000 homes with radio apparatus. These figures also are the result of canvass and investigation. It would be absurd to say that less than two persons heard the President speaking by means of each of the radio sets in St. Louis homes and suburbs. From these reports, and the figures collected in the five states before mentioned, it can be conservatively estimated that no less than a million persons heard the President on the night of June 21.

"Reports were received, however, from twenty-four states. Naturally the number of listeners decreased as we got further from St. Louis. We have no estimate on sets in other states."

One of the most popular broadcasting stations, and one that has achieved an extraordinarily wide range is WGY at Schenectady, New York, operated by the General Electric Company. Dur-

Breakfast, sports and radio! The lone listener, in the aggregate forms a large part of the radio audience

The old and the young renew their companionship through radio and make up a considerable part of the radio fraternity

The mobile radio members necessarily carry their apparatus with them on tours, hikes and voyages to enjoy the concerts—while Mary in the kitchen is endeared to her domestic life because Mistress has admitted her to radio land

ing the first sixteen months of its operation, the company received 65,000 letters from listeners scattered over the United States and from points as widely separated as Hawaii on one side, England on the other, Canada to the north and Chile in the south.

Out of this number of 65,000 some 13,000 represent duplicate names. If one out of ten persons who heard WGY during that period wrote to the station it would mean that the total number listening was 520,000. If, however, only one in a hundred wrote during that period, the audience must have been 5,200,000.

There is revealed the fundamental trouble in estimating the size of the radio audience. No one knows what proportion of the audience is addicted to letter writing. The factor of duplicate names affords the only possible guide. From WGY's experience it will be seen that less than one-quarter of the audience has written more than once during a period of sixteen months. If it be assumed that the same ratio holds good between those who write and those who do not, it would be proper to consider that WGY's 65,000 letters represent one-quarter of its audience, which therefore, would total 260,000. The average estimate of the stations in the eighth district in which WGY is located is 986,000, so it would seem that the ratio of duplicate names is perhaps not such a good guide as might be expected.

Perhaps a better guide to the situation would be to take the figures of KSD, which found one receiver to every 130 of the population within its range outside of St. Louis. On this basis, the total number of receivers in the country and suburban districts would be approximately 1,000,000, while the large cities might easily bring it up to a million and a half. This of course is far under the total estimate of two and three-quarter millions, revealed by the survey of THE WIRELESS AGE. It is entirely likely, however, that the difference may be accounted for by the fact that the KSD survey did not include crystal receivers. It will be seen, therefore, that when KSD's figures are corrected by an estimate of the number of crystal receivers located in large cities near the powerful broadcasting stations, the total will come very close to that arrived at by THE WIRELESS AGE.

The real figures, of course, never will be known unless the radio receiving set is brought under Federal supervision, with a license required. However, it is obvious from this survey, inaccurate as it is, and based on the guesswork of many different persons, that the broadcasters are reaching a tremendous section of the public.

That is nothing new. They have known it for a long time, and so have all those who have gone on the air with interesting features. The big test of anything is "Does it work?" and as everybody knows who has had contact with broadcasting, it works like magic.

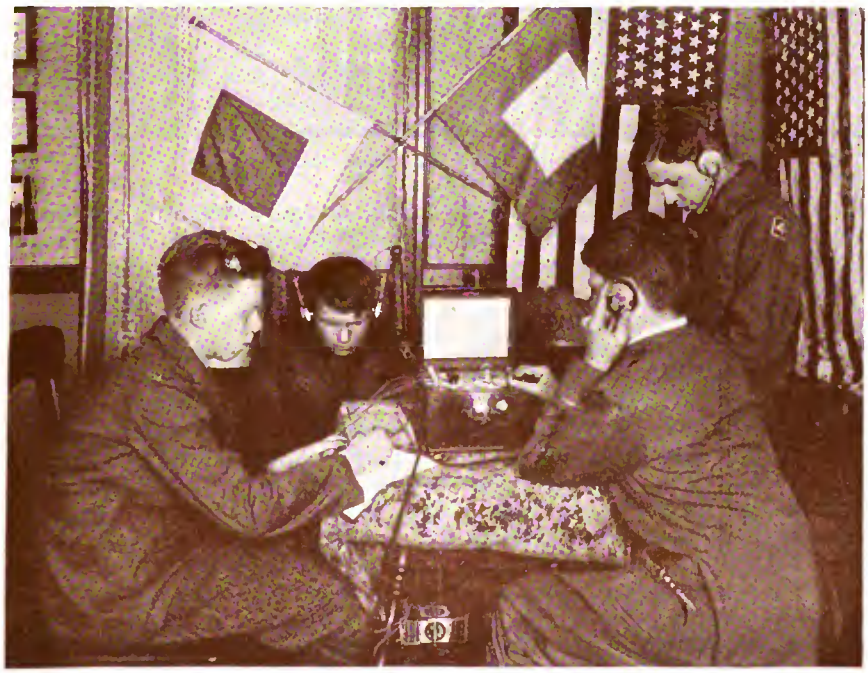
Following are a few quotations from broadcasters replying to THE WIRELESS AGE's request for their estimate as to the size of their audience.

"Letters received are only about 4 per cent. of telephone calls received. How does that figure out?"—KDYM.

"We have received 12,000 letters in a single week. Our mail showed 7,367 persons listening to our program broadcast at 5:45 a. m. Easter morning."—WOC.

"There are 225 receiving sets in Reno and Sparks, twin cities. All hear us so we took a radio census of the two towns."—KFFR.

"It is very difficult to estimate the number of letters we have received as the number received daily has varied considerably. We have received as high as 200 letters a day, and in some cases where we have had special speakers or a specially good concert this



The Boy Scouts are old-time members of the radio audience and recent broadcast developments have only increased their enthusiastic interest

The letters were acknowledged by a post card and on account of the great number received no regular file has been made of the letters so that we cannot estimate the number of duplicates.

"During the summer months our correspondence has fallen off considerably, due, we believe, to the fact that people do not care to write in the warm weather and the fact that we may not be heard at such distant points as during the winter.

"I am sorry that we cannot give you any definite, or any approximate information which would be representative of our response, outside of the fact that approximately 200 letters are received daily. This may be high for some periods."—KDKA.

"We have never kept exact estimate of those who have written us. Our station opened in July, 1922; since that time we have an approximate total of about 50,000 letters. Some of these letters have been signed by as many as 100 people. In 90 per cent. of the total given the letters commented on a particular concert or artist. On one concert alone we received 7,500 written messages. We do not estimate our telephone messages, which are many in the course of a week. We might also state that we have in the neighborhood of 100,000 who listen in to us daily, so far as we are able to determine. which I have mentioned were nearly all, with but few exceptions, from the New England states."—WNAC.

"Station WMAQ operated by *The Daily News* began operating the beginning of 1922, since then it has received approximately 12,000 letters of which 2,000 are duplicates, that is letters coming from the same person.

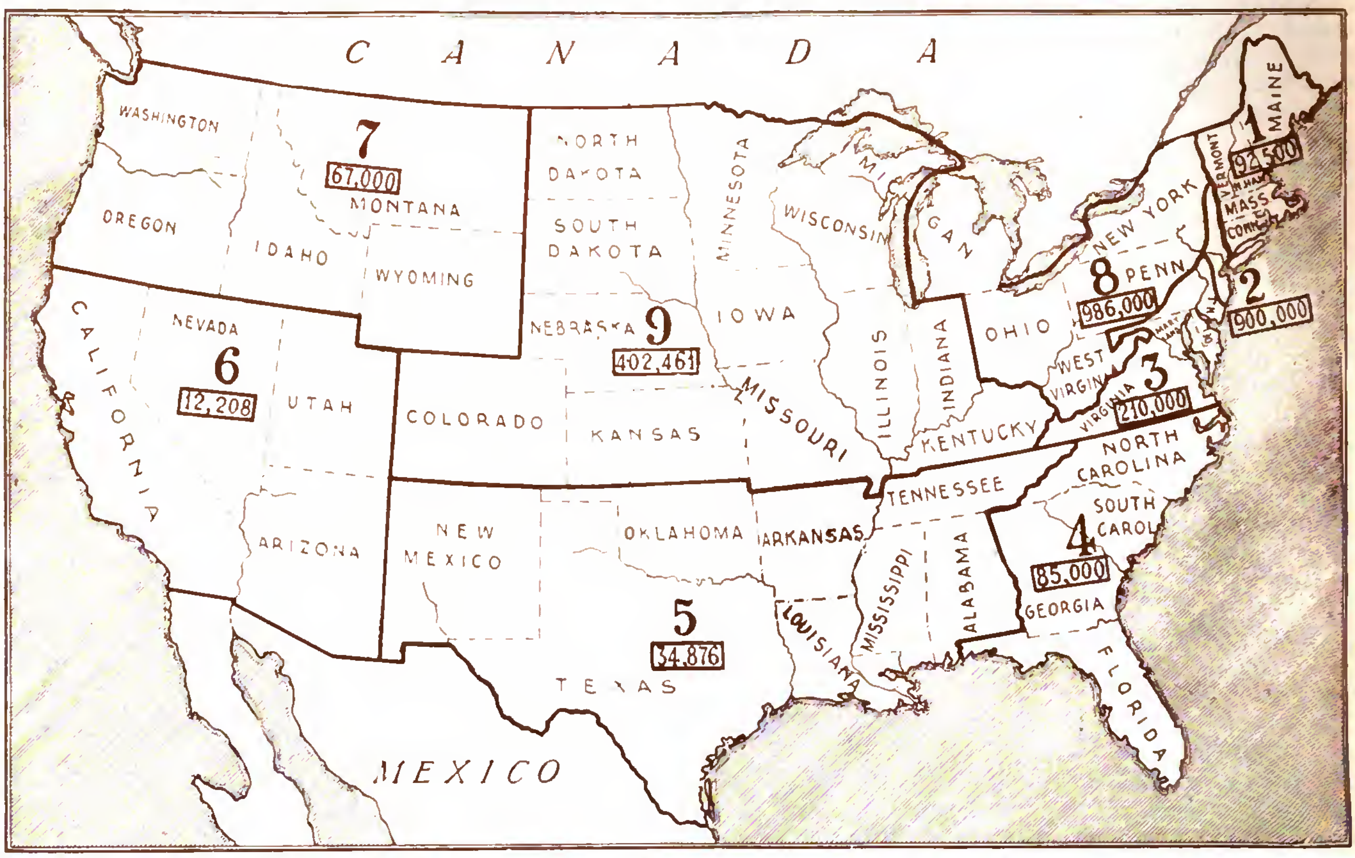
"In our files we have about 10,000 cards from individuals who have heard our programs, and who have sought technical information. About half of the letters are for performers. We estimate that not more than 5 per cent. of our listeners have written us. Using that as a basis, about 200,000 sets have picked up our programs. For each set there is an average audience of three, making WMAQ's audience 600,000 persons.

"I might add that our audience includes persons in every state in the Union, and also many from Canada. Half of our audience is in Chicago, judging from the letters received. Outside of Chicago, another quarter of the audience lives in Illinois. This makes three-eighths of our audience scattered throughout the United States. Therefore, it would seem that there are 300,000 Chicagoans in our audience, 75,000 are outside of Chicago and in Illinois, and 225,000 are scattered throughout the United States. You can see from this estimate that one out of tener to our station."—WMAQ.

"Station WWB does not solicit correspondence because an experience of doing so made the matter of handling it very burdensome. Upon the occasion of one single program, when such solicitation was made, we received more than 250 letters and post cards, including a few telegrams. Therefore, our answer to your questionnaire is not conclusive either for yourselves or us.

"We believe that there are about 3,000 receiving sets in our immediate vicinity, this including three sizable towns in addition to Canton. It is not impossible that a reasonable approximation of the total number of sets might be had through direct appeal to listeners by the broadcast stations. We know many people here, however, who listen to and enjoy our programs, but accept the service as purely matter of course, never thinking to send a post card.

"One interesting phase of the thing would be to get the number of listeners who ignore the clock to hear programs. As an example of this, we were putting on a test program one morning at 2 o'clock, Eastern time, and secured nearly 200 letters from all parts of the country. And our station is of limited power, being but 100 watts. This test, however, brought letters from early morning hour listeners in 22 states of the Union."—WWB.



Map showing the distribution of the vast radio audience throughout the United States

Paradise for the Deaf

By John G. Gebhard, Sr.

Mr. and Mrs. John G. Gebhard, Sr. listening-in

WHEN Tantalus of old displeased the gods, they fixed him immovably, up to his chin, in a stream of cool, crystal water, with the most luscious of fruits hanging just over his head. Consumed with burning thirst, his parched lips came just a trifle short of being able to reach the cooling water. Tortured with hunger, the tempting fruit hung just beyond his eager grasp. The situation was "Tantalizing."

This is precisely the position of many thousands of deaf people today. I am one of them, on the shady side of sixty, or was, before getting my radio. Since then I have been living on the sunny side. My friends say that I am no longer an aging man of 65, but have been transformed into five lively boys of 12 years, and then some. The radio "transformer" did it.

Let me draw two word-pictures for my deaf friends. They will recognize the first at once. Would that every one of them might, by his own experience, know the joys of the second. The first picture is a sketch of a deaf man's "Paradise Lost." Many a time before getting my radio receiver, friends would beg me to go to some public entertainment. Half the things said I could not hear. People laughed at and applauded the brights bits of humor (at which a speaker always drops his voice, to make them more effective), while I would sit, looking like a dumb idiot that didn't know enough to laugh at good fun. When the meeting was out, I would vow never again to be caught in a public gathering, no matter what good things were promised in the way of speeches.

Now for my "Paradise Regained." There has been a mighty change. Last December a friend said to me, "Mr. Gebhard, you ought to have a radio. You would enjoy it immensely."

"No," I replied, "radios are not for us deaf people. We have trouble enough trying to hear our friends in a small room. Where would we be, trying with our poor ears to hear sounds coming through fifty or a hundred miles of space?"

"Well, I think you could hear a good radio. At any rate, come over and try mine."

I went, and heard, and then and there became inoculated with the radio germ, and the happy victim of a violent attack of Radioitis.

How I secured my radio is a story by itself, but I got one, and within ten successive days I had broken into the broadcasting world, and my deaf ears had enjoyed such feasts of auditory good things as I had not known in ten preceding years. I had heard with perfect clearness concerts of the finest vocal and instrumental music; after-dinner speeches given in the greatest hotels of the metropolis; and speaking delivered in social, political and religious meetings. I had sat with perfect delight, listening to the ablest of speakers, to governors and senators, to Salvation Army leaders and cabinet ministers, and to other specialists in every line of human effort and interest.

When I came away from these "radio meetings," my face was not stolid, disappointed, resigned to hopeless deafness; nor was my step slow and purposeless. Deaf though I was, I had enjoyed an evening of solid hearing. Every feature of my countenance was alive—with "radio frequency"—and my step was as springy as a boy's. I caught every broadcast bit of humor on the fly; no first or second bound for me now, to say nothing of entirely missing the fun.

Deaf people have had so much promised them in the way of helps to hearing, and have been disappointed so often and so sadly, that I would be the last to raise one more false hope in their hearts in this direction. So I want to describe fully in this article just what radio broadcasting has done for the deaf and how it has done it.

As a deaf person of small means I had spent much more than I could well afford on helps to hearing, every one of which has gone into the discard. None of them did what I wanted. But radio broadcasting has opened wide a new and glorious avenue to the joys of hearing, for all who can use a good telephone. Not all deaf people can use a phone, but a large proportion of them can, and many of them can hear a good phone better than ordinary conversation.

While perhaps not having deaf people especially in mind, the broadcasting stations have done three things for them which no other agency has ever accomplished. There are three reasons why the deaf do not hear distinctly. First, because a speaker has a poor voice, soft or weak, with but little resonance. Second, because a good voice is badly used, the speaking being too rapid, the enunciation indistinct, and the voice dropping at the vital points of humor or of pathos. Third, because ever so good a voice, if out of the range of a deaf person's hearing, never conveys the words distinctly.

Right here radio broadcasting comes in. The seller of the best helps to hearing may give you a first-class hearing instrument, which will amplify sound, but there is one thing which he does not and cannot do—he does not guarantee that you will be sure to hear the sounds and voices that come to

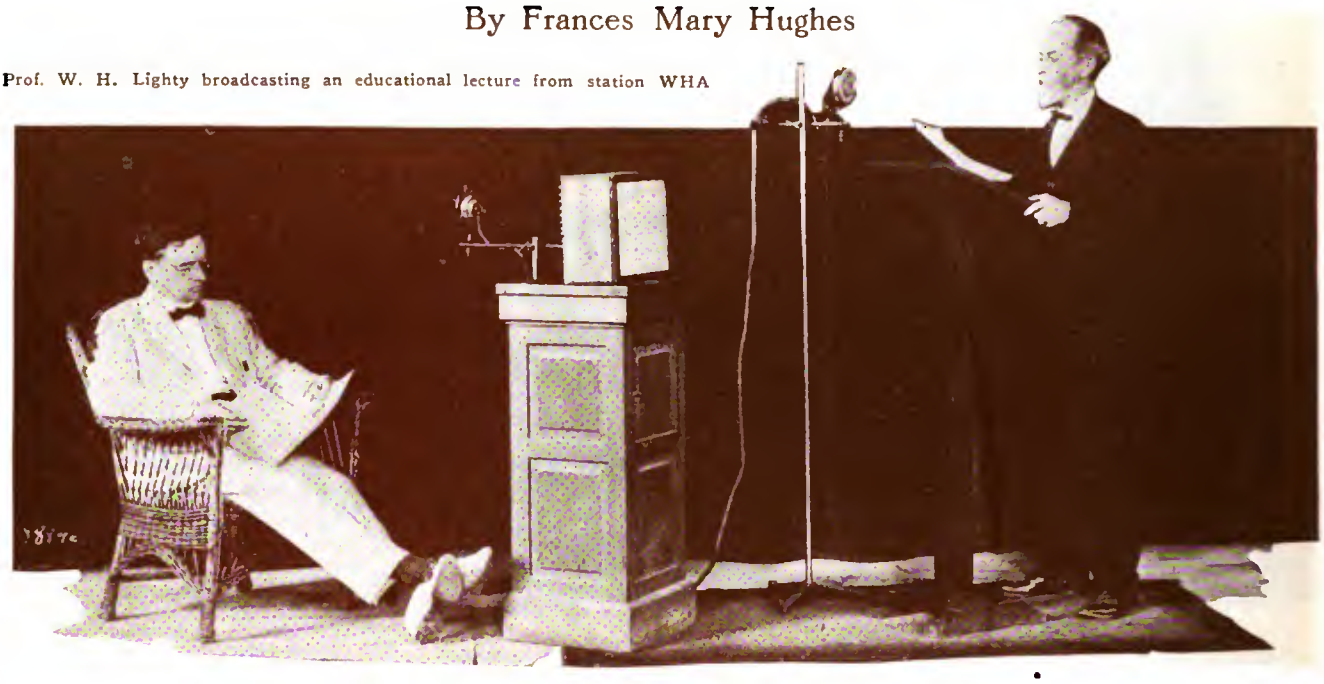
(*Continued on page* 46)

University Education by Radio

Interpreting the Real University of Work, Research, Scholarly Achievement and High Ideals to the People by Means of Radio

By Frances Mary Hughes

Prof. W. H. Lighty broadcasting an educational lecture from station WHA



EDUCATION by radio! Fostered by the leading universities in America, such a thing is actually coming to pass. W. H. Kiekhofer, professor of economics at the University of Wisconsin, once laughingly said to a class with a large absence record: "Oh, well, in a few years from now I shall probably be lecturing into the air; the students will lazily turn over in their beds and tune in, and the hour's work will be done without the bother of rising and dressing and breakfasting, and walking up the hill to class."

But although such a thing has not yet come to pass among the student body, that service is being rendered by the faculty of the University of Wisconsin to all individuals who desire it, over an area bounded roughly by California, Oregon, Canada, the Atlantic coast, Texas, and Porto Rico, on a wave length of 360 meters, by station WHA.

W. H. Lighty, secretary of the correspondence study department, extension division, of the University of Wisconsin, and head of the educational broadcasting project of that University, says: "It is not enough to discover truth and record results. The university must make the truth known so that it may have its chance to prevail among men. . . . Institutions of higher learning have their opportunity in the present, and their obligations to the future, to make available the usable knowledge in forms that guide men and women in their decisions on the basis of known facts."

When the plan was first put into daily operation, May 5, 1922, a noonday program was offered, including a brief, educational, informational address, weather and market reports, time signals and music. At first, the type of addresses followed a somewhat rigid order.

Monday: A talk on the fine inner spirit and meaning of the University. One such address was that given on May 27, 1922, by Prof. E. H. Gardner on "The Spirit of the University of Wisconsin." He said in part: "Wisconsin Spirit burned brightest in the Great War, with a flame of devotion to country and to right. . . . Let one story be told as typical of the fruits of the Wisconsin Spirit. . . . The war is won. . . . A group of officers, English and American, are discussing the work of the Allies, and one, an American, asks what, in their judgment, turned the tide of victory. 'I answer for the Grand Fleet,' replied the ranking Englishman, 'when I say that the submarine detector, invention of an American university professor, made certain the success of the Allies on the sea.'

"But if you ask Max Mason, he disclaims the credit, saying that the department of physics worked as one man in the war, and that the spirit of coöperative research in the service of mankind, developed before the war as part of the spirit of Wisconsin, made possible this invention.

"We of Wisconsin, students, alumni, and faculty, are inheritors of this renown. Will it be sustained? Will the light of the University be kept burning, and Wisconsin Spirit know a more glorious future?"

Tuesday: Representative men and women of the faculty give brief addresses on their respective subjects. When spring was a newcomer among us, Professor Pearse of the zoology department spoke on "Signs of Spring." He spoke of the new and interesting things within everyone's scope of enjoyment; bursting buds, the leaves, the flowers, the coming of the birds, and then he elaborated on these things, closing by exclaiming enthusiastically: "Gosh! I'm glad spring's here, aren't you? Good-bye."

And comments on the talk came back to the department punctuated with expressions like these: "Say, they've got a *regular* fellow over there at the U in the zoology department!" "He's all right!" "That prof's an honest-to-goodness man!"

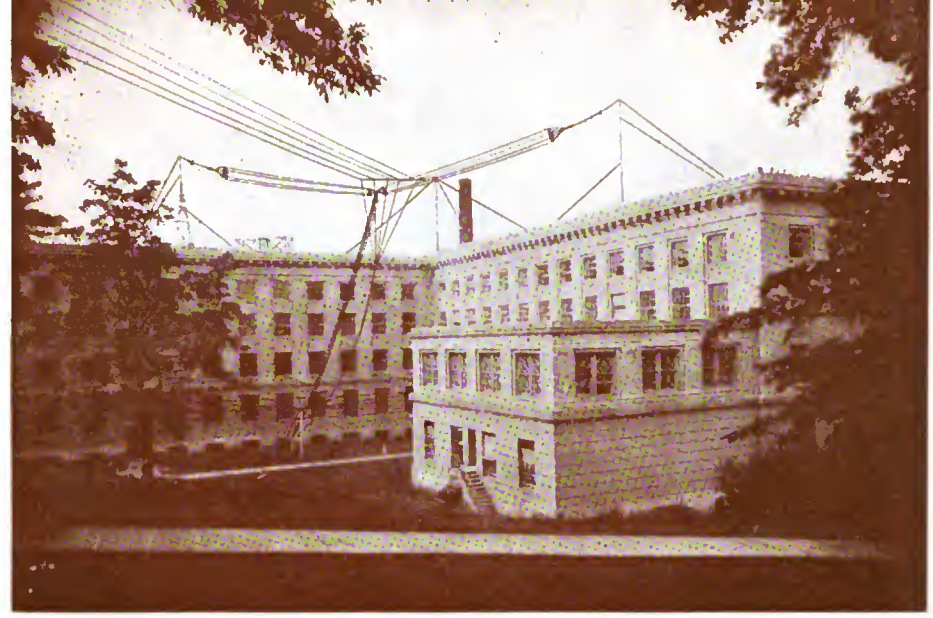
Does the feeling back of such remarks mean a closer sympathy between the taxpayer and his State university? Rest assured that it does.

The aim of the broadcasting is to interpret the real university to the people of the State; the university of work, of research, of scholarly achievement, of high ideals of manhood and womanhood. To too many people

means just dances and fraternities and much money needed for clothes and gasoline.

Wednesday: A message from any department able to discuss health promotion, disease prevention, and general welfare. One day a talk was given on a cure for diabetes. As soon after as the mails could bring it, a letter came from out of the State, asking for the name of the man who had spoken. It was from the father of a little girl who was suffering from diabetes. He had tuned-in too late to get the name of the speaker, but the talk put hope in his heart.

Dr. J. S. Evans, professor of clinical medicine, told one Wednesday of how the university clinic came into being, and of how its plan of work might be profitably followed in every community. Direct help, you see, is the aim of the service. Fourteen years ago a student was taken ill, and did not consult a physician at once. As a result, fifty students were stricken with typhoid, and nine died. From that time on, every student at the University of Wisconsin has had to "undergo a physical examination upon entrance, and in case of absence from classes on account of illness must report to the University clinic for an excuse." This gives the physician an opportunity to discover any threatened disease that may be lurking among the students of the University, and gives them a further opportunity to correct any defects in the health of the individual student. "What has been accomplished for the students at the University," states Dr. Evans, "can be and should be accomplished for all the people of the State. The people of the community should look upon their physician as an adviser in the days of health, instead of as only a savior in the days of illness."



View of the Physics Building, University of Wisconsin, showing antenna and counterpoise system

Thursday: Addresses to stimulate ideals of personal fitness, such as talks on athletics, recreations, etc., etc. Prof. J. E. Jones of the physical education department has talked on water sports, and Dr. J. C. Elsom of the same department spoke last spring on "Springtime Lure for Out-Door Recreation." Still other talks have been given on wood-craft, and similar subjects.

Friday: Things of artistic significance are featured once a week. Such subjects as art in the home, readings from literature, and author's reading of poetry, the latest being given by Prof. William Ellery Leonard, are among the things used for such a program.

Saturday: Technical and scientific subjects. Prof. M. F. Guyer of the zoology department recently gave a talk on heredity. A few days later he was down at the Northwestern station and was approached by a man in overalls who said: "You are Professor Guyer?" Mr. Guyer acknowledged his identity. "Well," continued the other, "I'd like to talk to you about the lecture you gave the other night on heredity."

It is one of the earnest aims of the committee in charge of the programs to have the talks given in layman's English. Director Cheney of Tufts College puts it well when he says: "Avoid technical terms. Speak in terms of literary art, rather than in the narrower terms of chemistry, mathematics, or engineering."

The late President Charles R. Van Hise said in his inaugural address that he "should never rest content until the beneficent influence of the University of Wisconsin should be felt in every home in the State." He was not thinking of radio achievement, but what matters the instrument, as long as results are obtained?

Professor J. H. Mathews, director of the course in chemistry, broadcast a talk not long ago in which he mentioned a certain valuable book on chemistry which was obtainable from the library. The very next day there were calls for that book.

"The response that has come to the University on radio broadcasting has been most interesting and stimulating," declares Mr. Lighty. "Personal letters from listeners to broadcasting professors have often been surprising and incontrovertibly convincing to

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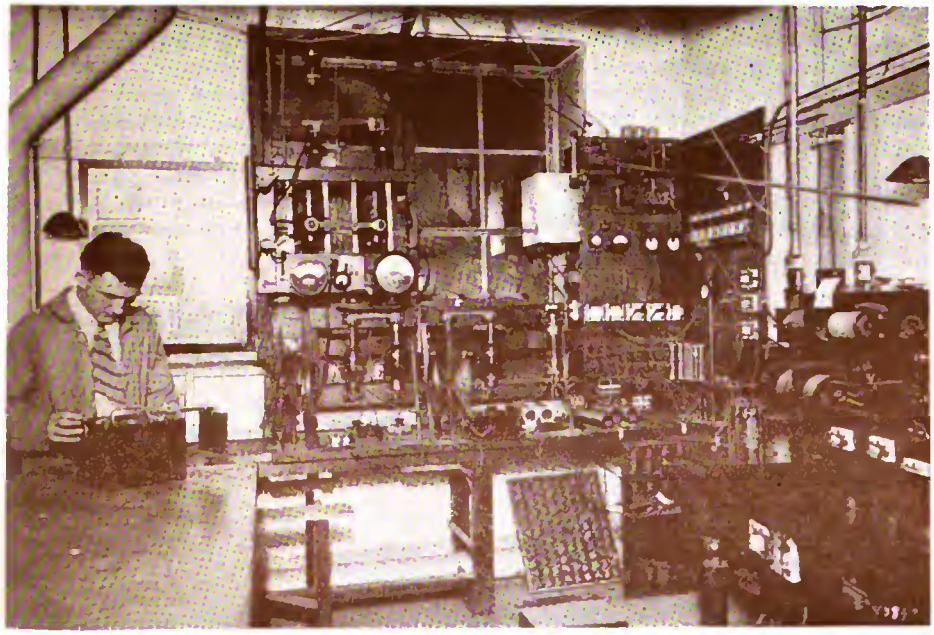


The 500-watt radiophone transmitter of the University of Wisconsin, station WHA

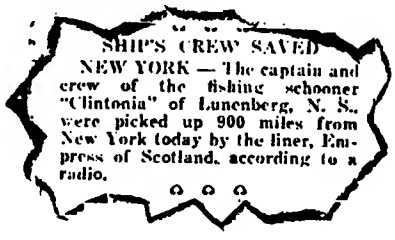
Uncle Sam's Seagoing Humanitarians Depend on Wireless for Communication with Ships and Shore—Many Lives Saved

By S. R. Winters

"A FINE night for trouble," the officer on duty remarked to the quartermaster. "I'll bet we have a call before morning," continued this officer, who had a "hunch" of distress on the stormy waters. His words had scarcely been uttered, when the radio operator approached him, with a slip of paper in his hand, and reported: "Sir, an SOS from a coasting steamer says that the schooner *Sunbeam,* all sails blown away, is rolling helplessly 55 miles off shore." The reply of the officer was, "Keep in communication and get the usual data." Subsequently, the radio operator determined the accurate position of the vessel in distress. All that night, two days, and another night, the cutter *Manning* ploughed the storm-tossed sea until the distressed schooner was rescued.

True story, this—and the recital of only one of numerous successful and heroic efforts of the Coast Guard of the United States Treasury Department in lessening the toll of life and property exacted by angry winds and waters. The part that radio has played in this humanitarian service of rendering assistance to mariners and passengers on shipwrecked vessels is one of the outstanding contributions of this speedy vehicle of communication. The wireless telephone and telegraph, with all its useful applications on land, really finds its most indispensable opportunity for service where the telegraph and telephone wires terminate and endless stretches of waters interrupt all land-line communication systems. Radio apparatus constitutes the one link between shore and vessel as well as between different ships sailing the high seas.

The Coast Guard is Uncle Sam's emergency service and while it has perfunctory duties to perform, such as the protection of customs revenue and the safeguarding of game and fisheries in Alaska, its activities are essentially of a humanitarian character. Somebody has fittingly described this branch of the Federal Government as "Uncle Sam's Coast Guard Sentinels—those soldiers of humanity." Wireless telegraphy has been an indispensable instru-



SHIP'S CREW SAVED

NEW YORK — The captain and crew of the fishing schooner "Clintonia" of Lunenberg, N. S., were picked up 900 miles from New York today by the liner, Empress of Scotland, according to a radio.

ment of service on Coast Guard cutters since this form of communication demonstrated its value on passenger ships and cargo-carrying vessels many years ago. At present, the 37 active cruising cutters, whose operations embrace the Atlantic and Pacific Coasts, Gulf Coast, Alaska, and Honolulu, are all equipped with apparatus for the transmission and reception of wireless messages. For instance, Coast Guard vessels sailing along the Pacific Coast "pick up" distress signals sent from Honolulu.

"The steamship *Neptune,* Liverpool to New York, is reported drifting in heavy seas, leaking badly, engines disabled, 280 miles east of New York. The United States Coast Guard cutter *Seneca* standing by"—with certain modifications in text, this is a report appearing in print with periodic frequency. The short message indicates that radio telegraphy has served a humanitarian purpose, and that the Coast Guard has been instrumental in the rescuing of life and property, and possibly the vessel itself. All told, 277 Coast Guard stations and 75 cutters, taking into account both cruising vessels and small craft, are ready for immediate action when summoned to render relief to any vessel in distress.

Just as the Coast Guard station is invariably equipped with life-saving apparatus, the cruising cutter does not fail to include radio apparatus on board. The transmitting device, in the main, consists of either a 2-kilowatt spark or arc set. An auxiliary sending outfit, to be used in the case of emergency, consists of a one-half kilowatt spark transmitter. The antenna stretches ordinarily 89 feet above the deck of the vessel. Negotiations are already under way, and orders have been placed for the purchase of tube transmitters. These will eventually displace the arc and spark sets now in use. Four of the modern Coast Guard cutters are electrically-propelled, namely, *Tampa,* Boston; *Haida,* Seattle; *Modoc,* Wilmington, and *Mojave,* Honolulu.

In the old days, before radio had demonstrated its usefulness on board seafaring craft, a Coast Guard cutter leaving Seattle in the spring, for a cruise in Alaskan waters, would be out of touch with civilization until its re-

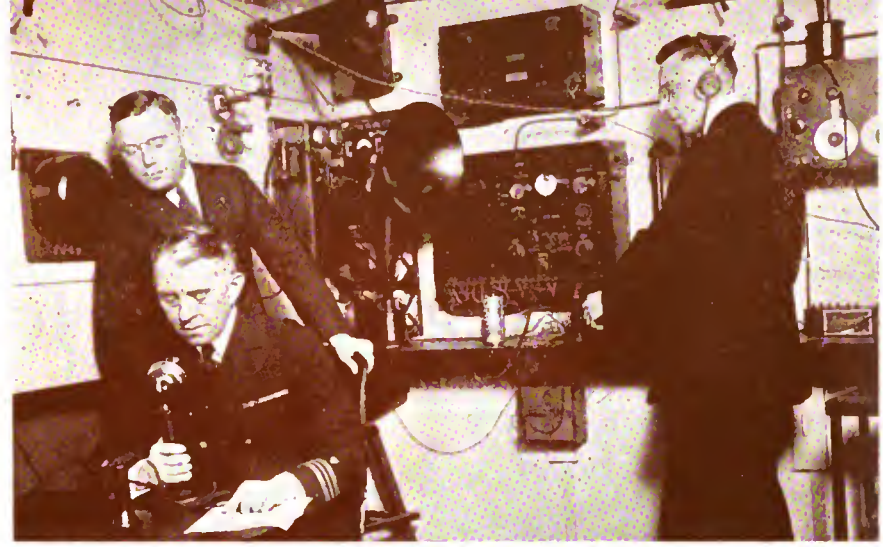
Coast Guard Cutter "Bear" in the frozen north—here too radio annihilates distance and saves lives and property

sional letter would give belated information concerning the whereabouts of the vessel. Today, the Coast Guard cutter *Bear,* cruising in the Bering Sea to Point Barrow, the northern extremity of Alaska, thousands of miles from home waters, by means of wireless telegraphy, is informed of current events daily from all over the world.

The States, too, by use of radio-transmitting apparatus installed on the *Bear,* may be informed periodically, within the twinkling of an eye, of conditions in Alaskan waters. This vessel, carrying the "Sentinels of Uncle Sam," may be 4,200 miles removed from home, but by means of radio telegraphy, Alaska and the States may be visualized as next-door neighbors, gossiping over the back fence. The cutter *Bear* some time ago traversed approximately 4,200 miles of waters in a period of six months. The itinerary included a cruise from San Francisco to Una, Alaska, thence to Point Barrow, the northern extremity of Alaska, and a return home by a more or less zigzag route.

The Coast Guard cutters *Tampa* and *Modoc,* equipped with both transmitting and receiving radio-telegraph apparatus, are compelled to perform a two-fold service when they launch forth, each April, on a ninety-day journey along the Grand Banks off Newfoundland. Other than rendering assistance to vessels in distress, these sentinels of the Federal Government are detailed to locate treacherous icebergs and warn other ships regarding this menace.

The Office of Communications of the United States Navy Department co-operates with the Coast Guard in the dissemination of information relative to derelicts at sea and ships in distress. When such news is received at a wireless station of the Navy Department, the radio operator consults a slate from which he ascertains the officers, stations, and vessels of the Coast Guard to be notified. The operator is informed daily of the location of the Coast Guard cutters in his vicinity, which information makes it possible for him to get into communication with any of them by radio in the course of a few minutes.



"This is NAA, Arlington, Virginia. We take pleasure in introducing Captain F. C. Billard of the United States Coast Guard, who will tell you of the work of the Coast Guard. Captain Billard." The captain is seen at the telephone in NAA's control room, speaking to the radio audience

The Coast Guard, in addition to its wireless facilities, maintains a more extensive telephone system in operation than that of any other Government bureau. All told, 2,000 miles of telephone line are at its command, including 200 miles of telephone submarine cable. Along one stretch of coast, communications can be relayed for 400 miles over the Coast Guard telephone system. The necessity for effective communication facilities, both radio and land-line, is forcibly emphasized by a notable illustration, effected by these "soldiers of humanity." When a great storm visited the coast near Cape Henlopen, Delaware, at the mouth of the Delaware Bay, crews of 22 stranded vessels, numbering 194 persons, were in jeopardy. By effective communication facilities, three stations of the Coast Guard were immediately notified and not a life was lost.

The radio compass is an invaluable ally to this life-saving service since the direction from which wireless signals come are immediately determined and the cutter is enabled to proceed to the ship in distress within the quickest possible time. Both the compass system of the Navy Department and that devised at the Bureau of Standards are employed in aiding storm-tossed vessels.

In addition to "standing watch" along the 10,000 miles of coast line of the United States, the "Sentinels of Uncle Sam" answer the calls of such emergencies as the eruption of Mount Katmai, in Alaska; the ravaging fires at Baltimore and San Francisco, and the hurricane which devastated Galveston. Moreover, among the thirteen duties imposed on this Government bureau, in both war and peace, seven are eminently humanitarian in purpose. For instance, during 1922, the Coast Guard saved the lives or rescued persons in peril to the number of 2,954. The value of vessels assisted during the corresponding period of time amounted to $35,346,765. So whether enforcing the sponge-fishing laws or "throwing out the life line" to vessels in distress, radio telegraphy and telephony constitute an agency of power in the hands of the "Sentinels of Uncle Sam."

The "Bear" at its work amid the icy floes. Its masts are far higher than any sails could be carried—they support something more vital than sails—the radio antenna!

Peggy Hopkins Joyce

All they get by radio is a sample and immediately after broadcasting the box office sales jump

Said

Peggy Hopkins Joyce

When Interviewed by Edwin Hall

THIS little article is principally concerned with a lady who has caused something extraordinary to happen in New York. The something extraordinary is this: the old-fashioned crowd-around-the-stage-door has come back!

Back in the days of 1900 the customers always used to dash out of the theater, run around the corner, and wait impatiently in the crowd for the hero or heroine, or both, to come out and enter his, her or their carriage. "Those days are gone forever," say you with a smile. But, no! Eager crowds, at Seventh Avenue and Fiftieth Street, New York, are a regular thing nowadays. The like of this New York has not seen in many a year.

Nor has there been a visible counterpart of the exceedingly modern young lady who has turned the stage-door clock back some twenty years—Peggy Hopkins Joyce, the Beauty with the Bankroll.

It takes quite a lot of wire-pulling to meet her, but it was accomplished.

The opening interrogation that suggested itself was: "What is radio doing to the theater?"

Peggy Joyce smiled.

"Radio is certainly helping the theater," she said. "People want to see. They aren't satisfied with hearing, alone. Why, by radio all they get is a sample, you might say. It seems to me that people who are afraid to give away samples must be putting out some pretty rotten stuff, don't you think?

"Now this show I am in now, 'The Vanities of 1923,' has been broadcast twice. Did you hear me on the opening night?"

Alas, the interviewer had been out of town, but reports from other listeners had sufficed. Anyhow, a bit of radio-theatrical history had been made, the première of the "Vanities" having been broadcast; so far as is known, the first time that a musical comedy first night was put on the air.

"But that wasn't the first time that I had broadcast," continued the famous Peggy. "Last winter, out in San Francisco, I made a speech. Oh, that was terrible! I was just scared so I could hardly read. They wanted me to tell San Francisco what it should do, whether it should build a bridge to Oakland, and a lot of things like that. What did I know about such things? But they insisted, and I gave in, and then they gave me a great long thing to read. Oh, it was fully this long (measuring a yard) and I had to stand up in front of a little black thing and read it.

"Well, do you know, I got just hundreds of letters in the next two or three days, and not foolish little girls' letters, either. Some of them came from big business men who wanted to know if they could see me and talk over my ideas for the improvement of the city.

"Wasn't it ridiculous? Of course I couldn't see them for I'd only have to tell them that I didn't know a thing about it at all, and that I no longer knew anyone I could ask about it, and that my whole speech had been written out for me and all I had done was to read it. That would have been a terrible confession!

"I hate radio speeches, anyhow. Seems to me there's too many of them. They ought to put on more jazz, more dance music, liven things up a bit. That's what I like to hear. That's why I come down here to the theater to listen-in, to hear jazz."

Just then a number of things happened all at once. First, the radio set began to deliver a lecture on what to do in case of sunstroke, and Peggy Joyce said "Shut up!" in a disgusted way and turned down the bulbs.

Second, Joe Cook came in. Know Joe Cook? Well, he's the laugh of the show. In fact, he's several laughs. But this time he was serious beneath his utterly ridiculous costume. "Your voice was kinda husky in the first act," he said. "Better try some of this," and he handed Peggy an atomizer half full of a clear, amber liquid.

"How about road shows?" was the next question, when the atomizer had done its duty and the hoarse voice had been vanquished.

"Radio, you mean?" asked the Vanities star. "It helps them too. Samples, you know. All helps. What do you think, Mr. Dixon?"

The latter question was directed to the show's press agent.

"Broadcasting the 'Vanities' has helped the sale," he said in a very professional manner. "Of course, with a hit show like this you can't tell just how much, but we can see the result. Even a hit, you see, takes a few days to get started, for the news to get around, but you know we broadcast the first night's performance through WJZ.

"Then after that we went over to Newark with the principals of the company and put on a special radio matinee. Buy the way," he turned to Peggy Joyce, "I called up WOR this afternoon, and they told me that they had a couple of thousand letters for you. They're going to send them over."

"Gracious, what will I do with them?" she cried. "Maybe you'll say in your magazine that I can't possibly answer them all; but that I'll read them all, and that I thank everybody so much who has written?"

'Tis done. Writing-readers, Peggy Joyce has thanked you.

As we went out of the stage door we saw a crowd. Men, boys, women, girls, gathered in a big semicircle, overflowing into the street, where stood a big Rolls-Royce. A policeman tried to keep them in order. They were waiting to have the five-second glimpse of Peggy Hopkins Joyce walking from the stage door to her car.

The sight made one wonder if radio has had anything to do with reviving the ancient institution of the stage-door jam.

Africa, where death stalks on every side. . . . This is the kind of bunk you have been given by many writers and photographers. But we found Africa a land of sunshine and health"

Read What

Mrs. Martin Johnson

Explorer, told Sam Lewis

Mrs. Martin Johnson

WHAT would you do if you were planning to settle in Africa? What would be an important part of your equipment? Radio, you say? Well, so does Mrs. Martin Johnson, and as she and her husand are leaving shortly to return to Lake Paradise in Africa, it is safe to predict that there will be some radio apparatus included in the baggage.

Explorers, big game hunters, but primarily photographers of the wilds, Mr. and Mrs. Johnson have earned fame among scientists in all parts of the world, as well as among movie fans and magazine readers. No travelers' tales are theirs, for the unimpeachable evidence of the photographic film corroborates their stories.

But when it came to reaching the radio audience—alas, the voice had to suffice. Mrs. Johnson spoke through WEAF, giving a word-picture of life in Africa, where the latest Martin Johnson pictures were made, the pictures that were the first to receive the endorsement of the American Museum of Natural History, being considered to be invaluable records of animal life in wildest Africa.

Since the film itself could not be shown by radio, why did Mrs. Johnson choose to broadcast? The answer is this—she and her husband consider that part of their job is to dispel the current misconceptions regarding life in Africa. They want to reach America with the truth about life in the wilds. And in the back of their minds is the thought that perhaps by showing the life of the pioneer in its true aspect, a better light may be thrown on the hectic, unnatural life of the cities. Neither of them like cities and crowded places. They chafe and fret under the noise and confusion, are irritated by the artificial difficulties and restraints, are scornful of what seems to them, in comparison with elemental Africa, the mean struggle of city folk to achieve petty and worthless ends. Life in Africa is simpler and easier than that, and utterly, satisfyingly beautiful.

Here is a quotation from an address that both Mr. and Mrs. Johnson deliver with eagerness on every opportunity:

"To get an idea of the terrible hardships we underwent in getting these films you must picture us crouched in tangled African bush, tortured by deadly insects and poisonous snakes, surrounded by savage tribesmen, with ferocious wild animal enemies ready to tear us to pieces on every hand; picture us breathing the fevers of damp earth, constantly in terror of the deadly tsetse fly. Always in terror, in Darkest Africa, in a land of gloom and sinister superstitions, where death stalks on every side.

"This is the kind of bunk you have been given by many writers and photographers. But we found Africa a land of sunshine and health. Picture the long rolling plains of your own west, with here and there a clump of scrub trees or a wooded valley; forest-covered hills with rivers flowing down them in waterfalls and rapids; fields of waving cane grass; groves of mimosa and acacia; a sandy desert stretching off to a faint blue line, with a friendly oasis here and there. . . . During the two years we were in Africa neither of us was sick a day. We found the black tribes friendly and trustworthy. . . . Tsetse flies killed one mule, we never saw a mosquito, never had fever and neither did any of the 'boys.' We saw less than fifty snakes during the time.

"Take it all in all, we never lived a cleaner, happier and healthier life than we did while making these pictures. . . . We did very little shooting, for with one or two exceptions we shot only for food or protection. There is far more satisfaction in getting a photograph of one animal than in shooting a thousand."

In this environment Mrs. Martin Johnson hopes some day to transmit radio television motion pictures of animal life

And their satisfaction in this line must have been great, as anyone can imagine who has seen the Martin Johnson motion pictures as well as the "stills" taken in Africa.

"Of course, our position is somewhat illogical," confessed Mrs. Johnson. She was curled up on a big divan in a New York apartment. On the walls hung mounted heads of various animals, such as zebra and gazelles. She is a dainty little thing, and in her dark bobbed hair and black velvet dress she looked anything but the dead-shot sportswoman and world explorer that she is. By the time this gets into print she probably will be on her way back to Africa, so it ought to be safe to say that you would mistake her for a flapper! However, not in that apartment with its trophies, and especially after having glimpsed a human head on a bookcase—a souvenir of an earlier expedition among the head hunters of Borneo. But to continue:

"Our position is somewhat illogical," she said. "If it weren't for civilization we couldn't sell our pictures, we

(*Continued on page* 45)

five million people were listening to me all over the country"—and for excitement it beats an airplane crash

Anna Case

An Interview With

Anna Case

By R. M. Clarke

"THE well balanced program," said Anna Case, "should always have some of the more popular songs, of almost the folk-song type, such as 'Coming Through the Rye,' and 'Annie Laurie,' and similar compositions. Of course it should also have one or two of the old French and Italian composers, and a representation of modern concert composers such as Schumann and Strauss, but I have noticed in my concerts that the old familiar songs that every family knows always are eagerly applauded.

"The same principle applies to the radio program as to the selection of compositions for the concert hall. That is why at Carnegie Hall you heard me sing just such a program, very briefly, of course.

"Thrill? I should just say so! I never was more thrilled in my life than I was that night, at the thought that perhaps five million people were listening to me all over the country, and that maybe they were hearing me even in England on the one side and in Japan and Hawaii on the other!"

She was speaking of the remarkable demonstration of the possibility of universal broadcasting, on June 7, when the program of the convention of the National Electric Light Association was broadcast direct from Carnegie Hall, New York City, by four stations simultaneously, in as many cities. WEAF, New York; WGY, Schenectady; KDKA, Pittsburgh, Pa.; and KYW, Chicago, were linked with Carnegie Hall by telephone lines, and every word spoken there and every note of Miss Case's songs went forth at the same instant from the four transmitters. At that time it was the most important broadcasting event in the history of the art. Miss Case sang to more people simultaneously than any singer ever had done before in the history of the world. Her voice, magnified millions of times, was heard from coast to coast, and in the oceans.

"Nothing was ever like that thrill," continued the famous singer of the Metropolitan Opera, who is such a favorite in American concert halls. "I was very anxious to be heard plainly, and so I took particular pains to enunciate very clearly, and I stood just as still as could be in front of the two microphones. I didn't even turn my head from one side to the other lest one microphone should get more than the other."

Anna Case is an American girl, by birth and musical training, and like all vivacious girls she leads an active life in sports and outdoor things generally, as well as in music. Thrills a-plenty have come to her, including even falling in an aeroplane nose first (the aeroplane's nose!) into a muddy cornfield. The plane struck deeply into the ground, perpendicularly, and swayed back and forth like a knife thrown into hard wood, vibrating in every wire and strut as it swung like a reversed pendulum. Miss Case and the pilot had both been well strapped in. They undid the straps and scrambled to safety.

How's that for a thrill? Well, singing to the whole United States by radio beats it! Of course, having an audience of millions gives quite a different feeling from coming safely out of an airplane wreck, and so the comparison isn't exactly logical. But it certainly does measure the height and depth and width of the emotion.

Singing on the great stage of the Metropolitan Opera House in New York City compares with it not at all. Though it should be stated that Miss Case, while still under a Metropolitan contract, has not appeared there for some time. She prefers to live her own life, free of the restraints of operatic work, and able to travel at will through the country she loves, giving recitals. She thinks that in concert work she comes closer in touch with America than she would in opera, even on the most famous operatic stage in the country. This is because, for one thing, nearly all the operatic artists are Europeans, and for another, it is only a comparatively small and largely foreign group that patronizes the opera in New York.

The true center of American music, then, is not the opera, but the concert stage, and it is there that Miss Case prefers to sing—there, and in the homes of the people through her Edison records, and now through radio receivers.

Her performance through four stations at once was a natural and logical thing after her first radio recital, for that too had created radio history. Not quite two years ago it was, and as the second anniversary approaches, many gratefully remember the occasion.

On September 29, 1921, Anna Case gave New York City and the surrounding territory its first taste of radio broadcasting, long before WDY and WJZ began operating. The occasion was the 1921 Electrical Show, in which was a radio section, presided over by the National Amateur Wireless Association and the staff of THE WIRELESS AGE. A broadcasting transmitter was installed in the armory in which the show was held, and Miss Case was chosen to dedicate it. The story will be found in THE WIRELESS AGE for November, 1921.

One thing that was not told in that account of New York's and Miss Case's broadcasting première was her lively interest in the "works." She wore a handsome evening gown, all lace and spangles, but she insisted in worming her way about the apparatus and being told just what each thing was, and how it worked.

"Really, the whole Case family always has been crazy over radio," she said, after her latest, history-making radio recital. "Out in my old home, Flemington, N. J., we had electric lights long before anybody else. All my brothers used to experiment with electricity from the time they were just boys (bet you Sister Anna helped them!) and now my brother Stanley, who always swore he was going to be an electrical engineer, is one. He's so

(Continued on page 43)

TA-ra-diddle-ump-de-ay, in music, will cheer you up or a funeral march will quell hysterics —according to the pharmacopoeia of medical music and the receiver is veritably a Radio, M.D.

Thinks

Robert Haven Schauffler

As Noted by Paul S. Gautier

Robert Haven Schauffler

RADIO M.D. That is the shingle that ought to be hung in front of every radio receiver in the home, because it provides medical treatment, musical medicine. With certain reservations Robert Haven Schauffler, the essayist, poet and lecturer, approves of this suggestion.

Schauffler is probably the first of the musical doctors. So far as we know he was the first, a number of years ago, to write out a pharmacopœia of medical music. It's to be found in a chapter called "The Musical Pharmacy" in a book of his, "The Musical Amateur."*

Are you sad? Try a teaspoonful of ta-ra-diddle-ump-de-ay every hour. Do you hate the world and all its works? The specific is Mszvxt's Bingle-dingle-bing-ding.

And so on. When suffering from an ingrowing sense of a single hateful emotion, instead of being happily balanced among them all, turn on your player piano or your victrola; get out your fiddle or your mouth organ, and play yourself back to normalcy. Or, listen in with your radio.

As for the latter—well, hum hunh! Schauffler gave us an hour on a very hot afternoon recently, after his first radio speech on the possibilities of musical medicine. "The trouble is," he explained, "that in the radio audience you will find all kinds of people with absolutely every emotional atmosphere. There's no one panacea, and so you can't prescribe for them all at once."

This looks terrible: the further you get into it the worse it looks. Frinst, here's Albert Gloog, who has an attack of the deep-sea blues and needs something jazzy and peppy to brighten his corner. He gets it by radio. Fine and dandy. But also listening at the same time is Gussie Glig, a feather-weight who is having hysterics and needs a funeral march or thereabouts. She also gets the jazz that is good for Gloog but not for Glig. Poor Gussie!

Yes, there are difficulties in the way of this medicine thing by radio. Just the same, Schauffler, D. Mus., thinks that there are possibilities. Part of his first radio talk consisted of quotations from that "Musical Pharmacy" chapter, with certain additions, and the next day he got numerous letters asking for copies of the prescriptions, the listeners not having been able to write them down fast enough. For such anxious inquirers after harmonied healing there is appended to this article a quotation from Schauffler's pharmacopœia.

And, ssh! let us whisper to you a secret—in the Fall the doctor himself may talk to you again by radio on the same subject, and, ssh! there is also a lecture tour of the country being planned. So if you don't hear him it'll be your own fault, and for your neglect may you stew in your own gloom every Monday instead of picking your own cure out of a disc, a roll or a radio program!

Now that you have been properly informed as to the essentials, let it be added that Schauffler thinks that radio's big field is in the spread of the gospel of music. On the level, now, he doesn't think that there is much direct healing going to be done by radio. But because broadcasting is increasing the popularity of music it is inevitably bringing within the comprehension of more and more people the manifold influences of the art. And that is good for everybody, musicians, listeners, publishers.

Now for the quotation:

(From "The Theatrical Amateur," by Robert Haven Schauffler.)

A cradle song, for example, if well played on the violin, might bring to the mind of the hearer the lapping of moonlit ripples in some quiet cove, to another the noon hour of luxurious indolence at the cracker-factory, to a third the slow waving of fronds on some crystalline sea floor, to yet another the moment when the airplane motor is cut off and the great bird starts on its long, smooth silent glide to earth. Perhaps to only one in the whole audience will that melody conjure up the vignette of a baby being rocked to sleep on its mother's breast. But note that to everyone alike, with all their varying concrete interpretations, this particular music can scarcely fail to bring a feeling of tranquillity. And note, as well, that the music does not convey the feeling by mere suggestion, as the other arts would be driven to do: it is, in some mysterious way, *the feeling itself.*

An excellent sarsaparilla for that condition which the younger generation elegantly terms "dopiness" and their elders describe as "feeling like a stewed owl," is a rousing performance of *The Ride of the Valkyries* (the pianola will even do at a pinch) or of Schubert's *Erl-King*, or of that *Carnival Overture*, by Dvorak, which is almost like a plunge into an electric fountain of youth.

Music is the comfort of the comfortless, the mighty consoler of them that mourn. What reader of De Morgan can forget how potently those few measures from the first movement of Beethoven's *Waldstein Sonata* comforted Joseph Vance when he had lost his beloved foster-father? Less calm and powerful and god-like than this, but more intimate and tender is Chopin's E major étude. One of my friends was once in a dangerous state of mind. Everything was black around him. There was no ray of comfort, no gleam of hope, nothing left to live for. He was fast slipping into melancholia. His thoughts turned often to the question: to be or not to be? One morning as he was dressing and pondering darkly on the relative attractions of life and death his small daughter began to play this étude in the room beneath. And all at once my friend was conscious of a wave of consolation flowing through him. It came with all the actuality of a physical wave. "Ah, what's the use of despair?" he cried. "This is really too beautiful!" and from that moment on, life held him.

When one happens to feel intellectually flabby or mawkishly sentimental or sicklied o'er with a pale cast of thoughtlessness, the best thing he can do, in my opinion, is to follow with all his might the closely-wrought, brilliant, exhilarating reasoning of a Bach fugue or "invention," which will prove as good a brain bracer as an hour's hard labor over Aristotle or Spencer's *First Principles.*

In the wide realm of the arts, I know of two supreme specifics for one of those ultramarine Mondays when you feel like the latter end of a misspent life. These are:

(*Continued on page* 45)

*Published by Houghton, Mifflin Co., Boston.

In Hawaii, at Koko Head, Island of Oahu, is one of the RCA Trans-Pacific stations. This is used for receiving.

Trans-Pacific Radio

How Messages "Via RCA" Dash in a Twinkling Over the Bounding Billows

By Earl Ennis

THE century's romance of speed is told in many tongues. It is muttered by the whirling belts of Manufacture, spinning madly day and night. It is hissed by the heated metal of Industry, incandescent with the molten glow of effort. It is droned by the hurrying wheels of Transportation, spanning continents in a frenzied race with time. But it remained for Radio Communication to ensnare the Speed Demon himself, and in the achievement, write one of the epics of the century.

When the spoken word was held prisoner to a tiny wire and sent from ocean to ocean within a second, it was thought that the zenith of accomplishment had been reached. But beside the high speed performance of the modern day wireless, this record fades like a winter sunset. Time ceases to be an element in human affairs. Space becomes as nothing. In an interchange of ideas, the only limits are those of desire and facility.

In no one portion of the globe has high-speed communication been developed to quite the perfected art that it has on the Atlantic and Pacific coasts of the United States. Particularly on the Pacific radio plays a master part in the rapid handling of the complex traffic of commercial, financial, marine and shipping messages that flow between San Francisco, Hawaii and Japan. Great are the accomplishments of the Radio Corporation of America in linking these three empires across more than 10,000 miles of sea at the dizzying transmission rate of 158,000 words a day.

The demands of this trans-Pacific traffic are great. For one thing there are great distances to be covered—the longest unrelayed radio spans in the world. Hawaii is 2,100 miles from San Francisco. Japan is approximately 6,000 miles distant. Between these points, hundreds of thousands of messages are handled annually, both by cable and wireless, to meet the requirements of commerce. For years there was the constant threat of a creeping congestion, the result of Oriental and far Eastern trade expansions, that threatened to overtake and swamp all communication facilities.

Time was when all radio transmission between the three points named was by the "relay" system. A shore station transmitted a message to the nearest vessel. This in turn passed it along to some other vessel. From boat to boat it went, until in due course of time it reached its destination, with all the incident delays and errors that are the natural accompaniments of such a method. Today, thanks to the development of high power and high-speed transmission, all this is changed, and now only two operators handle any commercial message from shore station of origin to the destination at another shore station far across the sea.

One of the methods by which the bogy of congestion in trans-Pacific message traffic has been frightened away, has been by perfecting the duplex method of sending and receiving simultaneously. Not less than 1,860,000 words can be handled every twenty-four hours between San Francisco, Hawaii and Japan, when the Radio Corporation completes its present program of construction at these points.

There are twelve units comprehended in the plans for bridging the Pacific by the Radio Corporation's high-speed radio transmission system. Six of these are transmitting units and six are receiving units. It is Radio Corporation practice to locate its receiving units at

units, so that independent use may be had of each, establishing an unusual flexibility in the handling of fast service. Through these separated units, a rapid interchange of messages is effected at a rate which exceeds anything ever before attempted in the entire field of telegraphic communication.

Of the six giant transmitting units used in bridging the Pacific, two are situated on the bleak wastes of Bolinas Bay in the most deserted portion of the Northern California coast; two have been erected on the tropical coral reefs of the Hawaiian Islands, where gaunt towers rise over the green vegetation, dazzlingly white sand and deep blue sea; and two stand guardian in far Japan, where cherry trees and pale wistaria blossom riotously beneath the spreading copper cables that chatter ceaselessly but silently.

There is much for these six silent guardians of a nation's commercial empire to do, out on the broad Pacific, where are thousands of vessels—palatial liners, outfitted in all the resplendent luxury of Oriental service, fleets of heavy-laden freighters, unpicturesque tankers rolling with the swells, dirty tramps, guano carriers, copra boats—all busy with the details of Pacific trade. Between them and the radio there is a common link, the tie of commercial brotherhood.

In the handling of the great volume of daily business that passes through the mechanisms of these six giant radio changing nature of the times. Where formerly a banker or a broker was compelled to depend upon the cable or the even slower relay transmission of the radio of those days, now he is given a thoroughly modernized service where delays have been minimized into a matter of split seconds. So perfect has high-speed transmission become that a business man in San Francisco may now pick up his telephone, dictate to a radio operator a message to an agent in Honolulu, 2,100 miles distant, and receive a *reply in less than five minutes!*

The methods by which this necromancy of time-abridgment have been perfected are fascinating in the extreme. To fully appreciate the scope and operation of it, one must start from the main western office of the Radio Corporation of America, in a little office building situated in the center of San Francisco's financial district. There, surrounded by great banking institutions, sit the wizards who hold the Demon in leash, and by his speed annihilate time and space in the twinkling of an eye.

At a table in this office sit two operators. In front of one is an ordinary telegraph key. Before the other is a typewriter. The office itself looks much like an ordinary telegraph office and the men like ordinary operators, save for the familiar head-receivers which each wears. And yet the man at the key is flashing a message directly into Hawaii, and the man before the typewriter is copying a message which is being sent him by a fellow operator, in the same room in distant Hawaii, at the same instant. They are duplexing —handling messages both ways, quicker than wire telegraphy, faster than the cable.

The impulses controlled by each operator are travelling at the speed of light, 186,000 miles a second. When the operator in San Francisco taps his key, the impulse is heard instantly in Honolulu without being relayed. The messages travel not between station and station, but between city and city. Out in the open, miles from each city, are the giant stations that actually hurl the impulses across the intervening space. But the control is in the cities, in the heart of each, the stations being but supple slaves of the tiny brass keys.

Messages filed with the Radio Corporation in San Francisco at its main office on California Street are sent over a land wire to the transmitting unit at Bolinas, fifty miles distant. There the waves generated by the giant Alexanderson alternators are interrupted by the operator sitting at the key in the little office in the financial district. If the message is destined for Honolulu, it is caught by the receiving aerials at Koko Head, Hawaii, automatically transferred to a land wire connecting Koko Head with the main office at Honolulu, and there copied by an operator sitting before a typewriter as in the San Francisco office. One operator is linked to the other as quickly and directly as though each sat with a telephone in his hand in adjoining offices of the same building.

The equipment by which this modern day miracle is made possible, and by which an even more astounding feat, that of instant communication between America and Japan is shortly to be made possible, is the result of carefully studied engineering achievements at the transmitting points, Bolinas, Cal., Kahuku Reef, Hawaii, and Iwaki, Japan; and the receiving points, Marshall, Cal., Koko Head, Hawaii, and Tamioka, Japan.

Signals zip off this antenna at Kahuku, Hawaii, and are heard in Japan almost instantaneously

If the antenna is the tongue of a radio system, this must be the lungs and vocal cords, for here are the alternators and switchboards in the RCA plant at Bolinas, Cal. Here the high-frequency currents are generated

One of the things that makes a radio operator's life pleasant is a view such as this. The operators and engineers who make their homes at Marshall, Cal., have this prospect before their eyes. Cottages, hotel, power house, hills and sea all unite kindly and gently

While there are certain technical differences between these stations, both in construction and engineering, due to various necessities, the stations at Bolinas and Marshall may be taken as fairly representative of the others in point of general equipment, and a consideration of these two, in brief, will give an approximate idea of the manner in which the Radio Corporation's high-speed radio business on the Pacific is conducted between countries widely separated in point of time and space.

Bolinas, the transmitting unit of the Pacific Coast, is located miles from human habitations, save those of the engineers and their families who form the little colony of workers at the point. Viewed from a distance, it seems a playground of some Cyclopean race which left behind its playthings to amaze the Lilliputians of the days to follow. Human things dwarf to insignificant proportions.

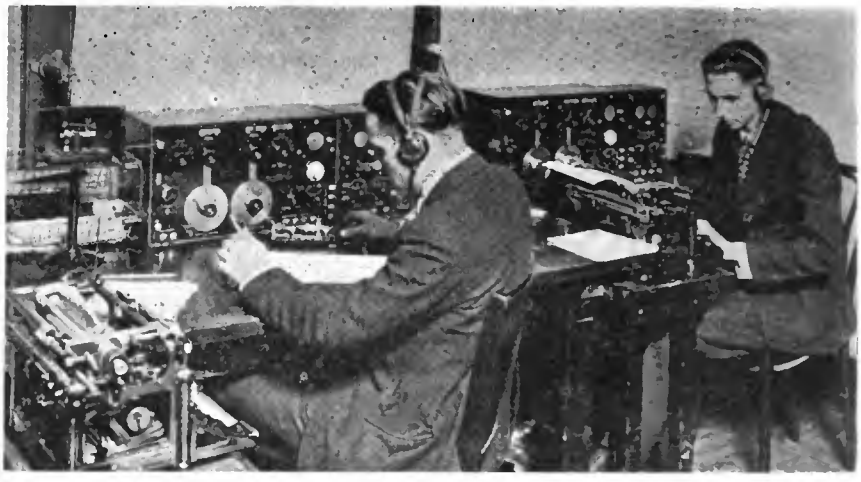
High overhead, and stretching inland in a row, standing like huge javelins speared into the ground by some prehistoric giant, are eight 300-foot towers which support the 2,500-foot antenna, which spreads its multiple-tuned arms over a width of 600 feet. Eight city blocks long and two blocks wide! That is the sending antenna at Bolinas, Cal. The input end is connected to a power-house in which drone the Alexanderson type alternators, arranged with an exceedingly simple circuit to supply the energy lost by radiation.

The wave length of this massive "electrical harp" is 13,100 meters. Into every nook and corner of the Orient, and, for that matter, all over the world, its flute-like notes have penetrated, in defiance of static, electrical storms and meteorological disturbances. Along the "air lanes" it is known as KET, its official call, and any hour of the day or night may be heard chattering away in the official shorthand of Continental code with its sister, KGI, in Hawaii, or its Japanese brother, JAA, at Iwaki.

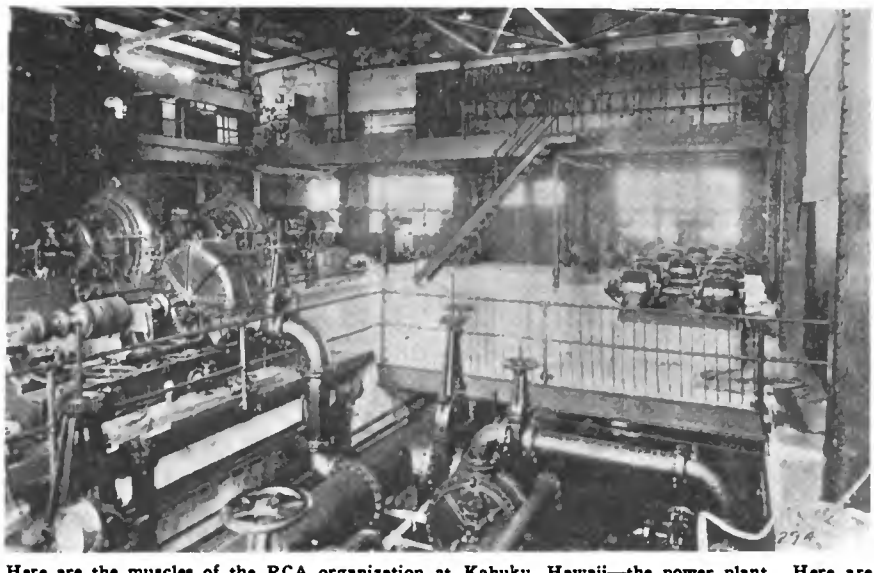
Marshall, the ear of Bolinas, is some forty-five miles distant from it. There all receiving of a high-speed nature is done, duplexing the Bolinas transmission without the slightest semblance of interference. Marshall's receiving antenna consists of two independent antennas, one for the Hawaiian business and the other for the incoming Japanese traffic. The one used for reception from Hawaii is nine miles in length, and runs from Marshall to Point Reyes, a famous reef on the California coast where many a shipwreck has occurred. The antenna used in the Japanese work extends from Marshall northward to Petaluma, the noted "egg basket" of the world.

The aerials are of telephone construction. They consist of two copper wires, on poles thirty feet in height, carried across country in much the same maner that a telephone line is stretched for rural service. At Marshall, they lead into the station in which is housed the unique receiving apparatus by which the return end of the high-speed duplex work is carried on, day and night, without interruption.

(*Continued on page* 40)



After viewing the tongue and vocal cords, and lungs and muscles, take a look at a part of the brain of the RCA on the Pacific Coast—two receiving operators at Marshall, Cal. Or are they just ears?



Here are the muscles of the RCA organization at Kahuku, Hawaii—the power plant. Here are the exciters, the rheostats, blowers, condensers, and other apparatus that supplies and controls the power for the electrical generators

Radio, The Musical Educator

How Broadcasting Is Raising the Musical Standards of Its Audience—Leads to a Better Appreciation of Good Music—Assistance in Music Memory Contests

By C. M. Tremaine

Director, National Bureau for the Advancementof Music.

WHEN the proper standards are maintained, the wedding of art and commerce means the extension of art and the elevation of commerce.

The utilitarian value of radio was the first to be recognized and was therefore the first to be developed. The appreciation and development of the educational and entertainment advantages came later.

Music is essential to life. It is essential to the radio, if it is to play a prominent part in life, if it is to be a factor in education and entertainment.

As soon as the adaptability of music to radio transmission became apparent —and that dated almost from the beginning of wireless in the home—it was evident that a new means had been found for extending the love of music and the reach of its influence. Today there is scarcely a program broadcasted in which music is not the principal, or at least a leading feature.

C. M. Tremaine

Preceding radio as missionaries of music were, of course, the phonograph and the player piano. They made the music lover independent of the ability to perform himself and of going to hear the performing artist. They annihilated distance and brought the latest popular song and the classics of the masters into the remotest corners of the earth. In their recent developments, moreover, they are capable of reproducing not only the composition but also its interpretation, down to the finest nuance, by the virtuosos of the day. In all this the phonograph and reproducing piano seem to have much in common with radio.

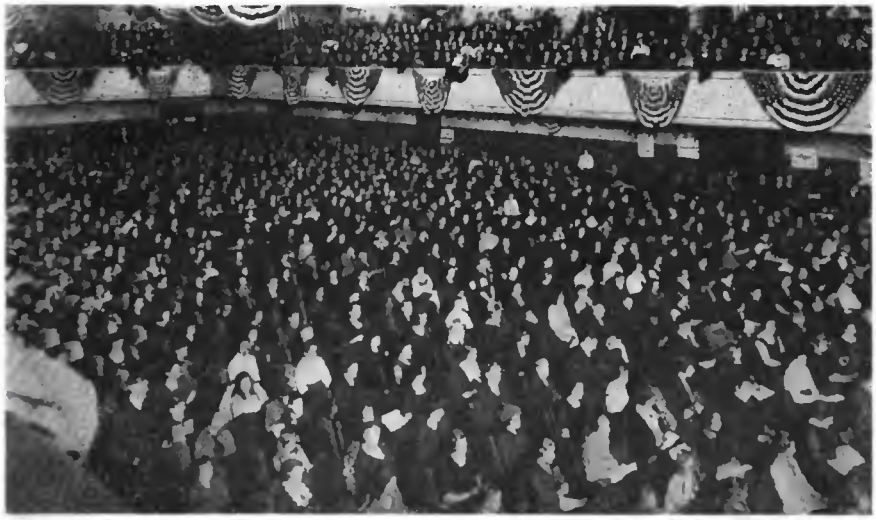
In its early stages the phonograph had little better to give than monologues and dialogues. The gradual domination of high class vocal and instrumental selections, followed by most acceptable recordings of the best symphony orchestras, was the product of twenty years' evolution in the mechanism of the instrument and an equally long evolution in the taste of the public.

Similarly with the player piano. It was almost as long a road from the first players, with their endless ragtime, to the reproducing piano of today, with its exact rendition of the playing of Hofmann, Rachmaninoff and Paderewski. If the programs broadcasted now, in the infancy of the radio, have no room for "Ikey and Moe" harangues it is because the general public has gained a knowledge of something more worth while. The radio today, immature as its musical development still is, gives more attention to Schubert and Beethoven, as interpreted by first class artists and even wonderful choruses and orchestras, than to jazz selections or "blues" by the cabaret type of performer.

The fact is, radio has come into a world in which music has already emerged as a potent force, largely through the aid of the once slightly-considered player piano, phonograph and other instruments not requiring technical skill in their operation. The radio has come as a new medium to extend and still further develop this force, to increase the desire for music; but it must establish and maintain the highest standards if it is to meet the requirements of an increasingly discriminating public.

Radio, as a novelty, has an appeal which is passing. As a carrier of the news of the day it renders a service of no small import, but its large place in the life of the people rests upon its entertainment and educational features. Radio sprang into popularity when music was sent out from the broadcasting stations and it is music which is sustaining its present popularity. It is also in the development of its musical program that its future popularity will rest. That this is appreciated by the radio leaders is shown by the way they associate it with the progressive music movements of the day.

One of the factors which has been responsible for the increasingly general appreciation of good music is the Music Memory Contest, and here too radio is playing an important and constantly expanding rôle. These contests have now been inaugurated in over 500 cities and towns throughout the country, and in many rural districts on a county-wide scale. In Texas, Michi-



Heavy brain work going on here—musical numbers are performed on the platform, contestants write down the name of the composition, the composer, and other facts. It's a Music Memory Contest in Grand Rapids, typical of acores held all over the country with previous coaching by radio

ganized.

The general method of carrying out the plan is the same everywhere, though the details, of course, differ greatly. A list of thirty to sixty standard compositions is announced, and the participants, usually all the upper-grade students in the school system, are given the opportunity to familiarize themselves with these during a "listening" period of eight to twelve weeks. At the end of that time preliminary meets are held to select from each school a team consisting of those who have been able to name the largest number of the pieces by title and composer and give most correctly such other information about them as may be asked. Then the finals are held, with prizes for teams and individuals making the best scores.

The idea originated as a parlor game which I played one Sunday about six years ago with my own children in my own home. I hit upon it as a means of arousing greater interest in my boy and girl in their fine new player piano and the correspondingly fine rolls I had purchased. It worked the miracle, and they have acquired as a permanent possession a love of good music which will serve them with its enriching companionship throughout life. The millions of other children who have entered these contests, and the many thousands of adults as well, have profited similarly, for the substance of the work is training in music appreciation; the form only is competitive.

It is in the preparatory, or "listening" period, the most important phase of the contest, that the radio is principally being used, and with very beneficial results. It is adding its contribution to that of the phonograph, piano, solo and ensemble performers in familiarizing the participants with the music of the masters. It has now become a frequent occurrence for Music Memory Contest selections to be announced as part of the radio programs, especially before the holding of final and preliminary meets, and eager contestants flock to their receivers so as not to miss the opportunity of fixing the music more firmly in their minds.

In Seattle, Wash., where a wonderfully successful city-wide Music Memory Contest has just been held under the auspices of the local Community Service and the public schools, the radio carried the numbers studied by the children practically every day for a period of a month or more. In one or two places newspapers have tried to run complete Music Memory Contests by radio, notably in Columbus, Ohio, but this is probably not the wisest course, since there can be no supervision over the contestants and hence no way of checking the papers.

MOZART MUSIC FILLS THE AIR

Minuet from "Don Juan," by Wolfgang Amadeus Mozart, was the fourteenth composition played in the Community Service's Music Memory Contest over the Post-Intelligencer radiophone last night. It was rendered by Miss Gwendolyn Mines, a Roosevelt High School student of unusual talent, a pupil of Paul McNeeley.

This composition, filled with graceful melody, is among the best the great composer wrote, critics say it differs from the Minuet by Beethoven, which was played during the first week of the Music Memory Contest, and from most of the so-called minuets in symphonies. These are usually conceived for hearing and not for dancing, and hence are faster and more elaborate.

In Mozart's minuet there is a beautiful tenderness and courtly quality combined with the ease of movement necessary for deep bows, which are characteristic of this regal dance at its best. There are three parts, the third being a repetition of the first, but even in the midst of the stately movement of the first a graceful little figure of embellishment is introduced.

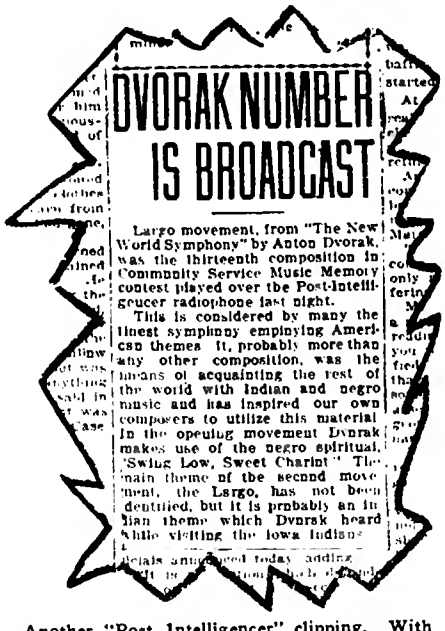
Mozart was born in Salzburg, Germany, in 1756, and died in Vienna in 1791.

SELECTION OF NEW

Newspapers have cooperated with broadcasting stations in training the public for Music Memory Contests. This clipping is from the Seattle, Wash., "Post Intelligencer"

But doubtless the chief value of the radio in disseminating the taste for good music is its informal day-by-day broadcasting, specializing in no particular type of composition, appealing to all grades of appreciation, but nevertheless containing enough of the good and the excellent to mould the desire for these by contrast with the less worthy.

What the radio is doing as a missionary of music is emphasized by cer-



DVORAK NUMBER IS BROADCAST

Largo movement, from "The New World Symphony" by Anton Dvorak, was the thirteenth composition in Community Service Music Memory contest played over the Post-Intelligencer radiophone last night.

This is considered by many the finest symphony employing American themes it, probably more than any other composition, was the means of acquainting the rest of the world with Indian and negro music and has inspired our own composers to utilize this material. In the opening movement Dvorak makes use of the negro spiritual, "Swing Low, Sweet Chariot." The main theme of the second movement, the Largo, has not been identified, but it is probably an Indian theme which Dvorak heard while visiting the Iowa Indians.

...icials announced today, adding ...

Another "Post Intelligencer" clipping. With radio programs and newspaper explanations Seattle musical memories were packed with information

for wireless transmission of its tones by the addition of a cylindrical metal sounding box out of which projects a horn. The obligation upon singers for the clearer enunciation demanded by the radio is another of these changes, for the human voice is really a musical instrument.

As the broadcasting of oratorios by great choruses and whole operas by the best companies becomes more frequent there will be, inevitably a greater and greater spread of musical culture.

Trans-Pacific Radio

(*Continued from Page* 38)

The general equipment is in principle similar to that used in many homes for broadcast reception. Radio frequency amplifiers pick up the faint distant whispers that impinge upon the nine-mile antenna, amplify them and turn them over to a highly sensitized form of synchronous detector, magnetically controlled. From the detector the impulses are fed, in turn, to audio frequency amplifiers, going from these to the "tone channels" that connect Marshall to San Francisco. At San Francisco the signals are again amplified for the operator's head telephones to whatever degree is adequate for comfortably easy reading.

At Hawaii, the same general condition exists, and in Japan also. There are the transmitting and receiving units, widely separated, the connecting "tone channels," and the amplifying units, with the alternators and the power house equipments. Giant antenna spreads are characteristic of all these stations. The long receiving antennas are of the Beverage type.

Extensive improvements are contemplated in Japan to meet the needs of the new high-powered fast service between that point and the west coast of America. At the present time, there is a 350-kilowatt arc at Iwaki which is struggling with the ship and long distance business, which is to be replaced by Alexanderson-type alternators. At all three points, Bolinas, Kuhuku, and Iwaki, 600-meter ship antennas, placed at right angles to the giant trans-Pacific aerials, are used for ship business.

In the perfection of this system the Radio Corporation has clipped dollars from the costs of commercial traffic, as an automobile racer clips seconds from a world's record. The radio waves that lap the distant shores of foreign ports are whispers from the great ocean of commerce of which it is an intrinsic part. And always the words are the same: "Faster! Faster!" And always the reply is the same: "Faster! Faster!"

Prevent Fire!

How the Fire Underwriters Find Radio Helps Them Reduce Fire Losses

An Interview with T. A. Fleming

DO you know that 87 per cent. of all fires in the United States originate from preventable causes? That is the figure determined upon by the National Board of Fire Underwriters as a result of its long experience.

Do you know that radio broadcasting is helping to reduce that percentage? For a number of months the radio audiences in all parts of the country have been hearing monthly lectures on the subject of fire prevention. These talks have been given by prominent local men in each case, sometimes the Mayor and sometimes the Chief of the Fire Department, sometimes a local insurance executive, and in a few cases T. Alfred Fleming has been heard over the radio telephone. However, Mr. Fleming has not delivered any one of the specific lectures of fire prevention, confining his remarks to allied subjects. That is because Mr. Fleming is modest. He is supervisor of the Conservation Department of the National Board of Fire Underwriters, and is the one responsible for the series of radio talks.

"In the few months that I have had the experience with radio broadcasting," said Mr. Fleming, "I have had some overwhelming proofs of the value of that sort of thing to the community. The talks on fire prevention have been carefully classified so that each one would take up only a particular subject. After each we always get a flood of correspondence from listeners and from insurance men, too.

"I cannot give you any figures because no one ever can know how much has been saved by preventing something from happening. You can tell how much has been lost when something does break loose somewhere, but there is no way of estimating damage that merely might be done if such and such a thing would happen. So I cannot set a figure of a definite money saving accomplished by these radio talks, but you know that a great many fires are caused by carelessness, sometimes carelessness only, and sometimes carelessness coupled with ignorance of the terrible possibilities of a single little mistake.

Just one of the thousands of preventable fires—a cigarette, a careless flip of the wrist, and valuable property lies in ashes. It need not be thus, as you have heard by radio

"Take oily rags, for instance, particularly rags that have vegetable oil on them, such as linseed oil. Now a lot of people use linseed oil to polish furniture. Then they throw the oily rag in a corner and the chances are that if conditions are at all favorable that rag will be afire within a few days. Comparatively few people know that. One of our radio talks explained it and urged everybody to keep oily rags and waste in metal containers, if they had to keep them at all, and preferably to burn them up.

"Every one of these talks has been timely and gave information that was particularly valuable at the moment that it was broadcast. The first one was released all over the country in November, and covered the subject of soft coal. You will remember that it was then that everybody suddenly discovered that they weren't going to get much anthracite and they would have to buy bituminous coal. Soft coal needs special treatment in furnaces and unless it gets it, it is going to cause considerable fire hazard by generating combustible gases and filling the chimneys with soot.

T. Alfred Fleming, caught by the camera on one of the rare occasions on which he has broadcast personally. Mostly he writes for others to read to you over the air

"The following talk was in December and explained the extra hazards brought about by the Christmas shopping. I guess very few people ever thought of that. We explained just what it meant to have a store packed from top to bottom with inflammable novelties and crowded from morning to night with hundreds and thousands of people. I know that in one city alone, in Cleveland, no less than fourteen large stores applied to the fire department for special firemen to be assigned to duty within the stores during the holiday rush. This was a direct result of the broadcasting of this Christmas shopping talk.

"In January the subject of New Year's resolutions was chosen. In February, electricity, and more particularly the appliances used in the average home, such as fans, irons and toasters. March is just about the opening of the season when warmer weather makes spontaneous combustion more possible than it is in the winter, and so the March talk discusses that. The April lecture is on the subject of spring cleaning up, which is as important from the point of view of fire prevention as it is for health and beauty. Subsequent talks are going to cover similarly timely subjects."

The Radio Cathedral

Embarking Upon a Great Missionary Enterprise in the Radio Broadcasting of the Gospel on a Scale That Would Have Astonished the Old-Time Apostles

By R. E. Flynn

THE service was over. The large congregation slowly walked out of the Cathedral as the last notes of the recessional hymn were heard from the choristers, marching away in the cloister.

By the center door of the church stood the man who for over one year has numbered his "flock" in the hundreds of thousands. He was bidding his "visible" friends a kindly good night.

As the crowd diminished to nothing he turned to find a young lady waiting at his side, and a pleasant voice inquiring, "Is this Dean Rogers?"

It was he—the Very Rev. Warren L. Rogers, dean of St. Paul's Episcopal Cathedral, Detroit, whose services have been broadcast by station WWJ for the past year. To the stranger's question he replied, "Yes, I am he. What can I do for you?"

Then the young lady told her story.

"My home is in Highland Park," she said, "a distance of some four miles from the Cathedral.

"We have a small radio receiving set at home, and for some time I have been enjoying your services broadcast by station WWJ. Your beautiful service has appealed to me very strongly, but somehow I just could not make up my mind to join the church.

"But tonight," she continued, "as I listened in, I heard you speak so earnestly of the great work of the church, and received the invitation which you gave to your congregation, both present and 'listeners in,' to join the confirmation class which you are just starting, and then I made my decision. So strongly did it appear as my duty to act at once, that I went out to the garage, started my car, and have driven down here tonight to enroll in the confirmation class that you are now forming."

After making the necessary arrangements, and seeing the young lady start for home, happy, the Dean turned away, a smile of deep satisfaction on his face. He could not help feeling gratified, for his convictions as to the value of the radio in the broadcasting of Divine services once more had been completely vindicated.

For several months following the installation of microphones in the Detroit Cathedral, the Dean was called upon to answer many adverse criticisms. Some said it was not in keeping with the dignity of the church. Others said it cheapened the service to have it broadcast so freely. Still others declared that it would make it much easier for people to remain away from church, and contribute thereby to the growing moral and religious laxity.

The Very Reverend Warren L. Rogers broadcasting a service at St. Paul's Episcopal Cathedral, Detroit

To all these criticisms the Dean stoutly replied that it is the duty of the church to "preach the Gospel unto every creature."

From the very first he believed that radio offered a means of reaching a large part of the "unchurched" population of America, and by means of a broad and varied program, such as only a cathedral could provide, to break down many of the modern prejudices of people toward the church.

Perhaps the strongest of these prejudices was based on the seeming lack of co-operation between the different Christian denominations. To combat this, Dean Rogers decided to broadcast proof of such co-operation; more, to allow ministers of other faiths to preach to the radio congregation from his pulpit. Thus it has come about that services have been conducted in the cathedral by a Methodist Bishop; a Jewish Rabbi; ministers from the Presbyterian, Central Christian and Congregational Churches; a Baptist layman; a representative of the International Committee of the Young Men's Christian Association; a national figure in the American Prison Reform Movement; an Indian professor of high repute from the University of Baroda in Bombay; and the leading woman preacher of the British Empire. A number of other ministers in his own and other communions have likewise conducted their service from the cathedral.

Following the appearance of each of these men, Dean Rogers received many letters from all parts of the country, expressing commendation of his efforts, and welcoming this move toward promoting a closer bond of fellowship between the churches. Perhaps the greatest single recognition of his work in this respect was his election to the Presidency of the Detroit Council of Churches for the ensuing year.

Conversing with the Dean a few days ago, the writer asked the following question: "After a year's experience at the microphone, Dean, are you convinced that the radio has proved of any practical benefit to the church in its work?"

His reply was characteristic, quick and decisive. "I am convinced," said he, "that radio has unquestionably proved a most valuable adjunct to the work of the church. It has enabled us here in the cathedral to embark upon a great missionary enterprise in the broadcasting of the Gospel of Jesus Christ, on a scale that would have astonished the old-time Apostles of our Lord. By it we have been able to reach and help many thousands of non-churchgoers, and it has, therefore, opened the way for the greatest missionary achievements since the time of Christ.

"Numerous examples of the far-reaching effects of our radio ministry," continued the Dean, "have come to me in the form of letters and verbal communications, since I delivered my first message into the microphone one year ago Palm Sunday night.

"One of the first letters I received the following week was from a man living in a Middle Western city, who frankly stated that he had not attended church in over twenty years. The radio enabled us to reach him where nothing else would, and he pledged a renewed interest in the church of his

St. Paul's Episcopal Cathedral, Detroit, where services have been broadcast every Sunday for the past year through Station WWJ which is connected by land wire a distance of two miles

early youth. He sent me five dollars as a pledge of his good faith.

"Two other cases that appealed to me very strongly were those of returned soldiers. One, a member of a prominent club in Chicago, was slowly dying of tuberculosis. The other, living in a large Michigan city, had been badly 'gassed' while in action in France, and was in a similar condition. Both of these lads write me frequently that they listen-in every Sunday, and that the Divine Message of the church is proving their only comfort in their dying days. Occasionally, I give them a word of greeting during the course of a service in the cathedral.

"Then there is the case of the clergyman, a former rector of one of our churches in the Diocese of Michigan. For several years this man suffered from a dread disease, which finally necessitated his resignation from his rectorship, and submission to a series of amputations of one limb. A few weeks ago he wrote me a letter, from a small town in Ohio where he is convalescing, stating that he attends service with the cathedral congregation every Sunday, and expressing his thanks for this wonderful invention that 'makes it possible for a poor old one-legged parson to go to church.'

"Many other evidences of the great practical benefits of radio in a more general way are apparent to us here in the cathedral," went on the Dean. "I am certain that the greater interest that is now being manifested in the church is due in no small measure to the radio as a means of appeal to them.

"For instance, during the last calendar year, we have had the largest confirmation classes by far in our history, and also the greatest number of baptisms of any previous year. The astonishing fact is, that of 172 persons confirmed in St. Paul's Cathedral last year, over one-half were persons whose early training was received in communions other than our own. I am convinced that radio has proved a great factor in enabling us to widen the scope of our appeal as evidenced by these figures.

"As a further proof of the remarkable field that this wonderful invention has opened for us in doing intense missionary work, I should mention the case of the banker in a small Canadian town, whose church was minus a rector, and who wrote me saying that after 'listening in' to some of our services in his home he had finally decided to purchase a receiving set to be installed in the church, so that the members might worship on Sunday with us, even though they were without a minister of their own.

"Just last week I received a letter from one of the clergymen in our Diocese, who has two churches in neighboring towns under his charge. He has installed a receiving set in one of these churches, so that his people may have the privilege of worshiping there, while he is conducting services in the other town. He wrote for our schedule of services.

"From information that I have received I am certain that several other churches, without the services of rectors of their own, are likewise worshiping with us. And this is not confined to our own communion either, for only last summer a Presbyterian church in a Michigan town put in a receiving set and worshiped simultaneously with us, while their pastor was away on his summer's vacation.

"Of the invalid lady who sits propped up in her bed each Sunday with a receiver at her ear and a prayer book in her hand, worshiping earnestly and effectively with us, or of the many other instances of sick people and shut-ins, who can attend church in not been preaching to empty pews, as some people predicted during the early days of our great experiment. In fact, we have had the largest congregations in our history. Most people like a live church, and I believe this is what appealed to many of them in our case.

"Do you wonder," concluded Dean Rogers, "that I am enthusiastic about the wonderful possibilities of radio in the broadcasting of Divine services, and that I am convinced that by its means we can effectively follow the command of our Lord 'to preach the Gospel unto every creature.'"

On Palm Sunday night one year ago, the beautiful tones of the Barbour memorial organ in the cathedral and the triumphant choruses from the throats of the cathedral choristers, 103 voices strong, were sent forth from St. Paul's Cathedral by WWJ, the Detroit *News*, for the first time.

The earliest message broadcast from there was in the form of a great cantata, Christopher Marks' "Victory Divine." Down through the stretch of a year at the microphone have come echoes of that first great triumph, which in the words of America's radio Dean can best be described as "the greatest missionary achievement since the time of Jesus Christ."

Anna Case

(Continued from page 34)

crazy about radio, makes sets and everything, that they call him 'Radio Case.' He's going to make a little portable receiver for me to take along with me on the train, on my concert tours. He says I will be able to listen while I'm traveling. Won't that be wonderful?"

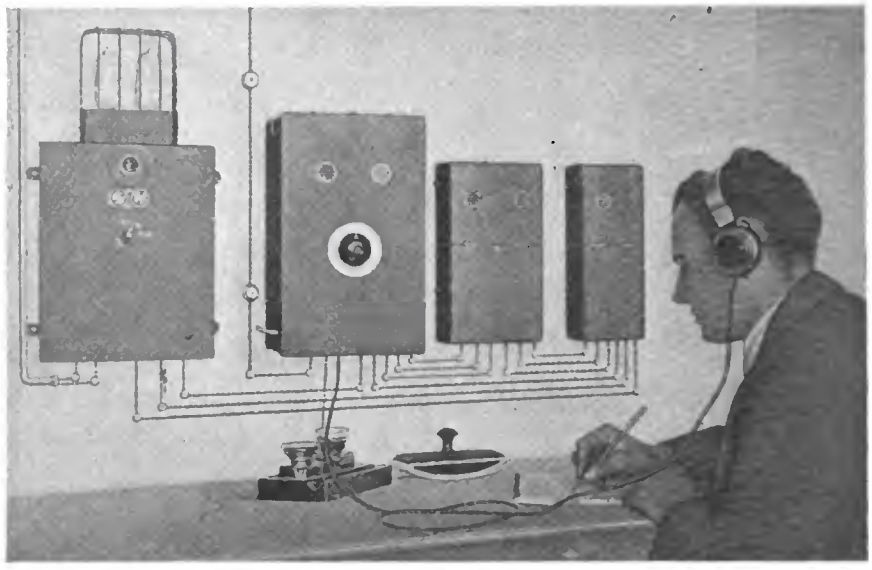
Not so wonderful as singing through four stations at once—and, to the residents of Flemington, not so wonderful as hearing Anna Case, the town's pride, by radio. Just about the whole town heard her on that historic night, too. A special receiving set was installed in the town hall, with a Western Electric power amplifier and several loud speakers. The horns not only made the program audible within the hall, but also were trained out of doors, and the hundreds who couldn't get inside, stayed out, and heard, too. The street was jammed. Every Flemingtonian who wanted to hear her did so—and it seemed that every one who was able to be up and about wanted to. If any were missing from the big public gathering, they were either in bed, or listening at home on their own sets—probably both!

AMERICANS who have returned recently from Germany have been bringing reports of broadcasting being conducted in that country along unusual lines. Radio telephone transmission is classified by the German government as a public utility, and is offered to subscribers on the same basis as the wire telephone. The German broadcasting service began in August, 1922, when subscribers were invited to enroll themselves for the service. The German post office undertook to supply, install and maintain the necessary receiving apparatus.

During the first year approximately 2,000 subscribers have been secured, chiefly business men such as bankers, merchants, traders and similar persons and firms to whom the broadcast service of market crop and weather reports is extremely valuable.

One of the twelve transmitting stations at Königswusterhausen is used. The station used has a power of 10 kw. and operates on 4,000 meters. The matter broadcast is supplied by the Berlin Telegraph Agency, Eildienst G. m. b. H.

The greatest novelty in this system lies in the receiving apparatus, which is designed to function almost as simply as the wire telephone. It takes the form of a small box for screwing to the wall, with a telephone receiver hanging from a hook. On the face of a box is a single dial. Batteries and plates of the detector and amplifier tubes are supplied from the local power mains. Removing the receiver from the hook turns on the filaments and in most cases tuning is unnecessary, for the receiver when installed is tuned to the wavelength of 4,000 meters and then sealed.



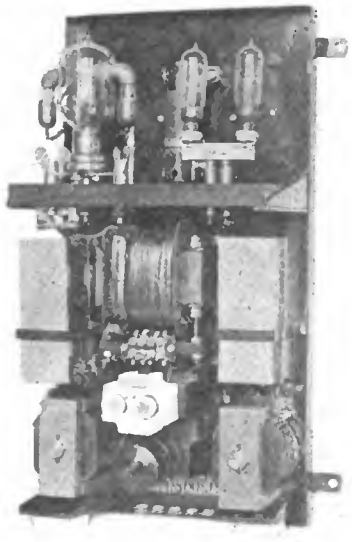
Complete broadcast receiving equipment as installed by German Post Office. The instrument on the left provides filament heating and plate current from D.C. mains. The tuner is in the center and the two instruments on the right are double and single L.F. amplifiers

However, a single tuning dial is provided, connected to a vernier adjustment of the inductance, so that a very small change in wavelength may be made in order to accommodate the receiver's quality and volume to the wishes of the listener. This vernier varies the wavelength within maximum limits of 2 per cent. of the fixed frequency and thus the receiver meets one of the requirements of the German post office, that it should not be possible of intercepting other messages.

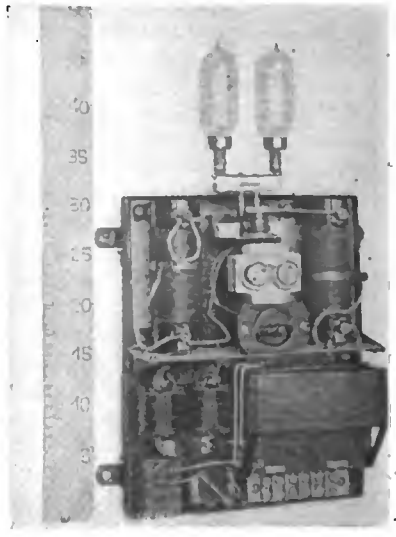
The tuner used is regenerative, of the two-circuit type. The coupling between the primary and secondary

(*Continued on page* 45)

The tuning unit with front removed. The plug and socket on the left and right is provided so that the instrument can he tuned approximstely to any wavelength depending upon the dimensions of the aerial. The knob in the center provides limited tuning and operates two circuits simultaneously. The knob in the top right hand corner varies the extent of reaction within fixed limits. In one position it produces maximum telephony signals and when the reaction coupling is increased it is suitshle for rendering C.W. telegrsphy audibie



Interior of the current transformer. The special festure is that a mercury rectifier of new design is employed for producing D.C. filament hesting and plate current



Apparatus for supplying power from direct current mains. The special feature of the apparatus is that tubes are used for the removal of any ripple that may exist on the D.C. mains. The fuses and potential adjusting potentiometers can be seen on the top half of the instrument while the choke coils and condensers can be seen on the lower half

favors its sire, Beethoven's *Hymn to Joy.*

Anger needs a big, broad, flowing antidote, sympathetically genial but not gay (for gayety would jar), with the least hint of the inhibitory powers of religion. It must have in it something at once calming and stirring. Such a strain, to my mind, is the *Pilgrims' Chorus* from *Tannhäuser.*

When we have been laying waste our powers by having the world "too much with us;" when our nerves are frazzled out by the strenuous, ugly confusion of modern, metropolitan existence; "when life becomes a spasm"—then we need such deep, serene beauty as the variations from the *Appassionata Sonata* of Beethoven, or one of those mellow German chorales like *O Haupt voll Blut und Wunde,* that say with their first benign harmonies: "Come unto Me, all ye that are weary and heavy laden and I will give you rest."

I should like to see the really musical misanthrope who could keep on hating his fellows under repeated applications of Schubert's *Unfinished,* or of the Romance from Schumann's *D Minor Symphony.*

As for feeling "chilly and grown old" and all dried up within, it is not to be thought of a moment longer with the minuet from Beethoven's first piano sonata sounding in one's ears and charming away the furrows with its humors, its exquisite kitten-like playfulness.

Jealousy requires much the same sort of music as anger, only it must not be so solemn, and more careless and swinging and magnanimous, with more of sunlight and laughter in it. I know nothing better than "the length and the breadth and the sweep" of the prelude to *Die Meistersänger.*

For boredom is indicated a bottle or two of such champagne as Liszt's *Les Preludes,* or the opening spree of either of the Schumann Carnivals.

For mere facial longitude the end of Beethoven's *Eighth Symphony* would not be amiss. And as for worry, it seems a contemptible thing when the Brahms *Wiegenlied* or the *Dream Music* from *Hänsel und Gretel* floats out upon the charmed air and draws the tired eyelids contentedly down over the tired eyes.

The best thing for the relaxing and soothing of mouth-muscles which have been made to ache through keeping up a chronic, insincere smile at a reception is Cesar Franck's gigantic piano Prelude in E Major.

And as for all manner of pettiness and fault-finding; as for the miserable odds and ends of human frailty and the half-broken-down partitions of prejudice that sometimes clutter up the soul and divide it into a series of miserable small ante-chambers to nothing at all—the *Procession of the Gods to Valhalla* from *Das Rheingold* will sweep these away in a tremendous trice and make one fairly spacious within.

As an antidote for pure misery, what could be better than a generous dose of unadulterated musical happiness? If there is any such purer than the great Schubert quintet for strings, I should like to be informed of it.

There are not a few universities that give men long rolls of parchment and the degree of D. Mus. when they really ought to dub las at so much per formula, and occasionally inventing one themselves.

The real doctor of music, when he appears, will be quite different. In the first place he will be such an accomplished musician that he can always give himself silent treatment with the proper unheard melody the instant any complaint shows its head. Thus he will enjoy chronic good health and be his own best advertisement. Then, he will be an exceedingly human sort of psychologist who can diagnose your diseased mind or heart or soul, or your slightest temperamental failing, and find out at once what is the trouble with the atmosphere in your home. For this trouble he will prescribe; and perhaps even open his instrument case and snatch out a fiddle and fill his prescription on the spot. Or he may walk into the house and take one look at your fluttering hands and sunken eyes; then make for the piano-stool, draw a deep breath and begin rolling out of his broad chest the calm verities of *"Du bist die Ruh."*

On second thought, let us call this servant in the house something besides Doctor of Music. The title has such disagreeable associations with dissecting rooms in conservatories, and laborious savants holding long-faced inquests over cadavers of counterpoint. It would be so much jollier to see in the window of every music store a small brass plate bearing some such legend as this:

JOHN BROWN—Soul Tuner.

Mrs. Martin Johnson

(*Continued from page* 33)

couldn't even make them at all, and as we have to depend on them for support, it is really civilization that keeps us going. The whole thing just goes around in a circle. It's awfully distressing to think about it all.

"Then there's radio. Here in New York I can't for the life of me see that it's anything but another of those useless complications—to add to the confusion—though again, you see, I was only too glad to talk over it the other day. But in Africa, if I can persuade my husband to take a set, it ought to be simply magnificent. If the apparatus is good enough it ought to bring us the advantages of civilization without the drawbacks, don't you think?"

Just then Martin Johnson himself entered. He looks his part rather more than his wife. You might take him for a retired army officer at least, only this particular morning he was nervous. Said he hadn't slept well. The city was terrible, miserable. A long tirade against civilization, and then:

"I'm going back to Africa in a couple of months, just as soon as we can get equipped. We'll take cattle, chickens, farming tools, everything necessary, even an electric light plant. Do you think I could get a transmitting and receiving radio set that would be powerful enough to reach Nairobi from If we could use wireless to keep in touch with Nairobi, we could reach the outside world in that way and it would be a great advantage.

"Really though, if what I hear is true about radio, maybe some time, when you can charge the radio audience for the programs, we will be able to live in Africa and never come back to this country at all. We could set up a transmitter, and send motion pictures of animal life direct from the jungle by radio, and even the barks of the jackals and the trumpets of the elephants and the cries of the birds, and all the other sounds of the African forests and plains. Think what a feature that would make! That's what would interest me, the commercial side. It would be a knock-out! There would be money in a thing like that for me, because as a thriller it would beat anything that has ever been done before. So I guess radio is the one thing of civilization that it will pay me to think well of and keep in touch with. But for the rest of it all—pooh! It's miserable, miserable!"

German Broadcasting Service

(*Continued from page* 44)

circuits is set at the factory and the installer has only to tune the primary circuit, which of course depends upon the constants of the antenna system. Once installed, the user is unable to alter the tuning without breaking the seals and is only authorized to open an especially provided and unsealed compartment for the replacement of tubes when necessary.

Within fifty miles of the transmitter only a detector tube is used but at distances greater than that, one, two and sometimes even three steps of audio frequency amplification are supplied.

In order to make use of such electric power which may be available locally, thus doing away with storage and dry batteries, the German post office was compelled to develop a number of power units for operation on both DC and AC. These power supply units contain nothing radical, the DC instruments being more or less conventional resistances with filters, while the AC power supply contains the usual transformers, rectifier tubes and filter system. Control of filament current is automatic, by means of ballast tubes.

When this system was first planned it was thought that loop antennas would be used, but the necessity of employing from three to five or more vacuum tubes prevented the adoption of this form of antenna and instead the conventional outdoor overhead wires are used.

Wireless Age requesting help in securing a radio set, has been provided with one through the courtesy of several individuals. E. H. Merriam, of New York, built a receiver from parts contributed by himself and several friends, including the Overland Radio Shop and A. J. Macsond. The receiver was made complete by the inclusion of a one-and-one-half volt tube, phones, batteries and antenna equipment.

WMH Resumes

STATION WMH, operated by the Precision Equipment Co., Cincinnati, Ohio, is back on the air again. This is a 50-watt transmitter and is to be heard locally at noon daily and at 4:00 p. m., on Tuesday and Friday. The station does not transmit on Saturday or Sunday.

"Good Turns" by Radio

BOY SCOUTS in Syracuse, New York, members of the Onondaga Council, B. S. A., are very active with radio these days. They use receiving apparatus, not only for their own entertainment, but for the benefit of Syracuse shut-ins. Numbers of Syracuse residents who are unable to leave their homes have been given radio concerts, the Scouts using portable receiving apparatus. Scout Elwin Newton, who has a paper route and thus is able to know which homes contain shut-ins, is taking a prominent part in the work.

University Education by Radio

(*Continued from page 29*)

more than one doubting and hesitating faculty member."

Not long ago a letter came in from a fourteen-year-old boy living in Baraboo, Wisconsin. He said in part: "I should appreciate a talk on mussels by radio from WHA next Friday evening. My chum and I are going fishing this summer."

"Did he get it?" Mr. Lighty was asked.

"I should say he did," came the quick, emphatic response. "The question is of economic interest to our people up there, because of the pearl button industry."

Service! Helpfulness! Advance! These seem to be the motivating forces of everyone connected with the project.

During the past year the hour has been changed from noon to seven P. M., partly because the sound carries better at that time, and partly because it is a more convenient hour for a greater number of people. The type of program for the various days is not strictly adhered to any longer, either.

of people at the most advantageous time.

Apropos of the broadcasting of the weather reports, comes a good story from one of the students in the agricultural department at Wisconsin. His father and many of his neighbors lived along a very muddy road, and word came by radio that a hard, and probably permanent frost might be expected within the next twenty-four hours. The man who received the message went to his telephone, got in touch with the other farmers on that road, and before the freeze came, they had that mud road smoothed as flat as a sheet of paper. All the rest of the winter the "radio fan" and his neighbors had a boulevard to town.

Nor is the University of Wisconsin the only school in the country to recog-

Col. Edward R. Green, son of the late Hetty Green in his radio bus, equipped with a seven-tube receiving set, listening to concerts

nize the value of the radio for educational purposes. Tufts College was a pioneer in the field, but at present is giving only a fifteen minute lecture once a week. It hopes soon to be able to give short lecture courses by radio, with certificates for those whose theses are worthy. The work at Tufts has been experimental, and interesting conclusions have been reached as to the character and technique of radio lecture requirements.

The University of Indiana, the University of Iowa, the College of the City of New York, the University of Oregon, the University of Kansas, and that of Missouri, are broadcasting from stations not their own. Some of these schools have found serious objections to such an arrangement, and are looking forward to having their own stations before much more time has elapsed. Others, on the contrary, regard the plan with favor.

Tulane University, Leland Stanford, University, Clark College, Antioch College, and Ohio State University—all are broadcasting with more or less frequency from their own stations.

Paradise for the Deaf

(*Continued from page 27*)

your ear through the instrument. He has no control of the sounds themselves. These things are just what radio broadcasting does control.

First, it provides the best voices in the world, clear, strong, resonant. Second, it provides not only voices that by nature are the very best, but good voices that have been carefully trained to the highest degree of efficiency in public speaking and singing.

Third, it keeps these voices positively within hearing range of deaf ears.

Anyone who can use a good telephone is doubly sure of hearing a good radio, because he is using two high-class phones, one on each ear.

Here are two scenes from my hearing "Paradise Regained." As I sit with my headpiece adjusted, a hand is laid on my shoulder, and my good wife calls into my covered ears, "John, when are you going to bed? Don't you know it is almost eleven o'clock?" "Sure I do; but wait until I hear this time signal from Arlington, and then I will know that it is just ten o'clock, 59 minutes and 60 seconds, Eastern daylight saving time." Or it is, "John, do come away from that radio. We want you in the other room." "Yes, yes, but I've got a new station! Wait until I hear who is sending this good music. Great Caesar! if it isn't WWJ, Detroit, 700 miles away."

When one of your deaf friends has just discovered that he can hear distinctly over a space of 700 miles, try to get him promptly to bed, and see how you succeed!

It is my sincere conviction that every deaf person who can use a phone would find his life transformed by the possession of a radio receiver. I have no special hook-up to recommend and no personal axe to grind; but I do wish all deaf people and their friends to know what radio broadcasting holds for them, and that those who have good hearing might realize what an unspeakable favor they would confer on their deaf friends by helping them to procure a good radio receiving outfit, with at least two steps of amplification, or its equivalent.

Deafness is a man's hearing "Paradise Lost."

Radio broadcasting is, in large measure, that "Paradise Regained."

When There's Laughter on the Radio Wave

Tubes

Tooth paste, cold cream and radio programs can be squeezed out of tubes. In the cities, millions of people are squeezed into tubes, morning and night. Tubes may be of lead, glass, brick, iron, steel and cement. Some tubes are made by the mile and sold by the ride, while other tubes are made by the piece and sold for many pieces of change. Tubes can be made to carry water, oil, and gas in both its illuminating and conversational forms. Radio tubes are peculiar in that the less there is in them the more they cost. When an ordinary tube bursts you call in either a plumber or a receiver, but when a radio tube blows you say good night.

—S. W. S.

For want of some solder the contact was bad;
For want of a contact no circuit was had;
For want of the circuit no current could flow;
For want of the current the filament couldn't glow;
For want of the glow not an electron stirred;
For want of the electrons not a thing was heard;
All for the want of a drop of solder.

Real Work!

Little Joe had completed his crystal receiving set and had made it "work." His astonished and proud mother said to him:

"Wasn't it very hard to do all this?"

"Naw," said Joe; "most of it was easy as anything."

"What was the hardest part of it?" she asked.

"Gettin' eight plunks out of pa," said Joe. —*N. Y. Mail.*

FAN—What do you think of station XYZ?

TAN—What! That rotten station? You mean the one that mixes jazz and coloratura sopranos every night? The one with the announcer with the tin voice? The one that went blooie for exactly eighteen and one-half minutes last night, from ten-twelve to ten-thirty and a half? That's a terrible station, simply awful. I never listen to it at all!

Letters From the Audience

Thanks awfully, Miss Screecher, for your soprano solos by radio. After listening to three numbers our company left early.—Mrs. Ben Blummox.

Please thank the Zip Zip Jazz Orchestra for us. They made us realize how cultured we have become.—The Stuckups.

Mr. and Mrs. Quilt want to thank Station KRUEL for its program last night. We, too, have a player piano, a phonograph and a saxophone.

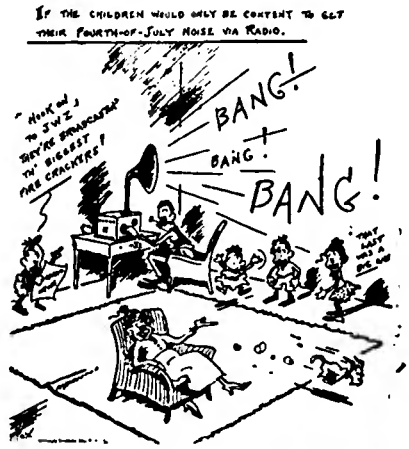
It was so good of you to broadcast Master Scrape the boy violinist. His parents, after hearing him by radio, have decided he has a great future as a plumber.—The Catguts.

Stung?

The French for "honeycomb coil" is *bobine en nid d'abeilles.* Literally, "coil in nest of bees," say Sam the Sophomore. Oh, well, probably these are the same radio bees that a lot of people keep in their bonnets.

When a man tells his wife, who is holding supper for him, that he wants to "listen in" just one more minute—he is usually picking a minute half an hour away. —*Crosley Weekly.*

WOULDN'T IT BE JUST FINE!



By FONTAINE FOX
—*Sun and Globe*

Wise Crack-les

We have heard our first radio sermon, and after all there isn't much difference between static and a deacon's snore.—*N. Y. Telegram.*

"It is more blessed to give than to receive" is a good motto for a broadcasting station.—*Minneapolis Tribune.*

AN airplane was flying over the English countryside and the pilot was indulging in a little stunting. Absent-mindedly he looped the loop, quite forgetting that he had on board a parcel containing a pair of boots.

Naturally they dropped out and landed just in front of an old woman in a cottage garden.

The package burst open, and out rolled the boots, much to her astonishment.

Picking them up, she hobbled indoors and called out to her husband:

"'Ere you are, Garge! Them boots you ordered 'ave come. What a wunnerful thing this wireless is! I thought I 'eard the buzz of 'em coming through the air."

—The N. Y. *Globe.*

Most broadcasting stations manage to keep their owners prosperously poor.

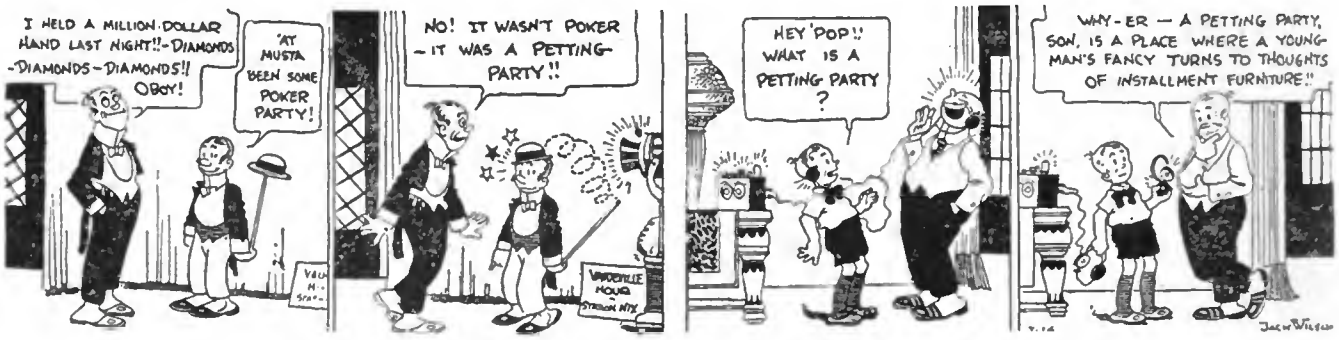
W. E. McF., optician and radio fan, reports that a woman brought him a crystal ball and asked him to drill a hole in it. Said she had gone out of the crystal gazing business and was building a crystal radio set. Next!

"A fresh celebrity entertains you every time you operate your set," is the blurb of a British maker of radio apparatus.

We don't know just what the word "fresh" means on the other side of the Atlantic, and so it's not clear just what this proclamation means. If it had been written by an American, now . . .

The Nimble Wit of the Nation's Cartoonists

RADIO RALF **By JACK WILSON**

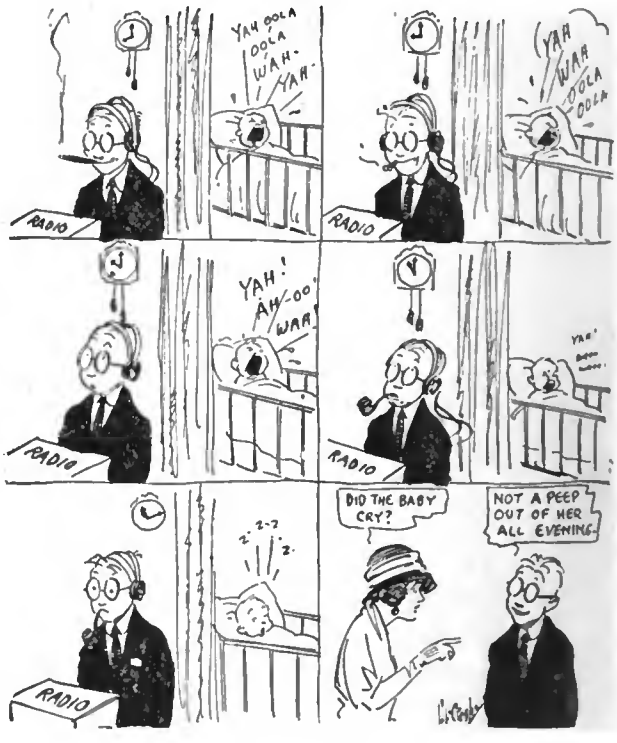


—Washington, D. C., Star

POKER PORTRAITS **By WEBSTER**

—N. Y. World

THREE ROOMS AND BATH **By PERCY CROSBY**



—Bklyn. Eagle

S'MATTER POP? **By C. M. PAYNE**

—Sun and Globe

BROADCASTING STATION DIRECTORY

(Revised to August 13th, 1923)

KAO Young Man's Christian Association, Denver, Colo. 360
KFI E. C. Anthony.....Los Angeles, Calif. 469
KFZ Doerr Mitchell Electric Co.....Spokane, Wash. 283
KGB Wm. A. Mullins Electric Co....Tacoma, Wash. 360
KGG Hallock & Watson Radio Service, Portland, Ore. 360
KGN Nnrthwestern Radio Mfg. Co.....Portland, Ore. 360
KGO Altadena Radio Laborstory.....Altadena, Calif. 360
KGU M. A .Mulrony.....Honolulu, Hawaii 360
KGW Oregonian Pub. Co.....Portland, Ore. 492
KGY St. Martins College.....Lacey, Wash. 256
KHJ Times Mirror Co.....Los Angeles, Calif. 393
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
KLN Mnnterey Electric Shop.....Monterey, Calif. 261
KLS Warner Brothars .....Oakland, Calif. 360
KLX Tribune Publishing Co.....Oakland, Calif. 360
KLZ Roynnlds Radio Co.....Denver, Colo. 360
KMC Lindsay-Weatherill & Co.....Readley, Calif. 360
KMJ San Joaquin Light & Power Co..,Fresno, Calif. 360
KMO Love Electric Co.....Tacoma, Wash. 360
KNJ Roswell Pubiic Service Co.....Roswell, N. M. 250
KNJ Roswell Pubiic Service Co.....Roswsll, N. M. 360
KNT Grays Harbor Radio Co.....Aberdeen, Wash. 283
KNV Radin Supply Co.....Los Angeles, Calif. 250
KNX Electric Lighting Supply Co., Los Angeles, Calif. 360
KOB New Mexico College of Agriculture and Mechanical Arts, State College, N. Mex. 360
KDP Detrnit Police Dept.....Detroit, Mich. 286
KDQ Modeatn Evening News.....Modesto, Calif. 360
KPD Hale Bros. .....San Francisco, Calif. 423
KQI University of California.....Berkeley, Calif. 360
KQP Apple City Radio Club.....Hood River, Ore. 360
KQV Doubleday-Hill Electric Co.....Pittsburgh, Pa. 360
KQW Charles D. Herreid.....San Jose, Calif. 300
KRE Berkeley Daily Oazette.....Berkeley, Calif. 276
KSD Post-Diepatch .....St. Louis, Mo. 546
KSS Prest & Dean Radio Rach. Lab., Long Beach, Calif. 360
KTW First Presbyterian Church.....Seattle, Wash. 360
KUO The Examiner Printing Co..San Francisco, Calif. 360
KUS City Dys Works & Laundry Co., Los Angeles, Calif. 360
KUY Coast Radio Co.....Del Monts, Calif. 360
KWG Portable Wireless Telephone Co..Stockton, Calif. 360
KWH Los Angeles Examiner.....Los Angeles, Calif. 360
KXO Herald Publishing Co.....Modesto, Calif. 360
KYQ Electric Shop.....Honolulu, T. H. 360
KYW Westinghouse Elec. & Mfg. Co....Chicago, Ill. 345
KZM Preston, D. Allen.....Oaklend, Calif. 360
KZN The Deesrt News.....Salt Lake City, Utah 360
KZV Wenatchee Battery & Motor Co., Wsnatchee, Wash. 360
KOKA Westinghouse Elec. & Mfg. Co..Pittsburgh, Pa. 326
KDPM Westinghouse Elec. & Mfg. Co..Cleveland, Ohio 270
KDPT Southern Electric Co.....San Diego, Calif. 244
KOYL Telegram Publishing Co....Salt Laks City, Utsh 360
KOYM Savoy Theatre .....San Disgo, Celif. 252
KDYQ Oregon Institute of Teehnology..Portland, Ore. 360
KOYS The Tribune, Ine.....Orsat Falls, Mont. 360
KDYW Smith, Hughes & Co.....Phoenix, Ariz. 360
KOYX Star Bulletin Publishing Co....Honolulu, T. H. 360
KDZE Rhodes Company .....Seattle, Wash. 453
KOZB Frank E. Sisfert.....Bakersfield, Calif. 360
KDZF Automobile Club of So. Calif., Los Angsles, Calif. 276
KOZI Elsctric Supply Co.....Wsnatchee, Wash. 360
KOZK Nevada Machinery & Electric Co....Reno, Nev. 360
KOZQ Pyle & Nichols .....Denver, Colo. 360
KDZR Bellingham Publishing Co...Bellingham, Wash. 261
KOZT Seattle Radio Association.....Seettle, Wash. 360
KDZU Western Radio Corporation.....Denver, Colo. 360
KOZV Cope & Cornwell Co.....Salt Lake City, Utsh 360
KFAO McArthur Brothsrs Mscantile Co., Phoenix, Ariz. 300
KFAE State College of Washington....Pullman, Wesh. 360
KFAF Western Radio Corporation.....Denver, Colo. 360
KFAJ University of Colorado.....Boulder, Colo. 360
KFAN Electric Shop .....Moscow, Idaho 300
KFAP Stenderd Publishing Co.....Butte, Mont. 360
KFAQ City of Sen Jose.....San Jose, Calif. 360
KFAR Studio Lighting Ssrvice Co....Hollywood, Calif. 280
KFAT Dr. J. T. Donohue.....Eugene, Ore. 273
KFAW The Radio Den, Ashford & White, Santa Anna, Calif. 280
KFAU Independent School District of Boiss City, Boise, Idaho 270
KFAV Abbot Kinney Company.....Venice, Calif. 256
KFAY W. J. Virgin Milling Co....Central Point, Ore. 300
KFBS F. A. Buttrsy & Co.....Hevre, Mont. 360
KFBC W. K. Azbill.....Sen Diego, Calif. 360
KFBE Reuhen H. Horn.....San Luis Obispo, Calif. 360
KFBK Kimhell-Upson Co. .....Sacramento, Calif. 283
KFBL Leese Rros. .....Everett, Wash. 224
KF66 Chronicls News and Gas & Elsc. Supply Co., Trinided, Colo. 360
KFBU Bishop N. S. Thomas.....Laramie, Wyo. 283
KFCO Salem Elec. Co.....Salem, Ore. 360
KFCF Frank A. Moore.....Wella Welle, Wash. 360
KFCH Electric Service Station.....Billings, Mont. 360
KFCK Colorado Springs Redio Co., Colorado Springs, Colo. 242
KFCL Los Angeles Union Stock Yds..Loe Angeles, Calif. 360
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. 300
KFCY Western Union College.....Le Mars, Iowa 360
KFCZ Omsha Central High School.....Omaha, Nebr. 258
KFOA Adler's Music Store.....Baker, Ore. 360
KFOB Meresntile Trust Co.....Sen Francisco, Calif. 509
KFDC Radio Supply Co.....Spokene, Wash. 283
KFOO St. Michaels Cathedral.....Roise, Idaho 360
KFOF Wyoming Radio Corp.....Casper, Wyo. 360
KFOH Iniversity of Arizona.....Tucson, Arlz. 300
KFOJ Oregon Agri. Colleps.....Corvallis, Ors. 300
KFDL Knight-Campbell Music Co.....Denver, Colo. 360
KFOO H. E. Cutting.....Rozeman, Mont. 248
KFOP Hswkeye Radio & Supply Co....Des Moines, Ia. 270
KFOR Bullock'a Hardware & Sporting Goods, York, Nebr. 360
KFOU Nebraska Radio and Electric Co., Lincoln, Nebr. 240

KFDV Oilbrech & Stinson.....Fayetteville, Ark. 360
KFDX First Baptist Church.....Shreveport, La. 360
KFDY South Dakota State College of Agri. & Mech. Arts, Brookings, S. D. 360
KFDZ Harry O. Iverson.....Minneapolis, Minn. 360
KFEC Meier & Frank Co.....Portland, Ora. 360
KFEJ Guy Oreason .....Tacoma, Wash. 360
KFEL Winner Radio Corporation.....Denver, Colo. 360
KFEP Radio Equipment Co.....Denver, Colo. 240
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., Kslisg, Idaho 360
KFEZ American Society of Mech. Engrs..St. Louis, Mo. 360
KFFA Dr. R. O. Shelton.....San Diego, Calif. 242
KFFB Jenkins Furniture Co.....Boise, Idaho 240
KFFE Eastern Oregon Radio Co.....Pendleton, Ore. 360
KFFJ Jenkins Furniture Co.....Boise, Idaho 360
KFFO Dr. E. H. Smith.....Hillsboro, Oregon 229
KFFP First Baptist Church.....Mobsrly, Mo. 273
KFFQ Markschoffel Motor Co....Colorado Springs, Colo. 360
KFFR Jim Kirk .....Sparks, Nev. 226
KFFV Oraceland College .....Lamoni, Iowa 360
KFFX McGraw Co. .....Omaha, Nebr. 276
KFFY Pineus & Murphy, Inc.....Alexandria, La. 275
KFFZ Al. O. Barnes Amusement Co.....Dallas, Tex. 226
KFGC Louisiana State University....Baton Rouge, La. 254
KFGD Chickasha Radio & Elec. Co...Chickashe, Okla. 248
KFGF Buchanan Stevene & Co....Mt. Vernon, Wash. 300
KFGH Leland Stanford, Jr., Univ..Stanford Univ., Colo. 360
KFGJ National Guards Mo., 138th Inf..St. Louis, Mo. 266
KFGL Arlington Oarage .....Arlington, Ore. 234
KFGP Cheney Radio Co.....Cheney, Kans. 229
KFGQ Crary Hdw. Co.....Boone, Iowa 226
KFGV Heidbreder Radio Supply Co.....Utica, Nebr. 224
KFGX First Presbytsrian Church.....Orange, Tex. 250
KFGY Gisibaug's Radio Shop.....Baudette, Minn. 224
KFGZ Emmanuel Missionary Co..Berrien Spgs., Mich. 286
KFHA Colorado State Normal School..Gunnison, Colo. 360
KFHB The Rielto Theatrs.....Hood River, Oregon 360
KFHD Utz Electric Co.....St. Joseph, Mo. 226
KFHF Central Christian Church.....Shreveport, La. 266
KFHH Ambrose A. McCue.....Neah Bay, Wash. 283
KFHI Charles V. Dixon.....Wichita, Kane. 274
KFHJ Fallon Co. .....Santa Barbara, Calif. 300
KFHL Penn Collage .....Oskaloose, Iowe 227
KFHP Radio Bulb Products Co.....Kearney, Nebr. 248
KFHQ Curtis Brothers Hardware Store, Los Oatos, Celif. 242
KFHR Star Elec. and Radio Co.....Seattle, Wash. 270
KFHS Robert Washington Nelson....Hutchinson, Kans. 229
KFHY R. S. McEwan.....Trinidad, Col. 242
KFIB Franklin W. Isnkens.....St. Louis, Mo. 244
HFIC Philip Laskowitz.....Denver, Colo. 244
KFID Ross Arbuckles Garage.....Iola, Kans. 246
KFIF Benson Tech. Student Body.....Portland, Ore. 360
KFIJ Sidney I. Thoreau.....Platte, S. D. 236
KFIK Gladbrook Electric Co.....Oladbrook, Iowa 234
KFIL Windisch Elec. Farm Equipment Co., Louisburg, Kans. 234
KFIQ Yakima Valley Radio Broadcasting Association, Yakima, Wash. 224
KFIO North Cantrel High School.....Spokane, Wash. 252
KFIU Alaske Elec. Light & Powsr Co...Juneau, Alaska 226
KFIV V. H. Broyles.....Pittsburgh, Kans. 240
KFIX Reorganized Church of Jesus Christ, of Latter Day Saints.....Independence, Kans. 240
KFIY Brott Laboratories .....Seattle, Wash. 236
KFIZ Daily Commonwealth.....Fond du Lac, Wisc. 273
KFJA Central Power Co.....Brand Island, Nebr. 244
KFJB Marshall Elec. Co.....Marshalltown, Iowa 248
KFJC Post Intellingencer .....Seettle, Wash. 233
KFJD Weld County Printing & Pub. Co., Oreeley, Colo. 238
KFJF National Radio Mfg. Co...Oklahoma City, Okla. 252
KFJH The Sugar Bowl .....Selma, Calif. 273
KFJI Liberty Theatrs.....Astoria, Ore. 232
KFJJ Carrollton Redio Shop .....Carrollton, Mo. 236
KFKA Colorado State Teachers College..Oreeley, Colo. 248
KFKH Denver Park Amusement Co.....Lakeside, Colo. 226
KFLE National Educational Service.....Denver, Colo. 266
WBL T. & H. Radio Co.....Anthony, Kansas 360
WBS May & Co.....Newark, N. J. 360
WBT Southern Radio Corporation....Charlotte, N. C. 360
WBU City of Chicago.....Chicago, Ill. 286
WBZ Westinghouse Elec. & Mfg. Co., Springfield, Mass. 337
WCE Findlsy Electric Co.....Minneepolis, Minn. 360
WCK Stix-Baer-Fullsr .....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. 360
WOT Ship Owners Radio Servies, Inc., Premier Grand Piano Corporation.....New York, N. Y. 405
WOZ James L. Bush.....Tuscola, Ill. 278
WEB Renwood Co. .....St. Louis, Mo. 360
WEV Hurlburt-Still Electrical Co.....Houston, Tex. 360
WEW St. Louis University.....St. Louis, Mo. 261
WFI Strewbridgs & Clothier.....Philadslphia, Pa. 395
WFY Cosradio Co. .....Wichita, Kans. 360
WGF The Register & Tribune.....Des Moines, Iowa 360
WGI American Radio and Research Corporation, Medford Hillside, Mass. 360
WGL Thomas F. J. Howlstt.....Philadelphie, Pa. 360
WGM Atlanta Constitution .....Atlanta, Ga. 429
WGR Federal Tel. & Tel. Co.....Buffalo, N. Y. 360
WGV Interstate Electric Co.....New Orleans, La. 360
WGY Oeneral Electric Co.....Schenectady, N. Y. 360
WHA Universlty of Wisconsin.....Madison, Wisc. 360
WHB Sweeney School Co. .....Kansas City, Mo. 411
WHD West Virginia University..Morgantown, W. Va. 360
WHK Ths Radiovox Company.....Cleveland, Ohio 360
WHN Ridgewood Times Printing & Pub. Co., ..Ridgewood, N. Y. 360
WHX Iowa Radio Corporation.....Des Moines, Iowa 360
WIK K. & L. Electric Co.....McKeesport, Pa. 360
WIL Continental Electric Supply Co., Washington, D. C. 360
WIP Gimbel Bros. .....Philadelphia, Pa. 509
WIZ Cino Radio Mfg. Co.....Cincinnati, Ohio 300
WJD Richard Harris Howe.....Oranville, 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. 453
WKA Landaus Music & Jewelry Co., Wilkes-Barre, Pa. 360
WKC Joseph M. Zamoiski Co.....Baltimore, Md. 360
WKY Oklahoma Radio Shop....Oklahoma City, Okla. 360
WLB University of Minnesota....Minneapolis, Minn. 360
WLH Hamilton Mfg. Co.....Indianapolis, Ind. 360
WMA Arrow Radio Laboratories.....Anderson, Ind. 360
WMC Commercial .....Memphis, Tann. 500
WMH Precision Equipment Co.....Cincinnati, Obio 248
WMU Doubleday-Hill Elec. Co.....Pittsburgh, Pa. 261
WNJ Shotton Radio Mfg. Co.....Albany, N. Y. 400
WNO Wireless Telephone Co. of Hudson County, N. J., Jersey City, N. J. 360
WOC Palmer School of Chiropractic...Davenport, Iowa 484
WOI Iowa State College.....Ames, Iowa 360
WOK Arkansas Light & Powar Co...Pine Bluff, Iowa 366
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 Rscord.....Fort Worth, Tex. 360
WPG Nushawg Poultry Farm.....New Lebanon, Ohio 234
WPI Electric Supply Co.....Clsarfield, Pa. 360
WQX Walter A. Kushl.....Chicago, Ill. 300
WRC Radio Corporation of America..Washington, D. C. 469
WRK Doron Brothers Electric Co....Hamilton, Ohio 360
WRL Union College .....Schenectady, N. Y. 300
WRM University of Illinois.....Urbena, Ill. 360
WRP Federal Institute of Radio Telegraphy, Camdsn, N. J. 360
WRR City of Dallas (Police and Fire Signal Department), Dallas, Tex. 360
WRW Tarrytown Radio Research Lab..Tarrytown, N. Y. 273
WSL J. & M. Electric Co.....Utica, N. Y. 273
WSB Atlanta Journel .....Atlanta, Ga. 429
WSY Alabama Power Co.....Birmingham, Ala. 360
WSZ Marshall-Gerken Co. .....Toledo, Ohio 360
WTG Kansas Stete Agr. College....Manhattan, Kans. 360
WTP Oeorge M. McBride.....Bay City, Mich. 360
WWB Daily News Printing Co.....Canton, Ohio 360
WWI Ford Motor Co.....Dsarborn, Mich. 273
WWJ The Detroit News.....Dstroit, Mich. 517
WWL Loyola Universlty .....New Orslans, La. 280
WWZ John Wanamaker .....New York, N. Y. 360
WAAB Valdemar Jenssn .....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
WAAH Commonwealth Electric Co.....St. Paul, Minn. 360
WAAK Oimbsl Bros. .....Milwaukee, Wis. 280
WAAM L. R. Nelson Co.....Newark, N. J. 263
WAAN University of Missouri.....Columbia, Mo. 254
WAAP Otto W. Taylor.....Wichita, Kans. 360
WAAQ New England Motor Sales Co., Oreenwich, Conn. 360
WAAS Georgia Radio Co.....Decatur, Oa. 360
WAAW Omahe Orain Exchange.....Omaha, Nebr. 360
WAAZ Hollister-Miller Motor Co.....Emporia, Kans. 360
WABA Lake Forest College.....Lake Forest, Ill. 360
WABB Dr. John B. Lawrence.....Harrisburg, Pa. 360
WABC Fulwider-Grimes Battery Co....Anderson, Ind. 229
WABO Parker High School.....Dayton, Ohio 280
WABE Y. M. C. A. .....Washington, D. C. 283
WABF Mt. Vernon Register-News Co., Mt. Vernon, Ill. 234
WABG Arnold Edwards Piano Co.....Jacksonville, Fla. 246
WABH Lake Shore Tire Co.....Sandusky, Ohio 240
WABI Bengor Railway and Electric Co....Bangor, Me. 240
WABJ Radio Laboratories.....South Bond, Ind. 240
WABK First Baptist Church.....Worcester, Mass. 252
WABL Connecticut Agri. College.....Storrs, Conn. 283
WABM F. E. Dohsrty.....Saginaw, Mich. 254
WABN Waldo C. Grover.....La Crosse, Wisc. 234
WABD Lake Avenus Baptist Church..Rochestsr, N. Y. 252
WAJV Indian Pipe Line Corp.....Princeton, Ind. 360
WBAA Purdue Universlty .....West Lafayette, Ind. 360
WBAD Sterling Electric Co. and Journal Printing Co., Minneapolis, Minn. 360
WBAH The Dayton Co.....Minneapolis, Minn. 360
WBAN Wireless Phone Corporstion.....Peterson, N. J. 244
WBAO James Millikin Universlty.....Decatur, Ill. 360
WBAP Wortham-Carter Pub. Co., The Star Telegram, Ft. Worth, Tex. 476
WBAU Republican Publishing Co.....Hamilton, Ohio 258
WBAV Erner & Hopkins Co.....Columbus, Ohio 390
WBAW Marietta College .....Marietta, Ohio 246
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
WBBC Sterling Radio Equipment Co.....Sterling, Ill. 229
WBBD Barbsy Battery Ssrvice.....Reading, Pa. 224
WCAD St. Lawrence Universlty.....Canton, N. Y. 280
WCAE Kaufman & Raer 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 280
WCAJ Nebraska Wesleyan University, University Pl., Nsbr. 360
WCAK Alfred P. Daniel.....Houston, Tex. 360
WCAL St. Olaf College.....Northfisld, Minn. 360
WCAM Villanove Collegs .....Villanova, Pa. 300
WCAD Sanders & Stayman Co.....Baltimore, Md. 360
WCAP Chesapeeke & Potomac Tel. Co., Washington, D. C. 469
WCAR Alamo Radio Electric Co....San Antonio, Tex. 360
WCAS William Hood Dunwoody Industrial Institute, Minneapolis, Minn. 360
WCAT South Dakota School of Mines..Rapid City, S. D. 240
WCAU Durham & Co. .....Philadelphia, Pa. 286
WCAV J. C. Dico Electric Co.....Little Rock, Ark. 300
WCAX Universlty of Vermont.....Burlington, Vt. 360
WCAY Kesselmen O'Driscoll Music House, Milwaukee, Wisc. 201
WCBA Charles W. Haimhach.....Allentown, Pa. 280
WCBB K. & K. Radio Supply Co....Oreenville, Ohio 240
WCBD Zion Radio Broadcasting Stsiion.....Zion, Ill. 345
WDAD Central Kanses Radio Supply..Lindsborg, Kans. 360

WDAH	Trinity Methodist Church........El Paso, Tex.	360
WDAI	Hughes Radio Corporation.....Syracuse, N. Y.	248
WDAJ	Atanta & West Point R. R. Co., College Park, Ga.	360
WDAK	Hartford Courant ....Hartford, Conn.	261
WOAL	Florida Times Union.........Jacksonville, Fla.	360
WDAM	Weston Electric Co............New York, N. Y.	360
WOAO	Automotive Electric Co...........Dallas, Tex.	360
WOAP	Midwest Radio Central, Inc........Chicago, Ill.	360
WOAR	Lit Brothers ....Philadelphia, Pa.	395
WOAS	Samuel W. Waite............Worcester, Mass.	360
WDAU	Slocum & Kilburn........New Bedford, Mass.	360
WOAX	First National Bank.........Centerville, Iowa	268
WOAY	Fargo Radio Service Co..........Fargo, N. D.	244
WDBC	Kirk Johnson & Co., Inc........Lancaster, Pa.	258
WDBF	Robert G. Phillips..........Youngstown, Ohio	261
WEAA	Fallain and Lathrop.............Flint, Mich.	280
WEAB	Standard Radio Equipment Co..Fort Dodge, Ia.	360
WEAO	Henry Radio & Elec. Supply....Atwood, Kans.	266
WEAE	Virginia Polytechnic Institute..Blacksburg, Va.	360
WEAF	American Tel. & Tel..........New York, N. Y.	492
WEAG	Nichols Hineline Bassett Laboratory, Edgewood, R. I.	231
WEAH	Wichita Board of Trade........Wichita, Kans.	244
WEAI	Cornell University ....Ithaca, N. Y.	286
WEAJ	University of South Dakota....Vermilion, S. D.	360
WEAK	Julius B. Abercombe..........St. Joseph, Mo.	360
WEAM	North Plainfield, Borough of N. Plainfield, North Plainfield, N. J.	252
WEAN	Shepard Co...................Providence, R. I.	273
WEAD	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	Electrical Supply Co........Port Arthur, Tex.	360
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
WFAT	Daily Argus Leader..........Sioux Falls, S. D.	360
WFAV	University of Nebraska..........Lincoln, Nebr.	360
WGAC	Orpheum Radio Stores Co.....Brooklyn, N. Y.	360
WGAO	Spanish Am. Sch. of Telegraphy, Ensonada, P. B.	360
WGAJ	W. H. Gless.................Shenandoah, Iowa	360
WGAL	Lancaster Elec. Supply & Const. Co., Lancaster, Pa.	248
WGAN	Cecil E. Lloyd.................Pensacola, Fla.	360
WGAQ	W. G. Patterson...............Shreveport, La.	360
WGAR	Southern American ....Fort Smith, Ga.	360
WGAU	Marcus G. Limb.................Wooster, Ohio	226
WGAW	Ernest C. Albright................Altoona, Pa.	261
WBAX	Radio Electric Co., Washington Courthouse, Ohio	360
WBAY	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
WHAC	Cole Brothers Elec. Co..........Waterloo, Iowa	360
WHAO	Marquette University ....Milwaukee, Wisc.	360
WHAG	University of Cincinnati......Cincinnati, Ohio	222
WHAH	J. T. Griffin.......................Joplin, Mo.	360
WHAK	Roberta Hardware Co......Clarksburg, W. Va.	360
WHAL	Lansing Capital News.........Lansing, Mich.	248
WHAM	School of Music, Rochester Univ., Rochester, N. Y.	360
WHAO	F. A. Hill.....................Savannah, Ga.	360
WHAP	Dewey L. Otta....................Decatur, Ill.	360
WHAQ	Semmes Motor Co..........Washington, D. C.	242
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.	360
WIAB	Joslyn Automobile Co............Rochford, Ill.	360
WIAO	Ocean City Yacht Club......Ocean City, N. J.	254
WIAF	Gustav A. De Cortin..........New Orleans, La.	234
WIAH	Continental Radio Mfg. Co........Newton, Ia.	360
WIAI	Heers Stores Co...............Springfield, Mo.	360
WIAK	Journal Stockman Co............Omaha, Nebr.	278
WIAP	J. A. Rudy & Sons...............Paducah, Ky.	360
WIAQ	Chronicle Publishing Co..........Marion, Ind.	226
WIAS	Burlington Hawkeye-Home Elec. Co., Burlington, Ia.	360
WIAT	Leon T. Noel.......................Tarkio, Mo.	360
WIAY	Fox River Valley Radio Supply Co., Neenah, Wisc.	224
WJAO	Jackson's Radio Eng. Lab..........Waco, Tex.	360
WJAF	Press Pub. Co....................Muncie, Ind.	360
WJAG	Huse Publishing Co..............Norfolk, Nebr.	360
WJAJ	Y. M. C. A.......................Dayton, Ohio	360
WJAK	White Radio Laboratory.......Stockdale, Ohio	360
WJAM	D. C. Perham ....Cedar Rapids, Iowa	268
WJAN	Peoria Star Co......................Peoria, Ill.	280
WJAP	Kelly-Duluth Co. ....Duluth, Minn.	360
WJAR	The Outlet Co.................Providence, R. I.	360
WJAS	Capper Publications ....Topeka, Kans.	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 & Republican Times, Cedar Rapids, Ia.	360
WKAC	Star Publishing Co................Lincoln, Nebr.	275
WKAO	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
WKAS	L. E. Lines Music Co..........Springfield, Mo.	360
WKAV	Laconia Radio Club...............Laconia, N. H.	360
WKAW	United Battery Service Co., Montgomery, Ala.	226
WKAX	W. A. Macfarlane..............Bridgeport, Conn.	231
WKAY	Brenau College ....Janesville, Ga.	360
WLAC	North Carolina State College...Raleigh, N. C.	360
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	A. E. Schilling................Kalamazoo, Mich.	360
WLAS	Central Radio Supply Co....Hutchinson, Kans.	244
WLAT	Radio and Specialty Co.......Burlington, Iowa	360
WLAV	Electric Shop, Inc..............Pensacola, Fla.	360
WLAW	New York Police Dept........New York, N. Y.	360
WLAX	Greencastle Community Broadcasting Station, Greencastle, Ind.	231
WLAY	Northern Commercial Co. of Alaska, Fairbanks, Alaska	360
WLAZ	Hutton & Jones Electric Co......Warren, Ohio	248
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.	256
WMAM	Beaumont Radio Equipment Co...Beaumont, Tex.	360
WMAN	First Baptist Church..........Columbus, Ohio	286
WMAP	Utility Battery Service, Inc.......Easton, Ohio	246
WMAQ	Chicago Daily News..................Chicago, Ill.	448
WMAT	Paramount Radio Corporation....Duluth, Minn.	360
WMAV	Alabama Polytechnic Institute.....Auburn, Ala.	250
WMAW	Wahpeton Elec. Co...............Wahpeton, N. D.	360
WMAY	Kingshighway Presby. Church....St. Louis, Mo.	360
WMAY	Kingshighway Presby. Church....St. Louis, Mo.	280
WMAZ	Mercer University ....Macon, Ga.	268
WNAB	Park City Daily News....Bowling Green, Ky.	360
WNAC	Shepard Stores ....Boston, Mass.	278
WNAO	Oklahoma Radio Eng. Co.......Norman, Okla.	360
WNAL	R. J. Rockwell........................Omaha, Nebr.	360
WNAM	Ideal Apparatus Co..............Evansville, Ind.	360
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	C. C. Rhodes..........................Butler, Mo.	360
WNAS	Texas Radio Corporation and Austin Statesman, Austin, Tex.	360
WNAT	Lenning Bros. Co..............Philadelphia, Pa.	360
WNAW	Henry Kunzmann ....Fortress Monroe, Va.	360
WNAX	Dakota Radio Apparatus Co.....Yankton, S. D.	244
WNAY	Ship Owners' Radio Service.....Baltimore, Md.	360
WOAA	Dr. Walter Hardy.................Ardmore, Okla.	360
WDAB	Valley Radio ....Grand Forks, N. D.	280
WOAC	Maus Radio Co........................Lima, Ohio	266
WOAO	Friday Battery & Elec. Co.....Sigourney, Iowa	360
WOAE	Midland College ....Fremont, Nebr.	360
WDAF	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
WDAJ	Ervin's Electrical Co..............Parsons, Kans.	360
WDAK	Collins Hardware Co..............Frankfort, Ky.	240
WDAL	Wm. E. Woods...........Webster Groves, Mo.	360
WOAN	James D. Vaughan........Lawrenceburg, Tenn.	360
WOAV	Pennsylvania National Guard..........Erie, Pa.	242
WOAW	Woodmen of the World..........Omaha, Nebr.	526
WOAX	Franklyn J. Wolff..................Trenton, N. J.	240
WOAZ	Penick Hughes Co................Stamford, Tex.	360
WPAB	Pennsylvania State College...State College, Pa.	360
WPAC	Donaldson Radio Co............Okmulgee, Okla.	360
WPAO	Wieboldt & Co......................Chicago, Ill.	360
WPAF	Peterson's Radio Co.......Council Bluffs, Iowa	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
WPAR	R. A. Ward.......................Beloit, Kans.	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, Pa.	360
WQAB	Southwest Missouri State Teachers College, Springfield, Mo.	236
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.	360
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
WQAY	Gaston Music & Furniture Co...Hastings, Nebr.	360
WQAZ	Greensboro Daily News......Greensboro, N. C.	360
WRAA	Rice Institute ....Houston, Tex.	360
WRAB	Savannah Board of Public Education, Savannah, Ga.	360
WRAD	Taylor Radio Shop..............Marion, Kans.	248
WRAF	Radio Club, Inc...................Laporte, Ind.	224
WRAH	Stanley N. Read.............Providence, R. I.	360
WRAL	Northern States Power Co..St. Croix Falls, Wisc.	248
WRAN	Black Hawk Electrical Co.......Waterloo, Iowa	229
WRAO	Radio Service Co................St. Louis, Mo.	360
WRAP	Winter Park Elec. Construction Co., Winter Park, Fla.	360
WRAR	Jacob C. Thomas............David City, Nebr.	226
WRAS	Radio Supply Co.............McLeansboro, Ill.	360
WRAU	Amarillo Daily News............Amarillo, Tex.	360
WRAV	Antioch College...........Yellow Spring, Ohio	360
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.	360
WSAA	B. S. Sprague Elec. Co.........Marietta, 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
WSAK	Daily News ....Middleport, Ohio	258
WSAL	Franklin Electrical Co.........Brookville, Ind.	246
WSAN	Allentown Radio Club............Allentown, Pa.	229
WSAQ	Round Hills Radio Corporation.Dartmouth, Mass.	360
WSAP	Seventh Day Adventist Church..New York, N. Y.	263
WSAR	Doughty & Welch Elec. Co...Fall River, Mass.	254
WSAT	Plainview Elec. Co..............Plainview, Tex.	268
WSAU	Camp Marienfeld ....Chesham, N. H.	229
WSAW	Curtiss & McElwee........Canandaigua, N. Y.	275
WSAX	Chicago Radio Laboratory..........Chicago, Ill.	268
WTAB	Fall River Daily Herald....Fall River, Mass.	248
WTAC	Penn Traffic Co...................Johnstown, Pa.	360
WTAD	Robert E. Compton................Carthage, Ill.	229
WTAG	Kern Music Co................Providence, R. I.	258
WTAK	Swan-Bower Co..............Steubenville, Ohio	266
WTAS	Charles E. Erbstein........................Elgin, Ill.	275
WTAU	Ruegy Battery & Elec. Co....Tecumseh, Nebr.	360
WTAW	Agriculture and Mech. College, College Station, Tex.	254
WWAC	Sanger Brothers ....Waco, Tex.	360
WWAD	Wright & Wright, Inc... ...Philadelphia, Pa.	360
WWAH	General Supply Co. ....Lincoln, Nebr.	360
WWAX	Worman Brothers ....Laredo, Tex.	360

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 Canada....Toronto, Ontario
CFUC	University of Montreal.............Montreal, Quebec
CFVC	Roy Russell Brown......Courtenay, British Columbia
CFYC	Victor Wentworth Odlum...... ....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, Manitoba
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
CHDC	Canadian Westinghouse Co., Ltd.....Vancouver, B. C.
CHVC	Metropolitan Motors, Ltd...........Toronto, Ontario
CHXC	J. R. Booth, Jr......................Ottawa, Ontario
CHYC	Northern Electric Co..............Montreal, Quebec
CJBC	Dupuis Freres ....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 Radiotelephones, 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	McLean, 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
CKCO	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

Hague Court Studies Rights to Radio Press

THE question of property rights in news items broadcast by radio now is up before the courts of Holland. One Dutch news agency has sued a second agency for intercepting and sending to its newspaper members news sent by radio by a third agency in Berlin, for the exclusive use of the first agency. Each of the press messages bore an indication of copyright in Holland by the addressee. When the case was brought before the court, an order was issued restraining the defendant from copying such messages pending trial of the case. The litigation is being watched with considerable interest in Europe, where the use of radio for press work has increased by leaps and bounds since the end of the war.

Naval Airship Will Carry Radio to Pole

WHEN the great U. S. Naval Airship ZR-1 goes to the North Pole, she will carry radio to the top of the world, whether it is late this summer or next spring. If she reaches that northern pinnacle, and experts insist there is no reason to doubt her ability to do so, the Naval airship will be able to prove the fact by virtue of her bearing from northern radio stations. In these days of scientific achievement, proof is required, and in the event an arctic explorer gets to the pole with a radio compass or a transmitting set, there can be no doubt of his exact position.

Together with a complete radio receiving and transmitting set, the ZR-1 is equipped with the latest type of radio compass, which at the pole should show radio stations picked up as bearing directly south, while at all radio stations within communication distance, her position should be due north.

Radio stations in the north are fairly numerous, and it is believed that the ZR-1, once on her trip, could keep in communication with several to check her course. In the event she was uncertain of her position, she would either call two or more radio compass stations and ask for her position, or, having picked up two or more radio stations and observing their bearings by her radio compass, plot her own position. In this manner she could hardly go wrong and could correct her course readily provided her radio continued to operate successfully.

Incidentally, she could not "fake" her position at the pole, as the world would soon be advised by radio stations that her reported position was incorrect. Captain Baldwin points out that in the Far North, the compass is sluggish and that data for its correction are meager. It is his belief that the only accurate method of proceeding in the polar trips today is with the aid of radio and radio compasses.

The radio side-car has been adopted by the motorcycle squad of the New York Police Department

Among the stations to which the ZR-1 could report are: Three in Iceland; Spitzbergen, on the 78 parallel; Ingoy 71 N.; several in northern Russia; the United States Army and Naval stations in Alaska; Jan Mayen station on Iceland, and Mijgbugton, 73 degrees N. on the coast of Greenland. Certainly these are sufficient to get cross bearings and correct the course northward. If the stations are equipped with compasses, all the better, but as the ship will have a radio compass, the reception of their signals is all the navigation officer will require.

The ZR-1 is equipped with a type S.E. 1390 transmitter, designed for flying boats like the NC-4 which made the record trip across to England. It has modifications, making it gas-proof.

The transmitter uses six 50-watt tubes, giving it an input of 300 watts and an average output of 150 watts for wavelengths of 507, 600, 800 and 975 meters on ICW and CW communication. It is possible to use this set for radio telephone work, but it is not contemplated on the early flights.

The airship's name will constitute her radio call, just as the ZR-2 before her destruction answered to ZR-2. Lieut. J. H. Gowan, U. S. N., will be in charge of radio, assisted by Chief Radioman J. T. Robertson. The electric power will be supplied by a gasoline-engine-driven generator and a 200-ampere-hour storage battery, similar in operation to the electric power plant of an automobile. These units will supply current for lighting as well as radio purposes. The battery itself will have sufficient capacity to provide between one and two hours' operation for the radio set in case of a generator breakdown.

French General's Car Carried Radiola IV

THE Radio Corporation installed in the private car of General Gouraud a Radiola IV during the French general's recent visit. Many broadcasting stations were heard while the party was touring by auto.

European Radio Press Dispatches for American Dailies

THE Canadian Department of Marine has issued a license for the erection of a high-powered press radio station at St. Margaret's Bay, Nova Scotia, near Halifax, to C. F. Crandall of the British United Press, acting for the American publishers' committee. For over a year a group of American papers, including New York, Philadelphia, Chicago and other dailies, has been operating an experimental radio station at Dartmouth, across the bay from Halifax, for the reception of wireless press reports from London and Europe, and relaying them by land lines to the newspapers. The project will now be made permanent.

According to the Department of Commerce, the Director of Telegraphs at Venezeula has announced that bids will be asked for the erection of a new high-power radio station at Caracas in the near future.

Navy Radio Personnel Changes

COMMANDER R. R. MANN, U. S. N., has relieved Commander J. J. London as superintendent of Atlantic Coast Naval Communications. He is in charge of both radio and land line circuits.

Capt. R. W. McNeely has been designated to relieve Commander S. C. Hooper as chief of radio section, Bureau of Engineering. Commander Hooper left to become Fleet Radio Officer under Admiral Coontz on July 14.

Radio for Japanese Fishing Boats

THE chief of the Nagasaki Perfectural Marine Products Bureau, together with a committee of men interested in marine products, is reported to be investigating the possibilities of installing wireless telephone outfits in the larger sized fishing boats which have their base at Nagasaki, to enable them to communicate with shore when in difficulties, and to report the catch in time for their owners to realize on it. Reports to the U. S. Department of Commerce from Consul Hitchcock state that the recent success of the Fukuoka - Fusan wireless telephone tests has been the immediate cause of this interest in more practical applications of wireless telephony.

There are about 150 fishing boats on which wireless telephone equipment might be installed, and though they frequently go to distances from shore too great for direct communication, it is believed that a system of relays could be developed by which messages could be sent to the land.

NAA Gets a New Voice

SEA-GOING radio operators, and many skippers and landsmen who listen in will note a change in the "voice" of NAA at Arlington on 2,650 meters. The peculiar tone of the old Fessenden spark will no longer carry the time signals, weather reports and information of great interest to mariners; this famous spark set, installed in December, 1912, was replaced on July 8 by a new tube transmitter.

Operating on the same wave length, 2,650 meters, the new set will carry all the governmental broadcasting formerly done on the spark. Although its power is not quite as great, the range is to be retired from active service, and it is understood that it may be presented to the National Museum, where many radio experts believe it should have the honor accorded to the early locomotive of Baldwin and the Morse telegraph key.

Even before its installation in 1912 as the first high-powered radio transmitting set in the United States, the Fessenden apparatus was used in test work for nearly two years between the Plymouth, Mass., radio station and the Mackaranish station in Scotland by the Fessenden Company. Its service of almost thirteen years is believed to be a record.

General Bramwell Booth, head of the Salvation Army, using radio amplifiers in his address at the 58th Anniversary of the Army held in Trafalgar Square

Sweden to Have Liberal Radio Laws

THE proposed Swedish law for regulating radio telephony in that country recognizes the principle of free competition, with regard to the manufacture of radio apparatus. It will permit amateurs to build their own sets, requiring only that these shall be constructed in accordance with certain regulations, advices to the U. S. Department of Commerce from Assistant Trade Commissioner Sorensen state. The Telegraph Department does not contemplate limiting within narrow margins the wave lengths on which amateurs may receive.

In accordance with the proposed law the Government would erect the broadcasting stations and rent them to the Radio Telephony Company, which in regarding sending apparatus. The Telegraph Department will control receiving sets and supply them with a certain control mark, whereas the Radio Telephony Company will give permission to use such against payment of a license fee, 10 per cent. of which reverts to the State for the control privilege.

Ship Phones in Denmark

THE United Steamship Company, of Copenhagen, Denmark, plans to install wireless telephone equipment on all boats plying between Copenhagen and the provincial harbors for the traveling public's convenience. Travelers will be able to secure direct communication, through the land telephone service, with their own homes or offices similar to the service planned for the S.S. *Leviathan*.

Canary Islands Considering Radio

U. S. Vice-Consul Phelan, in the Canary Islands, reports active discussion in the Cabildo Insular de Teneriffe of a proposal to establish in the near future wireless telephone stations at the various islands of the archipelago. The present cable service between the islands has been very inefficient and this condition has given rise to the suggestion of using wireless telephony.

Radio Letters from Latvia

THE Latvian Main Post and Telegraph Administration is accepting radio letters to the United States at all Latvian telegraph offices. The letters are mailed to Berlin, whence they are transmitted by wireless to New York, and from there are forwarded to the addressees by post. The letters must contain text in English, French or German. The charges are 35 centimes per word, plus 1 lat (equal to 1 French franc) ground fee per message.

Mexico Permits Broadcasting

TWO radio telephone broadcasting stations were recently opened in Mexico City, a report from U. S. Consul Thomas D. Bowman, Mexico City, states. Various efforts have been made in recent months to obtain concessions for the establishment of such stations, but it is only recently that the government granted this permission. There appears to be great enthusiasm in Mexico over broadcasting, and it is believed that the market for radio sets in Mexico is favorable to considerable development by American manufacturers.

England's "Rails" Ocean Radio System

Newly Developed Group of Stations with High-Power Tube Transmitters Controlled from London Maintains Constant Service with Europe, Canada and America

TWO of the most important of the many recent developments in radio communication, continuous-wave wireless telegraphy by means of tubes and remote control of the transmitting and receiving stations from a central city office have been incorporated in the new group of English Marconi stations comprising Radio House, London, the city control station, and Ongar, Brentwood, and Carnarvon, from which high-speed commercial services are conducted between London and France, Switzerland, Spain, Canada, and the United States.

The wireless stations at Ongar and Brentwood are situated in Essex, some 20 miles from London, but full control is centered at Radio House, Wilson Street, London, the relaying of signals from the land lines to the wireless transmitters at Ongar transmitting station and from the wireless receivers to the land lines at Brentwood receiving station being entirely automatic. The transmitting plant at Carnarvon used for communication to the United States is also controlled automatically from Radio House, and the signals from the United States are received at Brentwood and relayed automatically to Radio House.

The whole of the telegraphist staff is concentrated at the traffic headquarters, Radio House. Messages are thus actually dispatched from the building where they are handed in by the public, and are received at the telegraph office abroad at the same instant that the signaling apparatus is actuated in London, all the operations between the two offices being entirely automatic. Any number of commercial services can thus be brought under the personal supervision of one general supervisor.

In the equipment of Radio House the special needs of speed and accuracy have been kept in mind, and wherever a design, or piece of apparatus, has been forthcoming which could be proved to raise the efficiency of the Marconi service, that apparatus has been employed.

From the counter, in the public office, a conveyer runs into the main operating room, and deposits messages on the circulation table which is equipped with numerous time-saving devices. From this table each message is rapidly distributed to its proper circuit.

Having arrived at the circuit, the message is reproduced in Morse characters in the form of perforations on a paper tape. This is done by means of an instrument known as a keyboard perforator which is operated in much the same way as a typewriter. The paper tape is then fed into an automatic high-speed transmitter which actuates the wireless transmitting plant at Ongar or Carnarvon, according to the destination of the message.

By the side of each of the automatic high-speed transmitting instruments is the receiving instrument for that particular service, and it is therefore possible for the operator engaged in transmission to receive immediate acknowledgment of the messages he sends.

The high-speed automatic apparatus employed in reception on the European circuits operates a printer which transforms the signals into Roman characters, and prints them on a continuous paper tape. This printed tape is drawn through a gumming machine and affixed in suitable lengths to a form ready for delivery. The message is then sent to the telephone room, or one of the private wire circuits, for immediate transmission to the addressee, or to the messenger department for delivery by hand. Before passing to the messenger department the message is conveyed automatically to the "unpacking" room, where, by means of a comprehensive card index, an "unpacker" is enabled to place it in the appropriate envelope bearing the full address required for delivery.

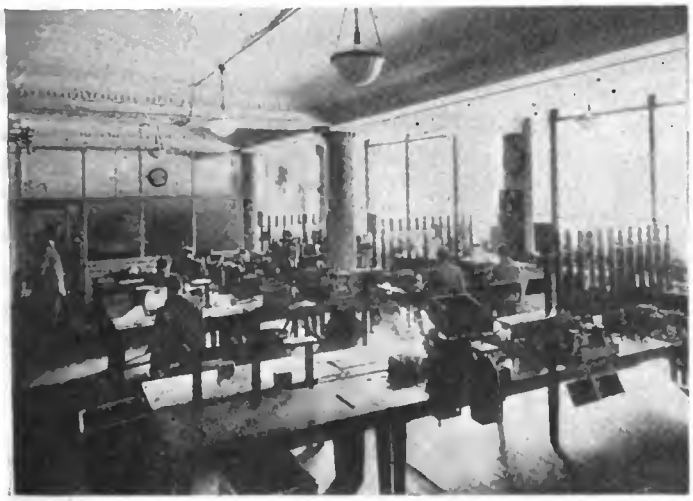
In the card index cabinet there are 65,000 cards, each bearing full details concerning a particular telepraphic address. Many of the delivery envelopes bear addresses already printed, and means are provided for locating any envelope instantly. Thus the whole process of decoding a telegraphic address and enveloping a message is a matter of a few seconds only.

One of the most interesting points about Radio House is the special provision made for express private delivery and collection where the traffic is consistently heavy. Apart from the number of telephone circuits available for the public, numerous private telegraph and telephone lines are rented by financial and commercial houses having traffic of a heavy and urgent character. Some of the telegraph circuits are operated with Teletype instruments by means of which messages are reproduced in typewritten characters at the other end of a telegraph line.

The Ongar group of wireless transmitting stations is built on a site just over one square mile in area. The site is on high ground, and in the center of it there still exists one of the large but little known forts built many years ago for the defense of London, but since abandoned by the War Office. Near this fort is the power house which supplies all the electric current required for running the transmitters and auxiliary apparatus.

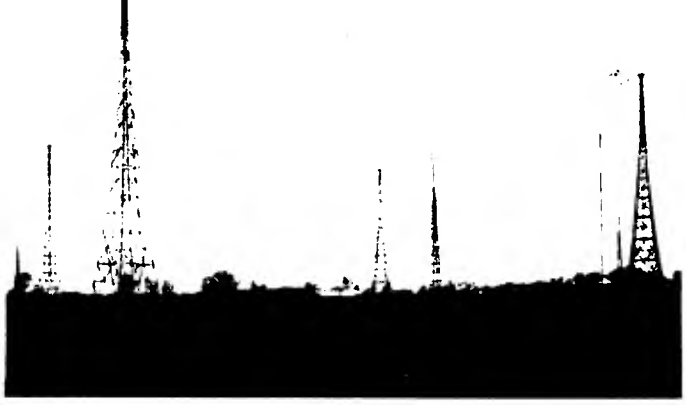
At present there are three separate transmitting stations at Ongar. One is carrying on a service with France, another with Spain and Switzerland, and a third with Canada. The aerial systems closely resemble one another, and consist, generally, of two circular cages with four wires suspended from two 300 ft. self-supporting lattice towers. The antenna is not connected directly to earth, but to an earth screen comprising a number of insulated wires supported on 30 ft. lattice masts. The provision of this metallic conducting screen between the aerial and earth reduces the losses in the soil under the aerial, and results in greatly increased radiation efficiency and in stronger signals being produced at the receiving stations than would be the case with a buried earth.

The efficiency of a transmitting station,

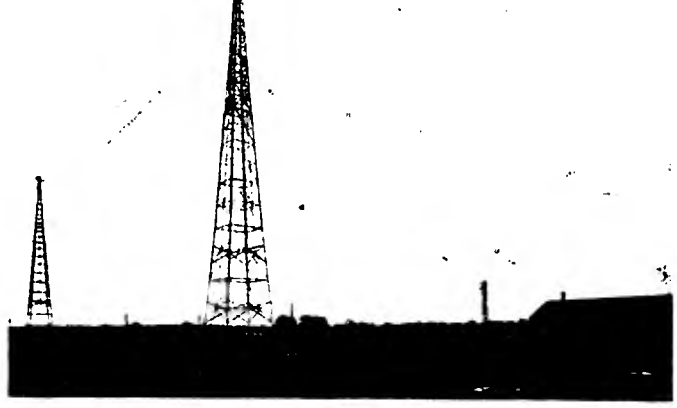


Operating tables at Radio House, London, where actual transmission and reception are carried on between London, New York and Canada

The Continental circuits for communication with France, Spain and Switzerland and other European countries



Brentwood Receiving Station where signals from six different stations are received simultaneously on the single antenna system



The main transmitting antenna at Ongar is a double cage, with counterpoise suspended below it on 30 ft. poles

and the legibility of the signals under bad atmospheric conditions, depend largely on the steadiness of the transmitted wave. This steadiness is attained at Ongar by the employment of the independent drive or master oscillator system. The fundamental principle of this system is the control of the main oscillations through the medium of a separate standard oscillation generator which, once adjusted to the required wave-length maintains its adjustment with perfect constancy. The transmitting plant is actuated by high-speed signaling keys, which are themselves controlled direct from the London central control office by means of land lines passing through the receiving center at Brentwood. Due to this link between the land line and the wireless plant telegraph operators are unnecessary at the wireless station.

The receiving station at Brentwood is less imposing in appearance than the Ongar transmitting station because it is possible to carry on reception with much smaller aerials than are required for efficient transmission. The circuits are so arranged that simultaneous reception can be carried on from four continental stations and from six Trans-atlantic stations. The latest devices for filtering out atmospherics are in successful operation in a new type of receiving apparatus.

Special attention has been paid in the design of the apparatus to its operation under adverse atmospheric conditions, and to the maintenance of adjustment with the minimum of attention. Here again there is no need for telegraphists, owing to an automatic linking device, and the duty of the attendant in charge of each set is merely to adjust and maintain it in such condition that clear signals of maximum strength are passed to the land lines for operating the recorders installed at the central control office in London.

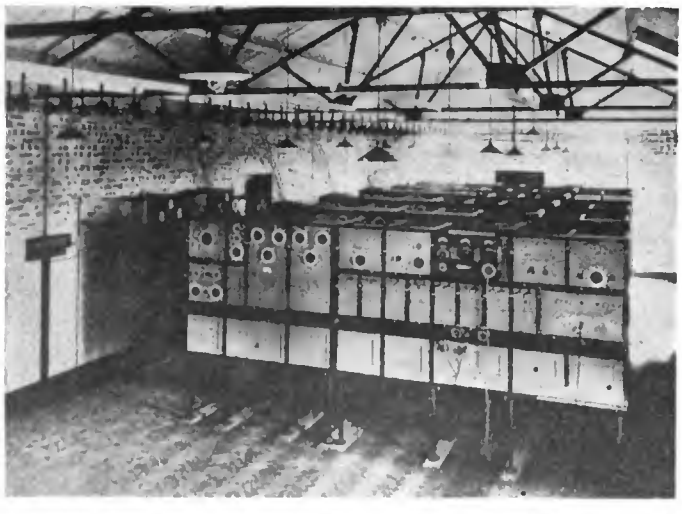
The receivers are very compactly constructed on a unit system. They make use of directional selectivity on the Marconi-Bellini system, and so efficient is this method that the six Trans-atlantic receivers, each tuned to a different transmitting station, are operated simultaneously from one aerial system.

Seven underground telegraph circuits and seven underground telephone circuits connect Brentwood and Radio House, and there are extensions to the transmitting center at Ongar. Check circuits are connected to these land lines in order to enable observations to be made of signals relayed to or from Radio House.

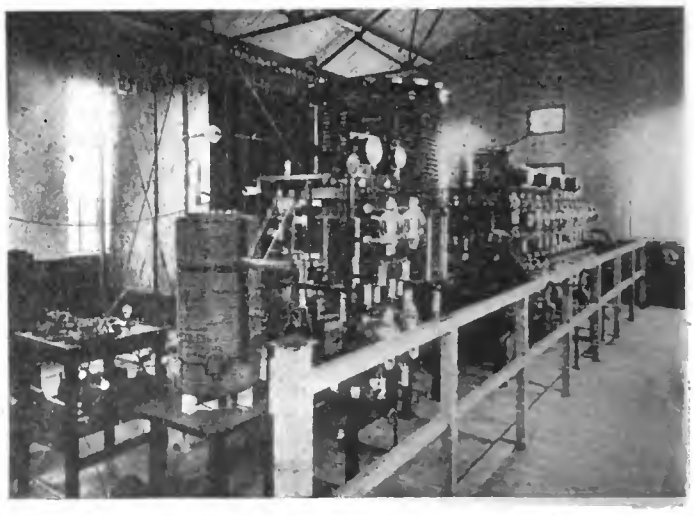
Medical Advice on Pacific

THE first use of radio for medical advice in the Pacific Ocean, so far as is known, took place on July 4th when medical atention was prescribed over several hundred miles of water by Dr. A. B. Carmichael, Los Angeles. Dr. Carmichael was a passenger on the S.S. *H. F. Alexander,* sailing between San Francisco and Seattle, when the radio operator picked up a medical call from the freighter *Floridian*, then off Puget Sound. The *Floridian* reported having a serious case of illness on board and asked for medical advice for the sick sailor.

Dr. Carmichael was called to the radio room on the *Alexander*, the duplex telephone transmitter was turned on and a two-way conversation carried on between th doctor and Capt. Schermerhorn of the *Floridian*. Late that night word came from the latter ship that the doctor's instructions had been followed and that the sailor was well on the road to recovery.



Interior of the Brentwood Receiving Station, where six different receiving circuits are operated from one antenna system



The tube transmitting equipment at Ongar consists of a fixed oscillator for constant frequency and banks of rectifier and oscillator tubes

Reception Above the Clouds

THE pilots of two of the balloons which took part in the national elimination balloon race which started from Indianapolis July 4th, have made interesting reports on radio conditions as they found them in the clouds high above the earah .during the contest.

Ralph Upson, one of the country's most prominent aircraft engineers, was the pilot of one of the big gas bags which was equipped with a General Electric receiving set..

From the report made by Upson after the contest it appears that interference from static is confined to a low atmospheric belt, comparatively close to the earth. The report in detail is as follows:

"One of the outstanding happenings in the use of radio in the balloon race was that at altitudes of 3,000 feet and above we observed absolutely no static whatever, although we could see lightning at various points on the horizon.

"Andrus, my aide, acted as chief radio operator. He began listening in at 8:30 o'clock the night of the race. At 9:45 o'clock, Central time, Andrus picked up the latter part of the weather report being broadcast from WGY in Schenectady. We heard just enough of it to make us wish we had heard the entire report. However, our disappointment was short for a few moments later the whole report was repeated, every word being received clear and distinct. It was just the news we wanted.

"As a result of the information, we decided to go a little higher but not to try any high altitudes unless forced to it by thunder storms. The report gave us full confidence of reaching New York State and possibly New England. Everything seemed so favorable that I turned in to sleep, leaving the balloon appendix partially closed. Then came the accident and you know the rest—a forced landing."

Lieut. R. S. Olmstead, winner of the National Balloon Race adjusting his Radiola II outfit prior to the start of the race from Indianapolis

Lieut. Robert S. Olmstead, pilot of the Army balloon S-6, which won the race, and who will be the leading American entry in the international race at Belgium, in September, reported that while drifting over lake Erie on July 4th he received radio returns of the Dempsey-Gibbons fight at Shelby, Mont., and later on picked up radio crop reports, bedtime stories and instrumental music.

Four balloons in all carried radio. Besides Upson's and Olmstead's balloons, the other two army entries were equipped. Lieut. Jordan has not yet made a report but Captain Lester T. Miller has written the General Electric Company, informally praising the radio set and its valuable use during the race.

"Lieut. Brown and myself during our flight found your set worked very satisfactorily in every way," Capt. Miller writes. "As you know the counterpoise we used was a seven strand copper wire, woven fifteen times about our basket. For our aerial we used 300 feet of the same kind of wire. During the night of July 4 and on July 5, we flew at an altitude of about 4,000 feet. All our weather reports were received very clearly, in fact the clearness of tones surprised both of us as they were clearer than our regular station sets on the ground.

"On July 5, after 8:30 A. M., we flew at a higher altitude and at heights of 5,000 feet and above we found that static was so bad that we were not able to receive satisfactory signals. We consider the set a very fine one and heartily recommend it for purposes of this kind."

Reception of American Broadcasting in San Salvador

By J. Frederico Mejia, E.E.

HAVING graduated from Rensselaer Polytechnic Institute, Troy, N. Y., a few years ago, it gave me great and unexpected pleasure recently to sit in my office here in San Salvador and hear a voice at WHAZ, 2,955 miles away, extending a friendly greeting to the former students of the Institute.

I became interested in radio through reading in THE WIRELESS AGE of the great popular interest in broadcasting in America and Europe and as a result I put together a receiving station which insures nightly reception of speech and music from the States. During the Summer season, however, the static prevailing here in the tropics is extremely heavy and although there is speech or music in evidence nightly, the static prevents anything like satisfactory reception.

In spite of this unsatisfactory condition, broadcasting from the following stations has been enjoyed:

WEAF	New York	2,800 Miles
WHAZ	Troy	2,955 Miles
WOC	Davenport	2,600 Miles
WDAF	Kansas City	2,500 Miles
WOS	Jefferson City	2,200 Miles
WBAP	Ft. Worth	1,900 Miles
KSD	St. Louis	2,000 Miles
PWX	Havana	1,200 Miles
6KW	Tunicia, Cuba	1,200 Miles

The receiving antenna used by Mr. Mejia

J. Frederico Mejia of San Salvador listening to broadcasting from America

of a loose coupler, detector and two steps of audio frequency, although for anything like regular reception two or three steps of radio-frequency amplification are required. WDAF is my favorite station and I have heard it practically every night this Summer, especially the late concert between 11:45 P. M. and 1 A. M.

My antenna is of the inverted L type. It consists of two posts located on the roof of the railroad station, the antenna proper being 70 feet above ground. It is made up of four No. 13 bare copper wires, properly insulated at all points and coming through the roof by means of porcelain tubes and wall insulators direct to the Barkelew lightning-arrester switch and then to the instruments. I sometimes use a "loop" 3 ft. square, which is advantageous when static is heavy. Both types of antennas give good service.

The main receiving set comprises a three-panel Federal radio-frequency set, with three radio, detector and two audio-frequency. The tuning element is made up of an antenna condenser, variocoupler and grid variometer, this combination being unsurpassed for reaching out for the far-away broadcasting stations.

Batteries and tubes: I use either Edison A-12 cells, Exide or dry batteries for the 1½ volt tubes, and Eveready and Mesco for the B batteries. Both De Forest DV-6 (5-volt) tubes, and various types of the Radiotron family are used for reception.

The ground consists of a No. 2 bare copper wire and about 100 feet was twisted into a thick cable with a spread bottom and placed in a hole two yards deep, with coke all around it. This is watered every day to keep it moist although this is really not necessary, being done primarily for electrical purposes.

Spare parts and tools used by Mr. Mejia in experimental work

As the photograph shows, I am well equipped with experimental equipment for all sorts of hook-ups and experiments. At the top may be seen an Atlas loud-speaker, Honeycombs (a complete set of each make) and Goodman spider-web coils. There are also W.E. 216-A, C-301-A tubes, and Federal rheostats, transformers and crystal detectors.

I have also a complete Remler five-panel set, RCA condensers, six Paragon V. T. control units to make a complete set, an Omnigraph and a large collection of light tools for any kind of radio experimental work.

Now for a word about radio in Salvador. I wish to mention in the first place, that our Government has placed no difficulties in the way of radio experimenters and we are proud of the radio regulations issued, which are almost identical with those of the United States. The amateur, therefore, has a very broad and well defined field for his work. Our present President, Dr. Alfonso Quinones Molina, is a very progressive man, and a radio fan himself, having a Federal set like mine installed at his official residence. He is interested in broadcasting too, so that in the near future, if present plans are carried out, we shall be broadcasting our own speech and music by radiophone.

Although there are only a few receiving stations at present, the outlook is very fair and no doubt with the coming of winter when receiving conditions are better, the number of radio sets will greatly increase. At this time of the year static is so bad that it sounds like machine gun firing in the phones, and believe me, there must be real love for the art to stand such racket in one's ears for hours at a time. With the development of radiophone transmitters in our own country it seems safe to predict that broadcasting will become popular in San Salvador.

Naval Radio in the War Zone

By Harry F. Breckel, Lieut. (jg) USNRF.
Former Chief Radio Operator U. S. S. *Corsair*

IN accordance with orders from the Bureau of Navigation, Navy Department, Washington, D. C., I reported to the radio officer on board the U. S. S. *Corsair*, then at the New York Navy Yard. He placed me in direct charge of the practical operation of the radio department and instructed me to get things in shape for an extended cruise away from any established base of supplies. This order could mean only one thing—that we were to go to European waters.

Within ten days we had completed all overhauling and repairs, and practically all of the supplies requested had been received on board, inspected, and carefully stored away for future use. Watch and station bills were made up, giving each man a particular duty to perform in the various emergencies that were likely to arise, and then the radio department was in all respects ready for sea.

The radio room was located on the main deck amidships, and at the time of my arrival was completely furnished with a large roomy desk, with plenty of drawers for stationery, etc., and amply large for use by the radio officer in his work of coding and de-coding dispatches, a bookshelf, several chairs, a large wall settee, which I used as a bunk during the entire time I was on board, and further, what in my estimation was a most valuable asset, a fair-sized combination safe, wherein could be kept the code books, ciphers, and other matter of a confidential nature. There was not a better "radio shack" on board any vessel of the Navy in regard to comfort. It was heated by steam, which was really unnecessary most of the time, as we were located directly over the after fire-room, which gave off sufficient heat to literally roast the operators on duty during the night watches, when it was necessary to keep all ports closed in order to prevent any light being seen by an enemy vessel. We also had a modern wash-basin installed in the radio room, with running water available at all times for our use. This water was, of course, cold, but we discovered that hot water could be obtained for the purpose of scrubbing clothes, paintwork, etc., from the steam radiator. This was certainly handy.

The author—chief radio operator of the U. S. S. Corsair

I ask you, "Sparks" and "ex-Sparks" of the Navy, can you picture such a condition to actually exist on board a real, honest-to-goodness man-o'war? We certainly had a fine "shack," and the operators' record for efficiency proves that a little comfort will help a whole lot in keeping them interested in

the brew of boiled compound that it turned out would keep a Mississippi colored gentleman with the hook-worm wide-awake! We sure had a "home" on board the old *Corsair*.

Finally, on that memorable 14th day of June, 1917, at about 4 a. m., the *Corsair* pointed her bow to the eastward and steamed slowly down the bay. We had received special instructions to keep radio communication down to a minimum, as it was possible for an enemy operator to judge by the amount of radio traffic in the air that something unusual was taking place, or pending, and further, in the event that the station he was operating was equipped with a direction-finder, or radio-compass, he could probably plot the exact position of the transmitter. This rule was followed by the Allied naval forces during the entire period of the war, as far as was possible, and there was very little doing in our radio department for several days beyond checking the ship's clock by the time signals and copying the weather reports, both from Arlington, and intercepting, for the "Skipper's" information, all radio traffic which was heard by the operator on watch. While the vessel was lying at her dock, awaiting orders to proceed, the radio force had constructed a long wave (undamped wave) receiver, and, as there was practically no traffic to be heard in mid-ocean, due to the fact that we were out of range of the ordinary spark stations, tests were carried out to determine the working efficiency of the undamped receiver. We had no trouble at all in copying signals from stations such as Darien, Canal Zone, Tuckerton, N. J., Boston, and other high-powered Naval Radio Stations, while the *Corsair* was well out in mid-Atlantic. Considering the fact that the apparatus and the "hook-up" used were all of the simplest design, and further that an amateur-type audion detector bulb was employed (no amplifier), this was excellent work.

About five days out our real work commenced. The *Corsair* radio was called by the flagship, and a long code message received. The apparatus functioned perfectly, and I was again assured that I had every reason to believe that very little trouble, barring accidents, would be encountered in the actual operation of the station.

Immediately after reception of the above message, I received orders from the radio officer to get in touch with the U. S. S. *Birmingham*, flagship of the Second Division

The first convoy of American troops enroute to France, June, 1917. The U. S. S. Corsair in the foreground

Damage caused by heavy seas during a hurricane in the war zone in December, 1917

experienced in "raising" the operator aboard the *Birmingham*, and the message was acknowledged by him a very few seconds after it was handed to me by the radio officer.

The *Corsair* left the First Division of the convoy shortly afterwards, and proceeded to join the *Birmingham* and the Second Division. There was absolutc silence for several days after joining the Second Division, and no radio signals were heard at all during the day, until we began to near the European coast, when we realized that we were at last in touch with war-torn Europe. As we began to ncar the borders of the so-called "war zone," as proclaimed by the enemy, radio traffic began to get heavier, and the operators on watch were kept busy copying messages into the "intercepted log book" every minute of the day and night.

This log was of inestimable value to the captain, for the radio station on board a man-o'war is in fact his information bureau, which keeps him in intimate touch with the events occurring in other districts, and without which he would, in these modern times, be badly handicapped. A man-o'war without a radio station can be likened unto a man who is deaf, dumb and blind. The operators who served on board the *Corsair* can well be proud of their work in connection with the radio department, the log book offering mute testimony to the fact that they were always on the job. The record established by the vessel also testifies to the efficiency of the radio department, for the rescue of not a few survivors is directly due to the fact that the operator on watch intercepted radio information concerning them.

During our approach to the coast of France, many distress messages were copied from vessels that had been, or were being attacked by enemy submarines. There are innumerable cases that could be cited where the radio message for help sent out by an Allied vessel was picked up by the radio operator on duty aboard an Allied warship which proceeded at once to the stricken ship's aid. Of course, there were times when the destroyer could not arrive at the scene in time to attack, and drive off or destroy the enemy submarine, but in most cases was able to rescue the survivors. This in itself was enough to make the value of the radio station on board ship priceless.

For some time I kept a chart upon which I plotted all the positions of vessels which within two months we had received so many reports that there was very little space left in which to record the new ones that were constantly being received during all hours of the day and night. The areas in the immediate vicinity of the British Isles and the coast of France were the scenes of the heaviest depredations by U-boats, as they were constantly operating therein. This distress call is typical of them all:

SOS SOS SOS 48' 12" North, 12' 00" West. Torpedoed, sinking, John Luckenbach 1025.

In the event of a vessel being shelled by an enemy submarine, practically the same form of message was transmitted with the exception that the word "shelled" was inserted in place of the word "torpedoed."

Many times, of course, a vessel which was armed would succeed in beating off her antagonist, in which case the radio operator would broadcast the following type of signal:

CQ CQ CQ de XXX, escaped; 2020.

In the case of a submarine being sighted by any Allied vessel, a simple form of position report was broadcasted by the operator at once, as follows:

ALLO (French for hello) 49' 15" N 09' 16" W 0815MXA.

The radio operator continued broadcasting the above signals until an acknowledgment was received by one of the larger, more powerful coastal stations, which immediately broadcasted the message on "high power" to all ships and stations for their information. The radio operators at sea who received such messages at once informed their captains.

These radio reports were of inestimable value in aiding the captains of vessels bound for European ports to pick the safest possible path through the submarine-infested war zone, and further, in the event of a vessel being sunk it was quite certain that the survivors would be picked up before many hours had elapsed, if the radio operator had succeeded in getting off a call for assistance before the sea water reached his apparatus and rendered it useless.

Finally, on the 25th day of June, 1917, the U. S. S. *Corsair* arrived safely at St. Nazaire, France, in company with the convoy, which had been successful in beating off one

department did not cease because of our arrival in port, for we kept a continuous watch, intercepting absolutely every message of importance which was transmitted, and which we could copy. We all had plenty of opportunity during the daytime, while at St. Nazaire, to make up for some of the sleepless nights spent in travelling across the Atlantic, and this, coupled with liberty on shore, was sufficient to bring up the spirits of the entire force to a high point.

After several days' stay, during which important confidential radio instructions were received from the French and British naval authorities, the *Corsair* received orders to proceed to Brest, France, which port was to be our base of operations. It was necessary for all vessels desiring to enter the port of Brest to transmit by radio a special form of radio message, addressed to the port authorities, requesting permission to do so. Failure to properly transmit this message would cause the vessel to run the risk of being fired upon by the naval batteries on shore. It was necessary to specify as to time, date, and also whether or not navigation lights were desired by the vessel entering the port. The port authorities would, upon receipt of the above message, transmit a reply by radio, stating whether or not it would be safe to enter the channel. This was vital, as the enemy submarines frequently mined the entrance to Brest.

The radio shore station at Brest was located about five miles from the U. S. Naval base that was established upon arrival of the *Corsair*, and the *Aphrodite* (another converted yacht), and had an old type low-frequency installation. The spark was, at the time of our arrival, very difficult to read through atmospheric electrical disturbances, and really did not have sufficient range. After the American Naval Base was established permanently at Brest, however, a modern installation replaced the old one, and American Naval radio operators went on duty to handle all American traffic.

After taking on fuel at Brest, the *Corsair* was assigned a patrol area, with orders to proceed to the aid of any vessel that desired assistance within its limits. The radio force maintained a constant watch twenty-four hours a day, and intercepted everything possible. Many distress calls were heard, and also many reports of submarines being sighted. Several times during the months that the *Corsair* was on patrol duty the operator on watch received calls for assistance from vessels in our patrol area, and we at once proceeded to their assistance. In all instances we were fortunate enough to arrive in time to save the vessels concerned from further attack.

The radio department during the ensuing months was kept extremely busy, for there was a constant stream of reports to be sent, and innumerable messages from the American Naval Headquarters to the captain of the *Corsair*, and also to our comrade on patrol in the adjoining area, the *Aphrodite*, telling of new situations to be dealt with, and other important information, without which the captains would have been sadly handicapped in their work of keeping the area assigned them free from submarines. The messages intercepted from the British radio station at Land's End, England, were coastal stations, and was handled very efficiently.

After some weeks of patrolling the "convoy system" was placed in effect, and the method of policing an assigned area discontinued. This increased the amount of traffic handled by the radio force. In working the convoy system the captain of a patrol vessel would receive orders to proceed to sea and "pick up" (locate) the convoy which was supposed to arrive at a designated position at a certain time. However, due to unforeseen difficulties, such as stormy weather,

The U. S. S. Corsair picking up survivors from the U. S. S. Californian which was sunk by a mine

breakdowns, etc., it was only upon rare occasions that a convoy was sighted in the exact position designated. With the aid of radio the commander of the escort force was enabled to ask the convoy commander for definite information as to the location, course and speed, and upon receipt of the desired information was able to determine just exactly what course and speed he must maintain in order to intercept the convoy without loss of time. Radio played a most important part in the escorting of vessels through the dangerous areas by destroyers and other patrol vessels, as there were times when it would have been utterly impossible to locate the convoy without its use.

At times the location of the various mine fields adjoining the coast of France would be changed while the *Corsair* was at sea, and again the radio would play its part in getting the important information regarding the changes. The importance of receiving information regarding the above-mentioned changes cannot be estimated too highly, for not only the safety of the *Corsair* depended upon it, but that of the entire convoy, it being a part of the vessel's duties to safely pilot the troop transports, merchant vessels, etc., through the various mine fields, and

occurred when the *Corsair* put into the port of Penzance, England, for a convoy. We were in port there a couple of days, and were due to sail for Brest the following day, when the radio operator on duty intercepted a radio message from the French high-powered station at Nantes, which stated that the entrance to the harbor of Brest had been mined by the enemy, and that entrance into the port was forbidden until further notice. The *Corsair* remained at Penzance with the convoy until a radio message was received some hours later stating that the entrance to Brest harbor had been swept clear of the mines, and that it was again possible for vessels to enter safely. It can easily be seen that the radio was directly responsible for avoiding the danger of running into this new mine-field.

The hardest test of all for the *Corsair's* radio personnel came during the month of December, 1917, and, in fact, it was the hardest test for all hands from the captain down to the last ordinary seaman. We were about to leave a convoy and return to Brest, when the weather began to get very bad, and the barometer showed all the indications of the approach of a severe storm. We steamed steadily toward Brest, and were within a few hours of port when the seas began to get so heavy that it was absolutely impossible for the vessel to buck them any longer with safety. Finally, after one huge wave had demolished the forward bulkhead of the officers' mess room, the captain decided it would be better to turn and run for it, that is, run before the storm and wind, in order to save the vessel from being battered to bits by the heavy seas.

The storm increased in force, until we were simply bobbed about on the huge seas like a match stick, the wind attaining hurricane velocity.

It was almost impossible for the operator on watch to keep in his chair, in spite of the fact that it was screwed down to the deck. The climax came some hours later, in the dead of night, when a terrific sea struck the *Corsair* on the port side amidships, crushed in the engine-room bulkhead, tore our heavy speed boat loose from the grips and lifted the hatch over the radio room clear of the deck and allowed about a ton or so of icy sea water to pour into it. The operator as well as the complete installation, received a terrific drenching, and the apparatus was rendered useless for the time being. The sea began to run still higher, and water began to force into the radio room through the seams of the doors, in spite of the fact that they were caulked up as tightly as was possible.

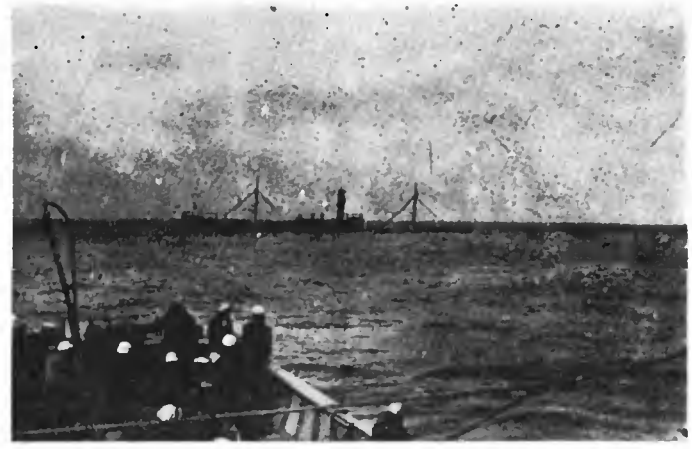
Soon more than a foot of water was in the radio room, and, as there was no system of drainage there, naturally every time the vessel would roll or pitch the water would all pile up in one end of the radio room, and then when the vessel recovered it would sweep over to the opposite side of the ship.

Just about this time our depth charges began to wash overboard, several of them exploding very close by us, and I can tell you that the "Sparks" on board the *Corsair* were sure up against a big proposition. Here we were with the entire receiver absolutely swimming in salt water, the transmitting panel splashed with water, the motor-gen-

erator submerged most of the time, our lead-in insulator and lead-in grounded very frequently by the huge waves which swept clear over us, and yet facing a probable order from the skipper to send out a distress call if we were battered up much more. We were all soaked to the skin with salt water, and it was impossible to get any "Java" to warm us up.

We set to work to get the apparatus back into shape. Taking one look at the receiver, I gave that up as an impossibility and devoted my time to clearing the grounds on the motor-generator, while the rest tried to bail out some of the water, but as it came in as fast as they bailed it out they soon gave it up as a bad job. However, we managed to keep the water below the level of the commutator, and the collector rings of the motor-generator, and after clearing up some of the worst grounds, during which I

"On Patrol"



The sinking of the Californian, caused by the explosion of a mine—U. S. S. Corsair in the foreground

was most beautifully "jolted" at times, we gave the transmitter a short test, and considering the conditions, it worked fairly well. I then made my way carefully up to the boat deck, and between seas managed to clean a heavy layer of salt off the lead-in insulator, and then gave it a heavy coat of oil, which kept it in fair condition for some time, when it would be necessary to repeat the treatment.

Meanwhile the rest of the gang were hard at work wiping the salt water off the various switches and other parts of the transmitter, and in this way we managed to keep it in fair shape, and ready in the event that it became necessary to transmit a distress call, which, judging from the terrific battering the ship was receiving would go out before many hours had elapsed. The deck force at this time succeeded in nailing some doors (ripped out of the cabins below) and canvas along the weather side of the radio room, and in my estimation this was the only thing that prevented our bulkheads from being smashed in, as were the engine-room bulkheads directly aft of us. In this case it would have been utterly impossible to keep the transmitter in satisfactory condition for transmitting.

Finally, after a two-and-a-half day siege of this, which seemed an age to all, we sighted land, and several hours later we dropped anchor in the harbor of Vigo, Spain. After a meal which tasted sweeter to me than any I ever ate either before or after that time (it was practically impossible to

cook during the storm), a survey of the damages caused by the storm was taken. The radio room was simply a mess! In fact, the entire vessel, from stem to stern, from truck to keelson, was simply a battered, salt-water soaked wreck.

The radio force immediately got busy straightening things out and getting the apparatus in shape again. The antenna lead-in was overhauled, lead-in insulators thoroughly inspected and cleaned, the receiver taken down, every part of it thoroughly inspected, necessary repairs effected, cleaned, and then thoroughly dried out. The entire transmitter was given a most thorough overhauling and cleaning, and then tested. It was found to be none the worse for its experience and submergence in salt water. Within eight hours the entire radio installation was in shape and ready for any emergency. Considering the fact that the radio room had been flooded with sea water for a period of two and a half days, I consider it mighty speedy work.

In spite of the condition of the vessel, we headed out to sea at about 5:30 p. m. the same day, and after an all-night run, arrived at Lisbon, Portugal, which nation was one of the Allies, so that we could remain in port for an indefinite period without danger of being interned for the period of the war, as would have been the case had we been forced to remain at Vigo. After a six weeks' stay at Lisbon, during which repairs were made on the vessel wherever they were needed, and the entire radio installation again was thoroughly overhauled and each individual piece of apparatus carefully looked over, we were again ready to return to France and take up our work of escorting convoys.

After our arrival at Brest, the *Corsair* was ordered to make Bordeaux her base, and we sailed for that port, arriving several days later. We proceeded to do escort work once more.

On one occasion the operator on watch was fortunate enough to intercept a very important message, addressed to the Commander of the U. S. Naval Forces in France, and knowing that the operator of the station to whom it was addressed had not succeeded in receiving it, reported the fact to the Radio Officer. The final result was that the message was forwarded to its proper address, and was directly responsible for the receipt of the following letter, which I quote:

Brest, France,
9 April, 1918.

From: Commander U. S. Naval Forces in France.
To: Commanding Officer, U. S. S. *Corsair*.

An important message was intercepted by the U. S. S. *Corsair* and forwarded to destination. This message was received in the Communication Office, Brest, about 3:00 p. m., Sunday, April 8th, 1918. The Commander U. S. S. Naval Forces in France is greatly pleased with this proof of the alertness and efficiency of the radio personnel on board the U. S. S. *Corsair*. The message was not heard by the French high-powered station, Brest, and while it was heard by the Flag Radio Station in Brest, it was not copied in its entirety because of interference from nearby stations, and the correct copy as received from the U. S. S. *Corsair* was of great assistance.

(Signed) Wilson.

You can readily imagine that after receiving a letter such as the above we all took still greater pride in our radio department, and I was truly sorry when, a short time later, I was transferred to shore duty with the Cherbourg District Commander, leaving my "right-hand man" in charge of the station.

In conclusion, the Radio Force of the *Corsair* can well take pride in having helped secure for her a citation from Admiral Sims, Commander of the U. S. Naval Forces in European Waters, who deemed her performance of duty in the War Zone such as to warrant the bestowal of that commendation so cherished by all naval men, "Well done, *Corsair*."

Lepers Hear Radio Concerts

CABRAS ISLAND is a land of exile no more. It is the leper colony maintained by Porto Rico, and is carefully shunned by men, save visiting doctors and scientists on errands of mercy or study. But it is not avoided by radio waves, and now the unfortunate lepers listen to radio concerts from Porto Rico, Havana, and the United States. An anonymous donor in the United States started a fund to provide Cabras Island with a radio set, contributing $100, and local men and women quickly added enough to buy the apparatus, including a loud speaker.

An Efficient Homemade Neutrodyne

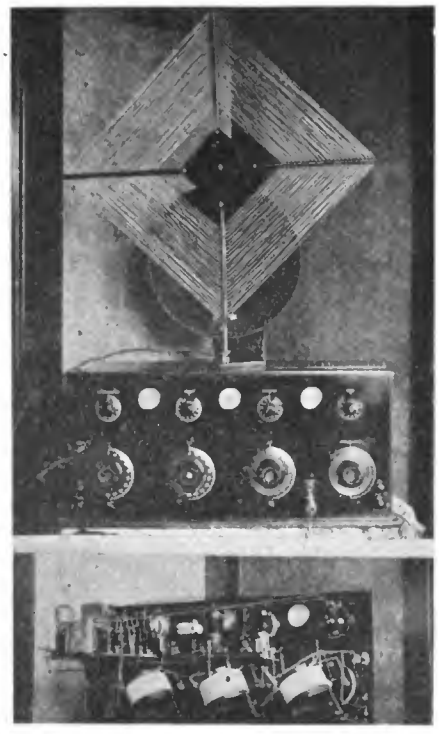
By L. Kranzl

A REALLY selective and extra sensitive broadcast receiver may be secured with the Neutrodyne circuit invented by Professor Hazeltine and described in the April issue of THE WIRELESS AGE.

These results will be readily obtained if the capacity coupilngs of the radio-frequency amplifying tubes are properly neutralized by means of the neutralizing condensers. If proper care is taken in handling the detector circuit there will be a total absence of whistling and at the worst a click in the phone may be heard when a carrier wave is located, whence it is an easy matter to bring in the speech or music. It is equally effective on short and long waves.

The radio frequency amplifying tubes with a properly designed circuit cannot be made to oscillate, but merely to amplify the incoming signals, and this prevents the oscillations of the detector circuit from finding their way into the antenna circuit and so eliminates radiation, which is coming to be a rather serious source of interference where several oscillating receiving sets are all operated in close proximity.

Some idea of its selectivity may be gained from the fact while the powerful 750-watt local broadcasting station KTW is working only four miles away using a wavelength of 360 meters, the smaller station KHT, Los Angeles, using a 395-meter wavelength and 1,100 miles distant, is received on the loud speaker with absolutely no interference. In fact, it is necessary to turn the condenser dials several degrees before the local station can be even heard. During the month of May, WBAP, Fort Worth, Texas, 2,000 miles distant, CRCB, Winnipeg, Manitoba, Canada, 1,600 miles distant, have been received with fair volume on the loud

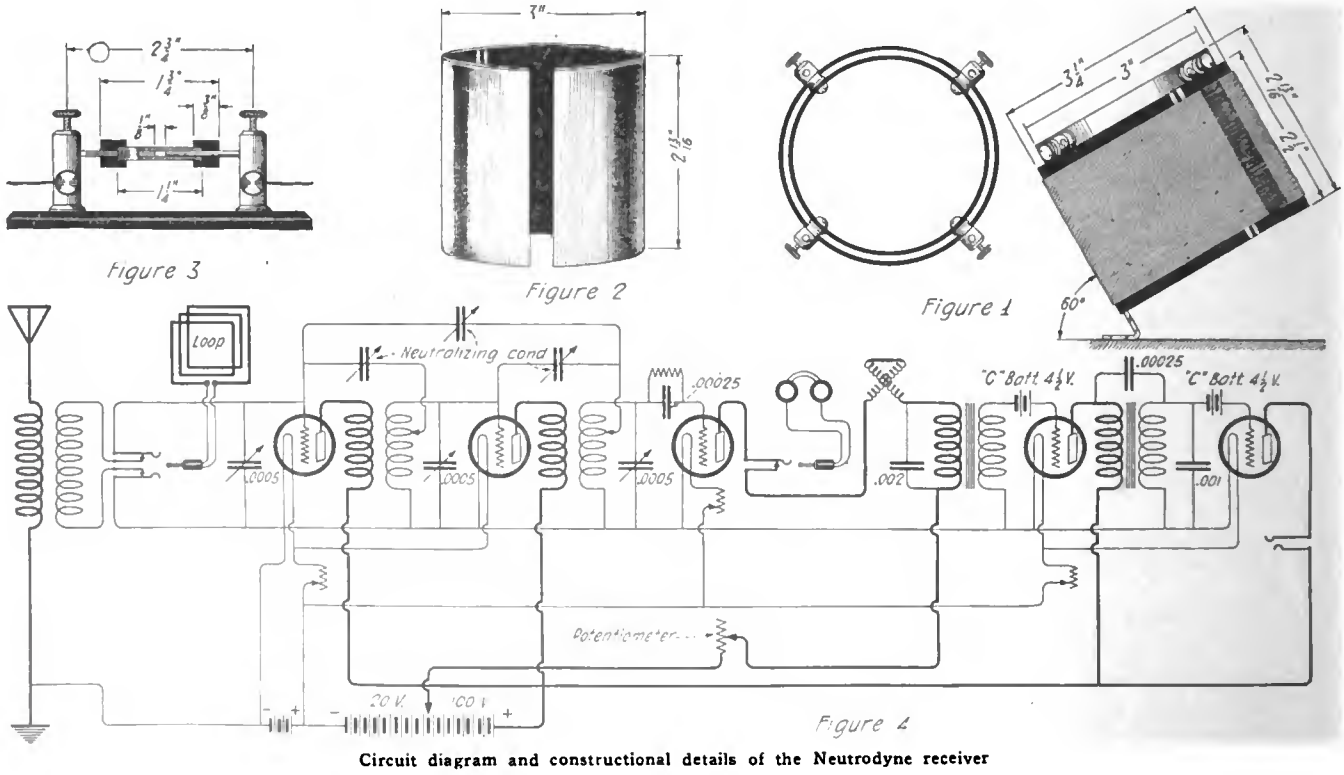


The homemade Neutrodyne receiver with loop antenna

speaker, early in the evening. The antenna used is of the invertcd L type, 2 wires, each 60 feet long and 27 feet above the ground. Small stations using 50 watts or less and within a radius of 50 miles come in strong on the loud speaker without the use of any audio frequency amplification or regeneration.

The following is a brief description of the construction of this set and some of the parts. The panel is of 3/16-inch bakelite 11 x 25 inches polished and the lettering engraved. There are few holes to be drilled since no switch points are used and the battery connections are all from the back, doing away with binding posts and unsightly, tangling wires in front of the panel. For the input a jack is provided permitting of quick and convenient change from antenna to loop or vice versa. On the lower left hand side of the panel are two binding posts for the ground and antenna, but the latter is not used in this case. On the extreme right two binding posts are provided for the "A" battery connections to be used where it is not practical to use the connection in the back of the cabinet. The first three large dials at the bottom are the tuning condensers, the fourth one the variometer, which controls the regeneration, which is sometimes useful for short wavelengths and C. W. reception. For ordinary broadcast reception, however, I have found so far very little use for it, and where a set is intended for the latter purpose only it may be omitted without in the least detracting from the efficiency of the set. Two jacks are used for the detector and second stage audio. The dial in the upper row to the left is a potentiometer, which can also be omitted. In this case it was used because one was on hand to help out the looks of the panel and for very fine adjustment of the detector tube plate potential, being connected in series with the "B" battery. The other three dials are rheostats, one for the two radio amplifying tubes, one for the detector and one for the two audio amplifying tubes.

It is better to use a separate rheostat for each circuit and in particular for the detector. Amplifier tubes can be used throughout, but better results will be obtained by



Circuit diagram and constructional details of the Neutrodyne receiver

are mounted on a shelf, the shelf resting on rubber cushions, supported by brackets. These help to eliminate a great deal of noise caused by jarring the tubes.

Probably the most difficult parts of this set to construct are the radio-frequency transformers, see figure 1. I used bakelite tubing 3¼ x 2½ inches for the secondary or outside coil and 3 x 13/16 inches for the primary or inside coil. The secondary has 53 turns of No. 24 D. S. C. wire, the primary 12 turns No. 24 D. S. C. wire. The four terminals are brought out on the inside and soldered to small metal binding posts, which are made fast to the primary or inside tube which in turn is made to prodate this post. This post also helps to keep the coils in place and provides an easy means for connecting the leads. Another good way to make these transformers is to get the same size tubing for both coils, take the longer, or primary, and cut out a strip of sufficient width the full length of the tube, see figure 2, to just permit it, when wound, of going inside the secondary. The width of the strip to be cut out depends on the size and thickness of the tube, plus the wire. The distance between the windings of the primary and secondary should not be more than ⅛ inch, but may be less, the windings are all in one direction on the secondary of the second and third transthe upper end of the windings of the primary for the leads to their respective neutralizing condensers, the transformers are mounted 6 inches between centers and at an angle of 60 degrees to prevent magnetic coupling.

Wonderful clarity of signals with very little loss of volume will be obtained by connecting a fixed condenser of approximately .001 mfd. across the secondary and another one of .00025 mfd. capacity in series with the plate and grid terminal of the second audio frequency transformer, thus forming a by-pass and ground for any stray radio frequency currents that finds their way into the audio frequency circuit.

Beware the Bootleg Radio Tube

An Investigation Has Disclosed Seven Factories in Newark, N. J. That Alone Produce 3,500 Counterfeit Inferior Tubes a Day

THE Newark, N. J., "Sunday Call," which recently conducted an investigation of the extent of manufacture of "bootleg" radio tubes in that city, stated in an article recently that the bootlegging of vacuum tubes used in radio receiving sets has grown to be one of the most widely-practiced and highly profitable undertakings.

Beginning about a year ago on a small scale, according to the "Call," with the manufacture of various crude types of tubes which were easily spotted, the radio bootlegger has developed his business to the point of so skilfully and accurately counterfeiting the products of several prominent manufacturers that only an expert is able to detect the difference. In the course of examining the receiving sets of about forty amateurs a day for the past year and a half, the "Call" has been afforded an unusual opportunity of examining a large variety of vacuum tubes, and whereas it was formerly a very simple matter to detect a bootleg product because of its faulty construction, the job has now become one requiring the closest examination.

The manufacture of the so-called standard vacuum tubes is in the hands of the General Electric Company and the Westinghouse Electric and Manufacturing Company, from whose factories come the UV-200, UV-201, UV-201-A, UV-199, WD-11, WD-12 and, in addition, a series of tubes used largely in transmitting circuits. These tubes are sold through the Radio Corporation of America to the jobbers and dealers of the country. From the General Electric factories also come a series of tubes identically the same as listed above, but bearing the trade designation C-300, C-301, C-301-A, C-299, C-11 and C-12 and the signature of E. T. Cunningham. These tubes are widely used on the Pacific Coast and have recently been introduced into New Jersey through an authorized distributor.

Another important manufacturer of standard tubes is the Western Electric Company, makers of the VT-1 and VT-2, used extensively by the Signal Corps of the United States Army, the 216-A used as a power amplifier and the "N" (peanut) tube employed as a detector, as well as a radio and audio amplifier. The latter tube, although not sold for amateur and experimental use in this country, has attracted considerable attention here. The interest thus aroused has been capitalized by the bootleggers, who have placed copies of this tube on the market.

The list of standard tube manufacturers also includes the Morehead Laboratories, the Radio-Audion Company of Jersey City, makers of the Lo-Mu and Hi-Mu amplifier tubes, and the De Forest Radio Telephone and Telegraph Company, makers of the DV-6 and the DV-6-A. Beyond this, it may be safe to admit into the standard group any manufacturer whose product is produced openly and which bears his trademark accompanied by his name and address, or any like guarantee of good faith.

The development of standard vacuum tubes to their present high point of efficiency has been achieved only after the expenditure of hundreds of thousands of dollars by the companies mentioned above. The patents resulting from this costly experimentation represent a form of protection for the manufacturer against the pirates of industry who seek to profit by the fruits of another's labor and brains.

Patents mean nothing to the radio bootlegger, however. Not only does he steal the fundamental principle which has taken a legitimate firm years to develop, but he completes the job to the last detail by counterfeiting the tube in size, shape and even in the design of the trademark.

Newark is reported to be the biggest source of bootleg vacuum tubes in the country, but, strangely enough, fewer bootleg tubes are sold in this city than in any radio center of its size and importance in the United States. The local public is afforded a large measure of protection through the integrity of the dealers and a constant watch over the radio market is maintained by the "Call's" staff for the protection and information of its readers. Because of this fact radio bootleggers find it more profitable to seek other dumping grounds for their products.

From a source believed to be very reliable the "Sunday Call" learns that there are approximately seven "factories" engaged in the manufacture of bootleg tubes in Newark alone. The combined capacity of these plants is figured at 3,500 tubes a day. There are five additional factories in New York and Brooklyn, this latter group being capable of producing about 2,000 tubes a day.

The reason Newark is such a big manufacturing center for bootleg tubes is because this city and vicinity affords the greatest market for skilled labor and materials, vital necessities to the bootlegger. In Harrison, just across the Passaic River from Newark, is the General Electric plant, employing thousands of workers—mostly girls on the various processes of vacuum tube construction. In Bloomfield, another suburban town, is the Westinghouse Lamp Works, also employing thousands of trained workers on radio tubes. In these factories inexperienced labor is taken and thoroughly trained in the delicate work of tube making. Once thoroughly trained and experienced, this labor is recruited by agents of the bootleggers who are known to have approached workers leaving the factories. Higher wages is the usual bait, but bonuses are offered to the girls skilled in the more delicate branches of the work.

With this labor at his command the bootlegger is better able to carry out the details of counterfeiting standard tubes. There has come to the attention of the "Call" some excellent copies of the UV-199. It is difficult to tell the copy from the original. Its weakness is in its extremely short filament life, the average bootleg lasting only a few hours as against 1,000 hours, the normal service of a standard tube. The bootleg 199's examined have a higher rate of current consumption than the genuine and a low percentage of electron emission, which means poorer service. This is largely because the bootlegger is unable to obtain the proper filament material and coating and is obliged to substitute a flattened platinum wire, which, incidentally, is also obtainable locally.

The counterfeit UV-199 is distinguished by the fact that the R. C. A., G. E. and W. trademarks impressed in white on the glass may be erased by rubbing a moistened finger over them. On the genuine these trademarks are etched on the glass and cannot be removed. The printing on the base of the tube is frequently badly smudged on the bootleg, whereas on the genuine it is quite clear and readable.

In addition to counterfeit UV-199, the "Call" has discovered fake Western Electric "N" tubes, fake UV-200 and UV-201, De Forest DV-6, WD-12 and UV-201-A.

Train Radio Tests in Iowa

RADIO reception aboard a moving train has been one of the most interesting fields of radio experimenting during the last few months, and a good many organizations have taken part in this work. In order that we may all benefit from each one of our tests, the writer has made an effort to describe and explain each detail of the recent installation made on the Booster Special which was made up by the Chicago & Northwestern Railway, and which train left Sioux City, Iowa, on a Trade Excursion Trip extending over four days from May 22 to May 25 inclusive. The route of the trip is laid out on the enclosed map and the trip extended over roads owned by the C., St. P. M. & O. Ry., the M. & St. L. R. R., the C., M. & St. P. Ry., and the C., R. I. & P. Road.

The complete installation was made by The McGraw Company in Sioux City assisted by the local yard foreman of the C. & N. W. road.

The antenna consisted of a single No. 14 stranded copper wire the length of two coaches. The supports for the antenna consisted of one-innch wrought iron pipe, one at each end of each coach, and these pipes were clamped to the hand grip at the side of the entrances to the coaches, thus aligning the antenna in a plane with the side of the coach.

Two complete receiving sets were carried, one a Westinghouse combination of models RT, AR, RA and DA, and the other a Radiola IV. The two sets were placed upon tables at the rear right corner of the car. The four unit combination set used was the same as the famous Westinghouse RC set with the addition of the RT antenna coupler and the AR 3 stage radio frequency amplifier unit.

Three UV-201-A tubes were used in the AR unit and two of them were used in the DA unit for the audio frequency amplifier. A UV-200 tube was used as detector. All of the amplifier plates were supplied with 68 volts and the detector plate was found to operate best at 22 volts.

Until the train reached a speed of about 15 miles per hour the clearness of reception was remarkable, but at above this speed the charging generator of the car would be cut in causing a loud generator hum which ruined reception.

The first day of the trip was rainy and damp, but the weather had but little effect upon reception for the first few hours. Later the atmospheric disturbance became heavy and remained so throughout the next two days. The last day there was almost no atmospheric disturbance and reception was remarkably clear.

The first evening out the operator had the misfortune of being side-tracked directly under a power line running at right angles to the railroad track and this line carried 33,000 volts. At this point reception was out of the question due to the induction from this line. The train was later pulled ahead about 250 feet and the reception was again very good, there being almost no interference from this line.

At several stops reception on loud speaker was impracticable due to the induction of telegraph lines and telegraph apparatus at the depot. Aside from the resultant clicking corresponding to the telegraph instrument, reception was very clear

The best results were obtained during the day time, between the hours of 8 A. M. and 5:30 P. M. After that time atmospherics became very prominent. The broadcasting stations within tuning range at any time were as follows:

WEAU, a 100-watt transmitter, belonging to Davidson Bros. Co. Sioux City, Iowa.

WLAG, Cutting & Washington Radio Co., Minneapolis, Minn.

WDAF, the Kansas City Star.

WBAP, the Fort Worth, Texas Star Telegram.

WJAG, the Norfolk, Nebr. Daily News.

WHB, Sweeny Automotive & Electrical School, Kansas City, Mo.

WEAB, Standard Radio Equipment Co., Fort Dodge, Iowa.

WOAW, Woodmen of the World. Omaha, Nebr.

WIAK, the Journal-Stockman Co., Omaha, Nebr.

News items and market reports broadcasted by WEAU for the benefit of the Good Fellowship Train were received at 42 out of the 47 stops. Several special talks by Sioux City business men who were unable to accompany the junketeers on the trip were received very satisfactorily. Part of the talks were received on loud speakers.

As to the reliability of radio reception aboard a train I would say that this apparatus is, of course, subject to the usual atmospheric disturbances and is also subject to the further disturbance of induction from the local charging generator when the train is moving. It would seem advisable to use a filtering system connected to the generator set on the one car at least in which the apparatus is housed or an audio frequency filter on the receiving set itself.

There was very little opportunity for observing the directional effects of the antenna because during the entire trip there were very few sharp curves encountered. At one time, however, the train rounded a sharp curve alongside a creek, but the reception did not seem to change in any respect. At this particular time the train was moving backward at a slow speed so that the charging generator was not interfering. It was impossible to observe the effect of the topography as the train was moving, due to the annoyance caused by the charging generator.

I should like to hear from other readers of THE WIRELESS AGE who have made similar train radio tests.

New $1,500,000 U. S. Navy Research Laboratory

By S. R. Winters

THE most pretentious facilities and quarters for conducting investigations in problems affecting radio communication, yet established by any government bureau, are now available to the United States Navy Department. The completion of an experimental research laboratory, representing an investment of $1,500,000, at Bellevue, District of Columbia, places at the disposal of scientists studying the subjects of radio and sound a floor space of 220 feet in length and 60 feet in width, all of which is under one roof. That is, the entire top floor of a newly built three-story government experimental laboratory is reserved for research in the problems of wireless communication and the science of sound.

The dedication of this $1,500,000 structure in response to "the need of adequate facilities for research in problems peculiar to naval application of the various arts," to quote a statement of Secretary of Navy Edwin Denby, places the United States on a parity with England, France, and Germany, in providing ample and convenient quarters for scientific research. This provision is peculiarly applicable to the conduct of investigations pertaining to instruments and methods used in radio communication. Located on a government reservation on the Potomac River, at a point seven miles from the headquarters of the Navy Department, the arts of radio, ordnance, sound, aviation, and navigation, may draw upon the resources and facilities of this experimental research laboratory for a solution of their problems. A machine shop, 300 by 80 feet in dimensions; a foundry, 100 by 60 feet in size; a pattern shop of like dimensions; and a powerhouse, are buildings which supplement the three-story research laboratory.

The radio research laboratory in operation by the Navy Department at the Bureau of Standards, the naval aircraft radio laboratory at Anacostia, D. C., and the engineering experiment station at Annapolis, Md.—heretofore widely separated quarters and facilities for research in the problems of wireless communication—are forthwith abandoned. There experimental units will be merged into unified facilities at the Bellevue laboratory, thus avoiding duplication of effort which characterized investigations under the former arrangement. The lack of unity in radio research activities of the Navy Department, under the former system is suggested by indicating the locations of the laboratories pursuing similar lines of investigations. The engineering experiment station, partially concerned with problems affecting wireless communication, is located at Annapolis, Md., 40 miles from Washington. The naval aircraft radio laboratory at Anacostia, D. C., and the naval radio research laboratory at the Bureau of Standards are approximately seven miles apart. The latter unit, however, was not housed under one roof. Dr. L. W. Austin conducted experiments relating to atmospheric disturbances on the ground floor of the radio laboratory of the Bureau of Standards, while Dr. J. M. Miller did research with reference to the characteristics of vacuum tubes on the fourth floor of the East Building, another struc-

(*Continued on page 82*)

Blind Boy Constructs Radio Sets

By L. L. Harned

AT Vancouver, Wash., lives a sixteen-year-old boy, Clifford Huntley, who, although blind since early childhood, has accomplished more than many boys of his age who are without his handicap. Two and a half years ago, after some study of wireless telegraphy, guided only by the sense of touch, he built a receiving set. Quickly learning the code, he began taking examinations for amateurs, and now holds a first-class license, operating under the call 7AZ. Recently he took an examination for a second-class commercial license, which is much more difficult than that for amatcurs. Later, he intends taking the examination for a first-class license, as he reasons that thc holders of first-class licenses are comparatively few and their chances for getting a position are better than arc those of second-class operators.

In addition to making his original receiving and transmitting sets, Clifford is now working on a new one that will bc much more powerful. He has wound the transformers and madc some of the parts himself, buying a few other parts. With a charging panel, madc by himself, he charges his batteries. One of his transmitters is a half K.W. spark, the other a 5-watt C.W. set. He intends later to replacc his outside 60-foot aerial with a new one 75 feet in height.

Clifford has received cards from other amateurs in many parts of the United States, even as far away as Atlanta, Ga., Ithaca, N. Y., and station 1AW in Connecticut. With his sending set, he and his chum, Robert Tomlinson, have sent signals that were heard in San Francisco.

Clifford's sight began to fail at the age of two years. Although able to see a faint light, he cannot distinguish objects. Twelve years ago he came West with his parents from his formcr home in Iowa. He entered the School for thc Blind at East Vancouver, where he was graduated thrce years ago. He has not taken an elcctrical course in any school, having learned all he knows from text-books read to him by his mother, and from cxperiments made by himself and by othcr amateur operators in Vancouver.

Clifford Huntley, 16-ycar-old blind boy and operator of Station 7AZ. Hc holds a second-class commercial operator's license and constructs and operates radio apparatus

A Novel Long-Distance Broadcast Receiver

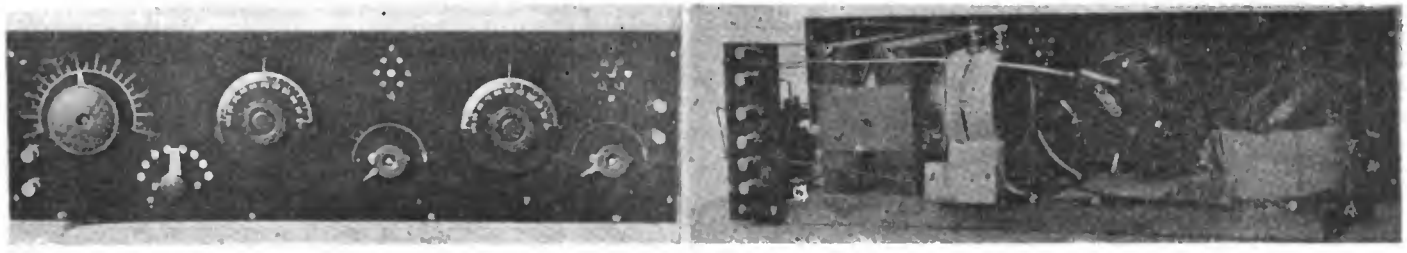
By A. L. Munzig, of 6 ZJ

THERE are so many ways of building a broadcast receiver, that the novitiate listener hardly knows which one to choose. Each writer has his own personal views and is always very enthusiastic about the receiver he describes. Obviously, then, the writer of this article would quite naturally be enthusiastic over his *own* design. You are right in your surmise, gentle reader—*I am enthused!*

Seriously, dear friends, this *is* a superior instrument and I am going to tell you why. In the first place it has the advantages of both tuned plate and tickler coupling to obtain capacitative feedback. This will allow the set to oscillate and regenerate over a wide band of wavelengths—wavelengths that are not accessible with variometer alone. While at short wavelengths the set is caused to regenerate by tuning the plate circuit to resonance and assisted, in a novcl way, by the secondary load-coil bcing in inductive relation to the variometer. It will be readily seen by those of you who are familiar somewhat with regenerative receivers, that the act of placing a coil in inductive relation to another, will cause some kind of a disturbance. What kind of an effect will this have? Will it detract or add to thc efficiency of the set? Let me inform you that it will *add!* The secondary load-coil is placed in this position to take advantage of thc radio-frequency present! This, however, does not hold true, when wavelengths above the natural period of the plate variometer, are used. The variometer then functions solely as thc tickler coil, oscillations being controlled by varying the mutual inductance of thc variometer.

In figure 1 is given the circuit. Circuit students will recognize this as thc famous Paragon circuit—but with a few modifications and improvements. Only one stage of audio-frequency amplification was used, the assumption being that two stages would only increase the volume of sound, necessary for loud speakers. As phones were the only typc of rccorders used, no extreme loud signals were desired, loud signals having the tendency to deaden the susceptibility of the ear diaphram to weak signals. However, if more steps of amplification are desired, they can readily be addcd.

Originally, this regenerative receiver was designed for reception on 200 meters, but with thc advent of broadcasting the receiver was unable to tunc up to these comparatively longer wavclengths. Conscqucntly, a secondary load was necessary. Desiring to get the most out of thc set that could possibly be had, the load coil was put in inductive relation to the plate variomcter, to take advan-



Figures 3 and 4—Front and interior views of the novel long-distance broadcast receiver

binding post as shown. A binding post was also placed at the end of the winding. By using a flexible lead either one of these posts can be connected in—the first one for broadcasting on 360 and 400 meters and the last one for wavelengths from 500 to 800 meters. It will readily be seen that this is quite an advantage—to have other wavelengths accessible, with no loss in efficiency. You fellows that like to listen to 600-meter traffic will find in this design exactly what you have been looking for!

Figure 3 shows the front view of this receiver. The controls from left to right are: coupling control; antenna inductance control; secondary condenser control, detector rheostat control; variometer control; and amplifier rheostat control. The binding posts at the extreme left are for the antenna and ground and the binding posts at the extreme right are the output posts, where the phones are connected. The "engraving" was done with a sharp pointed tool, a steel rule and a steel compass. The highly polished side of formica is very easily scratched and in these white crayon was rubbed, leaving a neat appearing panel.

In figure 4 is shown the rear view of the receiver. An idea can be had, from the photo, how to arrange the respective parts. The variable condenser seen, is an old mounted Murdock condenser that was improvised for the occasion. The shaft wasn't quite long enough, so it was necessary to add a small length of 3/16 round brass shafting to it. This was done by placing a small brass sleeving over the ends that meet and soldering thoroughly. So far it has given no trouble.

When connecting this receiver, try to avoid lengthy parallel leads as much as possible. Parallel wires act as miniature condensers and consequently increase the distributed capacity of the set. Capacitance under control is what we want—so let the variable condenser take care of it. Use No. 14 or 16 *bare* copper wire for inter-connections. Preferably No. 16, for it offers less surface, yet is large enough to carry the high frequency currents efficiently. It will be quite obvious that if more surface is exposed on these connections, the greater will be the area that electro-static charges can accumulate on—result: an increase in distributed sleeving, etc., the dielectric will proportionately increase its constant, with a resulting increase in capacity. Another practice in vogue these days is to connect with tinned bus-bar. Don't do this, even though it breaks your heart. Radio frequency currents follow an outside surface path and will follow this tinned proportion which is a very poor conductor. Of what value, then, would be the use of copper wire? Absolutely none, friends—absolutely none. Iron wire would do just as well. However, with silver-plated bus-wire, just the opposite is the case. Silver is the best conductor known and therefore recommended, if it can be bought, stolen or borrowed. Otherwise, use plain, bare copper wire—No. 16 preferred, as already stated.

If, upon the completion of this receiver, no regeneration can be obtained above 600 meters, reverse the leads to the variometer. It will then be found that the set regenerates and oscillates very consistently. If it shouldn't, something else is radically wrong. Trace over the connections and make sure they are O. K. If this doesn't reveal the trouble, increase the capacity of the by-pass condenser across the primary winding of the amplifying transformer.

When the set is ready for operation light up the tubes—the amplifier tube about three-quarters brilliancy, and the detector tube just below the point where a faint "hiss" is heard. Rotate the plate variometer control to about 30 degrees. Place the flexible lead in the center binding post of the secondary load inductance and very slowly rotate the Readjust the detector, using the vernier, for better results. With a little practice one will soon become familiar with the tuning and once this has been accomplished the results will be surprising to the average enthusiast.

The list of parts necessary for the construction of this novel type of receiver is included for the information of the enthusiasts who desire to build their own, and is as follows:

1 Large knob and pointer.
8 contact points.
1 switch and contact arm.
2 knobs and dials (3 in.).
2 rheostats (one with vernier).
12 binding posts.
1 variocoupler.
1 43-plate variable condenser.
1 3½ in. salt box.
1 variometer.
¼ lb. of No. 24 D. C. C. copper wire.
2 VT sockets.
1 Amplifying transformer.
1 Bakelite panel, 6 in. x 21 in. x 3/16 in.
1 terminal panel, 1 in. x 5 in. x 3/16 in.
1 white pine base ¾ in x 6 in. x 20 in.
2 fixed condensers (.001).

With the set herein described I have heard in my home at Redlands, Calif., practically all of the large broadcasting stations of the country, including those at Newark, N. J., Honolulu, Dallas, Seattle, Chicago, Schenectady, Sanford, Me., Pittsburgh, New York and Havana, Cuba.

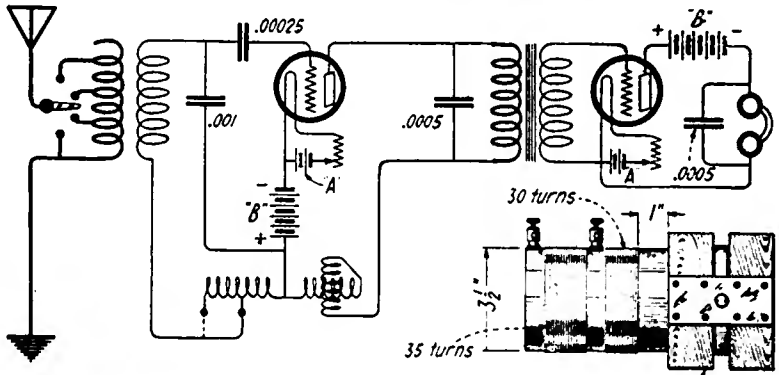


Figure 1 Figure 2

Circuit diagram and details of load-coil used in the long-distance broadcast receiver

A Single Circuit Receiver, With Special Features

By Jerome Snyder

IT has been clearly demonstrated in various articles and editorials that for the novice the best type of set especially for broadcast listening is the single circuit receiver. The single circuit receiver may, or may not, have one control knob. If the circuit is of the type shown in figure 1 it will have only one control knob. This is a great help in tuning as it simplifies the process of tuning as much as it will ever be simplified. But in these types of circuits only one element is usually varied, either the inductance or the capacity. With one control knob both factors are usually not capable of being varied. If both factors could be varied more selective tuning would be obtained and better proportioning of inductance and capacity secured with proportionately better results in reception. So as far as the circuits in figure 1 go they have the great advantage of one control knob, but have the disadvantage that both inductance and capacity cannot be varied with the one knob. On the other hand if the single circuit receiver is of the type shown in figure 2 this has the advantage that both inductance and capacity can be varied, thus enabling best proportions to be obtained with corresponding better results. But at the same time this type of circuit requires two control knobs, one for the capacity and one for the inductance. Thus the single circuit receiver has the advantage of varying both capacity and inductance, but the disadvantage of more than one control knob. These types of single circuit receivers are the ones in general use. None of them have the advantage of varying both inductance and capacity, and at the same time requiring only one control knob.

Such a single circuit receiver combining both these advantages can be built in the manner described in this article. The rheostat, grid leak and condenser, tube socket and other accessories are the same in this receiver as in every other type, and since the

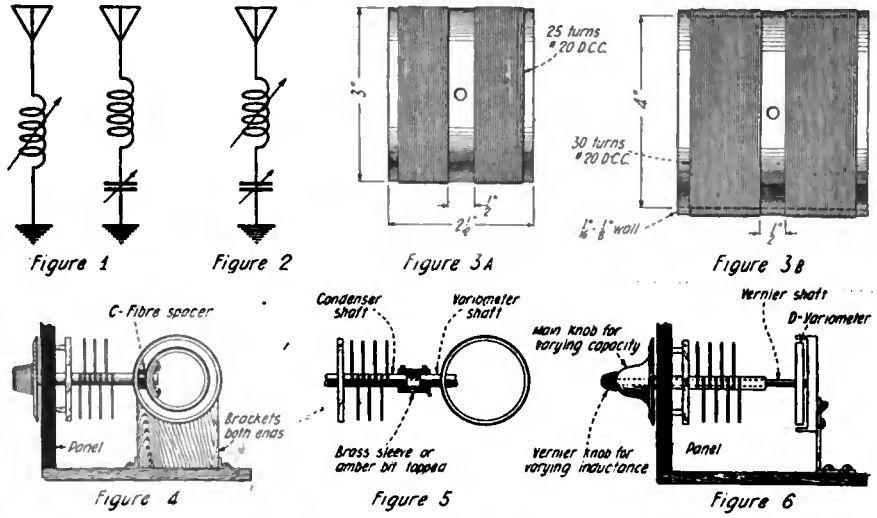
items are the inductance and condenser, how these are built and assembled in orde to obtain variation of both of these units with one control knob.

In this receiver the usual type of variable condenser is employed having 23 plates, and it is mounted on the panel in the regular manner. The inductance unit is a variometer having the following data. The two coils are wound on fiber tubes, of the dimensions shown in figure 3. The outside tube is 3½ inches long with an inside diameter of 4 inches. The thickness of the tube may be 1/16 inch to ⅛ inch, whichever is most convenient This tube or coil is the stationary one. The inside coil, which is the rotor, is 2½ inches long and 3 inches outside diameter, the wall having the same thickness as the outside one. Care should be taken that the inside tube is just 3 inches outside diameter, as this size will just permit free rotation of the coil inside the outer tube. The outside coil is wound with 30 turns of No. 20 double cotton covered wire, in the manner shown in figure 3, leaving a ½ inch space between windings in the center. The inside coil is wound in the same way, only 25 turns are here used. Holes are drilled in the center of each form for the shaft.

The idea in this set is to mount the variometer so that it is on the same shaft as the variable condenser as shown in figure 4. Wooden forms cut out like A in figure 4 are used to support the outside variometer coil. This may be tied to the bottom of the set by screws. The problem is simply one of mounting the inner rotor coil to the condenser shaft. The supporting brackets A should be made just high enough to bring the center holes of the variometer on a line with the condenser shaft. Ordinarily it will be found that the condenser shaft is too small to use for the variometer. The writer had a larger condenser from which he took off a few of the rear plates thus giving a larger extension for the shaft. A piece of thin sheet brass B was soldered to the end of the shaft as in figure 4 and fastened to the inside tube by means of two small screws. In order to prevent any motion of the inner coil between the inside of walls of the outer tube a small fiber tube C was placed between outer and inner tubes as shown in figure 4. With this construction which is of the very simplest type the variometer may be hooked up to the condenser shaft.

5. By one knob we can therefore vary the condenser and inductance simultaneously and so secure the advantage of both single control knob and inductance and capacity variation at the same time. With the constants as here given reception on the present

employing a 23-plate condenser which has a 3-plate vernier attached. The vernier plates should be removed and on the vernier shaft place the variometer by any of the above described methods. We thus have one control knob which makes two adjustments, figure 7.



Constructional details of the single circuit receiver with variometer and variable condenser on a common shaft

wave lengths can be very efficiently accomplished.

If the constructor does not desire to remove any plates from his condenser in order to lengthen the condenser shaft the following expedient may be employed. A brass shaft is fitted in the variometer and attached to the inner coil in the manner described above. This shaft is then coupled to the condenser shaft as shown in figure 6. A brass sleeve with two set screws may be used, or, as the writer did, an amber bit from a pipe was tapped on either end and fitted on to the shafts in the place of the brass sleeve. If the brass sleeve is used an electrical connection is made between variometer and condenser automatically, thus avoiding one extra connection. If the amber bit is used these two items are insulated from one another.

The above system gives simultaneous variation of capacity and inductance and very good results may be obtained. However, a very great improvement may be made by the following device. Instead of employing

The main knob varies the condenser capacity, and the smaller vernier knob varies the inductance of the variometer since this is connected to the vernier shaft. Although two adjustments are made we have but one knob. We have all of the advantages of the above construction, together with the important advantage of altering inductance and capacity in any manner desired.

The actual constructional features involved in such a receiver as is here taken up are very few and very simple. There are no complicated parts to turn, or make. It is more of an assembly proposition, nevertheless, it gives advantages which most single circuit receivers on the market do not possess. For the novice constructor this would be an excellent receiver to make, and many amateurs will find it good for some of their own work. The cost is small, no more than on any other type of single circuit set. It is less than on other simple two-circuit sets and will do the work of the two-circuit sets to a large extent.

Huge Insulators Tested by Means of Artificial Lightning

THE radio engineer at the giant trans-oceanic station uses tremendous voltages for testing purposes, which at times exceed a quarter of a million volts, with the same freedom from concern as the radio fan who connects a six-volt battery to his receiving set.

The use of such unusual high potentials in action resemble a mimic electrical storm. They have, however, an important place in the laboratory and field apparatus of the modern engineering staff, the chief use for which is the testing of the insulation material at the high-power trans-oceanic stations and other stations of the Radio Corporation of America. These stations are engaged day in and day out in exchanging over 25 per cent. of the message traffic between New York and four countries in Europe. In fair weather and in foul, subjected to high wind pressure, sleet and snow, the aerial insulators which hang from towers ranging in height from 350 feet to 750 feet must carry the strain of high voltages impressed upon them with the least possible chance of mechanical or electrical failure.

These are as essential to uninterrupted communication as the wheels of a locomotive are to continuous transportation. Insignificant as they may seem, elevated to great heights where they appear as mere black specks against the sky, these insulators must be thoroughly tested before installation. They must be tested under the most severe conditions that actual service might impose upon them.

The generator used to produce this high voltage for testing the insulator has a power of 200,000 watts or over 200 horsepower. It is connected through a circuit which increases the voltage to about 150,000. The test insulator has its metal connecting ends joined to the generating circuit when the power is turned on. One of two things can happen to the insulator; it will either allow current to pass through it, in which case it will explode into bits, or will force the surrounding air to break down under the influence of the high potentials, in which case its insulating properties are good and it is acceptable for use in the aerial.

duces True Piano Tones

TRANSMISSION of true piano quality has been a real problem for the radio engineers of the broadcasting stations. The difficulty is similar to that which has confronted the maker of phonograph records. The blows of the hammers on a piano are distinguishable, but the singing quality and the overtones which are relatively weak have not been reproduced through loud speakers or phones.

P. R. Fortin of the radio department of the General Electric Company, has devoted a great deal of time to the solution of the problem, and he has now developed a device which will make the piano solo a real feature of a broadcasting program.

The device, in brief, consists of a magnetic system between the poles of which is pivoted a suitable coil system. The magnet is firmly fastened to the frame of the piano and the coil is anchored to the sound board. By means of this pick-up device all tones in the piano are faithfully converted into corresponding electric currents which control the radio transmitter. When heard on the loud speaker the piano is no longer a tinkling sound. The listener gets all the characteristics of this percussion type of instrument, the blow of the hammer, the singing tone and the overtones.

The piano pick-up is free from the familiar hiss of the carbon microphone as well as the objectionable blasting that takes place when an artist plays too loudly for the microphone.

When the carbon or condenser microphone is used to pick-up a vocal solo with piano accompaniment the problem is to place the microphone in such a position that it picks up both voice and instrument in their proper ratio. The position of the microphone must be changed for each artist. The radio listener has probably noticed that as the singer increases the volume the accompaniment fades out, in other words the soloist "paralyzes" the microphone. When the piano magneto-microphone is used the intensity of the piano may be adjusted electrically in the control room, even while the selection is being rendered, as the voice is recorded on the customary carbon, or condenser, microphone.

The magneto microphone used at WGY to pick up accurately the piano tones

In the grand piano at WGY there are three of these devices, one in the extreme treble, one in the middle register and one in the bass. The output of the three sections of the piano can be readily balanced in the control room for the best results on receiving sets without tampering in any way with the instrument.

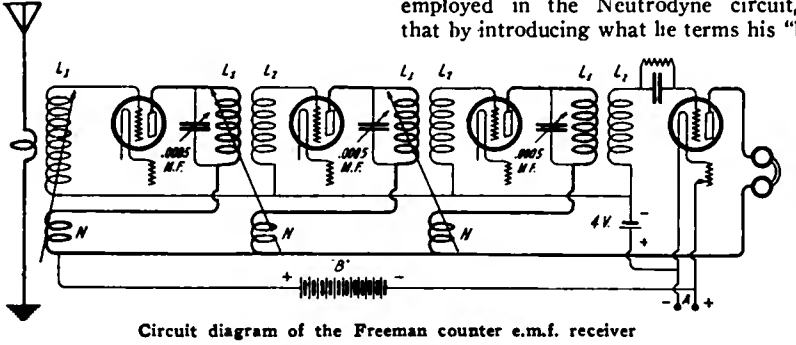
Another feature of the magneto microphone is that it allows WGY to correct the shortcomings of the present loud speakers. All loud speakers subdue the sounds of lower frequencies, from approximately middle C on the piano down. To give good piano music for users of the loud speaker it would be necessary for the transmitting station to distort the music from the instrument, making the lower section of the piano several times as loud as the treble. Some stations have actually tried to regrade their pianos to improve them for broadcasting. This means that the music, as heard by the musician at the keyboard, is distorted and the good musician, even though convinced that his radio audience is getting perfect tones, cannot do his best work on a regraded piano.

The magneto microphone may also be used in broadcasting phonograph music where the Federal license of the station permits the use of "record" music. When the carbon microphone is used the mechanical energy of the phonograph is converted into sound energy in the usual way and is picked up by the microphone. With the magneto microphone the needle is attached to the coil and the mechanical energy is converted directly into electrical energy without recourse to any sound whatever, thus giving truer production of the record. By proper design and the use of suitable filters in the electrical circuit of the coil a large amount of the needle scratch may be eliminated.

The Freeman Counter E.M.F. Receiver

By Dr. A. E. Banks

AT the recent meeting of the San Diego chapter of the Radio "Round and Rounders," held at San Diego, Cal., one of the members, Roy K. Freeman, of San Diego, consulting engineer for the United Dredging Company, disclosed a somewhat new principle of radio reception.



Circuit diagram of the Freeman counter e.m.f. receiver

Mr. Freeman said that the principles underlying the circuit were similar to those employed in the Neutrodyne circuit, but that by introducing what he terms his "buckling" coil, instead of an infinitesimal condenser, in the grid circuit, he attains the same object Hazeltine does. Both the Hazeltine and the Freeman circuits depend for their functioning upon the neutralization of tube capacity whereby receiving tubes are permitted to amplify at the maximum point of efficiency without oscillating. The details of the circuit are shown in the accompanying diagram.

It will be noted that the reaction of the coils is applied in the opposite direction to that normally used for regeneration. The general result is a series of tickler feedback regenerative circuits. It is therefore essentially a regenerative arrangement.

Mr. Freeman uses what is known as an aperiodic primary, one turn of inductance, whereby the antenna functions purely as a collector of energy, but is untuned. A simple 80-turn winding on a 2-inch cardboard tube forms the inductance marked "L"-2 in the first step. All succeeding steps have two windings closely coupled of 80

(*Continued on page 82*)

Reception of C.W. by Heterodyned Crystal Detector

By L. W. Hatry, 5XV

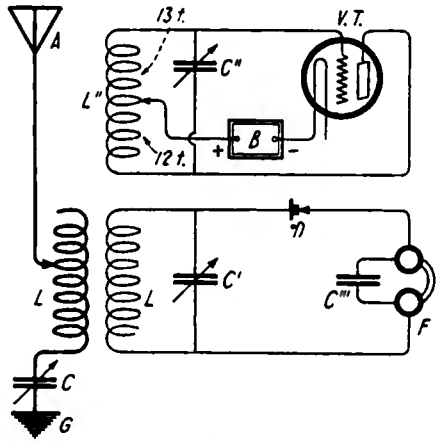
IN a recent issue of THE WIRELESS AGE there was a request for information on the reception of continuous wave or undamped signals by the use of the heterodyned crystal detector. Being in possession of the necessary "dope," I am submitting it in hope that it will prove of value.

First of all these things can be claimed for the arrangement:

Reduction of static to the point that it does not interfere where, before, using the regenerative vacuum tube detector as the standard of comparison, it was impossible to copy signals because of atmospherics. Signals are reduced also, but the stray-signal ratio is enormously better. By the use of a two-stage, audio-amplifier where interference permits, good signal strength and excellent distance are assured.

Long distance reception up to 1,000 miles is possible without amplification and with amplification a consistent 1,000-mile reception range is possible. On detector only, in Port Arthur, amateurs up to Minnesota and Ohio could be heard. All the regulars up to 500 miles came in good.

Extreme simplicity of control is possible, because the heterodyne control is the only one that need be varied when searching for signals. The heterodyne control, by itself, will find signals over a range from 175 to 225 meters efficiently with the receiver set approximately to 200 meters. I have successfully picked up signals as much as 75 meters off the setting of the receiver. After the signal is found by the oscillator it is only necessary to tune in for maximum signal strength by adjusting the primary and secondary. Selectivity can be obtained through the usual procedure of loosening the primary-secondary coupling. Once a signal is tuned in on the oscillator no further adjustment of it is necessary unless it is desired to vary the note of the received signal. I would suggest that every ham arrange such a set to use on the bad QRN



Hook-up of the heterodyne crystal receiver

nights, for it would open up lots of dead times.

Now as to actual constructional data: The complete circuit is shown in figure 1. L' is 45 turns of No. 18 DCC wire on a 3- to 4-inch form. Variation is, however, allowable, such as 45 turns on a 13-leg spiderweb with a 2-inch inside diameter. The number of legs is variable, hut 13 is the number I found best and most convenient. L is 50 turns of the same size wire wound on a form easy to couple to the L'' and should be tapped at 10, 15, 20, 30, 40, and 50. L can be wound on another spiderweb form, in a straight coil, or as you wish. Or L'' and L can be the inductances of the standard variocoupler. If the variocoupler ball has turns less than 35 it is advisable to add a loading coil that will raise the total number of turns to 45. A is the aerial and G the ground. C is a 43-plate, .001 mfd., variable condenser, or larger. C' is a 23-plate, .0005 mfd, and can be, with easier adjustment, a 13-plate condenser. C''' is a fixed mica .001 phone condenser. D is the crystal detector which should preferably be one like the semi-fixed "Gold Grain" detector or else should be a good detector with dust proof case and galena crystal.

Now we come to the oscillator which is shown in figure 1 just above L'C'. The oscillator inductance L'', is a 25-turn coil tapped at the 13th turn for center tap. It can be a straight wound coil or spiderweb, or honcycomb, etc. It can be wound with any size wire from No. 28 to as large as convenient as it does not affect the efficiency of your set. The variable condenser C'' can be any old condenser handy that has 23 or more plates, or a capacity of .0005 or greater, at the maximum. It need not be efficient although it must be easily variable. The tube used as the oscillator would preferably be a UV-199, as it can be run so economically off of dry cells. Any tube that will oscillate will do, however. The "B" battery need not necessarily have a potential greater than ten volts, for the tube oscillates freely. A higher plate voltage will, however, make possible the use of a slightly lower filament voltage.

In actual operation the oscillator inductance should be placed about a foot from the tuning inductances, no closer, and then the tuning adjustments won't affect the signal except to make it louder or weaker. The oscillator inductance can be three feet away. Place the oscillator coil behind its tuning condenser and ground the rotary plates, to avoid any chance of capacity effect.

Now as to tuning. Adjust the secondary tuning condenser to about 10 on the dial scale and having the crystal adjusted on a sensitive point, get the primary somewhere near resonance. Turn up the oscillator tube filament till a very weak watery swishing is heard and static is slightly muffled, if you can hear QRN; this with the oscillator condenser set a little off zero. The next thing to do is to vary the oscillator tuning condenser until a signal is picked up and adjust the other tuning controls for maximum signal strength to complete the tuning.

Transoceanic Radio Telegraphy

By E. F. W. Alexanderson

Chief Engineer, Radio Corporation of America

(Abstract of paper delivered before American Institute of Electrical Engineers)

THE radio engineer is, more than any other, compelled to work with conditions which are not within his control, and only partially understood. The law of probability and averages must therefore figure largely in his calculations.

A good many of those present here are undoubtedly radio amateurs. When you have received some clear signals from Kansas or Cuba, it is an interesting fact and you relate it to your friends. Many of you are no doubt fond of fishing, especially when you have caught a big trout. That is an event worth mentioning. These are single facts highly subject to the law of chance. Nevertheless the professional fishermen succeed in providing fish for our dinner tables with great regularity. It is the aim of the radio engineer to charter the sea of the ether, to weather its storms and to provide a continuous service of communication day and night.

The transoceanic radio station is a power station. Its input is kilowatts and its output is words. The problem of radio engineering is to establish the relation between kilowatts input and words output. This relation between kilowatts and words is a chain comprising four separate subjects which are being studied by specialists in those subjects.

They are:

1. Relation between kilowatts consumed and wave energy radiated.

2. Relation between wave energy at the transmitting and receiving station.

3. Relation between wave energy at the receiving station and the speed at which words can be received.

4. Influence of atmospheric disturbances.

The first subject deals with the radio power station and the antenna. The Radio Central antenna, is designed from the ground up. It has six ground connections distributed over a distance of one mile and has 150 miles of wire buried in the ground. Through these devices the ground resistance has been reduced to 1/10 ohm. The best antennas of types previously used have ground resistances of about 2 ohms. The losses in the ground have thus been reduced at the rate of 20 to 1.

The second subject is wave propagation.

the most economical wave length for communication over a certain distance is about one five-hundredth of the distance.

The third subject deals with the design of the receiving station. It has been found that the speed in words per minute at which it is possible to receive telegraph code is directly proportional to the amplitude of the wave. A signal field strength of 50 microvolts per meter corresponds under average conditions to a speed of 50 words per minute.

The fourth subject deals with the atmospheric disturbances. Our modern receiving system eliminates about 9/10 of the disturbances but the residual which is not eliminated determines the speed of reception by the law of inverse proportionality.

For elimination of disturbances we use a new type of antenna about ten miles long. It is a simple telegraph wire mounted on lengths travel along the wire with the velocity of light. The ether wave thus starts a wave on one end of the wire, and this wave travels along the wire while the original ether wave follows beside it in space, constantly adding energy to the wave on the wire, just as the wind starts a ripple at one shore of a lake and rolls it up to a large wave as it travels along. Thus the wave intensity in the wire grows and becomes a maximum at the far end of the wire. Fortunately on the Atlantic coast most of the disturbances come from the west, whereas the signals come from the east. The wave antenna thus separates the signal from the disturbance so that the signal appears at the east end of the wire and the disturbance at the west end. The energy of the disturbance is destroyed by absorption in a resistance at the west end of the wire, whereas a practically

planning of a new radio system is no longer a matter of guesswork. Before designing our South American system we sent an expedition of engineers to chart the atmospheric disturbances. Their findings led to a modification of the original plan because it was discovered that at the location first selected the principal disturbances came from the same direction as the signal, and therefore could not be eliminated. From the data now available it is possible to calculate the number of words that can be received during each month in the year, although the stations have not yet been built.

We can thus say that radio engineering has reached a point where sound foundations both technically and financially can be laid for the expansion of this system of communication.

The Rice Receiving System

By Arthur B. Cole

Member, I. R. E.

ALTHOUGH a new "circuit" appears every little while, it is seldom that one is brought to light which has sufficient real merit to warrant detailed description. In fact, most "circuits" which are described from time to time are only such slight modifications of well known systems, that they should not be called "new."

Some time ago the system described in this article was disclosed to the writer by a young engineer named Rice.

The Rice system employs one stage of radio frequency amplification, a detector and as many audio frequency stages as desired. The noteworthy difference between this and other systems is the method whereby the radio frequency stage is coupled to the detector.

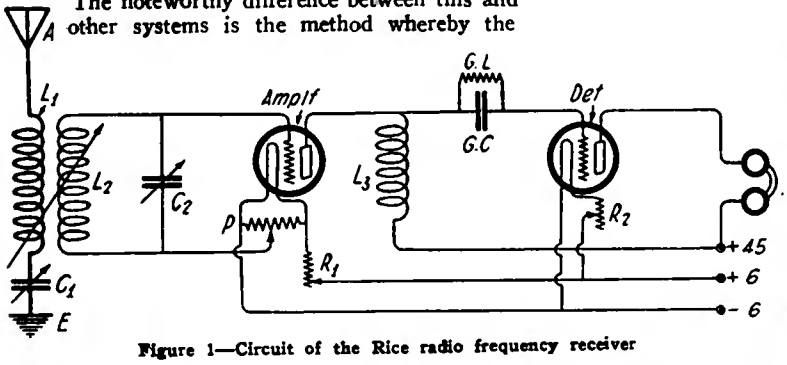


Figure 1—Circuit of the Rice radio frequency receiver

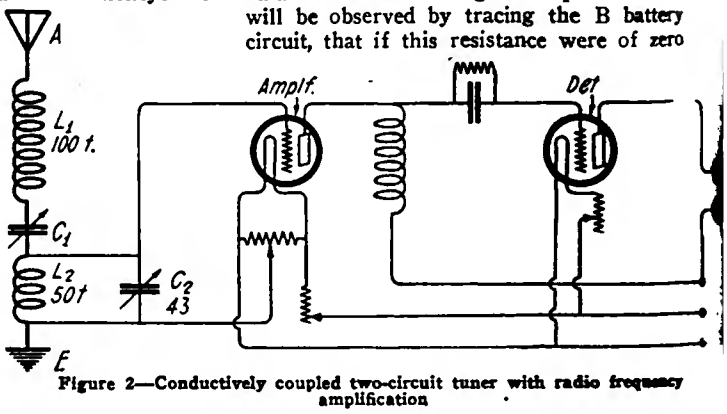


Figure 2—Conductively coupled two-circuit tuner with radio frequency amplification

Figure 1 illustrates a two-tube set which has proven very satisfactory for local and distant reception. It makes an excellent portable outfit, as well as being suitable for stationary use. Where received signals are strong, a loud speaker can be used, but in general a head set is more satisfactory as only two tubes are employed.

The primary circuit A-L1-C1-E comprises the aerial A, the fixed primary inductance L1, the variable condenser C1 and the ground connection E. While the best value for the inductance L1 varies somewhat with different aerials, numerous tests on aerials having lengths from 50 feet to 250 feet and heights from 6 feet to 30 feet, indicate the best all-around inductance to be simply a 100-turn honeycomb coil. It will be noted that the coil has no taps, hence no dead ends, all the primary tuning being accomplished by using the variable condenser, which is the 5-plate size, equipped with a vernier attachment. With some aerials, the 11-plate size could be used satisfactorily, but in general the 5-plate is preferable.

The secondary circuit consists of a 43-plate variable condenser C2, equipped with a vernier attachment, and the secondary inductance L2, which is a 50-turn honeycomb coil. This coil is arranged to rotate in any of the usual ways with respect to the primary coil. It was found best to equip the dial controlling this movement with a vernier attachment.

The coupling inductance L3 is a honeycomb coil of 100 turns. The grid condenser GC is a standard mica type of .0005 mfd. capacity. The coupling resistance CR is of the same construction of the first form of grid leak, namely a pencil mark between two binding posts mounted on a strip of fibre. Its action is not that of a grid leak. The initial adjustment of its resistance value is a matter of great importance. It will be observed by tracing the B battery circuit, that if this resistance were of zero value, the grid of the detector tube would be maintained at plus 45 volts. Of course this would never do, and so the adjustment should be carefully done.

No explanation is deemed necessary for the balance of the circuit as it is conventional.

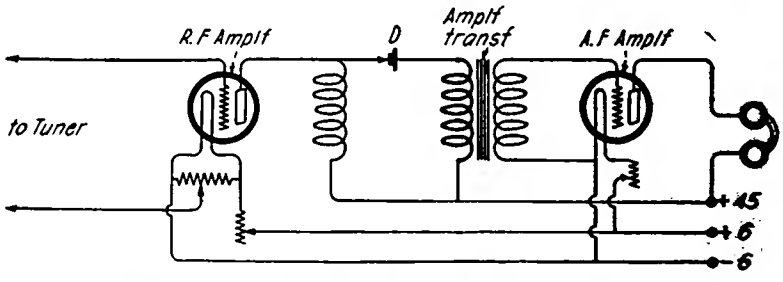


Figure 3—The Rice system, using two tubes and a crystal detector

The tubes used were the UV 201-A type, both for detector and amplifier. The UV 199 tubes can be used with good results. The potentiometer P is a standard make and

In figure 2 the same system is shown. It

(*Continued on page 72*)

The How and Why of Crystal Detectors

By Jerome Snyder

UNTIL comparatively recently the crystal detector was one of the chief means of detecting radio waves. Operators and amateurs used to swear by it and, in fact each ship operator had his pet crystal which he always carried with him, whether on land or sea, and which he guarded jealously. Almost all commercial traffic was accomplished with the crystal detector, and accomplished quite satisfactorily. Even today the crystal detector is still used to some extent in commercial ship traffic. However, with the popularization of the vacuum tube, development of new tube circuits, and the moderate cost of these tubes, the crystal, little by little, seems to have been crowded out and relegated to an undeserved position in the background.

However with the coming of the broadcasting stations the crystal detector has been given a new lease on life. This for a number of reasons. First because of its extremely small cost as compared to tube detectors, and because of its suitability for inexpensive receiving sets; and second because of its obvious advantages in short range reception. Within a radius of 15 miles from a broadcasting station a good crystal gives very satisfactory reception. Furthermore, for the novice, the crystal detector is just the thing. With a couple of crystals the writer has seen newcomers learn as much as they might have learned in the lifetime of two or three tubes—considering how long a tube might last in the hands of a green radio fan.

In view of this renewed interest in and importance of the crystal detector it is proper that an explanation be given of its action, of how and why it works as it does. This, not so much for those who know, as for the newcomers who have their eyes and ears open for the reasons of things.

Function of Crystal

In the first place why is it necessary to use a crystal detector? What does it do? Without the crystal detector you would not be able to hear any signals in the telephones. The crystal is not so much a detector as it is a converter, that is, it converts the incoming radio frequency energy into such a form that it can be made audible in a pair of telephones. Suppose that no crystal or other detector were employed, but that otherwise the telephones were connected in the usual manner, as in the circuit of figure 1. The incoming radio waves (figure 2) would then be impressed on the telephone receivers, but no sound would be heard, for there would be no motion of the telephone diaphragm for two reasons.

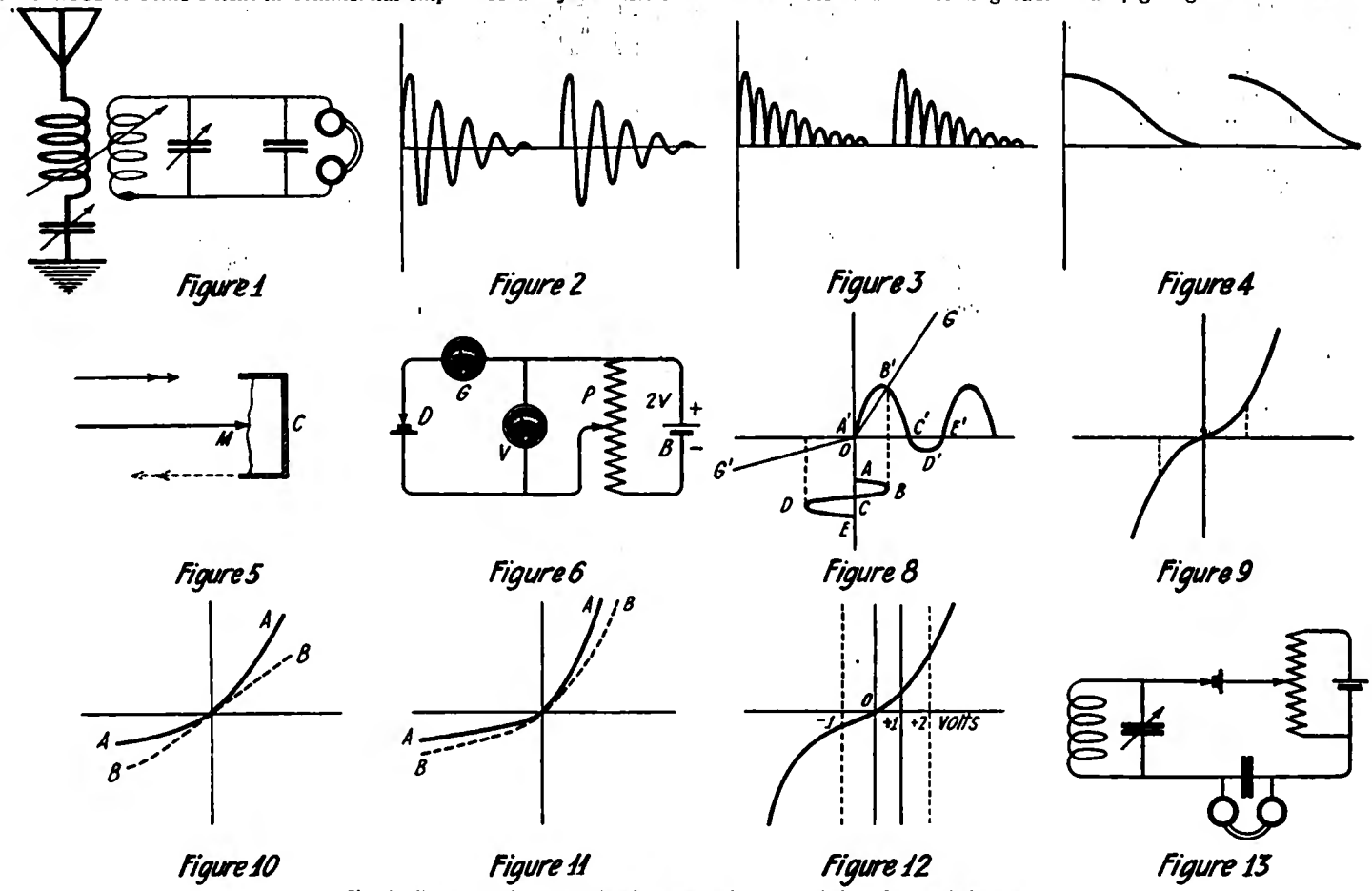
In the first place the diaphragm would be motionless because it would have an equal positive and negative motion imparted to it by the positive and negative parts of the radio wave, and since these opposite motions would be equal they would neutralize each other. Thus no effect is produced on the telephone receiver. In the second place even if the diaphragm could move no sound would be heard, for the diaphragm would move at the same rate as the frequency of the radio wave, which frequency is above the audible range. It therefore becomes necessary to employ some device which will so alter these incoming radio waves as to render them audible.

How the Crystal Performs

What the crystal does in effect is this: It cuts off practically one half of the incoming radio wave, giving it a form as in figure 3, in this way preventing the telephone diaphragm from having opposite forces acting on it. This means that the diaphragm is acted upon by a number of forces tending to move it in one direction. These various forces in each wave occur so rapidly in one direction that they are cumulative, that is, they add up to make one impulse acting on the diaphragm as shown in figure 4. If these radio wave groups are sent out, say 1,000 times a second, this one impulse will be given to the diaphragm also 1,000 times per second and a signal will be heard in the phones corresponding to this frequency.

Why the Crystal Works

The above explains concisely what the function of the crystal is and how this function is performed. We now come to the most interesting question as to why the crystal behaves as it does. First let us consider the actual scientific facts and data at our command, and then we will consider



Circuit diagram and graphs showing use and characteristics of crystal detectors

From the explanation of the action of the crystal detector given above it appears that in order for the crystal to be able to eliminate half of the radio frequency wave it must present a very high resistance to that half of the wave, whereas its resistance to the other half must be very low. Thus in figure 5 we have illustrated a crystal detector where C is the crystal and M the metallic point making contact with it. During the positive half of the radio wave, say, the current flows in the direction of the full line arrow and is effectively conducted through the crystal. The resistance presented by the crystal to current flowing in this direction is relatively very small. During the negative half of the radio wave the current tends to flow in the direction of the dotted arrow, but is not effectively conducted on account of the crystal offering a very high resistance to currents flowing in this direction. Hence this negative half of the radio wave is entirely or almost entirely suppressed.

The crystal, then, behaves as a rectifier and seems to have a low resistance to currents flowing in one direction and a high resistance to currents flowing in the other direction. In other words, the crystal conducts better in one direction than in the other. This very important fact is extremely well illustrated by means of characteristic curves experimentally obtained as follows: The crystal is connected in a circuit as in figure 6 in which B is a dry cell of 2 volts shunted hy a potentiometer P of several hundred ohms resistance, V is a low reading d. c. voltmeter, G is a highly sensitive micro-ammeter or galvanometer to read the extremely small currents flowing through the detector, D. By means of the potentiometer P the voltage across the detector may he varied between 0 and + 1 volts. Reading of current should bc taken for several values of voltage between 0 and + 1. Now by reversing the connections of the battery to the potentiometer we reverse the direction of current flow through the crystal and read the current through the detector for values of voltage between 0 and minus 1.

Such an experiment was actually performed for a perikon crystal and the curve obtained by plotting current against voltage is shown in figure 7. This curve was obtained for a sensitive adjustment of the crystal and shows very clearly the most important characteristic of the crystal detector. For voltages in one direction the currents are very high, and hence the resistance is very low. For voltages in the opposite direction the current is extremely low, in fact, hardly any current flows at all in the opposite direction no matter how large the voltage may be, hence the resistance of the crystal to currents in this direction is extremely high.

This shows very clearly the rectifying properties of the crystal and explains at once why half of the radio wave is eliminated when it impinges upon the crystal. In figure 8 we have redrawn the characteristic curve. Suppose a radio voltage wave acts on the crystal, and let this radio wave be represented hy curve A B C D E, one complete cycle of the wave. As the voltage acting on the crystal increases from A to B there will be a corresponding large increase with the characteristic curve OG. In a similar way the detector current will decrease from B′ to C′ as the radio voltage decreases from B to C. Thus for the positive half of the radio voltage A B C we have a corresponding half current cycle A′ B′ C′ through the crystal detector.

Now as the radio voltage reverses in direction, it increases in value from C to D, but in the opposite or negative direction. The current flow in the opposite direction, according to the characteristic curve OG′ is very small, and the currents corresponding to the voltages from C to D to E on the voltage wave are represented by the half wave of current C′ D′ E′. Thus we see that half of the radio wave is cut off by the rectifying properties of the crystal, and hence signals can be heard in the phones. Other crystals such as galena, cerusite and so on show the same general form of unilateral conductivity and rectifying characteristics.

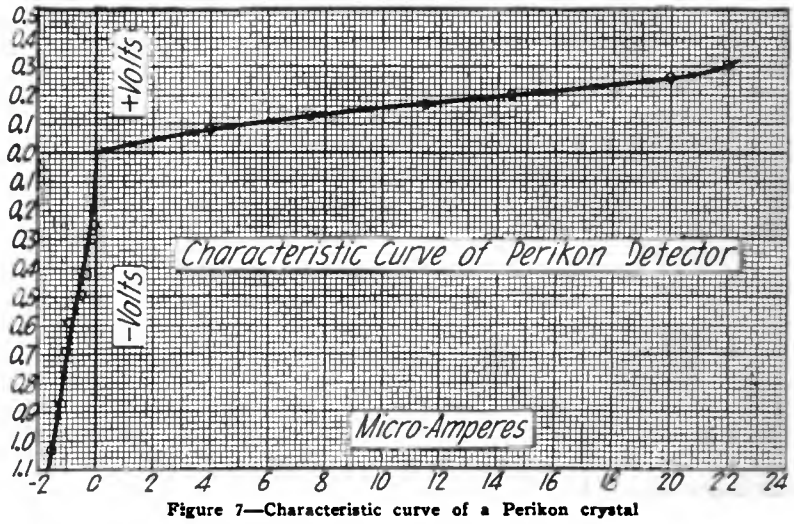


Figure 7—Characteristic curve of a Perikon crystal

The important thing to note about these characteristics is the asymmetry of the characteristic curve on either side of the zero point. It is this difference in shape on each side that makes the crystal detect. If the curve were not asymmetrical, hut was the same on each side of the zero axis, no rectification or detection would take place. For, as in figure 9, the same voltage in either direction would produce exactly the same changes in current, which changes would neutralize each other as far as their effect on the telephone diaphragm went. The greater the asymmetry of the characteristic curves the better will the crystal detect. It is this fact which explains why a crystal which is good on one spot may not be good on other spots, for each spot may give a characteristic curve which is different, some of them being favorable to good detection, and others unfavorable.

The surface of a crystal has an infinite number of points, but all of these points are not necessarily sensitive. Thus figure 10 shows the characteristics for a cerusite crystal, curve "A" giving the characteristic for a good adjustment of the crystal, whereas curve "B" gives the characteristic for a poor adjustment of the crystal. It is seen that for the good adjustment the characteristic curve is very asymmetrical and hence on this point the crystal makes a very good detector. However, curve "B" is not given change of voltage. Hence on this point of the crystal the resistance is uniformly high and the crystal is a poor detector of radio waves. Such a crystal is therefore not very suitable for use in stations which are subject to much jarring and vibration, as on ships, for if the good spot is thrown out of adjustment it may take quite a while before another good spot is found, and hence traffic will be delayed.

On the other hand, consider now the characteristic curves of a certain perikon detector as shown in figure 11. Curve "A" was taken for a good adjustment of the crystal, while curve "B" was taken for a poor adjustment. It is evident here that even for a poor adjustment there is considerable asymmetry in the characteristic curve and hence good signal detection will he secured. Such a detector is therefore practicable for stations where disturbances such as jarring and vibration are presented. For even if the crystal should be thrown out of its good adjustment another point may be quickly found which, even though relatively poor, will give sufficient asymmetry in the characteristic curve to result in good detection.

There is a certain group of crystal detectors which, to give best results, have to be operated with a battery. The reason for this is often asked. The reason is to be found in the shape of the characteristic curve for the crystal. Thus, carborundum is one of the most important of the detectors requiring such a polarizing battery, and its characteristic curve is found in figure 12. It will he noted that between minus 1 and plus 1 volts the curve is practically symmetrical on either side of the zero axis, and that therefore equal changes of voltage produce equal and opposite changes of current which will neutralize each other's effects on the telephone diaphragm, and hence produce no detection.

Now if the zero axis could be shifted to plus 1 volt then the curve would be asymmetrical between 0 and plus 2 volts, because a change of 1 volt from plus 1 to plus 2 volts would produce a large change of current, while a similar change of 1 volt from plus 1 to 0 would produce only a very small change in current. Thus rectification and good detection would result. In order to shift the axis from zero to plus 1 volt all that is necessary is to

using a battery and potentiometer as in figure 13. By using a potentiometer the best and most efficient biasing voltage may be secured and hence best detection secured.

It is interesting to inquire why these crystals have this power of rectification, or why they appear to have a higher resistance in one direction than in the other. The problem has not been definitely solved, but two main explanations have been advanced by different scientists. These explanations are the following:

Electrolytic Theory

This theory is somewhat similar to that of the dry cell. It is claimed that on the surface of every crystal there is present always a certain amount of moisture. Due to electrolytic action at this contact a small electromotive force is developed, just as in the battery. In other words, we have here, at the point of contact on the crystal, a very minute battery. The direction of this voltage which is here developed is always be in the same direction, and the other half in the opposite direction to that in which the small voltage is developed on the crystal surface. When the radio voltage is in the same direction it adds on to the small voltage developed at the contact and hence a high current flows, and the resistance of the crystal in this direction is very small. When the radio voltage is in the opposite direction to the small voltage developed at the contact of the crystal it bucks the small voltage and hence a small current flows, or the crystal presents a very high resistance to the flow of current in the other direction. In this way we are able to account for the apparent difference in conductivity of the crystal and its rectifying properties.

Heat Theory

The second theory explains the phenomenon in the same way except that it offers a different explanation for the development of the small voltage at the crystal contact. When two dissimilar conductors are placed in contact and the junction is heated, it is direction. This fact has been known for many years, and the principle is used daily in thousands of heat-recording instruments used for measuring the great temperatures of gas and electric furnaces. It is also known that an electric current will produce heat. It is thought, therefore, that the alternating radio current flowing through the tiny point of the crystal develops heat enough to produce a small direct current in the crystal circuit. This heat-generated current being assumed, the rest of the theory is the same as before, namely, the small direct current allows the radio current to pass in one direction, the two reinforcing each other, while in the other direction the two tend to neutralize each other.

Neither of these theories has been definitely accepted by scientists as the correct theory. Whichever is correct, the outstanding facts of unilateral conductivity are true and help us to explain the interesting action of the crystal in a radio circuit.

The Calculation and Measurement of Inductance

WHEN the current in an electric circuit is altered an E. M. F. is induced in the circuit by the simultaneous change in the magnetic field which surrounds it. The E. M. F. is opposite in direction to that which produced the change in current.

This property of a circuit is termed inductance, the practical unit of which is the international henry. The henry is defined as, that degree of storing up of magnetic energy which would be possessed by an electric circuit of one turn, if a variation in it of one ampere per second were to produce an E. M. F. of one volt. The henry is equal to 10^{9} C. G. S. electro-magnetic units (centimeters). In radio calculations the henry would be far too large a unit to work with and consequently the "microhenry" or one-millionth of one henry is a more common term.

The values of inductance depend upon the shape and dimensions of the circuit, its arrangement, and where accuracy is a big factor the surrounding medium has to be taken into consideration; this, of course is negligible in most cases.

The inductance of a coil is the most important in general work; this is usually wound on a cylindrical form either in single or multiple layers. In most cases the coil has an air core, but sometimes we have an iron-core inductance or "choke-coil" to deal with. The latter case presents considerable difficulty in theoretical calculations as the physical properties of the iron are very important factors.

Single-layer coils with an air core is a case that occurs very frequently and there are many formulas given for the various ratios of diameter to length. The formula developed by Dr. Nagoaka, however, covers practically all those which are likely to be met in common practice and is considered to maintain a high degree of accuracy; it is expressed as,

$$L = 4\pi^2 \frac{a^2 n^2}{b} K \qquad (1)$$

Where L = Inductance of the coil in centimeters.
a = Mean radius of the coil in centimeters.
n = Total number of turns.
b = Length of coil in centimeters.
K = Variable factor which varies as the ratio $\frac{2a}{b}$

The values for K appear in table 1.

A derivation of this formula, in which turns per inch is used instead of the total number of turns, is given below,

$$L = 100.2\ n^2\ a^2\ b\ K. \qquad (2)$$

Where L = Inductance of the coil in centimeters.
n = Number of turns per inch.
a = Mean radius of the coil in inches.
b = Length of the coil in inches.
K = Variable factor, see table 1.

This formula may be transposed as,

$$n = \sqrt{\frac{L}{100.2\ a^2\ b\ K}} \qquad (3)$$

In calculating the inductance of multilayer or bank-wound coils a formula has been developed, which is expressed as,

$$L = \frac{31.9\ n^2\ a^2}{.23a + .44b + .39w} \qquad (4)$$

Where L = Inductance in cms.
n = Total number of turns.
a = Mean radius.
b = Length of coil in inches.
w = Radial depth.

The mean radius, a, is calculated as,

$$\frac{\text{Outside Diam.} + \text{Inside Diam.}}{4}$$

and the radial depth, as, $\frac{\text{Outside Diam.} - \text{Inside Diam.}}{2}$

Transposing formula (4) to find the number of turns gives,

$$n = \frac{\sqrt{L\,(.23a + .44b + .39w)}}{31.9a} \qquad (5)$$

then turns per inch $= \sqrt{\frac{n}{bw}}$

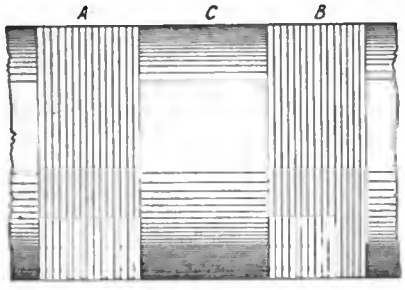


Figure 1

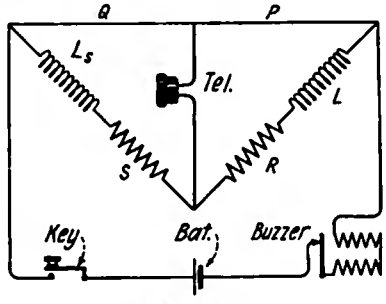


Figure 2

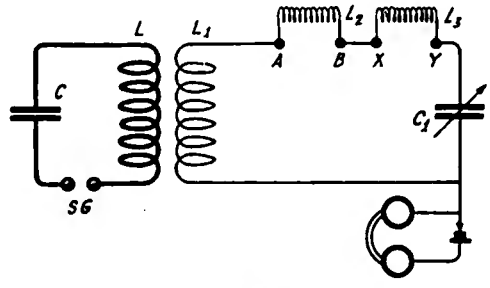


Figure 3

Apparatus used in the calculation and measurement of inductance

method: suppose the space between A and B is wound with a coil C of the same size wire; then the mutual inductance between A and B can be calculated by,

$$2M_{ab} = L_{abc} + L_c - L_{ac} - L_{bc} \qquad (6)$$

Where L = Self inductance of coils A, B and C in series and so on. These may be worked out from formula (1).

There are several methods of determining inductance by the "bridge" system and one of these, using a simple single slide-wire bridge, is described herewith. R and L_x in figure 2, are the resistance and inductance of the coil under test; Ls is a standard inductance and S a variable resistance. Then the required relations for both non-inductive and inductive balance is that

$$\frac{L}{L_s} = \frac{R}{S} = \frac{P}{Q} \qquad (7)$$

Then for any given value of S, the slider is moved on the slide wire PQ until a minimum sound is heard in the telephone. Another value of S is then tried, and the best balance again obtained; this operation is repeated until a value of S is found at which no sound is recorded in the telephone.

Out of the several methods of measuring ing inductance by impedance probably the most popular is by means of ordinary voltmeter and ammeter. The fall of potential in a circuit containing the inductance is measured when a current of known freqency is passed through it. If the resistance has been previously determined then,

$$L = \sqrt{\frac{E^2 - I^2 R^2}{(2\pi f I)^2}} \qquad (8)$$

Where E = Drop in volts.
I = Current in amperes.
R = Resistance in ohms.
f = Frequency in cycles per second.

For inductance coils possessing an iron core, the inductance depends upon the physical properties of the core as well as the dimensions, etc. of the coil; these physical properties are variable. The flux density B which is induced in a piece of iron by a magnetizing force H is expressed as,

$$B = \mu H \qquad (9)$$

where the permeability of the iron, μ, varies with H and also varies for the different grades of iron. A convenient formula for calculating the inductance of an open core coil is,

$$L = \frac{N^2 A \mu}{l} \qquad (10)$$

where L = Inductance in henries.
N = Total number of turns.
l = Length of iron core.
A = Cross section of core.
μ = Permeability for H at center of core.

It must be borne in mind by the reader that the formulas and methods given so far in this article pertain only to the simple inductance as compared to values at radio frequencies, known as the effective inductance. The effective inductance is usually found to have a higher value than the simple inductance due to the great difference in frequency. Another point in distinguishing between these two values is that the effective inductance can only be determined accurately by actual measurement and the wavemeter is the common instrument for this work.

$\frac{L}{b}$	K	$\frac{L}{b}$	K	$\frac{L}{b}$	K	$\frac{L}{b}$	K
0.00	1.000	0.40	0.849	0.80	0.735	2.00	0.525
0.01	0.995	0.41	0.846	0.81	0.732	2.10	0.513
0.02	0.991	0.42	0.843	0.82	0.730	2.20	0.502
0.03	0.987	0.43	0.840	0.83	0.727	2.30	0.491
0.04	0.983	0.44	0.836	0.84	0.725	2.40	0.481
0.05	0.979	0.45	0.833	0.85	0.722	2.50	0.471
0.06	0.974	0.46	0.830	0.86	0.720	2.60	0.462
0.07	0.970	0.47	0.827	0.87	0.718	2.70	0.453
0.08	0.966	0.48	0.824	0.88	0.715	2.80	0.445
0.09	0.962	0.49	0.821	0.89	0.713	2.90	0.437
0.10	0.958	0.50	0.818	0.90	0.710	3.00	0.429
0.11	0.954	0.51	0.815	0.91	0.708	3.10	0.421
0.12	0.950	0.52	0.812	0.92	0.706	3.20	0.414
0.13	0.946	0.53	0.809	0.93	0.704	3.30	0.407
0.14	0.943	0.54	0.806	0.94	0.701	3.40	0.400
0.15	0.939	0.55	0.803	0.95	0.699	3.50	0.394
0.16	0.935	0.56	0.800	0.96	0.697	3.60	0.388
0.17	0.931	0.57	0.797	0.97	0.695	3.70	0.382
0.18	0.927	0.58	0.794	0.98	0.692	3.80	0.376
0.19	0.923	0.59	0.791	0.99	0.690	3.90	0.370
0.20	0.920	0.60	0.788	1.00	0.688	4.00	0.365
0.21	0.916	0.61	0.785	1.05	0.677	4.10	0.360
0.22	0.912	0.62	0.782	1.10	0.667	4.20	0.355
0.23	0.908	0.63	0.780	1.15	0.657	4.30	0.350
0.24	0.905	0.64	0.777	1.20	0.647	4.40	0.345
0.25	0.901	0.65	0.774	1.25	0.638	4.50	0.340
0.26	0.898	0.66	0.771	1.30	0.628	4.60	0.336
0.27	0.894	0.67	0.768	1.35	0.620	4.70	0.332
0.28	0.890	0.68	0.766	1.40	0.611	4.80	0.327
0.29	0.887	0.69	0.763	1.45	0.603	4.90	0.323
0.30	0.883	0.70	0.760	1.50	0.595	5.00	0.319
0.31	0.880	0.71	0.758	1.55	0.587	5.50	0.301
0.32	0.876	0.72	0.755	1.60	0.579	6.00	0.285
0.33	0.873	0.73	0.752	1.65	0.572	6.50	0.271
0.34	0.869	0.74	0.750	1.70	0.564	7.00	0.258
0.35	0.866	0.75	0.747	1.75	0.557	7.50	0.246
0.36	0.863	0.76	0.745	1.80	0.551	8.00	0.236
0.37	0.859	0.77	0.742	1.85	0.544	8.50	0.227
0.38	0.856	0.78	0.740	1.90	0.537	9.00	0.218
0.39	0.853	0.79	0.737	1.95	0.531	9.50	0.210

TABLE II—TURNS PER INCH OF COPPER WIRE

B & S Gauge	Enamel	Single Cotton	Double Cotton	Single Silk	Double Silk	Cotton Enamel	Silk Enamel
18	23	21	19	23	22	20	22
19	26	24	21	26	24	23	24
20	29	26	23	29	27	25	27
21	32	29	25	32	30	27	30
22	37	33	29	36	33	31	34
23	41	37	32	40	37	34	37
24	46	40	34	44	41	38	42
25	51	44	37	49	45	42	46
26	57	48	41	54	50	46	51
27	64	54	44	60	54	50	57
28	74	59	47	67	60	55	63
29	80	64	50	74	65	60	69
30	90	70	54	82	71	65	76
31	101	75	57	90	77	71	84
32	112	82	60	99	83	77	92
33	127	88	64	108	90	83	101
34	141	95	67	119	97	89	110
35	158	101	71	129	104	95	120
36	178	108	74	140	111	102	131

Suppose it is desired to measure the effective inductance of an ordinary coil with an air core, such as is usually found in radio receiving circuits. Connect the coil to the standard variable condenser so as to form a resonant circuit and tune to any desired wave length; read the condenser setting for resonance and call it Cx. Then replace the coil of unknown value by a standard coil whose inductance is Ls and again tune to exactly the same wave length. The setting of the condenser may now be designated by Cs. Then,

$$L_x = \frac{L_s C_s}{C_x} \qquad (11)$$

ure the wave length λ_1 of the circuit composed of the antenna connected with a coil whose inductance L_1 is known. Replace the coil by another, whose inductance is also known L_2 and again measure the wavelength λ_2. The effective inductance of the antenna can then be found by the following equation,

$$L = \frac{L_2 \lambda_1^2 - L_1 \lambda_2^2}{\lambda_2^2 - \lambda_1^2} \qquad (12)$$

The mutual inductance at radio frequencies may be measured with a fair amount of accuracy by the method shown in figure 3. Suppose the coils L_a and L_b are the primary and secondary of a coupled circuit whose mutual inductance is required to be measured. Join the terminals A and B and X and Y and tune the wavemeter L_x C_1 to the exciting circuit LCS. Designate the capacity of the wavemeter condenser C_x when at resonance, as C_2. The coils L_a and L_b are then connected in series and a new value of C_1 for resonance is obtained; call it C_3. Then, if the fields of the coils L_a and L_b are aiding, a value of inductance will be obtained equal to $L_a + L_b + 2M$, and in terms of the settings on the wavemeter,

$$L_a + L_b + 2M = \left(\frac{C_2}{C_3} - I\right) L_x \qquad (13)$$

Now reverse the connections at either X — Y or A — B and again tune the wavemeter. Designate the new reading of the condenser C_1 by C_4, then,

$$L_a + L_b - 2M = \left(\frac{C_2}{C_4} - I\right) L_x \qquad (14)$$

If $L_a = L_a + L_b + 2M$, and $L_s = L_a + L_b - 2M$, then,

$$M = \frac{L_a - L_s}{4} \qquad (15)$$

where M is the mutual inductance.

The coefficient of coupling K is calculated from

$$K = \frac{M}{\sqrt{L_a L_b}} \qquad (16)$$

Rice Receiving System

(Continued from page 68)

is used in connection with a conductively coupled, two-circuit tuner. Inductance L1 is a 100-turn honeycomb coil. Variable condenser C1 is a 5-plate size. Inductance L2 is a 50-turn honeycomb coil, and C2 is a 43-plate variable condenser. Both condensers should have vernier attachments.

Both figures 1 and 2 and the various values given, apply to the reception of wave lengths from 220 to 690 meters.

Figure 3 shows the Rice system using two tubes and a crystal detector to provide one stage of radio frequency amplification, detector and one stage of audio frequency amplification.

A second stage of audio amplification may be added to bring in the distant stations with loud speaker volume.

This system is easy to build, and although a little critical to tune when very weak signals are being received, is highly selective, reliable and extremely sensitive. It is well worth the experimenter's time to build such a set, as all the parts required are standard, and the cost of the entire assembly is low.

NEW APPLIANCES AND DEVICES

The Grewol Detector

THE Grewol Detector, distributed by the Randel Wireless Company, takes the crystal detector out of the group of adjusting instruments which the fan has to learn to operate. It performs all the duties of a detector but requires no more attention than a fixed condenser. The Grewol Detector comes to the consumer already set and fixed

Grewol detector

so that the adjustment is vibration and jar-proof. At the factory, the most sensitive spot on the crystal surface is found and the cat-whisker is secured so as to stay exactly on this spot. A glass cover fits snugly to keep out moisture and dust.

The "Midget" Model—MRC-10

A new product of the Michigan Radio Corporation is the Michigan "Midget" The tuning is controlled by two levers, one to govern the wave length, the other to amplify. The "Midget" is made of Michigan Quality parts and equipped with a standard socket. Capacity effect is eliminated by full metal panel and dead end shafts.

The "Midget" has been primarily designed for home radio reception. Owing to its size and compactness and the fact it can be

Michigan "Midget" receiver

operated with any of the dry cell tubes, equally as well as with standard 6-volt tubes, the "Midget" has met with the approval of campers, tourists and resorters.

The Michigan "Midget" is self contained in a mahogany finish cabinet, having dimensions of 14¼ inches long, 9⅝ inches wide and 7⅞ inches high. It is very compact, yet allows ample room for three No. 6 dry cells and one 22½-volt "B" battery and weighs approximately six pounds without batteries, making it readily portable and very rugged. It will cover wave lengths up to 600 meters which includes all broadcasting stations now licensed. The front panel is full metal inclined at an angle of 70 degrees, bringing the indicators into direct line of vision rather than below it. Dials have been eliminated because of difficulty in adjustment, and highly polished levers are used instead, as levers afford greater ease of operation

Kennedy Portable Receiver

THE Kennedy portable radio receiver is the latest product of the Colin B. Kennedy Corporation. It was placed on the market recently after more than a year of experimental and development work.

The set is housed in a strong and beautifully finished dark oak case with convenient

Kennedy portable receiver

carrying handle. This case is 7 x 7½ x 15 inches and contains the complete outfit, including tuner and detector, "A" and "B" batteries and head-phones. It is designed for use with the standard dry-cell tubes and when so used is entirely self-contained. In case it is desired to use the 4½ or 6-volt tubes, a storage battery may be connected to a binding post provided for this purpose on the back of the cabinet.

Filament Storage Battery For New Types of Tubes

THE Electric Storage Battery Company, has developed and placed on the market two new storage batteries of low voltage for use with the new, low voltage tubes. One is known as the 1-KZR-5 and the other, the 2-KZR-3.

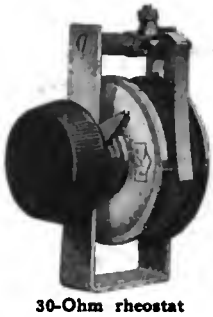
For WD-11 or 12 tubes, the 1-KZR-5 is recommended. In size it compares favorably with the ordinary dry cell, being only 6 13/16 inches high by 2 5/16 inches wide, by 4½ inches long. It weighs but 5 lbs.

The other "baby battery"—type 2-KZR-3 is designed for use with UV-199 tube which consumes six hundredths of an ampere at 3 to 3.6 volts. This battery is very similar to the first in its structural details, but has two cells instead of one. It weighs six pounds, is 5/32 inches wider but will heat the tube filament for approximately 200 hours on one charge.

Cutler-Hammer 30-Ohm Rheostat

THE Cutler-Hammer Mfg. Co. is now marketing a 30-ohm rheostat which is particularly adapted to the use of the new one-quarter ampere tubes.

The new rheostat is variable over its entime range of from 0 to 30 ohms, and is



30-Ohm rheostat

easy and convenient to mount and connect. The contact finger rides smoothly over the resistance and the rheostat is noiseless in operation. These rheostats are of the revolving drum type which have proven so successful in radio work in the past.

With a six-volt battery, it is necessary to insert a rheostat of approximately 30-ohm resistance in the circuit when using the new 201-A or 301-A receiving tube.

Fada-Hazeltine Neutrodyne Parts

TO make it most easy for the home experimenter to purchase materials for constructing "Neutrodyne" receivers, a combination package has been arranged in which is included three Fada-Hazeltine No. 163-A Neutroformers, two No. 164-A "Neutrodons" and a complete instruction book on "How to Build Hazeltine's Neutrodyne Cir-

Standard Neutrodyne parts

cuit Radio Receivers." These parts are packed in a single cardboard carton and form the nucleus for "Neutrodyne" receiver construction. These parts have been built upon the specifications of Prof. Hazeltine, who developed the Neutrodyne circuit.

C. Brandes, Inc., Purchase New Factory

C. BRANDES, Inc., whose main office is located at 237 Lafayette Street, New York, with branch offices and factories at Toronto, Canada, and London, England, have recently purchased another factory, containing 46,000 square feet of floor space, at Newark, N. J.

The plant at Newark, N. J., recently acquired by C. Brandes, Inc.

The new property acquired by the Brandes Corporation has a frontage of 339 feet on Mt. Pleasant Avenue, taking the entire block along Gouvenor Street to Ogden Street and along Ogden Street for a distance of 225 feet.

The plant itself has a frontage along Mount Pleasant Avenue of 100 feet, and runs to Ogden Strcet, where it has a frontage of 225 feet. The plant is two stories high over part of its area and three stories over the rest of the entire space occupied.

The new plant will be operated as a feeder plant for the rest of the corporation's factories. They will take possession of the lower portion of the building immediately and as soon as the assembly of machinery is completed, they will begin the manufacture of parts for their headsets.

The New York plant, which does assembling exclusively, will later be moved to Newark, bringing all the Brandes operations under one roof. This will mean the employment of approximately 1,000 persons.

The corporation with all its branch factories now occupy in the neighborhood of 70,000 square feet of space, probably the largest factory in the United States devoted entirely to the production of one item of radio. The present plants of the Brandes Corporation turn out one complete headset every ten seconds of the working day.

Annual Convention of the Associated Manufacturers of Electrical Supplies

THE annual convention of the Associated Manufacturers of Electrical Supplies was held at the Hotel Griswold in New London, Conn., from June 26th-28th, with a large membership in attendance.

This association is a representative of the engineers and executives of the leading electrical industries of the United States, an organization which in the versatility of its aims and objects, as well as membership, exceeds any of its kind in the country.

With the expansion of the radio industry, a section of the society was formed by radio manufacturers. The chief objects of the Radio Section are to further the simplification and standardization of radio apparatus, to devclop among the radio manufacturers more efficient manufacturing processes, and to establish a centralized bureau for the dissemination of unbiased radio information, whether news or technical, for universal press consumption.

During this convention, the following officers for the Radio Section of A. M. E. S. were elected to serve during the period of June, 1923, to June, 1924: For Chairman, E. B. Mallory, of the Westinghouse Electric & Mfg. Co.; for Eastern Vice Chairman, D. R. Murdock, of the William J. Murdock Co.; for Western Vice Chairman, C. E. Hammond, of Signal Electric & Mfg. Co.: for Secretary, Quinton Adams, of the Radio Corporation of America; for Treasurer, George E. Eltz, Jr., of the Manhattan Electric Supply Co.

ANNUAL sales of the General Electric Company increasecd from about $12,000,000 to $243,000,000 in the thirty years between Jan. 1, 1893, and Jan. 1, 1923, a statement issued by the corporation discloscs.

The outstanding capital stock increased from $35,000,000 to $184,000,000 and the value of its manufacturing plants from $4,000,000 to $167,000,000. The number of employees grew from 4,000 to more than 74,000.

The statement was issued as a review of the corporation's accomplishmcnts under the leadership of Charles A. Coffin, who is retiring as chairman of the board after thirty years of continuous service. Tribute is paid also to the accomplishments of E. W. Rice, Jr., former President of the corporation, and to its corps of engineers, including Professor Elihu Thomson and Dr. Charles P. Steinmetz.

Mention is also made of Thomas A. Edison, who gave the world the first central plant in which to generate electricity for public lighting.

THE American Radio Exposition Company will hold its second annual radio exposition on the fourth floor of the Grand Central Palace, New York City, October 6 to 13, inclusivc.

Development of the Radio Industry in the Argentine

WITHOUT doubt during 1923 the countries of the River Plate will purchase many millions of dollars worth of radio apparatus. Even today many retail establishments of every description are doing a rushing business in selling radio broadcasting and receiving sets as well as the many odds and ends that go to make up the equipment of radio enthusiasts.

Radio broadcasting stations have not been developed in Argentina on such a comprehensive scale as in the United States, consequently the owner of a radio receiving set is not so fortunate as the American enthusiast. However, there is a sufficient number of such stations to enable local owners to listen in on many concerts. Nearly all of the principal theatres are now equipped with radio outfits and on October 12th last the speech of the new President of the Argentine Republic was heard in the homes of thousands of radio enthusiasts. In a recent speech before the American Club of Buenos Aires, E. J. Nally, Managing Director of International Relations of the Radio Corporation of America, said it is estimated that in the United States the sales of radio apparatus and spare parts represents a turnover of more than $5,000,000 weekly. Therc is reason to expect that the radio business will develop in Argentina to a point where sales will reach at least $10,000,000 pcr year. Indeed, it is believed that this sum will be reached in 1923.

At present American and French equipment is being used almost exclusively. American manufacturcrs are in the lead. British manufacturers and their local representatives have not, as yet, accomplished very much in the development of this particular line. However, they are making a strong bid for a part of the business and no doubt they will have to be taken into consideration in the near future. The same may be said of German and Italian manufacturers.

een treated to open air gramophone con-erts broadcasted from an automobile quipped with a Westinghouse receiver hile being driven all over the city. Such ractical demonstrations as this are doing uch to popularize Ameriacn radio equip-ent with the Argentine people.

THE Spielman Electric Company, Inc., manufacturers of Seco perfected radio pecialties, has moved its offices and plant rom 116 West 65th Street, New York, to 11 West 59th Street.

Cunningham $5,000.00 Window Trim Contest

E. T. CUNNINGHAM, Inc., will award to radio dealers throughout the country $5,000.00 in prizes for the window trimmed to display to the best advantage Cunningham vacuum tubes, during the week of September 24 to October 1, inclusive, which has been designated as Cunningham Tube Week.

The first prize is to be $1,000.00 followed by fifty other prizes, the smallest of which is $50.00, and there will be 45 of them. The Cunningham Company has made extensive preparation for the announcement and exploitation of this contest. Advertising copy has been placed with leading radio magazines and merchandising publications as well as many newspapers throughout the country, and attractive window display cards have been prepared and sent to all jobbers and dealers.

It is a radio merchandising plan to help increase the radio dealer's sales. Aside from the actual publicity for the Cunningham tube itself, it has been suggested to contesting dealers that they especially display the various parts that enter into a radio set in a way that will make an educational appeal to the radio fan, and to those who might be interested, if they were better acquainted with the units that make radio reception possible.

Each dealer will be furnished with window trim material inviting his customers and the radio fans in his city to visit his special display and learn of the Cunningham product and the joy of radio. Advertising copy and layouts for his local newspapers will be sent out from the home office.

The Cunningham officials do not claim originality of the idea of such a contest, but they do believe that by making the week an exposition event for the display of radio equipment and thereby becoming sponsor to an educational campaign, they have taken it out of the class of plain advertising, and the company backs up its idea with the belief that more sales of Cunningham tubes must result as a greater number of people take up radio and one of the best ways to reach the local buyer is through the dealer's window. This campaign is being handled by the L. H. Waldron Advertising Agency of San Francisco.

THE Multiple Electric Products Co., Inc., of Newark, N. J., announces the appointment of The Marconi Wireless Telegraph Co. of Canada, Ltd., 11 Sacrament St., Montreal, Quebec, Canada, as Canadian distributor for Atlas products.

Milwaukee Exposition Will Have Radio Section

AN Educational Radio Exhibit will form part of the fifth annual Food, Household, and Electrical Exposition, to be held at the Milwaukee Auditorium, Milwaukee, Wisc., October 15 to 21, 1923, under the auspices of the Wisconsin Radio Association. The exhibit as planned will consist of four features, as follows:

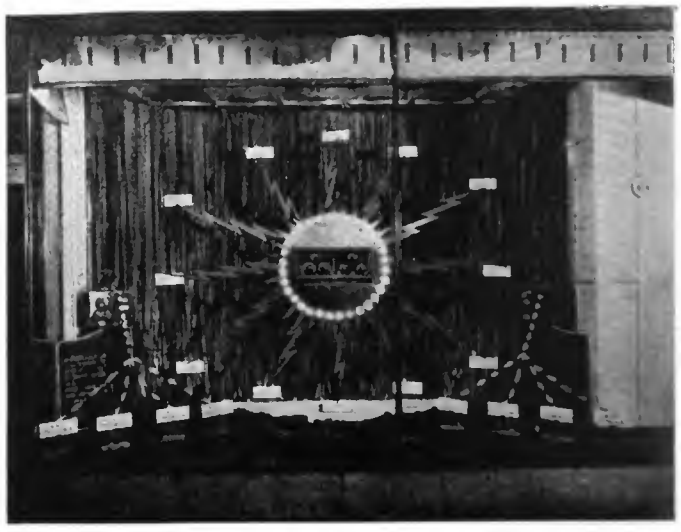
A small broadcasting station, giving daily programs; a large broadcasting station map; a series of tableaux suggesting the uses of radio by the public, and an information booth, where members of the association will be constantly on hand to answer all inquiries regarding radio.

The exhibit will be conducted on an educational basis, keeping the actual makes of radio sets in the background, and bringing out strongly the idea of radio and its desirability. Nothing will be sold. Every effort will be made to exclude any commercial exhibits of radio apparatus from the exposition, and no demonstrations of radio reception will be permitted, as the building is entirely unsuited for satisfactory reception of outside broadcasting.

The advertising in the Milwaukee Journal to follow the exposition will also be of an educational nature, without specific reference to any make of receiving set. The Wisconsin Radio Association was recently organized to include the radio manufacturers, jobbers, dealers, and broadcasting stations of Wisconsin. The Milwaukee market has never been properly sold on radio; this exhibit and the publicity it will receive through the Milwaukee Journal will be the biggest step ever taken toward this end.

Modern sales methods employed by live radio dealers include more than a mere display of apparatus

Window display of McCarthy Bros. & Ford, Buffalo, N. Y.



RCA window display of The National Electrical Supply Co., Washington, D. C.

Crosley Co. Holds Sales Convention

THE Radio Division of the Crosley Manufacturing Company held a sales convention July 10 and 11, at the home office and factory, Cincinnati, which was presided over by Powel Crosley, Jr, President of the company.

"Manufacturer and distributor must work in perfect harmony for the common good of the radio industry," said Mr. Crosley in his talk to his sales force: "We are assembled to discuss the future of the radio industry whose surface has just been scratched. It would be folly for our company to make apparatus without asking the public to express their wishes in this matter. It is impossible, of course, to have every radio fan and future purchaser of radio apparatus come to a convention, but we do have their representatives to speak for them. That is why the jobbers have been asked to take an active part in the formulation of plans for the designing and selling of Crosley Radio Apparatus."

"When I hear people say that radio is but a passing fancy and will not last, I am reminded of the days when the automobile was spoken of in the same way; people said that the auto could not last because it would drive the horses off of the street and by the looks of our streets with their thousands of automobiles, they seem to have succeeded. One of the barometers by which we know that radio is becoming more popular than ever before, is the increase in the number of broadcasting stations which now total nearly 600.

"We have spent thousands of dollars in our broadcasting station WLW in order that the radio public might more fully enjoy the work of such fine musicians as found in the Cincinnati Symphony Orchestra, Conservatory of Music, College of Music and the opera organization at the Zoo. All of the time and attention we are giving to our station is to aid you, as distributors in making the radio public better acquainted with Cincinnati, the home of Crosley 'Better—Cost Less' apparatus."

The delegates to the convention visited the Precision Equipment Company of which organization Mr. Powel Crosley, Jr., is also President. The new equipment in this line of radio apparatus manufactured under the Armstrong Patent, was displayed and the interest shown forecast a healthy sale in the near future.

A tour of Cincinnati and visit to the Fall Festival where WLW will broadcast a radio wedding in September proved interesting to the visitors.

A. B. AYERS, formerly with F. A. D. Andrea, Inc., is now with the Freed-Eisemann Radio Corporation in the capacity of Eastern District Sales Manager.

THE Magnus Electric Co., Inc., has a new 40-page Radio Catalog and Reference Book, which is now ready for distribution. It contains much information concerning radio products. Copy may be had upon request.

International Notes

By Charles Bailly, Paris

Radio Apparatus at the Paris Fair

OVER 5,000 exhibitors had space at the famous Paris Fair, held yearly, and great crowds thronged it daily. The electrical section was especially popular, due in great part to the very lively interest aroused in the public by the radio telephone concerts given during the winter. The electrical section of the fair filled three halls, in which 300 exhibits were placed. This section was divided into three categories: 1st. Electric lighting, telegraph, radio, telephone, etc. 2nd. Electrical materials and industrial installations. 3rd. Electrical apparatus such as generators, alternators, transformers, high tension apparatus, condensers, medical instruments, etc.

The radio section contained large numbers of parts, such as plugs, screws, transformers, headphones, rectifiers, detectors, and similar apparatus. Also complete sets were exhibited, including not only concert receivers with two stages of audio frequency, but also a number of radio-frequency outfits.

Powerful Loud Speaker on the Eiffel Tower

FOR the Pasteur Celebration, the military radio station on the Eiffel Tower installed a loud speaker of tremendous power. This was placed on the first platform of the tower and connected by a special line with a microphone before the speaker. It was heard across the entire Champ de Mars. Promenaders within a radius of several hundred meters were able to hear the voice of the speaker with ease.

New Broadcasting Station in Paris

THE High School of Posts, Telegraphs and Telephones of Paris is now broadcasting and its transmitter is noted for its remarkable purity. In addition to transmitting concerts from a studio, theatrical productions have been broadcast, and also addresses on the most diverse subjects. The station also has been conducting a course of code instruction, a series of lessons in English and a series of addresses on the functions and methods of the French postal, telegram and telephone services. This station operates on a wavelength of 450 meters and puts 400 watts into the antenna.

French Steamers

THE latest distance records made by radio telephone between the S. S. *Paris* and the S. S. *France* on their voyages between Havre and New York, reached a distance of 1,250 nautical miles. This is a great increase over the original range of 350 miles realized in the first tests. In the latest voyages a great number of passengers on both steamers were able to exchange telephone conversation with ease while the ships were 1,250 miles apart.

French Scientists Honor Edouard Branly

A GRAND radio celebration to do honor to the French savant, Edouard Branly, was held on June 7th, at Paris, at the Trocadero. The ceremonies were presided over by Leon Berard, Minister of Public Instruction, and by Paul Laffont, Under Secretary of State for Posts, Telegraphs and Telephones. Among the famous men who gathered to do honor to Branly were General Ferrie, French Director of Military Telegraphy; Daniel Berthelot, Edouard Belin, and Commandant Mesny. The program included addresses by Mr. Laffont, Mr. Berthelot and Mr. Belin, the first showing of a motion picture film reviewing the history of radio, the making of some sensational experiments with radio and other electrical apparatus, and a musical program by a number of celebrated artists, including the American violinist, Spalding.

One of the experiments consisted of a demonstration of automatic reception of an SOS signal. The transmitter installed at one end of the hall sent out the letters SOS. At the other end of the room were Chauveau receiving instruments. The transmission of the SOS signal automatically rang a bell on the receiving set and also illuminated a sign bearing the letters SOS.

Another demonstration consisted of high speed reception, with automatic printing of the signals from the St. Assise trans-continental station. The signals were picked up on a special antenna and came out of the apparatus in the form of plain language printed on a paper tape.

Edouard Belin showed his method of transmitting pictures by radio. First a luminous point and then a luminous circle, both corresponding to similar objects placed before the transmitter, were projected on the screen attached to the receiving set. A great ovation was given to Edouard Branly during the course of the addresses by Daniel Berthelot on the marvels of the Hertzian wave.

The following is taken from an interview with Mr. Branly appearing in *Le Matin*, the famous Parisian newspaper, in which Mr. Branly explains how he began late in 1899 to develop the application of radio phenomena to a practical point:

"It was toward the year 1887," said Mr. Branly, "when I was making various researches on the variation in conductivity of certain conductors, such as silver and platinum, under the action of light. The conductors were in the form of thin layers of metallic dust, and I was endeavoring to ascertain the precise values of these variations. These investigations led me to study the rôle of ultra-violet light in influencing these variations. In order to obtain this light I made use of an electrical spark from a Ruhmkorff coil. At once one could see that e passage of this spark at some distance from my metallized plates considerably augmented the electrical conductivity of that thin layer of metal. Copper dust spread lightly upon a glass plate presented a resistance of over 100,000 ohms to direct current from a battery, but while the spark was in action that resistance was not more than three or four ohms.

"But I noted still another phenomenon. That was that the greatly raised conductivity of my metallic powders continued after the spark that had caused it had been extinguished. However, the slightest shock on the glass plate, even a vibration in the air caused by the voice or by the whistle would destroy this abnormal conductivity, and the layer of the metallic dust would then resume its high resistance to the passage of a direct current. Was not that something to excite the curiosity of the laboratory worker? Of course, I decided to undertake a thorough study of this phenomenon.

The French savant, Edouard Branly

"I was soon able to determine that it was not at all the light of the spark that was the cause of this because, though I interposed an opaque screen between the spark and the metallized plate, the phenomenon nevertheless was observed. I was even able to perform this experiment at a considerable distance from the spark, making use of two separate rooms 26 meters (79 feet) apart, separated by two thick walls and by a court. It was then evident that this phenomenon could only be due to the wave, the electrical vibration, that had been noted previously by men such as Maxwell and Federsen, and to which Hertz gave his name.

material, with provision for giving periodic shocks to interrupt the conductivity caused by the wave. I found that by attaching an aerial metallic strip to one side of the gap of my Ruhmkorff coil, the phenomena was manifest at a much greater distance. Also I found that by enclosing my metallized plates in a metal cage, the walls of this cage would resist the passage of this wave and prevent the phenomenon. But I found this could be re-established, if I introduced within the cage, a metal strip extending outside.

"Thus were made in miniature, a transmitting and receiving antenna. In November, 1890, and again in January, 1891, I was able to give the Academy of Science a report of the results obtained in these tests and also to outline the principles of the antenna. It was thus that Mr. Marconi found material for his studies into the practical applications of these discoveries, when he was performing his military service in the Italian Navy. Several years later, on March 20th, 1899, as is well known, he made his first decisively successful tests over a distance of 50 kilometers (30 miles)."

In concluding it may be noted that Mr. Marconi addressed to Mr. Branly his first telegram in those tests, which were conducted across the English Channel.

STATIONS WORKED AND HEARD

Stations worked should be enclosed in brackets. All monthly lists of distant stations worked and heard which are received by the 10th of each month will be published in the next month's issue. For example, lists received by Sept. 10th will be published in the Oct. issue. Spark and C. W. stations should be arranged in separate groups.

9ZT, D. C. WALLACE, 54 Penn Ave. N., Minneapolis, Minn. (June.)

1fd, 1kc, (1yb), 1als, (1cpn), 1cpo, 2bn, (2ts), (2aay), (2agb), (2brb), 2bsc, (2cbw), 2ccd, (2cqz), (2cui), (2cur), (3ab), 3hs, (3pz), 3si, 3su, (3xn), 3anz, 3arp, (3bfu), (3bgj), (4eb), 4fg, (4ft), 4my, (5ek), (5kw), (5ll), (5rl), (5zb), (5agn), (6ec), 6iv, 6km, (6od), (6rm), 6xe, (6alk), (6auu), (6awt), (6bbc), 6bcl, 6beo, (6bez), (6bjq), (6bpb), 6bqc, (6bun), (6bvg), 6bvs, (6cbi), 6cgw, 7dh, 7ih, (7la), 7za, (7zu), 7zv, (8gp), (8ij), (8jy), (8qw), (8vq), (8xh), (8zv), (8ada), (8amp), (8awp), (8bdr), (8bjv), (8bki), (8caz), (8cdd), (8cur), (8cvg), (8dat), (8dge).

Canadian—(3de), (3he), 4cn.

Mexico—jh.

Bowdoin—wnp.

1fd, 1kc, 1ana, 1bbo, 1cpo, 2bn, 2fp, (2gk), 2qp, 2wr, (2agb), (2cbw), (2ckl), 2cto, 2cui, (2cur), (3ab), (3bg), 3jj, 3su, 3arp, (3bbv), (3bfu), (3bgj), 3bva, (3chg), (4fg), 4gl, 6km, (6rm), 6aak, (6arb), (6avn), 6beo, (6bjq), 6bnt, 6bvs, (6cbi), 6cgw, 7cf, 7fd, 7ry, (7agf).

NATIONAL AMATEUR WIRELESS ASSOCIATION

Guglielmo Marconi
President

J. Andrew White
Acting President

H. L. Welker
Secretary

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HEADQUARTERS: 326 BROADWAY, NEW YORK

21,967 Transmitting Stations in the United States

WASHINGTON, Aug. 6.—The end of the fiscal year shows a gain of 1,126 radio stations of all kinds in the United States, according to the Department of Commerce figures just compiled. On June 30 there were 21,967 ship and land radio stations, whereas a year ago there was a total of 20,841. The increase represents added interest among amateurs and broadcasters who have taken out station licenses during the past twelve months. Amateur stations increased from 15,504 in 1922 to 16,570 on June 30, a gain of 1,066. Broadcasting stations number 191 more today than a year ago, having increased from 382 last year to 573.

The totals for all classes of stations on June 30, 1923, were as follows:

General and restricted amateurs	16,570
Special amateurs	178
Trans-oceanic stations	12
General public service to ships	45
Point to point stations	179
Broadcasting	573
Technical and training	127
Experimental	261
Ship stations, commercial	2,723
Government ship, including Navy and Army	1,009
Government land, including 24 lightships	290
Total	21,967

RADIO night owls who have difficulty in getting up after an all-night session at the receiving set can now be wakened by radio. A Frenchman has just invented an alarm clock which responds to a certain radio wave-length sent out from a broadcasting station.

△ △

THE radio column of a newspaper recently contained the following:

"When signals become weak in a receiving set give the wiring a thorough dusting."

[Reducing the resistance of the antenna wires by means of a coat of grease *might* help the signals slide along easier, but we doubt it.—ED.]

△ △

LESTER PICKER, eighteen-year-old amateur radio expert, whose station, 6ZH, is known to amateurs on three continents, has been issued the first special amateur radio license provided under the new Department of Commerce regulations. He lives in San Ysidro, Calif.

△ △

THE officers of the newly organized Radio Association of West Orange are as follows: President, Dr. Max H. Weinmann; vice president, Otto H. Kleiman; treasurer, William J. Lavery; secretary, Henry C. Warnick; counsel, J. Henry Coyne; directors, Ernest McChesney, Dr. J. Pinsky, Leland A. Stanford, Hyman Nisselson, Samuel Klausner, Leon Diamond, Louis W. Deckenbach, J. Milstein.

Two New York amateurs listen to broadcasts through a receiver installed on a moving freight train

THE Second Convention of the National American Radio Relay League is to be held at Chicago, September 12 to 15, under the auspices of the Chicago Radio Traffic Association.

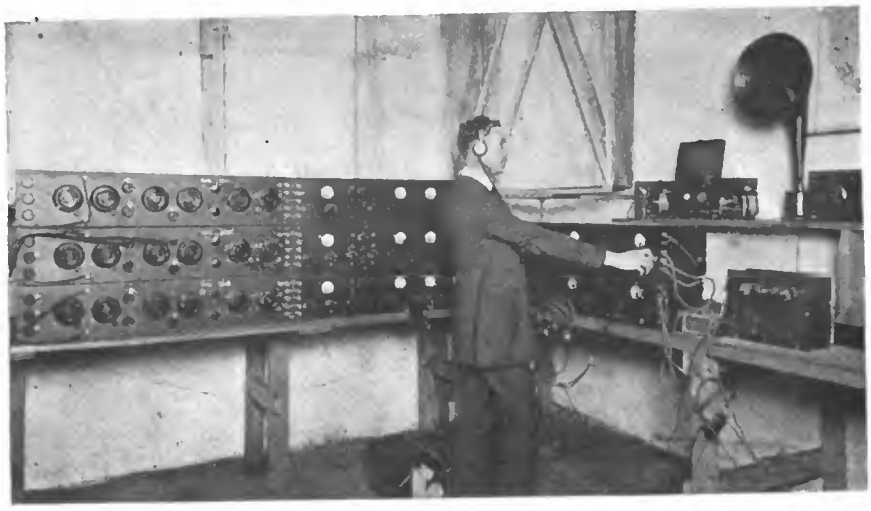
An intensive effort is being made by the officers of the League to secure speakers who will cover all phases of radio transmission and reception, bringing before those attending the convention all of the most recent developments which may be utilized for long distance work in the early Fall.

One of the most important meetings at the convention on the afternoon of Thursday will be that of the A. R. R. L. Traffic Department under the chairmanship of F. H. Schnell, traffic manager of the league, when coming international amateur long distance tests and kindred matters will be discussed at length.

Tours will be made to local broadcast and amateur stations. Saturday is to be a "night of mystery" and the convention will wind up with the initiation of candidates into the "Royal Order of the Wouff-Hong."

△ △

ACCORDING to the annual report of the Department of Commerce for the fiscal year ending June 30, 1923, there were 16,570 licensed amateur stations, general and restricted, in operation in the United States and its possessions. There was a decrease as compared with 1922 in the First, Second and Eighth Districts, but all others showed



Receiving five radio concerts simultaneously from different cities, Chicago, Cleveland, Pittsburg, Schenectady and New York. Claude Golden in the research laboratory of the Experimenters Information Service, New York

Districts	June, 1921	June, 1922	June, 1923
First	2,040	2,489	2,139
Second ...	1,880	2,348	2,055
Third	1,325	1,857	2,005
Fourth	208	341	449
Fifth	418	758	948
Sixth	1,136	1,756	1,957
Seventh ...	504	753	864
Eighth	1,615	2,354	2,013
Ninth	1,683	2,848	3,340
Totals...	10,809	15,504	16,570

△ △

AMATEURS are reminded that the St. Louis Radio Association holds its regular meetings every Friday night at the Claridge Hotel. All radio fans are invited to attend these meetings.

△ △

UNITED States Civil Service Examinations are listed below. Applications for these examinations may be had from the local secretary of the Civil Service Board at your Post Office, or, if not available there, may be secured from the U. S. Civil Service Commission, Washington, D. C. The examinations are held simultaneously on the dates given in several cities in each state, applicants presenting themselves at the nearest examining office.

Radio Engineer, $4,000 to $5,000 a year. Associate Radio Engineer, $3,000 to $4,000 a year. Assistant Radio Engineer, $2,000 to $3,000 a year. Applications will be rated as received until October 30. The examinations are to fill vacancies in the positions named, or in positions requiring similar qualifications, in the Federal classified service throughout the United States.

The duties are to conduct or superintend the development, design, construction, installation, standardization, and the writing of specifications for practical and special apparatus and methods of radio communication, such apparatus to include sets for land use for more or less permanent stations, also for portable land stations, and for airplane and ship sets, and similar lines of work.

Competitors will not be required to report for examination at any place, but will be rated on the following subjects: Education and preliminary experience, 30%; special experience and fitness, 40%; publications, reports, or theses, to be filed with application, 30%.

Book Reviews

"A" Batteries for Dry Cell Tubes

THE National Carbon Company has prepared a booklet entitled "The Story of Eveready Dry Cell Radio 'A' Batteries for Dry Cell Vacuum Tubes." The information in this booklet will enable the user to obtain the maximum of service and satisfaction from dry cells. The booklet specifies the correct filament voltage for each of the standard receiving tubes now on the market, and included also are diagrams for connecting dry batteries in series, multiple and series multiple in order to obtain proper voltages and the longest possible battery life. Copies of the booklet will be supplied upon request by the National Carbon Company.

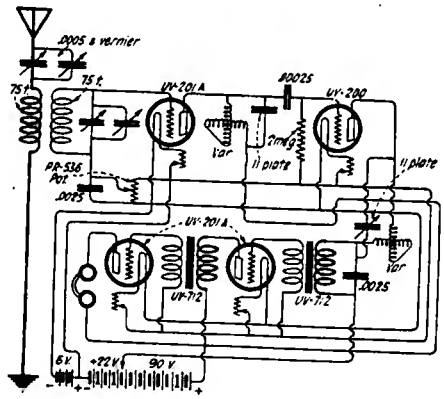
Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of one reader can be answered in the same issue. To receive attention these rules must be rigidly observed.

Positively no questions answered by mail.

Henry Burritt, Bridgeport, Conn.

Q. Would you be kind enough to publish in your next issue the best hook-up for a 4-tube set, using radio frequency, or audio frequency with a wavelength range of 150-800? Do you recommend Prof. Hazeltine's circuit?

A. A single stage of tuned radio frequency plus regeneration in the detector and two stages audio is probably the best four-tube arrangement.



L. A. Wells, Giet Edge, Mont.

Q. 1. In connection with the article on the Neutrodyne receiver in the April issue, I am going to build such a set and would like to know which hookup would be the best to use with a Magnavox loud speaker to retain its natural wave length, 500 meters, the five-tube set or the four-tube set?

Q. 2. Will there have to be additional steps of amplification to operate the loud speaker?

A. 2. Unless you want very loud reception, enough to fill a large hall, it is unnecessary to add more amplification.

Q. 3. Are the tubes in these hookups all hard, or is the detector tube soft? If the soft tube is used, will you have to use a potentiometer to adjust the plate voltage?

A. 3. All the amplifier tubes must be hard, preferably UV-201-A's. The detector may be either a hard or soft tube. In the latter case, a potentiometer must be used to adjust the plate voltage.

Q. 4. Do you know of any company who makes the new transformer and the new condenser of 1.2 mfd.?

A. 4. The F. A. D. Andrea Company and Freed-Eisemann Company of New York (see their advertisement in the April, 1923, WIRELESS AGE), make parts and complete sets for the Neutrodyne.

Q. 5. Can the UV-1820-V. C. with a capacity of .00004 to .0006 mfd. be used in this set?

A. 5. The Radio Corporation UV-1820 variable condenser gives good results when used in the Neutrodyne circuit.

* * *

C. N. House, Detroit, Mich.

Q. I have noted a very interesting article in the April issue of your magazine which gives many interesting hookups of the Hazeltine Neutrodyne system, as applied to various reflex circuits. In this article you state that the different hookups shown are good for approximately 200 to 500 meter wavelengths. You, of course, know that the broadcasting wavelengths have been changed so that they run up to as high as 545 meters, and I am wondering if you would be kind enough to tell me, in the next issue of your magazine, just what changes would be necessary in order to meet this higher wavelength, in the four-tube reflex circuit that is shown in detail on the last page of this article.

A. To go up to the higher wavelengths

for tuning. Another method is to retain the 11- or 13-plate condensers and use the following number of turns on the coils: Primary, 18 turns. Secondary, 70 turns.

* * *

Kenneth Mott, Peekskill, N. Y.

Q. In the April issue of THE WIRELESS AGE I was very much interested in the article on the Neutrodyne receiver, having heard Prof. Hazeltine's lecture at Columbia University. In the article referred to the receiver as described has a range of approximately 180 to 500 meters. I am anxious to build a receiver of this type to include the new broadcasting wavelengths, and would appreciate it if you have information available showing what modifications are necessary to reach the higher wavelengths.

A. To reach the higher wavelengths specified use 18 turns in primary and 70 turns on secondary.

* * *

Robert S. Wilder, New York City.

Q. Will you get for me or tell me where I can get a blueprint of figure 11 shown on page 58 of the April issue of THE WIRELESS AGE? This was one of the illustrations in the article on the Neutrodyne receiver by Abraham Ringel.

A. You will probably obtain prints by addressing the Secretary, Radio Club of America, R. H. McMann, 380 Riverside Drive, New York City.

THE WIRELESS AGE of April to build a Neutrodyne set as described therein under figure 11. Hard as I have tried I cannot make the radio frequency amplifiers work. What is meant by the statement on page 55? "It is important to have the windings in the proper direction so that neutralization of capacity coupling is obtained," and, again: "The polarity of the winding should be properly made in order to produce neutralization. Must the primaries and secondaries of the transformers be wound in opposite directions? Or must the ends of the coils be connected differently, if neutralization is not obtained? I wound all coils anti-clockwise. Am using Acme audio transformers and UV-200 detector tube, 3 UV-201-A amplifiers. What is the correct way of winding the transformer coils for these transformers? What is the correct hook-up for these tubes in this circuit? Would you be good enough to send me a diagram?

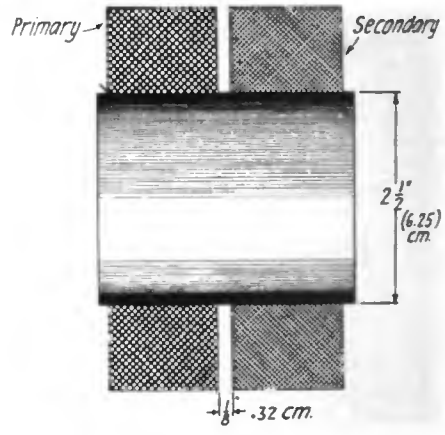
A. The coils are all wound in the same direction but connections are so made to the plate and grid that tracing the primary winding from the plate it appears to be wound in one direction, which, let me assume, is clockwise. Tracing the secondary winding, starting from the terminal connected to grid, they appear to be wound counter-clockwise. The UV-200 should, of course, be the detector. The UV-201-A's are the amplifying tubes.

* * *

Edgar B. Frank, Paris, France.

Q. 1. As a subscriber to your magazine I would be greatly obliged to you for the following information as regards the Neutrodyne circuit described by Abraham Ringel in your April number. Please give details of the windings of the special high frequency transformers for wavelengths of 600 to 1,000 meters, 1,000 to 2,000 meters and 2,000 to 3,000 meters.

A. 1. The following number of turns would be required on a 2½ inch (6.25 cm.) diameter coil.



Wavelength	Pri. turns	Sec. turns
600-1,000	50	150
1,000-2,000	75	250
2,000-3,000	100	350

Q. 2. Could transformers be made to cover all wavelengths between 200 to 3,000 meters by tapping them from place to place? If so, at what turns should tappings be made? Must they be made in the primary as well as the secondary?

A. 2. A single transformer can be used quite effectively here. Th primary should

100 turns. The secondary contains 350 or 400 turns with taps at 150 and 250 turns. Honeycomb coils are ideal for this purpose.

Q. 3. For use with the wavelengths mentioned above, will it be necessary to make any other changes in the parts of this circuit, and notably in the values of the condensers?

A. 3. The condensers should have a capacity of .00075 or .001 mfd. (43 plates).

Q. 4. For a receiver covering 200 to 3,000 meters could honeycomb coils of proper sizes be used in the plate of the first radio frequency transformer and a tickler coil in inductive relation to the closed circuit coil in the place of the variometer?

A. 4. Yes.

am very much interested in Prof. Hazeltine's Neutrodyne circuit, but there are some points in the article in your April number that I would like cleared up.

Q. 1. Page 56, first column, the capacity of the tuning condenser is given as .0005 microfarad, but states that it is of 11 plates. Is not a .0005 composed of 23 plates and which in this case is correct?

A. 1. A 23-plate condenser has a maximum capacity of approximately .0005. You may use either 11-plate or 23-plate, preferably the latter, since you will no doubt wish to include the 550 or 710 meter stations, although the latter may be secured by using 18 turns on primary and 70 turns on secondary.

Q. 2. In the neutralizing condenser is the gap of ¼ inch between ends of the wires to remain constant during adjustment? etc that this was accomplished by sliding the metal sleeve lengthwise so that the capacity between the sleeve and one wire would be greater than that between the sleeve and the other wire. Is this not correct?

A. 2. The neutralizing capacity is adjusted by sliding the metal sleeve over the wires.

Q. 3. Will not another good make of audio transformer work in this circuit in place of the UV-712?

A. 3. Any other good make of audio transformer is satisfactory, although the new UV-712 gives exceptionally good quality.

* * *

Fred W. Warner, Boston, Mass.

Q. 1. Will you kindly tell me what name, number, or make the audio transformers are, which are shown at the bottom of the cut

A. 1. The audio transformers on the photograph are American transformers.

Q. 2. I would like to ask if the wiring diagram shown on page 58 of this same issue is the wiring plan of the cut on page 55. If so, why does the plan of the wiring call for single circuit jacks, while the picture shows five contacts on each jack?

A. 2. The wiring diagram, figure 11, is practically the same as that of the photograph, except that in the former a plate variometer is added to the detector tube.

Q. 3. I would like to ask if the small round objects underneath the lamp sockets are condensers.

A. 3. The small round objects under the panel are blocking condenser and grid condenser and grid leak.

(Continued from page 66)

turns each for concert waves. The primary winding is shunted by a 23-plate variable condenser. All condensers in the set should be of the same make, and match, because by coupling them to a single control this will be the sole means of tuning. The action of the circuit depends on a third coil "N," and called by Freeman the "counter EMF coil." The turns of this coil should be so arranged as to oppose or "buck" the coils L-1 and L-2.

Some members of the "Round and Rounders" facetiously call it the "Freeman 10-Buck circuit," on account of the "N" coil. This coil is coupled with the L-1 and L-2 coils, and each step is adjusted until howling ceases.

(Continued from page 62)

tural unit of the Bureau of Standards.

The consolidation of these scattered units of investigational activities under a single roof, will not only avoid duplication of effort, but will unify the scientific personnel of radio telephony and telegraphy and bring it into close contact with other forms of scientific research, for which this medium of intelligence is finding increasing applications.

Approximately 15 laboratory rooms are provided on the top floor of this experimental research building, which will be devoted to studies of the sciences of radio and sound. A storage battery room, switchboard room, store room, library, and general assembling room, are among the compartments reserved for research in problems affecting wireless communication. An antenna, to be erected, will spread its network of wires from the research laboratory to the smokestack of the power house. This antenna, for the purpose of transmitting communications, will either be of the conventional straight type or designed in accordance with the multiple-tuned system. The antenna will be 150 feet high. For the purpose of the reception of radio communications, loop antennas will be installed atop the research laboratory.

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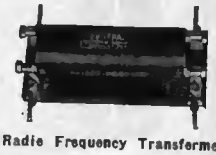

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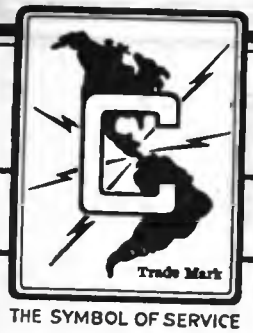

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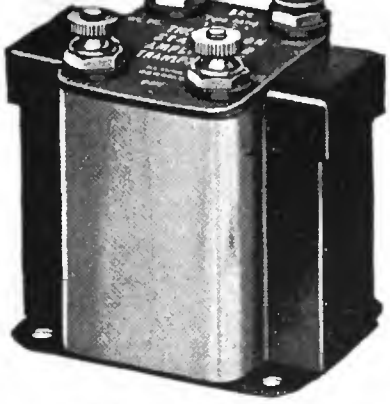

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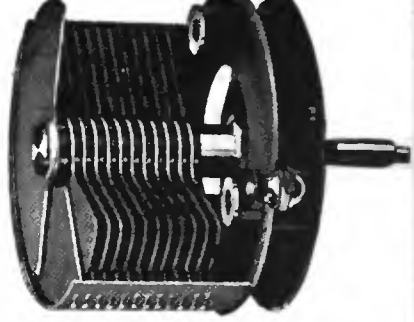

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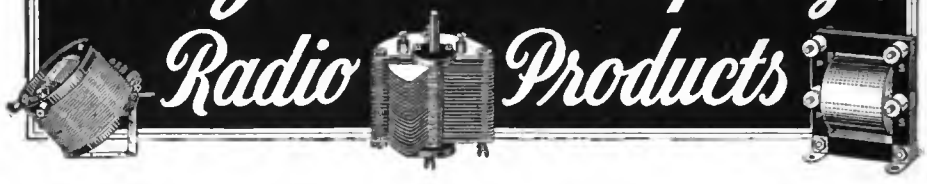

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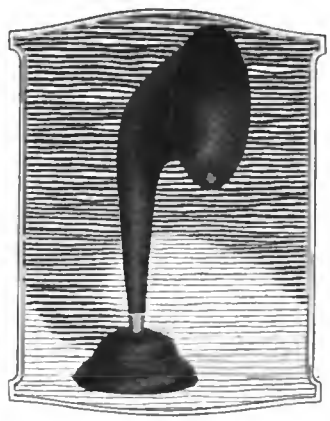

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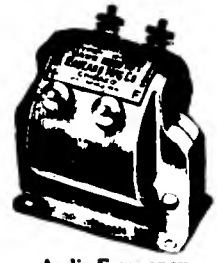

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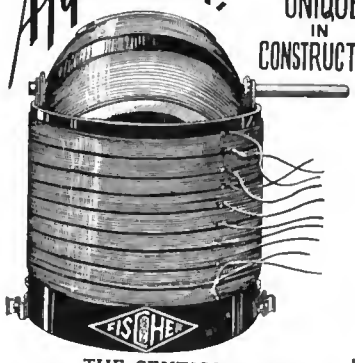

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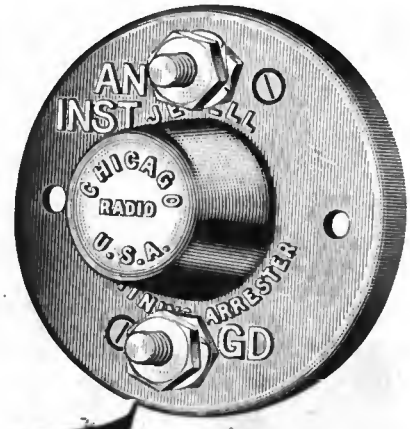

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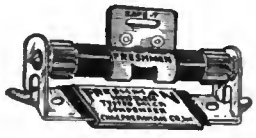

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Furnished in any value of Resistance from ¼ Megohm up.. **30c.**

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TESTED MICA CONDENSER and LEAK MOUNTING

The Freshman Condenser is so designed that constant equal pressure is exerted over the entire area of the condenser plates and the mounting is part of the condenser itself, which makes this new product the only True and Perfect Leak Mounting on the market.

Combination Condenser .00025 and leak Mounting..... **40c.**

All Freshman Products at your dealers—otherwise send purchase price and you will be supplied without further charge.

Also ask your dealer for our free diagrams of the Neutrodyne, Flewelling and Kaufman Circuits.

Chas. Freshman Co. Inc.
Radio Condenser Products
106 Seventh Ave. New York City

Write for illustrated folder on "Westinghouse Radio Storage Batteries"

Complete radio satisfaction is a matter of strict attention to every detail of your set. To many radio folk a battery may be "just a battery," but the fan who gets the utmost in results knows that *right* batteries are very, very important—just as important as right tubes, transformers, coils, aerials, etc. Westinghouse Batteries are the product of both battery and radio engineering. They are *even*-powered as well as full-powered. (You know how essential that is to fine tuning.)

You'll be well repaid for determining to have only Westinghouse Batteries. There should be a dealer near you who handles them. If not, get them at any Westinghouse Battery Service Station.

WESTINGHOUSE UNION BATTERY CO.
Swissvale, Pa.

Westinghouse "B" Batteries The 22-MG-2 (22 volts) is a marvel for long, steady, noiseless service. Glass case; visible interior; sealed-in tops. Larger types, too; also 2-volt single "C" cells.

Westinghouse "A" Batteries are full-capacity, slow-discharge, long-life batteries. Made in 4, 6 and 8 volt sizes, with 5, 9 and 13 plates per cell, to meet various filament requirements.

WESTINGHOUSE

Radio "A," "B" and "C" BATTERIES

Sound Method of Learning the Code, 50c
Wireless Press, 326 Broadway, New York.

A Booklet You Will Want

By W. J. Merritt Garvey, of New York World's Radio Section, Handbook of Helpful Hints for Radio Set Builders, includes tables, charts, legends, statistics and carefully selected hookups with diagrams and full descriptions. Reading this interesting book we discovered Mr. Garvey recommended the FIL-KO-STAT. We bought an edition of the books and will gladly send a copy anywhere at handling cost 10c. postpaid.

RADIO STORES CORPORATION, Inc.
Sole International Distributors for

FIL-KO-STAT

Filament Control of Infinite Adjustment
Dept. W9-218 West 34th St. New York

Super-Sensitiveness!

The crystal is the "bull's-eye" of your crystal receiving set. Unless it is super-sensitive you are wasting time and entertainment and cannot "hit" the combination for best results. Insist upon the genuine original Arlington tested "NAA" Detector minerals. They are carefully selected from bulk stock, individually tested and guaranteed super-sensitive.

Galena, Goldite or Silicon, price for crystal, 25c. Same mounted in brass cup, 40c. Obtainable at your dealer's or sent direct (postpaid) on receipt of price.

Newman-Stern Building
Cleveland, Ohio

The Newman-Stern Co

Another Use For Loud Speaker

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

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

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

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

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

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

AUDIOPHONE

THE BRISTOL COMPANY
WATERBURY, CONN.

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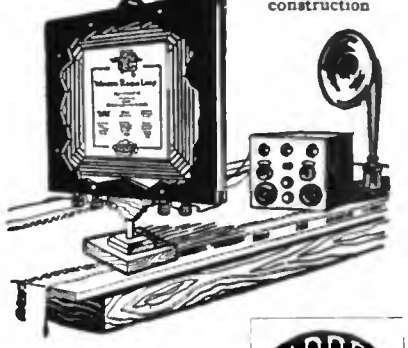

Adds These Advantages to Your Set

These advantages that no ordinary aerial can give plus freedom from danger and repairs—all incorporated in your set for the small cost of a *Warren Radio Loop*. Extremely accurate. Carefully made as the finest part of your set. Flat as an atlas. Completely enclosed—damp, dust and fool-proof. Use a modern aerial. Buy a *Warren Radio Loop* TODAY!

WARREN RADIO LOOP

Sharper Tuning One tuning adjustment — no others needed.

Directional Receives signals strongest.

Selective Picks out just the station you want to hear.

Portable Small, light, compact. Ideal for portable or mobile sets.

Wider Range of Frequencies on single coil.

Small re-radiative effect. Fine for regenerative circuit.

A Type for Every Set at the Best Dealers

Type A-737 (300-700 meters) 6 inches square—non-directional	$10.00
Type A-7236 (175-1000 meters) 6 inches square—non-directional	12.00
Type B-2537 (300-700 meters) 18 inches square—directional	20.00
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Write for Bulletin M-102.

V-DE-CO RADIO MFG. CO.
ASBURY PARK, N. J.
Dept. W

LEARN THE CODE

Get all the fun there is to be had from your wireless set. Learn to read the dots and dashes and double your pleasure.

The Marconi-Victor Records
Provide the ideal instruction

SIX DOUBLE FACED RECORDS—TWELVE LESSONS

From the alphabet to press and code work. Actual operating conditions reproduced. Satisfaction guaranteed.

Price: $5.00 per set

WIRELESS PRESS, Inc., 326 Broadway, New York

RUSONITE

CRYSTAL RECTIFIER

Patent Pending

THE PERFECT SYNTHETIC CRYSTAL DETECTOR
SENSITIVE OVER ENTIRE SURFACE
No Hunting for "Spots." Loud and Clear.
Endorsed by Thousands of Satisfied Users.

SENSITIVENESS GUARANTEED — Price Mounted..... 50c

14 K. Gold Supersensitive RUSONITE CATWHISKER, Price.. 25c
Permanent. Will Not Oxidize.

RUSONITE REFLEX CRYSTAL
Manufactured Expressly for Reflex Circuits.
Will Stand Up Under Heavy Plate Voltage
GUARANTEED — Price Mounted..... $1.00

Order From Your Dealer or Direct From
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15 PARK ROW, NEW YORK, N. Y.

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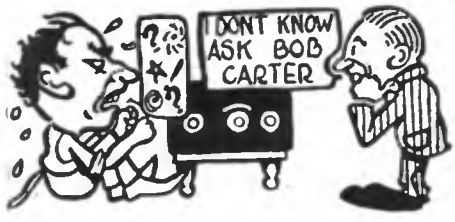
It's easy—which you know now

The amazing story of Bob Carter, a radio amateur, who became an authority overnight and surprised his friends

By Frank W. Daly

WHAT in blazes was the matter with the darned thing anyway? I was mad clean through. I'd been fiddling with my new set for hours and all I was getting was a weak little chorus of six stations and a lot of howls and squawks. Harry Brant was there offering his usual line of stupid suggestions which only made me angrier. "Don't stand there looking at me!" I bawled. "Why don't you do something? Why don't you tell me what's wrong with the thing?"

Harry shrugged his shoulders helplessly. "Sorry, old man, I don't know enough about Radio—you'd better ask Bob Carter, he'a the authority around here these days."



"Bob Carter!" I sbouted in derision. "What are you trying to do—kid me? Since when has Bob Carter become a rival of Major Armstrong? Bob Carter! That's a bot one. Say—three weeks ago tbat boob asked me if a microfarad was a disease germ."

"Just the same, Bob is an expert!" said Harry defiantly.

"Huh!—you've got to sbow me," I sneered. "Why don't yon phone tbis nine-day-wonder to come over bere and see what he can do witb this set?"

"All right, I will," said Harry.

Fortnnately, my sense of bumor came to the rescne just tben and I was able to langb at tbe picture of ntter helplessness I would soon be enjoying when poor old Bob Carter started "fixing" this receiver.

Bob answered Harry's call and said be'd be rigbt over. "—Always glad to be of service." Stnpid egotist!

"What's the trouble?" asked Bob, on bis arrival a few minntes later.

"Nothing mnch." I replied non-committally—I didn't want him to have any clues.

"Dandy set!" he commented, snrveying my outfit—and I had to admit be sure handled the thing like a seasoned amateur. "There's nothing wrong with it," be said, after a moment, "except—"

Witb the ease and confidence of an experienced engineer be made some minor adjnstment inside the cabinet.

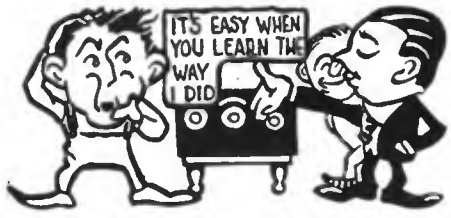
"—Except this!"

To my astonisbment WEAF suddenly burst out with knife-edge clearness and freedom from interruption.

"Why Bob—" I gasped. I couldn't conceal my admiration. "Gee! Yon're great! Wbere did you—? How—? Say—am I crazy or something?"

Bob chnckled—be knew what I was thinking. "Pshaw! Tbere's notbing to it." He protested modestly. "Eitber of yon fellows could do it in half tbe time it took me. Just think—I can make tbe dandiest receivers now, and tronble-sbooting? Easy as falling off a log! Bnt really—there's no credit due me at all. It's easy when you learn Radio the way I did."

I was quite prepared to believe tbe moon was made of hard-rubber by this time. "Of course we aren't a bit anxious to know bow you did it!" I said ironically.



"Tbere's notbing mnch to tell," said Bob. "You remember I didn't know a tbing about Radio, bnt I was anxious to learn. Still, I didn't feel like wading through miles of mathematics and verbosity to reach my goal. One day—reading a radio magazine—I bappened to glance at tbe ad of tbe Radio Guild and saw that Kennetb Harkness had written a new kind of home-study book on advanced Radio, a book tbat assumed you hadn't tbe slightest knowledge of Radio yet wbich dealt witb tbe most advanced phases of tbe subject. Tbis was exactly what I had been waiting for. I mailed the coupon and tbey shot me the book by return mail.

"Well sir! That very first nigbt I felt myself growing in knowledge—it was wonderful! There was no exbausting figbt for understanding because everytbing was delightfully clear. Each

subject was taken np so smoothly I clean forgot I was studying something that had been considered ponderonsly scientific. Wby—within the first week I was bnilding my own receiver and yon ougbt to see it! Hnh! It looks better than most commercial receivers and—well, that's all!"

I conldn't get tbe Radio Gnild's address from Bob qnick enongh. I sven nsed a special-delivery stamp on my letter to tbe Gnild. Tbey rusbed me my copy of this astounding book by retnrn mail and eagerly I commenced reading. It was called "Radio Freqnency Amplification" and if I was surprised at the knowledge Bob Carter had gained, I was even more dnmfounded at my own snccess. I tell you tbere wasn't a question on Radio I couldn't answer instantly and witb perfect confidence. I was absolutely sure of myself. And as for building sets—well, I've just taken another order for a six-tube receiver. I shall make over a hundred dollars ont of it. Is that reason enough for enthusiasm?

Now tbe above is a true story. Just think—Bob Carter was below average—yet, he became a real autbority. If he could achieve snch wonderful results in snch a surprisingly short time, and witb sucb ease—think what YOU could do! Yes—you can do better than Bob Carter. It doesn't make a jot of difference whether yon've been a radio bng for years or whether yon're an absolute beginner. In his new book "Radio Frequency Amplification" Kennetb Harkness will lead you step by step from tbe elementary principles to the most advanced aspects of modern radio reception. Jnst a few minntes a day with this book and you will be the anthority among your friends. Tbere won't be a thing that'll stump yon—not a qnestion yon can't answer.

With the aid of tbis book you will know how to construct the most up-to-date receivers—superior to any of tbe commercial sets made today. The assembly and wiring of several different types are explained tboronghly and illnstrated by scores and scores of diagrams, drawings and action photographs. Could anything be simpler? Yet remember—yon will be taught the most advanced and modern developments, you will be told professional engineering secrets of manufacture never before revealed to the amateur radio constructor.

SPECIAL LOW-PRICE QUICK ACTION OFFER

"Radio Freqnency Amplification" with its handsome red binding, its eight meaty lessons on tbeory and seven closely knit lessons on intensive practice has met witb an instantaneous, smasbing demand! So we cannot urge you too strongly to send for yonr copy today before the edition runs out. To indnce qnick action on yonr part, the senders of the first five hundred conpons will receive this wonderful new book AND "Super-Regenerative Receivers" by the same author—botb books for tbe astonishingly low price of only $1.25!

SEND NO MONEY

Simply fill in and mail tbe conpon below—when the books arrive pay the postman only $1.25 plus a few cents postage.

THE RADIO GUILD, Inc.,
256 West 34th Street, New York, N. Y.

Please rush me my copy of tbe new book "Radio Frequency Amplification" by Kenneth Harkness. I nnderstand you will send me "Super-Regenerative Receivers" by the same author as a special inducement. When the postman arrives I will pay him only $1.25 plus a few cents postage. (Outside U. S. $1.50 casb with order).

Name .....

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W. A. 9-28

Forget your battery troubles

The complete line of Exide Radio Batteries meets every requirement in radio receiving

YOUR success in radio receiving depends largely on the quality of your batteries. And you are sure of satisfactory battery performance when you use Exides. A specially designed Exide Battery is now available for every type of vacuum tube.

Whether you want a long-life storage battery for six-volt tubes, an A battery for low-voltage tubes, or a B battery, you can take your choice of Exide Radio Batteries and be sure of getting the right batteries for your set.

For low-voltage tubes

The two newcomers in the Exide radio family are two- and four-volt A batteries for tubes consuming .25 amps. at 1.1 to 1.5 volts and those using .06 amps. at 3.0 to 3.5 volts. These sturdy little batteries were specially designed to meet the requirements of WD-11 and UV-199 vacuum tubes. Weighing less than 6 lbs. each, they are midgets in size, but giants in power.

Exide Radio Batteries give steady, dependable current with only occasional recharging. They make it possible for you to reproduce broadcast selections in clear, bell-like tones. When your set is hooked up with an Exide, you have ample power for maximum signal strength at all times. You can tune in distant stations with the most satisfactory results.

In service over a generation

For more than a generation the famous Exide Storage Battery has helped to turn the wheels of industry. Long before radio broadcasting achieved its present popularity, the Exide proved its worth in commercial and marine wireless. It is used today in a majority of all government and commercial wireless stations. When the American public found in radio a new form of entertainment, the Exide became by reason of superiority the leading radio battery.

You can get Exide Batteries from a nearby radio dealer or Exide Service Station.

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

For six-volt tubes

Like all Exide Storage Batteries, the Exide A Battery for six-volt tubes is dependable and long-lasting. It is made in four sizes, of 25, 50, 100, and 150 ampere hour capacities.

Two- and four-volt A Batteries

The new Exide A Batteries consist of one and two cells, respectively, with rated capacities of 12 and 24 ampere hours. The two-volt A Battery will heat the filament for 96 hours; the four-volt A Battery for 200 hours.

Exide B Batteries

give noiseless, full-powered service over a long period of discharge. Designed throughout to prevent electrical leakage. Capacity, 3 amperehours.

Exide
RADIO BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, PHILADELPHIA

Service Stations Everywhere

Branches in Seventeen Cities

Just pick out the size you want

CELORON Radio Panels, ready-cut in standard sizes, save you the trouble and delay of having your panel cut to order. Just go to a near-by radio dealer who sells Celoron panels and pick out the size you want. Then you are sure of getting a panel that is neatly trimmed and finished, and something more—you get the necessary insulation for successful receiving.

Condensite Celoron has high dielectric strength and great insulation resistance. Its moisture-repelling properties prevent warping.

Easy to work

You will like the "workability" of Celoron panels. They are easy to drill, tap, saw, and mill, and will engrave evenly without feathering. Each panel is wrapped in glassine paper to protect the surface. On every one are complete instructions for working and finishing. You can get Celoron panels in glossy black finish.

One of these standard sizes will fit the set you intend to build:

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

7—12 x 14 x $\frac{3}{16}$

If your dealer cannot supply you, ask him to order for you, or write direct to us. Indicate by number the size you want. Celoron is also furnished in full-sized sheets, and we can cut panels in any sizes desired.

Write for this free booklet

You will find much that will interest you in our booklet, "Tuning in on a New World." It contains lists of the leading broadcasting stations in the United States and Canada, an explanation of symbols used in radio diagrams, and several efficient radio hook-ups. We will send this booklet to you free on request. A line on a card is sufficient. Write at once.

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

Diamond State Fibre Company

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BRANCH FACTORIES AND WAREHOUSES

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CONDENSITE CELORON

STANDARD RADIO PANEL

Volume! Clarity!! Delight!!!

With Correct Hook-up— Proper Inductance and Capacity —and Good Detection

You Are Assured a New and Better Amplification— Maximum Volume— Minimum Distortion

With Kellogg Shielded Type Transformers

Correct audio frequency amplification is important in the satisfactory operation of loud speakers. Proper amplification [with KELLOGG transformers] results in a clear reproduction with minimum distortion and maximum volume.

Kellogg transformers are designed to overcome any defects of existing types and to furnish the very best of amplification.

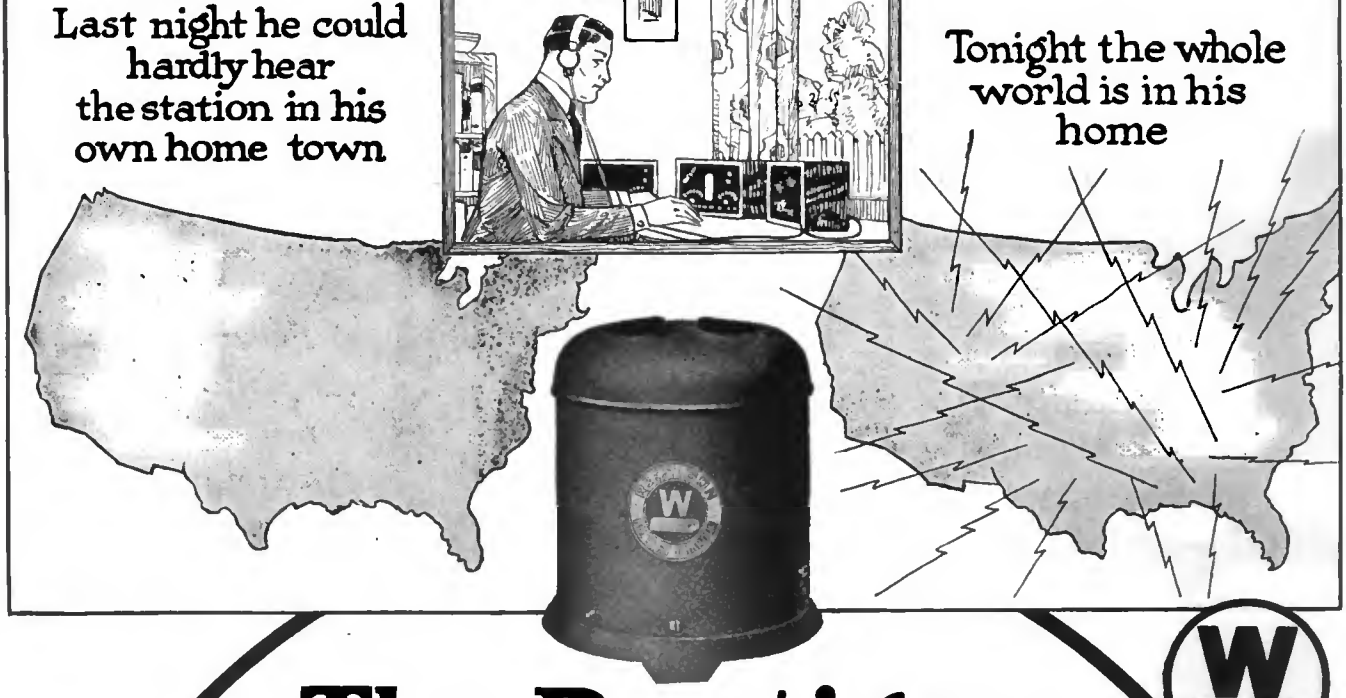
They are built complete by the Kellogg Company, using magnet wire with the very best insulation, and of exactly the correct number of turns. The metal case is heavily enameled in maroon with a Kellogg Bakelite connecting rack. The laminated cores of silicon steel are correctly proportioned and shaped for the most effective electrical field.

The primary and secondary binding posts are accessibly placed at the top of the transformers, and clearly marked so that there need be no error in connection. Every Kellogg transformer is thoroughly tested before leaving our plant and we guarantee the purchaser a product of exceptional efficiency.

No. 501—Ratio 4½ to 1—$4.50 each
No. 502—Ratio 3 to 1— 4.50 each

Kellogg Switchboard & Supply Company

Adams and Aberdeen Streets, Chicago



The Rectigon made all the difference

Last night he could hardly hear the station in his own home town—tonight, much of the world is in his home.

His battery was badly in need of charging. He didn't have time to lug it to a service station, call for it and bring it home again. As a consequence his set wouldn't work right because of "no juice."

The next day he had a Rectigon Battery Charger sent home, called his wife and had her attach it to the run down battery. That night the whole world was in his home because he had a battery full of "pep" to furnish power for his set.

Are you in this man's shoes?

If so, follow in his footsteps.

The Rectigon is a small, inexpensive device made especially for charging radio batteries. It is entirely automatic in operation and as simple to attach as an electric toaster. It is light and portable. The freedom from oil and grease assures against damage to your floors and rugs.

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania

Westinghouse

Brandes

One every ten seconds

PRODUCTION is the principal governing factor in determining costs.

The Popular demand for Brandes *Matched Tone* Headsets has caused the installation of so many special machine tools and other labor saving devices that a substantial reduction of cost has resulted.

This we pass on to the consumer in lowered prices. The standard of Brandes quality will ever be maintained or raised if possible—checked by twenty-two rigid tests and inspections of each headset.

NEW PRICES

Superior
$6.00

Navy Type
$8.00

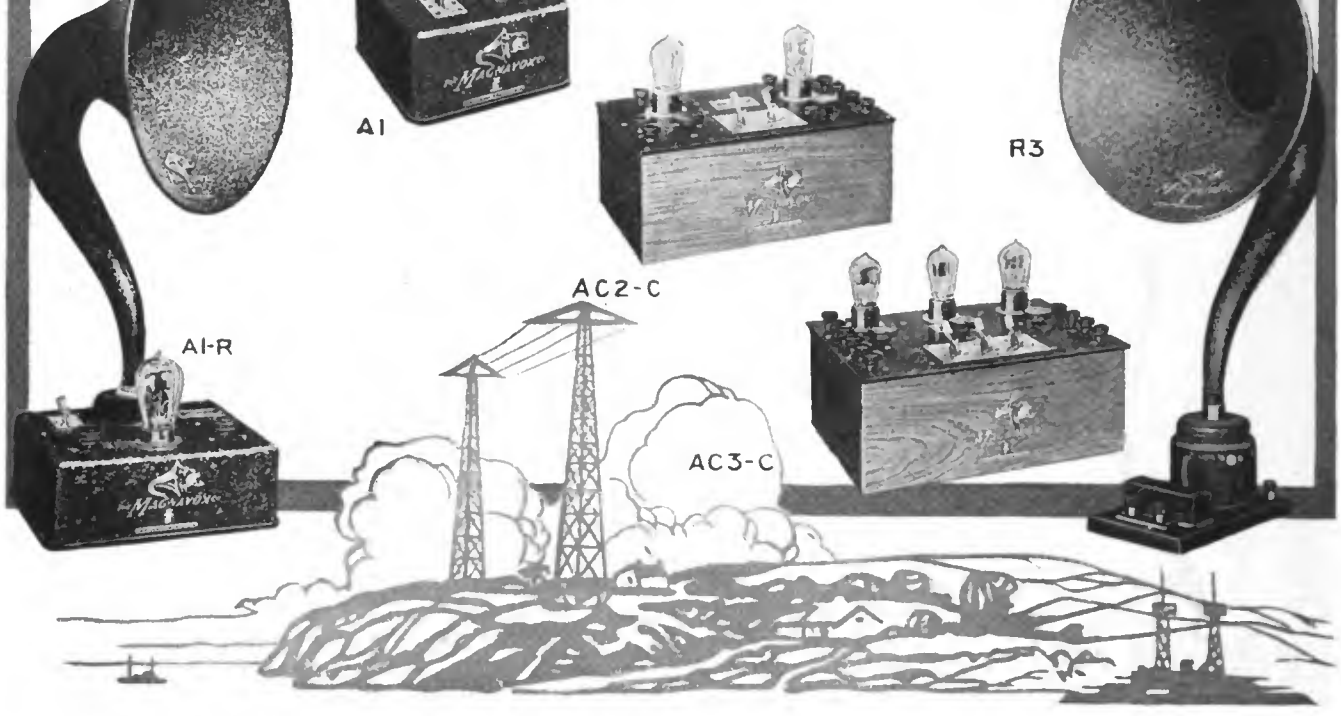
Made in Canada and England by
Canadian Brandes, Limited, Toronto and London

C. BRANDES, Inc. **237 Lafayette St., New York City**

Matched Tone

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

Radio Headsets



New Magnavox Combination Set

A2-R Insures convenient and perfect Radio reproduction. Consists of Magnavox Reproducer with 14-inch horn and 2-stage Magnavox Power Amplifier, as illustrated **$85.00**

Radio takes another step forward with these wonderful new Magnavox devices

THE new Magnavox models here shown extend and supplement the already famous Magnavox line of Reproducers and Power Amplifiers. There is a Magnavox for every receiving set.

Magnavox Reproducers

R2 with 18-inch curvex horn in new acoustic finish . **$60.00**

R3 with 14-inch curvex horn in new acoustic finish . **35.00**

M1 *new Magnavox Reproducer* requires no battery for the field, thus meeting requirements of dry battery receiving sets. With 14-inch curvex horn in new acoustic finish . . . **35.00**

Magnavox Combination Sets

A1-R consisting of Magnavox R3 Reproducer with 14-in. horn and 1-stage Magnavox Power Amplifier . **59.00**

A2-R consisting of Magnavox R3 Reproducer with 14-in. horn and 2-stage Magnavox Power Amplifier . **85.00**

A1-M same as A1-R but with the new Magnavox Reproducer M1 . . . **59.00**

A2-M same as A2-R but with the new Magnavox Reproducer M1 . . . **$85.00**

Magnavox Power Amplifiers

A1 meets the demand for a 1-stage Power Amplifier. Special finish metal case. **27.50**

AC-2-C Magnavox 2-stage Power Amplifier with Bakelite panel in highly finished hardwood case . **55.00**

AC-3-C Magnavox 3-stage Power Amplifier . . **75.00**

Ask your dealer for a demonstration. Interesting booklet will be sent on request.

The Magnavox Company
OAKLAND, CALIFORNIA
370 Seventh Avenue, New York
World pioneers in the development and manufacture of sound amplifying apparatus

MAGNAVOX PRODUCTS

Magnavox Reproducers and Amplifiers

When writing to advertisers please mention THE WIRELESS AGE

A new battery charger, noiseless and indestructible

FANSTEEL BALKITE is a new metal developed for this charger. It acts as a valve, allowing alternating current to flow into the battery but not out of it. It is the most efficient charger valve made, is practically indestructible, and does away with noisy, delicate vibrators and fragile bulbs.

The Gould Battery Company is also marketing, under the Fansteel Balkite Patents, a complete battery and recharging unit known as the Gould Unipower, into which this charger, under the name, "The Fansteel Balkite Rectifier," has been incorporated.

FANSTEEL
Balkite
PATENTS APPLIED FOR *Battery Charger*

The Fansteel Balkite Battery Charger for Radio "A" Batteries is an entirely new type of electrolytic rectifier, based on the use of Fansteel Balkite, a new and rare metal developed for this purpose. It does away with all noise, cannot deteriorate through use or disuse, has nothing to replace, adjust, or get out of order, cannot discharge or short circuit the battery, and requires no attention other than an occasional filling with distilled water. There are no moving parts, bulbs, or fuses. It will not overcharge, and cannot fail to operate when connected to the battery and line current. It is unaffected by temperature or fluctuations in line current, and will charge a completely dead battery. It is simple, efficient, and indestructible except through abuse.

This charger can be operated while the radio set is in use without affecting the set or its operation, and without disturbing noises.

The Fansteel Balkite Battery Charger will charge the ordinary 6 volt radio "A" battery at 3 amperes, and a 12 volt at 1½ amperes, from 110-115 AC, 60 cycle current. It comes complete and ready for use. Get it from your dealer, or use the coupon below.

Price, $18

($18.50 West of the Rockies)

FANSTEEL PRODUCTS CO., Inc.
DEPT. 4-B
North Chicago, Illinois

Dealers and Jobbers: The Fansteel Balkite Battery Charger does away with complaints and replacement troubles. Write for literature and discounts.

Dept. 4-B
FANSTEEL PRODUCTS CO., Inc.
North Chicago, Ill.
Enclosed please find $18. [$18.50 West of the Rockies.] Send me the Fansteel Balkite Battery Charger for Radio "A" Batteries. If I am not entirely satisfied I will return it and you will refund my money.

Name .....

Street .....

City ..... *State* .....

ADVANCED RADIO COURSE

A Home Study Course Specializing On Tube Transmission and Reception Radio Instruments and Measurements

THROUGH popular demand the Radio Institute of America has prepared this Advanced Home Study Course. It contains all of the latest data on tubes and their characteristics—tuned ground systems—counterpoise construction and installation—C.W., I.C.W., and TELEPHONE transmission — super-heterodyne—super-regeneration—tuned radio frequency. Everything worthwhile in advanced radio is treated and explained in a practical and understandable manner.

FOR THE AMATEUR

The amateur will find it chock-full of radio instruction that will prove especially valuable in accomplishing real radio results in both reception and transmission.

THE STUDENT

The advanced radio student will find it highly interesting, not only for its revelation of the latest developments and how they were accomplished, but through the experimental and research instruction it affords.

THE WIRELESS OPERATOR

For the ship operator, with hours at sea that can be devoted to useful study, this course is the link between the spark and tube station.

Through the inauguration of this instruction anyone, regardless of their remoteness or inability to attend school in person, may secure the latest and most complete Advanced Home Study Course offered.

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Operating as a Caree

What gnified,

Marconi on the Future of Wireless

GUGLIELMO MARCONI, in a signed article in the Nuvo Giornale of Florence on the predicted revolution in wireless communication, says:

"Eventually science will find a way of directing electrical energy without wires in an absolutely straight line. The result will be less expenditure of energy for short distances and hence less expense for messages. Once directive control has been established we shall undoubtedly be able by means of powerful machines to girdle the whole world with waves of electric energy without wires."

Marconi describes a radio telegraphic receiver no bigger than a gramophone by means of which, without any other communication with the atmosphere, he receives all day in his study every scrap of wireless news sent to the European press. He says that very soon with an instrument of this kind "bankers, politicians and business men in general will be able from minute to minute to keep themselves in contact with both hemispheres." He continues:

"Very soon, too, that miserable ticking machine on which all newspaper offices depend will yield place to this mighty invention, which is suitable for news sending, news receiving and simultaneous communication with any number of receiving stations.

"With that installment of radio telegraphic receivers throughout the civilized globe in every public school, university and library, the prevailing languid interest of the public in international happenings will be immensely stimulated."

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says the World's Authority on Wireless

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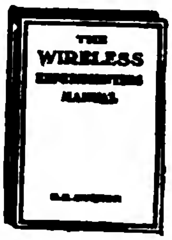

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By Elmer E. Bucher

The only book published that comprehensively covers the theory and design of amateur wireless transmitters and receivers. Construction of transformers, high voltage condensers, spark gaps, aerials, masts, receiving sets for long and short wave length reception. Construction and operation of a 50-mile buzzer transmitter, regenerative receivers, cascade amplifiers, preferred circuits for long and short wave receivers, quench-gap transmitters, methods of measuring the internal impedance and amplification of constant of vacuum tubes are explained.

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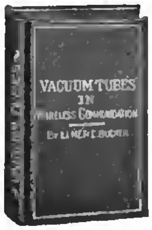
The most complete textbook on the subject yet published. Cloth bound, 351 pages. Fully illustrated. Price............. $2.25



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By Elmer E. Bucher

More than 65,000 copies of this book have been sold to date. It is used in practically every school, college, and library in this country. It is the recognized standard wireless textbook.

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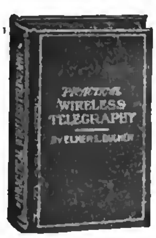

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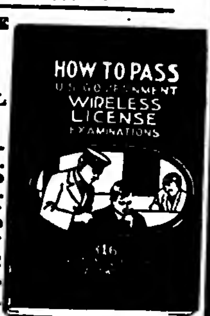

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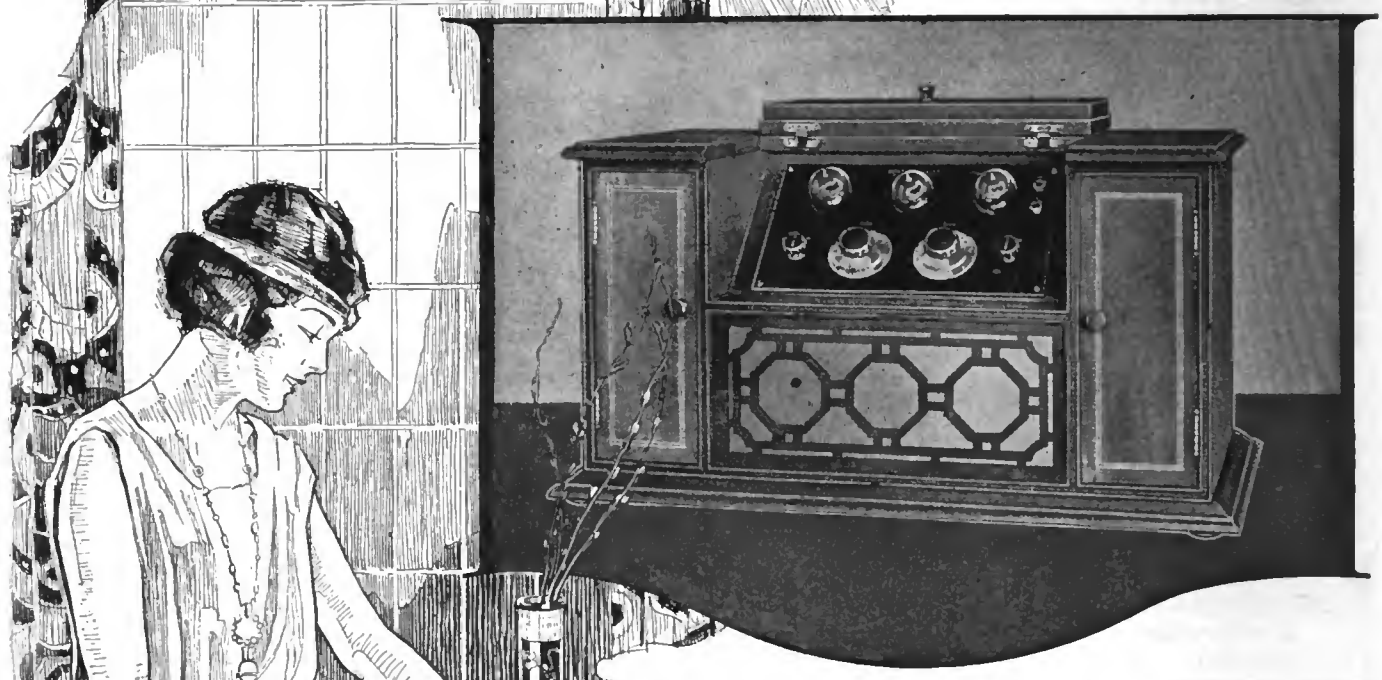

STRIKING BEAUTY
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THIS NEW ADDITION to the Kennedy line has a threefold appeal for you. First, its artistic beauty—simple, refined lines. Second, the faithfulness and unusual tonal purity of its reproduction. Third, it is a self-contained unit, all batteries and loud speaker unit enclosed in the cabinet. Ample volume is assured for dancing or entertainment.

In this set extreme simplicity of operation has been obtained, at the same time retaining the selectivity of tuning and long distance reception that has distinguished all Kennedy receiving sets. Only two dials are used—one to bring in the desired station, the other to regulate volume. Truly a set of which the Kennedy laboratories can justly be proud.

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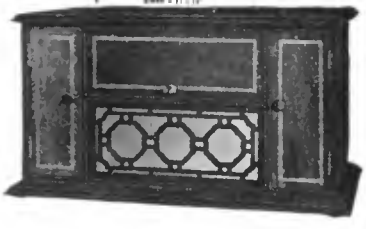

THE KENNEDY MODEL X

This beautifully inlaid mahogany cabinet encases a complete, self contained radio receiver (wave length range 150 to 600 meters.) Two stages of audio amplification, built-in loud speaker. Formica panel. Dials and metal trimmings gold plated. All dry batteries—three dry battery tubes—phones for weaker signals or individual reception—complete, $285.00

All Kennedy radio receiving sets are regenerative—licensed under Armstrong U. S. patent No. 1,113,149.

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3B

For Use With Storage Batteries or Dry Cell Tubes

ONLY

$50.00

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One of the few sets that functions perfectly with all makes of tubes. Has filament switch eliminates necessity of turning out the rheostats when set is not in use. With this switch you can turn off set and come back later to same concert without retuning. The telephone jack makes it possible to use head phones. When head phone plug is inserted it automatically eliminates loud speaker, but does not affect the filament current. Has genuine mahogany cabinet with beautifully engraved panel.

If your dealer cannot supply you, order direct, mentioning his name. Ask for "Simplicity of Radio." Your copy is FREE.

DEALERS: write on your letterhead for attractive sales proposition.

THE ACE TYPE V

Armstrong Regenerative Receiver

The low cost of this set together with its efficiency and simplicity makes the great demand for it increase daily.

A long range receiver. Stations from coast to coast can be heard distinctly. An Ace Two-step Amplifier in connection with this set at $20 makes use of loud speaker practical. Has Crosley Multistat, which permits use of any make tube.

$20

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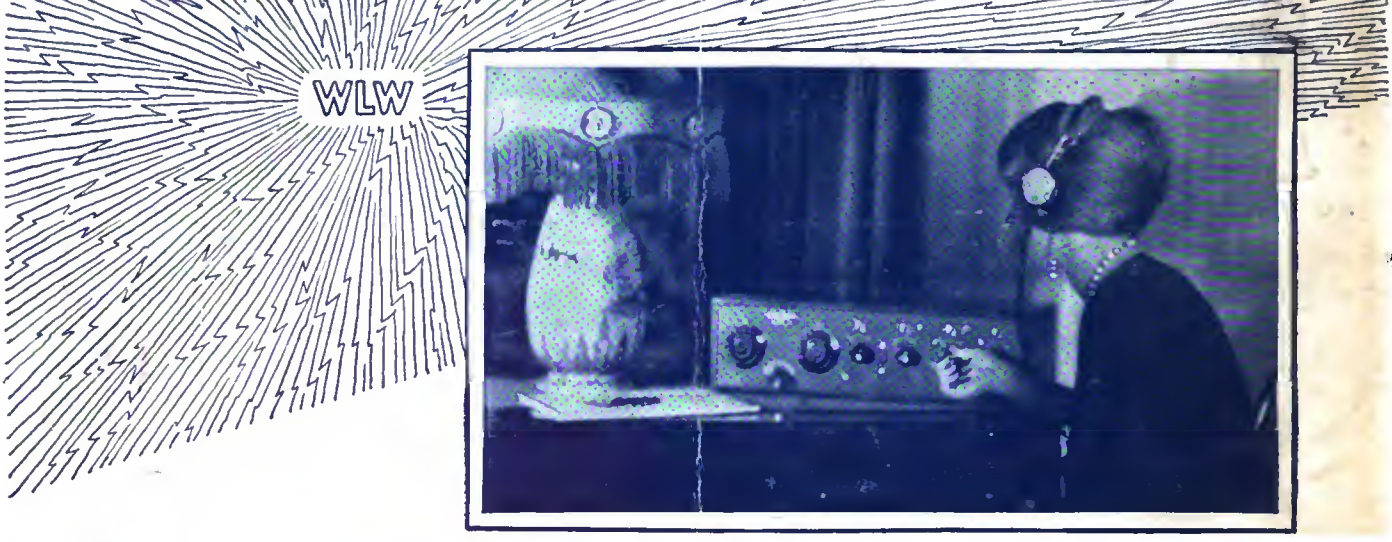
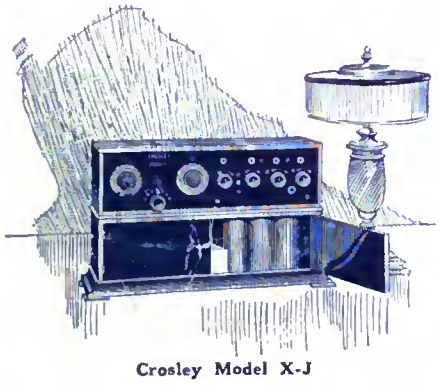
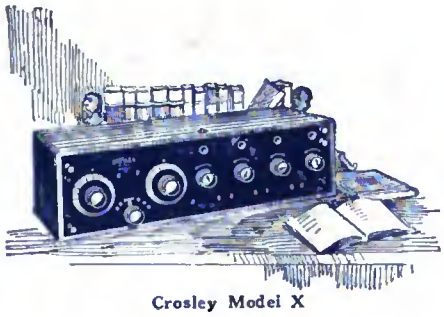




Crosley Model X-J

with Battery Cabinet. This combinstion makes the set completely self - contsined. The batteries are housed in this handsome mahogsny, wax finished cabinet. Price of cabinet alone is $16.00



Crosley Model X

This remarkable receiver—still priced at $55—contains many new features such ss the R.F.T.A. coil and the multistat. The battery cabinet, illustrated above, may be fitted to it, thus adding to its present beauty.

Announcing—

THE NEW CROSLEY MODEL X-J
PRICE $65.00

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

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

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

1. Knobs and Dials—larger, easier to control and better looking.
2. Filament Control Switch—snaps filaments on and off.
3. Jack—Allows you to plug in with head phones on three tubes. When tuned in, just pull the plug and you are switched to the loud speaker.
4. Elimination of Binding Posts on Front Panel. By removing the binding posts to the rear, the beauty of the set is greatly enhanced.
5. Sockets—The old white porcelain sockets are replaced with black compound sockets, which are just as efficient and better looking.
6. Condenser—The New Molded Crosley Condenser made of specially prepared compound will out-perform any condenser on the market.
7. Multistat—Allows use of all makes of tubes. (Now a feature of the standard Model X.)

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